FINAL REPORT

VOLUME 2 of 2 - APPENDICES

on

**A STUDY OF TOXIC EMISSIONS FROM A COAL-FIRED
POWER PLANT UTILIZING THE SNOX INNOVATIVE
CLEAN COAL TECHNOLOGY DEMONSTRATION**

Contract DE-AC22-93PC93251

Prepared for

**U.S. DEPARTMENT OF ENERGY
PITTSBURGH ENERGY TECHNOLOGY CENTER**

by

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July 1994

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APPENDIX A

LOG SHEETS OF SNOX AND
BOILER NO. 2 OPERATING CONDITIONS
JULY 18, 19, 21-24, 1993

Full Air Tank

TABLE 5.29 PROCESS DATA LOG NO. 4: SNOX PROCESS DATA
(Record data hourly)Date: 18-July-93

Time	Initials of Personnel Recording Data	SO ₂ Concentration, ppm		NO _x Concentration, ppm		Gas Temperature, F				TSP 0700 inlet
		Inlet	Outlet	Inlet	Outlet	SO ₂		WEA		
						SNOX Inlet	Reactor Inlet	Tower Inlet	Tower Outlet	
09:00	K.S.K.	2035	83	718	44	232	787	505	194	393
09:30	K.S.K.	2005	81	714	46	232	787	505	197	393
10:00	K.S.K.	2097	86	721	44	231	789	505	193	390
10:30	K.S.K.	2041	81	728	51	230	788	506	196	395
11:00	K.S.K.	2086	83	732	50	229	788	506	197	393
11:30	K.S.K.	2035	79	724	52	229	787	506	192	393
12:00	K.S.K.	1977	78	730	52	229	790	508	193	395
12:30	↑	1967	77	737	49	230	788	508	195	390
13:00		2010	77	738	50	230	790	508	197	395
13:30		1959	75	730	48	230	787	508	198	393
14:00		1960	76	724	46	231	787	507	197	385
14:30	↓	2009	80	724	45	230	787	506	196	387
15:00	K.S.K.	1970	74	744	55	229	788	506	199	385
15:30	MMP	2028	77	749	56	231	787	506	198	383
16:00		2038	81	737	40	234	788	505	198	385
16:30		2023	81	753	42	235	788	505	198	385
17:00		2025	81	748	42	235	789	505	198	385
17:30		2115	83	746	41	235	788	505	198	385
18:00		2089	85	717	41	236	787	505	199	383
18:30		2056	84	718	40	236	788	505	199	385
19:00		2029	84	704	40	236	787	505	197	383
19:30		2138	92	687	39	236	789	505	196	385
20:00		2105	84	690	40	236	788	505	196	385
20:30		2093	83	694	40	236	789	504	193	385
21:00		2062	86	691	40	236	788	504	191	385
21:30	MMP	2074	84	701	40	236	788	504	189	388

Project Engineer Review

Initials/Date

10/5/93

each 1/2 hour!

DATA AT 0700

7/18/93

Niles SNOX Conditions

July 18, 1993				
Time	Ammonia lbs Per hr.	inlet Oxygen Reading	SCR outlet Temperature	Mid point NOX Reading
8am	129	4.2	686	6
9am	128	3.9	686	6
10am	124	4.0	686	6
11am	123	3.8	687	6
12pm	123	3.6	688	6
1pm	123	3.6	689	6
2pm	124	3.7	689	6
3pm	122	3.7	688	6
4pm	139	3.3	689	6
5pm	140	3.5	690	6
6pm	140	3.2	689	6
7pm	139	3.7	688	6
8pm	139	3.4	688	7
9pm	140	3.6	688	6
10pm	140	3.4	688	5

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM
BOILER PROCESS DATA
(Record data hourly) 707 - End of test

Date: 7-18-93

Time	Initials of Personnel Recording Data	Load, MW <i>Gross</i>	Excess Oxygen, percent	Steam temp., F		Drum Steam Pres., psig ± 1	Throttle Steam Flow, klb/hr
				SH Outlet	RH Outlet		
0700	RP	116	1.52	1000	990	1535	863
0800	RP	116	1.85	1001	990	1532	862
0900	RP	117	1.62	1000	991	1534	862
1000	RP	115	1.41	1002	974	1532	863
1100	RP	117	1.73	1000	986	1533	865
1200	RP	116	1.48	1000	987	1532	865
1315	RP	116	1.91	1000	973	1531	865
1400	RP	116	1.57	1000	982	1535	867
1500	RP	116	1.64	1000	987	1532	866
1600	DG	116	1.24	1000	983	1534	864
1700	DG	117	1.43	1000	985	1534	865
1800	DG	117	1.43	1000	980	1535	868
1900	DG	116	1.57	1000	982	1532	865
2000	DG	116	1.35	999	978	1534	864
2100	DG	117	1.94	1000	987	1532	867

Project Engineer Review

RP/EL 10/5/93
Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM
EMISSIONS DATA
(Record data hourly)

Total
Coal Flow
lb/hr

Date: 7-18-93

Time	Initials of Personnel Recording Data	Percent excess Stack Oxygen, percent 10	Stack SO ₂ , ppm lb/mm btu 3H	Stack NO _x , ppm lb/mm btu	Stack Opacity, percent
0700	RP	91.4	1.25	0.75	3.0
0800	RP	92.8	1.35	0.77	3.5
0900	RP	93.2	1.36	0.77	3.0
1000	RP	94.3	1.39	0.87	3.5
1100	RP	92.5	1.37	0.80	3.0
1200	RP	92.9	1.29	0.79	3.5
1315	RP	94.2	1.31	0.81	3.5
1400	RP	93.0	1.27	0.80	3.9
1500	RP	93.4	1.26	0.80	3.0
1600	DE	93.2	1.25	0.74	3.0
1700	DE	93.3	1.27	0.77	3.0
1800	DE	92.0	1.25	0.70	3.5
1900	DE	93.0	1.36	0.70	3.0
2000	DE	93.1	1.34	0.60	3.0
2100	DE	93.0	1.37	0.66	3.5

Project Engineer Review

RPB 10/5/93
Initials/Date

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA
(Record data hourly)

Date: 19-1674-93

Time	Initials of Personnel Recording Data	SO ₂ Concentration, ppm		NO _x Concentration, ppm		Gas Temperature, F				O ₂ percent
		Inlet	Outlet	Inlet	Outlet	SNOX Inlet	Reactor Inlet	Tower Inlet	Tower Outlet	
08:00	K.S.K.	2086	83	704	41	236	788	504	193	390
08:30	^	2054	80	709	40	236	788	504	194	38
09:00		2015	82	700	40	236	788	505	195	390
09:30		2090	84	685	40	235	787	504	195	390
10:00		2070	82	679	40	235	788	504	196	3.1 388
10:30		2008	80	689	40	235	787	504	196	3.1 390
11:00		1955	77	716	41	235	788	504	197	3.0 390
11:30		1999	78	728	40	234	788	504	196	2.6 390
12:00		1988	78	715	40	235	789	504	193	2.2 387
12:30		2083	81	715	40	234	788	504	194	2.4 390
13:00		2113	85	722	40	234	787	505	195	2.4 390
13:30		2049	82	723	39	234	786	505	196	2.6 390
14:00		2065	83	719	29	235	788	505	196	2.9 390
14:30	V	2123	84	723	39	235	789	505	195	2.6 390
15:00	K.S.K.	2208	89	706	39	235	788	505	196	2.3 390
1530	MMP	2201	91	688	39	235	789	505	197	2.3 387
1600		2202	93	690	39	234	787	506	199	2.3 388
1630		2159	88	691	39	381	788	506	200	2.3 388
1700		2162	89	699	39	381	789	504	202	2.6 388
1730		2143	83	688	39	385	788	504	203	2.9 388
1800		2080	80	712	40	385	787	504	203	2.9 388
1830		2072	79	720	40	385	787	504	202	2.9 388
3 5 1900		2087	80	723	43	385	789	504	200	2.8 388
18 5 1930		2072	77	709	41	385	786	504	199	2.5 388
8 5 2000	✓	2111	81	712	42	385	788	504	199	2.4 388
7 4 2030	MMP	2086	80	700	41	386	789	503	197	3.1 388
8 4 2100	MMP	2057	79	711	42	386	788	504	196	3.0 388
7 5 2130	MMP	2045	77	715	43	385	788	503	195	2.8 388

Project Engineer Review RJB 10/5/93
Initials/Date

7/19/93 Niles SNOX Condition

July 19, 1993

8 AM	140	3.0	687	4
9 AM	140	2.7	688	5
10 AM	139	3.1	687	4
11 AM	139	2.9	688	5
12 PM	139	2.9	687	5
1 PM	137	2.7	687	6
2 PM	138	2.9	688	6
3 PM	138	2.5	688	6
4 PM	137	2.3	688	5
5 PM	137	2.6	688	6
6 PM	118	2.8	688	5
7 PM	118	2.9	687	5
8 PM	118	2.7	687	5
9 PM	118	3.3	687	4
10 PM	117	3.1	686	4
Ammonia lbs per hr.		In-let Oxygen Reading	SCR outlet temperature	mid point NOx Read:

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM
 BOILER PROCESS DATA
 (Record data hourly)

Furnace
Outlet

Date: 7-19-93

Time	Initials of Personnel Recording Data	Load, MW <i>Gears</i>	Excess- Oxygen, percent	Steam temp., F		Drum Steam Pres., psig	Throttle Steam Flow, klb/hr
				SH Outlet	RH Outlet		
0700	MP	116	1.60	1000	977	1533	867
0800	MP	117	1.47	1001	984	1533	867
0900	Q.P.T.	117	1.56	1000	982	1533	867
1000	Q.P.T.	117	1.77	1000	982	1533	867
1100	Q.P.T.	116	1.5	1000	981	1533	867
1200	Q.P.T.	116	1.22	999	980	1536	867
1300	Q.P.T.	116	1.14	996	971	1535	869
1400	Q.P.T.	116	1.23	1000	975	1535	868
1500	Q.P.T.	116	1.08	997	964	1534	870
1600	RDD	116	1.34	1002	965	1534	867
1700	RDD	116	1.20	1000	971	1534	868
1800	RDD	116	1.18	1000	971	1534	868
1900	RDD	116	1.06	1000	979	1533	867
2000	RDD	116	1.33	1000	980	1534	869
2100	RDD	116	1.26	1001	981	1532	868
2200	RDD	116	1.28	999	981	1532	868
			FINISHED				

Project Engineer Review

RDB 10/5/93
Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM
EMISSIONS DATA
(Record data hourly)

Total
Coal 1-2
Flue

Date: 7-19-93

Time	Initials of Personnel Recording Data	Stack Oxygen, percent klb/hr	Stack SO ₂ , ppm lb/mm Btu	Stack NO _x , ppm lb/mm Btu	Stack Opacity, percent
0700	MP	92.4	1.14	0.62	3.0
0800	J.P.T.	96.4	1.33	0.64	3.0
0900	A.P.T.	93.3	1.36	0.65	3.0
1000	J.P.T.	93.3	1.36	0.65	3.0
1100	J.P.T.	92.8	1.10	0.67	3.0
1200	J.P.T.	91.7	1.27	0.69	2.6
1300	J.P.T.	91.0	1.25	0.66	2.3
1400	J.P.T.	91.5	1.28	0.69	2.3
1500	J.P.T.	89.8	1.34	0.59	2.3
1600	RDD	90.3	1.30	0.56	2.25
1700	RDD	90.6	1.26	0.60	2.25
1800	RDD	91.7	1.27	0.65	2.25
1900	RDD	92.1	1.35	0.69	2.25
2000	RDD	92.1	1.27	0.66	2.25
2100	RDD	92.3	1.29	0.64	2.25
2200	RDD	93.6	1.25	0.68	2.25

Project Engineer Review

RJB 10/5/93

Initials/Date

F.UEI Air Toxics

5
2 MAR 1993

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA
(Record data hourly)

Date: 7-21-93

②		③		④		⑤		⑥		⑦		⑧		⑨		⑩	
SC K. OUTLET TEMP	MID NOX	Time	Initials of Personnel Recording Data	SO ₂ Concentration, ppm		NO _x Concentration, ppm		Gas Temperature, F				Inlet O ₂					
				Inlet	Outlet	Inlet	Outlet	¹⁸⁰⁰ SNOX Inlet	¹⁸⁰⁰ Reactor Inlet	Tower Inlet	Tower Outlet						
688	5	08:00	K.S.K.	1845	75	576	48	389	788	504	190	1.7					
688	5	08:20		1844	73	585	52	389	788	504	191	1.7					
688	6	09:00		CAH	Cal	CAH	Cal	390	789	504	191	1.7					
688	6	09:20		1895	70	609	53	390	788	504	191	1.6					
688	6	10:00		1780	69	597	48	389	788	504	192	1.6					
688	7	10:20		1925	71	601	55	389	788	504	195	4.3					
688	6	11:00		1879	63	610	60	389	787	504	195	4.1					
688	7	11:20		1699	57	564	69	389	787	505	197	4.3					
688	10	12:00		1846	60	687	71	391	789	505	195	4.4					
688	4	12:20		1929	67	675	59	387	787	505	196	3.9					
688	5	12:00		1923	67	668	52	387	787	505	195	3.8					
688	6	12:20		2091	76	663	50	385	786	505	196	4.1					
688	6	14:00		2408	96	656	45	386	790	505	196	4.1					
688	6	14:20		2229	89	650	44	386	788	506	197	3.6					
688	6	15:00	K.S.K.	2122	81	653	43	386	789	506	198	4.0					
688	6	15:20	M.M.P.	2171	84	663	43	387	786	506	197	4.4					
689	6	16:00		2243	86	677	46	386	788	506	196	4.2					
89	7	16:20		2238	87	668	45	388	787	507	197	3.8					
688	6	17:00		2135	78	661	54	384	790	506	197	4.3					
87	6	17:20		2106	79	668	48	383	788	506	197	4.4					
87	6	18:00		2126	81	665	46	384	788	505	196	4.5					
687	6	18:20		2020	75	661	48	383	789	505	196	4.5					
87	6	19:00		2013	70	693	57	383	788	505	195	4.8					
86	6	19:20		2007	70	691	58	384	787	504	194	4.7					
686	6	20:00		1978	67	693	60	384	789	504	193	4.7					
687	6	20:20	M.M.P.	2007	73	702	60	384	788	504	191	4.9					
687	5	21:00	M.M.P.	1915	69	680	51	388	787	504	190	4.4					
88	6	21:20	M.M.P.	1873	67	702	50	388	787	505	188	5.0					
88	5	22:00	M.M.P.	2041	75	706	56	389	787	505	190	4.8					
-	-	22:30	M.M.P.				58	388	789	504	190	4.2

64.61

M E M O

TO: TOM KELLY

DATE: JULY 22, 1993

XC: AIR TOXIC FILE

FROM: TIMOTHY D. CASSELL

SUBJECT: DAILY LOGS OF AIR TOXIC TESTING

Please note that between 0800 and 1000 the inlet O2 reading was lower than normal on the July 21, 1993 daily log. The Horiba instruments were working correctly, however the output was on an incorrect scale thus lowering the presumed value. After correcting the switch position, the readings were corrected.

If you have any questions, please call me at 652-4881.

Furnace
Outlet

Date: 7-21-93

Project Engineer Review

W RB 11/5/93

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA
(Record data hourly)

Date: ²²7-22-93

②		③		④		⑤		⑥		⑦		⑧		⑨		⑩	
SCR OUTLET TEMP	MID NOX	Time Each 1/2 hr	Initials of Personnel Recording Data	SO ₂ Concentration, ppm		NO _x Concentration, ppm		Gas Temperature, F				INLET O ₂					
				Inlet	Outlet	Inlet	Outlet	T ₈₀₀		WSA							
								SNOX Inlet	Reactor Inlet	Tower Inlet	Tower Outlet						
683	6	0800	KSK	1954	79	674	40	388	788	500	184	4.4					
683	6	30	^	1925	75	666	39	388	787	500	188	4.9					
684	6	30		1947	74	671	41	388	787	501	197	5.1					
684	5	1000		1885	71	680	41	388	787	502	195	4.5					
685	6	70		1930	71	685	42	388	788	502	197	4.5					
685	6	1100		1918	71	692	48	389	789	503	198	4.5					
687	6	70		1919	69	715	54	387	788	503	197	4.1					
687	6	1200		1920	67	727	58	387	787	503	191	4.2					
686	6	30		1960	69	703	54	387	789	503	191	4.6					
687	5	1300		1957	64	721	68	387	787	504	193	2.9					
687	5	70		1931	62	716	61	387	787	504	194	4.0					
686	6	1400		1927	61	704	62	385	788	504	195	3.9					
686	6	1500	V	1955	63	696	64	386	788	504	196	4.0					
686	6	1500	KSK	1947	65	695	60	387	790	504	196	4.2					
687	7	1530	SABA	1998	67	688	61	387	788	504	196	3.9					
687	6	1600		1993	70	695	55	388	787	505	198	3.9					
688	5	30		1932	68	685	50	386	787	505	194	4.1					
687	5	1700		1910	61	678	61	389	788	505	195	4.3					
687	5	30		1924	69	675	43	387	786	505	196	4.2					
687	5	1800		1907	67	676	53	388	789	505	196	4.3					
686	7	30		1922	59	676	61	388	788	505	194	4.4					
686	5	1900		1943	66	680	61	387	787	504	195	4.0					
686	6	30	V	1914	64	674	67	388	787	504	194	4.4					
686	6	2000		1942	67	681	58	387	787	504	196	3.7					
680	6	30	SABA	1937	66	674	60	387	788	503	195	4.5					

Project Engineer Review RBB 10/5/93
Initials/Date

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM
BOILER PROCESS DATA
(Record data hourly)

Furnace
Outlet

Date: 07-22-93.

Time	Initials of Personnel Recording Data	Load, MW	Excess Oxygen, percent	Steam temp., F		Drum ^{6A} Steam Pres., psig	Throttle Steam ^{1A} Flow, klb/hr
				^{6B} SH Outlet	^{6A 6B} RH Outlet		
0800	J.P.V.	116	0.87	993	951	1536	876.63
0900	J.P.V.	117	1.32	996	965	1535	878.97
1000	J.P.V.	117	1.15	997	968	1538	876.94
1100	J.P.V.	117	1.23	999	972	1535	875.53
1200	J.P.V.	117	1.48	998	974	1538	877.59
1300	J.P.V.	117	1.14	996	972	1538	878.64
1400	J.P.V.	117	1.18	996	974	1538	880.09
1500	J.P.V.	117	1.34	999	975	1536	879.17
1600	W.P.R.	117	1.40	995	971	1537	879.59
1700	W.P.R.	117	1.51	996	973	1535	880.20
1800	W.P.R.	117	1.31	999	972	1534	877.48
1900	W.P.R.	117	1.18	999	974	1536	878.44
2000	W.P.R.	117	1.16	1000	974	1536	879.61
2100	Test Completed 20:00						

Project Engineer Review

RBB 10/5/93
Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM
EMISSIONS DATA
(Record data hourly)

Total GA
Cool Flow 3H

3 H

3H Date: 07-22-93

Time	Initials of Personnel Recording Data	Stack Oxygen, percent kilb/hr	Stack SO ₂ , ppm lb/mm Dtn	Stack NO _x , ppm lb/mm Dtn	Stack Opacity, percent
0800	J.P.T.	89.7	1.32	0.72	2.6
0900	J.P.T.	92.1	1.34	0.70	2.6
1000	J.P.T.	91.2	1.25	0.73	2.6
1100	J.P.T.	92.1	1.30	0.79	2.6
1200	J.P.T.	91.9	1.30	0.87	2.6
1300	J.P.T.	91.4	1.27	0.83	2.6
1400	J.P.T.	92.0	1.28	0.82	2.6
1500	J.P.T.	92.8	1.34	0.81	2.6
1600	W.P.R.	92.5	1.34	0.79	2.6
1700	W.P.R.	92.9	1.31	0.77	2.6
1800	W.P.R.	93.14	1.33	0.75	2.6
1900	W.P.R.	92.5	1.33	0.77	2.6
2000	W.P.R.	92.3	1.33	0.77	2.6
2100					

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TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA
(Record data hourly)

Date: 7-23-93

Date: 7-28-73													
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩				
NH ₃ FLUX lb/hr	SCR OUTLET TEMP	MID NOX	Time	Initials of Personnel Recording Data	SO ₂ Concentration, ppm		NO _x Concentration, ppm		Gas Temperature, F				INLET O ₂
					Inlet	Outlet	Inlet	Outlet	T _{NO} O ₃₀₀ SNOX Inlet	SO ₂ Reactor Inlet	WSA Tower Inlet	Tower Outlet	
116	683	7	08:00	K.S.K.	2131	90	637	38	389	790	500	187	3.1
115	682	7	30		1929	40	695	55	388	787	501	188	3.6
115	683	7	09:00		1943	71	696	57	392	788	501	193	3.6
113	684	7	30		1984	71	674	52	388	788	502	193	3.9
111	685	6	10:00		2054	74	678	53	391	789	503	195	3.6
112	685	6	30		2036	73	674	52	391	786	503	197	3.8
113	686	5	11:00		2097	75	690	56	390	788	504	193	3.7
115	687	6	30		2126	80	682	48	389	790	505	194	3.7
111	688	6	12:00		2046	73	672	51	390	786	505	195	3.6
112	688	6	30		2050	74	677	53	390	788	505	196	3.5
114	687	5	13:00		2047	74	674	47	396	789	506	194	3.4
115	688	6	30		2041	74	681	49	387	788	506	195	3.5
118	687	5	14:00	✓	2054	78	669	43	392	788	507	195	3.4
111	687	6	30		2152	81	665	42	384	788	505	196	3.6
118	687	6	15:00	K.S.K.	2156	83	674	42	391	788	505	196	3.5
117	689	6	30	S.M.A.	2123	78	689	47	390	789	506	197	3.5
117	689	6	1600		2153	79	687	46	385	787	506	197	3.6
118	689	6	30		2091	79	688	46	386	790	506	198	4.1
117	689	6	1700		2055	75	674	45	384	788	505	199	3.4
			30										
			1800										
			30										
			1900										
			30	✓									
			2000										
			30	S.M.A.									

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Initials/Date

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM
BOILER PROCESS DATA
(Record data hourly)

Furnace
Outlet

Date: 07-23-93

Time	Initials of Personnel Recording Data	Load, MW	Excess Oxygen, percent	Steam temp., F		Drum Steam Pres., psig	Throttle Steam Flow, klb/hr
				6R	6A 5B		
0800	J.P.J.	117	0.62	993	957	1534	879.80
0900	J.P.J.	117	1.11	999	965	1535	878.69
1000	J.P.J.	117	1.20	998	967	1538	880.48
1100	J.P.J.	117	1.19	998	966	1538	880.78
1200	J.P.J.	117	.82	994	962	1535	880.84
1300	J.P.J.	117	1.18	1000	968	1536	879.70
1400	J.P.J.	117	1.02	1000	968	1536	882.08
1500	J.P.J.	117	1.07	997	966	1537	883.06
1600	WPR	117	1.05	992	960	1537	885.9
1700	WPR	117	1.02	991	960	1537	885.7
1800							
1900							
2000							
2100							
2200							
2300							
2400							

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TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM
EMISSIONS DATA
(Record data hourly)

Total 16
Fuel Flow 3A

3H

3H

Date: 07-23-93

Time	Initials of Personnel Recording Data	Stack Oxygen, percent klb/hr	Stack SO ₂ , ppm lb/mm Btu	Stack NO _x , ppm lb/mm Btu	Stack Opacity, percent
0600	J.P.T.	92.8	1.29	0.63	2.6
0900	J.P.T.	92.6	1.26	0.72	2.6
1000	J.P.T.	91.0	1.30	0.69	2.6
1100	J.P.T.	90.3	1.42	0.75	2.6
1200	J.P.T.	90.8	1.34	0.70	2.6
1300	J.P.T.	91.2	1.41	0.71	2.6
1400	J.P.T.	90.4	1.53	0.69	3.1
1500	WPR	89.9	1.43	0.69	3.1
1600	WPR	90.2	1.41	0.69	3.1
1700					
1800					
1900					
2000					
2100					
2200					
2300					
2400					

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Initials/Date

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA
(Record data hourly)

Date: 7-24-93

① N/A FLUE GAS	② SCR OUTLET TEMP	③ MID NOX	Time	Initials of Personnel Recording Data	④ SO ₂ Concentration, ppm		⑤ NO _x Concentration, ppm		⑥ Gas Temperature, F				⑩ INLET O ₂
					Inlet	Outlet	Inlet	Outlet	T80 0300 SNOX Inlet	S ₂ Reactor Inlet	WSA Tower Inlet	Tower Outlet	
			0800	MNP			6-						
112	685	6	0830		2153	79	678	43	390	787	503	193	4.0
108	684	6	0900		2125	74	674	54	389	788	504	193	4.0
107	684	6	0930		2151	73	664	53	391	788	504	195	4.0
105	685	6	1000		2174	74	663	53	390	786	504	196	3.7
107	684	6	1030		2138	75	657	53	390	787	504	198	4.0
107	686	5	1100		2139	75	651	51	389	787	504	199	3.9
105	686	6	1130		2041	66	685	63	390	788	504	204	3.9
105	686	7	1200		2067	63	683	64	386	787	505	206	3.9
115	687	6	1230		1987	66	686	49	387	788	504	200	4.2
113	687	6	1300		1988	65	693	53	388	788	505	198	4.0
116	688	5	1330	2047	69	694	51	384	787	505	200	3.9	
115	688	5	1400	1999	65	684	50	383	787	504	201	4.3	
109	687	5	1430	2076	71	699	50	384	788	504	196	4.0	
110	687	5	1500	MNP	2052	65	697	63	383	787	504	196	3.9
111	687	6	30	SNA	2046	65	707	63	386	790	504	198	4.1
112	687	6	1600		1985	60	686	63	383	787	504	199	4.5
110	687	6	30		2005	57	715	68	383	788	505	198	4.5
109	687	6	1700		1969	56	716	71	382	788	505	198	4.1
116	688	5	30		1984	65	684	48	384	787	504	199	4.1
117	687	6	1800		2076	73	674	44	384	788	504	200	3.7
117	688	6	30		2100	71	690	50	383	787	504	199	3.8
117	688	5	1900		2045	68	662	44	383	789	504	197	4.3
					V								
					SNA								

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TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM
 BOILER PROCESS DATA
 (Record data hourly)

*Korman
Orbit*

Date: 24 July 1993

Time	Initials of Personnel Recording Data	Load, MW	Excess Oxygen, percent 14	Steam temp., F <i>6B 6A 6B</i>		Drum ^{6A} Steam Pres., psig	Throttle Steam/A Flow, klb/hr
				SH Outlet	RH Outlet		
0800	MEP	116.5	1.43	999	969	1534	872.42
0900	RDD	117.5	1.77	1000	978	1536	874.31
1000	RDD	117.1	1.44	1000	976	1536	874.97
1100	RDD	117.1	1.54	1000	974	1537	874.02
1200	RDD	117.3	1.28	999	978	1537	874.33
1300	RDD	117.3	1.37	1000	981	1535	876.00
1400	RDD	117.5	1.63	1000	981	1537	878.23
1500	RDD	117.2	1.50	999	977	1536	877.28
1500	INCREASED O ₂		Maint	from 70% - 75%		WPR	
1600	WPR	117.2	2.01	1000	983	1534	877.6
1700	WPR	117.5	1.57	1000	985	1535	878.5
1800	WPR	117.0	1.3	999	975	1537	878.6
1900	WPR	117.5	1.8	1000	985	1534	878.3

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TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM
EMISSIONS DATA
(Record data hourly)

Total
Coal
Flow 60 2H 3H

Date: 24 July 1993

Time	Initials of Personnel Recording Data	Stack Oxygen, percent Lb/hr	Stack SO ₂ , ppm #/MM Btu PRIMARY	Stack NO _x , ppm #/MM Btu PRIMARY	Stack Opacity, percent
0800	MEPJ	90.25	1.59	0.75	3.10
0900	RDD	90.3	1.62	0.79	3.56
1000	RDD	90.3	1.63	0.71	3.56
1100	RDD	90.0	1.64	0.73	3.56
1200	RDD	89.6	1.56	0.80	3.56
1300	RDD	91.4	1.46	0.84	3.56
1400	RDD	90.7	1.49	0.83	3.10
1500	RDD	90.8	1.50	0.83	3.16
1600	WPR	91.6	1.51	0.89	3.0
1700	WPR	91.1	1.45	0.86	3.1
1800	WPR	90.2	1.51	0.74	3.0
1900	WPR	91.3	1.59	0.82	3.0

From 0925-0929 SO₂
READ 4.63

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Initials/Date

APPENDIX B

AUDITING

AUDITING

B-1. Introduction

During the week of July 18-24, while Battelle and Chester staff conducted six days of solid, liquid, and flue gas sampling at the SNOX process, Research Triangle Institute (RTI) conducted technical and performance audits of the field effort. Those audits took place on July 20 and 21, 1993.

The RTI activities included technical audits, performance audits, and CEM calibrations. Those separate activities are discussed in Sections B-2 through B-4, respectively. The RTI Field Sampling Audit Report for Niles Station is included at the end of this Appendix.

B-2. Technical Audits

The following are responses to specific comments made by RTI; these are organized under the same headings and in the same order as the original comments in the enclosed RTI report.

Findings

- (1) There is no intent of assigning all of the probe rinse particulate to any one particle size fraction. This material is considered as a separate component, for example in discussion of particle size distributions in Section 7.3. Given the constraints of flue gas sampling at the baghouse inlet, there was no alternative to use of the extractive sampling mode.
- (2) The glass cyclones were designed to provide the desired particle size cuts, and to be accommodated within a Method 5 heated box along with the particulate filter. Insufficient time was available before the field study to conduct verification tests, but

the flow rates used in the field were appropriate for achieving the desired 10 μm and 5 μm size cuts.

- (3) It is not entirely clear from the RTI comment which probe had the worn insulation at Location 19. In any case, as the RTI auditors noted, the impact on the data is probably insignificant. Comparison of measurements at Locations 18 and 19 (e.g., probe rinses) would not provide any useful information on probe differences, because of the great difference in flue gas composition at these sites upstream and downstream of the baghouse.
- (4) The Fyrite solutions used by Chester for O_2 measurements were replaced regularly, following this comment from the RTI auditors.
- (5) No response needed.
- (6) Blank samples were taken of all reagents made up with the deionized water, for blank subtraction.
- (7) The impact on data should be minimal, since gas flow/reagent volume ratios were similar with the two sizes of glassware.
- (8) The potential for some effect from SO_2 in the flue gas is real, however, it is not clear how "bleaching" of DNPH solution by SO_2 could be greater in the second impinger than in the first. The procedure used was discussed with knowledgeable staff at U.S. EPA prior to the study, and the aldehyde results appear reasonable (see Section 5.7).
- (9) The impact on ash composition data is almost certainly negligible, given the ample quantities of ash collected, and the small amount of damage to the sampling device.
- (10) The selection of which baghouse hoppers to sample was not based on an assumption by Battelle, but upon consultation with ABB staff concerning the quantities of material collected in each hopper. Compositing of the baghouse samples also reduces the impact of any inhomogeneities. Note that only composite samples were analyzed, so differences in the ash composition from different hoppers cannot be discerned from the analytical data.

Observations

- (1) No comment needed.
- (2) No comment needed.
- (3) This comment refers to an issue that field staff were not qualified to address. Careful review of analytical data has been conducted in compiling data for this report, and in preparing study data for the PISCES data base format.

Recommendations

- (1) This recommendation appears to contradict the comments made by RTI under Findings, Item 5. No critical weighings were conducted in the field, so NIST-traceable weigh checks are unnecessary.
- (2) Reagent blanks were analyzed for all sampling methods, and the data shown in this report have been properly corrected.
- (3) The scope of this study does not include such an investigation. As noted above, guidance from U.S. EPA indicates the method should not be invalidated by elevated SO₂ levels.
- (4) The use of such a model would be very prone to error, given the frequently changing configuration of the probe and flexible line combination. No useful information would be obtained from such an effort.
- (5) Validation testing such as that suggested is beyond the scope of the present study, though it may be of value in future work. Given that the cyclones were used at only one location having a very high particulate loading, such an effort would have minimal effect on the results of this study.
- (6) During sampling subsequent to the audit, the Fyrite sample solutions were changed regularly to avoid use of aged solutions.

B-3. Performance Audits

As indicated in the enclosed RTI Field Sampling Audit Report, RTI performed Performance Evaluation Audits (PEA) by spiking sampling materials with target analytes. Tables B-1, B-2, B-3, and B-4 show the results of analyses of the spiked samples for metals, PAH, VOST, and aldehydes, respectively. For each spiked sample, the mass of analyte found by Battelle, the mass of analyte spiked into the sample as reported by RTI, and the percent recovery of the spiked analyte are shown. The significance of these results is discussed according to analyte class in the following paragraphs.

Metals

As shown in Table B-1, six of the recoveries for the PEA samples are outside of the range of 70 to 130 percent. Battelle's accuracy requirement for metals was 80 to 120 percent recovery for certified standard materials. Since the PEA samples are not certified standards, and since analyte losses may have occurred during spiking, a wider range for these analyses is considered acceptable.

For the filter samples, mercury and selenium showed lower recoveries than the other three analytes (excluding cadmium in N-18-MUM-721). This result is attributed to the potential losses of these compounds during the spiking process or during sample handling, preparation, and analysis.

The 55 percent recovery for cadmium in N-18-MUM-721 filter is considered an outlier since cadmium recoveries for all other samples are acceptable.

The 44 percent recovery for selenium in N-18-MUM-721 is attributed to the low spike level and the anticipated lower analytical accuracy near the detection limit of a method. The detection limit for selenium in prepared H₂O₂ impinger solution was 0.01 mg/L; the detected level in N-18-MUM-721 was 0.07 mg/L. This low selenium recovery is not expected to occur in actual samples because selenium levels in most samples were found at much higher concentrations.

PAH

As shown in Table B-2, recoveries for almost all of the PAH in the PEA samples were between 50 to 150 percent. This accuracy limit was established on this project for recovery of deuterated PAH spiked into samples prior to extraction and is reasonable to use as a limit for the PEA samples.

The low recovery of the volatile PAH naphthalene results principally because this compound was spiked onto blank filters rather than onto particulate matter on filters. Volatile PAH are more stable on particulate matter than on blank filters. Much of the spiked naphthalene was likely lost from the blank filters during sample handling and transporting. Acenaphthylene and acenaphthene are similarly volatile and also showed slightly lower recoveries on the filter PEA samples in comparison to the other PAH. An alternative approach to spiking would be to spike collected filter samples with deuterated PAH. The low recovery for naphthalene on the filter PEA samples is not expected to affect sample results since this volatile PAH would be bound on particulate in actual filter samples and less susceptible to the losses described here.

The recovery (162 percent) for dibenzo(a,h)anthracene was higher than 150 percent for one of the four PEA samples. Since all the recoveries for other PAH in this sample were in the acceptable range, this high recovery is probably due to contamination in the field spiking process, or in the sample handling, or in the laboratory. However, this high recovery should not affect sample results because dibenzo(a,h)anthracene was not detected in the field blanks and laboratory method blanks.

VOST

For the majority of the VOST compounds, recoveries of the spiked compounds into the PEA samples were within 26 to 160 percent. This accuracy limit was established for recovery of surrogate spikes from VOST samples and is reasonable to use as a limit for PEA samples.

The recoveries for bromomethane were lower than 26 percent in two of the three PEA samples. These low recoveries are attributed to losses due to volatility. It cannot be determined whether these losses may have occurred during the spiking process or during analysis. If losses occurred during analysis, then sample results may have been affected in a similar manner.

The recoveries for trichloroethene were higher than 160 percent for two of the three PEA samples. This high recovery is probably not due to contamination in the field or laboratory since trichloroethene was not detected in actual samples (detection limit of 0.025 μg). It may be due to an error in the amount spiked or inaccurate quantification (i.e., calibration) of trichloroethene in the analysis. However, these two causes would not prevent the detection of trichloroethene in the actual samples; and since trichloroethene was not detected, the high trichloroethene recoveries do not affect sample results.

Vinyl chloride was not detected (ND) in the PEA samples at a detection limit of 0.025 μg . Since the spike levels are well above the detection limit, these results suggest that, like bromomethane, losses of vinyl chloride may have occurred during the spiking process or during analysis.

Methylene chloride results are not reported (NR) for the PEA samples because spurious contamination in VOST blank samples made data for all samples suspect.

Battelle did not analyze 1,3-butadiene, trichlorofluoromethane, or 1,2-dibromomethane as a part of this project so results are not provided for these compounds in the PEA samples.

Aldehydes

The recoveries for formaldehyde spiked into the PEA samples were between 50 to 150 percent as listed in Table B-4. This limit was established on this project for recovery of aldehydes spiked into acetonitrile and is reasonable to use as a limit for the PEA samples. These acceptable recoveries suggest that recovery of target aldehydes from actual samples was effective.

TABLE B-1. RESULTS FOR RTI PERFORMANCE EVALUATION AUDITS - METALS

	N-18-MUM-721 Filter			N-19-MUM-721 Filter			N-18-MUM-721 H2O2 Solution			N-19-MUM-721 H2O2 Solution			N-18-MUM-721 KMNO4 Solution			N-19-MUM-721 KMNO4 Solution		
	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery
Arsenic	26.8	30	89	28.3	30	94	23.1	30	77	23.1	30	77	NS	NS	NC	NS	NS	NC
Cadmium	10.9	20	55 *	26.5	30	88	14.4	20	72	30.6	40	77	NS	NS	NC	NS	NS	NC
Lead	13.1	15	87	27.3	30	91	11.88	15	79	7.5	10	75	NS	NS	NC	NS	NS	NC
Mercury	13.4	30	45 *	14	30	47 *	25.2	30	84	NS	NS	NC	24.8	20	124	13.12	10	131 *
Selenium	7.8	10	78	14.2	30	47 *	4.38	10	44 *	35.6	50	71	NS	NS	NC	NS	NS	NC

*Recovery outside of 70 to 130 percent.

NS = Not spiked; NC = Not calculated.

TABLE B-2. RESULTS FOR RTI PERFORMANCE EVALUATION AUDITS - PAH

Compound	N-18-MM5-720 (XAD)			N-19-MM5-720 (XAD)			N-18-MM5-720 (Filter)			N-19-MM5-720 (Filter)		
	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery
Naphthalene	10.80	10.0	108	15.00	20.0	75	0.288	5.0	6 *	0.671	15.0	4 *
Acenaphthylene	18.40	20.0	92	25.90	40.0	65	7.05	10.0	71	19.00	30.0	63
Acenaphthene	8.60	10.0	86	14.20	20.0	71	3.43	5.0	69	9.84	15.0	66
Fluorene	2.08	2.0	104	3.66	4.0	92	1.01	1.0	101	2.85	3.0	95
Phenanthrene	0.958	1.0	96	1.72	2.0	86	0.540	0.5	108	1.45	1.5	97
Anthracene	0.942	1.0	94	1.75	2.0	88	0.467	0.5	93	1.40	1.5	93
Fluoranthene	1.94	2.0	97	3.47	4.0	87	1.01	1.0	101	2.93	3.0	98
Pyrene	0.956	1.0	96	1.72	2.0	86	0.482	0.5	96	1.40	1.5	93
Benz(a)anthracene	1.05	1.0	105	2.08	2.0	104	0.575	0.5	115	2.05	1.5	137
Chrysene	1.09	1.0	109	1.80	2.0	90	0.534	0.5	107	1.88	1.5	125
Benzo(b+k)fluoranthene	3.95	3.0	132	8.40	6.0	140	1.88	1.5	125	4.37	4.5	97
Benzo(a)pyrene	1.16	1.0	116	2.48	2.0	124	0.486	0.5	97	1.64	1.5	109
Indeno(1,2,3-c,d)pyrene	1.03	1.0	103	2.05	2.0	103	0.45	0.5	90	1.83	1.5	122
Dibenzo(a,h)anthracene	2.57	2.0	129	5.79	4.0	145	1.15	1.0	115	4.86	3.0	162 *
Benzo(g,h,i)perylene	1.94	2.0	97	4.23	4.0	106	0.93	1.0	93	3.65	3.0	122

*Recovery outside of 50 to 150 percent.

TABLE B-3. RESULTS FOR RTI PERFORMANCE EVALUATION AUDITS - VOST

Compound	N-20-VOS-721-4			N-20-VOS-721-5			N-20-VOS-721-6		
	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery
Bromomethane	0.078	0.249	31	0.061	0.248	25 *	0.041	0.252	16 *
Chloroform	0.143	0.174	82	0.160	0.174	92	0.152	0.176	86
1,2-Dichloroethane	0.151	0.147	103	0.097	0.147	66	0.102	0.149	68
1,1,1-Trichloroethane	0.339	0.296	115	0.448	0.295	152	0.410	0.299	137
Carbon tetrachloride	0.221	0.245	90	0.275	0.244	113	0.273	0.247	111
1,2-Dichloropropane	0.566	0.382	148	0.470	0.380	124	0.458	0.385	119
Trichloroethene	0.258	0.206	125	0.384	0.205	187 *	0.363	0.208	175 *
Benzene	0.177	0.127	139	0.154	0.126	122	0.150	0.128	117
Tetrachloroethene	0.361	0.281	128	0.405	0.280	145	0.382	0.284	135
Toluene	0.271	0.302	90	0.302	0.300	101	0.293	0.304	96
Chlorobenzene	0.427	0.353	121	0.444	0.351	126	0.430	0.356	121
Ethylbenzene	0.319	0.306	104	0.320	0.305	105	0.285	0.309	92
Xylenes (Total)	0.138	0.317	44	0.123	0.316	39	0.088	0.320	27
Vinyl chloride	ND	0.0798	NC	ND	0.0794	NC	ND	0.0805	NC
Methylene chloride	NR	0.225	NC	NR	0.224	NC	NR	0.227	NC
1,3-Butadiene	NA	0.052	NC	NA	0.0514	NC	NA	0.0520	NC
Trichlorofluoromethane	NA	0.432	NC	NA	0.430	NC	NA	0.436	NC
1,2-Dibromomethane	NA	0.597	NC	NA	0.595	NC	NA	0.603	NC

*Recovery outside of 26 to 160 percent.

ND = Not detected (detection limit of 0.025 ug); NR = Not reported; NA = Not analyzed.

TABLE B-4. RESULTS FOR RTI PERFORMANCE EVALUATION AUDITS - ALDEHYDE

Compound	N-ALD-DUP-721 (Imp. 2)			N-ALD-DUP-721 (Imp. 3)		
	Found (ug)	Spiked (ug)	Percent Recovery	Found (ug)	Spiked (ug)	Percent Recovery
Formaldehyde	2.347	2	117	3.85	3.2	120

B-4. CEM and Sensor Audits

As described in the enclosed RTI report, RTI audited Battelle's paramagnetic O₂ analyzers, Chester Environmental's Fyrite O₂ analyzers, dry gas meters from both groups, and SO₂ and NO_x CEM instruments operated by ABB at the SNOX facility. Results of these audits are tabulated in the enclosed RTI report. Battelle's dry gas meter results, noted in the RTI report, were provided to RTI, and to the best of our knowledge agreed within a few percent with the RTI audit.

B-5. Battelle's Audits

A copy of Battelle's internal audit report on the project is included as the last portion of this appendix.

B-6. Results from Coal Analysis Round Robin

Results from the coal analysis round robin coordinated by Consol, Inc. (Consol) for DOE/PETC are presented in Tables B-5 and B-6 for Samples F and O, respectively, which are the duplicate samples generated from Niles coal provided by Battelle to Consol.

A comparison of the average round robin results for Niles coal from all five laboratories participating in the study with the results provided in Section 5 of this report for Niles boiler feed coal is provided in Table B-7. In general, the relative percent difference between the average results for detected elements in the boiler feed coal presented in Table 5-10 and the average result obtained for Niles coal (designated Samples F and O) by the five laboratories participating in the round robin study was less than 30 percent.

Antimony, arsenic, cadmium, copper, molybdenum, nickel, and selenium had relative percent differences above 30 percent; at 75 percent, 33 percent, 116 percent, 35 percent, 56 percent, and 91 percent, respectively. The large cadmium and molybdenum relative percent differences were due to the non-detect results obtained for each. For antimony and copper, the laboratory procedures apparently did not recover these elements

as expected. Although the arsenic and nickel relative percent differences were above 30 percent (33 percent and 56 percent, respectively), the percent relative standard deviation associated with each in the round robin study was also relatively high (averages of 36.2 percent and 33.1 percent, respectively) which suggested that the round robin results were not more accurate than the result presented in Table 5-10. The round robin study also demonstrated that the large relative percent difference for selenium (91 percent) was not unusual given the poor accuracy of the round robin results for this element.

TABLE B-5. INDIVIDUAL LABORATORY ANALYSES OF ROUND ROBIN SAMPLE F

PPM DRY WHOLE COAL BASIS

TRACE ELEMENTS	LAB I		LAB II		LAB III		LAB IV		LAB V	
	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2
As	4.82	50.43	35.51	35.07	17	17	24	ND	28.7	28.1
B	89.23	96.74	64.7	63.46	73	76	68	65	64.9	53.4
Ba	55.38	53.51	86.4	98.1	93	85.6	83	83	59	87.3
Be	2.67	2.78	2.14	2.18	1.9	2	2.3	2.4	2.75	2.41
Cd	0.07	0.09	0.1	0.12	<0.3	<0.3	<0.4	<0.4	0.093	ND
Cr	22.56	22.64	25.35	28.97	19.7	21.7	20	21	11	14.4
Co	9.74	11.32	5.9	5.88	6.23	6	8	7	4.56	3.59
Cu	21.54	21.61	17.95	17.07	<37.8	<37.4	20	21	22.2	29
F	<100	<100	90.46	92.55	90	100	ND	ND	63	65
Hg	0.21	0.27	0.238	0.251	0.24	0.26	0.25	0.25	0.338	0.323
Mn	25.64	15.73	26.6	26.6	27	23.2	30	31	25.5	26.6
Mo	7.38	6.48	4.25	4.46	3.65	3.8	<6	<6	1.92	1.51
Ni	26.67	29.84	21.98	22.39	26.8	28.2	25	28	23.5	23.8
Pb	7.28	<0.6	15.67	15.66	15	15	16	17	12.3	11.5
Sb	1.95	2.88	2.2	2.25	1.97	2.1	2	2	ND	ND
Se	1.13	2.26	3.27	3.29	2	2	3	ND	1.5	2.2
V	40	42.19	28.06	27.98	33.6	36.3	35	36	35.5	38.2

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% DRY BASIS

PROXIMATE & ULTIMATE

ASH	13.42	13.42	13.42	13.45	13.44	13.4	13.21	13.27	13.39	13.37
CARBON	66.75	66.24	71.23	71.11	71.34	71.38	70.41	70.23	69.98	69.94
HYDROGEN	5.3	5.28	4.76	4.77	4.94	4.88	4.63	4.58	4.77	4.75
NITROGEN	1.39	1.35	1.43	1.43	1.45	1.39	1.39	1.35	1.28	1.32
SULFUR	3.1	2.96	2.9	2.95	3.1	3	2.96	2.99	3.16	3.13
CHLORINE	0.6	0.05	0.155	0.14	0.119	0.122	ND	ND	0.12	0.13
Btu/lb	12207	10953	12674	12648	12645	12609	12665	12688	12623	12583

% DRY ASH

MAJOR ASH ELEMENTS

SiO ₂	45.86	49.3	47.16	46.04	ND	ND	44.91	ND	46.1	45.3
Al ₂ O ₃	23.1	24.62	23.19	23.37	22.98	23.97	22.55	ND	22.1	22.2
TiO ₂	1.12	1.23	1.06	1.07	1.3	1.12	1.12	ND	1	1
Fe ₂ O ₃	20.76	23.02	21.68	22.01	20.9	19.67	ND	ND	21.4	21
CaO	1.18	1.07	1.85	1.91	1.44	1.36	ND	ND	1.7	1.8
MgO	0.43	0.33	0.87	0.87	0.73	0.86	ND	ND	0.86	0.86
Na ₂ O ₃	0.22	0.21	0.3	0.3	0.25	0.25	0.38	ND	0.24	0.26
K ₂ O	2.39	2.22	2.3	2.32	1.92	2.11	2.05	ND	2.2	2.2
P ₂ O ₅	0.47	0.53	0.48	0.46	0.89	0.89	ND	ND	0.45	0.46
SO ₃	ND	ND	1.78	1.83	ND	ND	ND	ND	1.53	1.49

TABLE B-6. INDIVIDUAL LABORATORY ANALYSES OF ROUND ROBIN SAMPLE O
PPM DRY WHOLE COAL BASIS

TRACE ELEMENTS	LAB I		LAB II		LAB III		LAB IV		LAB V	
	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2
As	46.12	35.85	34.98	36.04	21	18	27	ND	29.4	31
B	99.41	74.78	58.5	62.38	73	77	72	80	54.5	47.8
Ba	53.29	46.15	84.8	86.2	107	100	85	89	ND	85
Be	2.97	2.25	1.9	2.03	2.7	2.4	2.1	2.4	2.58	2.61
Cd	0.11	0.08	0.14	0.13	<0.3	<0.3	<0.4	<0.4	0.11	ND
Cr	22.55	18.44	20.68	19.39	21	22.6	20	20	13.3	13.9
Co	9.74	9.12	5.9	6.16	6.67	7.72	8	7	4.6	5.8
Cu	23.57	18.44	17.81	18.62	<31	<32.6	22	22	22.7	23.5
F	0.01	0.1	80.03	68.12	90	90	ND	ND	73	73
Hg	0.14	0.3	0.248	0.273	0.23	0.23	0.2	0.2	0.399	0.353
Mn	26.64	21.51	27.2	24.8	27.4	30.4	30	31	26	26.4
Mo	10.25	5.33	4.05	4.09	5.09	5.68	<6	<6	1.85	2.79
Ni	27.67	21.51	21.12	22.1	54.5	61.9	26	25	23.7	24.1
Pb	9.94	11.27	15.29	15.14	17	20	19	18	10.5	9.7
Sb	2.15	1.43	2.09	2.17	1.85	1.78	2	2	2.6	2.4
Se	2.05	2.15	3.39	3.37	2	3	3	ND	3.3	2.2
V	44.07	33.8	28.47	30.13	32.3	32.1	28	26	35.6	36.6
% DRY BASIS										
PROXIMATE & ULTIMATE										
ASH	13.29	13.46	13.32	13.3	13.28	13.4	13.12	13.18	13.31	13.46
CARBON	69.61	69.56	71.35	71.16	71.19	71.46	70.38	70.79	70.5	70.66
HYDROGEN	5.08	5.24	4.82	4.78	4.91	5	4.6	4.65	4.76	4.79
NITROGEN	1.3	1.31	1.34	1.47	1.41	1.37	1.36	1.38	1.33	1.35
SULFUR	3.08	3.1	2.92	2.97	3.02	2.99	3.01	3.04	2.93	2.91
CHLORINE	0.02	0.02	0.13	0.13	0.127	0.13	ND	ND	0.12	0.12
Btu/lb	11774	11530	12737	12720	12654	12655	12690	12708	12644	12637
% DRY ASH										
MAJOR ASH ELEMENTS										
SiO ₂	52.88	39.14	46.16	46.9	ND	ND	42.89	ND	45.3	45
Al ₂ O ₃	24.76	20.13	23.46	23.32	20.52	20.27	21.3	ND	22.5	22.6
TiO ₂	1.29	0.96	1.09	1.08	1.03	1.02	2.32	ND	1.1	1.1
Fe ₂ O ₃	23.15	17.41	22.28	22.17	20.6	22.79	ND	ND	21	21.4
CaO	1.19	0.97	1.84	1.8	1.31	1.22	ND	ND	1.7	1.7
MgO	0.37	0.44	0.88	0.87	0.83	0.77	ND	ND	0.85	0.85
Na ₂ O	0.24	0.21	0.31	0.29	0.25	0.25	0.36	ND	0.47	0.44
K ₂ O	2.51	2.11	2.32	2.32	2.27	2.33	1.72	ND	2.2	2.2
P ₂ O ₅	0.53	0.4	0.48	0.47	0.97	0.85	ND	ND	0.49	0.53
SO ₃	ND	ND	1.83	1.75	ND	ND	ND	ND	1.74	1.74

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TABLE B-7. COMPARISON OF BOILER FEED COAL RESULTS
WITH ROUND ROBIN RESULTS

Analyte	Average Table 5-10 Result ($\mu\text{g/g}$, as received)	Average Table 5-10 Result ($\mu\text{g/g}$, dry)*	Average Round Robin Result (F/O) ($\mu\text{g/g}$, dry)	Relative Percent Difference
Aluminum	13700	14600	15925	9
Antimony	0.9	0.96	2.1	75
Arsenic	34	36	26	33
Barium	63	67	76.1	13
Beryllium	2.27	2.41	2.37	2
Boron	53	56	70.7	23
Cadmium	ND < 0.3	ND < 0.319	0.085	116
Chromium	15	16	20	23
Cobalt	5.4	5.7	6.95	19
Copper	14	15	21.2	35
Lead	13	14	13.6	2
Manganese	27	29	26.5	8
Mercury	0.26	0.28	0.26	6
Molybdenum	ND < 3	ND < 3.19	4.54	35
Nickel	15	16	28.2	56
Potassium	2000	2100	2405	14
Selenium	0.9	0.96	2.56	91
Silicon	24600	26100	28499	9
Sodium	300	319	297	7
Titanium	767	815	976	18
Vanadium	26	28	34	21

*Calculated using average moisture value of 5.9 percent for boiler feed coal.

RESEARCH TRIANGLE INSTITUTE

RTI/5960/193 - 07D

August 12, 1993

QA/QC AUDITS ON DOE UTILITY BOILER TEST PROGRAM

FIELD SAMPLING AUDIT REPORT

Site: Niles Station Unit 2, Niles, OH

DOE Contractor: Battelle

DOE Project Officer: Robert Evans

Performed for

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Office of Air Quality Planning and Standards
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Research Triangle Park, NC 27711**

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**Under EPA Contract No. 68D10009
Work Assignment No. I-193**

**POST OFFICE BOX 12194 RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709-2194
B-16**

Field Audit of:

**Niles Station Unit 2
Ohio Edison
Niles, OH**

**Contractors: Battelle Memorial Institute
Chester Environmental**

Dates: July 20 and 21, 1993

RTI Personnel: J.B. Flanagan and L.L. Pearce

Introduction

Niles Station Unit 2 is owned and operated by the Ohio Edison system and is located adjacent to the Mahoning River just south of Niles, Ohio. Unit 2 is a cyclone coal-fired boiler, burning bituminous coal from various sources. The coal has an average sulfur content of 3.0 percent. Typical gross electrical generation at full load is 100 MW. To maintain full load, four star-valve feeders supply approximately 44 tons per hour of coal into four burners. Approximately 20 to 30 percent of the ash in the coal is fly ash. An electrostatic precipitator (ESP) is the principal control for entrained fly ash. The rest of the ash, approximately 70 to 80 percent, is retained as molten slag in the bottom of the boiler and then drained into a tank filled with water.

A slipstream exits unit 2 prior to the ESP and is routed to the Innovative Clean Coal Technology Wet Gas Sulfuric Acid - Selective Catalytic Reduction of NO_x (ICCT WSA-SNOX) pilot plant managed by ABB Combustion Engineering. The WSA-SNOX process provides SO_2 and NO_x control on 35 percent of the flue gas from unit 2. There are no SO_2 or NO_x control systems for the remaining 65 percent of the flue gas. The WSA-SNOX process uses a selective catalytic reactor for the removal of NO_x and an SO_2 catalytic reactor in sequence with a cooling tower to convert SO_2 to sulfuric acid.

During the audit, the Niles plant had repeated operational problems with one of the four coal feeders. On Tuesday, July 20, sampling was postponed because of this problem. By 1:00 p.m. on Wednesday, July 21, this had been resolved, and a full day of organic sampling commenced. Thus, the entire sampling schedule was shifted.

Despite the schedule change, the auditors were able to complete all performance evaluation audits (PEAs) and audit questionnaires. In addition, more time was available on Tuesday and on Wednesday morning to interview the sampling personnel and to examine records. The auditors departed the site at approximately 6:00 p.m. on Wednesday.

Findings

1. **Finding:** Particulate fractions data may be compressed because cyclones were operated in an extractive mode instead of in the stack. In-stack sampling could not be performed because the ports were too small to allow the cyclones to pass through. Obtaining the sample required a sample probe and flexible Teflon line. According to Tom Kelly, up to 15 feet of tubing (probe length plus flexible line) were needed when performing a full traverse. When performing single-point sampling, shorter tubing runs were used. Battelle will wash the probe and lines to recover any particulate material lost.

Effect on Data: Extractive versus in-stack cyclone sampling may lead to different results because of particle loss in the probe and lines. Depending on the gas flow rate, tubing diameter, tubing length, and aerodynamic diameter particle loss will vary.

Rinsing the probe and flexible line is a good idea, but assigning all of this material to the first size fraction is questionable. See the Recommendation section of this report for a suggested investigation that might help clarify this issue.

2. **Finding:** Glass cyclones of new design were used to collect particulate for size-fractionated analysis of metals. According to George Sverdrup, these cyclones were of an original Battelle design and were developed specifically for this program and fabricated only weeks prior to the Niles field testing.

Effect on Data: Unknown. Using all-glass cyclones should eliminate the chance of metal contamination that is possible with the use of metal cyclones, but because the cyclones were fabricated only a few weeks before the test, it is not known if validation testing was adequate.

3. **Finding:** On one of the probes operated by Battelle, there was insufficient insulation to shield the thermocouple that controlled the temperature of the probe at 250°F from the high temperature flue gas. Consequently, when the thermocouple entered the duct, approximately half-way into the traverse, the temperature controller shut down thereby allowing the portion out of the stack to drop below 250°F. In Figure 1, the controller is controlling the probe heater to heat the probe to 250°F. In Figure 2, the controller is turned off. The probe inside the duct is at a high temperature, ~380°F, while the probe outside the duct is at a lower temperature, ~198°F, measured by Battelle.

Effect on Data: A few feet of the probe below 250°F seems unlikely to cause significant problems. This probe, operated at sampling point #19, should be compared with the probe at point #18 (which had adequate insulation) for evidence of any unexpected difference in probe rinse concentrations due to condensation in the unheated section.

Figure 1. Thermocouple outside duct.

Figure 2. Thermocouple inside duct.

4. **Finding:** The use of old absorbing solution in the Fyrite oxygen analyzers may have led to low oxygen results during the performance evaluation audit (PEA). During the Fyrite oxygen analyzer PEA with analyzer set #1, the oxygen analyzer measured oxygen 24 percent low compared to RTI's standard gas cylinder. The second oxygen analyzer measured oxygen approximately 3 percent lower than RTI's oxygen standard. It was determined that the source of error may have been the use of old absorbing solution in the analyzer.

Effect on Data: Even though Chester Environmental checked the Fyrite #1 periodically with ambient air, the oxygen analyzer continued to give erroneous results when challenged with a standard oxygen concentration. Checks of the Fyrite against a standard on a regular basis should be performed and the absorbing solution should be regularly replaced to prevent measuring incorrect oxygen concentrations at the flue gas sampling locations. Accurate oxygen measurements are necessary in determining the air in-leakage at the flue gas sampling locations for flue gas molecular weight calculations.

5. **Finding:** The field balance used to weigh impinger solutions, drierite, etc., was not being calibrated using NIST-traceable weights. Section 5.1.2.1, "Field Sampling Equipment," of the Sampling/Testing and QA/QC Plan states, "Field checks of balance accuracy will be made daily using a set of QC weights which have been weighed side-by-side with NIST-traceable weights."

Effect on Data: This will have minimal effects on data because none of the weighings are used for analytical measurements. This balance was not used for weighing filters, impactor catch, or any other critical measurements.

6. **Finding:** Water used for washing and making impinger solutions was a commercial brand of unknown chemical composition.

Effect on Data: The water should be carefully tested for the presence of any of the target analytes. If results show no contamination, or if background levels can be subtracted, there should be minimal impact on data.

7. **Finding:** Glassware used by Battelle's subcontractor, Chester Environmental, for aldehyde analysis was of a different size than that used by Battelle. Battelle used midjet impingers, while Chester used full-size impingers.

Effect on Data: Differences will probably be minimal, but without side-by-side comparison information, it would be impossible to be certain that the data are exactly comparable.

8. Finding: There appeared to be some bleaching of the DNPH solution, particularly the second DNPH impinger, possibly due to the high levels of SO₂.

Effect on Data: Unknown. See recommendations section for a suggested investigation.

9. Finding: Baghouse ash may have been contaminated by the sampling device. Battelle employed a painted steel tube within a tube device for sampling baghouse ash. Ash samples were obtained by inserting the device into the ash hopper, collecting the ash sample, and dispensing the collected sample into an amber jar. Auditors noticed a few spots where the black enamel paint had flaked off the tube and rusty metal was exposed.

Effect on Data: Sample contamination could result. The effect on the data is unknown, but trace metals analyses for these samples should be reviewed for any evidence of contamination.

10. Finding: Sampling of the baghouse ash may not have been representative. Baghouse ash was sampled from three of the six ash hoppers. This sampling configuration resulted from an obstructed sampling port for one of the ash hoppers.

Effect on Data: Battelle assumed that all six hoppers held identical material and the sampling ash from three hoppers was a representative sample of baghouse ash. Each of the ash hoppers will contain identical material given that there is a uniform flow of flue gas through the compartment of the baghouse and a uniform distribution of particles in the flue gas.

Auditors observed a 90-degree elbow in the duct at the baghouse inlet. This sharp bend in the ductwork could cause some gas flow disturbances and result in uneven particle distribution. Since the velocity traverses are unable to be performed at this location, the discovery of any effects of this disturbance are pending laboratory analysis.

Observations

1. No grease was used with Battelle's sampling trains. Because train components had been preselected for good fit, leakage was held to a minimum. Chester appeared to use Teflon tape on some of the ground glass joints in their trains to minimize leakage.
2. The sampling ports that had been provided in the SNOX facility ducts were only about 2 inches in usable diameter. This limited the diameter of probes used and prevented in-stack use of larger devices such as cascade impactors and cyclones. Battelle and

Chester were well-prepared for most potential problems resulting from the small port openings; however, comparison of these data with those obtained at other sites may reveal differences due to extractive versus in-stack sampling.

3. Field personnel did not know if any single data base would be used to manage the analytical data. If a laboratory audit is performed, it would be a good idea to audit data transfers between the data bases.

Recommendations

1. The field balance should be checked daily with NIST-traceable weights. Checks should be recorded in the log book.
2. Water analyses, including reagent blanks for the impinger solutions made with the Magnetic Springs water, should be presented in the QC section of the final report.
3. The observed bleaching of DNPH solutions should be investigated. It is especially important to verify (1) that high levels of SO_2 or NO_x do not degrade the adducts after they are formed, and (2) that unreacted DNPH is not degraded to such an extent that there is incomplete capture of the aldehydes and ketones. Stack conditions could be recreated in the laboratory to investigate the reactivity of DNPH and adduct solutions with high SO_2 gas, high NO_x gas, and zero air.
4. A computer model should be run to estimate the amount of particulate material lost in the tubing between the sampling nozzle and the cyclones outside the stack. Results of size-fractionated chemical analysis should be corrected based on modeling results and probe and tubing wash data.
5. The all-glass cyclones fabricated by Battelle should be subject to validation testing since they are of a new design. Important considerations include accuracy of calculated cutpoints, presence of any static charge buildup on the nonconductive glass surfaces, and losses in the sample probe and flexible line leading from the duct to the cyclone.
6. Battelle should assure that Chester checks the Fyrite oxygen analysis against a standard on a regular basis and that the solutions are changed to appropriate intervals.

Activities

1. Performance Evaluation Audits (PEAs)

All scheduled PEAs were performed for the following:

- Paramagnetic oxygen sensors
- Fyrite oxygen analyzers
- Aldehydes
- Trace metals
- PAHs
- VOST
- Dry gas meter/standard orifice
- SO₂ and NO_x (ABB SNOX monitors)

The results of the paramagnetic oxygen sensor PEA, the Fyrite oxygen analyzer PEA, and the CEM PEA are shown in Tables 1 through 3. Chester Environmental's dry gas meter audit results were within 2 percent of the standard critical orifice measurements. Battelle's dry gas meter audit data had not been received as of August 2, 1993. Sandy Anderson, the QA Officer, was contacted concerning the missing information.

2. Technical Systems Audits (TSAs)

Because of plant operational problems, not all sampling trains were observed; however, all basic activities including traverses, glassware and train preparation, and recoveries were observed. Recovery of material from the cyclones was not observed because the auditors were not present on an inorganics test day. Some additional calibration data not present at the site were requested.

Personnel Present During Site Visit

<i>Name</i>	<i>Organization</i>	<i>Telephone</i>
Robert Evans	DOE	
George Sverdrup	Battelle	(614) 424-5014
Paul Webb	Battelle	(614) 424-5014
John Kelly	Battelle	(614) 424-3495
Debbie Smith	Battelle	(614) 424-4114
Joe Tabor	Battelle	
Raj Rangaraj	Battelle	
Sandy Anderson	Battelle	(614) 424-5220
John Hilborn	Ohio Edison	(216) 384-5768
Mark Grunbach	Chester Environmental	
Timothy Cassell	ABB	(216) 652-4881
Jim Flanagan	RTI	(919) 541-6417
Lori Pearce	RTI	(919) 541-7182

TABLE 1. PARAMAGNETIC OXYGEN SENSOR PEA RESULTS

	RTI (Audit Standard)	Battelle	% Difference*
Model 570A Serial No. X-48490			
Zero (pure N ₂)	0.0	-0.2	---
O ₂ (%)	9.21	9.10	-1.20
Model 580A Serial No. X-43454			
Zero (pure N ₂)	0.0	0.0	---
O ₂ (%)	9.21	9.00	-2.30

* Acceptance limits were not provided in the QA Plan. A reasonable acceptance limit of $\pm 10\%$ was used by RTI in evaluating the PEA data.

TABLE 2. FYRITE OXYGEN ANALYZER PEA RESULTS

	RTI (Audit Standard)	Chester Environmental	% Difference*
Set #1			
Zero (pure N ₂)	0.0	0.0	---
O ₂ (%)	9.21	7.00	-24.0
Set #2			
Zero (pure N ₂)	0.0	0.0	---
O ₂ (%)	9.21	8.95	-2.82

* Acceptance limits were not provided in the QA Plan. A reasonable acceptance limit of $\pm 10\%$ was used by RTI in evaluating the PEA data.

TABLE 3. SNOX CEM AUDIT RESULTS

	RTI (Audit Standard)	ABB	% Difference*
O ₂ (%)	9.21	9.02	-2.10
SO ₂ (ppm)	1549	1555	0.40
NO _x (ppm)	815	810.5	-0.55

- Acceptance limits were not provided in the QA Plan. A reasonable acceptance limit of $\pm 10\%$ was used by RTI in evaluating the PEA data.

INTERNAL AUDIT REPORT

on

A STUDY OF TOXIC EMISSIONS FROM THE
NILES STATION BOILER NO. 2 AND WSA-SNOX PROCESS

to

U. S. Department of Energy
Pittsburgh Energy Technology Center

(Contract DE-AC22-93PC93251)

Prepared by

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INTERNAL AUDIT REPORT

on

A STUDY OF TOXIC EMISSIONS FROM THE NILES STATION BOILER NO. 2 AND WSA-SNOX PROCESS

INTRODUCTION

This report summarizes the audit activities conducted on-site at Ohio Edison's Niles Station WSA-SNOX demonstration project and at Battelle Columbus Laboratories from the time period of July 19 through October 11, 1993. As Project Quality Assurance Officer (QAO), I observed field sampling and laboratory activities which were compared to descriptions provided in the Management Plan for 'Study of Toxic Emissions from a Coal-Fired Power Plant Demonstrating the ICCT WSA-SNOX Project and a Plant Utilizing an ESP/Wet FGD System' (DOE Contract DE-AC22-93PC93251) dated June 21, 1993, and the 'Final Niles QA/QC, Sampling, and Analytical Plans', dated July 17, 1993, under the same contract number.

During these observations, I recorded detailed notes which are summarized on the attached Checklists including general information (date, place, time, what, who), a brief narrative account, sample collection and related procedures, comments and recommendations. All of the recommendations were discussed in real-time with either the Project Manager, Assistant Project Manager, Field Sampling Manager, or Analysis Leader as soon as possible after the observation. Corrective action was implemented in most instances before the QAO left the inspection site or within a reasonable time length thereafter.

SUMMARY

Field and laboratory inspections conducted during Niles Station, SNOX Process Power Plant activities indicated that, for the most part, the QA/QC Plan of July 17 was being followed as written, or according to formal, written deviations as described in 'Technical Note, Volume 1 of 3 - Sampling' dated November 1993. These deviations were initiated

either as a need for corrective action or because the technical and physical demands of field and laboratory operations precluded adhering to the original QA/QC Plan.

On-site field observations included: sample tracking, custody, storage, and shipping procedures; in-process sampling at Locations 20, SCR Reactor Outlet; 19, Baghouse Outlet; and 18, Baghouse Inlet. SNOX Process sampling was observed at Locations 1 (Boiler Feed Coal), 24 (Baghouse Ash), and 22 (Sulfuric Acid). Various sampling train recovery and preparation procedures were also observed.

The Battelle QAO also served as a point of contact, along with the Project Manager and Field Sampling Manager, for RTI personnel conducting an independent field audit on July 20-21, 1993. In the absence of the Field Sampling Manager, subsequent to the field sampling phase, the QAO provided the following to RTI Auditor L. Pearce: type S Pitot tubes calibration sheets dated July 13; completed Multimetals Train data sheets from sampling Location 19 (Run N-19-MUM-722) as requested by RTI's Jim Flanagan; nozzle calibration data forms dated 06/12/93 and 07/26/93, including one for Chester nozzle 54; and continuous instrument calibration data forms for Servomex 580A instrument (dated 07/24/93) and Servomex 570A instrument (dated 07/20/93). These are described in a letter to Ms. Pearce dated August 9, 1993.

Laboratory observations included: sample receipt, log-in, custody, and storage procedures; PAH/SVOC liquid samples extraction and concentration; systems audit of VOC-Canister sample receipt and analysis; anion analysis by ion chromatography and data tracking; PAH/SVOC liquid samples preparation; PAH/SVOC gas and liquid samples, filter preparation; PAH analysis by GC/MS and Dioxin/Furan analysis by GC/MS.

Following is a sequential account of Niles Station SNOX Process audit activities, each with a brief narrative and QAO's recommendations when applicable. For detailed records, dated observations recorded on either the Field Inspection Checklist or Laboratory Inspection Checklist should be consulted.

CHRONOLOGY

Sampling Day 02, 19 July 1993:

Observations: Process Sampling for Boiler Feed Coal at Location 1. Half-hour process samples were collected from each of the coal feeders with a painted, metal scoop into a cleaned coffee can and subsequently emptied into a plastic bag for compositing. Random-sized coal pieces are left in the sample collection. Impinger and train recovery procedures were observed for cyanide and multimetals, Location 19 baghouse outlet; and particulate filter recovery for Location 18, baghouse inlet. Impingers and trains arrived at the recovery sites on ice and connections were wrapped with tape when applicable. Rinsing, container, and collections procedures followed the QAP; Method 29 filter holder was brushed and wiped out, and reloaded for use at the same site location. Container labels and chain-of-custody forms were completed. Location 20, SCR reactor outlet, in-process sampling conducted by Chester staff, was observed as well as the sample preparation trailer used by the subcontractor team. Horizontal traverses as well as temperature and meter readings were noted.

Recommendations: Use of a painted scoop for boiler feed coal samples was discussed with the on-site Project Manager. Niles staff were requested to provide overnight sample custody for collected samples and to initial the last day's collection on the data form for traceability. Excursion from the QAP pg. 5.2-18 description of collecting into "precleaned glass bottles" must be addressed as a deviation. Sample custody and transfer must be clarified for times when samples are being transferred and the designated sample custodian is fulfilling sample collection obligations (three times daily samples for baghouse ash, Location 24). Individuals responsible for train recovery should also be clearly identified. Data sheets from sampling locations were observed with either no clock times for start/stop or names recorded were noted and this was discussed with the field sampling manager immediately.

Issues above were discussed during the second sampling day with Project Manager Sverdrup and Field Sampling Manager Tom Kelly. A formalized list of deviations was to be

initiated and will be updated as needed, to describe departures from the QAP and the impact of the changes on the study.

Response: The deficiencies in documentation of data sheets, sample recovery, and sample custody were addressed immediately following the QAO's comments by directions and reminders to the pertinent staff in the field. The coal collection device caused no contamination of the coal samples, due to the large sample size collected and the lack of damage to the device itself. Use of plastic bottles has been noted as a deviation from plan in the Draft Final Reports on the Niles sampling.

Canceled Sampling Day, 20 July 1993:

Observations: Process sampling from baghouse ash Location 24 was observed early in the day. However, because of sampling program cancellation due to plant problems, this was the only process sample collected on this day. Time was dedicated to the accommodation of the RTI performance audit activities. This included oxygen meter checks with standard cylinders provided by RTI; spiking of XAD-2 traps and filters; initiation of dry gas meter audits for Locations 18 and 19, using an EPA standard orifice supplied by RTI. A detailed examination of the sample processing, custody, and shipping procedures was conducted by the Battelle QAO.

Recommendations: There was no standard calibration form available on site for either Battelle or the subcontractor on which to record results of the RTI audit. Discussed data entry correction procedure with the Field Sampling Manager to eliminate obliterations of corrected values on sampling data forms. Situation was discussed with the custodian and train recovery leader in which filters prepped after recovery late on 07/19 were properly stored and labelled but were not logged onto the chain-of-custody form by mid-day of July 20.

Response: Further discussions were held with field staff responsible for the sample documentation and custody. The minor lapses still found in these areas were due to the conditions of field work and the large numbers of samples being logged in.

Sampling Day 03, 21 July 1993:

Observations: RTI staff continued the conduct of their performance audit. The Battelle QAO reviewed sample packaging and shipping procedures. "Cold" samples such as impinger solutions, XAD-2 traps, VOCS and SVOCs are shipped out daily on ice via courier. Process coal and preserved samples are shipped back to labs at the conclusion of sampling. VOC SUMMA canisters are shipped out within 24 hours of collection. All sample container labels are covered with clear tape, the containers wrapped in bubble wrap and double plastic bags for shipment. Receipt and temporary storage of Chester VOST tubes were observed. Baghouse inlet sampling at Location 18 was initiated with a dry gas meter calibration ongoing while the sampling team was setting the probe in place for the first of 22 vertical traverse sampling points. The second sampler was setting up for a horizontal traverse. Baghouse outlet sampling at Location 19 included setting up of the Nutech Stack Sampler, a critical orifice check and set up of the aldehyde impinger on the lower platform. The vertical traverse probe was already set up for the first sampling point. Transfer of SUMMA canisters to Locations 18 and 19 with chain-of-custody forms and cross check of canister identification tags were noted (88-044, 89-005, 88-033). Sulfuric acid sampling at Location 22 by ABB staff was observed from the tank under the SNOX tower. The sample was collected into a precleaned and labelled amber glass bottle and constituted the daily sample. RTI's spiking of two aldehyde trains was noted.

Recommendations: There were no additional recommendations for sampling day 03 observations.

A verbal debriefing was conducted by RTI and included the following highlights: Battelle is using bottled DI water that does not meet method requirements for ASTM Type II water. Even though blanks are run, consideration should be given to using bottled ASTM water. There is concern over use of a painted metal scoop for the coal feeder Location 1 process samples. The oxygen analogue meter was noted to be out of specified calibration ranges. There are differences in the aldehyde train connections: Battelle uses dry connections and a different sized impingers than Chester, which uses Teflon tape on ground glass joint connections. Fyrite tubes Chester is using must have a once/day standards check

for accuracy. Additional minor points included whether quartz or glass filters were used for dioxin sample collection since the QA Plan didn't specify, and a question as to how glass end caps for sampling trains were stored during sampling.

Response: Most of the items noted in the RTI debriefing have been addressed in the Draft Final Reports on the sampling studies conducted at the Niles-SNOX and Niles Boiler No. 2. In both reports, responses to the RTI comments are presented in Appendix B: Auditing. Quartz fiber filters were used for all sampling. Glass end caps were covered in aluminum foil or kept in plastic bags during sampling.

Sample Receipt and Log-in, July 29, 1993

Observations: Samples for N 5a MUM 727, N 4 MM5 728, N 13 PRL, and N 8 PRS samples were tracked from evening delivery to the Battelle lobby, transfer by the Laboratory Sample Custodian to the receipt and log-in area, to final storage locations prior to preparation and analysis. Three coolers and seven boxes of liquid, solid, and filter samples were cross-checked between container label information and completed chain-of-custody forms prior to being logged into the custodian's record book.

Recommendations: Several discrepancies from the sampling aspects of the QA/QC Plan were noted and discussed with the Custodian and the Field Sampling Manager. Certain of these are to be addressed as deviations to the QA/QC Plan; others for which subsequent data were completed to assure traceability of samples and completeness of the sampling record, should be addressed for future studies by more vigorous training of field staff prior to departure for the sampling site. QAP pg. 5.2-22 specifies 4-liter bottles for collection of samples from Locations 9, 10, and 13. 500-ml amber glass bottles of samples were received from these sites. Location 9 'river water' is referenced as 'makeup water' in the QAP. Sequential samples for N 13 PRL 729 and others were noted with identical labels for all four containers. Subset identifiers should be added for traceability for this type of replicate sampling, which is not spelled out in the QAP. Discrepancies in sampling times between the container labels and completed chain-of-custody forms varied from a few minutes to an hour. Certain sampling team members used only their first names on forms and labels. The

Laboratory Sample Custodian documented labelling and sample container discrepancies on both the custody form and the sample record logbook.

Response: As noted, some discrepancies were observed in documentation of samples. However, all such discrepancies were resolved in the chain-of-custody review process prior to sample analysis, and all samples were identified and accounted for. Improvements in the sample numbering scheme will be made in any future work. The collection of liquid samples is noted as a deviation from plan in the Draft Final Reports on the Niles sampling efforts.

PAH/SVOC Liquid Samples Extraction and Concentration, 04-05 August 1993

Observations: Method 3510 was followed for extraction, pH adjustment, spiking, and concentration. Spiking and surrogate solutions are traceable to neat stocks. Samples were labelled properly through the 2-day process and custody procedures observed through final transfer to the analyst. N 9 PRL 730 samples for pond water, river water, trip, and field blanks were tracked for this observation.

Recommendations: There were no recommendations for these observations.

VOC-Canister GC/MSD Analysis, 05 August 1993:

Observations: A system audit was conducted of VOC-canister analysis, from transfer to the analyst by the Lab Sample Custodian, instrument calibration with a 42-component NIST-traceable standard, sample analysis, data acquisition and review, and transfer to canisters for recleaning. VOC canisters are shipped within 24 hours of field collection and the analysis is initiated the next morning after sample receipt to maintain the holding time limitation of 2 days.

Recommendations: Clarification of using a 42-component, rather than the QAP p. 4.1-14 'containing the 41 target compounds' should be added to the study record. This is not technically a deviation, however.

Response: The cylinder used for calibration contained 42 compounds; however, for this study, only 41 compounds were targeted for analysis.

Ion Chromatography Analysis. 11 August 1993:

Observations: Process water samples from 728 are received in 40-ml amber vials and the labels checked to the chain-of-custody form copy. Twofold dilutions of samples are made using a calibrated autopipettor. Standard, calibration, and spiking solutions are traceable to a separate logbook. EPA Method 300.0, December 1989, is used as a guideline. EPA PE Standard WP029 is used as an accuracy check solution for Dionex instrumentation. Sample custody is documented from receipt through analysis. The analyst reviews generated data and sets up a data file for each set of samples that includes: Final Anion Report, Summary Report, Calibration Plots, Duplicate and Spike Data, Standards Prep Data, Analysis Conditions and Chromatograms.

Recommendations: Minor clerical traceability issues were discussed with the analyst. Reference to the specific method guidelines used and brief description of the sample preparations should be added to the study record book.

Response: Reference to specific method guidelines and a description of the sample preparation procedure were added to the study record book.

PAH/SVOC Gas and Liquid Filter Preparation. 20 August 1993:

Observations: N F 730 samples for Locations 5a, 5b, and 4 were observed from initial custody transfer, through column chromatography, extraction, spiking with internal standard, concentration, and storage until analysis. Chromatographic reagent preparation and glassware preparation were discussed with the analyst. Sample labels reflect identity throughout the process and tracking documentation is also described in the study record book.

Recommendations: Calibration of the storage refrigeration unit thermometer was suggested, as well as a lock on the freezer where sample extracts are stored. The latter suggestion was implemented within the next day or two and alleviated the problem of unassured sample custody after working hours caused by a faulty door lock in the laboratory area.

Response: The storage refrigeration unit thermometer was calibrated as suggested.

PAH Analysis by GC/MS, 20 August 1993

Observations: Tuning, calibration, and analysis of the first sample extract was observed. A Battelle Facility SOP describes the analysis using the Finnegan MAT TSQ GC/MS. The instrument logbook records the sample ID, file ID, and laboratory record book reference number. Freezer for instrument standards is monitored. Sample analysis flow begins with an instrument tuning run, standard, standard, sample, sample, sample, standard at end of the run. The Lab Analysis Manager determines when corrective action is needed and also performs the action. Third party review of data and spreadsheet is performed before transfer of data for reporting.

Recommendations: No recommendations were made for this observation.

Dioxin/Furan Analysis by GC/MS, 11 October 1993

Observations: Samples are stored in a monitored freezer from transfer through analysis. MM5 Site 5a filter was tracked as a filter extract from the prep logbook to the Mass Spec logbook. Sample custody and transfer is also documented in the Dioxin Lab sample logbook. Five point recalibration is performed initially for the dioxin analysis, with continuing calibrations being performed at periodic intervals. Calibration standards are made up by the Standards Custodian from commercially available standards, as are window mix and column performance checks. The MS logbook documents operating parameters, as well as file ID, Lab ID, sample ID for cross reference, injection volume and clock time of injection. Instrument used is VG Analytical HP5890A GC, and 11-250J computer which was last validated on 07/07/93, according to the facility SOP. Sample analysis flow begins with performance checks, calibration, decane blank, samples (including QC), and calibration point at the end of the run.

Recommendations: No recommendations were made for this observation.

FIELD INSPECTION CHECKLIST

AUDITOR J. M. Anderson DATE 19 July 1993

STUDY NUMBER 930714 SITE LOCATION Niles Station, Niles, Ohio

Process TIME 2 P: 540P Day 02

STUDY PROTOCOL QAPP QA/QC Plan DE-A22-93 93251

Field Phase Inspected Process Sampling Boiler Feed Coal Location #01

Personnel Involved Niles Staff - Fred

Protocol QAPP/SOP Requirements QAP pg 5.2 - 2 + SMA 5.2-18, 19 (Process) ^{18.0000 07/23/93}

Narrative Account Half hour sample collected into pre-cleaned glass bottles per QAP 5.2-18 changed to one scoopful of coal removed from each hopper into a coffee can. Random sized coal pieces are kept in can. Samples collected every half hour when the sampling team is collecting only

Sample collection, containers, custody and transfer procedures

Additional Comments Requested that last day's entry be initialed by sampler for traceability. Data form will note any system shutdown. Painted metal trays used to collect. Spcs. will be emptied from coffee can into plastic bag for composting.

Recommendations Process coal samples stored near boiler. Rec. moving samples to more secure location & assume custody for overnight collection of samples.

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① Deviation from QAP 'glass bottle' should be noted in Deviations for site.

FIELD INSPECTION CHECKLIST

AUDITOR S. Anderson DATE 19 July 1993
 STUDY NUMBER SC930214 SITE LOCATION Miles Station Miles, Ohio
SNOX Paces TIME 2 P, 4P Day 2
 STUDY PROTOCOL QAPP QA/NA Plan Continued DE-AC22-93PC93251
 Field Phase Inspected Cyanide Impinger Secondary Sighouse Outlet, Location 7819
 Personnel Involved Raj, Rangraj *error in location 8/7/93*
 Protocol QAPP/SOP Requirements APP 5.2-10, 5.2-4.2, 4.3; 5.3-7.8
 Narrative Account Observed impinger collection, rinse and transfer to labelled sample jars, weigh check, 7 impinger
Balance used = Mettler, P1200 N, calibration due 09/93

Sample collection, containers, custody and transfer procedures. Spl. Custodian is also collecting samples at this site. A designated back-up must be named to log in samples when she is unavailable.

Additional Comments Segregated samples to be kept outside in cooler under trailer are to be brought inside for security until shipment ok.

Recommendations No clock times recorded for sampling start/end time. Need to indicate approximate times on data sheet. "Completed by" on sample labels need to be

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picked out consistently by either Train Secondary Senior or sampling team secondary person

FIELD INSPECTION CHECKLIST

AUDITOR M. Anderson DATE 19 July 1993

STUDY NUMBER 84930214 SITE LOCATION Miles Station, Miles, Ohio

SNAX Process TIME 805 P Day 02

STUDY PROTOCOL (QAPP) DE AC 22-93 PC 93251 16 July 1993

Field Phase Inspected Method 29 Train Recovery, Bingham, Butler, Section 19

Personnel Involved Joe Tabor

Protocol (QAPP) SOP Requirements QAP p 5.1-14, 23-24, 28, 29, 30

Narrative Account Recovery of multimetal train. Train
arrives side arm wrapped & teflon tapes
Train recovery procedures followed
fig 5-14, p 5.2-30 QAP

Sample collection, containers, custody and transfer procedures Spl. labels for
train components filled out as 'compacted by' Joe
Tabor. Bottles for recovery rinses are predestined
amber & have label already on them.

Additional Comments None

Recommendations None

FLDLST.05/93

Auditor's Signature and Date Anthony M. Anderson 23 July 1993

FIELD INSPECTION CHECKLIST

AUDITOR SM Anderson DATE 19 July 1993

STUDY NUMBER A30214 SITE LOCATION Filter Station, Niles, Ohio

SWOX Process TIME 5 P M 02

STUDY PROTOCOL/QAPP _____

Field Phase Inspected Particulate Filter Recovery, Siphona Unit, Location 18

Personnel Involved Joe Laher

Protocol/QAPP/SOP Requirements OSM pg 5.2-9

Narrative Account Method 29 particulate filter transferred to labeled petri dish. Filter holder brush and cupped out, reloaded and used again for same site location

Sample collection, containers, custody and transfer procedures Petri dish has sample label affixed by Joe and custody form completed

Additional Comments None

Recommendations None

FDLST.05/93

Auditor's Signature and Date, Andy M. Anderson 23 July 1993

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FIELD INSPECTION CHECKLIST

AUDITOR J. Markheim DATE 19, 20 July 1993
 STUDY NUMBER 504302/4 SITE LOCATION Tules Station, Tules, Ohio

GNOX Process TIME 2308 Day 02

STUDY PROTOCOL (QAPP) DEAC22-93PC9325/ 16 July 1993

Field Phase Inspected MUM Method 29 Sampling Location 20

Personnel Involved (GAP Location Detail) Chester Staff

Protocol/QAPP/SOP Requirements GAP pg 5.2.17

Narrative Account Observed in-process sampling and horizontal traverses. Train ice. Staff taking Temp. & meter readings but taking c. T. Kelly w. possible plugged filters. ^{only the} 11/23/93

Sample collection, containers, custody and transfer procedures Checked Tatters Chester is using for sampling prep. Is neat and well-organized. Seminal staff of importance in completing sampling data forms as work is done. ①

Additional Comments Observed set-up on non-sampling as as Chester staff was working c. sampling port valve modifications to accommodate probes. One sampling 4/6 ports only.

Recommendations Field Spg. Tatters & Chester staff to describe sampling difficulties & change in spg time on 07/19/93

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Auditor's Signature and Date Andy M. Anderson 23 July 1993

① MUM custody signed over to D. Smith.

FIELD INSPECTION CHECKLIST

AUDITOR J. Miller DATE 20 July 1995
 STUDY NUMBER SC930214 SITE LOCATION Mike's, Mike's, Mike's
 STUDY PROTOCOL AP 05-0220-93 16 July 1995
 FIELD PHASE INSPECTED AP 05-0220-93 16 July 1995
 PERSONNEL INVOLVED Mike's, Mike's, Mike's
 PROTOCOL AP 05-0220-93 16 July 1995
 NARRATIVE ACCOUNT AP 05-0220-93 16 July 1995
 SAMPLE COLLECTION, CONTAINERS, CUSTODY AND TRANSFER PROCEDURES AP 05-0220-93 16 July 1995
 ADDITIONAL COMMENTS AP 05-0220-93 16 July 1995
 RECOMMENDATIONS AP 05-0220-93 16 July 1995
 AUDITOR'S SIGNATURE AND DATE AP 05-0220-93 16 July 1995

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8/24/95

FIELD INSPECTION CHECKLIST

AUDITOR J. M. Anderson DATE 20 July 1993
 STUDY NUMBER SA30214 SITE LOCATION Nicks Station, Niles, Ohio
SNOX Process TIME 1020A
 STUDY PROTOCOL/QAPP DE-AC22-93P893251 16 July 1993 ^{0.000}
 Field Phase Inspected Performance Audit RTI, CEM Calibration
 Personnel Involved Paul Nubb, L. Pearce
 Protocol/QAPP/SOP Requirements and RTI letter of 5 July 1993
 Narrative Account Oxygen Meter Calibration Check
(Battelle X18490, Servomex 570A); calibrated using
Battelle cylinder. Reading N_2 1700 psi
 O_2 50 ppm
11:40A 570A NO_2 = 9.1 ^{O_2 N_2} 9.0 1580A = O_2 = 0.0 ^{O_2 N_2} 9.0 (vs RTI 9.2)
 Sample collection, containers, custody and transfer procedures Not Applicable

Additional Comments None

Recommendations No calibration form was available on which
to record results of calibration. Readouts must be
retained on traceable data record form & book

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Auditor's Signature and Date J. M. Anderson 23 July 1993

FIELD INSPECTION CHECKLIST

AUDITOR J. Anderson DATE 20 July 1993
 STUDY NUMBER 795024 SITE LOCATION Niles Station, Niles, Ohio
SMX Process TIME 12P, 1210P
 STUDY PROTOCOL (QAPP) DE-A122-93 PC 9551 16 July 1993
 Field Phase Inspected Oxygen Indicator (Lyrite Set 01) Subcontractor
 Personnel Involved Mark Hrunback, Chester; RTI Staff
 Protocol/QAPP/SOP Requirements and RTI letter of 15 July 1993; p5.1-35
 Narrative Account Lyrite #9 Calibration at 2X = 0.0, < 0.0
RTI recommends using a certified standard to
recheck Lyrite Set

Sample collection, containers, custody and transfer procedures Not Applicable

Additional Comments Observed ^{unobs} RTI J. Hrunback doing
XAD-2 spikes on 2X filter and traps using
an RTI Performance Audit Solution

Recommendations None in narrative

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Auditor's Signature and Date Judy M. Anderson 23 July 1993

FIELD INSPECTION CHECKLIST

AUDITOR: J. Mendenhall DATE: 20 July 1993, 21 July 1993
STUDY NUMBER: SA3024 SITE LOCATION: Mike Station, Yule, Ohio
SNCI: P-8000 TIME: 1325 P

STUDY PROTOCOL: GAPP DE 44-22-93 PC 93251 16 July 1993
Field Phase Inspected: Sample Processing and Custody
Personnel Involved: Mike Smith

Protocol/GAPP/SOP Requirements: GAPP 5.1-25 & 29
Narrative Account: There are custody forms/assessments

for 07/19 samples; Station samples sent to Battelle
for Station 20, 21, run on 07/19. Station 20, 21, 22
custody to Mike Smith who then sends ops. to
Battelle with original chain of custody forms.
Sample collection, containers, custody and transfer procedures: Custody form

(chain) copied and preserved to Station. Original
form available necessary by Station sample
collection in Baltimore. Station will supply a custody form.

Additional Comments: Reviewer Sampling Rate sheet or
07/21/93. Reviewer Sampling Rate sheet need to
be reviewed as to completely and legally as
possible because traceability (Mittage, POST, Car, Gas, etc., etc.)
Recommendations: The above and note that Station must
not substitute original entry. Now change line item
Review: 21 July 02

FLDIST 05/93 Auditor's Signature and Date: Mike Mendenhall 20 July 1993
New meter 07/20. Active pump after review. Date on 07/19
How getting along in this not looking on the
custody form by Mike Smith. Reviewer
The Station and Mike Smith.
8407928

FIELD INSPECTION CHECKLIST

AUDITOR Sandy M Anderson DATE 21 July 1993 OS

STUDY NUMBER SL030214 SITE LOCATION Tule Station, Miles, Ohio

SNOX Process TIME 2:45 P day 03

STUDY PROTOCOL QAPP DE AC-22-93 AC 93251 16 July 1993

Field Phase Inspected Sample Processing and Custody Control

Personnel Involved Neha Smal

Protocol/QAPP/SOP Requirements QAPP pg 5.1-25 b 29

Narrative Account Chain of custody records review & processing:

Ambient temperature sample retained inside trailer
and shipped back to Battelle at end of study.

"Cold" samples are shipped out daily on ice
via courier. Picon rod and H₂SO₄ sample

Sample collection, containers, custody and transfer procedures VOST samples are Chester
Staff's responsibility. We store their VOST tubes in our fridge
only; retain C of C copies after spls. are relinquished
to Chester for analysis

Additional Comments We also shipped back at the end of
the study. Filter spls. for mms are shipped
out on dry ice. All spl. container labels are
covered & clear tape, wrapped in bubble wrap, 2x

Recommendations plastic bags then shipped on ice.

Battelle needs to design a calibration form for O₂ and other
analyses. Should fit generic use but still

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same as a prompt for user to complete information.
Reviewed & Tom Kelly.

FIELD INSPECTION CHECKLIST

AUDITOR Manderson DATE 21 July 1993

STUDY NUMBER 5430214 SITE LOCATION Miles Station, Miles, Ohio

SACX Process TIME 740A Day 03

STUDY PROTOCOL QAPP DA/OC Plan DE-AE22-93PC93251 07-16-93

Field Phase Inspected Byhouse Inlet Sampling Location 18

Personnel Involved Paul Webb, Kent

Protocol/QAPP/SOP Requirements QAPP 5.2-10

Narrative Account Dry Gas Meter calibration at location while setting probe for vertical traverse. Collecting 22 valid sampling points on the vertical. Points on probe marked with tape. Second sampler was setting up for horizontal traverse.

Sample collection, containers, custody and transfer procedures _____

Additional Comments Particulate Field Data forms - reminded sampling team to complete as much information as possible before transferring these forms to the sample custodian

Recommendations _____

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Auditor's Signature and Date Lindy Manderson 23 July 1993

FIELD INSPECTION CHECKLIST

AUDITOR M. Anderson DATE 28 July 1993 ^{10:00 AM}

STUDY NUMBER 1430214 SITE LOCATION Miles Station, Miles, Ohio

NOV PROCEEDS TIME 9:30 A day 03

STUDY PROTOCOL/QAPP QA/QA Plan DE-AL22-43M93251 07.16.93

Field Phase Inspected Baghouse Outlet Sampling Location 19

Personnel Involved Harry Leonard

Protocol/QAPP/SOP Requirements QAP 5.2-17

Narrative Account Mutech Stack sampler undergoing a
Critical Drive Check. Observed aldehyde
impinger train being set up on lower platform.
Vertical traverse probe already set up for first
sampling point. Distances marked on probe.

Sample collection, containers, custody and transfer procedures In-process
sampling not yet initiated.

Additional Comments Harry had discussion w/ Jim Henagan re probe
temp > 250° ± 25 requirement in method for last two sampling
points. Harry will do a single run to provide gas temp. &
verify no significant heat loss.

Recommendations None

FLDLST.05/93

Auditor's Signature and Date Sam M. Anderson 29 July 1993

FIELD INSPECTION CHECKLIST

AUDITOR J. M. Anderson DATE 21 July 1993

STUDY NUMBER 9113024 SITE LOCATION Miles Station, Miles Ohio

SADP Process TIME 12 noon day 03

STUDY PROTOCOL QAPP CM/DC Plan DE AC22-93PC93251 07-16-93

Field Phase Inspected Summa Canister Transfer to Locations 18, 19

Personnel Involved Paul Webb, Henry Leonard

Protocol QAPP SOP Requirements QAPP p 5.2-39

Narrative Account Summa canisters were taken to base of
each sampling platform with chain of custody
samples for each. Cross-checked tag numbers
on canisters.

Sample collection, containers, custody and transfer procedures Bottle X numbers

for these Summa canisters: 88-044

89-005

88-039

Additional Comments None

Recommendations None

FLDLST.05/93

Auditor's Signature and Date J. M. Anderson 21 July 1993

FIELD INSPECTION CHECKLIST

AUDITOR M. Anderson DATE 21 July 1993

STUDY NUMBER 21302/4 SITE LOCATION Niles Station, Niles, Ohio

TIME ~130 P Day 03

STUDY PROTOCOL QAPP D1/PL Plan 7E AC22-93PC 93251 Dated 16 July 1993

Field Phase Inspected Sulfuric Acid Sampling, Location 22

Personnel Involved ABB Staff

Protocol/QAPP/SOP Requirements QAPP p 5.2-19

Narrative Account Observed sample collection from tank under SNOX tower. Sample collected into pre-cleaned amber glass bottle. This constitutes daily sample for this process.

Sample collection, containers, custody and transfer procedures None

Additional Comments None

Recommendations None

FLDLST.05/93

Auditor's Signature and Date Sandy M. Anderson 23 July 1993

LAB INSPECTION CHECKLIST

AUDITOR Sandy M. Anderson DATE 29 July 1993

STUDY NUMBER SD 30214 SITE LOCATION Miles Station, Miles, Ohio
→ Battelle Room 6028 TIME 603 P to 8P

STUDY PROTOCOL QAPP OH/OP Plan DE AC 22-93DC 9.3.51 07-16-93

Lab Phase Inspected Sample Receipt and Log-in

Personnel Involved Sue Champagne, Jan Satola

Protocol/QAPP/SOP Requirements QAP pg 5.1-29-32

Narrative Account Samples picked up in lobby at 603P and transferred
to room 6028 (locked), included three lockers and seven boxes
SRB 46737 was used to record receipt. Included Biker
spls, MM5, MUM location SA. Chain of custody from 4
samples received by (Sue) Jan and Sue receipts

Sample storage, preparation, analysis and custody procedures Labels on bottles. Most
bottle caps are unlabelled. Tracked NSA MUM 727 spls.
to QAP pg 5.2-30 diagram. All spls. accounted for.
07/28 NA MM5 impingers, probe wires, cyclones

Additional Comments and PR-13 # 9, 10, 13 checked. All bags
and bubble wrap protecting samples were carefully
split with a ^(5P) knife. Poured out river water samples
in quart amber bottles as well as Cool Sea-off. ①

Recommendations QAP pg 5.2-22 specifies 4-liter glass
bottles for #9, 10 and 13 samples. Change to quart amber
bottles must be addressed

Cont'd to 29 July 02

LABLST.05/93

Auditor's Signature and Date

30 July 1993 Sandy M Anderson

① # 9 location called River water on labels is
 referred to as Makeup water, QAP pg 5.2-22

LAB INSPECTION CHECKLIST

AUDITOR Lanby M. Anderson DATE 29 July 1993-02 cont'd

STUDY NUMBER 519362/4 SITE LOCATION Niles Station, Niles, Ohio

TIME _____

STUDY PROTOCOL/QAPP _____

Lab Phase Inspected _____

Personnel Involved _____

Protocol/QAPP/SOP Requirements _____

Narrative Account N4-mm5-0728 trap samples were immediately transferred to cooler freezer (GI93219) in room 6031 N-13. PRA 0729 has single entry of "no pH adj. pH already < 2"; filter spl. N4-mm5 0728 and filter MUM 5A (and 5B) 0727 checked to cage forms.

Sample storage, preparation, analysis and custody procedures Aldehydes NAA0728, 40 ml amber amp 1, 2, 3 (had ID on label) transferred to monitored refriger. (I95283) in room #6028. N4 mm5 filters #1 and #2 0728 ESP filter transferred to freezer.

Additional Comments Four liter spls 9 and 10 for 0726 and 0728 placed in refrigerator. All samples received at 6P were properly transferred and stored. MUM and CN spls were transferred to room 7028 cold (40°F) storage

Recommendations facility which is locked. Custody form originals are sorted by sample ID, put into binder and pages numbered consecutively. Originals remain

LABLST.05/93

Auditor's Signature and Date

Lanby M. Anderson 30 July 1993

with custodian, copies go to analyst and technicians preparing spls. Initial pH and Temp recorded > 5 hours where required. All sample processing begins < 7 am holding time.

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Cont'd. 29 July 02
26 12 11 78

LAB INSPECTION CHECKLIST

AUDITOR Lindy M. Anderson DATE 29 July 1993-03 Cont'd.

STUDY NUMBER SC93024 SITE LOCATION Niles Station Niles, Ohio

Battelle Room 6028 TIME 6-8 P

STUDY PROTOCOL QAPP QA/OC Plan DE AC22-93 PC 93251 07.16.93

Lab Phase Inspected Sample receipt, custody, transfer, storage

Personnel Involved Sue Champagne, Jan Lalala

Protocol/QAPP/SOP Requirements QAP pg. 5.1-27, 28

Narrative Account Recommendations from here to bottom of page:

- ① N-13, PRS 0729 have four bottles with identical sample ids. Sequential samples must have sub-ID for traceability
- ② PRS sample in 40 ml vial for location 9 on 07/29 have identical IDs for 500 ml amber bottles. Need to differentiate

Sample storage, preparation, analysis and custody procedures for traceability and analysis ③ See recommendation re quart, amber bottles rather than 4L amber on pg 01; ④ Label /OC discrepancy follow: "N8 PRS 728 from hopper near" 1700 hrs" on

Additional Comments Label and "1600 hrs" on CQC; "07.28 air heater ash from #3 is called "leopomizu ash" on labels

Spl 2-3 times	11:45 label	11:30 CQC
	14:30 label	14:30 CQC
2-4 Times	16:50 label	17:00 CQC
	11:25 label	11:30 CQC
	14:45 label	14:30 CQC
	17:30 label	17:00 CQC

Recommendations

Load sample N-1, PRS-727 2 bags for 07.27.93 no time recorded

LABLST.05/93

Auditor's Signature and Date Lindy M. Anderson 30 July 1993

All of above issues were relayed to the Field Sampling Manager by phone on 30 July 1993 by the QAD.

LAB INSPECTION CHECKLIST

AUDITOR M. Anderson

DATE 04 August 1993

STUDY NUMBER SC930214 SITE LOCATION Niles Station, Niles Ohio

→ Battelle Room 7243

TIME 740A

STUDY PROTOCOL (QAPP) DE AC 22-93 PC 93 251 07-16-93

Lab Phase Inspected PH/310C - Liquid Samples Extraction

Personnel Involved Sue Champagne

Protocol (QAPP) SOP Requirements QAP 53-17-18

Narrative Account Method #3510 - Extraction Method Separatory
funnels all labeled 46707-9-X1. pH adjusted to <2.

One liter samples, amber four bottles brought up
from cold storage. QC samples prepared: MS, MSO (Pond)
Duplicate (Live Water), H₂O Blank

Sample storage, preparation, analysis and custody procedures Tracked N-9-PRL-730
Pond water, Live Water, Trip Blank, Field Blank to
lab and chain of custody forms

Additional Comments Added 1.0ml Surrogate Spike [(46399-77-05),
labeled c name, date, storage temp]; Added 1.0ml Spiking
Standard (46399-77-20); Add MeCl₃, shake two
minutes. Hand monitored (x92123) 04/13/93

Recommendations "Chad C." as sample on C-of-C form
insufficient for traceability. Discussed earlier
c Tom Kelly. Called lab safety re. updated hand monitoring.

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Auditor's Signature and Date Sandy M Anderson 05 August 1993

pg 16 of 28

LAB INSPECTION CHECKLIST

VERIFIED EXACT COPY
11.15.93

AUDITOR J. Mandum DATE 05 August 1993
STUDY NUMBER 90130203 SITE LOCATION Coal Creek / Miles P. M. Plate
TIME 10A

STUDY PROTOCOL/QAPP DEAL 22-93PC93251, dated 21 June 1993

Lab Phase Inspected VOC - Canister Analysis GC/MS Systems Audit

Personnel Involved William Keigley

Protocol/QAPP/SOP Requirements QAPP p 4-3-6, 7; A.2-3; A.1-31

Narrative Account Canister checked for vacuum & pressurized to 10 psi upon receipt (9-12 A in lab of rpt. received) 7 samples from Custodian; GC/MS is calibrated c a 42-Component mix traceable to NIST heptane std. (1117305 - calib. std). 42-comp. mix is injected into facility smog chamber, analyzed and @

Sample storage, preparation, analysis and custody procedures Sample Custodian delivers canisters after receipt & log-in to Bill Keigley who logs them into a facility sp. log book. Also has copy of sig. C- of C forms, indicating trip spike(s) Trip blank.

Additional Comments Cont. Quantitated. Std. Quantitation analysis report is placed into G2825 study record book for traceability from original mixing by B. Keigley. Data is acquired on an HP 5880 GC/FID with HP 5970 MSD. HP Computer system is

Recommendations HP Chemstation. New canister ID and Sample IDs as cross reference in logbook. Hard copy output transferred to M. Holden, as well as tape, which is retained for study duration.

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Auditor's Signature and Date J. Mandum 05 Aug. 1993

Analyst checks data & performs review as: Calibration, sample. All data is retained. Lab samples data file includes: C- of C copy, run log, hard copy output. Files run by daily sequence. After sps. are run, VOC canisters are taken to Richard Smith in cleaning. 17 of 28

LAB INSPECTION CHECKLIST

AUDITOR J. M. Anderson

DATE 05 August 1993

STUDY NUMBER SCA30214 SITE LOCATION Miles Station, Miles, Ohio

→ Battelle Dm 7335

TIME 130P, 325P

STUDY PROTOCOL QAPP PA/OC Plan DE-AC22-93PC 93251 Dated 16 July 1993

Lab Phase Inspected PAH/SVOC - Liquid Sample Concentration

Personnel Involved Sue Champagne

Protocol/QAPP/SOP Requirements QAP Pg 5.3-17

Narrative Account Concentrating samples (Kuduna-Durish) in Blue M Heated Water Bath; Mully Distinct combined acid/bas. Thermometer measures water temperature at 65°, 70°.

Concentrates to <1.0 ml → GC incl → Analyst for storage and analysis at JN-4 facility (Battelle).

Sample storage, preparation, analysis and custody procedures Spl. 46707-09-04

K-D flask + receiver ampul labeled c Sample ID. C-of-C original form remains c sample custodian. Samples are kept under locked custody.

Additional Comments Micro-Snyder concentration <1.0 ml are transferred to Wheaton Glass vials with Teflon-faced silicon septa. Vials are labelled and labels covered with clear tape; Teflon Tape wrapped. Spls: extrate

Recommendations not stored in X42319 freezer, Rm 7245

Tracked 46707-09-03 Pond Water

N. G. PRL 730-04 River Water N. G. PRL 730-06 Total Blank

N. G. PRL 731-05 Trip Blank 46707-24-10 Water Blank

LABLST.05/93

Auditor's Signature and Date Judy M. Anderson 06 August 1993

LAB INSPECTION CHECKLIST

AUDITOR J. Anderson DATE 11 August 1993
 STUDY NUMBER 56431214 SITE LOCATION Niles Station, Niles Ohio
→ Lm 7343 TIME 830A

STUDY PROTOCOL/QAPP DE AC-22-93 PC 93251 07-16-93

Lab Phase Inspected Anion Analysis - Ion Chromatography

Personnel Involved Dave Permillion

Protocol/QAPP/SOP Requirements QAP 14.5.3-8, 9; 5.1-16, 17

Narrative Account Sample storage at 5°C # 686-031 VWR, monitored on workday; locked during off-duty hours. WP3 - accuracy check same as Performance Evaluations on WP spls → (C, F, S) EPA → received by EPA → PE reports sent by EPA 2X/year; ICV's precision standards made from stock solutions

Sample storage, preparation, analysis and custody procedures ICV # assigned by Dave, cross-reference to original chain of custody record and spl. description. Dave receives spl. and C-ozl copies and also signs original form. Sample Status Sheet reviewed regularly

Additional Comments Low data acquired → analyzed → reported.

Separate duplicates and spikes sheet. Standards and Calibrations lab pgs. Bulk stds have exp. dates, kept 6 months. Phosphate made up fresh for

SM Recommendations la batch. Analytic Conditions describe column and eluents. Chromatograms are final output. File sent for QC Review includes: Final Anion Report,

LABLST.05/93

Auditor's Signature and Date J. Anderson 11 August 1993

Summary Report, Calibration Plate, Duplicate and Spike data, Standards Prep. Data, Analytic Conditions, Chromatograms.

B-57

Contd 11 Aug-02
8519728

LAB INSPECTION CHECKLIST

AUDITOR J. Manderson DATE 11 August 1993 - 02 Contd
 STUDY NUMBER 5013024 SITE LOCATION Niles Station, Niles, Ohio
 TIME 10:10 A

STUDY PROTOCOL/QAPP _____

Lab Phase Inspected _____

Personnel Involved _____

Protocol/QAPP/SOP Requirements _____

Narrative Account 40 Lb. will label checked & custody record after removal from locked refig. Spl. aliquot removed to Dionex vial. Analyst wears gloves for handling of samples. Vials marked c. spl. ID and dilution of 4.95 ml DI H₂O and 50 µl spl. c. 50 µl Gilson Autopipette. Line pipet c. "house" c.

Sample storage, preparation, analysis and custody procedures PRR (Process Waters)
1335-36, 1341-45 from 0728; 1345: spl. duplicate
and spike (0.2 ppm of ea. analyte); 1:100 spl. dilution
used. Equip error
18/11/93

Additional Comments Equipment: Gilson Autopipette # C 480039,
calib. before full use. Mettler AE160 # A61210, calib. due
09/93; weight set S/N 5386, calib. due Jan. 94.
Dionex # 13790; Balance record book in. Calibration record #

Recommendations DI water, also used as blank, plastic pipet
and plastic Achmea. DI H₂O put into flask fresh ea. day.
Spl. dilutions performed directly into Dionex vials. Contd-03

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Auditor's Signature and Date Judy M. Anderson 11 August 1993

Contd. and weight certificates. Pipette calibration - weights
50 µl H₂O into plastic beaker. Weights were: 0.050, 0.051 and
0.051 mg.

LAB INSPECTION CHECKLIST

AUDITOR J. Mendenhall DATE 11 August 1993-03 Contd.

STUDY NUMBER 930214 SITE LOCATION Niles Station, Niles, Ohio

TIME _____

STUDY PROTOCOL/QAPP _____

Lab Phase Inspected _____

Personnel Involved _____

Protocol/QAPP/SOP Requirements QAP p 5.1-45

Narrative Account Secondary dilution 4.5 ml H₂O and 0.5 ml of
Q from pg 02 this report. Two point & point sln. pipet for ea
one of duplicate set and all spls have calibrated Gilson for 1:100
spl. dilution. Spl. vials are not mixed before aliquotting
as analyst is looking for soluble materials only.

Sample storage, preparation, analysis and custody procedures Stock anion std. used for
spike; spls. capped & cap having built-in filter & mixed
has 50 µl Gilson autoinjector (calibrated) for H₂O. Stds. stored in
same repig as spls. 10 µl ea std spike used for 30 µl

Additional Comments total spike in 5.0 ml spl. Spiking &
100 ppm F; Cl and SO₄. Caps tightened, diluted & spiked
spls mixed. Trk p22, 23 describes prep. Washing stds.
in volumetric flasks made from stocks & verified

Recommendations in study records. EPA Method 300 followed.
Just blank = reprecipitated water blank → diluent blanks,
used vials. Acquires data according to run schedule

LABLST.05/93

Auditor's Signature and Date Judy Mendenhall 12 August 1993

made up & analysis starts Contd. 11 Aug. 04
Standards and just blank loaded into autosampler.
Analyst checks standards analysis as generated to check if
all elements are < M.L. limits. PA 21 of 28

LAB INSPECTION CHECKLIST

AUDITOR S. Mendenhall

DATE 11 August 1993 - 04 Contd

STUDY NUMBER SA 302/4

SITE LOCATION Miles Station Niles, Ohio

TIME _____

STUDY PROTOCOL/QAPP _____

Lab Phase Inspected _____

Personnel Involved _____

Protocol/QAPP/SOP Requirements _____

Narrative Account Routine Maintenance @ clean cell + conduct cell. Calib. Std. 2X year or when analyst determines need @ column change needed. Conductivity Cell Calibration Standard = 1 mM KCl made up 1X year. Non-routine maintenance recorded in logbook. Have has copy of 3 work Plan

Sample storage, preparation, analysis and custody procedures @ EPA Method 300.0, November 1989, pp 01-04 Test Method for Nitrate of Inorganic Anions in Water by Ion Chromatography. PE Std WPO29 from EPA EMGL - was 100ul inj. volume. Method calls for

Additional Comments 10% QC spls recommended & have that spiking proc. for matrix samples be performed. Data can be qualified in the Analytical report as 'not reported', 'estimated', etc. Peak Pro Version 2.1

Recommendations ① Add instrument ID spec. to record book
② Date and initial 'Final Anion Report' for traceability
③ Attach (tape) balance certificates in logbook

LABLST.05/93

Auditor's Signature and Date S. Mendenhall 12 August 1993

- ③ Add reference to use of EPA 300, Nov 1989, as guidelines
- ④ Add brief description of spl. prep to record book.

LAB INSPECTION CHECKLIST

AUDITOR J. Mander DATE 20 August 1993

STUDY NUMBER SA30214 SITE LOCATION Niles Station, Niles, Ohio

→ Bottle Room 6004 TIME 930A

STUDY PROTOCOL/QAPP DE-AC209PC93251 07/16/93

Lab Phase Inspected PAH/SVOC Gaseous Liquid Samples - Filters

Personnel Involved Rene Davis, gpn Satola

Protocol/QAPP/SOP Requirements QAP pg 5.3-13 to 16

Narrative Account Chromatography: deactivated silica gel - muffled
8 hr at 451°C - done fresh batch/da and approximately
10 g weighed onto ea column; Glassware ^{cleaning} ~~columns~~ (curran),
dilute acid, muffled afterwards; DI H₂O used for
cleaning. Silica gel columns are wet-picked

Sample storage, preparation, analysis and custody procedures Lab 96688 used for
PAH/SVOC tracking. Sample set 07-30 tracked. Sample code
ID used as ^{Cross} ~~batch~~ reference. Rene Davis extracts (ID #)
→ Rene O. Davis (new ID#) Chromatography Niles

Additional Comments freeze - monitoring 1x/week (SN974629)

Preliminary study for fractionation determined
volumes used and details for solvents using
a validated procedure.

contd 20 Aug 02

Recommendations Recommend calibrating freeze thermometer;
loose bottles into secondary containers to prevent
possible leakage; padlocking freezer during non-working

LABLST.05/93 Auditor's Signature and Date Judy Mander 23 August 1993

hours since laboratory is not locked.

LAB INSPECTION CHECKLIST

AUDITOR S. Mander DATE 20 August 1993-02 Cont.

STUDY NUMBER SL90214 SITE LOCATION Nile Station, Nile, Ohio

TIME _____

STUDY PROTOCOL/QAPP _____

Lab Phase Inspected _____

Personnel Involved _____

Protocol/QAPP/SOP Requirements _____

Narrative Account Concentration made, stopped, cones & c
teflon tape, labelled sample ID, sub# date & prep,
temperature/storage → silica column is labelled &
sample site ID → silica labelled & lab and spl. ID.
Caps have teflon liners and are muffled (8 hrs/451°) < use.

Sample storage, preparation, analysis and custody procedures Spl. loaded onto column
→ mil used & hexane (1 flush. discarded after packing
column) → elution & meth/ hexane → amber bottles
labelled & lab, spl. ID, type & fraction. White fractions

Additional Comments are stored in hood at st. until next step
(Saturday). Spl. set ^{Lab} 768 46688-43-8 thru 43-17;
Tiles 5B, F, 730, ^{MA} 4, 5A, 5B are spl. IDs Cont'd 20 Aug 93
Thuffle oven - Blum CN 7880F; SN CW 566; hood X96526

Recommendations Extraction hood last monitored 04/13/93 -
called safety re: monitoring face velocity
in 6004 to determine hood efficiency

LABLST.05/93

Auditor's Signature and Date Sandy M. Mander 23 August 1993

LAB INSPECTION CHECKLIST

AUDITOR J. M. Anderson DATE 20 August 1993-03 Cont'd
 STUDY NUMBER SC930214 SITE LOCATION Niles Station, Niles Ohio
Room 6004, 6031 TIME 11A, 20 August 1993-0
 STUDY PROTOCOL/QAPP (Sops were initiated for prep on 19 Aug. 1993)

Lab Phase Inspected _____

Personnel Involved _____

Protocol/QAPP/SOP Requirements _____

Narrative Account Sample Concentration - New remones label from amber bottle, transfers to X-D set-up. 2-3X rinse c mells. Add boiling chips. Wrap mells - Snyder c fid, short rinse c mells

Sample storage, preparation, analysis and custody procedures Cyclone Sample transfer from Dave Ogler / Melinda Hays to Dave Raine - documented in 4668 for log-in then stored in freezer until fractionation initiated; transfer also documented in D. Ogler's prep lab

Additional Comments Concentrated sample transferred to Chromaflex tube → spiked with internal standard then reduced c N₂ evaporator. Concentrated DCM fraction first then MCH fraction. Blue M water bath 65° → 80° → 90° C

~~SMA~~ Recommendations All glassware & boiling chips muffled; resealed and remuffled afterwards & clean glassware only. MM5 samples from lab 4668 p 92

LABLST.05/93

Auditor's Signature and Date Leahy M. Anderson 23 Aug 1993

LAB INSPECTION CHECKLIST

AUDITOR J. Anderson DATE 20 August 1993 - A
 STUDY NUMBER 50931214 SITE LOCATION Niles Station, Niles, Ohio
Battelle TIME 330P

STUDY PROTOCOL/QAPP DE-AC22-93PC 93251 07.16.93

Lab Phase Inspected PAH Analysis GC/MS

Personnel Involved Joe Chuang, Joe Tabor

Protocol/QAPP/SOP Requirements QAP P 5.1-19

Narrative Account FC-43 ^{cell} used for tuning filed ~ 1X/yr.
Calibration output record maintained. Two standards are run
at beginning of day, every 3rd injection = std, and one run
at end of day; FC-43 peak fit run at beginning of each day.

Sample storage, preparation, analysis and custody procedures "TSO" Logbook has:
sample ID, file ID, lab reference number. File ID
tracks to Instrument Run Log, then file → Tape for
data storage

Additional Comments Freezer for stds (X 73864074) monitored every
std day. Syringes are cleaned & toluene aspiration
between each use. Spl. analysis → Joe Tabor check IS peak →
QOP = CHEM-TI-046; Equipment Finnegan MAT TSO GC/MS

Recommendations → Joe QCS & generates Qwert Report → Y. Katone
puts into spreadsheet → 3rd party QC review

Corrective Action: Joe → Joe who checks peak resolution, decides ①

LABLST.05/93

Auditor's Signature and Date Andy M Anderson 20 August 1993

Run flow: FC 43 → std → std → spl. → spl. → spl. → std
① to replace septum, break off front of column or to
dilute the sample.

LAB INSPECTION CHECKLIST

AUDITOR J. Mandernak DATE 11 October 1993

STUDY NUMBER SC130214 SITE LOCATION Miles Station, Miles, Ohio
→ Bottell Ln 7249, 7228 TIME 210P

STUDY PROTOCOL QAPP DE-AC22-93 PC93251 07.16.93

Lab Phase Inspected Alcivn / Xuan Analysis GC/MS

Personnel Involved Mary Shrock

Protocol/QAPP/SOP Requirements QAP P5.1-20, 21

Narrative Account: Spl. stored in freezer SN386-024 (Ln 7249);
MS Log #6575 p83 for sent VG analyzed HY5890 A GC;
11-2505; Spl. removed from freezer, vortexed briefly
then injected c separate spl. syringe. MS log has spl. file
ID, GC/MS operating parameters; column is as specified

Sample storage, preparation, analysis and custody procedures Tracked spl.
46715-16-15, mms Lite 5A filter extract to MS logbook
46575 p83. Spl. custody transfer documented in Alcivn
Sub Sample Logbook

Additional Comments in QAP P5.1-21. Five point recalibration performed
on 10/07/93 (on MS log p.81). CONCAL is calibration point
03. Commercially available stds. (Cambridge Isotope)
used. Dave Ogler is original standards custodian. Cont. 11 Oct 93.

Recommendations Checked v Mary & Karen Lipp v QAP P5.1-49 which
implies that method blank will, cleanup lab and analysis blank.
Clarified that method blank/spl. set is analyzed.

LABLST.05/93

Auditor's Signature and Date Mary M. Anderson 11 October 1993

LAB INSPECTION CHECKLIST

AUDITOR J. Mander DATE 11 October 1993 - 02 contd.

STUDY NUMBER 5693024 SITE LOCATION Niles Station, Niles, Ohio

TIME _____

STUDY PROTOCOL/QAPP _____

Lab Phase Inspected _____

Personnel Involved _____

Protocol/QAPP/SOP Requirements _____

Narrative Account Spl. flow = Window Mix and Column performance
Check (both commercially purchased), run as a single
injection → Calibration point 03 → deion blank → Spl. as
method blank (once per), sample, matrix spike, spl. Cal. pt.
03 run at beginning and end of day

Sample storage, preparation, analysis and custody procedures MS log: MS file ID,
Lab ID, spl. ID for elution sequence, injection volume,
and clock time for injection; Cal. Standards window
& perf. now shown monitored, locked freezer (I-75025)

Additional Comments M. Shrock and J. Labov performing disin-
alyzer. Joe does integrations (data analysis) and
many enter data into spreadsheets which are transferred
to Assistant Project Manager for final review

~~JMA~~ Recommendations 70 SEC Computer calibration program
03/01/93, 07/07/93 (by M. Shrock) and both passed

LABLST.05/93

Auditor's Signature and Date Judy M. Anderson 11 October 1993

APPENDIX C

SAMPLING PROTOCOL

SAMPLING PROTOCOL

C-1. Introduction

The purpose of this Appendix is to summarize important aspects of the field sampling effort at the SNOX process that may not be adequately covered elsewhere. The actual schedules and sample recoveries achieved in the field are described in sections 1 through 3 of this report. This Appendix provides further detail on the procedures used in sampling, recovering, and storing samples from flue gas, solid, and liquid streams. This information is intended to supplement that provided in the QAPP for this project.

C-2. Reagent and Materials Preparation

The sampling conducted at SNOX process required a variety of chemical reagents and sampling materials, which were prepared or provided either by Battelle or by Battelle's subcontractors. All of the chemical reagents needed for flue gas sampling and sample treatment were prepared by Battelle, and distributed to Chester Environmental sampling personnel as needed. The purpose of this approach was to minimize sampling variance by using reagents from a single source. The list of reagents included acidified peroxide and permanganate for the Multi-Metals trains, carbonate/bicarbonate solution for the anion trains (Method 26A), 0.1 N H_2SO_4 for ammonia collection, 0.1 M NaOH for cyanide collection, and acidified 2,4-dinitrophenylhydrazine (DNPH) for aldehyde collection. These reagents were made up on-site from high purity starting materials, including deionized water, or were prepared from concentrated stock solutions brought from Battelle, when reagent stability made that approach appropriate. All reagent solutions were made up fresh on the day of sampling and distributed to Chester personnel.

Various rinse solutions were also brought to the site or made up by Battelle, for use in recovering samples from the various trains. Those brought to the site were deionized water, acetone, acetonitrile, and 50/50 methanol/methylene chloride. Rinse solutions made up at the site were 0.1 N HNO_3 and 8 N HCl. These solutions were supplied to Chester staff as needed.

Sampling materials were provided both by Battelle and by subcontractors. Materials provided by Battelle were Summa polished sampling canisters for VOC's, filters for all flue gas sampling runs except the HEST, and cleaned XAD resin for all SVOC sampling by Modified Method 5. The XAD was obtained and cleaned by Battelle, and was used to fill sampling glassware of different designs for Battelle and Chester. The filters provided by Battelle included 87 mm diameter for Battelle's flue gas sampling, 104 mm diameter for Chester's hot flue gas sampling, and 203 mm x 254 mm (8 in. x 10 in.) for Chester's PSDS sampling. All these filters were high purity quartz fiber. Filters used for SVOC sampling were muffled and stored in muffled aluminum foil before use. Filters used for Multi-Metals and particulate mass measurements were weighed under constant conditions before shipment to the field. Battelle also supplied pre-cleaned containers for most of the flue gas and solid/liquid samples.

Other sampling materials were supplied by subcontractors. Chester supplied pre-cleaned VOST traps for use by both Chester and Battelle, and provided HEST carbon-impregnated filters and associated quartz particulate pre-filters for both groups. Chester provided cascade impactors and the necessary stage components for particle size determinations at Locations 5a and 5b. Zande Labs provided pre-cleaned 40-ml vials for headspace-free collection of liquid samples for VOC analysis.

C-3. Sample Preparation

The Battelle and Chester field sampling teams prepared their own respective sampling trains using the reagents and materials described above. Within each of the Battelle and Chester field teams, a single staff member was designated the Sample Recovery Leader. That person, and only that person, directed and approved the preparation and recovery of sampling trains. Each group used their own laboratory facilities on-site, as described below:

- Battelle's field laboratory is a 40-foot air conditioned semi-trailer equipped with a side entrance door and an electrically operated platform lift at the rear double doors. The trailer accepts 100 A of 125 V/250 V AC power by hardwiring to a transformer or switch box. This trailer served as the primary contact point for

Battelle and Chester staff, and was used for meetings among project personnel to review the previous day's activities and plan for the current day. Such meetings were especially necessary on the 6 sampling days, but were useful in the setup and shutdown phases of the field effort.

- Two 28-foot rental trucks equipped with side entrances were used by Battelle staff for preparation of flue gas sampling equipment and for recovery of some samples. The two trucks were equipped with tables, storage areas, and a desk for equipment setup, and sample recovery. One of these trucks was used as the sample recovery area for aldehyde samples only. This arrangement minimized contamination of aldehyde samples by acetone used in other activities.
- Chester Environmental's field laboratory was a laboratory trailer approximately 15 feet long, and equipped with lights, air conditioning, storage, and work areas. The laboratory trailer was used by Chester for preparation of sampling equipment, cleanup, sample recovery, and sample documentation tasks.

The facilities described above were positioned close to one another near the stack and the SNOX demonstration project at the SNOX process. That location was roughly centrally located among the various flue gas and process sampling locations. In addition, two commercial compressed gas tube trailers were positioned near the base of the Boiler No. 2 stack. Those trailers were obtained by Chester, and supplied the N₂ and O₂ needed as diluent gas in the plume dilution sampling at the stack.

Written procedures for reagent and train preparation were provided to field staff, and were posted in the train preparation areas of the Field Facilities. Copies of those documents, which included sample recovery as well as preparation procedures, are included at the end of this Appendix. All sampling reagents and trains were prepared under the direction of the Sample Recovery Leader. Every flue gas sampling train was accompanied by a chain-of-custody form specific for that sample and sampling location, from the moment the train was assembled. That custody form remained with the train throughout sampling, and was returned to the field laboratory with the train once sampling was completed. That same form was then used during sample recovery and documentation procedures.

C-4. Sampling Methods

Table C-1 presents a summary of the chemicals measured, the type of samples in which each chemical was measured, and the sampling methods used for each.

The sampling methods used were detailed in the QAPP for this study. Brief descriptions of the sampling methods are as follows:

USEPA Method 29 (Draft June, 1992) - Multiple Metals. Method 29 is designed to determine emissions of metals from stationary sources. In Method 29, flue gas is withdrawn isokinetically from the source, with particulate emissions collected on a heated quartz filter and gaseous emissions collected in a series of chilled impingers. The series of impinger consists of two impingers containing a solution of dilute nitric acid and hydrogen peroxide, and two impingers containing a solution of dilute potassium permanganate and sulfuric acid.

A series of two glass cyclones preceded the pre-weighed quartz filter at the ESP inlet to provide size cuts of $> 10 \mu\text{m}$, $5\text{-}10 \mu\text{m}$, and $< 5 \mu\text{m}$ in the collected particulate matter. These cyclones were located in the heated sampler box along with the particulate filter. Thus the $10 \mu\text{m}$ and $5 \mu\text{m}$ cyclones replaced the single $10 \mu\text{m}$ cyclone normally used in the Method 5 type train. The cyclone cut points were based on a computer program used to design the cyclones. Insufficient time was available before the study to conduct confirmatory tests of the cyclone cut points.

Method 29 sampling at the baghouse inlet was modified to include the use of a flexible, heated, Teflon sample line connecting the probe to the heated cyclones and filter. The flexible heated line, which allowed the vertical sampling required at that location, was made of 1/2 in. diameter, thick-walled, smooth bore Teflon tubing and contained a temperature monitor. An empty impinger was used in the train for condensate drop-out.

USEPA Method 26A - Particulate Matter, Hydrogen Chloride, Hydrogen Fluoride. Sampling was conducted along the general procedures of EPA Method 26A, with adaptations to the guidelines of California Air Resources Board (CARB) Method 421 in the collection solution employed. Method 26A is designed to determine particulate matter,

TABLE C-1. SUMMARY OF REQUIRED MEASUREMENTS AND SAMPLING METHODS USED
TO ACHIEVE THEM

Measurement	Type of Sample	Method
Volatile Organic Compounds (VOC)	Flue Gas Flue Gas Liquid	Summa Canisters ^(a) Volatile Organic Sampling Train (VOST) Process Sample Collection
Semivolatile Organic Compounds (SVOC)		
Polycyclic Aromatic Hydrocarbons (PAH) and Other SVOC	Flue Gas (Vapor) Flue Gas (Particulate) Solid Liquid	Method 23/Modified Method 5 Method 23/Modified Method 5 Process Sample Collection Process Sample Collection
Volatile Elements (Hg, As, Se) Elements	Flue Gas (Vapor) Flue Gas (Particulate) Flue Gas (Vapor) Solid Liquid	Hazardous Element Sampling Train (HEST) Method 29 Method 29 Process Sample Collection Process Sample Collection
Anions (F ⁻ , Cl ⁻ , PO ₄ ³⁻ , SO ₄ ²⁻)	Solid Liquid Flue Gas (Particulate)	Process Sample Collection Process Sample Collection Method 26A/CARB 421
HCl, HF	Flue Gas (Vapor)	Method 26A/CARB 421
Ammonia	Flue Gas (Vapor) Liquid	Impingers, APHA 401 Process Sample Collection
Cyanide	Flue Gas (Vapor) Liquid	Impingers, APHA 808 Process Sample Collection
Aldehydes	Flue Gas (Vapor) Liquid	TO-5, APHA 122 Process Sample Collection
Radionuclides	Solid Flue Gas (Particle)	Process Sample Collection Filter from Ammonia/Cyanide Train

TABLE C-1. (Continued)

Measurement	Type of Sample	Method
Carbon	Solid	Process Sample Collection
	Flue Gas (Particle)	Filter from Ammonia/Cyanide Train
Particle Size Distribution	Flue Gas (Particle)	Impactors
	Flue Gas (Particle)	Cyclones with Method 29
	ESP Ash	Process Sample Collection
Moisture, Heat Content, Ultimate/Proximate	Boiler Feed Coal	Process Sample Collection

(a) On Method 23 train.

and hydrogen halides in the absence of other chloride-containing volatile species. It is suitable for combustion sources where the primary source of chloride is the dissociation of chlorinated organic compounds. In the present study this method was used to determine HF/HCl and their corresponding particulate anions, as well as particulate SO_4^{2-} and PO_4^{3-} .

A sample of flue gas is withdrawn isokinetically from the source, with particulate emissions collected on a heated filter and gaseous emissions collected in a series of chilled impingers containing a solution of sodium carbonate (1.8 mM) and sodium bicarbonate (1.7 mM). The method was used in this study in a single-point, nontraversing mode. The use of carbonate/bicarbonate solution as the collecting medium for HCl and HF followed the guidelines of CARB 421. The solution was prepared by a 1:1000 dilution of stock solution in the field. The same solution was used for rinsing of the probe and filter holder after sample collection. An empty impinger was used at the front of the chilled impinger train to collect condensed water from the stream. The collected condensate was saved as a sample fraction for chemical analysis.

USEPA Method 23 - Semivolatile Organic Compounds. Method 23 is designed to determine specifically dioxins and furans. In this study, Method 23 was adapted, according to Modified Method 5 guidelines, to measure polycyclic aromatic hydrocarbons (PAH). Thus Method 23 as referred to in this document is a modified method for measurement of PAH and other SVOC.

In addition, whole air samples were collected from the Method 23 train in SUMMA polished canisters, to determine volatile organic compounds (VOC). Samples for VOC were taken with both SUMMA canisters and VOST (volatile organics sampling train) for comparison of the two methods.

Glass cyclones were used in the Method 23 train as described above for the Multi-Metals train. At the ESP inlet the method employed a flexible heated Teflon sample line connecting the probe to the heated filter. The flexible heated line, which allowed the vertical sampling required at this location, was made of 1/2 in., thick-walled, Teflon tubing and contained a temperature monitor.

Canister Method - VOC. The SUMMA samples were taken directly into evacuated stainless steel canisters. The samples were taken from a tee in the Method 23 train between the condenser and the XAD-2 cartridge for the Chester samples, and were taken from a tee upstream of the integral condenser/XAD unit in the Battelle train. Each canister was equipped with a manual valve to maintain vacuum until sampling is initiated. A flow orifice was sized and installed in the sampling line (Teflon) between the tee and the canister valve, to provide a time integrated sample. The orifice was sized to allow the canister to fill over a one-half hour period. The Chester tee fitting was designed so that water condensing in the main air flow to the XAD-2 cartridge was separated by gravity from the small air flow (approximately 200 cm³/min) flowing to the canister. This arrangement prevented water from clogging the flow orifice in the canister line. In the Battelle train, a glass midget impinger containing hydrogen peroxide solution was placed in an ice bath, and served to condense out moisture and remove SO₂ in the flow line upstream of the orifice. Each canister connection had a compound pressure/vacuum gauge attached. This gauge was used to measure the initial canister vacuum, monitor canister pressure during sampling, and record the final canister pressure after sampling. Three canister samples were taken (approximately simultaneously with three VOST samples) on each organic sampling day.

VOST. VOST samples for volatile organic analysis were taken with a Graseby-Nutech 280 Volatile Organics Sampling Train (VOST), or equivalent. Sampling was conducted consistent with the procedures of SW-846 Method 0030 which provides for the collection of volatile organic compounds by adsorption onto Tenax and Tenax/charcoal sorbents, and with the guidelines stated in the VOST manual (Graseby-Nutech, Durham, NC). The standard VOST consists of a glass-lined probe followed by an isolation valve, a water-cooled glass condenser, a sorbent cartridge containing Tenax (1.6 g), an empty impinger for condensate removal, a second water-cooled glass condenser, a second sorbent cartridge containing Tenax and petroleum-based charcoal (3:1 by volume; approximately 1 g of each), a silica gel drying tube, a calibrated rotameter, a sampling pump, and a dry gas meter. The gas pressure during sampling and for leak-checking was monitored by pressure gauges which are in line and downstream of the silica gel drying tube. In this study, the Tenax/charcoal sorbent traps were augmented with a combination of modern carbon-based

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sorbent materials (Carbosieve, Supelco, Inc.). This approach enhanced collection and recovery of a variety of volatile organics from the flue gas streams.

Each VOST run consisted of three samples, each of which comprised a pair of traps in the VOST system. The three samples were taken over periods of 5, 10, and 30 minutes, at a flow rate of 0.5 L/min. Each VOST sample was run during the same time period as the SUMMA canister samples collected from the Method 23 train.

Impinger Sampling. Sampling for gaseous aldehydes, cyanide, and ammonia was conducted using a series of impingers downstream of a Method 26A type train operating at a single point (i.e., nontraversing) in the flue gas flow. The front half of the train consisted of a glass nozzle, glass heated probe, and a heated quartz fiber filter. The back half of the train was a separate set of impingers prepared for each of the analytes listed above, and changed out sequentially over the course of each sampling day at intervals corresponding to the appropriate sampling times.

The aldehyde samples were taken after the general provisions of EPA Methods 0011 and TO-5 and APHA Method 122 (Aldehydes in Ambient Air and Source Emissions). The sample were collected nonisokinetically, and the filter was not analyzed for aldehydes. The first impinger was an empty condensate collector, and the next two impingers contained an acidic 2,4-dinitrophenylhydrazine (DNPH) solution in which aldehydes in the sample are converted to form stable DNPH derivatives. These were followed by a silica gel impinger and a pump and metering box. The aldehyde samples were run for 1 hour at a flow rate of 1.0 L/min.

The sampling train used for ammonia and cyanide contained a filter to collect material for radionuclide and residual carbon analysis. Sampling was isokinetic at a single point. The cyanide samples were taken after the general provisions of APHA Method 808 (Determination of Cyanide in Air) with an impinger train, as those described above, but containing a dilute sodium hydroxide solution to collect gaseous cyanide and retain it in ionic form. The sampling time was about 1 hour.

The ammonia sample was also taken with an impinger train after the provisions of APHA Method 401. The train was similar to those described above, but contained a dilute

sulfuric acid solution. Ammonia in the sample gas is converted and retained in the impinger solution as ammonium sulfate. The sampling time was about one-half hour.

The need for analysis of the filter in Method 26A for F^- and Cl^- dictated a large sample flow for that method. Replacing impingers for HF and HCl with those for ammonia, and cyanide readily adapted Method 26A to sampling those constituents as well, but required use of standard glassware and reagent volumes. Consequently, sampling for gaseous ammonia and cyanide employed full-size Method 5 glassware, with sample flow rates of 10-15 L/min. A single particulate filter was used throughout the sampling of ammonia and cyanide in sequence, to maximize the particulate sample collected for radionuclide and residual carbon analysis.

HEST. The Hazardous Element Sampling Train (HEST) was used to determine volatile elements at the flue gas sampling locations. The HEST sampler consists of a filter pack with a stainless steel support screen, and three 47-mm filters. The air flow entering the HEST sampler first encountered a quartz filter for particle collection, followed by two charcoal impregnated filters for collection of volatile elements (arsenic, mercury, selenium). The first impregnated filter is for collection of the volatile elements, and the second allows checking for breakthrough. Because only volatile elements are of interest, the HEST was used for nonisokinetic, single point sampling.

Particle Size Determination. Glass cyclones were used to classify and collect particles by size at Location 18, the baghouse inlet. Pilot Model Mark III cascade impactors were used to determine particle size distributions in sampling at the baghouse inlet and outlet. The impactors had an inlet, seven impactor stages, and a back-up filter. The impactor performs aerodynamic sizing by routing the sample through a series of bends of increasing sharpness and jets of diminishing diameter. As the gas passes through the impactor jets, aerosol particles, which due to inertia cannot follow the gas flow stream, land on glass fiber filters attached to back-up plates. The smaller particles remain in the gas stream, continuing on to the next stage. With each successive stage, the mean diameter of the particles decreases down to the final back-up filter, which screens out all remaining particulate. The actual aerodynamic cut size per stage depends on the velocities of the gas

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through the impactor. All impaction substrates and the backup filter were of Reeve-Angel 934 AH glass fiber mats. This material is reported to have very low characteristics for absorption of SO_2/SO_3 .

A summary of the testing methodology follows:

1. Isokinetic sampling rates, nozzle size and sampling times were calculated based on preliminary velocity, temperature and moisture characteristics.
2. The units were assembled and sealed in a clean area, transported to the sampling location, attached to the sampling probe and train, and tested for leakage at 15 in. Hg vacuum.
3. The sampling head was then pointed downstream for a minimum of 10 minutes, to allow the assembly to warm to stack temperature. The assembly was then turned 180 degrees to begin sampling. The sampling consisted of a single point sample, collected isokinetically at a point of average flue velocity.
4. After the sample was collected, the sampling head was removed from the stack, disconnected from the sampling probe, sealed and transported to a clean area for disassembly and sample recovery. Collection plate filters were removed stage by stage using tweezers and placed in separate, labelled petri dishes. The jet stages were examined and any blocked jets cleaned.
5. The petri dishes were sealed for transport to Chester's laboratory for gravimetric determinations. The sampling head was then reassembled for the next test.

C-5. Sample Storage and Recovery Procedures

Flue gas sampling trains were returned to the field laboratories after sampling for sample recovery by the Sample Recovery Leader. Sample recovery areas were off-limits to all but those staff involved in the actual preparation, recovery, and documentation of samples. Sample recovery was generally done after the completion of all sampling for the day, and after sampling staff had left the site. This further minimized interference in the sample recovery process. Sample recovery procedures were set out in single-sheet protocol forms, that detailed the train preparation and sample recovery steps for each train. These

forms were distributed to sampling staff and were posted at each sample recovery area in the field laboratories.

Samples recovered typically involved several portions or fractions of various types, or intended for various purposes. Samples were preserved and stored under conditions appropriate for the sample type. Table C-2 summarizes the preservation and storage conditions for various samples. Sample preservation consisted of adjustment of pH for liquid or impinger samples. Most samples were refrigerated in the Battelle field facility (4 C), or were stored at room temperature in shipping boxes ready for transfer to the analytical laboratory. The Modified Method 5 (Method 23) particulate filters were stored on dry ice in the field to maintain the -78 C temperature indicated.

Although as Table C-2 indicates holding times for the collected samples were quite long, in practice some samples were returned to the analytical laboratories immediately after collection by daily express shipment from the plant site. Those samples included liquid samples for anions, VOC, and SVOC, Summa canisters, VOST cartridges, and (when space was available) impinger samples from flue gas trains. Other samples were returned to Battelle with the field facilities at the end of the study. Chain-of-custody forms accompanied all samples at all times during storage on-site at Niles, and during shipment. A Battelle staff member was designated to serve as Chain-of-Custody officer at Battelle for samples sent back or brought back from the field study. That staff member had complete control over access to samples at Battelle, and distributed samples to the appropriate analytical staff only after cross-checking of chain-of-custody forms.

C-6. Sampling QA/QC

Quality assurance activities in field sampling included collecting samples of all reagent and rinse solutions, including deionized water, for use as reagent blanks. Method blanks were also collected, by preparing a complete sampling train, exposing it to the normal handling and transport procedures used before and after sampling, and recovering the train without sampling of flue gas. This procedure exposes the train to potential sources of background contamination as in normal sampling. In addition, specific QC procedures

TABLE C-2. PRESERVATION AND STORAGE REQUIREMENTS

Sample	Analysis ^(a)	Preservation Requirements	Storage Conditions	Holding Time
Bulk Solid Samples	Elements, F-C-P	None	Room Temperature	30 days
	SVOC	None	Room Temperature	30 days
	U/P, RAD	None	Room Temperature	30 days
Liquid Samples	Dissolved trace elements	HNO ₃ to pH <2	Room Temperature	30 days
	Total trace elements	HNO ₃ to pH <2	Room Temperature	30 days
	Anions	None	4°C	14 days ^(c,d)
	VOC	No headspace	4°C	14 days ^(c)
	SVOC	None	4°C	14 days ^(c,d)
	CN	NaOH to pH >12	4°C	14 days
	NH ₄	H ₂ SO ₄ to pH <2	4°C	14 days
Method 29 Train Impinger Solutions	Trace Elements	HNO ₃ to pH <2	4°C	30 days
	Particulate Filter	Trace Elements	Room Temperature	30 days
Method 23 Train XAD-2 Resin	SVOC	None	4°C	28 days
	Particulate Filter	SVOC	-78°C	28 days
Summa Canister	VOC	None	Room Temperature	2 days ^(c)
Aldehyde Impinger Train	Aldehydes	None	4°C	28 days
HEST Samples	Hg, As, Se	None	4°C	6 months
Ammonia Train Impinger Solutions, Liquids	Ammonia	None	4°C	14 days
CN Train Impinger Solutions	CN	None	4°C	28 days
Method 26A Train Impinger Solutions	HF, HCl	None	4°C	28 days
Method 26A Train Filter	SO ₄ ²⁻ , PO ₄ ³⁻ , F ⁻ , Cl ⁻			
VOST Cartridges	VOC	None	4°C	14 days

- (a) F-C-P = Fluoride, Chloride, Phosphate
SVOC = Semi-volatile Organics
VOC = Volatile Organics
RAD = Radionuclides
UP = Ultimate/proximate coal analyses.
C = Carbon.
CN = Cyanide.
NH₄ = Ammonia.

(b) Extracted within 14 days, analysis within 40 days of extraction.

(c) Samples were returned to Battelle within 24 hours after collection in the field.

(d) Liquid samples were analyzed as soon as possible for phosphate to minimize degradation of this analyte in these samples.

specific to each of the sampling methods were used. Those specific procedures are described briefly below:

QC Checks for Velocity/Volumetric Flowrate Determination. Prior to flue gas sampling, volumetric gas flow rate data were collected at the flue gas sampling locations, using the procedures specified in EPA Method 2. Quality control procedures were as follows:

- Visually inspect the S-type pitot tube or standard pitot tube before and after sampling.
- Leak-check both legs of the pitot tube before and after sampling.
- Check the number and location of the sampling traverse points before taking measurements.
- Clean and check inlet tubes periodically and clear ash from impact side of pitot tube as necessary.

Quality Control Procedures for Moisture Determination. The moisture content of the gas streams was determined using the technique specified in EPA Method 4. However, the actual moisture sampling was conducted as part of Methods 23, Method 5, and Method 29 sampling procedures at the flue gas locations. The following internal QC checks were performed as part of the moisture determinations:

- The volume of impinger contents was measured by weighing to the nearest gram before and after sampling.
- The sampling train (including impingers) was leak-checked before and after each run.
- Ice was maintained in the ice bath throughout each run.
- The volume of water in the collection bottle, into which water from the first impinger was periodically drained, was measured by weighing to the nearest gram.

Quality Control Procedures for Flue Gas Sampling Methods. The following pretest QC checks were conducted for all flue gas sampling methods:

- All sampling equipment was thoroughly checked to ensure clean and operable components.
- Equipment was inspected for possible damage from shipment.
- The oil manometer or Magnehelic gauge used to measure pressure across the pitot tube was levelled and zeroed.
- The pitot tubes and connecting tubing were leak checked
- The temperature measurement system was visually checked for damage and operability by measuring the ambient temperature prior to each traverse.

In addition to the general QC procedures listed above, QC procedures specific to each sampling method were also incorporated into the sampling scheme. These method-specific procedures are discussed below.

Quality Control Procedures for Method 29. EPA Method 29 was used to sample for vapor phase and particulate elements. The following quality control procedures were followed:

Prior to Start of All Testing

- The trains were assembled in an environment free from uncontrolled dust.
- Each sampling train was visually inspected for proper assembly.
- All cleaned glassware was kept closed with tightly closed ground glass caps or Teflon tape.
- All filters were stored in a precleaned glass petri dish sealed with Teflon tape.
- Pretest calculations were performed to determine the proper sampling nozzle size.

Prior to Testing Each Day

- The number and location of the sampling points were checked before taking measurements.
- The sampling nozzle was visually inspected.
- Each leg of the pitot tube was leak-checked.
- The entire sampling train was leak-checked.

During Testing Each Day

- The roll and pitch axis of the pitot and the sampling nozzle were properly maintained.
- The train was leak-checked before and after a run, if the train was opened for any reason, and if a filter change took place.
- Additional leak-checks were conducted if a leak exceeded 4 percent of the sampling rate, and efforts were made to improve the leak tightness of the train.
- The filter was maintained at the proper temperature.
- Ice was kept in the ice bath at all times.
- Proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum were made during sampling at each traverse point. Copies of the field operator data sheets are shown in Appendix D.
- Isokinetic sampling was maintained within about 15 percent.
- Sample train and field blanks were collected for analysis and maintained at approximately 4°C.

After Testing Each Day

- The final meter reading was recorded.
- Completeness of the data sheet was checked.
- A final leak-check of the sampling train was done at the maximum vacuum observed during the test.
- Each leg of pitot tubes was leak-checked.

- Recovered train following prescribed procedures.

Quality Control Procedures for Method 23 (Modified Method 5, with Summa Canisters).

Prior to Start of All Testing

- The Method 23 trains were assembled in an environment free from uncontrolled dust.
- Each sampling train was visually inspected for proper assembly.
- All quartz filters to be used were muffled and cleaned XAD was prepared.
- Openings of all cleaned glassware and prepared sorbent traps were closed with ground glass caps or precleaned foil until train assembly.
- All filters were stored in a precleaned glass petri dish sealed with Teflon tape, and enclosed in aluminum foil.
- Pretest calculations were done to determine the proper sampling nozzle size.

Prior to Testing Each Day

- The number and location of the sampling points were checked before taking measurements.
- The sampling nozzle was visually inspected.
- Each leg of the pitot tube was leak-checked.
- The entire sampling train was leak-checked.
- The Summa canisters were checked for proper vacuum.

During Testing Each Day

- The roll and pitch axis of the pitot and the sampling nozzle were properly maintained.
- The train was leak-checked before and after the run, if the train was opened, and if a filter change took place.

- Additional leak-checks were conducted if the leak exceeded 4 percent of the sampling rate, and steps were taken to improve the leak tightness of the train.
- The filter and sorbent trap were maintained at the proper temperatures.
- Ice was kept in the ice bath at all times.
- Proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum were made during sampling at each traverse point. Copies of the field data sheets are included in Appendix D.
- Isokinetic sampling was maintained within 15 percent.
- Sample train and field blanks were collected for PAH and dioxin/furan.
- Canister pressure was monitored by means of a pressure gauge throughout filling of the canister.

After Testing Each Day

- Final meter reading was recorded.
- Completeness of data sheet was checked.
- Final leak-check of sampling train at maximum vacuum during test was done.
- Final canister pressure was recorded, and the canister tightly closed.
- Each leg of pitot tubes was leak-checked.
- The probe rinses and remaining train were recovered following prescribed procedures.
- Nozzle and cap were reattached for next day and the train was stored in a dry, safe place.

Quality Control Procedures for Method 26A (Impinger Sampling Methods (Cyanide, Acid Gases, Aldehydes, Ammonia)). Impinger-based sampling procedures were used for sampling aldehydes and inorganic compounds. These methods were conducted at

single points in the flue gas stream, isokinetically except for the aldehyde sampling. The following general quality control procedures applicable to all these methods were followed:

Prior to Start of All Testing

- The trains were assembled in an environment free from uncontrolled dust.
- Each sampling train was visually inspected for proper assembly.

Prior to Testing Each Day

- Fresh impinger and rinse solutions were prepared.
- The sampling nozzle was visually inspected.
- The entire sampling train was leak-checked.

During Testing Each Day

- The filter was maintained at the proper temperature.
- Ice was maintained in the ice bath at all times.
- Proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum during sampling at each traverse point were made. Sampling data sheets for these methods are included in Appendix D.
- Sample train and field blanks were collected for analysis.

After Testing Each Day

- Final readings were recorded.
- Completeness of data sheet was checked.
- Final leak-check of sampling train at maximum vacuum during test was done.
- Impinger solutions and rinses were recovered according to prescribed procedures.

Quality Control Procedures for VOST. Sampling for volatile organics was conducted using a Volatile Organic Sampling Train (VOST). The following are key quality control procedures followed in the field:

Prior to Start of All Testing

- VOST glassware was cleaned and assembled.
- The entire unit was assembled, visually inspected, leak tested, and its operation was checked.
- All VOST traps were cleaned, sealed, and labelled.

Prior to Testing Each Day

- VOST sorbent traps were kept sealed and stored in a refrigerator at 4°C.
- The VOST unit was assembled, minimizing the amount of time that the sorbent trap was open to air.
- A visual inspection was made and a leak test was made.

During Testing

- Flow rate was monitored.
- Operation of probe heater was monitored.
- Flow of ice water to condenser was maintained.
- Sampling time was watched closely, so the sampling interval was not overrun.

After Testing

- Final leak-check was performed.
- Sorbent traps were sealed immediately upon disassembly of the unit, and stored at 4°C until shipment for analysis.
- The VOST was prepared for its next use.

Quality Control Procedures for HEST Sampler. Volatile elements in flue gas were determined by means of a HEST sampler, that used carbon impregnated (CI) filters for collection of the metals. Field QC procedures for the HEST were as follows:

Prior to All Testing

- Lab ID numbers were recorded on the petri dishes in which the quartz and carbon impregnated (CI) filters are supplied.
- A clean table area for loading of the HEST filters was prepared.

Prior to Testing Each Day

- The positions of the one quartz and two CI filters in series were recorded as they were loaded, and recorded on the sample data sheet with the corresponding lab ID numbers.
- Both sides of each filter were examined to assure the proper side faced the air flow.
- Teflon-coated tweezers were used in loading the filters.
- The HEST filter assembly was visually inspected during and after assembly.
- Both ends of the assembly were sealed, and the entire assembly was then sealed in a clean plastic bag.

During Testing

- The system was leak tested after attachment of the HEST assembly to the probe.
- Condensate was not allowed to backwash into the HEST assembly.
- When inserting the HEST into the duct, care was taken to avoid scraping the head on the port.
- A proper seal was confirmed between the probe and port.
- Flow rate, sample time, and normal Method 5 sampling parameters were recorded.

After Testing

- When the assembly was removed from the duct, care was taken to avoid scraping the head on the port.
- Final leak test was performed.
- The HEST was kept vertical while the system was disassembled.

- The HEST was sealed, allowed to cool, and the entire assembly was then sealed into a plastic bag.
- Filters were kept flat with deposit side up while disassembling the HEST.
- Filters were placed flat with deposit side up in labelled petri dishes.
- Petri dishes were stored flat.
- Probe and filter chamber were rinsed with acetone and 0.1N HNO₃, and combined washes in a labelled sample jar.

Quality Control Procedures for Particle Size Distributions. At designated sampling locations, particle size distributions in flue gas were determined by cyclone or impactor sampling. The cyclones were incorporated in the Method 29 and Method 23 trains covered above, and used at Location 4. The following are QC procedures applicable to impactor sampling, which was conducted at Locations 5a and 5b.

Prior to Start of All Testing

- All impactor stage filters were preweighed.
- The impactors were assembled in an environment free from uncontrolled dust.
- Each unit was visually inspected for proper assembly.
- Labelled petri dishes were prepared for storage of impactor after sampling.
- Pretest calculations were performed to determine the proper sampling nozzle size.

Prior to Testing Each Day

- The sampling nozzle was visually inspected.
- The entire sampling train was leak-checked.

During Testing Each Day

- The impactor was allowed to warm to flue gas temperature before sampling.
- Isokinetic sampling was maintained within 10 percent.

After Testing Each Day

- Final leak-check of unit was done at maximum vacuum during test.
- Impactor was recovered following prescribed procedures.
- The impactor head was removed from the sampling probe, and sealed for transport to a clean disassembly area.
- Impactor filters were placed in pre-labelled dishes, and the impactor was cleaned for the next run.

Quality Control Procedures for Process Sample Collection. The process sampling quality control included the following procedures:

- The sampling equipment was cleaned and proper sample containers were used.
- Proper scheduling of sampling times was based on consultation with Niles staff.
- Immediate labelling of all samples was done at the time of collection.
- Observations were recorded on preformatted data sheets.
- Log-in and chain-of-custody procedures began as soon as samples were returned to the field laboratory.

APPENDIX D

FIELD SAMPLING DATA SHEETS

APPENDIX D

FIELD SAMPLING DATA SHEETS

In this Appendix, copies are provided of the original field sampling data sheets from the SNOX field study. These sheets show the data recorded by the Battelle and Chester staff in conducting the flue gas measurements. The data sheets are organized in the following order:

- D-1: Modified Method 5
- D-2: Multi-Metals
- D-3: Anions Train
- D-4: Ammonia Train
- D-5: Cyanide Train
- D-6: Aldehyde Train
- D-7: VOST Train
- D-8: HEST Samples
- D-9: Cascade Impactors
- D-10: Calculations of Flue Gas Sampling Parameters and
Particulate Matter Concentration

Within each of these sections, the data sheets are presented in order by site and date. For example, in Section D-1, data sheets from sites 18, 19, 20, and 21 on July 18 are provided, followed by those from sites 18, 19, 20, and 21 on July 21.

D-1: Modified Method 5 (Method 23)

D-2

PARTICULATE FIELD DATA

N-18-M75-718

PLANT Niles
 DATE 7-18-93
 LOCATION BH IN 18
 OPERATOR Webb/Cox
 STACK NO. _____
 RUN NO. 1 Organic
 SAMPLE BOX NO. _____
 METER BOX NO. X 40513

AMBIENT TEMPERATURE 80
 BAROMETRIC PRESSURE 29.16
 ASSUMED MOISTURE, % 6
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. .247
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 250

METER 11.64
 C FACTOR .9

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

Top		Time	4	102	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)				6 7 GAS SAMPLE TEMPERATURE AT DRY GAS METER		3	TEMP TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPIINGER #8 °F	PUMP VACUUM in. Hg gauge	21AD: VELOC
TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _s) (ft/min)	ACTUAL DESIRED			GAS SAMPLE VOLUME (V _m), (l)	INLET (T _{m in}), °F	OUTLET (T _{m out}), °F	SAMPLE BOX TEMPERATURE °F			
2	0	10:10	435	.6	4.3	1.3	1.3	832.843	95	91				
3	16		400	.3		.65	.65	846.3	97	93	260	267	62	7
4	24	10:34	420	.42		.72	.92	850.9						6
5	32		433	.52	4.0	1.2	1.2	854.0	101	97	258	267		8.5
6	40	10:50	424	.60		1.3	1.3	859.2						
7	48		424	.64	4.2	1.4	1.4	864.8	102	99	259	267	55	9.5
8	56		421	.64	3.9	1.5	1.5	870.1						
9	4		422	.7		1.5	1.5	877.2						
10	12		422	.75		1.7	1.7	882.2	105	104	260	260	64	14
11	20	11:00	416	.78	4.5	1.2	1.7	887.0						
12	28		423	.84		1.1	1.84							
Stop	36	11:45												
	2	11:50												
					</									

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g
FINAL	1 2 3 4	
INITIAL		
LIQUID COLLECTED		
TOTAL VOLUME COLLECTED		

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

COMMENTS Didn't do point #1

2

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT NilevDATE 7-18-93LOCATION BH IN 18OPERATOR Webb / COY

STACK NO. _____

RUN NO. 1 Organic

SAMPLE BOX NO. _____

METER BOX NO. X 40513AMBIENT TEMPERATURE 90BAROMETRIC PRESSURE 29.16ASSUMED MOISTURE, % 6PROBE LENGTH, in. 96NOZZLE DIAMETER, in. 0.247STACK DIAMETER, in. 80PROBE HEATER SETTING 250HEATER BOX SETTING 250METER ΔH , 1.64C FACTOR 0.9

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TOP		TIME	A	D ₂		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O			6 7		3	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER (T _g) °F	PUMP VACUUM in. Hg gauge	X10 ⁻³ F VELOCITY (ft/s)
TRAVERSE POINT NUMBER	SAMPLING TIME (t), min	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s) °F	VELOCITY HEAD (V _p) (ft/s)		ACTUAL	DESIRED	GAS SAMPLE VOLUME (V _m) (ft ³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F			
13	0	11.50	398	1.0	4.8	1.9	2.2	898.1	105	105	256	564	5m/	21.5
14	8		397	.98		1.8	2.15	903.5				256	62	
15	16	12:06	400	.94		1.6	2.0	911.0	107	106	258	256		
16	24		400	.86		1.5	1.84							46
17	32		409	.86	4.6	1.4	1.84	921.8						
18	40		405	.78		1.3	1.70	930.0	107	108	256	255		
19	48	12:38	403	.78		1.3	1.70						74	22.5
20	56		405	.78	5.0	1.2	1.70	939.6						
21	04		415	.75		1.1	1.69							
22	28	12:58	STOP -					945.9	5 min	to go at this point				
22	28	13:11	397						107	107	258	257		21
22	28	can't reach pt												46
23	28				22-23									
24	36	13:32	stop	.3	4.4	.45	.65	broken	shear pin					
24		13:44	start 403	.25		.52	.52	958.0			258	259	72	14
TOTAL	36	13:52	Stop					961.084						50

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
FINAL	1	2	3	4				
INITIAL								
LIQUID COLLECTED								
TOTAL VOLUME COLLECTED								

COMMENTS Probe Check .015' cfm at 11

PARTICULATE FIELD DATA

PLANT Niles AMBIENT TEMPERATURE 90 METER IN. 1.64
 DATE 7-18-93 BAROMETRIC PRESSURE 29.08 C FACTOR 0.9
 LOCATION Bit 1N 1B ASSUMED MOISTURE, % 6 PROCESS WEIGHT RATE _____
 OPERATOR Webb / Cox PROBE LENGTH, in. 96 WEIGHT OF PARTICULATE COLLECTED, mg
 STACK NO. _____ NOZZLE DIAMETER, in. .247
 RUN NO. 1 Organic STACK DIAMETER, in. 50
 SAMPLE BOX NO. _____ PROBE HEATER SETTING 250
 METER BOX NO. X-40513 HEATER BOX SETTING 250

SAMPLE	FILTER	PROBE WA:
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	Side	Time	4	102		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), ft ³	6 7 GAS SAMPLE TEMPERATURE AT DRY GAS METER		3 Box Probe		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	X100-7 VELOCITY ft/s	
				VELOCITY HEAD (V _p), (ft/s)		ACTUAL	DESIRED		INLET (T _{m,in}), °F	OUTLET (T _{m,out}), °F	SAMPLE BOX TEMPERATURE °F					
1		0	5:34P	236	.28		.6		961.3	102	101	255	259	67	5.5	
2		16							965.1							45
3		24		319	.50	3.9	1.1		969.2	107	103					
4		32		357	.65		1.4	1.4	973.5						8.5	42
5		40		364	.75	3.8	1.7	1.7	979.5	111	105	257	257	64	11.0	
6		48		366	.85		1.8	1.8	985.2							
7		56	6:30P	363	.90	3.8	1.95	1.95	991.6	113	106	255	256			40
8		4		364	.95		2.1	2.1	998.2						15.5	
9		12		365	1.1	3.8	2.0	2.4	1004.4	114	107	258	257	65		
10		20	6:54	365	1.1		2.0	2.4	1004.4					254	19	38
11		28		371	1.1		1.9	2.4	1004.4							
12		36		378	1.1	3.7	1.7	2.4	1004.4							
TOTAL																

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
FINAL	1	2	3	4	5			
INITIAL								
LIQUID COLLECTED								
TOTAL VOLUME COLLECTED								

0.00 - pt #1
 COMMENTS: Pre leak check Second half
 (changed filter) - 0.012 cfm
 0.102 v/a Para magnetic

A

SCHEMATIC OF STACK

The diagram illustrates the cross-section and profile of a stack. The left part shows a circular cross-section with a diameter of 24 inches, indicated by a horizontal line with arrows at both ends. The right part shows a vertical profile of the stack with a U-shaped sampling probe. The probe has two vertical sections: the upper section is labeled 'DISTURBANCE' and 'SAMPLING SITE', and the lower section is labeled 'DISTURBANCE' and 'GAS FLOW'. A horizontal dashed line indicates the sampling site level.

PLANT N. ler
DATE 7-18-93
LOCATION #18 BH INLET
OPERATOR Webb / Cox
STACK NO. _____
RUN NO. 1 Organic
SAMPLE BOX NO. _____
METER BOX NO. X-40573

AMBIENT TEMPERATURE _____
 BAROMETRIC PRESSURE 29.07
 ASSUMED MOISTURE, % 6
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. .247
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 272

METER IN 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

[illegible]

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT,
	1	2	3	4	
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

COMMENTS

Post beat check .018 at 23:
also s/s probe
with s/s probe at 4" Hg² ni

D-6

NOMOGRAPH DATA

PLANT Nike, Ohio, SNOx process

DATE July 18, 1993

SAMPLING LOCATION outlet of bag house

N-19-MM5-718

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH_0	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m,avg.}$	110
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{w0}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073 \times$ STACK GAUGE PRESSURE in in. H ₂ O)	P_s	27" H ₂ O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	$\frac{14}{15.3}$
AVERAGE STACK TEMPERATURE, °F	$T_{s,avg.}$	380°
AVERAGE VELOCITY HEAD, in. H ₂ O	$\Delta P_{avg.}$	0.642
MAXIMUM VELOCITY HEAD, in. H ₂ O	$\Delta P_{max.}$	1.05
C FACTOR		0.90
CALCULATED NOZZLE DIAMETER, in.		0.260
ACTUAL NOZZLE DIAMETER, in.		0.247
REFERENCE Δp , in. H ₂ O		0.82

EPA (Dwr) 234
4/72

PARTICULATE YIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Tulsa, Okla., SNOXAR AMBIENT TEMPERATURE 68
 DATE July 18, 1993 BAROMETRIC PRESSURE 29.15
 LOCATION Outlet of baghouse ASSUMED MOISTURE, % 7
 OPERATOR Leonard, Hump PROBE LENGTH, in. 72.0, Pass
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MM5-718 STACK DIAMETER, in. 8.86
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F
 METER BOX NO. X-40563 HEATER BOX SETTING 250°F

METER ΔH , 1.65
 C FACTOR 0.90
 PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

D-8

TRAVERSE POINT NUMBER	SAMPLING TIME (h), min	probe temp. STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (h _{p1}), (h _{p2})	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY hr
					ACTUAL	DESIRED		INLET (T _{m1}), °F	OUTLET (T _{m2}), °F				
1	0/10:00	255	336	0.37	0.82	0.82	422.723	75	75	259	59	9.2	4.5
2	10/10:30	256	380	0.52	1.18	1.18	420.1	77	76	260	56	10.5	4.5
3	20/10:40	257	380	0.69	1.50	1.50	434.0	80	78	260	57	13.5	4.5
4	30/10:50	256	384	0.66	1.50	1.50	441.0	81	79	260	57	13.6	4.6
5	40/11:00	260	385	0.73	1.60	1.60	442.8	84	81	261	59	13.9	4.5
6	50/11:10	256	387	0.65	1.50	1.50	454.6	86	83	261	61	13.8	4.6
7	60/11:20	256	388				462.0						
	62/11:22	power off											
	62/11:25	power on											
	63/11:26	power off											
	63/11:20	power on		0.64	1.50	1.50	462.5						
8	70/11:37	257	390	0.61	1.40	1.40	462.5	89	87	261	60	14.5	4.6
9	80/11:47	258	394	0.60	1.35	1.35	474.3	90	88	259	62	14.0	4.6
10	97.5/11:54.5	257	393	0.60	1.35	1.35	479.5	92	90	262	65	14.0	5.0
11	75/12:02	257	391	0.52	1.18	1.18	484.6	93	91	261	64	13.2	4.6
TOTAL													

AVERAGE

handline 101°C

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS

PLANT Niles-Chio, SNOX process AMBIENT TEMPERATURE 73 METER 1.65
DATE July 18, 1993 BAROMETRIC PRESSURE 29.15 C FACTOR 0.90
LOCATION outlet of baghouse ASSUMED MOISTURE, % 7 PROCESS WEIGHT RATE _____
OPERATOR Seward, Kupa PROBE LENGTH, in. 9 ft. glass WEIGHT OF PARTICULATE COLLECTED, mg
STACK NO. _____ NOZZLE DIAMETER, in. 0.247
RUN NO. N-19-MM5-718 STACK DIAMETER, in. 8 ft.
SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F
METER BOX NO. x-40563 HEATER BOX SETTING 200°F

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL

[illegible]

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₁	O ₂	CO	H ₂
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS

PARTICULATE YIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Niles, Ohio, SNOC process

DATE July 18, 1993

LOCATION outlet of baghouse

OPERATOR Lernard, Kupp

STACK NO. _____

RUN NO. N-19-M25-718

SAMPLE BOX NO. 3

METER BOX NO. X-40573

AMBIENT TEMPERATURE 75

BAROMETRIC PRESSURE 29.15

ASSUMED MOISTURE, % 7

PROBE LENGTH, in. 90. glass

NOZZLE DIAMETER, in. 0.247

STACK DIAMETER, in. 8.00

PROBE HEATER SETTING 250°F

HEATER BOX SETTING 250°F

METER V.H. 1.65

C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (h), min	pull time, F	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s),	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY
						ACTUAL	DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F				
21	170/13:52		385	383	0.41	0.93	0.93	539.0	90	91	260	66	13.2	5.3
22	172.5/13:58		382	383	0.43	0.95	0.95	543.4	92	92	261	68	11.8	5.2
23	183/14:05	off shearl pin						546.822						
22	183/14:36	on + off lost power						546.822						
22	183/14:38	on						546.822						
23	185/14:40	off power						548.164						
23	185/14:43	on			0.43	0.95	0.95	548.164						
24	192.5/14:50.5		383	384	0.30	0.66	0.66	552.7	97	96	262	68	9.6	5.1
	200/14:58	off						556.274						
side 7	200/15:09	on			0.24	0.54	0.54	556.274					8.8	
2	202.5/15:16.5		256	361	0.31	0.70	0.70	559.6	99	98	260	72	10.0	5.2
3	215/15:24		254	374	0.70	0.60	1.60	563.2	199	98	259	72	15.2	5.2
4	222.5/15:32.5		255	381	0.53	1.20	1.20	568.9	100	99	261	73	15.0	5.0
5	230/15:40		256	384	0.53	1.20	1.20	573.9	99	99	260	74	14.8	5.2
TOTAL														

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS

PARTICULATE YIELD DATA

PLANT Niles, Ohio SNOx process AMBIENT TEMPERATURE 80
 DATE July 18, 1993 BAROMETRIC PRESSURE 29.15
 LOCATION outlet of baghouse ASSUMED MOISTURE, % 7
 OPERATOR Bernard, Nuss PROBE LENGTH, in. 900. glass
 STACK NO. NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MM5-718 STACK DIAMETER, in. 800.
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F
 METER BOX NO. X-40513 HEATER BOX SETTING 250°F

METER IN, 1.65
 C FACTOR 0.90
 PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (h), min.	probe temp. of static pressure (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), (l)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY ft/min
					ACTUAL	DESIRED		INLET (T _{m,in}), °F	OUTLET (T _{m,out}), °F				
6	832.5/15:42.5	257	383	0.64	1.45	1.45	579.1	100	99	260	75	15.2	5.1
7	245/15:55	258	383	0.61	1.40	1.40	584.0	100	99	260	75	15.5	5.0
8	262.5/16:02.5	258	383	0.67	1.50	1.50	589.0	99	99	257	74	15.8	4.9
9	260/16:10	259	384	0.64	1.45	1.45	594.3	102	101	261	77	15.5	5.1
10	267.5/16:18.5	258	382	0.81	1.85	1.85	599.6	102	101	260	68	12.5	5.3
11	275/16:25	254	383	0.70	1.60	1.60	605.1	99	100	260	65	17.0	5.2
12	282.5/16:32.5	256	383	0.77	1.65	1.75	610.6	99	100	260	65	17.5	5.1
13	290/16:40	277	390	0.91	1.65	2.00	616.1	102	102	263	67	18.0	5.2
14	297.5/16:47.5	342	382	0.91	1.65	2.00	621.6	99	100	259	64	18.0	5.3
15	305/16:55	370	382	0.86	1.65	1.95	627.1	99	100	260	66	18.0	4.9
16	312.5/17:02.5	377	382	0.80	1.65	1.80	632.6	98	99	259	65	18.0	5.1
17	320/17:10	378	382	0.77	1.65	1.75	638.1	100	100	261	66	18.0	4.9
18	327.5/17:17.5	379	382	0.69	1.60	1.60	643.6	102	102	262	67	18.0	5.0
19	335/17:25	379	382	0.69	1.60	1.60	649.1	102	102	261	66	18.0	5.1
20	342.5/17:32.5	379	381	0.64	1.45	1.45	654.7	104	103	260	67	17.6	5.0
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₁	O ₁	CO	N ₁
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS

D-11

PLANT Niles, Ohio SNOX process

PLANT Nile, Ohio SNOWBERRY

DATE July 18, 1993

LOCATION outlet of backhouse

OPERATOR Leonard Hupp

STACK NO. _____

RUN NO. N-19-MM5-276

SAMPLE BOX NO. 3

METER BOX NO. X40513

AMBIENT TEMPERATURE 85

BAROMETRIC PRESSURE 29.15

ASSUMED MOISTURE, % 7

PROBE LENGTH, in. 90T, glass

NOZZLE DIAMETER, in. 0.247

STACK DIAMETER, in. 8.70.

PROBE HEATER SETTING 250°F

HEATER BOX SETTING 250°F

METER IN, 1.65

C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA.
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

CROSS SECTION

[illegible]

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₁	O ₂	CO	N ₂
	1	2	3	4							
FINAL						1					
INITIAL						2					
NOTED						3					
						4					

COMMENTS

Leak check 0.024 at 18.0" H₂O

D-12

KEYSTONE ENVIRONMENTAL RESOURCES AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

Page 1 of 5

CLIENT *Bottle / DOE* TEST DATE *7-18-93 (Sun)* OFFICE CORRECTION (Δ H₂O) *1.572* HOT/COLD BOX NO. *8*
 TEST UNIT *SO₂ Reactor Outlet* TEST NO. *N-20-MMS-74B* METER CORRECTION (Y) *1.0151* PROBE NO. *15-1*
 PROJECT NO. *93CB28-01* NOZZLE (SIZE) *0.448* # *G-37* CALIBRATION DATE *07-02-93* FILTER NO. *unmarked*
 TEST CREW *K/C* STATIC PRESSURE *17.0* PITOT CORRECTION *0.84* STACK DIA. *36"*
 BAROMETRIC PRESSURE *29.30* PORT DIRECTION *SE* CONTROL BOX NO. *THREE* PORT SIZE *36"*

Invert Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Motor Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
15.0"	10:30	527.352	.03	.51	.51	85	77	1.0	600	-250°F	468°F	-250°	15 min./point
		527.352	.03	.51	.51	89	78	1.0	599				
45"			.02	.34	.34	92	90	1.0	601				Abn. 12 min.
			.05	.86	.86	98	84	2.0	613				Abn. 1100 - 2000 on 10/10/93
			.05	.86	.86	100	86	2.0	614				CONTINUED 10/10/93
75"			.05	.86	.86	102	87	2.0	613				SAMPLE TIME
			.03	.51	.51	103	90	1.0	613				STARTED TO LEAK
			.04	.68	.68	104	91	1.0	613				YATES VALUE ON
105"			.04	.68	.68	104	91	1.0	613				TEST #4
			.04	.68	.68	103	94	1.0	615				WILL START ON
			.05	.86	.86	106	94	2.5	616				POST #4
11.33	557.030		.04	.68	.68	108	95	2.0	616				SAMPLE TIME
15.0"	13:08	558.750	.07	1.20	1.20	101	96	4.0	672				30 min./PT
105"			.07	1.20	1.20	108	97	4.0	674				Estimates:
			.07	1.20	1.20	110	97	4.0	672				MW=29.2
105"	14:12	569.549	.07	1.54	1.54	113	98	5.0	672				% H ₂ O=9

PITOT LEAK CHECK

	Positive	Negative
Before	0.15 sec	0.15 sec
After	0.15 sec	0.15 sec

	1	2
O ₂	13.5	13.5
CO ₂	6.0	6.0
CO	0	0
N ₂	80.5	80.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DCM Rate (cfm)
Before	5.0	10.02 cfm
After	15.0	10.02 cfm

000000	FLOW
764321	↑

Impinger

Impinger No.	Contents
1.	XB-2 + Concentrate
2.	Empty
3.	100 mL D.F.H. 20
4.	100 mL D.I. 40
5.	200g Silica Gel

Final

Final	Initial	Difference
1566.7	1227.6	339.1
390.1	373.8	16.3
595.0	549.2	45.8
483.6	535.5	-51.8
657.8	644.1	13.7

Initial

Atk
Moist
8.9
44.4
31.3
AQE 692
total

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

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CLIENT BATTLEDUE TEST DATE 07-18-93 ORIFICE CORRECTION (ΔH_0) 1.572 HOT/COLD BOX NO. 8
TEST UNIT SCR REACTOR OUTLET TEST NO. N-20-MM5-718 METER CORRECTION (Y) 1.0152 PROBE NO. 13-1
PROJECT NO. 930028-01 NOZZLE (SIZE, #) 0.448 *G-37 CALIBRATION DATE 07-02-93 FILTER NO. VN-13201
TEST CREW RC, AB STATIC PRESSURE +17.0" H₂O PITOT CORRECTION 0.87 STACK DIA.
BAROMETRIC PRESSURE 29.30 PORT DIRECTION PORT #4 CONTROL BOX NO. 7HRA PORT SIZE 31"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
185.0"	14:40	569.549	.095	1.62	1.62	107	99	5.0	673	225.8	268	250 F	30 min./point
			.095	1.62	1.62	107	99	5.0	673				
			.10	1.71	1.71	113	99	5.5	673				
75"			.10	1.71	1.71	116	100	5.5	671				
			.10	1.71	1.71	119	103	5.5	685				
			.10	1.70	1.71	119	102	5.5	685				
			.10	1.71	1.71	121	103	5.5	686				
			.10	1.71	1.71	122	105	5.5	686				
			.10	1.71	1.71	123	105	5.5	688				
45"			.11	1.74	1.74	123	107	6.0	693		21.85		
			.11	1.74	1.74	124	107	6.0	690				
			.11	1.74	1.74	123	108	6.0	690				
			.11	1.74	1.74	123	108	6.0	682				
			.11	1.74	1.74	123	107	6.6	686				
			.11	1.74	1.74	123	108	6.0	687				
15"			.04	.63	.63	123	109	3.0	687				Estimates:
			.04	.63	.63	120	107	3.0	690				MW= .022
			.03	.47	.47	118	107	2.5	690				%H ₂ O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	20.01 cfm
After	7.5	20.02 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
GAS	1	2
CO ₂	13.5	
O ₂	6.0	
CO	0	
N ₂	80.5	

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

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CLIENT BATTURE / DOE TEST DATE 07-18-93 (Sun) ORIFICE CORRECTION (ΔH_0) 1.572 HOT/COLD BOX NO. 3
 TEST UNIT SC-6 REACTOR OUTLET TEST NO. N-20-MM5-7182 METER CORRECTION (Y) 1.0152 PROBE NO. 13-01
 PROJECT NO. 930020-01 NOZZLE (SIZE, IN) 0.449 6-37 CALIBRATION DATE 07-02-93 FILTER NO. CHARGEMAN
 TEST CREW R.C. DB STATIC PRESSURE +17.0" H₂O PITOT CORRECTION 0.84 STACK DIA. 36
 BAROMETRIC PRESSURE 24.30 PORT DIRECTION PORT #4 CONTROL BOX NO. THRAE PORT SIZE 36

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
15"			.03	.47	.47	119	107	3.0	690	~250	68	~250	30 min./point
			.03	.47	.47	118	107	3.0	690				
			.04	.63	.63	118	107	3.5	686		34.5		
45"	45"		.10	1.58	1.58	121	107	6.5	689				* MISSOURI LAST
			.10	1.58	1.58	122	107	6.5	689				Set of Rotameter
			.10	1.58	1.58	122	107	6.5	689				At 17:38
			.10	1.58	1.58	123	107	6.5	688				Should be out of range
			.11	1.74	1.74	123	107	6.5	689				
			.11	1.74	1.74	124	108	6.5	688				
75"	75"		.10	1.58	1.58	123	109	6.0	687				
			.10	1.58	1.58	124	109	6.0	686				
			.10	1.58	1.58	124	110	6.0	686				CHARGED FILTERS AT
			.10	1.58	1.58	125	109	6.0	687				17:38
			.10	1.58	1.58	126	109	6.0	686				STRENGTH AT
			.10	1.58	1.58	123	110	8.0	688		4.5		At 17:55
105"	105"		.10	1.58	1.58	121	110	9.0	676				Estimates:
	17:38	686.900	.10	1.58	1.58	121	111	12.0	671				MW= 28.2
	17:55	686.900	.10	1.58	1.58	120	111	4.5	681				%H ₂ O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
GAS		
	1	2
CO ₂	13.5	
O ₂	6.0	
CO	0	
N ₂	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

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CLIENT BATTILIA / NO2 TEST DATE 07-18-93 (Sun) ORIFICE CORRECTION (ΔH_0) 1.572 HOT/COLD BOX NO. 8
TEST UNIT SCR Reactor Output TEST NO. N-20-MMS-718 METER CORRECTION (Y) 1.0152 PROBE NO. 13-1
PROJECT NO. 93C028-01 NOZZLE (SIZE, θ) 0.442 *G-18 CALIBRATION DATE 07-02-93 FILTER NO. W111X17H100
TEST CREW R/C, A/B STATIC PRESSURE +17.0" H₂O PITOT CORRECTION 0.84 STACK DIA.
BAROMETRIC PRESSURE 29.30 PORT DIRECTION Port #4 CONTROL BOX NO. THREE PORT SIZE 3/6"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
105"			.10	1.58	1.58	118	107	4.8	673	~280	141.5	~280	30 min./point
			.10	1.58	1.58	122	107	6.0	672				
75"			.10	1.58	1.58	122	107	5.0	684				
			.10	1.58	1.58	121	108	5.0	685				
			.10	1.58	1.58	122	108	5.0	686				
			.10	1.58	1.58	122	107	5.0	687				
			.10	1.58	1.58	121	107	5.5	697				
			.10	1.58	1.58	121	107	5.5	685				
45"			.095	1.50	1.50	122	108	6.0	686				
			.095	1.50	1.50	121	108	6.0	686				
			.095	1.50	1.50	121	108	6.5	686				
			.095	1.50	1.50	121	108	6.5	687				
			.095	1.50	1.50	120	107	8.5	689				
			.095	1.50	1.50	120	107	9.0	688				
15.0			.03	.47	.47	120	107	5.5	689				
			.03	.47	.47	116	106	5.5	689				Estimates:
			.03	.47	.47	116	105	5.5	689				MW= 28.2
			.03	.47	.47	115	106	6.5	688				%H ₂ O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
GAS	1	2
CO ₂	13.5	
O ₂	6.0	
CO	0	
N ₂	80.5	

Impinger

Impinger No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

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CLIENT BATTELIC / Doe TEST DATE 07-18-93 (Sun) ORIFICE CORRECTION (ΔH) 1.522 HOT/COLD BOX NO. 2
 TEST UNIT SCR Heating Outlet TEST NO. N-20-MM5-718 METER CORRECTION (Y) 1.052 PROBE NO. 13-1
 PROJECT NO. 93C028-01 NOZZLE (SIZE, #) 0.448 FG-18 CALIBRATION DATE 07-02-93 FILTER NO. CH 1313110
 TEST CREW RPC DB STATIC PRESSURE +17.0" H₂O PITOT CORRECTION 0.84 STACK DIA.
 BAROMETRIC PRESSURE 29.30 PORT DIRECTION PORT #4 CONTROL BOX NO. THAGC PORT SIZE 36"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
15"			.03	.47	.47	115	105	7.5	690	~250	~250	~250	30 min./point
	19:40	746.650	.03	.47	.47	115	105	8.0	699				
$\Delta = 6 \text{ min}$ $\Delta = 217.578 \text{ dcf}$ $(AP)_{H_2O} =$ $(AH)_{Avg} =$ $(T_{meter})_{Avg} = 110^\circ F$ $(T_{stack})_{Avg} = 672^\circ F$ 30 min 0.075 1.26 $Velocity = 22.2 \text{ ft/sec}$ $ISO = 88.4\%$													
													Estimates:
													MW = 29.2
													%H ₂ O = 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
GAS	1	2
CO ₂	13.5	
O ₂	6.0	
CO	0	
N ₂	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

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CLIENT *Bethell / DOE* TEST DATE *7-18-93 (Sun.)* ORIFICE CORRECTION (ΔH) *1.734* HOT/COLD BOX NO. *4, 4, 3A*
 TEST UNIT *SNX Tower Outlet* TEST NO. *N-21-MM5-718* METER CORRECTION (Y) *0.9832* PROBE NO. *10-3*
 PROJECT NO. *93C629-01* NOZZLE (SIZE, #) *0.197 #818* CALIBRATION DATE *5-27-93* FILTER NO.
 TEST CREW *SP, TM* STATIC PRESSURE *0.9" H₂O* PITOT CORRECTION *0.84* STACK DIA. *50" (depth) x*
 BAROMETRIC PRESSURE *29.30* PORT DIRECTION *A* CONTROL BOX NO. *5* PORT SIZE *99" (width)*

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
46.4	1015	957.098	0.8	0.89	0.89	81	75	4.5	194	~250°F	465°F	-250°F	13 min./point
			0.8	0.90	0.90	88	77	4.5	195				
39.3	1028		0.9	1.01	1.01	95	82	6.5	195				Readings every
			0.9	1.02	1.02	98	85	6.5	195				4.5 min
32.1	1041		1.0	1.14	1.14	104	90	7.0	195				
			1.0	1.16	1.16	106	93	7.0	195				
25.0	1054		1.0	1.16	1.16	110	96	7.0	198				
			1.0	1.16	1.16	111	98	7.0	198				
17.9	1107 1109		1.0	1.16	1.16	108	104	7.0	194				← With power 1109
			1.0	1.16	1.16	110	104	7.0	193				Restart 1134
10.7	1134 1145		1.2	1.42	1.42	114	103	9.0	193				Down 25 min
			1.2	1.42	1.42	116	105	9.0	193				
3.6	1158		1.0	1.18	1.18	117	106	7.5	190				
	1211	1013.923	1.0	1.18	1.18	118	107	7.5	190				
													Estimates:
													MW = 29.2
													%H ₂ O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.005
After	9.0	0.005

TIME = 91 min
 VOLUME = 56.825 dcl
 (AP)_{avg} = 1.0

PITOT LEAK CHECK 15 SEC

	Positive	Negative
Before	OK	OK
After	OK	0
GAS 1 2		
CO ₂	13.0	
O ₂	5.0	
CO	0	
N ₂	82.0	

(Transfer lag = 100°F)

Impinger Impinger Actual Moisture = 4.9%

No.	Contents	Final	Initial	Difference
1.	XAD-2 + condenser	1426.6	1269.1	157.5
2.	Empty	440.9	425.8	15.1
3.	100 mL D.S. 4.0	491.3	501.7	-10.4
4.	100 mL D.F. 4.0	552.2	537.2	15.0
5.	Silica Gel	722.4	675.9	46.5

velocity = 62.7 ft/sec
 ISO. = 98.5%

223.7g total
 AQE 60%
 Cracked coil condenser

D-18

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

CLIENT *Boothle Inc* TEST DATE *7-18-93 (Sun)* OFFICE CORRECTION (Δ HO) *(.734)* HOT/COLD BOX NO. *4143A*
 TEST UNIT *Snax Tower Unit* TEST NO. *N-21-MM5-718* METER CORRECTION (Y) *0.8832* PROBE NO. *10-3*
 PROJECT NO. *93C028-01* NOZZLE (SIZE, #) *0.191 #618* CALIBRATION DATE *5-17-93* FILTER NO.
 TEST CREW *JR, TA* STATIC PRESSURE *0.91* PITOT CORRECTION *0.84* STACK DIA. *50" (approx)*
 BAROMETRIC PRESSURE *29.30* PORT DIRECTION *B* CONTROL BOX NO. *547* PORT SIZE *99" (width)*

Transverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
46.4	1226	104.081	0.8	0.94	113	110	7.0	185	230F	48F	250°F	13 min./point
39.3	1231		0.8	0.94	117	109	7.0	196				
32.1	1235		1.0	1.19	119	109	8.5	197				Readings every 6.5 min
25.0	1305		1.0	1.19	119	109	8.0	197				
17.9	1310		1.0	1.19	120	110	8.0	197				
10.7	1317		1.0	1.19	115	110	8.0	200				stop at 1315 - plant delay
3.0	1347		1.0	1.19	118	108	9.0	200				plant delay
	1411		1.0	1.19	111	108	8.0	198				Restart - 1317
	1440		0.6	0.71	116	108	8.0	198				down 12 min
	1450		0.6	0.71	117	108	5.5	198				lost tower end
	1456	1063870	0.5	0.59	107	111	6.0	196				Plant delay - stop at 1330 - Restart - 1347
	1515	530.535	0.40	0.47	100	90	6.0	198				down 17 min
	1522	533.242	0.40	0.47	105	95	6.0	198				Estimates: MW = 27.2

SYSTEM LEAK CHECK		DOM Rate (cfm)	
Before	After	Before	After
1.0	0.005		

TIME = 84 min
 FLOW = 49.789 dcf
 (AP)ac = 0.9
 (AP)1.0 = 1.03

PITOT LEAK CHECK

Positive		Negative	
Before	After	Before	After
1	13.0		
2	5.0		
3	0		
4	82.0		

flow 1515 to 1522
 velocity = 318 ft/sec
 TPO = 95.5%

IMPINGER

Impinger No.	Impinger Comments	Final	Initial	Difference
1.		1456	1575	
2.		1456	1575	
3.		1456	1575	
4.		1456	1575	
5.		1456	1575	

velocity = 59.6 ft/sec
 TPO = 96.6%

lost power 1448 - Restart 1450
 lost power 1440 - Restart 1446

G 1.802
0.9619

HOT/COLD BOX NO. 4,434

TEST DATE 7-2-93 (Sun)

ORIFICE CORRECTION (ΔH_0) ~~FEET~~

TEST UNIT SVDX 7000 at 1/1

TEST NO. N-21-MM5-718

METER CORRECTION (Y) 0.0000

PROBE NO. 10-3

PROJECT NO. 93 CP 2B-01

NOZZLE (SIZE, IN) 0.197 #G18

CALIBRATION DATE 5-7-93

FILTER NO.

TEST CREW JPS, TM

STATIC PRESSURE 0.9" H₂O

PITOT CORRECTION 0.84

STACK DIA. 50" (40" x

BAROMETRIC PRESSURE 29.30

PORT DIRECTION

CONTROL BOX NO. 17

PORT SIZE 99" (1.111)

Estimates:
MW- 29.2
%H ₂ O- 8.5

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

Gas	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

$$(T_{\text{melt}})_{\text{avg}} = 111^{\circ}\text{F}$$

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

velocity = 66.0 ft/sec

ISO. = 101.4%

AOE 6/92

Page #1

PARTICULATE ELD DATA

N-18-MM5-721

PLANT Niles
 DATE 7-28-93
 LOCATION BH (N #18)
 OPERATOR Webb / Col
 STACK NO. _____
 RUN NO. 3 Organic
 SAMPLE BOX NO. _____
 METER BOX NO. X-40513

AMBIENT TEMPERATURE 90
 BAROMETRIC PRESSURE 29.17
 ASSUMED MOISTURE, % 8
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. 0.215
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 250

METER 1.64
 C FACTOR 0.9

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TOI	TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	Time	STATIC PRESSURE (in H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (ft/s) ²	VELOCITY (V), (ft/s)	1.02	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H ₂ O	ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), ft ³	#6	#7	#3	Flat / Probe	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST FINGER #8 °F #2 °F	PUMP VACUUM in. Hg gauge	KAD-2	VELOCITY (ft/s)
		0	13:23																
	1																		
	2																		
	3	24			388	.35			.48	.98									
	4	32	13:45		396 101	.50	4.2		.68	.68	427.3								
	5	40			395	.65	3.7		.90	.90	931.2								
	6	48	14:11		398	.70			.96	.96									
	7	56			401	0.80	2.0		1.1	1.1	490.1								
	8	4			399	0.83			1.15	1.15	445.6								
	9	12	14:34		398	.93	2.4		1.28	1.28	499.9								
	10	20			398	.98			1.35	1.35	455.0								
	11	28				1.0			1.4	1.4	460.9								
	12	36				1.0			1.4	1.4									
	TOTAL																		

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
FINAL								
INITIAL								
LIQUID COLLECTED								
TOTAL VOLUME COLLECTED								

COMMENTS

Pre leak check
 .01 cfm at 17.44g
 Pt 1, 2 no flow indication

D-22

#2

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT NiterAMBIENT TEMPERATURE 90METER AM, 1.64DATE 7-21-93BAROMETRIC PRESSURE 29.17C FACTOR 0.9LOCATION BH IN 18ASSUMED MOISTURE, % 8

PROCESS WEIGHT RATE

OPERATOR Webb/CojPROBE LENGTH, in. 96

WEIGHT OF PARTICULATE COLLECTED, mg

STACK NO. 3NOZZLE DIAMETER, in. 0.215

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

RUN NO. OrganicSTACK DIAMETER, in. 80SAMPLE BOX NO. X-40513PROBE HEATER SETTING 250METER BOX NO. X-40513HEATER BOX SETTING 250

TRAVERSE POINT NUMBER	SAMPLING TIME (A), min.	Time	#4	0.2	VELOCITY HEAD (in. H ₂ O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)	GAS SAMPLE VOLUME (V _m), ft ³	#6	#7	#3	Flux / Probe	PUMP VACUUM in. Hg gauge	X10.2
						ACTUAL DESIRED					TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F		VELOCITY ft/s
13	44		393	1.0	1.4	1.4	979.0	100	97	244	#8 #2	18	
14	52	15:13	394	1.0	1.2	1.9							
15	60		399	.98	1.35	1.35	983.2	79	95	242	251	259	19
16	8	15:30	404	.90	1.1	1.22							
17	16		404	.85	1.05	1.05	993.6	99	95	244	252	261	20
18	24	15:45	406	.85	1.05	1.05	998.0						
19	32		410	.80	1.05	1.1	503.0	96	93	244	253	261	20 1/2
20	40		408	.75	0.9	1.05	510.0						
21	48		414	.65	.90	.90	518.1	93	92	244	250	261	23
22	56	*											
23	4		413	.50	.68	.68	523.3	72	91	243	251	262	20 1/2
24	12	16:33	407	.53	.72	.72	529.44	STOP					41
TOTAL													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g
FINAL	1 2 3 4	
INITIAL		
LIQUID COLLECTED		
TOTAL VOLUME COLLECTED		

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

* Apparent Humidity on Sampling platform - Stack gas temp dropped to ~ 340 for ~ 10-20 seconds

(2) Run 23 for 16 min at 24 for close to duct work

Filter change - drain condensate

D-23

#3

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE ELD DATA

PLANT Niles AMBIENT TEMPERATURE 80
 DATE 7-21-93 BAROMETRIC PRESSURE 29.17
 LOCATION BH IN #18 ASSUMED MOISTURE, % 8
 OPERATOR Webb/CoX PROBE LENGTH, in. 96
 STACK NO. 3 NOZZLE DIAMETER, in. 0.215
 RUN NO. Organic STACK DIAMETER, in. 80
 SAMPLE BOX NO. X-40513 PROBE HEATER SETTING 250
 METER BOX NO. X-40513 HEATER BOX SETTING 250

METER IN, 1.64C FACTOR 0.9

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

Side		Time	#4	% O ₂	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) In. H ₂ O				#6	#7	#3	Flop	Probe	PUMP	XAD	
TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	STATIC PRESSURE (In. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (ft/s) ²	ACTUAL		DESIRED		GAS SAMPLE VOLUME (V _m), (ft ³)	INLET (T _{m,IN}), °F	OUTLET (T _{m,OUT}), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	VACUUM In. Hg gauge	VELOCITY ft/s	
	0	5:43							530.6				#1	#2		
1	16	18:07														
2	24		310	4.5	4.8	.60	.60			92	89	243	254	252	5	42
3	32	18:15	376	.62	4.5	.85	.85	540.9								
4	40	18:23	375	0.72		1.0	1.0	545.7	95	90	245	252	251	8	40	
5	48		375	0.79		1.02	1.02	559.5								
6	56		372	0.80		1.1	1.1		96	90	244	251	253			
7	4		372	0.86		1.2	1.2	560.1								
8	12	18:55	370	.88	4.4	1.21	1.21	566.0	94	88	245	248	252	11	38	
9	20		371	0.90		1.22	1.22	570.8								
10	28		375	0.98	4.6	1.38	1.38	576.5	95	89	245	250	254	14 1/2		
11	36		380	1.1		1.5	1.5	582.1								
12								589.6								
TOTAL																

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT					TIME	CO ₂	O ₂	CO	H ₂
FINAL	1	2	3	4		1									
INITIAL						2									
LIQUID COLLECTED						3									
TOTAL VOLUME COLLECTED						4									

COMMENTS #1-2 - no flow indicate
 plus #3 for 24 min
 static = -2.2 1/2

D-24

#4

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT Nitor AMBIENT TEMPERATURE 75
 DATE 7-21-73 BAROMETRIC PRESSURE 29.17
 LOCATION BH IN / #18 ASSUMED MOISTURE, % 8
 OPERATOR Webb / Cox PROBE LENGTH, in. 96
 STACK NO. 3 NOZZLE DIAMETER, in. 0.215
 RUN NO. 3 STACK DIAMETER, in. 80
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 250
 METER BOX NO. X-40513 HEATER BOX SETTING 250

METER 1.64
 C FACTOR 0.9

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WAS
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

Side		Time	#4	1. O ₂	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)			#6	#7		#3	Alex Probe			
TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (in. H ₂ O)	ACTUAL	DESIRED	GAS SAMPLE VOLUME (V _m), (ft ³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER			SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	AD-7	VELOCITY ft/s
								INLET (T _{m_{in}}), °F	OUTLET (T _{m_{out}}), °F						
13	44	*	393	1.1	1.5	1.5	587.4	96	90	245	#1 249	#2 254	15	40	
14	52	19:35	4												
15	60	19	405	.94	1.3	1.3	599.3	94	88	244	248	256	15	42	
16	8		405	.90	1.22	1.22									
17	16	19:59	411	.85	1.19	1.19		90	86	244	247	256		44	
18	24		423	.82	1.1	1.1									
19	32		423	.82	1.1	1.1	618.8	87	82	244	246	254	15 1/2	53	
20	40	20:23	419	.78	1.05	1.05	623.5								
21	48		425	.74	1.0	1.0	629.0	85	80	292	247	259	15 1/2	57	
22	56		426	.75	1.0	1.0	638.0								
23	4	20:47	430	.69	.93	.93									
24	12	20:55	427	.68	.92	0.92		85	80	244	250	262	16	40	
							645.400								
							417.710								
							276.90								
TOTAL															

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	1	2	3	4	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g
FINAL						
INITIAL						
LIQUID COLLECTED						
VOLUME COLLECTED						

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

Post leak check .015 at 11/14g
 with probe at 40° rise
 COMMENTS • O₂ high? checked 20 min
 ambient at 21.0
 • check O₂ directly from
 stack 3.9
 • previously using gas meter on the
 1011021 FINE GAGE SCIENTIFIC, INC.

D-25

NOMOGRAPH DATA

PLANT Niles, Ohio, SNOX process

DATE July 20, 1993

SAMPLING LOCATION outlet of bag house

N-19-MM5-720

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH_e	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m,avg.}$	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wv}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073 \times$ STACK GAUGE PRESSURE in in. H ₂ O)	P_s	6.0" H ₂ O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.0
AVERAGE STACK TEMPERATURE, °F	$T_{s,avg.}$	380
AVERAGE VELOCITY HEAD, in. H ₂ O	$\Delta p_{avg.}$	0.65
MAXIMUM VELOCITY HEAD, in. H ₂ O	$\Delta p_{max.}$	1.20
C FACTOR		0.90
CALCULATED NOZZLE DIAMETER, in.		0.260
ACTUAL NOZZLE DIAMETER, in.		0.247
REFERENCE Δp , in. H ₂ O		0.85

EPA (Dut) 234
4/72

#1

PARTICULATE FIELD DATA

PLANT Niles, Ohio SNOX process AMBIENT TEMPERATURE 75°F METER 1.63
 DATE 7/21/93 BAROMETRIC PRESSURE C FACTOR 0.90
 LOCATION outlet of baghouse ASSUMED MOISTURE, % 7 PROCESS WEIGHT RATE
 OPERATOR Leonard, Kuff PROBE LENGTH, in. 9.02 glass WEIGHT OF PARTICULATE COLLECTED, mg
 STACK NO. NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MM5-721 STACK DIAMETER, in. 800
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F
 METER BOX NO. X-40513 HEATER BOX SETTING 250°F

SAMPLE	FILTER	PROBE WA:
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TOP TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	probe Temp °F STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _f)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O ACTUAL DESIRED		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	02 % VELOCITY
1	0/13:00	236	360	0.27	0.60	0.60	82.747	85	85	202	246	63.246	5.0	3.6
2	10/13:10	251	370	0.42	0.90	0.90	87.2	88	87	248	259	60	7.0	4.0
3	20/13:20	255	378	0.64	1.35	1.35	92.8	94	90	251	261	59	8.0	4.3
4	30/13:30	254	379	0.59	1.25	1.25	99.3	95	90	257	259	58	8.0	4.0
5	40/13:40	257	383	0.77	1.65	1.65	104.3	97	92	256	259	59	9.0	4.0
6	45/13:53	261	384	0.68	1.50	1.50	109.4	101	95	264	262	60	9.0	3.8
7	52.5/14:00	259	384	0.62	1.30	1.30	114.8	102	95	267	262	61	9.5	4.2
8	60/14:08	262	384	0.65	1.40	1.40	120.3	102	96	255	261	62	9.0	4.5
9	67.5/14:15.5	260	383	0.72	1.60	1.60	124.9	101	96	254	261	61	9.5	4.0
10	75/14:23	259	383	0.60	1.25	1.25	130.1	103	97	256	261	63	9.0	4.3
11	82.5/14:30.5	258	384	0.52	1.15	1.15	135.4	102	97	257	261	63	8.0	4.2
12	90/14:38	257	383	0.54	1.15	1.15	140.0	102	98	259	262	64	8.0	4.6
13	97.5/14:45.5	283	384	0.89	1.90	1.90	144.9	102	97	238	262	63	10.0	4.6
14	105/14:53	339	384	0.91	2.00	2.00		104	99	229	264	64		
TOTAL														

AVERAGE

Heating 250°F

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT					
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS

2

PARTICULATE FIELD DATA

CROSS SECTION

PLANT Niles, Ohio SNOC process AMBIENT TEMPERATURE 80°
 DATE 7/21/93 BAROMETRIC PRESSURE 29.11
 LOCATION outlet of bag house ASSUMED MOISTURE, % 7
 OPERATOR Leonard, Kupa PROBE LENGTH, in. 9.0
 STACK NO. NOZZLE DIAMETER, in. 0.249
 RUN NO. N-19-MME-701 STACK DIAMETER, in. 8.0
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F
 METER BOX NO. X-40573 HEATER BOX SETTING 250°F

METER IN, 1.65
 C FACTOR 0.90
 PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (h), min	probe temp of static pressure (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _{TP})	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m), (V _T)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ %
					ACTUAL DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F					VELOC
15	180/15:00	372	384	0.70	1.50 1.50	156.1	103	98	222	264	64	9.7	4.5
16	180/15:08	381	385	0.76	1.65 1.65	161.9	103	98	221	263	66	9.8	4.6
17	180/15:15	380	384	0.59	1.25 1.25	167.1	103	98	216	264	66	9.8	4.2
18	185/15:23	381	384	0.54	1.15 1.15	172.3	105	100	213	263	69	8.1	4.7
19	190/15:29	380	383	0.45	0.96 0.96	176.6	103	99	210	262	65	7.5	4.4
20	190/15:38	381	384	0.40	0.86 0.86	180.9	103	100	209	261	66	7.0	4.5
21	195/15:45	381	384	0.33	0.70 0.70	184.9	104	100	204	262	66	6.8	4.3
22	195/15:53	380	383	0.28	0.60 0.60	188.5	104	100	200	261	66	6.6	4.3
23	195/16:00	380	383	0.32	0.68 0.68	192.2	103	100	198	262	66	6.5	4.4
24	190/16:08	382	384	0.29	0.72 0.72	195.7	105	102	208	263	67	7.0	4.6
	1925/16:05	off				199.366							
SIDE													
1	1925/16:05			0.17	0.37 0.37	199.366							
2	195/16:37	256	331	0.35	0.74 0.74	202.0	100	99	20	260	62	7.0	4.7
3	2025/16:40	255	3	0.38	0.82 0.82	205.6	100	98	204	260	58	7.5	4.8
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT				
	1	2	3	4		TIME	CO ₁	O ₂	CO	N ₂
FINAL						1				
INITIAL						2				
LIQUID COLLECTED						3				
TOTAL VOLUME COLLECTED						4				

COMMENTS

#3

SCHEMATIC OF STACK

PARTICULATE YIELD DATA

PLANT Niles, Ohio ENKOR AMBIENT TEMPERATURE 88°FMETER 114, 1.65DATE 7/21/92

BAROMETRIC PRESSURE

C FACTOR 0.90LOCATION OUTSIDE of bag houseASSUMED MOISTURE, % 7OPERATOR Servanly, Napp

PROCESS WEIGHT RATE

STACK NO. 3PROBE LENGTH, in. 28.5 glassNOZZLE DIAMETER, in. 0.247RUN NO. N-19-MMF-721STACK DIAMETER, in. 8.80SAMPLE BOX NO. 3PROBE HEATER SETTING 250°FMETER BOX NO. X-40513HEATER BOX SETTING 260°F

WEIGHT OF PARTICULATE COLLECTED, mg			
SAMPLE	FILTER	PROBE WA	
FINAL WEIGHT			
TARE WEIGHT			
WEIGHT GAIN			
TOTAL			

TRAVERSE POINT NUMBER	SAMPLING TIME (s), min	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (ft/s) ²	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °F	PUMP VACUUM in. Hg	VELOCITY ft/s
					ACTUAL DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F			
4	210/16.48	256	379	0.44	0.94	0.94	103	100	58	8.0	4.4
5	212/16.58	256	380	0.73	1.60	1.60	105	101	58	10.0	4.7
6	225/17.03	257	380	0.59	1.25	1.25	104	100	58	2.8	4.2
7	238/17.08	257	380	0.67	1.45	1.45	104	100	56	10.0	4.0
8	240/17.18	258	380	0.59	1.25	1.25	102	98	54	10.0	4.5
9	245/17.23	262	380	0.56	1.20	1.20	104	99	56	10.0	4.4
10	255/17.33	263	381	0.64	1.35	1.35	105	100	57	10.0	4.5
11	263/17.45	288	381	0.67	1.45	1.45	106	101	58	10.0	4.5
12	270/17.48	285	379	0.79	1.70	1.70	104	99	57	10.0	4.8
13	275/17.55	296	382	0.87	1.85	1.85	106	102	59	11.5	4.5
14	285/17.02	349	382	0.88	1.85	1.85	108	103	60	11.5	4.5
16	292/17.08	374	380	0.79	1.70	1.70	107	102	59	11.5	4.8
16	300/17.18	383	381	0.80	1.75	1.75	107	102	57	11.5	4.8
17	307/17.25	384	381	0.74	1.60	1.60	106	101	55	11.0	4.4
18	315/17.33	393	380	0.67	1.45	1.45	108	103	56	10.6	4.4
TOTAL											
AVERAGE											

static pressure 8.6 H₂O

COMMENTS

IMPINGER VOLUME ml

SILICA GEL WEIGHT, g

ORSAT MEASUREMENT

TIME

CO₂O₂

CO

H₂

FINAL

INITIAL

LIQUID COLLECTED

TOTAL VOLUME COLLECTED

#4

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE YIELD DATA

PLANT Niles, Ohio SNX process AMBIENT TEMPERATURE 92°F METER IN, 1.65
 DATE 7/21/93 BAROMETRIC PRESSURE 7 C FACTOR 0.90
 LOCATION outlet of baghouse ASSUMED MOISTURE, % 7 PROCESS WEIGHT RATE _____
 OPERATOR Leonard, Napp PROBE LENGTH, in. 180 glass
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MM5-721 STACK DIAMETER, in. 8.00
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 370°F
 METER BOX NO. X-40513 HEATER BOX SETTING 250°F

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	probe temp. STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (ΔP), (in. H ₂ O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ %
					ACTUAL	DESIRED		INLET (T _{m,in}), °F	OUTLET (T _{m,out}), °F	INLET	OUTLET			
19	323.5/19:45	392	381	0.90	1.90	1.90	288.9	109	104	213	263	57	10.5	5.1
20	330/19:48	392	379	0.84	1.80	1.80	294.4	106	102	229	261	58	10.5	5.0
21	332.5/19:50	400	379	0.76	1.65	1.65	299.8	106	103	239	261	56	10.7	5.1
22	346/19:03	399	379	0.74	1.60	1.60	305.1	104	101	240	260	56	10.7	5.0
23	325/19:10.5	400	380	0.63	1.40	1.40	310.5	104	100	242	262	56	10.7	5.0
24	360/19:18	400	379	0.41	0.88	0.88	315.7	104	100	240	262	56	8.0	5.0
	367.5/19:25	off					320.180							
TOTAL														

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	H ₂
	1	2	3	4							
FINAL											
INITIAL											
LIQUID COLLECTED											
TOTAL VOLUME COLLECTED											

COMMENTS

leak check 0.025 cm at 13.0" Hg

D-30

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE

TEST UNIT SCR Reactor Duct

TEST DATE 7-28-93 (Wed.)

PROJECT NO. 93002821

TEST NO. N-20-MMS-728

CONTROL BOX OPERATOR 2920

NOZZLE (SIZE, ID, 44")

BAROMETRIC PRESSURE 29.80

STATIC PRESSURE 7.0" H₂O

PORT DIRECTION Port #2

PITOT CORRECTION 0.84

CONTROL BOX NO. 11000

STACK DIA. 15.0" ID

Page 1 of 1

HOT BOX NO. 8

COLD BOX NO. 8

PROBE NO. 133

FILTER NO. 133

STACK DIA. 15.0" ID

Comments

Hot Box Temp. (°F)

Inspiring Temp. (°C/°F)

Probe Temp. (°F)

Stack Temp. (°F)

Vacuum (in. Hg)

Meter Temperature In (°F)

Meter Temperature Out (°F)

Req'd. (in. H₂O)

Act. (in. H₂O)

Pitot a P (in. H₂O)

Dry Gas Meter Reading (dcl)

Time

110"

90"

70"

50"

30"

10"

14.30/022.858

SYSTEM LEAK CHECK

Vacuum (in. Hg)

Before 5.0

After 9.0

DGM Rate (cfm)

Before 20.0

After 20.2

FLOW

0 0 0 0

4 3 2 1

AGE 202

7.352.29

KEYSTONE

Before	After	Positive	Negative
6.9	6.9	0.2	1.9

CO2	O2	CO	N2
14.0	6.5	0	79.5
14.2	6.5	0	79.5

Before	After	DGM Rate (cfm)
20.0	20.2	20.2

Before	After	DGM Rate (cfm)
20.0	20.2	20.2

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	N2-2+ Condensate	1539.4	1231.9	307.5
2.	Empty	379.3	375.2	4.1
3.	100ml 0.5% H ₂ O	551.9	552.2	-0.3
4.	100ml 0.5% H ₂ O	544.6	538.0	6.6
5.	200g Silica Gel	109.5	107.1	2.4

Actual Moisture	8.3%
-----------------	------

STACK SAMPLING DATA SHEET

Page 2 of 4

CLIENT Antenna Dome TEST DATE 07-21-93 (1166) OFFICE CORRECTION 1.572 HOT BOX NO. 8
 TEST UNIT 500 TEST NO. 11-20-1115-721 METER CORRECTION 1.0151 COLD BOX NO. 8
 PROJECT NO. 930428-01 NOZZLE SIZE 1/4" CALIBRATION DATE 07-02-93 PROBE NO. 13-3
 CONTROL BOX OPERATOR ELC STATIC PRESSURE 13.0 PITOT CORRECTION 0.84 FILTER NO. 041515100
 BAROMETRIC PRESSURE 29.88 PORT DIRECTION Port #3 CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot & P (in. H2O)	Orifice A/H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
110"	14:37	1022.900	.04	.65	.65	106	99	2.0	645	230.2	26.8	~300	Sample for
			.04	.65	.65	108	99	2.0	645				
			.04	.65	.65	110	99	2.0	645				Run Time 95 min
90"			.04	.65	.65	110	100	2.5	645				stopped at left
			.04	.65	.65	111	99	2.5	653				Probe 5 minutes
			.04	.65	.65	111	100	2.5	654				large to measure
70"			.04	.65	.65	112	100	2.5	657				Run Time 105 min
			.04	.65	.65	111	99	2.5	657				checked left side
			.04	.65	.65	111	99	2.5	655				oc readings
50"			.04	.65	.65	111	99	2.5	655				
			.04	.65	.65	111	106	3.0	652				
			.03	.49	.49	112	99	2.5	653				
30"			.03	.49	.49	110	99	3.0	653				
			.03	.49	.49	111	99	3.0	654				
			.03	.49	.49	110	98	3.0	653				Estimates:
10'			.03	.49	.49	111	99	3.0	653				MW = 21.2
			.03	.49	.49	111	99	3.0	653				%H2O = 9
	14:12	1067.975	.04	.65	.65	112	90	3.5	634				

PITOT LEAK CHECK

	Positive		Negative	
	Before	After	Before	After
CO2				
O2				
CO				
N2				

	DOM Rate (cfm)	
	Before	After

Impinger Contents

No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

AQE 2092

STACK SAMPLING DATA SHEET

Page 3 of 4

CLIENT Battelle TEST DATE 07-21-93 (Wed.) ORIFICE CORRECTION 1.572 HOT BOX NO. 8
 TEST UNIT SCF Kerosene TEST NO. N-20-MM5-721 METER CORRECTION 1.0151 COLD BOX NO. 8
 PROJECT NO. 93C028-01 NOZZLE (SIZE, IN) 0.441 CALIBRATION DATE 07-02-93 PROBE NO. 15-2
 CONTROL BOX OPERATOR KPC STATIC PRESSURE 17.0" H2O PITOT CORRECTION .24 FILTER NO. white-gold
 BAROMETRIC PRESSURE 29.28 PORT DIRECTION PORT #4 CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
110"	1627	1067.977	.10	1.62	1.62	98	97	6.5	673	250°	68.2	300°F	15-min. LAT
			.10	1.62	1.62	111	98	6.5	673				15 min. LAT
			-10	1.62	1.62	113	99	6.5	673				TOTAL
90			.10	1.62	1.62	114	98	6.5	672				
			.10	1.62	1.62	114	99	6.5	679				
			.10	1.62	1.62	115	99	6.5	680				
70			.10	1.62	1.62	115	99	6.5	680				
			.10	1.62	1.62	114	99	7.0	682				
			.10	1.62	1.62	115	99	7.0	682				
50			.10	1.62	1.62	115	99	7.0	683				
			.11	1.78	1.78	116	99	8.0	685				
			.11	1.78	1.78	115	99	8.5	685				
30			.11	1.78	1.78	116	99	8.5	685				
			.11	1.78	1.78	115	100	8.5	689				
			.11	1.78	1.78	116	100	8.5	688				
10			.06	.81	.81	113	100	4.5	682				Estimates:
	17:52	1129.790	.05	.81	.81	113	99	4.5	682				MW= 29.2
													%H2O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.5	
CO	0	
N2	79.5	

Impinger

Impinger No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

STACK SAMPLING DATA SHEET

Page 4 of 4

CLIENT Battelle / pos TEST DATE 07-21-95 (Wed) ORIFICE CORRECTION 1.572 HOT BOX NO. 8
 TEST UNIT SCM TEST NO. 0727 TEST NO. 0727 METER CORRECTION 1.572 COLD BOX NO. 8
 PROJECT NO. 930918-01 NOZZLE (SIZE) 0.441 CALIBRATION DATE 07-22-93 PROBE NO. 13-2
 CONTROL BOX OPERATOR 2A STATIC PRESSURE 17.2760 PITOT CORRECTION 0.34 FILTER NO. untested
 BAROMETRIC PRESSURE 29.28 PORT DIRECTION 180 CONTROL BOX NO. 11252 STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot ΔP (in. H2O)	Req'd. (in. H2O)	Act. (in. H2O)	Orifice ΔH	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	18:21	1129.790	.05	.81	.81	.81	97	95	5.0	683	~250	48.2	~200°F	15 min per
			.05	.81	.81	.81	105	95	5.0	690				
90			.05	.81	.81	.81	107	95	4.5	690				
			.06	.97	.97	.97	108	96	4.5	693				
			.06	.97	.97	.97	109	96	4.5	695				
			.07	1.13	1.13	1.13	110	96	5.0	695				
70			.05	.81	.81	.81	111	97	4.5	696				
			.05	.81	.81	.81	110	96	4.5	697				
			.05	.81	.81	.81	110	97	4.5	698				
50			.06	.97	.97	.97	111	96	4.5	698				
			.07	1.13	1.13	1.13	110	97	4.5	699				
			.06	.97	.97	.97	111	96	4.5	700				
30			.06	.97	.97	.97	111	96	4.5	699				
			.06	.97	.97	.97	110	97	4.5	699				
			.06	.97	.97	.97	110	96	4.5	698				Estimate:
10			.04	.65	.65	.65	109	96	3.0	699				MW = 21.2
			.04	.65	.65	.65	108	96	3.0	669				%H2O = 9.0
	19:59	181.075	.04	.65	.65	.65	108	96	3.0	650				

SYSTEM LEAK CHECK		PITOT LEAK CHECK		IMPINGER		IMPINGER		DIFFERENCE	
Vacuum (in. Hg)	DOM Rate (cfm)	Before	After	Positive	Negative	No.	Contents	Final	Initial
Before						1.			
After						2.			
						3.			
						4.			
						5.			

TEST TOTALS
 TIME = 36.0 min
 VOLUME = 198.231 scf
 AQE 292 (AP) AVG = 0.055
 (ΔH) AVG = 0.90
 (T_{stack}) AVG = 662°F
 (T_{impr}) AVG = 104°F
 velocity = 18.9 ft/sec
 ISO = 97.7%

STACK SAMPLING DATA SHEET

Page 1 of 4

CLIENT Bethelle/DSE TEST DATE 7-24-93 (Wed) ORIFICE CORRECTION 1.734
 TEST UNIT SNOX Tower Outlet TEST NO. N-21-MM5-720 METER CORRECTION 0.9832
 PROJECT NO. 93C020-01 NOZZLE (SIZE, IN) 0.197 918 CALIBRATION DATE 5-17-93
 CONTROL BOX OPERATOR JPS, TM STATIC PRESSURE 0.8" H₂O PITOT CORRECTION 0.87
 BAROMETRIC PRESSURE 29.78 PORT DIRECTION A CONTROL BOX NO. 5 FILTER NO.
 STACK DIA. 50" (depth) X

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot A/P (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
46.4	1300	400.437 439.346	0.8	0.90	0.90	90	86	4.0	200	~250°F	~68°F	~250°F	13 min/point
			0.8	0.90	0.90	98	88	5.0	196				
39.3	1313		0.8	0.90	0.90	103	90	5.0	199				Readings every
			0.8	0.92	0.92	105	92	5.0	199				6.5 minutes ✓
32.1	1326		1.0	1.15	1.15	108	95	6.5	197				
			1.0	1.15	1.15	110	97	7.5	197				
25.0	1339		1.1	1.27	1.27	112	100	7.5	199				
			1.1	1.27	1.27	113	101	8.0	199				
17.9	1352		1.1	1.27	1.27	114	103	8.0	198				
			1.1	1.27	1.27	115	103	6.5	199				
10.7	1405		1.2	1.40	1.40	115	105	10.0	199				
			1.2	1.40	1.40	114	104	10.0	199				
3.6	1418		1.2	1.40	1.40	115	105	8.0	199				
	1431	497.610	1.2	1.40	1.40	116	105	8.0	199				
Estimates:													
Δ = 91 Δ = 58.27 (ΔP) _{avg} = (ΔH) _{avg} = 1.19 (T _{stack}) _{avg} = 103°F (T _{probe}) _{avg} = 199°F													MW = 29.2
dcf 1.0													%H ₂ O = 8.5
Velocity = 63.0 f/Sec ISO = 100.8%													

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	0.005
After	10.0	0.005

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	OK	OK
After		

	1	2
CO ₂	12.0	
O ₂	7.0	
CO	0	
N ₂	81.0	

Impinger

No.	Contents	Final	Initial	Difference
1.	ROD + carbonate	1586.4	1276.2	310.2
2.	Empty	442.1	424.2	17.9
3.	100 mL DI H ₂ O	589.6	551.2	-38.4
4.	100 mL DI H ₂ O	488.6	519.1	-30.5
5.	200g Silica Gel	680.4	663.7	16.7

+36.9
→ 717.3

389.69 total
KEYSTONE

Actual Moisture = 8.08%
38.4

STACK SAMPLING DATA SHEET

Page 2 of 4

CLIENT Battelle / DOE TEST DATE 7-28-93 ORIFICE CORRECTION 1.734 HOT BOX NO. 4
 TEST UNIT SNOX Tower Outlet TEST NO. A-21-MM5-72 METER CORRECTION 0.9832 COLD BOX NO. 473A
 PROJECT NO. 93CB2D-01 NOZZLE (SIZE, IN) 0.97 1/8 CALIBRATION DATE 5-17-93 PROBE NO. 10-3
 CONTROL BOX OPERATOR JPS, TM STATIC PRESSURE 0.8" H₂O PITOT CORRECTION 0.81 FILTER NO.
 BAROMETRIC PRESSURE 29.28 PORT DIRECTION B CONTROL BOX NO. 5 STACK DIA. 50" (60" X)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
46.4	1440	497.775	0.8	0.92	0.92	108	104	6.0	199	~250°F	~68°F	~250°F	13 min / point
			0.8	0.92	0.92	110	102	6.5	199				
39.3	1453		1.0	1.17	1.17	111	102	7.0	199				Reading every 6.5 minutes
			1.0	1.17	1.17	112	102	7.0	199				
32.1	1456		1.1	1.29	1.29	112	102	8.0	199				
			1.1	1.29	1.29	112	102	8.0	199				
25.0	1459		1.0	1.17	1.17	112	102	8.0	199				
			1.0	1.17	1.17	112	102	8.0	199				
17.9	1452		1.0	1.17	1.17	113	103	8.0	199				
			1.0	1.17	1.17	113	103	8.0	199				
10.7	1453		0.6	0.70	0.70	113	103	5.5	197				
			0.6	0.70	0.70	113	103	5.5	197				
3.6	1453		0.5	0.59	0.59	113	104	4.0	197				
	1461	553.470	0.5	0.59	0.59	113	104	4.0	195				
Estimates: $\Delta = 9 / \Delta = 55.695$ $\Delta P_{avg} = 0.8$ $(\Delta H)_{avg} = 1.00$ $(T_{stack})_{avg} = 102^\circ F$ $(T_{stack})_{avg} = 198^\circ F$ $Velocity = 56.3 ft/sec$ $ISO. = 106.9\%$													

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DCM Rate (cfm)
Before		
After	10.0	0.015

PITOT LEAK CHECK 13 JUL

	Positive	Negative
Before	OK	OK
After		

	1	2
CO ₂	12.0	
O ₂	7.0	
CO	0	
N ₂	86.0	

Impinger

No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

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STACK SAMPLING DATA SHEET

Page 4 of 4

CLIENT *Bethlehem Steel*
 TEST UNIT *510X Tower by the*
 PROJECT NO. *73C02B-01*
 CONTROL BOX OPERATOR *JBS, TM*
 BAROMETRIC PRESSURE *29.28*

TEST DATE *7-24-93*
 TEST NO. *N-21-MM5-7201*
 NOZZLE (S.Z.E.) *0.197 G18*
 STATIC PRESSURE *0.8" H₂O*
 PORT DIRECTION *D*

ORIFICE CORRECTION *1.734*
 METER CORRECTION *0.9832*
 CALIBRATION DATE *5-17-93*
 PITOT CORRECTION *0.84*
 CONTROL BOX NO. *5*

HOT BOX NO. *4*
 COLD BOX NO. *4-7-34*
 PROBE NO. *10-3*
 FILTER NO.
 STACK DIA. *50" (Depth) x*

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
46.4	1816	1008.737	1.0	1.15	1.15	97	95	7.0	195	~250°F	468°F	~250°F	13 min/point
			1.0	1.15	1.15	103	95	7.0	195				Readings every 6.5 minutes
39.3	1824		1.3	1.50	1.50	107	96	8.0	195				
			1.5	1.73	1.73	109	96	10.0	194				
32.1	1842		1.7	1.96	1.96	107	97	11.0	195				
			1.7	1.99	1.99	108	98	12.5	194				
25.0	1858		1.7	1.99	1.99	106	98	13.0	194				
			1.7	1.97	1.97	105	97	14.0	194				
17.9	1908		1.2	1.39	1.39	104	97	10.0	193				
			1.2	1.39	1.39	106	97	10.0	193				
10.7	1921		1.1	1.27	1.27	107	98	9.0	192				
			1.1	1.27	1.27	108	97	9.0	192				
3.6	1934	676.300	1.0	1.16	1.16	107	98	8.5	192				
	1947		0.8	0.93	0.93	108	97	7.0	191				
		Δ=91 min	Δ=67.923	(ΔK) _{avg} = 1.49	(ΔK) _{avg} = 1.49	(T _{stack}) _{avg} = 101°F	(T _{probe}) _{avg} = 194°F						Estimates: MW=29.2 %H ₂ O=8.5
			1.3					velocity = 71.5 ft/sec					
								Reo. V = 102.7%					

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	18.0	0.015

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	12.0	
O ₂	7.0	
CO	0	
N ₂	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

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N-18-MM5-723

PLANT Niles
DATE 7-29-93
LOCATION #18
OPERATOR Webb / Cox
STACK NO. _____
RUN NO. 5 Organic
SAMPLE BOX NO. -
METER BOX NO. X-40513

AMBIENT TEMPERATURE 76
 BAROMETRIC PRESSURE 29.16
 ASSUMED MOISTURE, % 8
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. .215
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 250

METER ΔH , 1.64
 C FACTOR 0.9
 PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED		
SAMPLE	FILTER	PROB
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

[illegible]

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO,	O,	CO	N
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS

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#2

PARTICULATE 'ELD DATA

PLANT Niter
 DATE 7-23-93
 LOCATION #18 B&H IN
 OPERATOR Webb/Cox
 STACK NO. 5
 RUN NO. Organic
 SAMPLE BOX NO. X-40513
 METER BOX NO. X-40513

AMBIENT TEMPERATURE 87
 BAROMETRIC PRESSURE 29.16
 ASSUMED MOISTURE, % 8
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. 0.215
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 250

METER 1H, 1.64
 C FACTOR 0.9

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg	
SAMPLE	FILTER
FINAL WEIGHT	PROBE WAS
TARE WEIGHT	
WEIGHT GAIN	
TOTAL	

CROSS SECTION

TRAVERSE POINT NUMBER	Time	Static Pressure (H ₂ O)	Stack Temperature (T _s), °F	Velocity (V _p), ft/min	Pressure Differential Across Orifice Meter (H ₂ O)	GAS SAMPLE VOLUME (V _m), l/s	GAS SAMPLE TEMPERATURE AT DRY GAS METER (T _{in}), °F	Outlet (T _{out}), °F	Probe	Temperature of Gas Leaving Condenser or Last Impinger (T _g), °F	Pump Vacuum in. Hg gauge	XAD-2 Velocity
13	44	11:08	392	.9	1.3	1.3	920.3	116	#1	253		
14	52	11:10	394	.82	1.2	1.2	925.2	110	#2	245	19	39
15	60	11:18	403	.82	1.2	1.2	930.9	101		241	20	
16	8	11:26	398	.78	1.15	1.15	936.3	101		245	20	46
17	16	11:34	402	.75	1.11	1.11	941.0	99		244	19 1/2	
18	24	11:42	404	.70	.98	.98	946.3	76		245		
19	32	11:50	408	.69	.98	.98	951.3					
20	40	11:58	407	.60	.88	.88	955.0					
21	48	12:06										
22												
23												
24	32	12:30	408	.3	2.9	2.9	961.5	95		252	12	54
		12:32					974.32					
							978.50					
TOTAL												
AVERAGE												

COMMENTS: Filter change and condenser from 1st Impinger collected. Leak checked - .125 at 2054g

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT	ORSAT MEASUREMENT	TIME	CO	O ₂	CO	N ₂
FINAL	1	2	3	4				
INITIAL								
LIQUID COLLECTED								
LIQUID COLLECTED								

#3

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE 'ELD DATA

14:50 → Fed. DOE
Pittsburg → Mildred Perry DoePLANT MilesAMBIENT TEMPERATURE 80METER 1.64DATE 7-23-93BAROMETRIC PRESSURE 29.16C FACTOR 0.90LOCATION #18 BH INASSUMED MOISTURE, % 8OPERATOR Webb/CoxPROBE LENGTH, in. 96STACK NO. 5NOZZLE DIAMETER, in. 0.215RUN NO. 5STACK DIAMETER, in. 80SAMPLE BOX NO. 5PROBE HEATER SETTING 250METER BOX NO. X40513HEATER BOX SETTING 250

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

Side	TRaverse POINT NUMBER	SAMPLING TIME (H), min	Time	#4	VELOCITY HEAD (1P, 1/2)	1/2 O ₂	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (1/2 H) In. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	#6	#7	Plot	Probe	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER #3 F ↓	PUMP VACUUM in. Hg gauge	XAD-1 VELOCITY
				STACK TEMPERATURE (T _s), °F			ACTUAL DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F		SAMPLE BOX TEMPERATURE °F			
	1	0	13:25					974.424							
	2	16	13:41	142?	.28		0.3 0.3	974.500							
	3	24	13:49	345	.50	2.7	.72 .72	980.6	95	95		254	65	246	65
	4	32	13:57	366	.60		.88 .88	985.1	105	99		255	252	246	59
	5	40	14:05	367	.68	2.7	1.0 1.0	989.0							
	6	48	14:13	366	.75		1.12 1.12								
	7	56	14:21	364	.78		1.15 1.15	998.7	108	101		252	250	246	61
	8	1	14:29	366	.88	2.8	1.30 1.30	1004.6							11 1/2
	9	12	14:37	368	.90		1.30 1.30	9.5	111	103		252	252	246	64
	10	20	14:45	374	.98		1.4 1.45	16.2							13
	11	28	14:53	382	1.05	2.8	1.4 1.5	22.5	112	106		251	252	246	68
	12	36	15:01	386	1.05		1.4 1.5	25.6							18 1/2
	13														
	TOTAL														

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	1	2	3	4	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL VOLUME COLLECTED						

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

COMMENTS

#4

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT NitroDATE 7-23-93LOCATION #18 BHNOPERATOR Walt E. CoxSTACK NO. 5RUN NO. 5 OrganicSAMPLE BOX NO. X-40513METER BOX NO. X-40513AMBIENT TEMPERATURE 80BAROMETRIC PRESSURE 29.16ASSUMED MOISTURE, % 8PROBE LENGTH, in. 96NOZZLE DIAMETER, in. 0.215STACK DIAMETER, in. 80PROBE HEATER SETTING 250HEATER BOX SETTING 250METER IN, 1.64C FACTOR 0.9PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (s), min	Time	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (ft/s)	✓ O ₂	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m), (ft ³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER	INLET (T _{m,in}), °F	OUTLET (T _{m,out}), °F	Sample Box Temperature °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER #3 °F	PUMP VACUUM in. Hg gauge	X10-2 VELOCITY
							ACTUAL DESIRED	1000 ±							
13	44	15:09	393	1.0	3.0	1.9	1.5	32.0	110	105	251	254	246	69	20
14	52	15:17	402	.95		1.9	1.4	37.7							
15	60	15:25	414	.90	2.7	1.3	1.3	43.1	108	103	249	255	246	70	21
16	8	15:33	422	.85		1.25	1.25	48.6							
17	16	15:41	424	.85	2.4	1.25	1.25	53.0	106	103	250	259	245	71	21 1/2
18	24	15:49	421	.82		1.2	1.2	59.7							
19	32	15:57	423	.80		1.18	1.18	64.8	106	103	250	257	245	73	23
20	40	16:05	424	.80	2.9	1.0	1.18	69.0							
21	48	16:13	432	.75		1.0	1.1	76.5	103	102	249	259	244	59	22 1/2
22	56	16:21	435	.70	2.6	1.0	1.0	79.9							
23	4	16:29	435	.60		.88	.88	85.3	102	101	250	261	246	60	21 1/2
24	12	16:37	432	.53	2.7	.76	.76	89.7	STOP					19	39
								93.33							
TOTAL	384	384													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT				
	1	2	3	4						
FINAL						1				
INITIAL						2				
LIQUID COLLECTED						3				
TOTAL VOLUME COLLECTED						4				

COMMENTS

Post leak check at 23° Hg
 .035" cfm with flex line
 with s/s at 7° .02 cfm

D-42

NOMOGRAPH DATA

PLANT Niles, Ohio SNOX process

DATE July 23, 1993

SAMPLING LOCATION outlet of bag house

N-18-MM5-723

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH_o	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m,avg.}$	110 87.2
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wv}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.16
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073 \times$ STACK GAUGE PRESSURE in in. H ₂ O)	P_s	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.0
AVERAGE STACK TEMPERATURE, °F	$T_{s,avg.}$	382
AVERAGE VELOCITY HEAD, in. H ₂ O	$\Delta p_{avg.}$	0.65
MAXIMUM VELOCITY HEAD, in. H ₂ O	$\Delta p_{max.}$	0.96
C FACTOR		0.90
CALCULATED NOZZLE DIAMETER, in.		0.260
ACTUAL NOZZLE DIAMETER, in.		0.247
REFERENCE Δp , in. H ₂ O		0.85

EPA (Dur) 234
4/72

#1

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Tulsa, Okla. SWP processDATE 7/23/93LOCATION outlet of baghouseOPERATOR Leonard, Kupp

STACK NO. _____

RUN NO. N-19-MD5-723SAMPLE BOX NO. 3METER BOX NO. 2-40573AMBIENT TEMPERATURE 75BAROMETRIC PRESSURE 29.16ASSUMED MOISTURE, % 7PROBE LENGTH, in. 9 ft. glassNOZZLE DIAMETER, in. 0.247STACK DIAMETER, in. 8 ft.PROBE HEATER SETTING 250°FHEATER BOX SETTING 250°FMETER AN, 1.65C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (h), min.	probe temp STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m), (L)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ %
					ACTUAL	DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F				
1	0/9:01	246	342	0.39	0.82	0.82	631.177	67	66	260	54	7.5	3.7
2	7.5/9:08.5	259	375	0.54	1.15	1.15	635.1	71	67	260	53	8.5	3.5
3	15/9:16	246	382	0.54	1.15	1.15	639.6	75	69	261	52	8.5	3.7
4	22.5/9:23.5	251	384	0.57	1.20	1.20	644.0	80	73	262	55	9.0	3.7
5	30/9:31	248	384	0.59	1.25	1.25	648.7	83	75	261	54	9.0	3.9
6	37.5/9:38.5	248	385	0.66	1.40	1.40	653.3	85	77	262	56	9.8	3.8
7	45/9:46	254	386	0.63	1.35	1.35	658.2	87	79	262	55	9.8	3.5
8	52.5/9:53.5	253	386	0.57	1.20	1.20	663.2	89	82	261	56	9.5	3.8
9	60/10:01	255	383	0.57	1.20	1.20	668.0	91	85	262	57	9.5	3.8
10	67.5/10:08.5	250	383	0.64	1.15	1.15	672.6	92	86	262	57	9.5	4.0
11	75/10:16	254	384	0.57	1.10	1.10	677.9	93	87	261	57	9.0	3.6
12	82.5/10:23.5	249	384	0.53	1.10	1.10	682.0	94	88	259	57	9.0	4.0
13	90/10:31	255	385	0.80	1.90	1.90	686.6	96	90	263	58	12.9	3.9
14	97.5/10:38.5	252	384	0.76	1.70	1.70	692.3	98	91	262	54	11.5	4.0
15	105/10:46	256	385	0.89	1.90	1.90	697.8	99	93	262	53	12.0	4.0
TOTAL													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
	1	2	3	4							
FINAL											
INITIAL											
LIQUID COLLECTED											
TOTAL VOLUME COLLECTED											

COMMENTS

#2

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Niles, Ohio SNEX processAMBIENT TEMPERATURE 80METER ΔH , 1.65DATE 7/23/93BAROMETRIC PRESSURE 29.16C FACTOR 0.90LOCATION Outlet of baghouseASSUMED MOISTURE, % 7

PROCESS WEIGHT RATE

OPERATOR Leonard, KnapPROBE LENGTH, in. 98.2800

WEIGHT OF PARTICULATE COLLECTED, mg

STACK NO. _____

NOZZLE DIAMETER, in. 0.247

SAMPLE FILTER PROBE WA

RUN NO. N-19-MMS-723STACK DIAMETER, in. 800

FINAL WEIGHT

SAMPLE BOX NO. 3PROBE HEATER SETTING 250°F

TARE WEIGHT

METER BOX NO. 40513HEATER BOX SETTING 250°F

WEIGHT GAIN

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	probe Temp °F STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ % VELOCITY
							INLET (T _{in}), °F	OUTLET (T _{out}), °F				
16	112.5/10:05	254	384	0.89	1.90 1.90	703.7	99	93	260	50	12.0	3.9
17	120/11:01	255	385	0.80	1.70 1.70	709.5	99	93	261	50	11.8	4.0
18	127.5/10:05	257	385	0.72	1.50 1.50	715.2	100	95	261	51	10.5	4.0
19	135/11:16	251	385	0.61	1.30 1.30	720.6	100	95	261	51	10.0	3.8
20	142.5/11:24	252	385	0.64	1.40 1.40	726.7	101	95	260	51	10.0	3.9
21	150/11:31	255	384	0.44	0.84 0.84	730.6	102	97	262	52	8.7	4.0
22	157.5/11:24	248	384	0.37	0.80 0.80	735.2	102	97	261	54	7.8	4.2
23	165/11:46	250	384	0.34	0.74 0.74	739.0	101	97	261	54	7.6	4.0
24	172.5/11:53	249	385	0.34	0.74 0.74	742.8	101	98	261	54	7.6	4.0
	180/12:01	off		0		746.622						
SIDE												
1	180/12:04	on	324	0.23	0.60 0.60	746.622	97	97	261	52	7.2	4.1
2	187.5/10:22	262	352	0.34	0.74 0.74	750.7	97	96	261	53	8.0	4.3
3	195/12:29	249	369	0.37	0.80 0.80	754.0	99	96	261	53	8.2	4.2
4	202.5/12:34	248	3	0.42	0.90 0.90	758.0	100	97	260	54	9.0	4.1
TOTAL												

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT				
	1	2	3	4		TIME	CO ₁	O ₁	CO ₂	N ₂
FINAL						1				
INITIAL						2				
LIQUID COLLECTED						3				
TOTAL VOLUME COLLECTED						4				

COMMENTS

#3

6835450

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Miles, Ohio, S.W. Power AMBIENT TEMPERATURE 82
 DATE 7/23/93 BAROMETRIC PRESSURE 29.16
 LOCATION outlet of baghouse ASSUMED MOISTURE, % 7
 OPERATOR Lernak, Hupp PROBE LENGTH, in. 280. glass
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MM5-723 STACK DIAMETER, in. 840
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F
 METER BOX NO. 8-40673 HEATER BOX SETTING 250°F

METER 1.65
 C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	probe Temp OF STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), (l)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ %
					ACTUAL	DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F				
5	210/12:34	246	388	0.62	1.25	1.25	727.9	100	97	260	53	10.0	4.0
6	213.0/12:35	247	389	0.60	1.30	1.30	767.1	102	97	260	53	10.1	4.2
7	225/12:59	249	388	0.62	1.30	1.30	771.9	103	98	260	54	10.2	4.4
8	232.5/13:06.5	250	383	0.62	1.30	1.30	776.8	103	98	262	55	10.5	4.2
9	240/12:14	249	389	0.60	1.30	1.30	791.9	103	99	261	56	10.5	4.4
10	247.5/12:16	249	386	0.62	1.30	1.30	786.9	104	99	262	54	10.5	4.3
11	255/12:29	250	388	0.65	1.40	1.40	791.9	103	99	260	54	11.0	4.3
12	262.5/12:35	249	388	0.70	1.50	1.50	797.4	102	98	259	53	11.2	4.4
13	270/12:44	249	389	0.81	1.75	1.75	802.4	103	99	259	53	12.0	4.0
14	277.5/12:51	252	350	0.81	1.75	1.75	808.2	105	100	261	54	12.2	4.0
15	285/13:59	252	386	0.8	1.70	1.70	813.8	103	99	259	55	12.2	4.4
16	286/14:06	250	383	0.8	1.70	1.70	819.6	102	99	260	55	12.2	4.4
17	300.0/14:14	251	382	0.8	1.70	1.70	825.3	102	97	258	55	12.2	4.6
18	309.5/14:26	247	381	0.8	1.71	1.71	831.0	102	98	258	55	12.3	4.4
19	315.0/14:29	248	381	0.74	1.60	1.60	836.8	101	78	257	55	11.5	4.4
TOTAL													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₁	O ₂	CO	H ₂	COMMENTS
	1	2	3	4								
FINAL												
INITIAL												
LIQUID COLLECTED												
TOTAL VOLUME COLLECTED												

D-46

FAH IICULATE FIELD DATA

PLANT	MAKING, 1916, SNOX BURNING
DATE	7/23/93
LOCATION	2500 of log house
OPERATOR	General, 7/20/93
STACK NO.	N-19-M15-723
RUN NO.	8
SAMPLE BOX NO.	3
METER BOX NO.	X-40513
AMBIENT TEMPERATURE	85.5
BAROMETRIC PRESSURE	29.16
ASSUMED MOISTURE, %	7
PROBE LENGTH, in.	850 9440
NOZZLE DIAMETER, in.	0.2419
STACK DIAMETER, in.	8801
PROBE HEATER SETTING	2505
HEATER BOX SETTING	2505

METER A.H.		1.65
C FACTOR		0.90
PROCESS WEIGHT RATE		
WEIGHT OF PARTICULATE COLLECTED, MG.		
SAMPLE	FILTER	PROBE W/
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

[illegible]

Leaf chaff 0.032 at 15" Hg

COMMENTS.

VOLUME OF LIQUID WATER COLLECTED	1						SILICA GEL VOLUME ml	WEIGHT.	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
FINAL									1					
INITIAL									2					
LIQUID COLLECTED									3					
TOTAL VOLUME COLLECTED									4					

STACK SAMPLING DATA SHEET

Page 1 of 4

CLIENT Rattelle/DOE TEST DATE 7-23-92 (Fri.) ORIFICE CORRECTION 1.0522 HOT BOX NO. 8
 TEST UNIT SR Reactor Outlet TEST NO. N-20 MM5-723 METER CORRECTION 1.0151 COLD BOX NO. 8
 PROJECT NO. 93C1628-01 NOZZLE (SIZE, IN.) 0.441" CALIBRATION DATE 07-02-93 PROBE NO. 13-2
 CONTROL BOX OPERATOR RPC STATIC PRESSURE 15.0" H₂O PITOT CORRECTION 0.04 FILTER NO. Unchanged
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION Port #2 CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot a P (in. H ₂ O)	Orifice a H Req'd. (in. H ₂ O)	Orifice a H Act. (in. H ₂ O)	Meter Temperature In. (°F)	Meter Temperature Out. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	09:04	508.905	.03	.47	.47	81	81	1.0	628	-250°F	46°F	-250°F	15 m/sec
			.03	.47	.47	82	82	1.0	630			-300°F	
			.03	.47	.47	96	87	1.0	630				
90			.03	.47	.47	97	86	1.0	630				
			.04	.65	.65	100	86	2.0	631				
			.04	.65	.65	102	80	2.5	632				
70			.04	.65	.65	106	81	2.5	632				
			.04	.65	.65	107	94	2.5	635				
			.04	.65	.65	107	94	2.5	636				
50			.05	.81	.81	110	95	3.5	630				
			.05	.81	.81	113	97	4.0	635				
			.03	.47	.47	112	100	1.5	631				
30			.06	.97	.97	112	100	4.0	630				
			.06	.97	.97	112	100	4.0	631				
			.06	.97	.97	114	101	4.0	639				Estimates:
10			.06	.97	.97	116	102	4.0	636				MW=29.2
			.06	.97	.97	116	103	4.0	634				%H ₂ O=9
	10:34	552.324	.06	.97	.97	115	103	4.0	630				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	40.02 cfm
After	15.0	40.02 cfm

PITOT LEAK CHECK

	Positive	Negative
Before	0.15 sec	0.15 sec
After	0.15 sec	0.15 sec

	CO ₂	O ₂	CO	N ₂
	14.0	7.0	0	79.0

Flue gas check O₂ = 21% at 0.35

Impinger

Impinger No.	Contents	Final	Initial	Difference
1.	XAD-2 + Carbonate	1549.3	1226.3	323.0
2.	Empty	380.2	375.1	5.1
3.	100 ml DI H ₂ O	553.5	551.9	1.6
4.	100 ml DI H ₂ O	543.3	544.6	-1.3
5.	200 ml Silica Gel	690.9	652.8	38.1

Actual Moisture 8.3%

000000
7644321

AGE 202

366.59 tot
KEYSTONE
ENVIRONMENTAL SYSTEMS, INC.

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STACK SAMPLING DATA SHEET

Page 2 of 4

CLIENT BATHURST BOE

TEST DATE 07-23-93

ORIFICE CORRECTION 1.572

HOT BOX NO. 8

TEST UNIT SCR Reactor outlet

TEST NO. N-20-MMS-723

METER CORRECTION 1.015

COLD BOX NO. 8

PROJECT NO. 730628-01

NOZZLE (SIZE) 0.441

CALIBRATION DATE 07-02-93

PROBE NO. 13-2

CONTROL BOX OPERATOR RFC

STATIC PRESSURE 15.0" H2O

PITOT CORRECTION 0.84

FILTER NO. UN61344-0

BAROMETRIC PRESSURE 29.38

PORT DIRECTION Port 45

CONTROL BOX NO. TH660

STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H2O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
110"	10:40	552.324	-10	1.62	1.62	115	103	6.0	646	250°F	68°F	~300°F	15ma/1r
			-10	1.62	1.62	115	101	6.0	643				
			-10	1.62	1.62	115	101	6.5	644				
90"			-08	1.30	1.30	115	101	5.0	644				
			-10	1.62	1.62	114	100	6.5	655				
			-10	1.62	1.62	115	99	6.5	656				
70"			-10	1.62	1.62	115	99	6.5	655				
			-10	1.62	1.62	115	99	6.5	652				
			-10	1.62	1.62	115	99	6.5	653				
50"			-11	1.78	1.78	116	99	6.5	657				
			-11	1.78	1.78	116	100	6.5	657				
			-10	1.62	1.62	117	100	6.5	651				
30"			04	.65	.65	114	100	3.0	654				
			04	.65	.65	112	100	3.0	654				
			04	.65	.65	112	100	3.0	655				
10"			04	.65	.65	115	100	3.0	653				Estimates:
			03	.49	.49	111	100	2.5	657				MW= 28.2
	12:10	608.125	03	.49	.49	111	100	2.5	639				%H2O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 cfm
After	4.0	<0.01 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.

Impinger No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

STACK SAMPLING DATA SHEET

Page 3 of 4

CLIENT BPTB126 1102 TEST DATE 07-23-93 ORIFICE CORRECTION 1.572 HOT BOX NO. 8
 TEST UNIT SCR ROCKETD 04201 TEST NO. N-20-MAF-723 METER CORRECTION 1.0151 COLD BOX NO. 8
 PROJECT NO. 93028-01 NOZZLE (SIZE, #) 0.411 CALIBRATION DATE 07-22-93 PROBE NO. 13-2
 CONTROL BOX OPERATOR LIC STATIC PRESSURE 15.040 PITOT CORRECTION 0.84 FILTER NO. WJH-6-1000
 BAROMETRIC PRESSURE 21.38 PORT DIRECTION PORT "H" CONTROL BOX NO. THREE STACK DIA. WJH-6-1000

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pilot ΔP (in. H2O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
116"	12:16	608.125	-07	1.13	1.13	106	99	6.0	650	425.0	4.0	2300	157-10T
			.08	1.30	1.30	109	100	6.0	668				
			.08	1.30	1.30	109	100	6.0	668				
90"			.09	1.46	1.46	115	100	6.5	675				
			.10	1.62	1.62	115	100	7.0	678				
			.10	1.62	1.62	116	100	7.0	679				
70"			.10	1.62	1.62	116	101	7.0	679				
			.10	1.62	1.62	116	101	7.5	682				
			.10	1.62	1.62	116	101	7.5	680				
50"			.11	1.77	1.77	117	102	7.5	682				
			.10	1.61	1.61	118	102	7.5	692				
			.10	1.61	1.61	118	102	7.5	682				
30"			.095	1.53	1.53	119	102	7.5	682				
			.11	1.77	1.77	119	103	8.0	688				
			.11	1.77	1.77	120	103	8.0	688				
10"			.10	1.61	1.61	119	104	8.0	687				Estimates:
			.04	.64	.64	116	104	4.0	685				MW=28.2
			.04	.64	.64	117	104	4.0	685				%H2O=9.0
	13:46	608.045	.04	.64	.64	117	104	4.0	685				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	21.0	
CO	0	
N2	79.0	

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

STACK SAMPLING DATA SHEET

Page 4 of 4

CLIENT Battelle / DOE TEST DATE 07-23-93 ORIFICE CORRECTION 1.572 HOT BOX NO. 8
 TEST UNIT CCR ROXITEM OUTLET TEST NO. N-20-MM5-723 METER CORRECTION 1.0151 COLD BOX NO. 8
 PROJECT NO. 93CB28-B1 NOZZLE (SIZE, #) 0.441" CALIBRATION DATE 07-02-93 PROBE NO. 1.3-2
 CONTROL BOX OPERATOR CPC STATIC PRESSURE 15.0710 PITOT CORRECTION 0.84 FILTER NO. UNL-19-001
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION RET #6 CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pilot ΔP (in. H2O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
110"	13:56	668.045	06	.97	.97	104	104	5.0	689	~250°F	160°F	~300°F	15 min / 105
			.09	1.45	1.45	114	103	7.5	691				
110"	14:11	675.448	.10	1.61	1.61	115	103	13.5	690				CHANGED FLOW
90"	14:28	675.540	.10	1.61	1.61	102	102	6.5	691				AT 75 min
			.06	.97	.97	113	103	4.0	696				1411
			.06	.97	.97	115	102	4.0	698				
70"			.04	.64	.64	115	102	3.0	699				
			.04	.64	.64	115	103	3.0	700				
			.04	.64	.64	115	103	3.0	700				
50"			.05	.81	.81	116	103	4.0	702				
			.05	.81	.81	116	104	4.0	702				
			.06	.97	.97	117	103	4.0	700				
30"			.06	.97	.97	118	104	4.0	704				
			.06	.97	.97	118	104	4.0	702				
			.06	.97	.97	119	104	4.0	700				
10'			.05	.81	.81	119	105	4.0	699				Estimates:
			.04	.64	.64	118	105	3.5	698				MW = 28.2
	15:43	714.108	.04	.64	.64	118	105	3.5	698				%H2O = 8.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

TOTAL TEST

TIME = 360 min

VOLUME = 205.111 dcl

AQE 2/92

(ΔP)_{AVG} = 0.065

	1	2
CO2	14.0	
O2	2.0	
CO	0	
N2	74.0	

(ΔH)_{AVG} = 1.10

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

(T_{meter})_{AVG} = 106°F

(T_{stack})_{AVG} = 665°F

velocity = 20.6 ft/sec

ISI = 93.2%

KEYSTONE
ENVIRONMENTAL SYSTEMS, INC.

D-51

Page 1 of 4

TEST DATE 7-23-93 (Fri.)

ORIFICE CORRECTION ~~1.79~~ 1.802

HOT BOX NO. 4

TEST UNIT SNOX Tower Outlet

TEST NO. N-2/-MM5-723

METER CORRECTION ~~0.00~~ 0.96

9 COLD BOX NO. 4430

PROJECT NO. 93C028-01

NOZZLE (SIZE, #) 0.195 A17

CALIBRATION DATE 5-17-93

PROBE NO. 10-3

CONTROL BOX OPERATOR TN

STATIC PRESSURE 9.746

PITOT CORRECTION 0.84

FILTER NO.

BAROMETRIC PRESSURE 29.78

PORT DIRECTION

CONTROL BOX NO. 17

STACK DIA. 50" (depth) x 90"

D-52

PITOT LEAK CHECK		
	Positive	Negative
Before	OK	OK
After		

	1	2
CO2	14.0	
O2	5.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 ml + concentrate	1561.4	1266.1	295.3
100 ml H ₂ O	100 ml + 2.5 ml O	497.6	424.7	72.9
100 ml H ₂ O	100 ml + 2.5 ml O	544.5	542.1	2.4
	Empty	475.4	505.9	-30.5
5.	200 ml Silica Gel	714.2	671.0	43.2

Actual
Moisture
7.8%

383.39 *pt*
KEYSTONE
ESTABLISHED 1944

Page 3 of 4

TEST DATE 7-23-93 (Fri.)

ORIFICE CORRECTION ~~1.734~~ 1.802

HOT BOX NO. 4

TEST UNIT SINOX Tower Outlet

TEST NO. N-21-MMS-723

METER CORRECTION ~~0.03%~~ 0.9%

COLD BOX NO. 4734

PROJECT NO. 93C022-01

NOZZLE (SIZE, #) 0.195 917

CALIBRATION DATE 5-17-92

PROBE NO.	0-3
-----------	-----

CONTROL BOX OPERATOR

STATIC PRESSURE 0.7" H₂O

PITOT CORRECTION

FILTER NO.
STACK DIA.

BAROMETRIC PRESSURE 29.38

PORT DIRECTION C

CONTROL BOX NO. 17

STACK DIA. 50" (depth) x

Estimates:
MW-29.2
%H2O-8.5

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

KEYSTONE
Serving the Pennsylvania Insurance Industry

STACK SAMPLING DATA SHEET

Page 4 of 4

CLIENT Bottelle DOE TEST DATE 7-23-93 (Fri.) ORIFICE CORRECTION 1.802 HOT BOX NO. 4
 TEST UNIT SNOX Tower Outlet TEST NO. N-31-MMS-723 METER CORRECTION 0.967 COLD BOX NO. 4-34
 PROJECT NO. 93C028-01 NOZZLE (SIZE, IN) 0.195 G17 CALIBRATION DATE 5-12-93 PROBE NO. 10-3
 CONTROL BOX OPERATOR JPS STATIC PRESSURE 0.7" H₂O PITOT CORRECTION 0.84 FILTER NO.
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION D CONTROL BOX NO. 87 STACK DIA. 50" (depth) x 9'

Σ Time	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pilot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments (wt)
					Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
0	46.4	1407	403.485	0.95	1.11	1.11	116	98	13.0	197	~250°F	~48°F	~250°F	13 min/pair
13	39.3	1400		0.95	1.11	1.11	118	98	14.5	198				Readings even
				0.80	0.94	0.94	118	98	14.5	196				6.5 min
26	32.1	1435		0.85	1.00	1.00	118	98	15.0	197				
				1.15	1.35	1.35	118	98	20.0	197				
				1.10	1.29	1.29	108	96	20.0	195				
39	25.0	1446		0.90	1.05	1.05	108	97	20.0	196				
				0.90	1.05	1.05	108	97	20.0	195				
52	17.9	1459		1.00	1.17	1.17	108	97	20.0	196				
				1.00	1.17	1.17	108	97	20.0	196				
65	10.7	1502		1.00	1.17	1.17	108	97	20.0	192				
				1.06	1.17	1.17	108	97	20.0	193				
78	3.6	1528		0.90	1.05	1.05	108	97	20.0	190				
91		1538	461.342	0.85	0.99	0.99	108	97	20.0	196				
														Estimates:
			Δ=91 min	Δ=51.867 dcl	(ΔP) _{avg} = 0.95	(ΔH) _{avg} = 1.12	(T _{meter}) _{avg} = 104.4°F	(T _{stack}) _{avg} = 195°F						MW = 29.2
														% H ₂ O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	20.0	0.020

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	14.0	
O ₂	5.0	
CO	0	
N ₂	86.0	

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

IBO = 102.3%

velocity = 61.1 ft/sec

D-2: Multi-Metals (Method 29)

PARTICULATE ELD DATA

N-18-MUM-719

PLANT Niles
 DATE 7-19
 LOCATION BH IN 18
 OPERATOR Webb / Cox
 STACK NO. _____
 RUN NO. 2 Metals
 SAMPLE BOX NO. _____
 METER BOX NO. X-40513

AMBIENT TEMPERATURE 90
 BAROMETRIC PRESSURE 28.95
 ASSUMED MOISTURE, % 6
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. 1.215
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 250

METER A.H. 1.64
 C FACTOR 0.9

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TOE		Time	4	1.02 VELOCITY HEAD (V _P) (V _T)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O ACTUAL DESIRED		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		FLT	Probe #2	#9 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	#3 Box VELDET lbs
TRAVERSE POINT NUMBER	SAMPLING TIME (h), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F						INLET (T _{m IN}), °F	OUTLET (T _{m OUT}), °F		SAMPLE BOX TEMPERATURE #8 °F			
1	0	10:42		3	3	92	92	90.466							
2					3.9			96.4	99	96	252	254	57	3	
3	24		391	37	3.9	92	92								
4	32		410	4		52	52	102.8							
5	40		419	55	9.0	72	72								
6	48			-				115.5	Lost power for ~ 1 minute !! Plant employees not com.						
7	56	11:38	411	72	4.8	92	92	115.5	Adj. anemograph						
8	4		416	75		1.1	1.1	121.0	100	96	250	255	56	4 1/2	248
9	12		412	8	4.4	1.15	1.15	123.8						6	
10	20		412	9		1.28	1.28	129.2	106	99					
11	28		412	95	4.3	1.35	1.35	135.0			252	257	63	8	249
12	36		405	1.0		1.4	1.4	140.6	108	99					
								145.4							
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
	1	2	3	4							
FINAL											
INITIAL											
LIQUID COLLECTED											
TOTAL VOLUME COLLECTED											

• Pre leak check 0.15 at 20%
 COMMENTS • Pts 1, 2 = zero flow
 start pt 3

PARTICULATE FIELD DATA

PLANT Nilex AMBIENT TEMPERATURE 90 METER ΔH 1.64

DATE 7-19 BAROMETRIC PRESSURE 28.96 C FACTOR .90

LOCATION 18 BH IN ASSUMED MOISTURE, % 6 PROCESS WEIGHT RATE _____

OPERATOR Walt / Cat PROBE LENGTH, in. 96 WEIGHT OF PARTICULATE COLLECTED, mg

STACK NO. _____ NOZZLE DIAMETER, in. 0.215

RUN NO. 2 Metals STACK DIAMETER, in. 80

SAMPLE BOX NO. _____ PROBE HEATER SETTING 250

METER BOX NO. X-40513 HEATER BOX SETTING 250

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (t), min.	Time	#4 STACK TEMPERATURE (T _s), °F	1.02 VELOCITY HEAD (ΔP _s), (ΔP _s)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O ACTUAL DESIRED		GAS SAMPLE VOLUME (V _m), ft ³	#6 #7 GAS SAMPLE TEMPERATURE AT DRY GAS METER		Flex Probe SAMPLE BOX TEMPERATURE °F		#9 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Box #3 VELOCITY ft/s
				(ΔP _s)	(ΔP _s)				INLET (T _{m, in}), °F	OUTLET (T _{m, out}), °F	#1	#2			
13	44	12:26	390	1.0	4.3	1.4	1.4	148.4	108	100	257	258	65	9 1/2	248
14	52		392	1.0		1.4	1.4	157.5							
15	60		394	.96	4.0	1.38	1.38	159.3	109	102	251	258	63	12	248
16	8	12:50	397	.88		1.22	1.22	164.6							
17	16		400	.85	4.1	1.2	1.2							12	
18	24	13:06	400	.85		1.2	1.2	176.0	111	105	252	260	71		248
19	32		400	.82	4.3	1.15	1.15	181.0							
20	40		404	.78		1.1	1.1								
21	48	13:22	402	.75		1.08	1.08	192.0	115	108	252	261	67	14	249
22	56		403	.70	4.7	.98	.98	197.1							
23	4		401	.55		.78	.78							13	
24	12	13:55		.50		.69	.69								
								Stop 210.66							
TOTAL															

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

D-58

PARTICULATE ELD DATA

Ref Ap = 1.3

SCHEMATIC OF STACK

PLANT Thelan
 DATE 7-19-90
 LOCATION #18
 OPERATOR Wish/coy
 STACK NO. 2
 RUN NO. MM
 SAMPLE BOX NO. X-40513
 METER BOX NO. X-40513

AMBIENT TEMPERATURE 90
 BAROMETRIC PRESSURE 28.8
 ASSUMED MOISTURE, % 6
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. 2.15
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250 F
 HEATER BOX SETTING 230 F

METER IN, 1.64
 C FACTOR 0.9

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg	
SAMPLE	FILTER
FINAL WEIGHT	
TARE WEIGHT	
WEIGHT GAIN	

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (h), min	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (ft/s) ²	VELOCITY (V), (ft/s)	ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), (ft ³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (T _{m,i}), °F	OUTLET (T _{m,out}), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY (ft/s)
1	0	16.55					210.66						1307
2	16	17.12	340	.3		.90		101	100	255	250		249
3	24		355	.5	4.4	.70	245.5				79	10	249
4	32		358	.70		.98							
5	40		364	.78		1.1					64	15	249
6	48	17.44	361	0.83	4.1	1.15	227.3	112	107	252			
7	56		363	0.85		1.2	232						
8	4	17.5	17:49				237.25701						
9	12	16.07											
10	20		365	.9	3.5	1.25	241.0						
11	28		366	1.0		1.4	248	113	105	252	63		249
12	36		367	1.0		1.4							
13	44		369	1.0		1.4	258.6	114	107				
TOTAL			380	1.1		1.5						8	
AVERAGE													

No flow on pt #1

COMMENTS

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml				SILICA GEL WEIGHT, g				ORSAT MEASUREMENT				TIME				CO, O ₂ , CO, N ₂			
FINAL		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
INITIAL																					
LIQUID COLLECTED																					
TOTAL VOLUME COLLECTED																					

PARTICULATE FIELD DATA

PLANT Niles AMBIENT TEMPERATURE 90 METER ΔH 1.64

DATE 7-19-93 BAROMETRIC PRESSURE 28.95 C FACTOR 0.9

LOCATION BH 1N / 18 ASSUMED MOISTURE, % 6 PROCESS WEIGHT RATE _____

OPERATOR Webb / Cox PROBE LENGTH, in. 96

STACK NO. _____ NOZZLE DIAMETER, in. 0.215

RUN NO. 2 Metals STACK DIAMETER, in. 80

SAMPLE BOX NO. _____ PROBE HEATER SETTING 250

METER BOX NO. A-40517 HEATER BOX SETTING 200

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WAS
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	Time	#9	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s)	1.0 ₂	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER	INLET (T _{m in}), °F	OUTLET (T _{m out}), °F	SAMPLE BOX TEMPERATURE °F	#9	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Box #3	VELOCITY
													#8 #2					
13	52				1.1	3.9	1.5	1.5										
14	60	19:06	403	1.0			1.4	1.4	277.5	115	107				74			
15	8		405	.98	4.0		1.35	1.35										
16	16	19:24	408	0.90			1.22	1.22	289.7	113	106	252	257		80	9	249	
17	24		412	.88	4.1		1.2	1.2	295.1									
18	32		412	.85			1.2	1.2	301.1	111	107					9 1/2		
19	40		418	.82	9.0		1.12	1.12	308.9									
20	48		416	.79			1.1	1.1	312.7							10 1/2	248	
21	56	20:05	421	.75			1.05	1.05	323.1	112	106	252	260		67			
22	4		423	0.70			.98	.98	327.4									
23	12																	
24	20	20:30	423	.6			.82	.82	332.1	110	105	254	261		70	10	298	
									335.952									
									90.466									
									245.486									
TOTAL																		
AVERAGE																		

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
FINAL	1	2	3	4				
INITIAL								
LIQUID COLLECTED								
TOTAL VOLUME COLLECTED								

COMMENTS

Post leak check = .022 at 19 with flex - w/o s/s probe with s/s probe at 4' = .01

D-60

NOMOGRAPH DATA

PLANT Niles, Ohio, SNOx process

DATE July 19, 1993

SAMPLING LOCATION outlet of bag house

N-19-MUM-718

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH_o	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m\text{avg.}}$	110
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	28.95
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073 \times$ STACK GAUGE PRESSURE in in. H ₂ O)	P_s	28.918 27" H ₂ O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	0.972 .93
AVERAGE STACK TEMPERATURE, °F	$T_{s\text{avg.}}$	380
AVERAGE VELOCITY HEAD, in. H ₂ O	$\Delta P_{\text{avg.}}$	0.642
MAXIMUM VELOCITY HEAD, in. H ₂ O	$\Delta P_{\text{max.}}$	1.05
C FACTOR		0.90
CALCULATED NOZZLE DIAMETER, in.		0.260
ACTUAL NOZZLE DIAMETER, in.		0.247
REFERENCE Δp , in. H ₂ O		0.82

EPA (Dur) 234
4/72

5-1
9

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT Niles, Ohio SNOX AMBIENT TEMPERATURE 75°F
 DATE 7/19/93 BAROMETRIC PRESSURE 28.95
 LOCATION outlet of baghouse ASSUMED MOISTURE, % 7
 OPERATOR Leonard, Hupp PROBE LENGTH, in. 980
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MUM-719 STACK DIAMETER, in. 802
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F
 METER BOX NO. X-40513 HEATER BOX SETTING 250°F

METER ΔH , 1.65
 C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	probe Temp of STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST-IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ % VELOCITY
					ACTUAL	DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F				
1	0/9:58	250	285	0.43	0.94	0.94	681.987	80	80	256	54	5.0	4.6
2	10/10:02	251	340	0.48	1.10	1.10	687.4	81	79	256	53	5.1	5.0
3	20/10:18	252	316	0.51	1.13	1.13	693.5	86	81	257	54	5.1	5.0
4	30/10:28	254	385	0.64	1.4	1.4	705.4	87	83	258	55	5.1	5.0
5	40/10:38	254	384	0.64	1.4	1.4	705.2	89	85	257	55	5.1	5.0
6	50/10:48	256	384	0.62	1.39	1.39	711.3	91	86	257	55	6.0	4.0
7	60/10:58	256	385	0.6	1.38	1.38	718.2	91	86	254	56	6.0	4.5
8	70/11:08	257	384	0.63	1.40	1.40	724.9	92	87	257	58	6.0	4.5
9	80/11:18	257	384	0.60	1.40	1.40	731.9	92	88	257	59	6.0	4.5
10	90/11:28	255	384	0.58	1.30	1.30	738.8	91	87	256	60	6.0	4.5
11	100/11:38	255	383	0.64	1.40	1.40	745.7	91	88	257	61	6.0	4.5
12	110/11:48	256	384	0.58	1.30	1.30	752.5	91	87	256	63	6.0	4.5
13	120/11:58	257	385	0.59	1.30	1.30	759.3	94	89	257	65	6.0	4.6
14	130/12:08	368	385	0.6	1.31	1.31	765.9	95	90	260	77	6.0	4.5
15	140/12:18	378	385	0.98	2.20	2.20	772.6	94	90	259	70	6.0	4.5
TOTAL													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g
	1	2	3	4	
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

COMMENTS

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2

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Nuke Ohio SNOX processDATE 7/19/93LOCATION outlet of bag houseOPERATOR Leonard, NARR

STACK NO. _____

RUN NO. N-19-MUM-719SAMPLE BOX NO. 3METER BOX NO. A 40513AMBIENT TEMPERATURE 80°FBAROMETRIC PRESSURE 28.95ASSUMED MOISTURE, % 7PROBE LENGTH, in. 90"NOZZLE DIAMETER, in. 0.247STACK DIAMETER, in. 28"PROBE HEATER SETTING 250°FHEATER BOX SETTING 250°FMETER AM, 1.65C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (t), min.	probe temp of static pressure (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (h _p), (h _v), ft	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	02 %
16	150/12:28	379	384	1.0	2.2	2.2	850.9	93	89	255	72	8.0	4.5
17	160/12:38	384	384	1.2	2.15	2.15	737.5	93	90	256	77	8.0	4.5
18	170/12:48	381	384	0.64	1.45	1.45	797.8	94	90	257	81	6.5	4.5
19	180/12:58	380	384	0.52	1.20	1.20	804.9	93	90	257	77	6.0	4.4
20	190/13:08	382	384	0.45	1.00	1.00	811.5	95	91	259	77	5.5	4.5
21	200/13:18	382	384	0.5	1.1	1.1	817.4	96	92	259	79	5.5	4.5
22	210/13:28	381	384	0.45	1.0	1.0	823.3	96	93	259	83	5.5	4.5
23	220/13:38	381	383	0.43	0.98	0.98	822.1	97	93	258	84	5.5	4.6
24	230/13:48		384	0.62	1.4	1.4	838.9						
END	243.58			0.34	0.75	0.75	842.93						
SIDE													
1	240/14:40	250	320	0.25	0.55	0.55	840.93	87	86	258	70	4.0	4.6
2	250/14:50	250	348	0.20	0.46	0.46	844.8	87	86	258	62	4.4	4.4
3	260/15:00	253	357	0.38	0.85	0.85	848.8	90	87	259	63	5.0	4.4
4	270/15:10	254	375	0.45	1.0	1.0	853.9	92	88	259	60	5.5	4.3
TOTAL													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT					
	1	2	3	4		TIME	CO ₂	O ₂	CO	H ₂	
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS

164N
3

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT Nile, Ohio SNOX process AMBIENT TEMPERATURE 80
 DATE 7/19/73 BAROMETRIC PRESSURE 29.15
 LOCATION outlet of bag house ASSUMED MOISTURE, % 7
 OPERATOR Bernard, Hupp PROBE LENGTH, in. 980. glass
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MUM-719 STACK DIAMETER, in. 880.
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F
 METER BOX NO. X40513 HEATER BOX SETTING 250°F

METER ΔH, 1.60C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	probe Temp °F STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (ΔP _s) (1/ΔP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), l _i	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY ft/min
5	290/15:20	255	253.383	0.53	1.20 1.20	859.9	95	90	258	62	5.8	4.4
6	290/15:30	257	384	0.61	1.35 1.35	865.8	97	92	258	64	6.2	4.2
7	300/15:40	259	385	0.63	1.40 1.40	872.8	100	94	259	64	6.3	4.3
8	310/15:50	260	385	0.59	1.30 1.30		101	97	258	65	6.0	4.0
9	320/16:00	259	385	0.68	1.50 1.50	886.4	103	99	258	68	6.0	4.4
10	330/16:10	262	388	0.68	1.50 1.50	892.0	107	102	260	69	6.0	4.4
11	340/16:20	256	386	0.75	1.80 1.80	899.5	105	101	257	70	7.0	4.7
12	350/16:30	256	382	0.77	1.80 1.80	906.8	105	102	257	70	7.0	4.6
13	360/16:40	268	381	0.87	1.95 1.95	914.6	107	102	258	75	7.0	4.5
14	370/16:50	362	382	0.85	1.90 1.90	922.3	110	105	259	76	7.0	4.7
15	380/17:00	372	380	0.79	1.80 1.80	930.7	109	105	259	76	7.0	4.8
16	390/17:10	377	382	0.79	1.80 1.80	938.6	110	105	258	79	7.0	5.0
17	400/17:20	379	382	0.79	1.80 1.80	946.4	110	106	259	83	7.0	5.0
18	410/17:30	379	382	0.79	1.80 1.80	954.3	111	107	260	86	7.0	4.8
19	420/17:40	379	382	0.97	1.95 1.95	962.1	111	107	260	89	7.5	4.9
TOTAL												

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT					
	1	2	3	4		TIME	CO ₂	O ₂	CO	N ₂	
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS:

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT Nike, Ohio Shoxpress AMBIENT TEMPERATURE 85° METER ΔH , 1.60

DATE 7/19/93 BAROMETRIC PRESSURE 29.15 C FACTOR 0.90

LOCATION outlet of bag house ASSUMED MOISTURE, % 7 PROCESS WEIGHT RATE _____

OPERATOR Howard, Kupp PROBE LENGTH, in. 9 ft. glass

STACK NO. _____ NOZZLE DIAMETER, in. 0.247

RUN NO. N-19-MUM-719 STACK DIAMETER, in. 800

SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F

METER BOX NO. X-40513 HEATER BOX SETTING 250°F

WEIGHT OF PARTICULATE COLLECTED		
SAMPLE	FILTER	PRO
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

[illegible]

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS:

leak rate 0.009 at 10^{-4} Hz.

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STACK SAMPLING DATA SHEET

Page 1 of 5

CLIENT *Bethlehem Steel* TEST DATE *7-19-93 (Mon)* ORIFICE CORRECTION *1.573* HOT BOX NO. *6*
 TEST UNIT *SR Reactor Off* TEST NO. *11-20-MMM-719* METER CORRECTION *1.0151* COLD BOX NO. *6*
 PROJECT NO. *930228-01* NOZZLE (SIZE) *0.441* G-31 CALIBRATION DATE *07-02-93* PROBE NO. *13-1*
 CONTROL BOX OPERATOR *R/C* STATIC PRESSURE *17.0* PITOT CORRECTION *0.84* FILTER NO. *---*
 BAROMETRIC PRESSURE *29.10* PORT DIRECTION *Port 4* CONTROL BOX NO. *THREE* STACK DIA. *36"*

Traverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot & P (in. H2O)	Orifice ΔH (in. H2O)	Act. (in. H2O)	Meter Temperature In (°F)	Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110	10:08	150.730	10	1.59	1.59	86	83	1.0	680	~200F	468F	-200F	See note 1/ST
90			10	1.59	1.59	89	85	1.0	669				
70			10	1.59	1.59	102	88	1.5	670				
50			11	1.75	1.75	105	90	3.0	672				
3000			10	1.59	1.59	106	90	3.0	678				
1800			10	1.59	1.59	108	90	3.0	679				
			10	1.59	1.59	109	93	3.5	679				
			10	1.59	1.59	109	93	3.5	679				
70			11	1.75	1.75	111	95	4.5	680				SPARK TEST AT 0118 TO CHANGE RATE.
	10:58	782.850	11	1.75	1.75	111	95	4.5	680				SPARK TEST AT 0118 TO CHANGE RATE.
	11:46	782.850	10	1.59	1.59	96	92	1.0	684				SPARK TEST AT 0118 TO CHANGE RATE.
	11:56	789.558	10	1.59	1.59	104	92	1.0	683				SPARK TEST AT 0118 TO CHANGE RATE.
80	12:51	789.358	10	1.59	1.59	91	90	2.0	683				SPARK TEST AT 0118 TO CHANGE RATE.
			10	1.59	1.59	103	91	3.5	682				SPARK TEST AT 0118 TO CHANGE RATE.
			10	1.59	1.59	104	91	3.5	681				SPARK TEST AT 0118 TO CHANGE RATE.
			10	1.59	1.59	105	92	3.5	689				SPARK TEST AT 0118 TO CHANGE RATE.
30			090	1.43	1.43	110	97	4.0	687				SPARK TEST AT 0118 TO CHANGE RATE.
			09	1.42	1.43	112	97	4.5	688				SPARK TEST AT 0118 TO CHANGE RATE.

SYSTEM LEAK CHECK		PITOT LEAK CHECK		NEGATIVE	
Vacuum (in. Hg)	DGM Rate (cfm)	Before	After	Positive	Negative
Before 5.0	40.02 cfm	04/15 sec	04/15 sec	04/15 sec	04/15 sec
After 5.20	40.02 cfm	04/15 sec	04/15 sec	04/15 sec	04/15 sec
		CO2	13.0	13.0	13.0
		O2	6.0	6.0	6.0
		CO	0	0	0
		N2	81.0	81.0	81.0

SYSTEM LEAK CHECK		PITOT LEAK CHECK		NEGATIVE	
Vacuum (in. Hg)	DGM Rate (cfm)	Before	After	Positive	Negative
Before 5.0	40.02 cfm	04/15 sec	04/15 sec	04/15 sec	04/15 sec
After 5.20	40.02 cfm	04/15 sec	04/15 sec	04/15 sec	04/15 sec
		CO2	13.0	13.0	13.0
		O2	6.0	6.0	6.0
		CO	0	0	0
		N2	81.0	81.0	81.0

SYSTEM LEAK CHECK		PITOT LEAK CHECK		NEGATIVE	
Vacuum (in. Hg)	DGM Rate (cfm)	Before	After	Positive	Negative
Before 5.0	40.02 cfm	04/15 sec	04/15 sec	04/15 sec	04/15 sec
After 5.20	40.02 cfm	04/15 sec	04/15 sec	04/15 sec	04/15 sec
		CO2	13.0	13.0	13.0
		O2	6.0	6.0	6.0
		CO	0	0	0
		N2	81.0	81.0	81.0

SYSTEM LEAK CHECK		PITOT LEAK CHECK		NEGATIVE	
Vacuum (in. Hg)	DGM Rate (cfm)	Before	After	Positive	Negative
Before 5.0	40.02 cfm	04/15 sec	04/15 sec	04/15 sec	04/15 sec
After 5.20	40.02 cfm	04/15 sec	04/15 sec	04/15 sec	04/15 sec
		CO2	13.0	13.0	13.0
		O2	6.0	6.0	6.0
		CO	0	0	0
		N2	81.0	81.0	81.0

STACK SAMPLING DATA SHEET

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CLIENT BATTHELL - DOE - NILES TEST DATE 07-19-93 ORIFICE CORRECTION 1.572 HOT BOX NO. 6
 TEST UNIT SCR REACTOR OUTLET TEST NO. N-20-MUM-712 METER CORRECTION 1.0151 COLD BOX NO. 6
 PROJECT NO. 93CD 28-01 NOZZLE (SIZE, #) 0.441 G-37 CALIBRATION DATE 07-02-93 PROBE NO. 13-1
 CONTROL BOX OPERATOR K/C STATIC PRESSURE +17.0" H₂O PITOT CORRECTION 0.84 FILTER NO.
 BAROMETRIC PRESSURE 29.10 PORT DIRECTION Port 4, Port 3 CONTROL BOX NO. THREE STACK DIA. 36"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot & P (in. H ₂ O)	Orifice & H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
			.09	1.43	1.43	114	100	5.5	680	~280	468°	~300°	
			.09	1.43	1.43	114	100	5.5	680				
10.0			.03	.48	.48	114	101	3.0	649				
			.03	.48	.48	115	100	3.0	651				
			.03	.48	.48	115	103	6.5	680				
	13:51	824.488	.03	.48	.48	115	103	8.5	688				
											Changed Filter between ports		
11.0"	14:19	824.881	.04	.64	.64	100	100	1.0	685				
			.04	.64	.64	112	100	1.0	646				
			.04	.64	.64	113	100	1.0	640				
			.04	.64	.64	113	100	1.0	649				
90			.04	.64	.64	113	101	1.5	650				
			.04	.64	.64	113	101	1.5	654				
			.04	.64	.64	112	101	2.0	659				
			.04	.64	.64	113	101	2.5	656				
70			.04	.64	.64	112	102	3.5	655				Estimates:
			.04	.64	.64	112	102	3.5	661				MW= 28.3
			.04	.64	.64	112	102	5.5	654				%H ₂ O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	20.015 cfm
After	8.0	20.02 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

STACK SAMPLING DATA SHEET

Page 3 of 5

CLIENT CATTELL - NOE - NICK TEST DATE 07-19-93 ORIFICE CORRECTION 1.572 HOT BOX NO. 6
 TEST UNIT SCR, REACTOR, OUTLET TEST NO. N-20-MJM-7A METER CORRECTION 1.0151 COLD BOX NO. 6
 PROJECT NO. 93CD28-01 NOZZLE (SIZE, #) 0.441 G-37 CALIBRATION DATE 07-02-93 PROBE NO. 13-1
 CONTROL BOX OPERATOR RPC STATIC PRESSURE +12.0" H₂O PITOT CORRECTION 0.84 FILTER NO.
 BAROMETRIC PRESSURE 29.70 PORT DIRECTION PORT 3 PORT 2 CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
	15:19	852.454	.04	.64	.64	112	102	12.5	680	~250	268±10		Change filters at 15:19
50'	15:48	852.600	.04	.65	.65	107	101	1.0	655				
			.04	.65	.65	109	101	1.0	655				
			.04	.65	.65	112	100	1.0	655				
30'			.05	.81	.81	114	101	1.5	655				
			.04	.65	.65	115	102	1.5	654				
			.04	.65	.65	116	103	1.5	655				
			.04	.65	.65	116	103	1.5	651				
10"			.04	.65	.65	116	104	1.5	651				
			.04	.65	.65	117	105	3.5	640				
			.04	.65	.65	119	105	6.0	651				
16:48		881.496	.24	.65	.65	120	105	12.5	656				Change filters
110	18:40	982.475	.04	.65	.65	98	95	1.0	635				Estimates: 22.5
			.04	.65	.65	106	96	1.5	635				MW= 28.2
			.04	.65	.65	110	96	1.5	650				%H ₂ O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	20.02 cfm
After	13.0	20.01 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE
 ENVIRONMENTAL SERVICES, INC.

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STACK SAMPLING DATA SHEET

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CLIENT BATTELLE Dose NILES TEST DATE 07-19-93 ORIFICE CORRECTION 1.572 HOT BOX NO. 6
 TEST UNIT SCR Reactor OUTLET TEST NO. N-20-MUM-719 METER CORRECTION 1.0151 COLD BOX NO. 6
 PROJECT NO. 93C028-01 NOZZLE (SIZE, #) 6-3/4" G-37 CALIBRATION DATE 07-02-93 PROBE NO. 13-1
 CONTROL BOX OPERATOR ELC STATIC PRESSURE 0.41 17.0" H₂O PITOT CORRECTION 0.84 FILTER NO.
 BAROMETRIC PRESSURE 29.80 PORT DIRECTION PORT 2 CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
90			.04	.65	.65	111	99	1.5	656	~250	~68	~300	20 mm/PT
			.04	.65	.65	111	99	1.5	634				
			.04	.65	.65	111	99	1.5	635				
			.04	.65	.65	112	99	1.5	630				
70			.04	.65	.65	114	100	1.5	635				
			.04	.65	.68	115	101	1.5	632				
			.04	.65	.65	114	102	1.5	626				
			.04	.65	.65	115	102	2.0	629				
50			.04	.65	.65	116	102	2.0	625				
			.05	.81	.81	117	103	2.0	639				
			.05	.81	.81	117	103	2.0	639				
			.04	.65	.65	117	103	2.0	636				
30			.04	.65	.65	115	103	2.0	637				
			.04	.65	.65	116	103	2.0	636				
			.04	.65	.65	116	104	2.0	632				
			.04	.65	.65	116	103	2.0	637				Estimates:
10			.04	.65	.65	115	103	2.0	632				MW= 29.2
			.04	.65	.65	115	103	2.0	632				%H ₂ O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	10.026
After	5.0	10.015

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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[illegible]

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

	Positive	Negative
Before		
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

1.	2.	3.	4.	5.
1.				
2.				
3.				
4.				
5.

KEYSTONE
FOR BUSINESS & INDUSTRY

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE TEST DATE 7-19-93 (Mon.) ORIFICE CORRECTION (ΔH) 1.734 HOT/COLD BOX NO. 5
TEST UNIT SNOW TOWER OUTLET TEST NO. N-21-MUM-719 METER CORRECTION (Y) 0.9832 PROBE NO. 10-4
PROJECT NO. 93CB28-01 NOZZLE (SIZE, #) 0.197 #G18 CALIBRATION DATE 5-17-93 FILTER NO. #3
TEST CREW JTS, TM STATIC PRESSURE 0.8" H₂O PITOT CORRECTION 0.84 STACK DIA. 50" (depth) X
BAROMETRIC PRESSURE 29.10 PORT DIRECTION A CONTROL BOX NO. 5 PORT SIZE 99" (width)

Time	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
					Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
0	46.4	0:53	0.78 0.78	0.8	0.89	0.89	88	82	2.0	198	~250°F	~250°F	~250°F	18 min./point
			0.78, 962	0.8	0.89	0.89	102	90	2.0	198				
18	39.3	1:04		0.8	0.91	0.91	107	95	2.0	199				Readings every 9 min
				0.8	0.93	0.93	110	97	2.0	199				
36	32.1	1:39		0.9	1.05	1.05	112	100	2.0	199				
				0.9	1.05	1.05	113	101	2.0	199				
54	25.0	1:57		1.1	1.28	1.28	115	102	2.0	198				
				1.1	1.28	1.28	115	104	2.0	199				
72	17.9	1:15		1.1	1.28	1.28	116	103	3.0	199				
				1.1	1.28	1.28	116	105	3.0	199				
90	10.7	1:33		1.2	1.40	1.40	117	104	3.0	198				
				1.2	1.40	1.40	117	104	3.5	196				
108	3.6	1:51		1.2	1.40	1.40	116	104	3.5	196				
126		12:09	150.927	1.2	1.40	1.40	116	105	3.5	195				
														Estimates:
														MW=29.2
														%H ₂ O=8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	6.0	0.020
After	4.0	0.005

TIME = 126 min
VOLUME = 79.965 dcl
(AP)_{avg} = 1.0
(ΔH)_{avg} = 1.17

PITOT LEAK CHECK 15 SEC

	Positive	Negative
Before	OK	OK
After	OK	OK
OAS	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

(T_{meter})_{avg} = 106°F
T_{static} = 100°F

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	150ml H ₂ O / H ₂ O ₂	681.8	535.9	145.9
2.	150ml H ₂ O / H ₂ O ₂	691.2	559.0	132.2
3.	Empty	744.9	466.1	278.8
4.	100ml KMnO ₄	563.9	557.6	6.3
5.	100ml KMnO ₄	543.6	547.8	-4.2

6. 200g Silica gel 712.7 463.4 49.3
63.1 g/sec
velocity = 63.1 ft/sec
Actual = 0.07
608.3g/h

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

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CLIENT <i>Bottle / DOE</i>	TEST DATE <i>7-9-93 (Mon)</i>	ORIFICE CORRECTION (ΔH_0) <i>1.734</i>	HOT/COLD BOX NO. <i>5</i>
TEST UNIT <i>SNOW Tower Outlet</i>	TEST NO. <i>N-21-Mum-7A</i>	METER CORRECTION (Y) <i>0.9832</i>	PROBE NO. <i>10-4</i>
PROJECT NO. <i>93CB28-01</i>	NOZZLE (SIZE, #) <i>0.197 #618</i>	CALIBRATION DATE <i>5-17-93</i>	FILTER NO. <i>#3</i>
TEST CREW <i>IDS TM</i>	STATIC PRESSURE <i>0.8" H₂O</i>	PITOT CORRECTION <i>0.84</i>	STACK DIA. <i>50" (depth) X</i>
BAROMETRIC PRESSURE <i>29.10</i>	PORT DIRECTION <i>B</i>	CONTROL BOX NO. <i>5</i>	PORT SIZE <i>99" (depth)</i>

E Time	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
					Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
0	46.4	1222	151.113	0.8	0.93	0.93	107	103	2.5	196	~250°F	<68°F	~250°F	18 min./point
18	39.3	1240		1.1	1.28	1.28	115	103	3.5	196				Readings every 9 min
				1.1	1.30	1.30	115	104	3.5	196				
36	32.1	1258		1.1	1.30	1.30	117	104	3.5	196				
				1.1	1.29	1.29	117	106	4.0	196				
54	25.0	1276		1.0	1.17	1.17	118	106	4.0	197				
				1.0	1.17	1.17	118	107	3.5	198				
12	17.9	1294		1.0	1.17	1.17	120	107	3.5	198				
				1.0	1.17	1.17	119	108	3.5	198				
70	10.7	1312		0.6	0.70	0.70	118	108	3.0	198				
				0.6	0.70	0.70	116	107	3.0	197				
08	3.6	1410		0.5	0.59	0.59	116	107	2.5	197				
126		1428	225.920	0.5	0.59	0.59	116	107	2.5	197				
														Estimates:
														MW = 29.2
														%H ₂ O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After	4.0	0.005

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
GAS	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Temp. Avg = 111°F

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

velocity = 59.8 ft/sec
 TD = 96.9%

AQE 692

TIME = 126 min
 VOLUME = 74.807 dcf
 (AP) Avg = 0.9
 (All) = 1.07

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE TEST DATE 7-19-93 (Mon.) ORIFICE CORRECTION (ΔH) 0.134 HOT/COLD BOX NO. 5
 TEST UNIT SNOX Tower Orifices TEST NO. N-21-MUM-719 METER CORRECTION (Y) 0.9832 PROBE NO. 10-4
 PROJECT NO. 93C028-01 NOZZLE (SIZE, θ) 0.197 #98 CALIBRATION DATE 5-17-93 FILTER NO. #3
 TEST CREW JRS, JM STATIC PRESSURE 0.8 H₂O PITOT CORRECTION 0.84 STACK DIA. 50" (depth) x
 BAROMETRIC PRESSURE 29.10 PORT DIRECTION C CONTROL BOX NO. 5 PORT SIZE 92" (width)

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Time	Transverse Point (inches)	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
0	46.4	1438	226.011	1.0	1.17	110	107	4.0	196	~250°F	~68°F	~250°F	18 min./point
18	39.3	7456		1.0	1.17	115	105	5.0	196				Readings every 9 min.
30	32.1	1574		1.1	1.29	116	104	5.5	197				
54	25.0	532		1.3	1.53	118	106	7.0	198				
1	17.9	530		1.4	1.64	119	107	7.5	199				
0	10.7	160		1.4	1.64	119	108	8.0	199				
08	3.6	1626		1.4	1.65	120	109	8.0	200				
26		1644	315.320	0.9	1.06	119	110	9.0	201				
				0.9	1.06	118	109	9.5	201				
				0.9	1.06	119	110	7.5	201				
								7.5	201				
													Estimates:
													MW = 29.2
													SH2O = 8.5

SYSTEM LEAK CHECK

Vacuum (in. Hg)	DOIM Rate (cfm)
Before	
After	0.005

TIME = 126 min
 VOLUME = 89.309 dcl
 (AP)MS = 1.2
 1.1.1.1 - 1.1.1.7

PITOT LEAK CHECK

Before	After	Positive	Negative

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

(Under)MS = 112°F

Impinger Contents

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

velocity = 69.2 ft/sec
 ISO = 100.1 ft/min

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

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CLIENT *Bethlehem/DXE* TEST DATE *7-19-93 (Mon.)* ORIFICE CORRECTION (ΔH_{O2}) *1.734* HOT/COLD BOX NO. *5*
 TEST UNIT *SWOX Tower Orific* TEST NO. *11-21-MW-719* METER CORRECTION (V) *0.9832* PROBE NO. *10-4*
 PROJECT NO. *93C0228-01* NOZZLE (SIZE) *0.197* #*8/8* CALIBRATION DATE *5-17-93* FILTER NO. *#3*
 TEST CREW *SPS, TM* STATIC PRESSURE *0.8" H₂O* PITOT CORRECTION *0.34* STACK DIA. *50" (66pk) x*
 BAROMETRIC PRESSURE *29.10* PORT DIRECTION *D* CONTROL BOX NO. *5* PORT SIZE *99" (wick)*

Traverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Mean Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
0	46.4	1656	0.9	1.06	1.06	115	110	9.5	203	~250°F	~68°F	~250°F	18 min./point
18	39.3		0.9	1.06	1.06	118	109	6.5	203				Readings every 9 min.
36	32.1		0.9	1.06	1.06	117	110	11.0	203				
54	25.0		1.1	1.30	1.30	117	110	13.5	204				
72	17.9		1.1	1.30	1.30	115	110	12.5	204				
90	10.7		1.1	1.30	1.30	116	110	12.0	203				
108	3.6		1.1	1.30	1.30	116	110	11.0	203				
126			1.2	1.42	1.42	117	110	11.5	203				
			1.2	1.42	1.42	118	110	11.0	204				
			1.2	1.42	1.42	117	110	14.5	203				
			1.2	1.42	1.42	112	109	16.5	203				
			1.2	1.40	1.40	109	108	17.0	202				
			1.2	1.40	1.40	108	108	17.0	202				
													Estimates:
													MW = 29.2
													%H ₂ O = 8.5

PITOT LEAK CHECK

Before	Positive	Negative
After		

GAS	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	86.0	

SYSTEM LEAK CHECK

Before	Vacuum (in. Hg)	DDM Rate (cfm)
After	17.0	0.015

TIME = 126 min
 VOLUME = 84.515 scf
 (DP)_{AC} = 1.1
 at 1.2

Impinger Contents

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

velocity = 66.5 ft/sec
 J.S.O. = 99.1 %

AQE 672

PLANT Niles AMBIENT TEMPERATURE _____ METER ΔH_g 1.64
DATE 7-22-93 BAROMETRIC PRESSURE 29.20 C FACTOR 0.9
LOCATION 34 in #15 ASSUMED MOISTURE, % 8 PROCESS WEIGHT RATE _____
OPERATOR Webb/cap PROBE LENGTH, in. 96
STACK NO. _____ NOZZLE DIAMETER, in. 0.215
RUN NO. 4 MUM STACK DIAMETER, in. 80
SAMPLE BOX NO. _____ PROBE HEATER SETTING 250
METER BOX NO. X-40513 HEATER BOX SETTING 250

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE Wt
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL

[illegible]

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	H ₂
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS: Pre lock check .01 cfh at 20" Hg

#2

PARTICULATE FIELD DATA

PLANT Niles
 DATE 7-22-93
 LOCATION BSH IN #18
 OPERATOR Walt Cox
 STACK NO. _____
 RUN NO. 4 THUM
 SAMPLE BOX NO. _____
 METER BOX NO. X-40513

AMBIENT TEMPERATURE 75
 BAROMETRIC PRESSURE 29.20
 ASSUMED MOISTURE, % 8
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. 0.215
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 250

METER ΔH_p 1.64
 C FACTOR 0.9

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE Wt
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	Time	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), ft/min	% D ₂	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	#6	#7	#3	Flow	Probe	PUMP VACUUM in. Hg gauge	Lead
						ACTUAL DESIRED								
13	49		388	.95		1.38 1.38	699.2	112	109	246	#8	#2		
14	52		396	.85		1.1 1.1	703.6				248	255	10	53
15	60	11:20	392	.80		1.12 1.12	709.1	110	107	246	249	257	10 1/2	58
16	8		396	.80	3.3	1.12 1.12								
17	16		401	.75		1.05 1.05	720.6	108	109	249	252	258	11 1/2	63
18	24	11:53	402	.72		1.0 1.0	729.7							
19	32		403	.72	3.3	1.0 1.0	729.7	106	102	247	252	259	12	67
20	40		405	.67		.95 .95	734.2							
21	48													
22	56													
23	54													
24	32	12:43	408	.9	3.3	.55 .55	740.0	107	102	248	252	260	10	78
							752.405							
TOTAL	192 min													

AVERAGE 6.11 vertical
 4.09 horizontal

VOLUME OF LIQUID WATER COLLECTED	1
FINAL	
INITIAL	
LIQUID COLLECTED	
TOTAL VOLUME COLLECTED	

IMPINGER VOLUME ml	2	3	4	SILICA GEL WEIGHT, g

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

COMMENTS: Cross member has been a problem with last 3 pts on vertical traverse for all previous runs

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#13

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT NilesDATE 7-22-93LOCATION BH IN, #18OPERATOR Webb/CorSTACK NO. 4 MUMRUN NO. 4 MUMSAMPLE BOX NO. X-40513METER BOX NO. X-40513AMBIENT TEMPERATURE 84BAROMETRIC PRESSURE 29.15ASSUMED MOISTURE, % 8PROBE LENGTH, in. 96NOZZLE DIAMETER, in. 0.215STACK DIAMETER, in. 80PROBE HEATER SETTING 250HEATER BOX SETTING 250METER ΔH_0 1.64C FACTOR 0.9PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE Wt
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p) (V _s)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m), ft ³	# #7 GAS SAMPLE TEMPERATURE AT DRY GAS METER		#3 SAMPLE BOX TEMPERATURE °F	Plot Probe TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Leak in. VELO ft/min
				ACTUAL	DESIRED	INLET (T _{m in}), °F	OUTLET (T _{m out}), °F							
	0	14:50	250					752.54				#8 #2		
1	7	no flow indicated												
2	24	14:06	250	.3		.4 .4		752.54						
3	24		360	.5	3.1	.66 .66		758.9	103	101	241	251 254	3 1/2	52
4	32	14:22	366	.62		.82 .82								
5	40		367	.70		.94 .94		767.6						
6	48	14:38	367	.78		1.05 1.05		772.5	107	103	243	253 252	6	56
7	56		366	.52		1.1 1.1		776.7						
8	4	14:55	367	.84	3.0	1.1 1.1							6	
9	12		368	.89		1.12 1.12		786.8	109	104	243	252	6 1/2	59
10	20		370	.75		1.2 1.2		791.7						
11	28	15:08	374	.75		1.2 1.2		796.5	110	104	241	251 254	8	62
12	36		380	1.1		1.4 1.4		792.1						
TOTAL	96 MIN													
AVERAGE														

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	1	2	3	4	SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
FINAL							1				
INITIAL							2				
LIQUID COLLECTED							3				
TOTAL VOLUME COLLECTED							4				

COMMENTS:
 • 1.1 lb. change and empty
 Condensate #1 imp
 • Leak check at 12:04g 2.02cfm

#1

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT Alcoa
 DATE 11-22-95
 LOCATION BSH 1st 218
 OPERATOR V1064/cox
 STACK NO. _____
 RUN NO. 4 MUM
 SAMPLE BOX NO. _____
 METER BOX NO. X-40513

AMBIENT TEMPERATURE 54
 BAROMETRIC PRESSURE 29.15
 ASSUMED MOISTURE, % 8
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. .25
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 75"
 HEATER BOX SETTING 250

METER ΔH_2 1.64
 C FACTOR 0.9

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	Time STACK PRESSURE (in. H ₂ O)	#4 STACK TEMPERATURE (T _s), °F	1% CO ₂ VELOCITY HEAD (V _p), (V _s)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O ACTUAL DESIRED		GAS SAMPLE VOLUME (V _m), ft ³	#6 #11 GAS SAMPLE TEMPERATURE AT DRY GAS METER		#13 SAMPLE BOX TEMPERATURE °F	#1 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F		PUMP VACUUM in. Hg gauge	1st Imp. VELOCITY ft/s
									INLET (T _{m(in)}), °F	OUTLET (T _{m(out)}), °F					
13	40	15:33	401	.05	3.1	1.2	1.2	808.1	112	105	242	#8 252	#2 255	9	67
14	52		409	.92		1.1	1.1	813.1							
15	60		416	.85		1.0	1.0	817.2	111	105	242	248	252		71
16	8			.85		1.0	1.0	821.0							
17	16		421	.87	3.0	.98	.98	827.1	110	107	242	253	257	10 1/2	67
18	24		422	.80		.93	.93	833.1							
19	32		425	.80		.93	.97								
20	40		421	.78		1.05	1.05	841.9	110	107	243	253	258	10	70
21	48		430	.72		.84	.84	846.2							
22	56		437	.70		.82	.82								
23	1		435	.65		.76	.76	856.2	109	104	244	253	262	11	74
24	12		434	.57	3.2	.80	.80	863.124	2700						
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
FINAL	1	2	3	4	5			
INITIAL								
LIQUID COLLECTED								
TOTAL VOLUME COLLECTED								

COMMENTS: ~~test check at 12" = .01 cfm~~
 Post leak check at 12" = .01 cfm
 with flow line
 including S/S at 7" = .01 cfm

D-78

NOMOGRAPH DATA

PLANT Niles, Ohio GNOX processDATE 7/22/93SAMPLING LOCATION outlet of bag house

N-19-MUM-722

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH_e	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m\text{ avg.}}$	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{w0}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.20
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073 \times \text{STACK GAUGE PRESSURE in in. H}_2\text{O}$)	P_s	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.0
AVERAGE STACK TEMPERATURE, °F	$T_{s\text{ avg.}}$	380
AVERAGE VELOCITY HEAD, in. H ₂ O	$\Delta p_{\text{ avg.}}$	0.65
MAXIMUM VELOCITY HEAD, in. H ₂ O	$\Delta p_{\text{ max.}}$	1.00
C FACTOR		0.90
CALCULATED NOZZLE DIAMETER, in.		0.260
ACTUAL NOZZLE DIAMETER, in.		0.247
REFERENCE Δp , in. H ₂ O		0.85

EPA (Dut) 234
4/72

#1

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE YIELD DATA

PLANT Niles Ohio NOx process AMBIENT TEMPERATURE 800
 DATE 7/22/93 BAROMETRIC PRESSURE 29.20
 LOCATION outlet of baghouse ASSUMED MOISTURE, % 7
 OPERATOR Donald, Kupp PROBE LENGTH, in. 9 ft. glass
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MUM-722 STACK DIAMETER, in. 8 ft.
 SAMPLE BOX NO. _____ PROBE HEATER SETTING 250°F
 METER BOX NO. X-40513 HEATER BOX SETTING 250°F

METER A.H. 1.65
 C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WAS
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TOP TRAVERSE POINT NUMBER	SAMPLING TIME (h), min	probe Temp. OF STATIC PRESSURE (in. H ₂ O)	① STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE (T _{box}), °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F ⑥	PUMP VACUUM in. Hg gauge	O ₂ % VELOCITY fps	
					ACTUAL	DESIRED		⑥ INLET (T _m), °F	⑦ OUTLET (T _m), °F					
1	0/9:09			0.43	0.91	0.91	323.468							
2	10/9:17	230	339	0.48	1.00	1.00	328.9	79	74	260	53	5.2	3.4	
3	20/9:27	252	376	0.40	0.99	0.99	334.8	83	77	261	53	5.2	3.5	
4	30/9:37	258	382	0.47	0.99	0.99	340.0	86	80	262	54	5.3	3.7	
5	40/9:47	256	383	0.48	1.0	1.0	345.7	89	82	262	55	5.35	3.7	
6	50/9:57	248	383	0.65	1.40	1.40		92	86	244	262	56	6.0	3.5
7	60/10:07	259	382	0.70	1.50	1.50	357.5	93	86	252	261	55	6.2	4.1
8	70/10:17	261	384	0.58	1.25	1.25	364.6	95	80	260	261	54	6.1	3.6
9	80/10:27	258	384	0.57	1.20	1.20	371.2	97	91	262	262	58	6.25	3.6
10	90/10:37	260	383	0.6	1.29	1.29	377.8	99	93	264	262	58	6.5	3.6
11	100/10:47	260	384	0.62	1.3	1.3	384.35	100	94	265.6	261	58	6.6	3.8
12	110/10:57	259	382	0.65	1.4	1.4	391.4	98	92	253.0	258	52	6.9	3.75
13	120/11:07	285	383	0.65	1.4	1.4	398.2	94	90	224.0	258	51	6.9	3.5
14	130/11:17	357	383	0.91	1.90	1.90	404.6	94	90	228	259	54	7.5	4.1
15	140/11:27	403	383	0.96	2.00	2.00		98	92	246	261	57	7.0	4.0
TOTAL														
AVERAGE														

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO	O	CO	N ₂
	1	2	3	4							
FINAL											
INITIAL											
LIQUID COLLECTED											
TOTAL VOLUME COLLECTED											

COMMENTS

heated line = 256

#2

PARTICULATE FIELD DATA

CROSS SECTION

PLANT Niles, Ohio, SNOCARC AMBIENT TEMPERATURE 79
 DATE 7/22/93 BAROMETRIC PRESSURE 29.20
 LOCATION outlet of baghouse ASSUMED MOISTURE, % 7
 OPERATOR Leonard, Kupp PROBE LENGTH, in. 90. glass
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MUM-722 STACK DIAMETER, in. RFC
 SAMPLE BOX NO. #1 PROBE HEATER SETTING 390°F
 METER BOX NO. 5-40513 HEATER BOX SETTING 250°F

METER ΔH , 1.65
 C FACTOR 0.90
 PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	probe temp OF STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s),	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ %
					ACTUAL	DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F	PROBE	OUTLET			
16	150/11:37	404	383	0.85	1.80	1.80	420.7	100	94	256	262	58	2.6	3.6
17	160/11:47	404	385	0.83	1.75	1.75	428.0	95	91	255	260	59	2.5	3.5
18	170/11:57	404	383	0.66	1.40	1.40	436.0	96	92	259	261	60	6.8	3.5
19	180/12:07	403	382	0.60	1.30	1.30	442.7	95	91	248	260	58	6.5	3.7
20	190/12:17	404	384	0.43	0.92	0.92	449.4	99	94	255	262	58	5.5	3.9
21	200/12:27	403	382	0.37	0.78	0.78	455.1	99	94	248	262	61	5.1	3.7
22	210/12:37	404	383	0.51	1.10	1.10	460.3	100	96	246	261	63	5.9	4.2
23	220/12:47	403	382	0.31	0.66	0.66	466.1	100	96	250	260	61	5.0	3.9
24	230/12:57	403	382	0.30	0.64	0.64	471.0	100	96	235	261	59	5.0	3.9
	240/12:07 off						475.659							
SIDE														
1	240/14:00 on			0.21	0.45	0.45	475.659	91	91	237	260	67	4.5	4.2
2	250/14:10	268		0.34	0.72	0.72	479.8	94	93	200	261	64	5.0	3.7
3	260/14:20	321	375	0.36	0.77	0.77	484.7	98	94	281	259	63	5.2	4.7
4	270/14:30	289	376	0.57	1.20	1.20	489.9	97	93	242	258	63	5.2	4.0
TOTAL														
AVERAGE														

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
	1	2	3	4							
FINAL											
INITIAL											
LIQUID COLLECTED											
TOTAL VOLUME COLLECTED											

COMMENTS

D-81

#3

(1290046)

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Niles Ohio SNA process

AMBIENT TEMPERATURE _____

DATE 7/22/93BAROMETRIC PRESSURE 29.20LOCATION outlet of baghouseASSUMED MOISTURE, % 7OPERATOR Lemard, KuppPROBE LENGTH, in. 9 ft. glass

STACK NO. _____

NOZZLE DIAMETER, in. 0.247RUN NO. N-19-MUM-722STACK DIAMETER, in. 8 ft.SAMPLE BOX NO. #1PROBE HEATER SETTING 390°FMETER BOX NO. X-40513HEATER BOX SETTING 250°FMETER A.H. 1.65C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WAS
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	probe temp OF STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s), ft/min	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER	INLET (T _{m in}), °F	OUTLET (T _{m out}), °F	SAMPLE BOX TEMPERATURE (T _{box}), °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Or % VELOCITY
5	290/14:40	307	383	0.50	1.10	1.10	495.3	99	95	265	260	60	6.0	4.2
6	290/14:50	300	384	0.55	1.20	1.20	501.0	100	95	261	259	59	6.1	4.3
7	300/15:00	302	385	0.56	1.20	1.20	507.1	101	96	264	259	63	6.1	4.1
8	310/15:10	303	384	0.55	1.20	1.20	513.6	101	97	268	258	65	6.2	4.2
9	320/15:20	302	385	0.53	1.15	1.15	519.6	102	98	262	260	59	6.2	4.2
10	330/15:30	302	385	0.57	1.20	1.20	526.6	103	99	261	260	58	6.2	4.0
11	340/15:40	296	384	0.59	1.25	1.25	532.7	101	98	268	258	58	6.2	4.2
12	360/15:50	282	385	0.73	1.60	1.60	539.1	103	99	273	259	60	6.2	3.9
13	360/16:00	307	386	0.80	1.70	1.70	545.5	107	102	282	261	61	7.0	4.1
14	370/16:10	362	386	0.80	1.70	1.70	552.7	109	102	241	262	56	7.2	4.1
15	380/16:20	381	386	0.80	1.70	1.70	560.3	110	104	221	262	54	7.5	4.2
16	390/16:30	397	385	0.76	1.65	1.65	56	111	105	243	262	54	7.5	4.4
17	400/16:40	403	385	0.72	1.60	1.60	575.5	111	105	247	262	58	7.5	4.2
18	410/16:50	402	385	0.75	1.60	1.60	582.9	112	106	250	262	60	7.5	4.5
19	420/17:00	400	384	0.77	1.70	1.70	590.3	110	105	253	260	60	7.7	4.3
TOTAL														
AVERAGE														

VOLUME OF LIQUID WATER COLLECTED

IMPINGER VOLUME ml

SILICA GEL WEIGHT, g

	1	2	3	4	5
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

COMMENTS

#4

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Niles Olef SNOX process AMBIENT TEMPERATURE _____
 DATE 7/22/93 BAROMETRIC PRESSURE 29.20
 LOCATION outlet of baghouse ASSUMED MOISTURE, % 7
 OPERATOR Lemard, Kapp PROBE LENGTH, in. 90.0 plus
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MUM-722 STACK DIAMETER, in. 28.0
 SAMPLE BOX NO. 1 PROBE HEATER SETTING 390°F
 METER BOX NO. 440513 HEATER BOX SETTING 250°F

METER NH, 6.65C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WAS
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (h), min	probe temp of static pressure (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (ΔP _s), (ΔP _s), in. H ₂ O	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), (l)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ %
					ACTUAL	DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F	OUTLET (T _{m out}), °F	INLET (T _{m in}), °F			
20	430/17:10	401	384	0.57	1.2	1.2	598.0	112	107	255	262	63	7.0	4.2
21	440/17:20	400	385	0.58	1.25	1.25	604.6	113	107	254	263	66	7.0	4.2
22	450/17:30	401	384	0.60	1.25	1.25	611.3	112	108	254	264	68	7.0	4.0
23	460/17:40	401	382	0.54	1.15	1.15	617.9	111	107	256	263	69	6.8	4.0
24	470/17:50	401	383	0.52	1.10	1.10	624.8	110	106	262	262	66	6.5	4.5
	480/18:00	off					630.693							
TOTAL														

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
	1	2	3	4							
FINAL											
INITIAL											
LIQUID COLLECTED											
TOTAL VOLUME COLLECTED											

leak check 0.028 at 8.5" Hg

COMMENTS

STACK SAMPLING DATA SHEET

Page 1 of 6

CLIENT Battelle / DOE

TEST UNIT SCR Reactor Outlet

PROJECT NO. 95C-028-01

CONTROL BOX OPERATOR RPL

BAROMETRIC PRESSURE 29.38

TEST DATE 7-22-93 (Thurs)

TEST NO. N-20-MUM-722

NOZZLE (SIZE, #) 0.445

STATIC PRESSURE 17.01 H₂O

PORT DIRECTION Port

ORIFICE CORRECTION 1.572

METER CORRECTION 1.0151

CALIBRATION DATE 07-01-93

PITOT CORRECTION 0.84

CONTROL BOX NO. THREE

HOT BOX NO. 6

COLD BOX NO. 6

PROBE NO. 13-A

FILTER NO. Unchanged

STACK DIA. Unchanged

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pilot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
110"	07:08	181.490	.04	.64	.64	80	80	1.0	641	~250°F	468°F	~300°F	20 m/s
			.04	.64	.64	98	82	1.0	630				
			.04	.64	.64	97	85	1.0	630				
			.04	.64	.64	101	86	1.0	629				
90"			.10	1.61	1.61	104	81	1.5	629				
			.10	1.61	1.61	111	73	1.5	630				
			.04	.64	.64	111	94	1.5	631				
70"			.04	.64	.64	114	96	1.0	632				
			.04	.64	.64	112	96	1.0	632				
			.06	.96	.96	112	96	1.0	633				
			.06	.96	.96	113	79	1.5	635				
50"			.03	.48	.48	112	79	1.5	635				
			.03	.48	.48	112	79	1.0	633				
			.03	.48	.48	111	79	1.0	633				
			.03	.48	.48	111	79	1.0	638				
30"			.03	.48	.48	111	79	1.0	635				
			.03	.48	.48	110	79	1.0	634				
			.03	.48	.48	111	79	1.0	635				

Estimates:

MW = 29.2

%H₂O = 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	2.0156
After	18.0	2.0200

PITOT LEAK CHECK

	Positive	Negative
Before	115 sec	115 sec
After		

	1	2
CO ₂	14.0	14.0
O ₂	6.0	6.0
CO	0	0
N ₂	80.0	80.0

Impinger

No.	Empty Contents	Final	Initial	Difference
1.	150 mL H ₂ O	746.2	432.6	313.6
2.	150 mL H ₂ O	834.1	609.6	224.5
3.	150 mL H ₂ O	672.1	633.3	38.8
4.	Empty	465.6	462.3	3.3
5.	100 mL KMnO ₄	558.8	558.8	0.0
6.	100 mL KMnO ₄	496.7	498.5	-1.8
7.	200 mL Silver	100.4	61.8	38.6

629.2 total

Actual Moisture = 8.9

50.8 IF

0.00	0.00	0.00	0.00	0.00	0.00
7.6	4	3	2	1	

AQE 2/92

D-84

STACK SAMPLING DATA SHEET

Page 2 of 6

CLIENT BATELUM 1005 TEST DATE 07-22-93 (TUES) ORIFICE CORRECTION 1.573 HOT BOX NO. 6
 TEST UNIT 3cc. Remote unit TEST NO. N-20-mum-723 METER CORRECTION 1.0157 COLD BOX NO. 6
 PROJECT NO. 93c029-01 NOZZLE (SIZE, IN) 0.440 CALIBRATION DATE 07-02-93 PROBE NO. 13-2
 CONTROL BOX OPERATOR RFC STATIC PRESSURE 12.9" H2O PITOT CORRECTION 0.84 FILTER NO. unlabeled
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION Port 2, 3 CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
			-03	.48	.49	112	106	1.0	645	~280	468	~300	
			.05	.80	.80	111	100	1.0	630				
10"			.05	.80	.80	113	100	1.0	630				
			-05	.80	.80	113	100	1.0	635				
			.05	.80	.80	113	100	1.0	635				
	11:08	243.975	.05	.10	.90	113	100	1.0	611				
110"	11:18	243.975	.06	.96	.96	95	99	1.0	642				
			.06	.96	.96	110	89	1.0	646				
			.07	1.12	1.12	110	90	2.0	641				
			-10	1.61	1.61	115	95	4.0	640				
90			-10	1.61	1.61	116	99	4.5	647				
			10	1.61	1.61	116	99	4.5	653				
			-10	1.61	1.61	116	100	4.5	655				
			-10	1.61	1.61	116	99	4.5	659				
70			-10	1.61	1.61	116	100	5.5	653				Estimates:
			-10	1.61	1.61	116	100	6.0	651				MW= 29.2
			-09	1.45	1.45	116	100	6.5	655				%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	80.0	

Impinger No. Impinger Contents

	Final	Initial	Difference
1.			
2.			
3.			
4.			
5.			

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STACK SAMPLING DATA SHEET

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CLIENT BATTALIA / DOE

TEST DATE 07-22-93

ORIFICE CORRECTION 1.572

HOT BOX NO. 6

TEST UNIT SR Reactor OUTLET

TEST NO. 11-20-MUM-722

METER CORRECTION 1.0151

COLD BOX NO. 6

PROJECT NO. 93C028-01

NOZZLE (SIZE) 0.440"

CALIBRATION DATE 07-02-93

PROBE NO. 13-2

CONTROL BOX OPERATOR RPC

STATIC PRESSURE 17.0" H₂O

PITOT CORRECTION 0.84

FILTER NO. 12645 102

BAROMETRIC PRESSURE 29.39

PORT DIRECTION Ret 3.4

CONTROL BOX NO. THREE

STACK DIA. 12.625" ID

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pilot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
50			.09	1.45	1.45	117	100	6.5	655	~250	~108	~300	20 ml / 14
			.10	1.61	1.61	117	100	6.5	656				
			.10	1.61	1.61	116	100	7.0	657				
			.10	1.61	1.61	117	102	7.0	659				
			.10	1.61	1.61	117	103	8.0	656				
30			.10	1.61	1.61	118	103	10.5	659				
			.10	1.61	1.61	115	100	15.0	654				
			.10	1.61	1.61	114	100	15.0	654				
			.11	1.77	1.77	109	99	18.0	659				
			.11	1.77	1.77	109	89	18.0	630				
10			.10	1.61	1.61	110	89	16.5	629				
			.095	1.53	1.53	108	98	15.0	629				
	13:18	328.128	.16	1.61	1.61	110	98	15.0	630				Changed 2.14
													at 13:18
110"	13:31	328.750	.12	1.93	1.93	98	98	2.0	660				Estimates:
			.15	2.41	2.41	117	99	3.0	668				MW= 2/2
			.15	2.41	2.41	118	99	3.0	668				%H ₂ O= 9
			.15	2.41	2.41	120	101	3.0	666				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	<0.01 cfm
After	5.5	<0.01 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	14.0	
O ₂	6.0	
CO	0	
N ₂	80.0	

Impinger No.

Impinger Contents

	Final	Initial	Difference
1.			
2.			
3.			
4.			
5.			

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KEYSTONE
Environmental Research, Inc.

STACK SAMPLING DATA SHEET

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CLIENT BATFEL DOE

TEST DATE 07-22-93

ORIFICE CORRECTION 1.572

HOT BOX NO. 6

TEST UNIT SOR REACTOR OUTLET

TEST NO. N-20-MUM-722

METER CORRECTION 1.0151

COLD BOX NO. 6

PROJECT NO. 93028-01

NOZZLE (SIZE, IN) 0.440

CALIBRATION DATE 07-02-93

PROBE NO. 13-2

CONTROL BOX OPERATOR RPC

STATIC PRESSURE 17.0" H2O

PITOT CORRECTION 0.81

FILTER NO. Unweighed

BAROMETRIC PRESSURE 29.38

PORT DIRECTION Port 4

CONTROL BOX NO. Three

STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H2O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
90'			.07	1.12	1.12	121	101	1.5	675	~210	41.0C / 106F	~300F	20 min / 105
			.10	1.61	1.61	118	101	2.15	679				
			.10	1.61	1.01	116	101	2.5	682				
			.06	.96	.96	117	102	1.5	679				
70'			.08	1.28	1.28	118	102	2.0	680				
			.15	2.41	2.41	120	103	3.0	681				
			.15	2.41	2.41	123	103	3.0	681				
			.10	1.61	1.61	121	104	2.5	681				
50'			.09	1.45	1.45	121	104	3.0	681				
			.07	1.12	1.12	121	104	2.0	682				
			.07	1.12	1.12	118	105	1.5	682				
30'			.07	1.12	1.12	118	104	1.0	683				
			.13	2.09	2.09	118	105	3.5	687				
			.13	2.09	2.09	123	105	3.5	687				
			.13	2.09	2.09	124	105	3.5	687				
10'			.15	2.41	2.41	124	105	4.0	687				Estimates:
			.15	2.41	2.41	126	106	4.0	685				MW= 29.2
			.06	.96	.96	124	106	1.5	685				%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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STACK SAMPLING DATA SHEET

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CLIENT BATTERSEA / DOE

TEST DATE 07-22-93

ORIFICE CORRECTION 1.572

HOT BOX NO. 6

TEST UNIT See Permit Outlet

TEST NO. N-20-MUM-722

METER CORRECTION 1.0151

COLD BOX NO. 6

PROJECT NO. 93C628-01

NOZZLE (SIZE, #) 0.440

CALIBRATION DATE 07-02-93

PROBE NO. 13-2

CONTROL BOX OPERATOR RPC

STATIC PRESSURE 17.0" H₂O

PITOT CORRECTION 0.84

FILTER NO. W-1000

BAROMETRIC PRESSURE 29.38

PORT DIRECTION Port 4, 6

CONTROL BOX NO. THREE

STACK DIA. 12"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pilot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
			.07	1.12	1.12	121	106	2.0	685	~280°	~68°	~300°	see inlet
	15:31	418.980	.07	1.12	1.12	121	106	2.0	680				
110	15:46	418.980	.04	.64	.64	107	106	1.0	681				
			.06	.96	.96	113	104	1.0	691				
			.07	1.12	1.12	117	104	1.0	690				
90			.07	1.12	1.12	118	104	1.0	691				
			.13	2.09	2.09	120	104	2.0	694				
			.12	1.93	1.93	121	104	2.5	697				
			.12	1.93	1.93	121	103	2.5	697				
70			.12	1.93	1.93	121	103	2.5	698				
			.13	2.09	2.09	122	104	3.0	699				
			.12	1.93	1.93	122	104	2.0	700				
			.06	.96	.96	122	104	1.0	700				
50			.06	.96	.96	123	104	1.0	699				
			.08	1.28	1.28	117	103	1.5	700				
			.12	1.93	1.93	117	103	3.0	701				
			.11	1.77	1.77	122	103	2.5	701				
			.10	1.61	1.61	120	104	2.0	701				

Estimates:

MW= 28.2

%H₂O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	14.0	
O ₂	6.0	
CO	0	
N ₂	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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KEYSTONE
ENVIRONMENTAL DESIGN, INC.

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STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE TEST DATE 07-22-93 ORIFICE CORRECTION 1.572 HOT BOX NO. 4
 TEST UNIT SCR Reactor outlet TEST NO. N-20-MW-728 METER CORRECTION 1.0157 COLD BOX NO. 6
 PROJECT NO. 93 CP 28-41 NOZZLE (SIZE, #) 0440 CALIBRATION DATE 07-02-93 PROBE NO. 13-2
 CONTROL BOX OPERATOR RAC STATIC PRESSURE 17.0" H₂O PITOT CORRECTION 0.84 FILTER NO. UNUSABLE
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION PORT 86 CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
30			.10	1.61	1.61	122	104	2.0	701	~250	468°F	~300°F	20 mL/PT
			.10	1.61	1.61	123	104	2.0	700				
			.12	1.93	1.93	120	104	2.0	701				
			.12	1.93	1.93	121	103	2.5	701				
10"			.13	2.09	2.09	121	104	3.5	701				
			.13	2.09	2.09	122	104	3.5	699				
	17:46	508.356	.15	2.41	2.41	122	104	3.5	700				
$\Delta = 86$ $= 480$ min				$\Delta H_{avg} = 1.42$		$(T_{meter})_{avg} = 108^{\circ}F$		$(T_{stack})_{avg} = 664^{\circ}F$		velocity = 23.5 ft/sec			
$\Delta = 326.24$ dcl				$(AP)_{avg} = 0.085$						ISO. = 97.1%			Estimates:
													MW = 29.2
													%H ₂ O = 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	14.0	
O ₂	6.0	
CO	0	
N ₂	80.0	

Impinger

Impinger No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

STACK SAMPLING DATA SHEET

Page 1 of 4

CLIENT *Battelle DOE* TEST DATE *7-22-93 (7/25)* ORIFICE CORRECTION *1.734* HOT BOX NO. *5*
 TEST UNIT *SV01 Tave 0781* TEST NO. *N-21-MUM-722* METER CORRECTION *0.9832* COLD BOX NO. *5*
 PROJECT NO. *93028-01* NOZZLE (SIZE) *0.197* CALIBRATION DATE *5-7-93* PROBE NO. *10-4*
 CONTROL BOX OPERATOR *173* STATIC PRESSURE *0.8" H₂O* PITOT CORRECTION *0.81* FILTER NO. *5*
 BAROMETRIC PRESSURE *29.38* PORT DIRECTION *A* CONTROL BOX NO. *5* STACK DIA. *50" (depth) x*

Traverse Point (inches)	Time	Dry Gas Meter Reading (cfm)	Pitot a P (in. H ₂ O)	Orifice a H Req'd (in. H ₂ O)	Orifice a H Act. (in. H ₂ O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	0906	676.724	0.7	0.80	0.80	94	92	2.0	203	~250°F	48°F	~250°F	18 min/point
39.3	0924		0.7	0.80	0.80	101	95	1.5	200				Recheck every 9 min
32.1	0942		0.7	0.81	0.81	110	98	1.5	200				
25.0	1000		0.8	0.93	0.93	115	102	1.5	198				
17.9	1018		0.8	0.93	0.93	117	105	1.5	197				
10.7	1036		1.0	1.17	1.17	119	106	1.5	197				
3.6	1112	750.410	1.0	1.17	1.17	118	106	1.5	200				
			1.0	1.17	1.17	118	106	1.5	199				
			1.0	1.17	1.17	118	106	1.5	197				
			1.0	1.17	1.17	119	106	1.5	201				
			0.7	0.82	0.82	118	106	1.0	203				Velocity = 56.3 ft/sec
			0.7	0.82	0.82	117	106	1.0	203				Estimate: MW = 27.2 %H ₂ O = 8.5

Impinger No.	Impinger Contents	Final	Initial	Difference
1. 100 ml Water	Water	693.0	452.9	240.1
2. 150 ml H ₂ O	H ₂ O	688.0	540.4	147.6
3. 150 ml H ₂ O	H ₂ O	584.0	562.4	21.6
4. Empty		471.5	466.1	5.4
5. 100 ml H ₂ O	H ₂ O	554.7	558.1	-3.4

Actual Moisture = 8.17%

PITOT LEAK CHECK 1530c	
Before	After
Positive OK	Negative OK

PITOT LEAK CHECK 1530c	
Before	After
CO ₂ 13.0	O ₂ 6.0
CO 0	N ₂ 81.0

SYSTEM LEAK CHECK	
Vacuum (in. Hg)	DCM Rate (cfm)
Before 5.0	0.010
After 5.0	0.010

MOISTURE = 8.1%
 ACTUAL
 KEYSTONE
 45.99
 7-22-93
 678.3
 721.2
 42.9

STACK SAMPLING DATA SHEET

Page 2 of 4

CLIENT Battelle DOE TEST DATE 7-22-93 (Thurs.) ORIFICE CORRECTION 1.734 HOT BOX NO. 5
 TEST UNIT SNOW Trench Outlet TEST NO. N-21-MUM-722 METER CORRECTION 0.9832 COLD BOX NO.
 PROJECT NO. 93C028-0 NOZZLE (SIZE, #) 0.17 G18 CALIBRATION DATE 5-17-93 PROBE NO. 10-4
 CONTROL BOX OPERATOR JTB STATIC PRESSURE 0.8" H₂O PITOT CORRECTION 0.84 FILTER NO.
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION B CONTROL BOX NO. 5 STACK DIA. 50" (depth) x

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
46.4	1120	750.560	0.8	0.93	0.93	108	104	1.0	199	~250°F	<68°F	250°F	18 min/point
			0.9	1.04	1.04	114	103	1.0	202				
39.3	1130		0.9	1.05	1.05	116	104	1.0	202				Reading every 9 minutes
			0.7	0.82	0.82	115	103	1.0	197				
32.1	1132		0.9	1.05	1.05	115	103	1.0	193				
			0.9	1.05	1.05	117	104	1.5	196				
25.0	1144		0.9	1.06	1.06	116	104	1.5	195				
			0.9	1.06	1.06	118	105	1.5	195				
17.9	1232		0.7	0.83	0.83	118	106	1.0	196				
			0.9	1.06	1.06	119	106	1.5	196				
10.7	1250		0.6	0.71	0.71	119	107	1.0	196				
			0.6	0.71	0.71	119	107	1.0	196				
3.6	1308		0.4	0.47	0.47	118	108	1.0	198				
12.6	1326	819.881	0.4	0.47	0.47	117	107	1.0	199				
Estimates: A=126 min Δ=69.321 dcf ΔP _{avg} = (ΔH) _{avg} =0.88 (T _{stack}) _{avg} =111°F (T _{stack}) _{avg} =197°F velocity = 52.5 ft/sec IPD = 102.15%													

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After	5.0	0.015

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	13.0	
O ₂	60	
CO	0	
N ₂	81.0	

Impinger No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

STACK SAMPLING DATA SHEET

Page 3 of 4

CLIENT Bethelle / DOE TEST DATE 7-22-93 (TUES.) ORIFICE CORRECTION 1.734 HOT BOX NO. 5
 TEST UNIT SNOW TOWER OUTLET TEST NO. N-21-MUM-722 METER CORRECTION 0.9832 COLD BOX NO.
 PROJECT NO. 93C-28-01 NOZZLE (SIZE, IN) 0.197 G18 CALIBRATION DATE 5-17-93 PROBE NO. 10-4
 CONTROL BOX OPERATOR JPS STATIC PRESSURE 0.8" H₂O PITOT CORRECTION 0.84 FILTER NO.
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION C CONTROL BOX NO. 5 STACK DIA. 50" (depth) x 99"

Traverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
46.4	1334	820.075	0.4	0.47	0.47	110	107	1.0	199	~250°F	468°F	-250°F	18 min/port
			0.5	0.59	0.59	114	106	1.0	198				
39.3	1352		0.5	0.59	0.59	115	105	1.0	198				Readings every 9 minutes
			0.5	0.59	0.59	116	105	1.0	199				
32.1	1410		0.5	0.59	0.59	116	106	1.0	199				
			0.5	0.59	0.59	117	107	1.0	200				
25.0	1428		0.5	0.59	0.59	118	107	1.0	200				
			0.5	0.59	0.59	117	108	1.0	201				
17.9	1446		0.5	0.59	0.59	118	107	1.0	200				
			0.5	0.59	0.59	118	108	1.0	199				
10.7	1504		0.5	0.59	0.59	118	107	1.0	199				
			0.5	0.59	0.59	118	107	1.0	200				
3.6	1522		0.3	0.35	0.35	117	108	1.0	200				
	1540	874.000	0.3	0.35	0.35	116	107	1.0	199				
													Estimates:
		Δ=126 min drift	Δ=53.925	(ΔP) _{avg} = 0.58	(ΔH) _{avg} = 0.58	(T _{in}) _{avg} = 112°F	(T _{out}) _{avg} = 199°F						MW = 29.2
						Velocity = 44.5 ft/sec							%H ₂ O = 8.5%

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After	5.0	0.010

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Impinger

No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE
ANALYTICAL SERVICES, INC.

D-92

STACK SAMPLING DATA SHEET

STACK SAMPLING		Hot Box	Comments
CLIENT <i>Battelle / DOE</i>	TEST DATE <i>7-22-93 (Thurs.)</i>	ORIFICE CORRECTION <i>1.334</i>	HOT BOX NO. <i>5</i>
EST UNIT <i>5N0X Tower Unit</i>	TEST NO. <i>N-21-MCM-722</i>	METER CORRECTION <i>0.7832</i>	COLD BOX NO.
NOZZLE (SIZE, #) <i>0.197 GIB</i>	CALIBRATION DATE <i>5-17-93</i>	PITOT CORRECTION <i>0.84</i>	PROBE NO. <i>10-4</i>
PROJECT NO. <i>93C-423-81</i>	STATIC PRESSURE <i>0.8" H₂O</i>	CONTROL BOX NO. <i>5</i>	FILTER NO.
CONTROL BOX OPERATOR <i>JTB</i>	PORT DIRECTION <i>D</i>		STACK DIA. <i>50" (dipk) x 99"</i>
DATE RECEIVED <i>7-29-93</i>			

[illegible]

PITOT LEAK CHECK		Positive	Negative
Before			
After			

CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

SYSTEM LEAK CHECK		
	Vacuum (in. Hg)	DGM Rate (c/m)
Before		
After	5.0	0.010

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

#1

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

N-19-MUM-724

PLANT Niles AMBIENT TEMPERATURE 77 METER ΔH_g 1.66
 DATE 7-24-93 BAROMETRIC PRESSURE 29.14 C FACTOR 0.9
 LOCATION BH IN #78 ASSUMED MOISTURE, % 8 PROCESS WEIGHT RATE
 OPERATOR WEL/COF PROBE LENGTH, in. 96 WEIGHT OF PARTICULATE COLLECTED, mg
 STACK NO. 6 NOZZLE DIAMETER, in. 0.215 SAMPLE WEIGHT
 RUN NO. MUM STACK DIAMETER, in. 80 TARE WEIGHT
 SAMPLE BOX NO. X-40513 PROBE HEATER SETTING 250 WEIGHT GAIN
 METER BOX NO. X-40513 HEATER BOX SETTING 250 TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (h:min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p) (1/16")	VELOCITY (V) (ft/min)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER (T _m), °F	OUTLET (T _m), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST JAPINGER (T _g), °F	PUMP VACUUM in. Hg gauge	VELOCITY (ft/min)
1	0	08:55					99.116			#8	#7		
2	16	09:11	276	.25	2.4	.35		96	84	254	246	2 1/2	
3	24	09:19	332	.4	2.6	.58	100.2						
4	32	09:27	395	.5	3.3	.72	103.8						
5	40	09:35	407	.6	3.3	.88		99	93			5	
6	48	09:43	405	.68	3.0	1.0							
7	56	09:51	400	.70	3.0	1.1	121.7	104	96	251	246	5 1/2	
8	1	10:00	400	.75	3.0	1.1							
9	12	10:07	400	.80	3.0	1.2	132.2		100	253	247	8	
10	20	10:15	401	.82	3.0	1.2							
11	28	10:23	401	.88	2.9	1.25	137.1	108					
12	36	10:31		.95		1.4							
TOTAL													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml				SILICA GEL WEIGHT, g				ORSAT MEASUREMENT				TIME				CO ₂ O ₂ CO N ₂													
1		2		3		4		1		2		3		1		2		3		1		2		3		1		2		3	
FINAL																															
INITIAL																															
LIQUID COLLECTED																															
TOTAL VOLUME COLLECTED																															

TEST filter .01 at 10" Hg

Pre leak elcd = .015 at 15% COMMENTS

zero O₂ N₂ = -0.2
zero N₂ = 0.0
zero Air = 21.6
zero 21.0
zero using 4.97 read 4.7
zero to 4.9-5.0

CROSS SECTION

PARTICULATE FIELD DATA

PLANT	Niles	AMBIENT TEMPERATURE	77	METER AM	1.64														
DATE	7-24-93	BAROMETRIC PRESSURE	29.14	C FACTOR	0.9														
LOCATION	BH IN #18	ASSUMED MOISTURE, %	8	PROCESS WEIGHT RATE															
OPERATOR	Webb/Cox	PROBE LENGTH, in.	96	<table border="1"> <tr> <th colspan="3">WEIGHT OF PARTICULATE COLLECTED</th> </tr> <tr> <th>SAMPLE</th> <th>FILTER</th> <th>PROBE</th> </tr> <tr> <td>FINAL WEIGHT</td> <td></td> <td></td> </tr> <tr> <td>TARE WEIGHT</td> <td></td> <td></td> </tr> <tr> <td>WEIGHT GAIN</td> <td></td> <td></td> </tr> </table>	WEIGHT OF PARTICULATE COLLECTED			SAMPLE	FILTER	PROBE	FINAL WEIGHT			TARE WEIGHT			WEIGHT GAIN		
WEIGHT OF PARTICULATE COLLECTED																			
SAMPLE	FILTER	PROBE																	
FINAL WEIGHT																			
TARE WEIGHT																			
WEIGHT GAIN																			
STACK NO.		NOZZLE DIAMETER, in.	0.215																
RUN NO.	6 HUM	STACK DIAMETER, in.	80																
SAMPLE BOX NO.		PROBE HEATER SETTING	250																
METER BOX NO.	X-40513	HEATER BOX SETTING	250	TOTAL															

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
--------	--------	----------

FINAL WEIGHT		
--------------	--	--

TARE WEIGHT		
-------------	--	--

TOTAL

[illegible]

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT.	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS: Change filter and collect
exp. data from #1 diff.
Leak checked at 12:00 = .02%

FIRM AND SCIENTIFIC INC.

#3

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT Nike
 DATE 7-24-93
 LOCATION BH Fh #18
 OPERATOR Webb/Cox
 STACK NO. 6
 RUN NO. 6
 SAMPLE BOX NO. X-40513
 METER BOX NO. X-40513

AMBIENT TEMPERATURE 85
 BAROMETRIC PRESSURE 29.14
 ASSUMED MOISTURE, % 8
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. 0.215
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 250

METER ΔH_g 1.67
 C FACTOR 0.9

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	Time	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (ft/s) ²	0	2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	#4	#7	Plot	Probe	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER (T _g), °F	PUMP VACUUM in. Hg gauge	VELOCITY (ft/s)
	0	13:39						202.6							
1				0.25			0.35					#8 #2	#3 #4		
2	16	13:50	213						104	103	253	266	247	69	3
3	24	13:58	341	0.50			0.70	208.8							
4	32	14:06	360	0.60			0.84	213.0							
5	40	14:14	368	0.70			1.00	217.5	109	104	254	251	247	70	5
6	48	14:22	369	0.74	3.0		1.05								
7	56	14:30	372	0.78			1.10	228.2	115	109	250	252	248	67	6
8	9	14:38	370	0.83	3.0		1.18	232.8							
9	12	14:46	371	0.88	3.0		1.22	237.5	115	109	251	251	246	60	6 1/2
10	20	14:54	374	0.95			1.35	242.7							
11	28	15:02	374	0.98			1.38	247.7	117	110	253	254	248	65	9
12	36	15:10													
TOTAL															
AVERAGE															

Leaked
 A.V.
 O₂

VOLUME OF LIQUID WATER COLLECTED	1
FINAL	
INITIAL	
LIQUID COLLECTED	
TOTAL VOLUME COLLECTED	

IMPINGER VOLUME ml	2	3	4	SILICA GEL WEIGHT, g

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

COMMENTS:

O₂ Meter reading 24.5
 on Air - Battery Low
 7 to pump supply O₂
 Set air at 21.0%

D-96

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE FIELD DATA

PLANT Niter
DATE 7-24-93
LOCATION BH 10 #18
OPERATOR Wells/Cox
STACK NO. -
RUN NO. 6 MUM
SAMPLE BOX NO. -
METER BOX NO. X-40513

AMBIENT TEMPERATURE 86
 BAROMETRIC PRESSURE 29.14
 ASSUMED MOISTURE, % 8
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. 0.215
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 250

METER AM 1.64
C FACTOR 0.9

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL[illegible]

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT,
	1	2	3	4	
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO ₁	O ₂	CO	N
1					
2					
3					
4					

COMMENTS: Post back check .015¢/hr at 1

NOMOGRAPH DATA

PLANT Niles, Ohio Ohio Edison
 DATE 7/24/93
 SAMPLING LOCATION outlet of bag house

N-19- MUM- 724

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH_e	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m\text{ avg.}}$	110
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.14
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073 \times$ STACK GAUGE PRESSURE in in. H ₂ O)	P_s	8.5" H ₂ O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.0
AVERAGE STACK TEMPERATURE, °F	$T_{s\text{ avg.}}$	383
AVERAGE VELOCITY HEAD, in. H ₂ O	$\Delta p_{\text{avg.}}$	0.65
MAXIMUM VELOCITY HEAD, in. H ₂ O	$\Delta p_{\text{max.}}$	0.89
C FACTOR		0.90
CALCULATED NOZZLE DIAMETER, in.		0.260
ACTUAL NOZZLE DIAMETER, in.		0.247
REFERENCE Δp , in. H ₂ O		0.850

EPA (Dur) 234
 4/72

PARTICULATE FIELD DATA

PLANT *Miller, Blue Box* DATE *7/24/93*
 LOCATION *at top of baghouse*
 OPERATOR *Levent, Yusuf*
 RUN NO. *N-19-MUM-724*
 SAMPLE BOX NO. *1*
 METER BOX NO. *X-40513*
 AMBIENT TEMPERATURE *70* BAROMETRIC PRESSURE *29.14* ASSUMED MOISTURE, % *7*
 PROBE LENGTH, in. *100 glass* NOZZLE DIAMETER, in. *0.247* STACK DIAMETER, in. *8.0*
 PROBE HEATER SETTING *250°F* HEATER BOX SETTING *250°F*

METER A ⁴	1.66	
C FACTOR	0.90	
PROCESS WEIGHT RATE		
WEIGHT OF PARTICULATE COLLECTED, m		
SAMPLE	FILTER	PROBE W.
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

CROSS SECTION

SCHEMATIC OF STACK

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T), °F	VELOCITY HEAD (V _p), (ft. ² /s ²)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)	GAS SAMPLE VOLUME (V _m), (l.)	INLET (T _m), °F	OUTLET (T _m), °F	SAMPLE BOX TEMPERATURE (T _s), °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER (T _c), °F	PUMP VELOC. %
1	0/9:00	264	275	0.35	0.76	0.76	73	72	260	26	2.3
2	10/9:10	264	349	0.46	0.95	0.95	78	74	261	51	4.4
3-2	20/9:20	264	349	0.46	0.95	0.95	78	74	261	51	4.4
	16/9:18	258	381	0.55	1.20	1.20	81	76	257	49	
3	20/9:22	258	381	0.60	1.25	1.25	82	76	257	49	
4	30/9:22	260	380	0.60	1.25	1.25	86	79	260	49	4.5
5	40/9:42	261	384	0.65	1.40	1.40	87	80	260	49	4.5
6	50/9:52	259	384	0.65	1.40	1.40	88	82	260	49	4.5
7	60/10:02	260	384	0.55	1.20	1.20	88	83	260	52	4.0
8	70/10:12	260	384	0.55	1.20	1.20	89	83	260	52	4.0
9	80/10:22	259	385	0.55	1.20	1.20	89	83	260	52	4.0
10	90/10:32	260	385	0.55	1.20	1.20	91	86	261	53	4.0
11	100/10:42	260	385	0.55	1.20	1.20	92	87	261	54	4.0
12	110/10:52	259	384	0.55	1.20	1.20	94	88	261	55	4.0
13	120/11:02	258	386	0.52	1.10	1.10	96	91	262	58	4.0
TOTAL											

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	1
FINAL	
INITIAL	
LIQUID COLLECTED	
TOTAL VOLUME COLLECTED	

IMPINGER VOLUME ml	1
SILICA GEL WEIGHT, g	
1	
2	
3	
4	

ORSAT MEASUREMENT	1
TIME	
CO ₂	
O ₂	
CO	
H ₂	

COMMENTS

Analysis 250°F

52

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE YIELD DATA

PLANT Niles, Ohio smxAMBIENT TEMPERATURE 82°DATE 7-28-53BAROMETRIC PRESSURE 29.14LOCATION outlet of bag houseASSUMED MOISTURE, % 7OPERATOR Leonard, HuppPROBE LENGTH, in. 72. glass

STACK NO. _____

NOZZLE DIAMETER, in. 0.247RUN NO. N-19-MUM-724STACK DIAMETER, in. 8.80SAMPLE BOX NO. 1PROBE HEATER SETTING 250°FMETER BOX NO. X-40513HEATER BOX SETTING 250°FMETER ΔH, 1.65C FACTOR 0.92

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WT
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRaverse POINT NUMBER	SAMPLING TIME (h), min	Probe Temp OF STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (ΔP _s) (in. H ₂ O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ % VELOC ft/s
					ACTUAL	DESIRED		INLET (T _{m,in}), °F	OUTLET (T _{m,out}), °F				
14	180/11:12	265	386	0.52	1.0	1.0	918.9	99	93	262°F	62	6.0	4.3
15	180/11:22	265	386	0.86	1.86	1.86	955.4	100	95	262	63	7.0	4.2
16	180/11:32	266	385	0.64	1.40	1.40	962.6	104	97	262	65	6.5	4.3
17	180/11:42	266	386	0.72	1.60	1.60	969.6	105	98	264	69	6.0	4.4
18	170/11:52	264	389	0.68	1.45	1.45	976.9	105	98	261	64	6.5	4.4
19	180/12:02	264	383	0.50	1.10	1.10	984.0	105	100	261	61	5.8	4.5
20	190/12:12	261	384	0.70	1.50	1.50	990.3	104	100	261	61	6.3	4.5
21	200/12:22	266	385	0.40	0.86	0.86	997.4	107	102	262	65	5.2	4.9
22	210/12:32	261	383	0.58	1.20	1.20	1003.0	104	101	262	56	6.0	4.7
23	220/12:42	263	383	0.32	0.70	0.70	1009.2	104	101	262	56	5.0	4.7
24	230/12:52	262	382	0.25	0.54	0.54	1014.3	103	101	261	59	4.8	4.5
	240/13:02	262					1018.688						
SIDE													
1	240/13:12 on			0.18	0.40	0.40	1018.688						
2	250/13:22	252		0.28	0.60	0.60	1023.5	102	100	262	64	4.8	4.5
TOTAL													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	1
FINAL	
INITIAL	
LIQUID COLLECTED	
TOTAL VOLUME COLLECTED	

IMPINGER VOLUME ml	2	3	4	SILICA GEL WEIGHT, g

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

COMMENTS

Static pressure 9.5" H₂O

#3

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Nike, Ohio SNX process AMBIENT TEMPERATURE 87°F
 DATE 7/29/93 BAROMETRIC PRESSURE 29.14
 LOCATION outlet of bag house ASSUMED MOISTURE, % 7
 OPERATOR Leonard, Hupp PROBE LENGTH, in. 80. glass
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MUM-724 STACK DIAMETER, in. 8.00
 SAMPLE BOX NO. 1 PROBE HEATER SETTING 250°F
 METER BOX NO. 8-40513 HEATER BOX SETTING 250°F

METER ΔH, 1.65
 C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE W/
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	probe Temp OF STXTC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s), ft/s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H ₂ O ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), l/s	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (T _{m in}), °F OUTLET (T _{m out}), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ % VELOC
3	260/13:32	252	375	0.37	0.80 0.80		103 100	262	63	5.1	4.6
4	270/13:42	252	381	0.48	1.05 1.05		101 97	258	57	5.8	4.6
5	280/13:52	256	384	0.50	1.05 1.05	1038.8	105 101	262	61	6.0	4.7
6	290/14:02	258	379	0.50	1.05 1.05	1044.9	101 98	257	61	6.0	4.8
7	300/14:12	261	382	0.58	1.25 1.25	105	105 100	261	65	6.0	5.0
8	310/14:22	256	382	0.72	1.55 1.55	1057.5	106 103	262	68	6.8	4.5
9	320/14:32	258	383	0.60	1.30 1.30	1064.7	107 102	262	68	6.5	4.4
10	330/14:42	262	384	0.72	1.55 1.55	1071.5	108 103	262	70	6.8	4.6
11	340/14:52	245	383	0.63	1.35 1.35	1078.7	109 104	262	62	6.4	4.6
12	350/15:02	263	383	0.72	1.55 1.55	1086.5	111 105	262	61	6.8	5.0
13	360/15:12	266	383	0.80	1.70 1.70	1092.7	114 108	262	62	7.0	5.0
14	370/15:22	250	383	0.68	1.50 1.50	1100.1	112 107	261	62	6.8	5.0
15	380/15:32	266	384	0.79	1.70 1.70	1107.4	111 107	261	65	7.0	4.8
16	390/15:42	259	385	0.60	1.30 1.30	1114.9	114 109	262	55	6.5	5.0
17	400/15:52	263	384	0.77	1.70 1.70	1121.9	115 110	263	55	7.0	5.3
TOTAL											

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	1	2	3	4	SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₁	O ₁	CO	N ₁
FINAL											
INITIAL											
LIQUID COLLECTED											
TOTAL VOLUME COLLECTED											

COMMENTS:

D-101

#9

SCHEMATIC OF STACK

CROSS SECTION

PARTICULATE YIELD DATA

PLANT Niles, Ohio Smelter AMBIENT TEMPERATURE 88°F
 DATE 7/24/93 BAROMETRIC PRESSURE 29.14
 LOCATION outlet of bag house ASSUMED MOISTURE, % 7
 OPERATOR Leonard, Mark PROBE LENGTH, in. 90. glass
 STACK NO. _____ NOZZLE DIAMETER, in. 0.247
 RUN NO. N-19-MUM-724 STACK DIAMETER, in. 90.
 SAMPLE BOX NO. 1 PROBE HEATER SETTING 250°F
 METER BOX NO. 2-40513 HEATER BOX SETTING 250°F

METER ΔH , 1.65
 C FACTOR 0.90

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (hr, min)	probe temp °F STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _{sp})	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), (l)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O ₂ %
					ACTUAL	DESIRED		INLET (T _m in), °F	OUTLET (T _m out), °F				
18	410/16:02	262	384	0.56	1.20	1.20	1129.7	116	110	262	56	6.3	5.4
19	420/16:12	262	384	0.78	1.70	1.70	1136.2	114	110	260	56	7.0	5.5
20	430/16:20	260	384	0.82	1.80	1.80	1144.0	114	110	261	59	7.1	5.2
21	440/16:22	265	382	0.76	1.65	1.65		117	111	261	60	7.1	5.3
22	450/16:42	265	383	0.75	1.65	1.65	1159.0	118	112	262	62	7.1	5.3
23	460/16:52	263	382	0.75	1.65	1.65	1166.4	117	112	261	60	7.1	5.2
24	470/17:02	265	382	0.52	1.15	1.15	1174.0	119	113	262	63	6.0	5.0
	480/17:12 off						1180.567						
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	1
FINAL	
INITIAL	
LIQUID COLLECTED	
TOTAL VOLUME COLLECTED	

IMPINGER VOLUME ml	2	3	4	SILICA GEL WEIGHT, g

ORSAT MEASUREMENT	TIME	CO	O ₂	CO	N ₂
1					
2					
3					
4					

leak check after run 0.040 cfm at 10" H₂O

COMMENTS

D-103

STACK SAMPLING DATA SHEET

Page 1 of 6

CLIENT Battelle DOETEST DATE 7-24-95 (Sat.)ORIFICE CORRECTION 1.572HOT BOX NO. 6TEST UNIT Sub Reactor OutletTEST NO. N-20-MUM-724METER CORRECTION 1.0157COLD BOX NO. 6PROJECT NO. 93C-28-01NOZZLE (SIZE, #) 0.441CALIBRATION DATE 07-02-93PROBE NO. 13-2CONTROL BOX OPERATOR RPCSTATIC PRESSURE 16.0" H₂OPITOT CORRECTION 0.84FILTER NO. unassignedBAROMETRIC PRESSURE 29.35PORT DIRECTION Port #2CONTROL BOX NO. TICERSTACK DIA. 10' x 34'

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pilot a P (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
110"	09:00	714.650	.10	1.62	1.62	70	70	3.5	639	~250°F	160°F	~250°F	30.mil/PT
			.08	1.29	1.29	86	72	3.5	650				
			.08	1.29	1.29	88	73	3.5	628				
			.08	1.29	1.29	92	76	3.5	627				
90"			.09	1.45	1.45	96	78	3.5	628				
			.09	1.45	1.45	96	81	3.5	629				
			.10	1.62	1.62	98	81	3.5	626				
			.10	1.62	1.62	101	83	4.0	629				
70"			.08	1.29	1.29	103	87	4.0	626				
			.08	1.29	1.29	104	87	4.0	620				
			.08	1.29	1.29	104	87	4.0	640				
			.08	1.29	1.29	104	88	4.0	631				
50"			.05	.81	.81	104	89	2.5	629				
			.07	1.13	1.13	104	89	3.0	631				
			.08	1.29	1.29	105	90	3.0	633				
			.08	1.29	1.29	104	90	3.0	635				Estimates:
30"			.10	1.62	1.62	104	91	4.5	637				MW=29.2
			.09	1.45	1.45	102	91	4.5	631				%H ₂ O=9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	6.12	10.01 cfm
After	13.0	10.02 cfm

PITOT LEAK CHECK

	Positive	Negative
Before	0.1/13.5	0.1/13.5
After	0.1/13.5	0.1/13.5

	1	2
CO ₂	13.5	13.5
O ₂	6.0	6.0
CO	0	0
N ₂	80.5	80.5

Fyrite check 21% 10:25

Impinger

Impinger No.	Contents	Final	Initial	Difference
1.	Empty	710.2	434.3	275.9
2.	150ml HNO ₃ /H ₂ O ₂	804.3	607.4	196.9
3.	50ml HNO ₃ /H ₂ O ₂	664.1	633.4	30.7
4.	Empty	464.3	462.3	2.0
5.	100ml KMnO ₄	501.1	500.0	1.1

6. 100ml KMnO₄ 553.7 558.7 2.5.0

7. Silica Gel 620.0 643.7

KEYSTONE

00 00 00 00 00
76 45 21
AQE 2/92

543.9 total

Actual Moisture 8.7

STACK SAMPLING DATA SHEET

Page 2 of 6

CLIENT BATTELIC / MGE TEST DATE 07-24-93 ORIFICE CORRECTION 1.572 HOT BOX NO. 6
 TEST UNIT 50R RAA-100 OUTLET TEST NO. N-20-000-724 METER CORRECTION 1.051 COLD BOX NO. 6
 PROJECT NO. 93C028-01 NOZZLE (SIZE, IN) 0.441 CALIBRATION DATE 07-02-93 PROBE NO. 13-3
 CONTROL BOX OPERATOR RPS STATIC PRESSURE 16.0" H2O PITOT CORRECTION 0.84 FILTER NO. UNUSABLE
 BAROMETRIC PRESSURE 29.35 PORT DIRECTION PORT #2 CONTROL BOX NO. THREE STACK DIA. 20" / 10"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot Δ P (in. H2O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
			.07	1.13	1.13	105	92	4.0	631	~250°K	~65°K	~300°K	20" / 10"
			.08	1.29	1.21	108	92	4.0	631				
10'			.04	.65	.65	109	93	2.0	630				
			.04	.65	.65	106	93	2.0	625				
			.04	.65	.65	106	93	2.0	629				
	11:02	787.581	.04	.65	.65	106	93	2.0	631				
100'													
110'	11:07	787.581	.04	.65	.65	100	94	2.0	631				
			.04	.65	.65	105	94	2.0	635				
			.06	.97	.97	107	95	3.0	642				
			.06	.97	.97	108	95	3.0	651				
90"			.08	1.29	1.29	111	97	5.0	644				
			.08	1.29	1.29	114	98	5.0	652				
			.07	1.13	1.13	114	99	4.5	653				
			.08	1.29	1.29	115	99	5.0	653				
70'			.10	1.62	1.62	115	100	6.5	656				Estimates:
			.09	1.45	1.45	117	100	6.0	659				MW= 29.2
			.10	1.62	1.62	117	101	6.5	651				%H2O= 90

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	50.01 cfm
After	7.0	50.05 cfm

2nd FILE

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

STACK SAMPLING DATA SHEET

Page 3 of 6

CLIENT RAHALLIS / DOE TEST DATE 07-24-97 ORIFICE CORRECTION 1.572 HOT BOX NO. 6
 TEST UNIT 566 RACER 01267 TEST NO. 11-20-MUM-724 METER CORRECTION 1.0157 COLD BOX NO. 6
 PROJECT NO. 95C028-01 NOZZLE (SIZE, #) 0.441 CALIBRATION DATE 07-02-93 PROBE NO. 13-2
 CONTROL BOX OPERATOR RFC STATIC PRESSURE 16.0" H₂O PITOT CORRECTION 0.84 FILTER NO. UNWEIGHTED
 BAROMETRIC PRESSURE 29.35 PORT DIRECTION PORT 3, 4 CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pilot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
			.09	1.45	1.45	118	101	6.0	651	~250K	~65°C	~300°F	20 min / AT
50'			.05	.81	.81	116	102	4.0	650				
			.06	.77	.97	116	102	4.0	651				
			.06	.97	.97	116	102	4.0	650				
			.06	.97	.97	116	102	4.0	651				
30"			.08	1.29	1.29	117	102	5.0	654				
			.07	1.13	1.13	118	103	5.0	655				
			.07	1.13	1.13	118	103	5.0	656				
			.07	1.13	1.13	117	103	5.0	659				
10'			.05	.81	.81	117	103	4.0	657				
			.05	.81	.81	117	103	4.0	657				
			.05	.81	.81	117	103	4.0	650				
	13:07	857.676	.05	.81	.81	117	103	4.0	649				
110"	13:13	857.676	.08	1.29	1.29	108	104	4.5	649				Estimates:
			.08	1.29	1.29	108	104	5.5	656				MW=29.7
			.08	1.29	1.29	114	103	9.5	669				%H ₂ O=9
			.07	1.13	1.13	114	103	5.0	669				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	13.5	
O ₂	6.0	
CO	0	
N ₂	80.5	

Impinger No.

Impinger No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

D-105

STACK SAMPLING DATA SHEET

Page 4 of 6

CLIENT BATTEL 1004 TEST DATE 07-24-93 ORIFICE CORRECTION 1.572 HOT BOX NO. 6
 TEST UNIT SCR BAKTOR OUTLET TEST NO. N-20-MW-724 METER CORRECTION 1.0151 COLD BOX NO. 6
 PROJECT NO. 93C020-01 NOZZLE (SIZE, #) 0.441 CALIBRATION DATE 07-03-93 PROBE NO. 13-2
 CONTROL BOX OPERATOR RPL STATIC PRESSURE 16.0" Hg PITOT CORRECTION 0.84 FILTER NO. UNKN
 BAROMETRIC PRESSURE 29.35 PORT DIRECTION 165° CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pilot ΔP (in. H2O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
90"			0.08	1.13	1.13	113	103	16.0	685	~350	68	~300	20m/15
	13:43	874.53	.07	1.29	1.29	113	103	18.0	680				
	13:58	874.60	.07	1.13	1.13	112	102	2.0	681				changed filter
80"			.07	1.13	1.13	112	103	2.0	680				13:45
			.08	1.29	1.29	116	103	3.0	681				
			.09	1.45	1.45	118	103	3.5	682				
			.09	1.45	1.45	119	103	3.5	682				
60"			.09	1.45	1.45	119	104	3.5	683				
			.09	1.45	1.45	120	104	3.5	683				
			.09	1.45	1.45	120	104	3.5	683				
			.09	1.45	1.45	120	104	3.5	683				
30"			.09	1.45	1.45	121	105	4.0	683				
			.10	1.62	1.62	121	105	5.0	682				
			.10	1.62	1.62	123	105	5.0	686				
10'			.10	1.62	1.62	123	106	5.0	684				Estimates:
			.04	.65	.65	120	107	2.0	685				MW=29.2
			.04	.65	.65	120	106	2.0	682				%H2O=9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	805	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE
INTEGRATED SYSTEMS, INC.

D-106

STACK SAMPLING DATA SHEET

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CLIENT Battelle 1000 TEST DATE 07-24-93 ORIFICE CORRECTION 1.572 HOT BOX NO. 6
 TEST UNIT SLA Parameter Outlet TEST NO. N-20-MUM-724 METER CORRECTION 1.0151 COLD BOX NO. 6
 PROJECT NO. 93CB-28-41 NOZZLE (SIZE, #) 0.441 CALIBRATION DATE 07-02-93 PROBE NO. 13-2
 CONTROL BOX OPERATOR RPC STATIC PRESSURE 16.0" H₂O PITOT CORRECTION 0.84 FILTER NO. 100-6131100
 BAROMETRIC PRESSURE 29.35 PORT DIRECTION Bottom CONTROL BOX NO. THREE STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
	5:28	930.120	.04	.65	.65	118	107	2.0	656	250F	165	200F	20 min/15
			.04	.65	.65	118	107	2.0	655				
110"	15:36	930.120	.04	.65	.65	109	107	2.0	692				
			.04	.65	.65	110	109	2.0	691				
			.08	1.29	1.29	118	106	3.0	690				
			.09	1.45	1.45	121	106	3.0	691				
90"			.10	1.62	1.62	122	107	4.0	694				
			.10	1.62	1.62	122	107	4.0	695				
			.08	1.29	1.29	123	106	4.0	697				
			.09	1.45	1.45	124	107	4.0	696				
70"			.10	1.62	1.62	125	108	5.0	696				
			.08	1.29	1.29	125	109	4.5	697				
			.09	1.45	1.45	125	109	4.5	699				
			.08	1.29	1.29	125	109	4.0	699				
50"			.09	1.45	1.45	124	109	4.5	701				Estimates:
			.10	1.62	1.62	124	109	4.5	701				MW= 2.2
			.10	1.62	1.62	126	110	5.0	701				%H ₂ O= 90

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	13.5	
O ₂	16.0	
CO	0	
N ₂	20.5	

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

STACK SAMPLING DATA SHEET

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CLIENT BATTELLE / MGR. TEST DATE 07-24-93 ORIFICE CORRECTION 1.572
 TEST UNIT SCR REACTION OUTLET TEST NO. N-20-MUM-724 METER CORRECTION 1.0151 HOT BOX NO. 6
 PROJECT NO. 93CJ28-d1 NOZZLE (SIZE, IN) 0.441 CALIBRATION DATE 07-01-93 COLD BOX NO. 6
 CONTROL BOX OPERATOR RPC STATIC PRESSURE 16.0" H₂O PITOT CORRECTION 0.84 PROBE NO. 13-2
 BAROMETRIC PRESSURE 29.35 PORT DIRECTION West CONTROL BOX NO. THREE FILTER NO. UNUS, 9303
 STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
30"			.09	1.45	1.45	127	109	6.0	702	-250	-68	-30	2000/AT
			.10	1.62	1.62	126	110	5.5	702				
			.08	1.29	1.29	127	110	4.5	701				
			.08	1.29	1.29	125	110	4.5	701				
10"			.07	1.13	1.13	125	110	4.0	702				
			.04	.65	.65	124	110	3.0	702				
			.04	.65	.65	123	116	3.0	701				
			.04	.65	.65	122	110	3.0	696				
	17:36	1006.111	.04	.65	.65	123	110	3.0	697				
$\Delta = 8 \text{ hr}$ $\Delta = 291.371 \text{ dcl}$ $(AP)_{avg} = 0.07$ $(\Delta H)_{avg} = 1.20$ $(T_{meter})_{avg} = 107^\circ\text{F}$ $(T_{stack})_{avg} = 664^\circ\text{F}$ $velocity = 21.3 \text{ ft/sec}$ $ISO = 95.5\%$													
													Estimates:
													MW = 29.2
													%H ₂ O = 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	13.5	
O ₂	6.0	
CO	0	
N ₂	80.5	

Impinger No.

Impinger Contents

	Final	Initial	Difference
1.			
2.			
3.			
4.			
5.			

AQE 2/92

KEYSTONE
ANALYTICAL SERVICES, INC.

D-108

P-c 10/4

TEST DATE 7-24-93 (Sat.)

TEST NO. N-21-MUM-724

NOZZLE (SIZE, #) 0.197 G18

STATIC PRESSURE 0.8" H₂O

PORT DIRECTION A

HOT BOX NO. 5

COLD BOX NO.

PROBE NO. 10-4

PROBE NO.
FILTER NO.

STACK DIA. 50" (depth) x

D-109

	in. Hg	Rate (cfm)
Before	5.0	0.020
After	8.0	0.020

velocity = 61.3 ft/sec
Iso. = 103.77.

POS.	NEG.
OK	OK

6. 100 mL KMnO₄ 552.8 556.7 -3.9
7. Silica Gel 706.6 670.3 36.3

527.59 total

STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE
 TEST UNIT SNOX Tunnel Outlet
 PROJECT NO. 93C-028-01
 CONTROL BOX OPERATOR TS
 BAROMETRIC PRESSURE 29.35

TEST DATE 7-24-93 (Sat.)
 TEST NO. N-21-MUM-724
 NOZZLE (SIZE, IN) 0.197 AIB
 STATIC PRESSURE 0.8" H₂O
 PORT DIRECTION B

ORIFICE CORRECTION 1.802
 METER CORRECTION 0.9619
 CALIBRATION DATE 5-19-93
 PITOT CORRECTION 0.84
 CONTROL BOX NO. 7

HOT BOX NO. 5
 COLD BOX NO.
 PROBE NO. 10-4
 FILTER NO.
 STACK DIA. 50" (depth) x 77" (width)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
46.4	1115	543.650	0.80	0.94	0.94	106	90	5.5	205	~250°F	468°F	~250°F	18 min/point
39.3	1133		0.80	0.94	0.94	116	90	5.5	206				
			0.95	1.14	1.14	120	92	7.0	206				
			0.95	1.14	1.14	120	92	7.0	208				Readings every 9 min
32.1	1151		0.95	1.14	1.14	121	94	7.0	207				
			0.95	1.14	1.14	122	95	7.0	215				
25.0	1209		0.95	1.14	1.14	122	95	7.0	213				
			0.95	1.14	1.14	122	95	7.0	207				
17.9	1227		0.90	1.08	1.08	124	96	6.5	200				
			0.85	1.03	1.03	124	96	6.5	205				
10.7	1245		0.50	0.61	0.61	124	97	4.0	203				
			0.60	0.73	0.73	124	97	5.0	203				
3.6	1303		0.40	0.49	0.49	124	97	4.0	201				
	1321	618.327	0.50	0.61	0.61	122	96	4.0	201				
Δ = 126 min Δ = 74.677 dcf (ΔP) _{avg} = 0.80 (ΔH) _{avg} = 0.95 T _{amb} = 108°F T _{stack} = 204°F													Estimates:
													MW = 29.2
													%H ₂ O = 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before		
After	8.0	0.010

PITOT LEAK CHECK

POS.	NEG.

	1	2
CO ₂	13.0	
O ₂	8.0	
CO	0	
N ₂	79.0	

velocity = 56.5 ft/sec
 ISO = 101.6%

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

D-110

Page 2 of 4

TEST DATE 7-24-93 (Sat.)

ORIFICE CORRECTION 1.802

HOT BOX NO. 5

TEST UNIT SNOW TOWNS OUTLET

TEST NO. N-21-MUM-724

METER CORRECTION 0.9%

COLD BOX NO.

PROJECT NO. 93C-112B-117

NOZZLE (SIZE, IN) 0.197 3/8

CALIBRATION DATE 5-19-9

PROBE NO. 10-4

CONTROL BOX OPERATOR TR

STATIC PRESSURE 0.8" H₂O

PITOT CORRECTION 0.84

FILTER NO.

BAROMETRIC PRESSURE 29.3

PORT DIRECTION 1

CONTROL BOX NO. 7

STACK DIA. 58" (depth) x 99" (width)

D-111

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

POS.	NEG.

velocity = 58.0 ft/sec
ISO.1 = 103.7%

STACK SAMPLING DATA SHEET

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CLIENT Bethelle / DOE

TEST UNIT SNOW Tower Outlet

PROJECT NO. 93C022-01

CONTROL BOX OPERATOR JP

BAROMETRIC PRESSURE 29.35

TEST DATE 7-24-93 (Sat.)

TEST NO. N-21-MUM-724

NOZZLE (SIZE, IN) 0.197 5/16

STATIC PRESSURE 0.84 H₂O

PORT DIRECTION C

ORIFICE CORRECTION 1.802

METER CORRECTION 0.9619

CALIBRATION DATE 5-19-93

PITOT CORRECTION 0.84

CONTROL BOX NO. 7

HOT BOX NO. 5

COLD BOX NO.

PROBE NO. 104

FILTER NO.

STACK DIA. 52" (depth) x 79" (width)

Traverse Point	Time	Dry Gas Meter Reading (dcl)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
46.4	1332	618.490	0.90	1.09	1.09	108	97	6.0	201	~250°F	~48°F	~20°F	18 min / point
39.3	1350		0.90	1.09	1.09	121	96	6.0	201				
			0.95	1.16	1.16	122	96	6.5	202				
32.1	1400		0.95	1.16	1.16	123	96	6.5	201				Readings over 7 minutes
			1.30	1.58	1.58	124	97	8.5	201				
25.0	1426		1.30	1.58	1.58	125	98	8.5	198				
			1.35	1.64	1.64	125	98	9.0	198				
17.9	1444		1.35	1.64	1.64	126	100	9.0	198				
			1.30	1.60	1.60	126	100	9.0	197				
10.7	1502		1.35	1.66	1.66	128	100	9.0	197				
			1.30	1.60	1.60	127	100	9.0	197				
3.6	1530		1.20	1.47	1.47	126	100	8.0	198				
			0.95	1.17	1.17	126	100	7.0	198				
	1538	708.739	0.90	1.10	1.10	126	100	6.5	198				
Δ = 26 Δ = 90.24 Δ P _{avg} = (Δ H) _{avg} = 1.40 (T _{stack}) _{avg} = 111°F (T _{stack}) _{avg} = 199°F													Estimates:
MW = 29.2													% H ₂ O = 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before		
After	9.0	0.020

ITOT LEAK CHECK

POS.	NEG.

	1	2
CO ₂	13.0	
O ₂	8.0	
CO	0	
N ₂	79.0	

velocity = 67.5 ft/sec
Iso. = 101.6%

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

D-112

D-3: Anions Train (Method 26)

D-113

~~RE-ENTRY METHOD~~ SOURCE SAMPLING DATA SHEET

N-18-FCI-719

TEST DATE 7/19/93

TEST UNIT

TEST NO. W-18-FCL-719

METER CORRECTION (Y)

PROJECT NO.

SITE NO. Bachman Inlet 18

CALIBRATION DATE _____

SYSTEM OPERATOR Karl Penner

STACK DIAMETER

BAROMETRIC PRESSURE

PORT DIRECTION

.242" North $\Delta P_p = .80"$

%1120=

Impinger

Impinger

Final

Initial

Difference

1.	Contents	Price	Initial	Difference
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

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N-19-FCL-719

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

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HRA METHOD 21 SOURCE SAMPLING DATA SHEET

CLIENT D&E/PECO TEST DATE 7/17/93 DRY GAS METER NO. #2
 TEST UNIT Airco JNOx TEST NO. FCL METER CORRECTION (Y)
 PROJECT NO. 62525 SITE NO. 19 CALIBRATION DATE
 SYSTEM OPERATOR D.L. Smith STACK DIAMETER
 BAROMETRIC PRESSURE PORT DIRECTION

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	Buck Reading (cc/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
	10:53	617.552									
	10:58	621.1			81	3	381	229	70	187/273	
	11:03	624.0			82	3	381	242	69	181/268	
	11:08	629.2			82	3	380	249	68	190/264	
	11:13	633.0			84	4.5	381	244	68	180/262	
	11:18	637.4			84	5	380	237	69	186/260	
	11:23	642.2			86	5	380	247	69	188/257	
	11:28	646.8			86	5	380	254	70	184/256	
	11:33	651.6			86	5	381	259	71	184/254	
	11:38	656.3			87	5	380	265	71	190/254	
	11:43	661.0			87	5	380	251	68	166/253	
	11:48	665.7			87	5	380	258	67	171/252	Estimates:
	11:53	670.1			86	5	341	262	71	186/252	MW=
											%1120=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	18"	.018
After		

Impinger
No.Impinger
Contents

Final

Initial

Difference

1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle 100E TEST DATE 7-19-93 (Mon.) ORIFICE CORRECTION (ΔH_0) 2.002 HOT/COLD BOX NO. 3
 TEST UNIT 542 Reactor Outlet TEST NO. N-20-FCL-719 METER CORRECTION (Y) 0.9812 PROBE NO. 13-2
 PROJECT NO. 93C028-01 NOZZLE (SIZE, #) 0.440 CALIBRATION DATE 06-09-93 FILTER NO. —
 TEST CREW KPC STATIC PRESSURE +17.0" H₂O PITOT CORRECTION 0.84 STACK DIA. —
 BAROMETRIC PRESSURE 29.60 PORT DIRECTION PORT #6 CONTROL BOX NO. SIX PORT SIZE 3/8"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pilot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
90'	13:41	43.456	-10	1.99	1.99	85	82	2.0	680	~250°F	~250°F	~250°F	90 min./point
			.10	1.99	1.99	98	83	2.0	681				Single Point
			.10	1.99	1.99	99	83	2.0	679				Isokinetic
			.10	1.99	1.99	105	85	3.5	681				Sampling for
			.05	1.00	1.00	110	90	4.5	679				1.5 hours
			.05	1.00	1.00	107	91	4.5	680				
			.05	1.00	1.00	108	94	5.5	681				Readings every
			.05	1.00	1.00	110	95	5.5	680				5 minutes
			.06	1.19	1.19	114	95	5.5	671				
			.05	1.00	1.00	114	95	5.5	680				
			.05	1.00	1.00	114	95	6.0	659				
			.05	1.00	1.00	115	97	6.5	658				
			.05	1.00	1.00	115	98	6.5	659				
			.05	1.00	1.00	117	99	7.0	650				
			.05	1.00	1.00	116	99	7.0	656				
			.05	1.00	1.00	115	99	7.0	656				Estimates:
			.05	1.00	1.00	115	100	7.0	654				MW = 29.2
15:11	15:11	100.400	.05	1.00	1.00	117	100	7.5	650				%H ₂ O = 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	20.01 cfm
After	9.0	< 0.02 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO ₂	130	130
O ₂	60	60
CO	0	0
N ₂	81.0	81.0

Graveling = 669°F
100.9°F

Impinger

Impinger No.	Contents	Final	Initial	Difference
1.	50 mL D.F. H ₂ O	611.6	538.8	72.8
2.	100 mL CO ₂ /H ₂ O	577.0	553.1	23.9
3.	100 mL CO ₂ /H ₂ O	467.7	463.0	3.9
4.	200g Silica Gel	1679.0	1664.0	15.0
5.				

velocity = 19.9 ft/sec

ISO = 105.3%

115.69 total
AQE 6/92
Actual Moisture = 9.6%

TIME = 90 min
VOLUME = 56.944 dcl
(AP/AG = 0.06)

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT <u>Battelle / DOE</u>	TEST DATE <u>7-19-93 (Mon.)</u>	ORIFICE CORRECTION (ΔH_0) <u>1.808</u>	HOT/COLD BOX NO. <u>1</u>
TEST UNIT <u>SNLX Tower Outlet</u>	TEST NO. <u>N-21-FCL-719</u>	METER CORRECTION (Y) <u>0.9619</u>	PROBE NO. <u>7-2</u>
PROJECT NO. <u>97C02B-01</u>	NOZZLE (SIZE, θ) <u>0.195" 617</u>	CALIBRATION DATE <u>5-12-93</u>	FILTER NO.
TEST CREW <u>TM-73</u>	STATIC PRESSURE <u>0.1" H₂O</u>	PITOT CORRECTION <u>0.84</u>	STACK DIA. <u>50" (depth) x</u>
BAROMETRIC PRESSURE <u>29.10</u>	PORT DIRECTION <u>D</u>	CONTROL BOX NO. <u>7</u>	PORT SIZE <u>99" (width)</u>

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
50"	7:30	662.800	1.05	1.17	1.17	87	82	5.0	198	~250°F	<68°F	~250°F	90 min./point
	"		1.15	1.29	1.29	102	82	5.5	198				Single Point
	"		1.15	1.29	1.29	113	84	5.5	198				Isokinetic
	"		1.15	1.29	1.29	117	85	5.5	198				Sampling for
	"		1.10	1.26	1.26	117	85	5.0	198				1.5 hours
	"		1.07	1.23	1.23	118	85	6.5	198				
	"		1.07	1.23	1.23	118	85	6.0	198				Readings every
	"		1.10	1.26	1.26	118	85	7.0	198				10 minutes
	"		1.10	1.26	1.26	118	85	7.0	198				
	10:00	723.310	1.10	1.26	1.26	118	85	7.0	198				
	$\Delta =$												
	90 min	$\Delta = 60.510$	$(\Delta P)_{avg} =$	$(\Delta H)_{avg} = 1.25$		$(T_{inlet})_{avg} = 99^\circ F$			$(T_{stack})_{avg} = 198^\circ F$				
		dcf											
			1.10										
													Estimates:
													MW = 29.2
													%H ₂ O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	0.007
After	7.0	0.010

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	OK	OK
After	OK	OK
Gas	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Impinger

Impinger No.	Contents (H ₂ O / CO ₂)	Final	Initial	Difference
1.	100 mL water	687.9	545.9	92.0
2.	100 mL CO ₂ / H ₂ O	578.3	566.6	11.7
empty 3.	100 mL CO ₂ / H ₂ O	435.0	433.3	1.7
4.	200g Silica Gel	658.6	646.3	12.3
5.				

$\text{Total} = 118.3g$
 AQE 6/92
 Actual Moisture = 9.

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N-18-FCL-722

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

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~~PARAMETER~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE

TEST UNIT Rachauke SNOX

PROJECT NO. Niles

SYSTEM OPERATOR Kent Rennie

BAROMETRIC PRESSURE

TEST DATE 7/22/93

TEST NO. N-18-FCL-722

SITE NO. Inlet 18

STACK DIAMETER

PORT DIRECTION

DRY GAS METER NO.

METER CORRECTION (Y)

CALIBRATION DATE

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcl)	Stack Flow Reading Rate (cuff/min) (scfm)	Rotameter Reading on flow manometer (in H ₂ O)	Meter Avg. Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. Filter Inlet (°F)	Comments
Start	19:35	908.100									
	19:37		.675	1.5	80	2	366	248	59	179	
	19:45	915.105	.75	1.9	84	2.5	366	259	58	221	
	19:55	922.492	.725	1.8	85	3.0	366	247	61	248	
	20:05	929.648	.71	1.7	85	3.5	367	250	60	255	
	20:20	940.085	.68	1.6	85	4.5	367	251	59	249	
	20:35	950.705	.69	1.6	86	6.0	366	255	59	249	
	20:50	961.189	.70	1.7	86	7.0	368	254	59	238	
End	20:56	964.848									
											Estimates:
											MW=
											%H ₂ O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (scfm) out/min
Before	15	.005
After		

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

10-11-92
FCL

N-19-FCL-722

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

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STANDARD METHOD 4 SOURCE SAMPLING DATA SHEET

CLIENT _____ TEST DATE 7/22/92 DRY GAS METER NO. _____
TEST UNIT _____ TEST NO. N-19-FCL-722 METER CORRECTION (Y) _____
PROJECT NO. _____ SITE NO. 19 CALIBRATION DATE _____
SYSTEM OPERATOR Karen Rose STACK DIAMETER _____
BAROMETRIC PRESSURE _____ PORT DIRECTION _____

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcl)	Sample Flow Rate (scfm)	Back Reading P.T. Table H ₂ O	Rollometer Reading Sampling Line Temp °F	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
0	1008	708.4	0.72	0.72	2	70	0	380	206	68	356	
Start	1010	708.1	2.0	0.72		70	12	380	206	68	356	
10 min	1020	716.3	2.2	0.72	249	73	12	380	229	65	247	
20 min	1031	725.5	2.2	0.69	248	74	20.3	380	259	71	226	
30 min	1040	729.9	2.2	0.71	248	76	20.3	379	256 254	75	220	
40 min	1050	740.6	2.2	0.67	249	78	19	380	266	75	261	
50 min	1100	748.9	2.8	0.70	249	79	19.5	379	243	71	249	
60 min	1110	758.2	2.8	0.67	251	79	19.6	380	233	73	251	
Stop	1117	760.6										
												Estimates:
												MW=
												%H ₂ O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before		
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

760.9 = 52.5 cu ft.

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STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle / DOE TEST DATE 7-22-93 (Thurs) ORIFICE CORRECTION 2.002 HOT BOX NO. 3
 TEST UNIT SCR Regener Outlet TEST NO. N-20-FCL-722 METER CORRECTION 0.9812 COLD BOX NO. 5
 PROJECT NO. 93C028-01 NOZZLE (SIZE, #) 0.485 CALIBRATION DATE 06-09-93 PROBE NO. 13-1
 CONTROL BOX OPERATOR RPC STATIC PRESSURE 17.0" H₂O PITOT CORRECTION 0.84 FILTER NO. UNUS. USED
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION Port 6 Left CONTROL BOX NO. SIX STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
90"	10:44	285.900	.05	1.45	1.45	85	85	3.0	633	~250°F	468°F	~250°F	Single Point
			.05	1.45	1.45	84	82	3.0	632				Isokinetic
			.05	1.45	1.45	100	85	3.0	635				Sampling for
			.05	1.45	1.45	109	87	3.0	645				1.5 hours
			.06	1.74	1.74	115	91	3.5	645				
			.06	1.74	1.74	116	93	4.0	642				Readings every
			.06	1.74	1.74	119	94	4.0	653				10 minutes
			.06	1.74	1.74	117	95	4.0	655				
	12:14	350.240	.06	1.74	1.74	119	95	4.0	651				
Δ=90 min		Δ=64.340 dcf	(ΔP) _{avg} = 0.06	(ΔH) _{avg} = 1.61	(T _{meter}) _{avg} = 99°F	(T _{stack}) _{avg} = 643°F							
										velocity = 19.5 ft/sec		Estimates:	
										ISO = 96.9%		MW = 29.2	
												%H ₂ O = 9	

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.015 cfm
After	5.0	<0.020 cfm

PITOT LEAK CHECK

	Positive	Negative
Before	0.015 sec	0.015 sec
After		

	1	2
CO ₂	14.0	14.0
O ₂	6.0	6.0
CO	0	0
N ₂	80.0	80.0

Impinger

Impinger No.	Contaminant	Final	Initial	Difference
1.	100 mL H ₂ O	616.6	539.3	77.3
2.	100 mL H ₂ O	569.0	550.6	18.4
3.	100 mL H ₂ O	467.7	464.9	2.8
4.	200g Silica Gel	681.6	667.9	13.7
5.

AQE 2/92

112.29 total
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STACK SAMPLING DATA SHEET

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CLIENT Battelle DOE TEST DATE 7-22-93 ORIFICE CORRECTION 1.802 HOT BOX NO. 1
 TEST UNIT SNOX Tower Outlet TEST NO. A-21-FCL-722 METER CORRECTION 0.9619 COLD BOX NO. 1
 PROJECT NO. 930029-21 NOZZLE (SIZE, #) 0.75 417 CALIBRATION DATE 5-17-93 PROBE NO. 72
 CONTROL BOX OPERATOR TN STATIC PRESSURE 0.15" H₂O PITOT CORRECTION 0.84 FILTER NO.
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION D CONTROL BOX NO. 7 STACK DIA. 50" (depth) x 99"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pilot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments (Lith)
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
50"	11:00	318.638	1.05	1.20	1.20	90	84	5.5	200	~250°F	468°F	~250°F	Single Port
			1.05	1.20	1.20	104	83	5.5	200				Isokinetic
			1.05	1.20	1.20	111	80	5.5	200				Sampling for
			1.05	1.20	1.20	111	80	5.5	200				1.5 Hours
			1.05	1.20	1.20	118	85	5.0	200				
			1.05	1.20	1.20	118	85	5.0	200				Reading every
	12:00		1.05	1.20	1.20	118	85	5.0	200				10 minutes
			1.05	1.20	1.20	118	85	4.5	200				
			1.05	1.20	1.20	118	85	4.5	200				
	12:30	979.380											
A=90		A=60.72	(ΔP) _{NE} =	(ΔH) _{AS} =120	(T _{stack}) _{NE} =98°F	(T _{stack}) _{NE} =200°F							
mva		dcf	1.05										
Velocity = 64.4 ft/sec												Estimates:	
Bo. = 105.0%												MW= 29.2	
												%H ₂ O= 8.5	

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	0.003
After	5.5	0.003

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	OK	OK
After	OK	OK
1		
2		
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Impinger

Impinger No.	Before	Final	Initial	Difference
100ml CO ₂ /H ₂ CO ₃	615.7	547.0	68.7	
2. 100ml H ₂ CO ₃ /CO ₂	581.9	563.4	18.5	
dry 3. 100ml H ₂ CO ₃ /CO ₂	438.2	434.4	3.8	
4. 200ml Silica Gel	675.1	659.4	15.7	
5.				

MW= 29.3

2,106.7g total
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CLIENT DOE

TEST DATE 7/29/93

DRY GAS METER NO.

TEST UNIT Baghouse Inlet

TEST NO. N-18-FCL-724

METER CORRECTION (Y)

PROJECT NO. Niles

SITE NO. Inlet 18

CALIBRATION DATE

SYSTEM OPERATOR Kent Rennie

STACK DIAMETER

BAROMETRIC PRESSURE

PORT DIRECTION

Estimates:

MW-

%1120-

Impinger

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

Final

Initial

AOE 7/92

$$\begin{array}{r} 971 \\ 55 \\ \hline 1026 \end{array}$$

149-^{FCL}ACB-724

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~~FPM METHOD 04~~ SOURCE SAMPLING DATA SHEET

CLIENT _____ TEST DATE 5/24/93 DRY GAS METER NO. _____
TEST UNIT _____ TEST NO. N-19-FCL-724 METER CORRECTION (Y) _____
PROJECT NO. _____ SITE NO. 19 CALIBRATION DATE _____
SYSTEM OPERATOR Kevin Rose STACK DIAMETER _____
BAROMETRIC PRESSURE _____ PORT DIRECTION _____

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	Buck Sample Reading in H ₂ O (cc/min)	Pot Tube Reading in H ₂ O	Rollometer Reading Sample Line Temp (°F)	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
	0903	795.595	0	0.74	254	70	0	382	267	68	252	0
	0914	795.595	2.2	0.75	252	69	2.25	381	252	69	247	START
	0926											2000 ppm
	0928	—	2.2	0.75	249	73	5.0	381	229	63	254	Recheck
	0939	813.4	2.2	0.75	256	76	5.0	382	257	65	253	
	0949	821.5	2.15	0.74	265	78	5.0	382	266	67	266	
	0959	829.7	2.15	0.75	271	79	5.0	381	269	64	256	Increased to 2.4 in. H ₂ O
	1015	844.1	2.3	0.73	275	82	5.0	381	272	63	264	
	1022	848.6	2.3	0.72	273	82	5.0	381	272	66	265	
												Estimates:
												MW=
												%H ₂ O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	15	59 cc/min
After	15	58 cc/min

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

Goal = 52.5 cc/ltr
848.1

AQE 7/92

D-123

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT BATTELLE / DOE TEST DATE 07-24-93 ORIFICE CORRECTION 1.883 HOT BOX NO. 5
 TEST UNIT SCR REACTOR OUTLET TEST NO. N-20-FCL-724 METER CORRECTION 1.0338 COLD BOX NO. 5
 PROJECT NO. 93C928-61 NOZZLE (SIZE, #) 0.485 CALIBRATION DATE 07-16-93 PROBE NO. 13-1
 CONTROL BOX OPERATOR RCC STATIC PRESSURE 14.0" H₂O PITOT CORRECTION 0.84 FILTER NO. ULV-5140
 BAROMETRIC PRESSURE 29.35 PORT DIRECTION PORT #1 CONTROL BOX NO. ONE (CONICAL) STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
90"	10:00	659.200	.05	1.37	1.37	68	67	3.5	639	~250°	~68°	~250°	Single Point
			.05	1.37	1.37	82	69	4.0	640				ISOTHERM
			.06	1.64	1.64	87	72	5.0	640				Sampling Area
			.06	1.64	1.64	93	76	5.0	640				1.5 Hours
			.06	1.64	1.64	95	77	5.0	639				
			.06	1.64	1.64	96	79	5.0	637				Remainder
			.06	1.64	1.64	98	80	5.0	629				Area 10 min
			.06	1.64	1.64	100	83	5.0	639				
	11:30	720.371	.06	1.64	1.64	102	85	5.0	635				
A=90 A=61.171 (ΔP) _{avg} = (ΔH) _{avg} = (T _{meter}) _{avg} = 84°F (T _{stack}) _{avg} = 641°F													
min dcf													
0.06													
velocity = 19.5 ft/sec													Estimates:
ISO = 70													MW = 29.2
100.5													%H ₂ O = 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	20.0102
After	5.5	20.0102

PITOT LEAK CHECK

	Positive	Negative
Before	0.1570	0.1530
After	0.1570	0.1530

CO ₂	13.5	13.5
O ₂	6.0	6.0
CO	0	0
N ₂	80.5	80.5

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml H ₂ O / CO ₂	621.0	540.1	80.9
2.	100ml H ₂ O / CO ₂	572.4	552.9	19.5
3.	Empty	467.3	464.8	2.5
4.	Silica Gel	607.4	607.5	14.9
5.				

0 0 0 0 0 9 FLOW
 76 4 3 2 9
 AQE 2/92
 26

FLAME CHECK 21% O₂ 1005

117.89 total
KEYSTONE
 ENVIRONMENTAL SERVICES, INC.

D-124

STACK SAMPLING DATA SHEET

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CLIENT *Bethlehem Steel*

TEST UNIT *SNOW TOWER 0.115*

PROJECT NO. *93C-022-01*

CONTROL BOX OPERATOR *MM*

BAROMETRIC PRESSURE *29.35*

TEST DATE *7-24-93 (Sat.)*

TEST NO. *N-21-KCL-724*

NOZZLE (SIZE, IN) *0.195 @ 17*

STATIC PRESSURE *0.5" H₂O*

PORT DIRECTION *3*

ORIFICE CORRECTION

METER CORRECTION

CALIBRATION DATE

PITOT CORRECTION

CONTROL BOX NO.

HOT BOX NO. *1*

COLD BOX NO. *1*

PROBE NO. *7-2*

FILTER NO.

STACK DIA. *50" (depth) x 99" (width)*

CONTROL BOX NO. 4														STACK DIA. 50" (diam.) x 99" (height)	
Traverse Point	Time	Dry Gas Meter Reading (dcl)	Pitot & P (in. H ₂ O)	Orifice & H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments		
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)								
50"	9:30	484.430	1.0	1.07	1.07	108	90	4.0	195	~250°F	~160°F	~250°F	Single Point Isokinetic Sampling for 1.5 hours		
			1.0	1.07	1.07	110	90	5.0	195						
			1.0	1.07	1.07	112	91	5.0	196						
			1.0	1.07	1.07	114	92	5.0	197						
			1.0	1.07	1.07	115	92	5.0	197						
10:00			1.0	1.07	1.07	115	94	5.0	198				Reading every 10 min		
			1.0	1.07	1.07	115	94	5.0	198						
			1.0	1.07	1.07	116	95	5.0	198						
			1.0	1.07	1.07	116	95	5.0	198						
			1.0	1.07	1.07	116	95	5.0	198						
10:30		533.330													
A=90 min		A=51.900 dcl	(ΔP) _{AG} =	(ΔH) _{AG} =	1.07	<i>(T_{stack})_{AG} = 103°F</i>		<i>(T_{stack})_{AG} = 197°F</i>							
			1.0												
						velocity = 62.8 ft/sec									
						ISO. = 93.5%									
LEAK CHECK															
														1	
														2	
														Impinger	
														Impinger	
														Estimates: MW=29.2 %H ₂ O=8.5	

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	0.004
After	5.0	0.006

PITOT LEAK CHECK 15 sec

POS.	NEG.
OK	OK

	1	2
CO ₂	13.0	
O ₂	8.0	
CO	0	
N ₂	77.0	

Impinger No.	Impinger Contents	Final	Initial	Difference	
1.	100ml H ₂ O/100ml	603.2	545.2	58.0	Actual Moisture = 8.1%
2.	100ml H ₂ O/100ml	582.0	566.2	15.8	
3.	Empty	437.0	434.6	2.4	
4.	Silica Gel	663.5	651.8	11.7	
5.					

87.9 g total
KEYSTONE ENVIRONMENTAL RESEARCH, INC.

D-125

D-4: Ammonia Train

D-126

FIELD DATA

PLANT Niles
DATE 7/17/93
SAMPLING LOCATION Bayshore Inlet 19
SAMPLE TYPE _____
RUN NUMBER _____
OPERATOR Walt Rennie
AMBIENT TEMPERATURE _____
BAROMETRIC PRESSURE _____
STATIC PRESSURE, (P_s) _____
FILTER NUMBER (s) _____

~~AL-18-102~~
~~N-18-NH4-719~~
N-18-NH4-719

PROBE LENGTH AND TYPE SS 4H
NOZZLE I.D. .245"
ASSUMED MOISTURE, % _____
SAMPLE BOX NUMBER _____
METER BOX NUMBER _____
METER ΔH _____
C FACTOR _____
PROBE HEATER SETTING _____
HEATER BOX SETTING _____
REFERENCE ΔP _____

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY _____ MINUTES

[illegible]

COMMENTS:

D-127

~~FRM METHOD 26~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE / PETS

TEST DATE 7/19/93

DRY GAS METER NO. 2

TEST UNIT

TEST NO. NH3

METER CORRECTION (Y)

PROJECT NO. 62825

SITE NO. 19

CALIBRATION DATE

SYSTEM OPERATOR DL Smith

STACK DIAMETER

— CALIBRATION DATE

BAROMETRIC PRESSURE

PORT DIRECTION

[illegible]

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Flow Rate (cc/min)
Before	15	.02
After	6	.03

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

AOE 7/92

Impinger No.	Impinger Contents	Final	Initial	Difference
-----------------	----------------------	-------	---------	------------

1.				
2.				
3.				
4.				
5.				

Page 1 of 1

HOT/COLD BOX NO. 1

PROBE NO. 13-2

FILTER NO.

STACK DIA.

PORT SIZE 36"

% H₂O = 5

Initial

	Weight	Volume
1. 50 mL D.F. H ₂ O	515.7	504.6
2. 100 mL Oil NA H ₂ SO ₄	566.3	560.6
3. 100 mL D.I.N H ₂ SO ₄	395.7	397.9
4. 200g Silica Gel	666.2	660.9
5.		

1.) 50 mL OF H_2O	559.0	525.1	33.9
2.) 100 mL 0.1 N H_2SO_4	579.5	571.2	8.3
3.) 100 mL 0.1 N H_2SO_4	381.7	380.5	1.2
4.) 200 g Silica gel	636.5	630.0	6.5

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT *Battelle DOE* TEST DATE *7-19-93 (Mon.)* ORIFICE CORRECTION (ΔH_0) *1.802* HOT/COLD BOX NO. *7*
 TEST UNIT *SNUX Tower outlet* TEST NO. *N-21-NH4-719* METER CORRECTION (Y) *0.245* PROBE NO. *7-8*
 PROJECT NO. *93C028-01* NOZZLE (SIZE, θ) *0.195" 617* CALIBRATION DATE *5-12-93* FILTER NO.
 TEST CREW *TN JS* STATIC PRESSURE *10" H₂O* PITOT CORRECTION *0.84* STACK DIA. *50" (depth) x*
 BAROMETRIC PRESSURE *29.10* PORT DIRECTION *D* CONTROL BOX NO. *7* PORT SIZE *99" (width)*

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
50"	11:20	723.510	1.07	1.23	1.23	102	84	4.0	198	~250°F	168°F	~250°F	30 min./point
			1.07	1.23	1.23	110	84	4.0	197				Single Point
			1.07	1.23	1.23	115	85	4.0	199				Isokinetic
			1.07	1.23	1.23	116	85	4.0	198				Sampling for
			1.07	1.23	1.23	110	85	4.0	197				30 minutes
			1.07	1.23	1.23	117	85	4.0	198				
	11:50	744.250	1.07	1.23	1.23	116	85	4.0	198				Readings every 5 minutes
	$\Delta = 30$ min	$\Delta = 20.740$ dcl	$(\Delta P)_{avg} = 1.07$	$(\Delta H)_{avg} = 1.23$		$(T_{in})_{avg} = 109°F$			$(T_{stack}) = 198°F$				
													velocity = 65.4 ft/sec
													ISO = 106.8%
													Estimates:
													MW = 29.2
													%H ₂ O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.009
After	5.0	0.007

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	OK	OK
After	OK	OK
GAS	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	8.0	

Impinger

No.	Contents	Initial	Final	Difference
1.	100ml 0.1N H ₂ SO ₄	515.2	484.6	30.6
2.	100ml 0.1N H ₂ SO ₄	566.3	566.6	5.7
3.	100ml 0.1N H ₂ SO ₄	395.7	394.9	0.8
4.	200g Silica Gel	666.2	660.9	5.3
5.				

Actual Moisture = 9.8%

AQE 692

42.4g
bbl

29 " "

D-130

~~RESEARCH~~ METHOD SOURCE SAMPLING DATA SHEET

CLIENT DOE TEST DATE 7/22/93 DRY GAS METER NO. _____
TEST UNIT Baghouse SNOX TEST NO. N-18-NH4-722 METER CORRECTION (Y) _____
PROJECT NO. Niles SITE NO. Inlet 18 CALIBRATION DATE _____
SYSTEM OPERATOR Rent Rennie STACK DIAMETER _____
BAROMETRIC PRESSURE _____ PORT DIRECTION _____

[illegible]

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min) ^(ml/min)
Before	17	.002
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

Page of

CLIENT _____	TEST DATE <u>7/22/97</u>	DRY GAS METER NO. _____
TEST UNIT _____	TEST NO. _____	METER CORRECTION (Y) _____
PROJECT NO. _____	SITE NO. <u>19</u>	CALIBRATION DATE _____
SYSTEM OPERATOR <u>Kevin Rose</u>	STACK DIAMETER _____	
BAROMETRIC PRESSURE _____	PORT DIRECTION _____	

[illegible]

	Vacuum (in. Hg)	Rate (cc/min)
Before	9	34 <i>ml</i>
After	14	22 <i>ml</i>

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

AQE 7/92

10.5 cu/ft
at gook
~ 772.66 Pind

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Page / of /

STACK SAMPLING DATA SHEET				Page / of /
CLIENT <i>Bethell / DOE</i>	TEST DATE <i>7-22-93 (Thurs.)</i>	ORIFICE CORRECTION <i>2.002</i>	HOT BOX NO. <i>3</i>	
TEST UNIT <i>SE Reactor Outlet</i>	TEST NO. <i>N-20-NH4-722</i>	METER CORRECTION <i>0.9812</i>	COLD BOX NO. <i>3</i>	
PROJECT NO. <i>93C020-01</i>	NOZZLE (SIZE, IN) <i>0.485</i>	CALIBRATION DATE <i>06-09-93</i>	PROBE NO. <i>13-1</i>	
CONTROL BOX OPERATOR <i>RPC</i>	STATIC PRESSURE <i>17.0" H₂O</i>	PITOT CORRECTION <i>0.84</i>	FILTER NO. <i>UNKN. good</i>	
BAROMETRIC PRESSURE <i>29.38</i>	PORT DIRECTION <i>Port #6</i>	CONTROL BOX NO. <i>518</i>	STACK DIA.	

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pilot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. . (in. H ₂ O)	In (°F)	Out (°F)						
90"	12:31	350.460	.06	1.74	1.74	94	92	3.0	659	~250°F	~68°F	~250°F	Single Point
			-.08	2.32	2.32	105	94	4.0	659				Isokinetic
			.08	2.32	2.32	111	95	4.0	658				Sampling for
			.08	2.32	2.32	112	93	4.0	654				30 minutes
		JTS	-.08	2.32	2.32	119	94	5.0	659				Reading error
13.01		367.022 376.022	.08	2.32	2.32	119	94	5.5	659				5 minutes
A=30 min		A=16.562 A=26.562 dcf	(ΔP) _{AG} = 0.08	(ΔH) _{AG} = 2.22	(T _{meter}) _{AG} = 102°F	(T _{stack}) _{AG} = 658°F							
						velocity = 22.7 ft/sec							
						ISO. = 99.6%							
						Estimates:							
						MW = 29.2							
						%H ₂ O = 9							

PITOT LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	<0.01 cfm
After	5.5	<0.01 cfm

	Positive	Negative
Before	<i>1/15/60</i>	<i>0/1/60</i>
After		

CO2	14.0	14.0
O2	6.0	6.0
CO	0	0
N2	80.0	80.0

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	50 mL D.I. H ₂ O	559.5	529.0	30.5
2.	100 mL 0.1 N H ₂ SO ₄	579.9	573.6	6.3
3.	100 mL 0.1 N H ₂ SO ₄	382.3	381.4	0.9
4.	200 g Silica Gel	540.2	636.6	3.6
5.

Actual
Moisture
7.8%

41.39 total
KEYSTONE
CONSTRUCTION MATERIALS

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STACK SAMPLING DATA SHEET				Page (of)
CLIENT <i>Bottle 6 / DOE</i>	TEST DATE <i>7-22-93 (Thurs.)</i>	ORIFICE CORRECTION <i>1.802</i>	HOT BOX NO. <i>7</i>	
TEST UNIT <i>SNOX Tuner Outlet</i>	TEST NO. <i>N-21-NH4-722</i>	METER CORRECTION <i>0.9617</i>	COLD BOX NO. <i>2</i>	
PROJECT NO. <i>93C028-01</i>	NOZZLE (SIZE, #) <i>0.195 G17</i>	CALIBRATION DATE <i>5-7-23</i>	PROBE NO. <i>72</i>	
CONTROL BOX OPERATOR <i>JM</i>	STATIC PRESSURE <i>0.15 H₂O</i>	PITOT CORRECTION <i>0.84</i>	FILTER NO.	
BAROMETRIC PRESSURE <i>29.38</i>	PORT DIRECTION <i>D</i>	CONTROL BOX NO. <i>7</i>	STACK DIA. <i>60" (60" x 99")</i>	

[illegible]

PITOT LEAK CHECK *15 JLC*

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.003
After	5.0	0.005

	Positive	Negative
Before	OK	OK
After	OK	OK

CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

MW = 29.3

No.	Impinger Content	Final	Initial	Difference
1.	50 mL D.F. H ₂ O	506.0	486.3	19.7
2.	100 mL 0.1N H ₂ SO ₄	568.0	561.7	7.3
3.	100 mL 0.1N H ₂ SO ₄	398.3	396.6	1.7
4.	20g Silica Gel	671.5	666.3	5.2
5.				

Actual
Moisture =
8.1%

33.99 total
KEYSTONE
ESTABLISHED 1914

N-18-NH4-724

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

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~~FR-1 METHOD 26~~ SOURCE SAMPLING DATA SHEET

CLIENT DoE

TEST DATE 7/29/93

DRY GAS METER NO.

TEST UNIT Barhouse SNOX

TEST NO. N-18-NH4-724

METER CORRECTION (Y)

PROJECT NO. Notes

SITE NO. Inlet 18

CALIBRATION DATE

SYSTEM OPERATOR Kent Rennie

STACK DIAMETER

BAROMETRIC PRESSURE

PORT DIRECTION

[illegible]

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	15	.0025
After		

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

AGE 7/92

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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~~FRM METHOD 26~~ SOURCE SAMPLING DATA SHEET

CLIENT _____ TEST DATE _____ DRY GAS METER NO. _____
TEST UNIT _____ TEST NO. _____ METER CORRECTION (Y) _____
PROJECT NO. _____ SITE NO. _____ CALIBRATION DATE _____
SYSTEM OPERATOR J. Kevin Rose STACK DIAMETER _____
BAROMETRIC PRESSURE _____ PORT DIRECTION _____

[illegible]

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	15	173 cc / 0.005 cu ft
After	15	120 cc / 0.005 cu ft.

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO ₂		
N ₂		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

Goal = 10.5 cu ft

177

TEST DATE 7-24-93 (C.A.)

ORIFICE CORRECTION 1.975

HOT BOX NO. 3

TEST UNIT SCR Receiver Outlet

TEST NO. N-20-NH4-334

METER CORRECTION 0.9921

COLD BOX NO. 7

PROJECT NO. 93C020-01

NOZZLE (SIZE, N) 0.485

CALIBRATION DATE 07-16-93

PROBE NO. 73 -

CONTROL BOX OPERATOR *RIC*
BAROMETRIC PRESSURE *29.27*

STATIC PRESSURE 16.0" H₂O

PITOT CORRECTION 0.84

FILTER NO. UNG 154

HYDROSTATIC PRESSURE 27.55

PORT DIRECTION PORT #6

CONTROL BOX NO. *PORTLAND BOX #1*

STACK DIA.

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1 2

CO2	13.5	13.5
O2	6.0	6.0
CO	0	0
N2	80.5	80.5

Impinger Impinger

No.	Contents	Final	Initial	Difference
1.	100ml 0.1N H ₂ SO ₄	532.9	525.4	7.5
2.	100ml 0.1N H ₂ SO ₄	575.1	570.0	5.1
3.	Empty	382.8	382.3	0.5
4.	Silica Gel	631.8	625.2	6.6
5.				

39.79 total
KEYSTONE
ENVIRONMENTAL REPAIR CORP.

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STACK DIA. 50" (depth) K

velocity = 63.1 ft/sec
Iso. = 98.3%

33.4% total
KEYSTONE
ENVIRONMENTAL REPAIR, INC.
Actual Moisture = 8.7%

D-5: Cyanide Train

D-139

N-18-~~WAT~~-719
CN

PLANT Niles
DATE 7/19/93
SAMPLING LOCATION 18 B&T Inlet
SAMPLE TYPE _____
RUN NUMBER _____
OPERATOR Robert Korman
AMBIENT TEMPERATURE _____
BAROMETRIC PRESSURE _____
STATIC PRESSURE, (P₁) _____
FILTER NUMBER (s) _____

PROBE LENGTH AND TYPE SS, 4 ft
NOZZLE I.D. .042"
ASSUMED MOISTURE, % _____
SAMPLE BOX NUMBER _____
METER BOX NUMBER _____
METER ΔH _____
C FACTOR _____
PROBE HEATER SETTING _____
HEATER BOX SETTING _____
REFERENCE ΔH _____

READ AND RECORD ALL DATA EVERY _____ MINUTES

[illegible]

EPA (Dwt) 235

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RE-1 METHOD 84 SOURCE SAMPLING DATA SHEET

CLIENT DOE / PETC

TEST DATE 7/19/93

DRY GAS METER NO. 2

TEST UNIT

TEST NO. CN

METER CORRECTION (Y)

PROJECT NO. 62825

SITE NO. 19

CALIBRATION DATE

SYSTEM OPERATOR D.L. Smith

STACK DIAMETER

BAROMETRIC PRESSURE

PORT DIRECTION

[illegible]

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before		
After		

FYRITE MEASUREMENTS

	Run 1	Run 2
GAS		
CO2		
O2		
CO		
N2		

AOE 7/92

Impinger

**Impinger
Contents**

Final

Initial

Difference

Sl. No.	Persons	First	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE TEST DATE 7-19-93 (Mon.) ORIFICE CORRECTION (ΔH_0) 2.002 HOT/COLD BOX NO. 1
 TEST UNIT SR Reactor Outlet TEST NO. N-20-CN-719 METER CORRECTION (Y) 0.9812 PROBE NO. 13-2
 PROJECT NO. 93C028-A NOZZLE (SIZE, θ) 0.441" CALIBRATION DATE 06-02-93 FILTER NO. —
 TEST CREW RPC STATIC PRESSURE 17.0" H₂O PITOT CORRECTION 0.84 STACK DIA. —
 BAROMETRIC PRESSURE 29.10 PORT DIRECTION Port 6 CONTROL BOX NO. SIX PORT SIZE 3G

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
90"	16:32	121.909	.05	1.02	1.02	93	92	1.0	639	-250°F	<68°F	-250°F	60 min./point
			.06	1.23	1.23	105	92	1.0	659				Single Point
			.07	1.43	1.43	113	93	1.5	656				Isokinetic
			.06	1.23	1.23	113	94	1.0	656				Sampling for
			.06	1.23	1.23	118	96	1.0	656				1 hot
			.06	1.23	1.23	121	97	2.0	659				
			.06	1.23	1.23	122	97	2.0	656				Readings every
			.06	1.23	1.23	121	97	2.0	660				5 minutes
			.06	1.23	1.23	123	97	2.5	661				
			.06	1.23	1.23	123	101	3.0	661				
			.06	1.23	1.23	124	101	4.0	660				
	17:32	160.085	.06	1.23	1.23	124	101	5.5	650				
$A = 60$		$A = 38.176$	$(\Delta P)_{H_2O} =$	$(\Delta H)_{H_2O} = 1.23$	$(T_{meter})_{H_2O} =$	107°F	$(T_{stack}) = 656°F$						
min		dcl	0.06					velocity = 19.7 ft/sec					Estimates:
								ISO. = 104.6%					MW = 29.2
													%H ₂ O = 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	<0.01 cfm
After	5.5	<0.015 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
GAS	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Impinger No.

Impinger No.	Contents	Final	Initial	Difference
1.	50 mL DI H ₂ O	584.1	530.0	54.1
2.	100 mL 0.1M NaOH	579.3	565.7	13.6
3.	100 mL 0.1M NaOH	448.9	447.3	1.6
4.	200g Silica Gel	658.4	649.9	8.5
5.				

77.8g total
 AQE 6/92
 Actual Moisture = 9.8%

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[illegible]

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.008
After	5.0	2.009

	Positive	Negative
Before	OK	OK
After	OK	OK

Gas	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

No.	Contents	Initial	Difference	
1.	100 mL distilled H₂O	615.7	571.6	44.1
2.	100 mL D.I.M. NoH	574.6	556.0	18.6
3.	100 mL distilled H₂O	452.3	448.4	3.9
4.	200 g Silica Gel	667.2	652.1	15.1
5.				

Actual moisture = 9.6% 81.7g total
AQE 6/92

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N-18-CN-722

Page of

CLIENT DOE

TEST UNIT Bashour

PROJECT NO. Niles

SYSTEM OPERATOR Kent Rennie

BAROMETRIC PRESSURE

TEST DATE 7/22/93

TEST NO. N-18-CN-722

SITE NO. 18 Inlet

STACK DIAMETER

PORT DIRECTION

DRY GAS METER NO.

METER CORRECTION (Y)

CALIBRATION DATE

Estimates:

MW=

%1120-

SYSTEM LEAK CHECK

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

AQE 7/92

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Page / of /

CLIENT	TEST UNIT	TEST DATE	TEST NO.	ORIFICE CORRECTION	HOT BOX NO.	Page	of
Battelle / DOE	SR Reactor D-Tet	7-22-93 (Thurs.)	N-20-CW-722	2.002	3		
	PROJECT NO. 93CD23-D		NOZZLE (SIZE, IN)	0.485	COLD BOX NO. 3		
	CONTROL BOX OPERATOR EPC		STATIC PRESSURE	17.0" H ₂ O	PROBE NO. 13-1		
	BAROMETRIC PRESSURE 29.38"		PORT DIRECTION	6.27 ft	FILTER NO. CW-655-50-1		
	TEMPERATURE		CONTROL BOX NO.	8.14	STACK DIA.		

[illegible]

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	10.01 CFM
After	4.4	10.015 CFM

PITOT LEAK CHECK		Positive	Negative
Before		0.1 / 0.44	0.0 / 0.44
After		0.1 / 0.44	0.0 / 0.44

CO2	14.0	14.0
O2	6.6	6.0
CO	0	0
N2	80.0	80.0

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	50 mL D.F. H ₂ O	584.0	528.5	56.3
2.	100 mL 0.1 M NaOH	578.2	565.5	12.7
3.	100 mL 0.1 M NaOH	457.6	439.1	18.5
4.	200 mL 5.1% Gel	668.2	658.4	9.8
5.				

Actual Moist 8.17

[illegible]

		8130 total
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AOE 2/92 /

KEYSTONE

STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE TEST DATE 7-22-93 (Thurs.) ORIFICE CORRECTION 1.802 HOT BOX NO. 7
 TEST UNIT SNOX TOWER OUTLET TEST NO. N-21-CN-722 METER CORRECTION 0.967 COLD BOX NO. 2
 PROJECT NO. 93-028-01 NOZZLE (SIZE, #) 0.75 817 CALIBRATION DATE 5-12-93 PROBE NO. 7-2
 CONTROL BOX OPERATOR STATIC PRESSURE 0.15" H₂O PITOT CORRECTION 0.84 FILTER NO.
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION D CONTROL BOX NO. 7 STACK DIA. 50" (48" x 99")

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments (with)
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
50"	13:35	000240	1.05	1.20	1.20	100	92	4.0	200	~250°F	48°F	~250°F	Single Point
			1.05	1.20	1.20	116	92	4.0	200				Isokinetic
			1.05	1.20	1.20	120	96	4.0	200				Sampling for
			1.05	1.20	1.20	120	96	4.0	200				1 hour
			1.05	1.20	1.20	120	96	4.0	200				
			1.05	1.20	1.20	120	97	4.0	200				Readings every
	14:55	010.930											10 minutes
	A=60 min	A=10.810 dcf	Q _P /A ₀ =	(ΔH) _{A0} = 1.21		(T _{meter}) _{A0} = 105°F			(T _{stack}) _{A0} = 200°F				
			1.05										
													velocity = 64.5 ft/sec
													Is. = 104.4%
													Estimates:
													MW = 29.2
													%H ₂ O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	0.012
After	7.0	0.010

PITOT LEAK CHECK 17562

	Positive	Negative
Before	OK	OK
After	OK	OK
	1	2
CO ₂	17.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Impinger No.	Impinger Content	Final	Initial	Difference
1.	10ml 0.1M NaOH	624.3	572.0	52.3
2.	10ml 0.1M NaOH	567.2	555.9	11.3
3.	10ml 0.1M NaOH	450.8	449.9	0.9
4.	200g Silica Gel	667.6	658.8	8.8
5.				

MW = 29.2

73.3g total
KEYSTONE
 ANALYTICAL SERVICES, INC.

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CLIENT DOE

TEST UNIT Bachouse SNOX

PROJECT NO. Niles

SYSTEM OPERATOR Kent Rennie

BAROMETRIC PRESSURE

TEST DATE 7/24/93

TEST NO. N-18-CN-724

SITE NO. Inlet 18

STACK DIAMETER

PORT DIRECTION

DRY GAS METER NO.

METER CORRECTION (Y)

CALIBRATION DATE

Estimates:

MW=

%1120-

SYSTEM LEAK CHECK

 $64 \frac{3}{4} \text{ min}$

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

AQE 7/92

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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~~HA-METHOD-24~~ SOURCE SAMPLING DATA SHEET

CLIENT _____ TEST DATE 7/24/93 DRY GAS METER NO. _____
TEST UNIT _____ TEST NO. _____ METER CORRECTION (Y) _____
PROJECT NO. _____ SITE NO. 17 CALIBRATION DATE _____
SYSTEM OPERATOR J Kevin Rose STACK DIAMETER _____
BAROMETRIC PRESSURE _____ PORT DIRECTION _____

[illegible]

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	18	75 cc./0.05 cc./t
After	15	62 cc./0.05 cc./t

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

good: 21 in the

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Traverse Point	Time	Dry Gas Meter Reading (dcl)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments	
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)							
	12:30	915.400	.06	1.70	1.70	89	85	1.0	690	~250°F	468°F	250°F	Single Pitot Isokinetic Sampling at 1 hour.	
			.06	1.70	1.70	108	87	2.0	682					
			.06	1.70	1.70	112	89	2.0	686					
			.06	1.70	1.70	116	95	2.0	691					
			.07	1.99	1.99	119	92	3.0	699					
	13:30	959.388	.07	1.99	1.99	120	92	3.0	695				Recheck at 10 minute	
A=60 min	Δ=43.988 dcl	(ΔP) _{avg} =0.06	(ΔH) _{avg} =1.80	(T _{meters}) _{avg} =100°F		(T _{stack}) _{avg} =691°F		velocity = 20.0 ft/sec Bo. = 103.1%						Estimates: MW=29.2 %H ₂ O=9

80.59 tax
KEYSTONE
ENVIRONMENTAL REHABILITATION

FLOW
↓

Page 1

TEST DATE 7-24-83 (Set)

1.673

7

TEST NO. N-24-CN-734

0.9912

2

NOZZLE (SIZE, #) 0.195 A17

5.19.73

2

STATIC PRESSURE 0.5" H₂O

84

PORT DIRECTION

CONTROL BOX NO.

STACK DIA. 50" (depth) x

D-151

1 2

CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Date
-----------------	----------------------	-------	---------	------

	Initial	Final	Difference
1. 100ml 0.1M NaOH	619.1	572.0	47.1
2. 10 ml 0.1M NaOH	564.8	555.4	9.4
3. Empty	450.1	449.2	0.9
4. Silver Gel	664.0	655.7	8.3
5.			

65.7% total
KEYSTONE
Industrial Mineral Services, Inc.
Actual Moisture =
1 0.7%

D-6: Aldehyde Trains

As noted in Section 3.2.4, no aldehyde samples were taken at Locations 20 and 21 on July 18, 1993. Those samples were made up by conducting two aldehyde sampling runs at those locations on July 23.

~~EPA METHOD 41~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE-VETC

TEST DATE

DRY GAS METER NO.

TEST UNIT Notes - SNOW

TEST NO. N-1B-ALD-718

METER CORRECTION (Y)

PROJECT NO.

SITE NO.

CALIBRATION DATE

SYSTEM OPERATOR Kent Rennie

STACK DIAMETER

BAROMETRIC PRESSURE

PORT DIRECTION

[illegible]

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before		
After		

FYRITE MEASUREMENTS

	Run 1	Run 2
OAS		
CO2		
O2		
CO		
N2		

Impinger
No.

**Impinger
Contents**

Final

Initial

Difference

1.				
2.				
3.				
4.				
5.				

~~FR-1 METHOD C~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE

TEST UNIT Bashiruse

PROJECT NO. Miles

SYSTEM OPERATOR Gen. Rennle

BAROMETRIC PRESSURE

TEST DATE 7/21/93

TEST NO. N-18-ALD-721

SITE NO. Inlet 18

STACK DIAMETER

PORT DIRECTION

DRY GAS METER NO.

METER CORRECTION (Y)

CALIBRATION DATE

[illegible]

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (ml/sec/min)
Before	15	.05
After		

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

AGE 7/92

Impinger
No.

Impinger Contents

Final

Initial

Difference

1.	2.	3.	4.	5.
1.				
2.				
3.				
4.				
5.				

1122: 7121143
K. Ross

N-19-ALD-721

Time	Flow ml.	Vacuum Hg	Liters	Bath Temp. F	Oven Temp. F	Notes
			Gas meter mls			
1608	40	0	0482.0	33	222	Start
1623	40	0	0490.0	33	244	15 min.
1638	40	0	0498.0	33	259	30 min.
1708	40	0	0514.32	33	253	60 min.

ALD-5

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle DOE TEST DATE 07/21/93 (WED) ORIFICE CORRECTION —
 TEST UNIT SCR Reactor Unit SITE 20 TEST NO. N-20-ALD-721 METER CORRECTION 0.9735 HOT BOX NO. NCA 3
 PROJECT NO. 93C028-01 NOZZLE (SIZE, M) 6/155 746 CALIBRATION DATE 06/14/93 COLD BOX NO. A.W. 5M
 CONTROL BOX OPERATOR M.G. STATIC PRESSURE 17.0" H₂O PITOT CORRECTION 0.84 PROBE NO. GLASS
 BAROMETRIC PRESSURE 29.28 PORT DIRECTION #2 CONTROL BOX NO. DCM-934586555 STACK DIA. —

Traverse Point (inches)	Time	Dry Gas Meter Reading (in. H ₂ O)	Pitot & P (in. H ₂ O)	Orifice & H		Motor Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
	2045	59.540		cc/min	1055	68	68	0.0	657	250	468	245	ONE POINT
					1045	68	68	0	661				
					1051	68	68	0	658				
					1035	68	68	0	645				
					1038	67	67	0	655				
					1033	67	67	0	655				
					1035	67	67	0	652				
					1035	67	67	0	653				
					1040	67	67	0	651				
					1042	67	67	0	645				
					1030	66	66	0	647				
					1033	66	66	0	643				
	2145	121.753			1025	66	66	0	645				
	A=60	Δ=62.213											Estimates:
	min	dry liters											MW= 21.2
													%H ₂ O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DCM Rate (cc/min)
Before	4.0	10.5
After	3.5	4.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	14.0	
O ₂	0.5	
CO	0	
N ₂	79.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100% DCMH	95.1	96.0	-0.9
2.	20% DCMH	95.9	95.9	0.0
3.	20% DCMH	79.9	79.4	0.5
4.	5% H ₂ O	101.9	98.5	3.4
5.				

AQE 292

KEYSTONE
ENVIRONMENTAL DESIGN, INC.

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STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Bottelle DOE TEST DATE 7-21-93 (Wed) ORIFICE CORRECTION — HOT BOX NO. 1
 TEST UNIT SNOW TOWER Outlet TEST NO. N-21-A-2-7201 METER CORRECTION 0.9993 COLD BOX NO. 1
 PROJECT NO. 93CB28-01 NOZZLE (SIZE, #) 0.196 917 CALIBRATION DATE 4-23-93 PROBE NO. 7-2
 CONTROL BOX OPERATOR TM STATIC PRESSURE 0.8" H₂O PITOT CORRECTION 0.84 FILTER NO. —
 BAROMETRIC PRESSURE 29.78 PORT DIRECTION 8 CONTROL BOX NO. Natch #500304 STACK DIA. 53" (depth) x 99"

Traverse Point (inches)	Time	Dry Gas Meter Reading (in. H ₂ O)	Pilot A P (in. H ₂ O)	Orifice A H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Baro. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
50"	20:45	6619.80		1000	cf/min	78		1.0	195	~250°F	468°F	~250°F	Single Point Sampling at 1 1/2 min for 60 min
	"			992		78		1.0	185				
	"			1002		78		1.0	195				
	"			1000		77		1.0	195				
	"			1002		78		1.0	195				
	"			1006		78		1.0	197				
	"			1004		77		1.0	197				1000 cc/min
	3'			998		77		1.0	199				
	5'			999		77		1.0	195				
	7'			999		77		1.0	195				
	9'			1001		76		1.0	197				
	10'			1001		76		1.0	197				
	21:45	6675.20											
	Δ=60 min	Δ=55.40 dry Liters				(T _{meter}) _{avg} = 77°F			(T _{stack}) _{avg} = 196°F				Estimates: MW= 29.2 %H ₂ O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/(min)
Before	6.0	< 10
After	8.0	< 10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
	1	2
CO ₂	12.0	
O ₂	7.0	
CO	0	
N ₂	81.0	

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	20 mL D ₂ O	93.8	95.8	-2.0
2.	20 mL D ₂ O	93.4	93.6	-0.2
3.	20 mL D ₂ O	79.6	79.3	0.3
4.	Sil. Gel	103.3	99.5	3.8

1.99 total
KEYSTONE
 ENVIRONMENTAL RESEARCH, INC.

Page of

CLIENT DOE

TEST UNIT Bathouse ~~Int~~ SNOX

PROJECT NO. Niles

SYSTEM OPERATOR Kent Rennie

BAROMETRIC PRESSURE

TEST DATE 7/23/93

TEST NO. N-18-MLD-723

SITE NO. Plot 18

STACK DIAMETER

PORT DIRECTION

DRY GAS METER NO.

METER CORRECTION (Y)

CALIBRATION DATE

Estimates:

MW=

%1120=

SYSTEM LEAK CHECK

Rate (cc/min)	Time (min)	Volume (cc)	Pressure (mm Hg)	Temperature (°C)	Notes
10	10	100	100	100	
20	20	200	200	200	
30	30	300	300	300	
40	40	400	400	400	
50	50	500	500	500	
60	60	600	600	600	
70	70	700	700	700	
80	80	800	800	800	
90	90	900	900	900	
100	100	1000	1000	1000	

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO ₂		
O ₂		
CO		
N ₂		

AQE 7/92

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

1. J. Kevin Rose
Bn1 X-39011 = UOST 280/01B

~0.5 L/min
Time = 60 min.

Initial Vacuum Check = ~2 min / 0.01 cu ft

Time	Vacuum (Hg)	Flow (psi)	Liters Gas Meter (mls)	Open Temp (°F)	Bath Temp (°F)
1108	0	39.5	0540.7	201	36
1128	0	39.0	0551.0	256	36
1148	0	40.0	0562.0	256	36
1208	0	40.0	0572.55	256	35

Final ~~vacuum~~ vacuum check = ~2 min / 0.01 cu ft

ALD-9

+ 25-73 (+77.)
N-20-ALD-723-1

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle DOE TEST DATE 7-23-93 (Fri.) ORIFICE CORRECTION — HOT BOX NO. 3
TEST UNIT SCR Reaction outlet TEST NO. N-20-ALD-723-1 METER CORRECTION 0.9735 COLD BOX NO. 3
PROJECT NO. 93 CB28-01 NOZZLE (SIZE, M) Glass tube CALIBRATION DATE 06/14/93 PROBE NO. —
CONTROL BOX OPERATOR M. G. STATIC PRESSURE 15.5 PITOT CORRECTION 0.84 FILTER NO. —
BAROMETRIC PRESSURE 29.38 PORT DIRECTION Port # B 3A CONTROL BOX NO. DEM93458655 STACK DIA. —

Traverse Point (inches)	Time	Dry Gas Meter Reading (in. H2O)	Pilot A/P (in. H2O)	Orifice A/H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
	1420	62.440		11,000	1065	80	80	0.0	655	280F	48F	250F	Single Point
	1425				1024	80	80	0.0	657	250	54	250	Sampling at
	1430				1056	80	80	0.0	657	250	48	255	1 1/4 min for
1435	1440				1052	81	81	0.0	656	250	43	255	60 min.
1440	1445				1018	81	81	0.0	653	255	42	253	
	1445				1031	81	81	0.0	654	255	44	255	
	1450				1031	81	81	0.0	654	255	45	255	
	1455				1034	81	81	0.0	655	255	46	255	
	1500				1021	80	80	0.0	655	256	46	255	
	1505				988	80	80	0.0	655	256	46	255	
	1510				1020	80	80	0.0	655	250	47	250	
	1515				1012	80	80	0.0	652	250	47	250	
	1520	134.280			1035	80	80	0.0	654		47		
	A=60 min	A=66.840 dry 1st run											Estimates: MW= 29.2 %H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate cal (cc/min)
Before	4.0	10.2
After	4.0	0.0

00000000	Flow
7684321	↓
AQE 2/92	

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	71.0	

Impinger No.	Contents	DPH	Final	Initial	Difference
1.	20mL DI H ₂ O		96.2	96.8	-0.6
2.	20mL DI H ₂ O		96.1	95.6	0.5
3.	20mL DI H ₂ O		79.8	79.8	0.0
4.	Silica Gel		100.7	97.4	3.3
5.					

KEYSTONE

D-160

Active Moisture 6.7% (3.2g) total

N-20-AD-723-2

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle / DOE TEST DATE 7-23-93 ORIFICE CORRECTION (ΔH_0) — HOT/COLD BOX NO. —
TEST UNIT SCR Reactor Outlet TEST NO. N-20-AD-723-2 METER CORRECTION (Y) 0.9735 PROBE NO. —
PROJECT NO. 93C028-01 NOZZLE (SIZE, M) Glass Tube CALIBRATION DATE 06/14/93 FILTER NO. —
TEST CREW MG STATIC PRESSURE 15.5" H₂O PITOT CORRECTION 0.84 STACK DIA. —
BAROMETRIC PRESSURE 29.38 PORT DIRECTION #3 CONTROL BOX NO. 84934586555 PORT SIZE —

Traverse Point (inches)	Time	Dry Gas Meter Reading (in. H ₂ O)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
	11008	140.810		21.000	1065	80	80	0.0	655	250°F	168°F	~250°F	min./point
	11013				1054	80	80	0.0	658				Single Point
	11018				1051	80	80	0.0	657		41	250	Sampling at
	11023				1048	80	80	0.0	659				4 L/min for
	11028				1041	80	80	0.0	656		42	250	600 min
	11032				1044	80	80	0.0	653		43		
	11038				1021	80	80	0.0	654		42	250	
	11043				1025	80	80	0.0	652				
	11048				1009	80	80	0.0	657		41	250	
	11053				995	80	80	0.0	656				
	11058				972	80	80	0.0	656		43	250	
	11703				1027	80	80	0.0	654				
	11708	202.595			1044	80	80	0.0	657		43		
		202.595											
	A=60 min	A=61.785 deg L/min				(T _{meter}) _{AS} = 80			(T _{stack}) _{AS} = 656°F				Estimates:
													MW= 29.2
													%H ₂ O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate cc/(in.) min
Before	4.0	0.0
After	4.0	0.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
GAS	1	2
CO ₂	14.0	
O ₂	7.0	
CO	0	
N ₂	7.0	

Impinger

No.	Contents	Final	Initial	Difference	Actual
1.	20 mL DAPH	95.2	95.3	-0.1	Moisture
2.	20 mL DAPH	95.5	95.4	0.1	
3.	20 mL DAPH	79.9	79.8	0.1	7.3%
4.	Silica Gel	100.3	97.0	3.3	
5.					

AQE 6/92

3.49%

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TEST DATE 7-23-93 (FRI.)

ORIFICE CORRECTION

HOT BOX NO.

TEST UNIT SNOW Tower Outlet

TEST NO. N-21-44-723-

METER CORRECTION 12.9993

COLD BOX NO.

PROJECT NO. 93C028-01

NOZZLE (SIZE, #) ~~1/2" 1/4" 3/8" 1/2" 3/4" 1"~~

CALIBRATION DATE 4-23-93

PROBE NO. 7-2

CONTROL BOX OPERATOR

STATIC PRESSURE 0.744

PITOT CORRECTION 0.84

FILTER NO.

BAROMETRIC PRESSURE 29.38

PORT DIRECTION

..CONTROL BOX NO. *74726* # *500304*

STACK DIA. 50" (deck) x 9'

Estimates:	
MW=	29.2
%H ₂ O=	8.5

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

Impinger	Impinger				
No.	Contents	DUPH	Final	Initial	Difference
1.	Home 2.5 1.5		96.7	97.7	-1.0
2.	20mL DUPH		92.3	93.4	-0.6
3.	20mL DUPH		79.7	79.4	0.3
4.	Silica Gel		104.2	103.4	1.8
5.					

Actual
Moisture
1.07
0.59
total

AGE 2/92

KEYSTONE
 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808 2809 2810 2811 2812 2813 2814 2815 2816 2817 2818 2819 2820 28

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N-21-AD-723-2

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING

STACK SAMPLING DATA SHEET

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CLIENT Battelle 1206 TEST DATE 7-23-93 (Fr) ORIFICE CORRECTION (ΔH) —
 TEST UNIT SVOX Tower Outlet TEST NO. N-21-AD-723-2 METER CORRECTION (Y) 0.9993 HOT/COLD BOX NO. —
 PROJECT NO. 97CP28-01 NOZZLE (SIZE, #) Glass Tube CALIBRATION DATE 4-23-93 PROBE NO. 72
 TEST CREW TMS STATIC PRESSURE 0.9" H₂O PITOT CORRECTION 0.84 FILTER NO. —
 BAROMETRIC PRESSURE 30.0 PORT DIRECTION B CONTROL BOX NO. Natch #500304 STACK DIA. 50" (depth) x 99" (width)
 PORT SIZE 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dry) (cc/min)	Pitot MP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
50"	11:10	628.20	997			80		1.0	200	120°F	160°F	~200°F	60 min./point
	11:10		1004			80		1.0	200				Single Point
			1003			80		1.0	200				Sampling at
			1000			87		1.0	202				1 1/2 min for
			1000			88		1.0	202				10 min
			999			88		1.0	202				
			1001			88		1.0	202				
			1002			88		1.0	201				
			1001			80		1.0	200				
			998			90		1.0	200				
	11:10		998			90		1.0	200				
	11:10		999			90		1.0	200				
	11:10	6545.20											
	A=120 min	A=56.00 dry L/min											Estimates:
													MW=29.2
													%H ₂ O=8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/(min)
Before	5.0	<20
After	5.0	<20

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
GAS	1	2
CO ₂	14.0	
O ₂	5.0	
CO	0	
N ₂	31.0	

Impinger

No.	20 mL Contents	Final	Initial	Difference
1.	10 mL DPH	93.5	93.2	0.3
2.	20 mL DPH	96.2	96.2	0.0
3.	20 mL DPH	79.6	79.5	0.1
4.	Silica Gel	101.8	78.3	3.5
5.				

Actual Moisture 9.0%
3.9g total

D-7: VOST Train

Note that on July 21, three additional VOST samples were run at Location 20 (N-20-VOS-721-4, -5, and -6) for the RTI audit.

VOST

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

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~~USE METHOD 24~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE-PETC

TEST UNIT Niles - SNOX

PROJECT NO. _____

SYSTEM OPERATOR Kent Rennie

BAROMETRIC PRESSURE _____

TEST DATE 7/18

TEST NO. N-18-VOS-718

SITE NO. 18

STACK DIAMETER _____

PORT DIRECTION _____

DRY GAS METER NO. _____

METER CORRECTION (Y) _____

CALIBRATION DATE _____

Traverse Point (inches)	Clock Time (min)	Dry Gas Meter Reading (dscf)	Buck Reading (cc/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°C)	Impinger Temp. (°C)	Probe Temp. (°F)	Comments
	0	384.65	T056			5	362	4	15		
	5.2	388.12	T056			3		4	17		
	0	388.40	T057			4		4	15		
	10.5	393.67	T057			3		3	13		
	0	394.26	T057			3	362	3	16		
	15	400.99	T054			3	357	3	18		
	32.1	410.19				3.25	371	4	14		
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
① Before	15	.05
② After	12	.03
③	15	.01

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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CLIENT <i>Battelle DOE</i>	TEST DATE <i>7-18-93 (Sun)</i>	ORIFICE CORRECTION (ΔH_0) <i>—</i>	HOT/COLD BOX NO. <i>—</i>
TEST UNIT <i>SCR Reactor Outlet</i>	TEST NO. <i>N-20-V05-718-1</i>	METER CORRECTION (Y) <i>0.9735</i>	PROBE NO. <i>—</i>
PROJECT NO. <i>93CD28-01</i>	NOZZLE (SIZE, θ) <i>—</i>	CALIBRATION DATE <i>06-14-93</i>	FILTER NO. <i>—</i>
TEST CREW <i>MG</i>	STATIC PRESSURE <i>+17.0" H₂O</i>	PITOT CORRECTION <i>—</i>	STACK DIA. <i>—</i>
BAROMETRIC PRESSURE <i>29.30</i>	PORT DIRECTION <i>Port #3</i>	CONTROL BOX NO. <i>93115-96555</i>	PORT SIZE <i>—</i>

PITOT LEAK CHECK

	Vacuum (in. Hg)	DOM Rate cc/(cm ² min)
Before	10.0	6.5
After	10.0	10.5

	Positive	Negative
Before		
After		

Gas	1	2
CO ₂	13.5	13.5
O ₂	6.0	6.0
CO	0	0
N ₂	80.5	80.5

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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CLIENT <i>Battelle / DOE</i>	TEST DATE <i>7-18-93 (Sun.)</i>	ORIFICE CORRECTION (ΔH_0) <i>—</i>	HOT/COLD BOX NO. <i>—</i>
TEST UNIT <i>SCR Reactor Outlet</i>	TEST NO. <i>N-20-Vas-718-2</i>	METER CORRECTION (Y) <i>0.9735</i>	PROBE NO. <i>—</i>
PROJECT NO. <i>93C-020-01</i>	NOZZLE (SIZE, θ) <i>—</i>	CALIBRATION DATE <i>06/14/93</i>	FILTER NO. <i>—</i>
TEST CREW <i>MB</i>	STATIC PRESSURE <i>17.0" H₂O</i>	PITOT CORRECTION <i>—</i>	STACK DIA. <i>—</i>
BAROMETRIC PRESSURE <i>29.30</i>	PORT DIRECTION <i>Port #3</i>	CONTROL BOX NO. <i>pgm-usb6555</i>	PORT SIZE <i>X</i>

[illegible]

PITOT LEAK CHECK

	Vacuum (in. Hg)	DOM Rate cc/(min)min
Before	10	18.7
After	10	16.5

	Positive	Negative
Before		
After		

Gas	1	2
CO ₂	13.5	13.5
O ₂	6.0	6.0
CO	0	0
N ₂	80.5	80.5

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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STACK SAMPLING DATA SHEET				Page 1 of 1
CLIENT <u>Battelle / DOE</u>	TEST DATE <u>7-18-93 (Sun)</u>	ORIFICE CORRECTION (ΔH_0) <u>—</u>	HOT/COLD BOX NO. <u>—</u>	
TEST UNIT <u>SCR Reactor outlet</u>	TEST NO. <u>N-20-VOS-718-3</u>	METER CORRECTION (Y) <u>0.9735</u>	PROBE NO. <u>—</u>	
PROJECT NO. <u>93CB28-01</u>	NOZZLE (SIZE, θ) <u>—</u>	CALIBRATION DATE <u>06/14/93</u>	FILTER NO. <u>—</u>	
TEST CREW <u>MG</u>	STATIC PRESSURE <u>17.0" H₂O</u>	PITOT CORRECTION <u>—</u>	STACK DIA. <u>—</u>	
BAROMETRIC PRESSURE <u>29.30</u>	PORT DIRECTION <u>#3</u>	CONTROL BOX NO. <u>02A-11USB655</u>	PORT SIZE <u>—</u>	

[illegible]

PITOT LEAK CHECK

	Vacuum (in. Hg)	DOM Rate cc/(min)
Before	10.0	19.5
After	10.0	18.4

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.5	13.5
O2	6.0	6.0
CO	0	0
N2	80.5	80.5

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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TEST DATE 7-12-93 (Sun)

ORIFICE CORRECTION (ΔH_o)

HOT/COLD BOX NO.

TEST NO. N-21- VDS-718-1

METER CORRECTION (Y) 0.9993

PROBE NO. 7-2

NOZZLE (SIZE, #)

CALIBRATION DATE 4-23-93

FILTER NO. _____

STATIC PRESSURE 0.9" H₂O

PITOT CORRECTION

STACK DIA. 5 1/2" (deck 1 x

BAROMETRIC PRESSURE 29.30

PORT DIRECTION

CONTROL BOX NO. Wired # 570324

PORT SIZE 59" (width)

Temp #T071
Temp #T072
Channel #TC075

↑
2% of average
flow rate

GAS	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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TEST DATE 7-18-91 (Sun)

ORIFICE CORRECTION (ΔH_o)

HOT/COLD BOX NO.

TEST UNIT *SNUX Toner Outlet*

TEST NO. N-21-VOS-71B-2

METER CORRECTION (Y) 0.9993

PROBE NO. 7-2

PROJECT NO. 9JC028-01

NOZZLE (SIZE, #)

CALIBRATION DATE 4-23-93

FILTER NO. 7-2

TEST CREW MG, JTS, TM

STATIC PRESSURE 0.9" H₂O

PITOT CORRECTION

STACK DIA. 50" (depth) x

BAROMETRIC PRESSURE 29.30

PORT DIRECTION A

CONTROL BOX NO. *Netech #500304*

PORT SIZE 99" (width)

Temp #	TP070
Temp #	+
Charal #	TC064

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

↑
2% of average
flow rate

OAS	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

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CLIENT Bethell/DUE TEST DATE 7-18-93 (Sun) ORIFICE CORRECTION (ΔH_0) — HOT/COLD BOX NO. —
 TEST UNIT SVOX Tower Outlet TEST NO. N-21-VOS-718-3 METER CORRECTION (V) 0.9993 PROBE NO. 7-2
 PROJECT NO. 93-0220-01 NOZZLE (SIZE, #) — CALIBRATION DATE 4-23-93 FILTER NO. —
 TEST CREW JPS STATIC PRESSURE 0.9" H₂O PITOT CORRECTION — STACK DIA. 50" (depth) R
 BAROMETRIC PRESSURE 29.30 PORT DIRECTION A CONTROL BOX NO. Nitech #500304 PORT SIZE 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (SCFH)	Pilot ΔP (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
	1924	6554.55		0.54/min		87		5.0		250°F		250°F	30 min./point
	1934					89		5.0					VST Tube #3
	1944					90		5.0					0.5 4/min
	1954	6567.00				92		5.0					30 min run
	$\Delta = 30$ min	$\Delta = 12.45$ dry Liters				Tanks $\Delta H = 91^\circ F$							Tenax # TP72
													Tenax # TP72
													Channel # TP66
													Estimates:
													MW = 29.2
													%H ₂ O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DM Rate cc/(dm) min
Before	10.0	10
After	7.0	10

2% of average flow rate

PITOT LEAK CHECK

	Positive	Negative
Before		
After		
GAS	1	2
CO ₂	13.0	
O ₂	5.0	
CO	0	
N ₂	82.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 6/92

D-172

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

Page of

~~TEST METHOD~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE TEST DATE 7/21/92 DRY GAS METER NO. _____
TEST UNIT Baghouse / SNOX TEST NO. N-18-VOS-721 METER CORRECTION (Y) _____
PROJECT NO. Nile SITE NO. Inlet 18 CALIBRATION DATE _____
SYSTEM OPERATOR Kent Rennie STACK DIAMETER _____
BAROMETRIC PRESSURE _____ PORT DIRECTION _____

Traverse Point Sample Name (inches)	Clock Time	Dry Gas Meter Reading (dcl)	Buck Reading Flow rate (lit per min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. Ice Bath °C (°F)	Impinger Temp. Condenser °C (°F)	Probe Temp. (°F)	Comments
A	T065	13:50	489.70	.75 lit/min		3.5	367	3	17	160	
	TC063	13:55		.53		3.0	367	3	16	171	
	End		493.53								
B	T062	14:12	494.35	.49 lit/min		3.0	369	3	14	162	
	TC061	14:17	497.07	.65		3.0	367	3	14	171	
		14:22	499.93	.44		3.0	368	3	13	186	
	End		500.35								
C	T064	14:35	500.42	.40 lit/min		3.0	370	3	14	186	
	TC062	14:45	505.31	.57 lit/min		3.2	369	5	13	195	
		14:56	511.11	.48		3.0	367	5	14	209	Estimates:
		15:06	516.19	.40		3.2	370	6	13	209	MW=
	End		517.17								%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)	
Before	15	.01	5 min run
After	15	.01	10 " "
	15	.01	30 " "

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

N-19-V-921

5, 10, 30 min. run. VOST
K. Rose
7/21/93

Time hh:mm	Path Temp. °C	Flow meter rds.	Column Temp. °C	Vacuum H _g	Gas Meter Start Stop	
30 sec.					0442.8	5 min Run
1335	14	38	29	3.8	0443.0	
Top 1340	16	39.0	29	3.8	0445.95	
START 1353	17	40	26	3.0	0447.0 START	
1358	14	40	27	3.0	0448.32	
Top 1403	14	40	28	3.0	0450.0	10 min. Run
					0452.32	Stop
START 1416	15	40	26	3.0	0453.0 Start	
1422	14	40	27	3.0	0456.0	7 min Run
1431	14	40	28	3.0	0460.0	
1441	14	40	27	4.5	0466.0	Ran for 53 min
1459	13	40	27	3.5	0475.0	
1508	14	39	27	5.0	0475.0	
1510	14	39	27	5.0	0480.0	
					0480.75	Stop

STACK SAMPLING DATA SHEET

Page 1 of 1

STACK SAMPLING DATA SHEET				Page 1 of 1
CLIENT <u>Battelle / DOE</u>	TEST DATE <u>7-24-73</u> (Wed.)	ORIFICE CORRECTION <u>0.9735</u>	HOT BOX NO. <u>3</u>	
TEST UNIT <u>SCR Reactor Outlet</u>	TEST NO. <u>AL-20-V05-720-1</u>	METER CORRECTION <u>0.6/14/93</u>	COLD BOX NO. <u>3</u>	
PROJECT NO. <u>93CB2B-01</u>	NOZZLE (SIZE, M) <u>610SS tube</u>	CALIBRATION DATE <u>06/14/93</u>	PROBE NO. <u>5-0</u>	
CONTROL BOX OPERATOR <u>M.C.</u>	STATIC PRESSURE <u>17.0" H₂O</u>	PITOT CORRECTION	FILTER NO. <u>None</u>	
BAROMETRIC PRESSURE <u>29.28</u>	PORT DIRECTION <u>#4</u>	CONTROL BOX NO. <u>DCM-9345B6533</u>	STACK DIA.	

[illegible]

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/(min)
Before	10.0	0.0
After	10.0	3.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger

Impinger

Final

Initial

Difference

Q. No.	Topic	Answer	Marking	Mark
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE
INTERNATIONAL SERVICES, INC.

Page 1 of 1

CLIENT <u>Battelle/DOE</u>	TEST DATE <u>7-24-93 (Wed.)</u>	ORIFICE CORRECTION <u>—</u>	HOT BOX NO. <u>3</u>
TEST UNIT <u>SCR Reactor Outlet</u>	TEST NO. <u>N-20-VAS-724-2</u>	METER CORRECTION <u>0.9735</u>	COLD BOX NO. <u>3</u>
PROJECT NO. <u>93CB28-01</u>	NOZZLE (SIZE, M) <u>GLASS Tube</u>	CALIBRATION DATE <u>06/14/93</u>	PROBE NO. <u>5-0</u>
CONTROL BOX OPERATOR <u>M.G</u>	STATIC PRESSURE <u>17.2" H₂O</u>	PITOT CORRECTION <u>0.84</u>	FILTER NO. <u>NONE</u>
BAROMETRIC PRESSURE <u>29.28</u>	PORT DIRECTION <u>6#</u>	CONTROL BOX NO. <u>DEM-93458655</u>	STACK DIA. <u></u>

[illegible]

PITOT LEAK CHECK

	Vacuum (in. Hg)	DOM Rate <i>cc/(min) min</i>
Before	10.0	0.0
After	10.0	0.0

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger

Impinger

No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

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ESTABLISHED 1948

Page 1 of 1

TEST DATE 7-21-93 (Wag.)
D.S.

ORIFICE CORRECTION

HOT BOX NO. 3

TEST UNIT SCR Reactor Outlet

TEST NO. N-20-V05-721-3

METER CORRECTION 0.9735

COLD BOX NO. 3

PROJECT NO. 93C020-01

NOZZLE (SIZE, #) 8/35 Tube
 STATIC PRESSURE 17.8"

CALIBRATION DATE 6-14-93

PROBE NO. 5-6

CONTROL BOX OPERATOR MB

STATIC PRESSURE 17.0" H₂O

PITOT CORRECTION	0.84
------------------	------

FILTER NO. 11

BAROMETRIC PRESSURE 29.28

PORT DIRECTION #6

CONTROL BOX NO. DEM-934586533

STACK DIA.

Tenax #	
T068	
TC069	← Tenax + Charcoal #

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

Page 1 of 1

CLIENT <u>Battelle/DOE</u>	TEST DATE <u>07/21/93</u>	ORIFICE CORRECTION <u>—</u>	HOT BOX NO. <u>3</u>
TEST UNIT <u>See Reactor Output</u>	TEST NO. <u>N-20-VOS-721-4</u>	METER CORRECTION <u>0.9735</u>	COLD BOX NO. <u>3</u>
PROJECT NO. <u>93C028-01</u>	NOZZLE (SIZE, #) <u>—</u>	CALIBRATION DATE <u>06/14/93</u>	PROBE NO. <u>5-0</u>
CONTROL BOX OPERATOR <u>MC</u>	STATIC PRESSURE <u>17" H₂O</u>	PITOT CORRECTION <u>—</u>	FILTER NO. <u>—</u>
BAROMETRIC PRESSURE <u>29.28</u>	PORT DIRECTION <u>#6</u>	CONTROL BOX NO. <u>06M-934586355</u>	STACK DIA. <u>—</u>

[illegible]

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

Page 2 of 2

CLIENT <u>Battelle DOE</u>	TEST DATE <u>07/21/93</u>	ORIFICE CORRECTION <u>—</u>	HOT BOX NO. <u>3</u>
TEST UNIT <u>SEE Remarks</u>	TEST NO. <u>N-20-VOS-721-5</u>	METER CORRECTION <u>0.9735</u>	COLD BOX NO. <u>3</u>
PROJECT NO. <u>93C820-01</u>	NOZZLE (SIZE, #) <u>—</u>	CALIBRATION DATE <u>06/14/93</u>	PROBE NO. <u>5-0</u>
CONTROL BOX OPERATOR <u>M. G.</u>	STATIC PRESSURE <u>17.460</u>	PITOT CORRECTION <u>—</u>	FILTER NO. <u>—</u>
BAROMETRIC PRESSURE <u>29.28</u>	PORT DIRECTION <u>#6</u>	CONTROL BOX NO. <u>06N-93458433</u>	STACK DIA. <u>—</u>

[illegible]

PITOT LEAK CHECK

	Vacuum (in. Hg)	DGM Rate <i>cc/min</i> (close)
Before	10.0	3.2
After	10.0	0.0

	Positive	Negative
Before		
After		

CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

D-179

Page / of /

CLIENT <u>Battelle/DOE</u>	TEST DATE <u>07/21/93</u>	ORIFICE CORRECTION <u>—</u>	HOT BOX NO. <u>3</u>
TEST UNIT <u>SR Reactor 0767</u>	TEST NO. <u>N-20-V03-721-6</u>	METER CORRECTION <u>0.9735</u>	COLD BOX NO. <u>J</u>
PROJECT NO. <u>93C028-2</u>	NOZZLE (SIZE, #) <u>—</u>	CALIBRATION DATE <u>06/14/93</u>	PROBE NO. <u>5-4</u>
CONTROL BOX OPERATOR <u>M.G.</u>	STATIC PRESSURE <u>17.45</u>	PITOT CORRECTION <u>—</u>	FILTER NO. <u>—</u>
BAROMETRIC PRESSURE <u>29.28</u>	PORT DIRECTION <u>#6</u>	CONTROL BOX NO. <u>06m-93458135</u>	STACK DIA. <u>20</u>

[illegible]

PITOT LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cc/min)
Before	10.0	5.5
After	10.0	7.7

	Positive	Negative
Before		
After		

CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

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STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle DOE TEST DATE 7-21-93 (Wet.) ORIFICE CORRECTION —
 TEST UNIT Solar Tower Outlet TEST NO. N-21-105-724-1 METER CORRECTION 0.9993 HOT BOX NO. —
 PROJECT NO. 93CB28-B1 NOZZLE (SIZE, #) — CALIBRATION DATE 4-23-93 COLD BOX NO. —
 CONTROL BOX OPERATOR JPS STATIC PRESSURE 0.8" H₂O PITOT CORRECTION — PROBE NO. 7-2
 BAROMETRIC PRESSURE 29.78 PORT DIRECTION D CONTROL BOX NO. Notch #500304 FILTER NO. —
 STACK DIA. 50" (dph) x

Traverse Point (inches)	Time	Dry Gas Meter Reading (dry 1000 L/min)	Pilot & P (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
	1526	6578.37		500 cfm		89		3.0		250°			5 min run - Vost Tube #1
	1531	6580.20				90		3.0					0.5 L/min
	A=5 min	A=1.83 dry L/min				(Stack Temp) = 90°F							
													Trax # T007A
													Trax + Orifice #
													T0.032A
													Estimates:
													MW=29.2
													%H ₂ O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate cc/(min) min
Before	10	< 10
After	10	< 10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂		
O ₂		
CO		
N ₂		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

Page 1 of 1

CLIENT <i>Bottle/DOE</i>	TEST DATE <i>7-28-93 (Wed)</i>	ORIFICE CORRECTION <i>---</i>	HOT BOX NO. <i>---</i>
TEST UNIT <i>SNOW TOWER OUTLET</i>	TEST NO. <i>N-21-V05-728-2</i>	METER CORRECTION <i>0.9993</i>	COLD BOX NO. <i>---</i>
PROJECT NO. <i>93C028-01</i>	NOZZLE (SIZE, θ) <i>---</i>	CALIBRATION DATE <i>4-23-93</i>	PROBE NO. <i>72</i>
CONTROL BOX OPERATOR <i>JHS</i>	STATIC PRESSURE <i>0.8" H₂O</i>	PITOT CORRECTION <i>---</i>	FILTER NO. <i>---</i>
BAROMETRIC PRESSURE <i>29.28</i>	PORT DIRECTION <i>D</i>	CONTROL BOX NO. <i>Natch #500304</i>	STACK DIA. <i>50" (depth) X</i>

[illegible]

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

CO2		
O2		
CO		
N2		

Impinger Contents

1.				
2.				
3.				
4.				
5.

KEYSTONE
 1000 10th Avenue, Suite 1000, Denver, CO 80202

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle / DOE TEST DATE 7-24-93 (Wed) ORIFICE CORRECTION HOT BOX NO.
 TEST UNIT SNOW TOWER outlet TEST NO. N-21-V05-724-3 METER CORRECTION 0.9993 COLD BOX NO.
 PROJECT NO. 93C028-01 NOZZLE (SIZE, #) CALIBRATION DATE 4-23-92 PROBE NO. 7-2
 CONTROL BOX OPERATOR JS STATIC PRESSURE 0.8" H₂O PITOT CORRECTION FILTER NO.
 BAROMETRIC PRESSURE 29.28 PORT DIRECTION D CONTROL BOX NO. Natch #500304 STACK DIA. 50" (dip #) x

Traverse Point (inches)	Time	Dry Gas Meter Reading (in. H ₂ O)	Pitot & P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
	1657	6596.33		500 cc/min		89		3.0		250°F			30 min run
	1702					88		3.0					V05 TUBE #3
	1707					87		3.0					0.5 L/min
	1712					86		3.0					
	1717					85		3.0					
	1722					85		3.0					TERRA # T.D. 3/A
	1727	6616.50				85		3.0					TERRA and OROVAL # TC-034/A
	Δ=30 min	Δ=15.17 dry Liters											Estimates:
													MW= 29.2
													%H ₂ O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate cc/(1 min)
Before	10	<10
After	10	<10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂		
O ₂		
CO		
N ₂		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

N-18-VOS-723

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
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Page of

CLIENT DOE

TEST UNIT Bacharach SNOX

PROJECT NO. Niles

SYSTEM OPERATOR Kent Rennie

BAROMETRIC PRESSURE

TEST DATE 7/23/93

TEST NO. N-18-VOS-723

SITE NO. Inlet 18

STACK DIAMETER

PORT DIRECTION

DRY GAS METER NO.

METER CORRECTION (Y)

CALIBRATION DATE

Inverse Port Sample Name (inches)	Clock Time	Dry Gas Meter Reading (dcl)	Buck Flow Reading rate (l/min)(cc/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Impinger Temp. Condenser °C (°F)	Impinger Temp. Dry Bath °C (°F)	Probe Temp. (°F)	Comments
TD15A	9:30	581.52		.3	18	3	360	14	2	87	
TC017A	9:32	582.36	.53	.3		3	364	16	2	94	
	9:35	583.97	.59	.3		3	366	16	2	102	
	End	585.02									
		NR									
TD12A	9:55	585.38	.41	.3		3	363	14	2	147	
TC039A	10:00	588.00	.59	.3		3	362	13	3	155	
	10:05	590.58	.58	.3		3	357	12	3	169	
	End	591.46									
TC008A	10:20	591.59	.52	.3		3	364	12	4	183	
TC005A	10:30	597.18	.49	.3		3	365	10	4	192	Estimates:
	10:40	602.65	NR 600.50	.3		3	367	9	3	200	MW=
End	10:50	608.95	.49	.3		3	366	12	4	198	%1120=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)(l/min)	
Before	17	.015	1st run
After	16	.01	2nd run
	15	.01	3rd run

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

D-184

	STRAIT	FINCH
0953	0524.50	0540.50
1000	0528.00	0536.00
1014		
1023		
	21	23
	2.0	3.2
	39.0	39.5
		37.0
		39.5

Station	Depth (m)	Time (min)	Notes
0934	0518.80	8	20
0935	0518.80	8	20
0940	0522.00	8	20
0945	0524.24	8	20
5.44 sec			
240000/0.1 sec.			
0945	0524.24	8	20
0940	0522.00	8	20
0935	0518.80	8	20
0934	0518.80	8	20

[illegible]

BM I
X-39011
UOST 280/012

5
10
30

750 = 7006

STACK SAMPLING DATA SHEET

STACK SAMPLING DATA SHEET			
CLIENT <i>Bottle Lake</i>	TEST DATE <i>7-23-93 (Fri.)</i>	ORIFICE CORRECTION <i>—</i>	HOT BOX NO. <i>3</i>
TEST UNIT <i>SR Reactor Unit</i>	TEST NO. <i>N-20-VOS-723-1</i>	METER CORRECTION <i>0.9735</i>	COLD BOX NO. <i>—</i>
PROJECT NO. <i>92-028-01</i>	NOZZLE (SIZE, M) <i>GLASS</i>	CALIBRATION DATE <i>06/14/93</i>	PROBE NO. <i>—</i>
CONTROL BOX OPERATOR <i>MG</i>	STATIC PRESSURE <i>15.0" H₂O</i>	PITOT CORRECTION <i>—</i>	FILTER NO. <i>—</i>
BAROMETRIC PRESSURE <i>29.38</i>	PORT DIRECTION <i>#6</i>	CONTROL BOX NO. <i>06m-493-59/535</i>	STACK DIA. <i>—</i>

[illegible]

	in. Hg	Rate (cc/min)
Before	10.0	3.0
After	10.0	3.0

	1	2
CO2	14.0	
O2	7.0	
CO	6	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

PITOT LEAK CHECK	
POS.	NEG.

KEYSTONE
INSTRUMENTAL CONSULTANTS, INC.

STACK SAMPLING DATA SHEET

CLIENT Bartell / WE

TEST UNIT SEP Reactor outlet

PROJECT NO. 93C 28-01

CONTROL BOX OPERATOR

BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri.)

TEST NO. N-20-405-723-2

NOZZLE (SIZE, #) GLASS

STATIC PRESSURE 15.0740

PORT DIRECTION *W*

ORIFICE CORRECTION

METER CORRECTION 0.9735

CALIBRATION DATE 06/14/93

PITOT CORRECTION

CONTROL BOX NO. D 6M-434586555

HOT BOX NO. 3

COLD BOX NO.

PROBE NO.

FILTER NO. —

STACK DIA.

[illegible]

LEAK CHECK

	in. Hg	Rate (mm)
Before	10.0	5.0
After	10.0	2.0

PITOT LEAK CHECK

POS.	NEG.

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

KEYSTONE
ENVIRONMENTAL REMEDIES, INC.

STACK SAMPLING DATA SHEET

CLIENT Bottleke / DOE
TEST UNIT Sr Reactor Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR MG
BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri.)
TEST NO. N-20-V05-723-3
NOZZLE (SIZE, M) 60/AS S
STATIC PRESSURE 17.0" H₂O
PORT DIRECTION #6

ORIFICE CORRECTION _____
METER CORRECTION 0.9735
CALIBRATION DATE 06/14/93
PITOT CORRECTION _____
CONTROL BOX NO. D6A-9345865

HOT BOX NO. 3
COLD BOX NO. —
PROBE NO. —
FILTER NO. —
STACK DIA. —

[illegible]

	in. Hg	Rate (cc/min)
Before	10.0	2.0
After	10.0	0.0

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

PITOT LEAK CHECK

POS.	NEG.

KEYSTONE
INSTRUMENTAL REPAIR, INC.

Page 1 of 1

STATION SAMPLING DATA SHEET				Page 1 of 1
CLIENT <u>Bottle / etc</u>	TEST DATE <u>7-23-93 (Fri)</u>	ORIFICE CORRECTION <u>—</u>	HOT BOX NO. <u>—</u>	
TEST UNIT <u>SNOW TOWER W/LET</u>	TEST NO. <u>N-21-V45-723-1</u>	METER CORRECTION <u>0.9993</u>	COLD BOX NO. <u>—</u>	
PROJECT NO. <u>93CB28-01</u>	NOZZLE (SIZE, #) <u>—</u>	CALIBRATION DATE <u>1-23-93</u>	PROBE NO. <u>7-2</u>	
CONTROL BOX OPERATOR <u>—</u>	STATIC PRESSURE <u>0.7450</u>	PITOT CORRECTION <u>—</u>	FILTER NO. <u>—</u>	
BAROMETRIC PRESSURE <u>29.38</u>	PORT DIRECTION <u>D</u>	CONTROL BOX NO. <u>note #500304</u>	STACK DIA. <u>50" (deck) x 99</u>	

[illegible]

PITOT LEAK CHECK

	Vacuum (in. Hg)	DGM Rate. cc/(min)
Before	10	< 10
After	10	< 10

	Positive	Negative
Before		
After		

CO2	14.0	
O2	5.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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STACK SAMPLING DATA SHEET		Page 1 of 1	
CLIENT <i>Boyle Bros</i>	TEST DATE <i>7-23-93 (Fri)</i>	ORIFICE CORRECTION <i>—</i>	HOT BOX NO. <i>—</i>
TEST UNIT <i>SNOX Tube Unit</i>	TEST NO. <i>N-21-Y05-723-2</i>	METER CORRECTION <i>0.9993</i>	COLD BOX NO. <i>—</i>
PROJECT NO. <i>93C0281-01</i>	NOZZLE (SIZE, #) <i>—</i>	CALIBRATION DATE <i>4-21-93</i>	PROBE NO. <i>4-2</i>
CONTROL BOX OPERATOR <i>TPD</i>	STATIC PRESSURE <i>0.77650</i>	PITOT CORRECTION <i>—</i>	FILTER NO. <i>—</i>
BAROMETRIC PRESSURE <i>29.38</i>	PORT DIRECTION <i>—</i>		

Traverse Point (feet)	Time	Dry Gas Meter Reading	Pilot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Suck Temp. (°F)	Probe Temp. (°F)	Hot Box Temp. (°F)	Combined Wind
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)					
		Dry 6690.19		80 cfm/min		87		4.0	88°F	88°F	~23°F	VOST TUBE #
	1019	6690.19				85		4.0				10 min ON at 0.54 pm
	1024	6695.93				86		4.0				
	A=10 min	Δ = 5.76 dry liter				(Inductive) = 85°F						
												Taper # TP434
												Therm & Control # TC-019A
												Estimate:
												MW = 312
												% H ₂ O = 8.5

SYSTEM LEAK CHECK		
	Vacuum (in. Hg)	DOM Rate
Before	10	<10
After	10	<10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

CO2	14.0
O2	5.0
CO	0
N2	81.0

Impinger	Impinger
----------	----------

No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Bethell / DE TEST DATE 7-23-93 (Fri.) ORIFICE CORRECTION HOT BOX NO.
 TEST UNIT SNOW Level out let TEST NO. N-21-VOS-723-3 METER CORRECTION 0.9993 COLD BOX NO.
 PROJECT NO. 73 C02B-01 NOZZLE (SIZE, #) CALIBRATION DATE 4-23-93 PROBE NO. 7.2
 CONTROL BOX OPERATOR JP STATIC PRESSURE 0.7" H₂O PITOT CORRECTION FILTER NO.
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION B CONTROL BOX NO. Notch #505204 STACK DIA. 60" (depth) x 60"

Traverse Point (inches)	Time	Dry Gas Meter Reading (in. H ₂ O)	Pilot A P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments (with)
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
	1140	6708.73		500 u/min		81		4.0		-250°F	468°F	-250°F	VOST Tube #2
	1145					83		3.0					30 min run at 0.5 u/min
	1150					83		3.0					
	1155					83		3.0					
	1200					83		3.0					
	1205					83		3.0					
	1210	6724.52				84		3.0					Tank # TP40A Temp & Chemical # TC022A
	Δ=30 min	Δ=15.79 dry Liter				(T _{stack}) = 83°F							Estimates: MW=29.2 %H ₂ O=8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cc/min)
Before	10	<10
After	10	<10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	14.0	
O ₂	5.0	
CO	0	
N ₂	81.0	

Impinger

Impinger No.	Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

D-8: HEST Samples

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PARTICULATE ELD DATA

N-18-H-719

PLANT Niles
 DATE 7-19
 LOCATION BH IN HEST
 OPERATOR Webb / Cox
 STACK NO. _____
 RUN NO. 1 HEST
 SAMPLE BOX NO. _____
 METER BOX NO. _____

AMBIENT TEMPERATURE 90
 BAROMETRIC PRESSURE 28.96
 ASSUMED MOISTURE, % _____
 PROBE LENGTH, in. 9' 10 8"
 NOZZLE DIAMETER, in. _____
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250 F
 HEATER BOX SETTING 250 F

METER $\frac{1}{16}$ _____
 C FACTOR _____
 PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	Time STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), ft/min	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O) ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (T _{m,in}), °F OUTLET (T _{m,out}), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Probe VELOCITY ft/min
	0	15:48				422.9		201			266
		16:03				430.3					
		16:10				437.5		211			203
		16:44				465.7		130?	Power failed?		183.8
		16:55				479.0		195			287
		17:18				490.7		302			207
		17:33				500.0	102	275			282
		17:45				510.1	102	287			
		18:13				527.9		295			
		18:27				536.2					
		18:46				548.8					
		18:50	Stop			551.6	101	99	298		283
						522.9					
						128.78					
TOTAL											
AVERAGE											

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT				
FINAL	1	2	3	4		TIME	CO ₂	O ₂	CO	N ₂
INITIAL						1				
LIQUID COLLECTED						2				
TOTAL VOLUME COLLECTED						3				
						4				

COMMENTS

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PARTICULATE ELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT Miles, Ohio Sneyd AMBIENT TEMPERATURE _____
 DATE 7/19/93 BAROMETRIC PRESSURE _____
 LOCATION outlet of bag house ASSUMED MOISTURE, % _____
 OPERATOR Lemard PROBE LENGTH, in. 540 S.S.
 STACK NO. _____ NOZZLE DIAMETER, in. 0.180
 RUN NO. N-19-HST-719 STACK DIAMETER, in. _____
 SAMPLE BOX NO. _____ PROBE HEATER SETTING _____
 METER BOX NO. _____ HEATER BOX SETTING 250°F

METER IN, _____

C FACTOR _____

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL _____		

TRAVERSE POINT NUMBER	SAMPLING TIME (h), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s),	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY ft/s
					ACTUAL	DESIRED		INLET (T _{m,in}), °F	OUTLET (T _{m,out}), °F				
	<u>0/16:32</u>						<u>1037.662</u>						
	<u>0/16:43</u>		<u>381</u>				<u>183.722</u>			<u>289</u>			
	<u>10/16:53</u>		<u>382</u>				<u>194.3</u>			<u>273</u>			
	<u>20/17:03</u>		<u>382</u>				<u>203.4</u>			<u>255</u>			
	<u>30/17:13</u>		<u>382</u>				<u>213.3</u>			<u>248</u>			
	<u>40/17:23</u>		<u>382</u>				<u>223.5</u>			<u>242</u>			
	<u>50/18:03</u>		<u>382</u>				<u>266.7</u>			<u>261</u>			
	<u>110/18:33</u>		<u>381</u>				<u>290.2</u>			<u>255</u>			
	<u>160/19:23</u>		<u>381</u>				<u>329.5</u>			<u>263</u>			
	<u>185/19:48</u>						<u>360.473</u>						
							<u>183.722</u>						
							<u>176.701</u>						
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂	COMMENTS
	1	2	3	4								
FINAL												
INITIAL												
LIQUID COLLECTED												
TOTAL VOLUME COLLECTED												

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle DOE TEST DATE 7-19-93 (Mon.) ORIFICE CORRECTION (ΔH_0) 2.002 HOT/COLD BOX NO. 1
 TEST UNIT SCR Reactor Outlet TEST NO. N-20-1025-717 METER CORRECTION (Y) 0.9812 PROBE NO. 13-2
 PROJECT NO. 93C028-01 NOZZLE (SIZE, #) 0.4414 CALIBRATION DATE 06-08-93 FILTER NO. 9302543
 TEST CREW RPC STATIC PRESSURE 17.0" H₂O PITOT CORRECTION 0.84 STACK DIA. 4"
 BAROMETRIC PRESSURE 29.80 PORT DIRECTION 10.5° E CONTROL BOX NO. SIX PORT SIZE 36

Traverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pitot ΔP (in. H ₂ O)	Orifice ΔH		Motor Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
				Required (in. H ₂ O)	Actual (in. H ₂ O)	In (°F)	Out (°F)						
	18:17	160.255	1.03	1.03	1.03	92	92	5.0	656	~250°F	~68°F	~250°F	240 min./point
10				1.50	1.50	105	91	9.0	650				Single Point
				1.50	1.50	109	92	9.0	636				Non-Isokinetic
				1.50	1.50	114	96	9.5	651				Sampling for
				1.50	1.50	117	99	10.5	651				X-Holms
				1.50	1.50	117	99	10.5	635				3 hrs. as per Battelle
				1.50	1.50	117	99	11.0	629				Readings every
				1.50	1.50	115	100	11.5	626				10 minutes
				1.50	1.50	115	99	11.5	624				
				1.50	1.50	115	100	11.5	636				Filter #9302543
				1.50	1.50	116	100	11.5	639				#93 H54
				1.50	1.50	116	100	11.5	640				#93 H55
				1.50	1.50	116	99	11.5	641				
				1.50	1.50	116	99	12.0	630				
				1.50	1.50	114	98	12.0	629				
				1.50	1.50	113	98	12.0	629				Estimates:
				1.50	1.50	112	97	12.0	620				MW= 29.2
	21:17	285.116		1.50	1.50	112	97	12.0	609				%H ₂ O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	20.05 cfm
After	13.0	20.95 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO ₂	13.0	13.0
O ₂	6.0	6.0
CO	0	0
N ₂	81.0	81.0

Impinger

No.	Contents	Final	Initial	Difference
1.	100 mL D.F. 6.0	725.0	548.8	176.2
2.	100 mL D.F. 6.0	489.9	462.9	27.0
3.	Empty	439.3	435.9	3.4
4.	200 g silica gel	687.2	660.0	27.2
5.				

00000000 FLOW
764321
10"

TME = 8180 min
 $114.14 \text{ m}^3 = 124.861 \text{ scf}$
 $(\Delta H)_{avg} = 1.47$
 $T_{meter}/avg = 105^\circ\text{F}$
 $(T_{air}/avg) = 1.35^\circ\text{F}$

~~Filter~~

233.8 g tota
 AQE 6/92
 Actual
 Moisture = 9.0%

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle/DOL TEST DATE 7-17-83 (Mon) ORIFICE CORRECTION 1.802 HOT BOX NO. 2
 TEST UNIT NOX TOWER OUTLET TEST NO. N-21-H-719 METER CORRECTION 9.7619 COLD BOX NO. 2
 PROJECT NO. 290028-01 NOZZLE (SIZE, #) 1/4" Stack CALIBRATION DATE 3-17-83 PROBE NO. 10-1
 CONTROL BOX OPERATOR TM STATIC PRESSURE 0.35" H₂O PITOT CORRECTION 0.84 FILTER NO. 93M26
 BAROMETRIC PRESSURE 29.10 PORT DIRECTION A CONTROL BOX NO. 7 STACK DIA. 77" 1/4" DIA

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
50"	17:55	786.5 CB	1.25	1.30	1.30	98	90	20.0	202	-250°F	-65°F	-250°F	210 min/at
	01		1.30	1.30	1.20	100	92	20.0	202				Single PT.
	13		1.30	1.15	1.15	110	96	20.0	202				NH ₃ 170
	25		1.30	1.15	1.15	110	96	20.0	202				Temp F.R.
	37		1.30	1.15	1.15	110	96	20.0	202				3# H ₂ S
	49		1.25	1.30	1.30	110	96	20.0	202				
	17:25		1.30	1.30	1.30	111	98	20.0	202				10 min
	03		1.30	1.30	1.30	114	98	20.0	202				Reading
	15		1.30	1.40	1.40	114	100	19.5	202				
	27		1.30	1.60	1.60	115	100	19.5	202				Filter #93027
	39		1.25	1.70	1.70	115	102	19.5	202				#93M26
	51		1.25	1.75	1.75	115	100	19.0	202				#93M26
	17:35		1.25	1.50	1.50	120	100	15.0	202				
	07		1.30	1.50	1.50	125	100	14.0	202				
	19		1.30	1.50	1.50	125	102	13.0	202				Estimates:
	31		1.25	1.50	1.50	125	102	12.5	202				MW= 29.7
	43		1.30	1.50	1.50	126	102	11.5	202				%H ₂ O= 8.5
	55	917.680	1.30	1.50	1.50	126	102	11.0	202				

SYSTEM LEAK CHECK P755

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	5.08
After	20.0	5.16

TUNE = 180 min
 VOLUME = 131.180 dcf
 AQE 2992 (AP) AVG = 1.30

PITOT LEAK CHECK P755

	Positive	Negative
Before	OK	OK
After	OK	OK

	1	2
CO ₂	13.0	
O ₂	6.0	
CO	0	
N ₂	81.0	

Temp Avg = 202°F

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 mL H ₂ O	665.0	547.5	117.5
2.	100 mL H ₂ O	573.1	537.4	35.7
3.	empty	465.6	444.7	20.9
4.	200 mL H ₂ O	676.0	640.3	35.7
5.				

velocity = 72.2 ft/sec

209.89 total
KEYSTONE
 INDUSTRIAL SERVICES, INC.

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PARTICULATE FIELD DATA

N-18-H-722

PLANT _____
 DATE 7-22-93
 LOCATION BH IN #18
 OPERATOR Webb
 STACK NO. _____
 RUN NO. 2 NEST (Ver)
 SAMPLE BOX NO. _____
 METER BOX NO. _____

AMBIENT TEMPERATURE 80
 BAROMETRIC PRESSURE 29.20
 ASSUMED MOISTURE, % _____
 PROBE LENGTH, in. _____
 NOZZLE DIAMETER, in. _____
 STACK DIAMETER, in. 80
 PROBE HEATER SETTING 250
 HEATER BOX SETTING 250

METER ΔH_g _____
 C FACTOR _____

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, m

SAMPLE	FILTER	PROBE W
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (h), min	Time	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s), ft/s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER (T _m), °F		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Pro
						ACTUAL	DESIRED		INLET (T _m _{in}), °F	OUTLET (T _m _{out}), °F				
	0	13:04						551.465						
		13:48		396-400				551.465						
		14:30		V				580.90	96	83	287			326
		14:51						609.5	95	84	285			327
		15:10						626.7	99	84	280			316
		15:30						640.6					5	
		15:42						656.9	113	87	256		10	307
		16:10		stop				668.9	114	88	242		12	303
								690.10						
								551.465						
								738.633						
TOTAL														
AVERAGE														

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₁	O ₁	CO	N
	1	2	3	4							
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS: Atk. change condenser #
Imp drained
Leak check at 12:17 = .065 c/s
Leak check at 10:12 = .065 c/s

127 cu. ft.

PARTICULATE FIELD DATA

PLANT Niles, Ohio SNOC process AMBIENT TEMPERATURE 79
 DATE 7/22/93 BAROMETRIC PRESSURE 29.20
 LOCATION outlet of baghouse ASSUMED MOISTURE, % 7
 OPERATOR Leonard PROBE LENGTH, in. _____
 STACK NO. N-19-HST-722 NOZZLE DIAMETER, in. 0.180
 RUN NO. _____ STACK DIAMETER, in. _____
 SAMPLE BOX NO. _____ PROBE HEATER SETTING _____
 METER BOX NO. _____ HEATER BOX SETTING 250°F

METER NH₃

C FACTOR _____

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	probe temp. STATIO PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _P), (V _P)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	meter # 1037662	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY ft/s
	0/13:57	26.3	383				543.164			227		15.0	
	10/14:07		382				550.6			251		15.0	
	20/14:27	26.3	381				566.6	8.3	80	281		15.0	
	40/14:57	27.8	384				587.4	9.5	81	279		15.0	
	60/15:27	27.1	384				609.2	8.9	84	269		15.0	
	80/15:57	27.9	384				631.4	8.9	84	257		15.0	
	100/16:22	29.4	385				642.4	9.2	85	274		15.0	
	120/16:37	25.7	384				660.8	9.5	87	275		15.0	
	140/16:57	off					675.688						
							543.164						
							132.52						
TOTAL													

AVERAGE

leak check 0.07 cfm at 15" Hg

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT					
	1	2	3	4		TIME	CO ₂	O ₂	CO	N ₂	
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4					

COMMENTS

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STACK SAMPLING DATA SHEET

CLIENT Battelle / DPE TEST DATE 7-22-93 (Tues.) 2.002 Page 1 of 2
 TEST UNIT SEA Register Outlet TEST NO. N-20-H-722 ORIFICE CORRECTION +592 HOT BOX NO. #2
 PROJECT NO. 93C028-01 NOZZLE (SIZE, #) 0.485" METER CORRECTION +10.9% COLD BOX NO. #2
 CONTROL BOX OPERATOR RPC STATIC PRESSURE 17.0" H₂O CALIBRATION DATE 6-7-93 PROBE NO. 13-2
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION Left #2 PITOT CORRECTION 0.04 CONTROL BOX NO. 61X FILTER NO.
 STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pilot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
90"	15:10	425.225		2.00	2.00	85	85	9.0	681	~250°F	68°F	-250°F	Single Point
				2.00	2.00	105	87	10.0	686				Non-Isokinetic
				2.00	2.00	111	90	10.5	696				Sampling for
				2.00	2.00	115	91	11.5	689				4 H ₂ O
				2.00	2.00	116	96	11.5	689				
				2.00	2.00	118	97	11.5	690				Target ΔH =
	16:10			2.00	2.00	115	99	12.0	691				1.5
				2.00	2.00	117	99	12.5	697				Readings every
				2.00	2.00	116	99	12.5	698				10 min
				2.00	2.00	117	99	12.5	700				
				2.00	2.00	115	100	12.5	700				
	17:10			2.00	2.00	117	99	13.0	701				File # 93-028-186
				2.00	2.00	115	100	13.0	701				# 93- 186 187
				2.00	2.00	115	99	13.0	701				# 93- 186 188
				2.00	2.00	115	100	13.0	698				Estimates:
				2.00	2.00	117	100	13.0	696				MW = 29.2
				2.00	2.00	117	100	13.0	696				%H ₂ O = 9
				2.00	2.00	119	100	13.0	671				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	20.015 cfm
After	14.0	2.02 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	14.0	
O ₂	6.0	
CO	0	
N ₂	80.0	

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml D.I. H ₂ O	709.2	517.4	191.8
2.	100ml D.I. H ₂ O	607.2	542.4	64.8
3.	Empty	455.1	444.3	10.8
4.	200g Silica Gel	678.4	632.2	46.2
5.				

0 0 0 0 0
 7 6 4 3 2 1
 AQE 2/92
 PLOW
 ↓

313.69 total
KEYSTONE
 ENVIRONMENTAL SCIENCE INC.

D-199

STACK SAMPLING DATA SHEET

Page 2 of 2

CLIENT Bottle 1206 TEST DATE 7-22-93 (Thurs.) ORIFICE CORRECTION 2.002 HOT BOX NO. 42
 TEST UNIT SCR Reactor Outlet TEST NO. N-20-H-722 METER CORRECTION 0.9812 COLD BOX NO. 42
 PROJECT NO. 93028-01 NOZZLE (SIZE, #) 0.485 CALIBRATION DATE 06-09-93 PROBE NO. 15-2
 CONTROL BOX OPERATOR RPL STATIC PRESSURE 17.0" H₂O PITOT CORRECTION 0.84 FILTER NO. 15-2
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION PORT #2 CONTROL BOX NO. Six STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (scf)	Pilot a P (in. H ₂ O)	Orifice a H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
90"	1810			2.00	2.00	115	98	13.0	650	~250°F	168°F	~250°F	Single Point
				2.00	2.00	115	99	13.0	633				Non Isokinetic
				2.00	2.00	115	99	13.0	639				Sampling for
				2.00	2.00	114	97	13.0	633				4 hours
				2.00	2.00	114	97	13.0	633				
	19:10	620.794		2.00	2.00	114	97	13.0	635				Target AH =
													1.5
	A = 240min	Δ = 195.569 scf		(AH) _{AG} = 2.00		(T _{inlet}) _{AG} = 108°F			(T _{stack}) _{AG} = 679°F				Readings every
													10 min
													File # 93-Q284-06
													# 93- 0284 H44
													# 93- 0284 H44
													Estimates:
													MW = 29.2
													%H ₂ O = 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO ₂	14.0	
O ₂	6.0	
CO	0	
N ₂	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

STACK SAMPLING DATA SHEET

Page 1 of 2

CLIENT Battelle / DOE TEST DATE 7-22-93 (Thurs.) ORIFICE CORRECTION 1.02 HOT BOX NO. 1
 TEST UNIT SNOW BURN OUTLET TEST NO. N-21-H-722 METER CORRECTION 0.9617 COLD BOX NO. 1
 PROJECT NO. 93-028-01 NOZZLE (SIZE, #) 1/2" CALIBRATION DATE 5-12-93 PROBE NO. 10-1
 CONTROL BOX OPERATOR JM STATIC PRESSURE 0.10" H₂O PITOT CORRECTION 0.84 FILTER NO. 1
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION 0 CONTROL BOX NO. 7 STACK DIA. 50" (depth) x 99"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments (with)
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
50"	15:10	041360	0.90	1.5	1.5	110	98	9.5	200	-250°F	468°F	~250°F	Sample Point
			0.95	1.5	1.5	118	96	10.0	200				Non-Bio kinetic
			0.95	1.5	1.5	120	96	10.0	200				Sampling for 4 hours
			0.95	1.5	1.5	120	96	10.0	200				
			0.95	1.5	1.5	120	96	10.0	200				
			0.95	1.5	1.5	120	96	10.0	200				
			0.95	1.5	1.5	120	96	10.0	200				Readings every 10 minutes
	16:10		0.90	1.5	1.5	121	98	10.0	200				
			0.90	1.5	1.5	121	98	10.0	200				
			0.90	1.5	1.5	121	98	10.0	200				
			0.95	1.5	1.5	121	98	10.0	200				
			0.95	1.5	1.5	121	98	10.0	200				
			0.95	1.5	1.5	121	98	10.0	200				
			0.95	1.5	1.5	121	98	10.0	200				
	17:10		0.90	1.5	1.5	121	98	10.0	200				File # 93-Q2847
			0.90	1.5	1.5	121	98	10.0	200				# 93-H45
			0.90	1.5	1.5	121	98	10.0	200				# 93-H46
			0.90	1.5	1.5	121	98	10.0	200				Estimates:
			0.95	1.5	1.5	121	98	10.0	200				MW= 29.2
			0.95	1.5	1.5	121	98	10.0	200				%H ₂ O= 8.5
			0.90	1.5	1.5	121	98	10.0	200				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	0.009
After	10.5	0.012

PITOT LEAK CHECK 15 SECS

	Positive	Negative
Before	OK	OK
After	OK	OK

CO ₂	13.0
O ₂	6.0
CO	0
N ₂	81.0

Impinger

No.	Contents	Final	Initial	Difference	Actual
1.	100 mL DI H ₂ O	751.2	542.2	209.0	Moisture = 8.2%
2.	100 mL DI H ₂ O	513.5	475.6	37.9	
3.	Empty	442.5	435.5	7.0	
4.	222g Silica Gel	700.7	659.7	41.0	
5.					

244.9g total
KEYSTONE
 ENVIRONMENTAL SYSTEMS, INC.

D-201

STACK SAMPLING DATA SHEET

Page 2 of 2

CLIENT Battelle NW TEST DATE 7-22-93 (Thurs.) ORIFICE CORRECTION 1.602 HOT BOX NO. 1
 TEST UNIT Quox Tower Outlet TEST NO. N-21-H-722 METER CORRECTION 0.9619 COLD BOX NO. 1
 PROJECT NO. 93-028-01 NOZZLE (SIZE, #) — CALIBRATION DATE 5-17-93 PROBE NO. 10-1
 CONTROL BOX OPERATOR TW STATIC PRESSURE 29.38 PITOT CORRECTION 0.84 FILTER NO. —
 BAROMETRIC PRESSURE 29.38 PORT DIRECTION 8/10" 420 CONTROL BOX NO. 7 STACK DIA. 50" (depth) x 9"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcl)	Pilot ΔP (in. H2O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments (with)
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
	18:10		0.90	1.5	1.5	118	96	10.5	200	~250°F	48°F	~250°F	Single Point
	↓		0.95	1.5	1.5	118	97	10.5	200				Non-Exhaustive
			0.95	1.5	1.5	116	94	10.5	200				Sampling for 4 hours
			0.95	1.5	1.5	114	93	10.5	200				
			0.90	1.5	1.5	114	90	10.5	200				
			0.90	1.5	1.5	112	90	10.5	200				Readings every 10 minutes
	19:10	218.872											
	Δ=240 min	Δ=177.512 dcl	(ΔP)AG=0.95	(ΔH)AG=1.5	(Tmeter)AG=07°F	(Tstack)AG=200°F							
	↑												
	0.65 dcl/min												velocity = 61.4 ft/sec
													Filter #93-02847
													#93-H45
													#93-H46
													Estimates:
													MW=29.2
													%H2O=8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

Gas Meter
SN, 36710

SCHEMATIC OF STA

CROSS SECTION

HEST

PARTICULATE FIELD DATA

N-18-H-724

PLANT Nile
DATE 7-24-93
LOCATION BA IN 18
OPERATOR Webb
STACK NO. —
RUN NO. 3 HEST
SAMPLE BOX NO. —
METER BOX NO. —

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE 29.14
ASSUMED MOISTURE, % —
PROBE LENGTH, in. 108
NOZZLE DIAMETER, in. —
STACK DIAMETER, in. 80
PROBE HEATER SETTING 2250
HEATER BOX SETTING 250

METER ΔH, —
C FACTOR —

PROCESS WEIGHT RATE —

WEIGHT OF PARTICULATE COLLECTED, m

SAMPLE	FILTER	PROBE W
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

D-203

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	Time STATIC PRESSURE (in H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (ft/s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H ₂ O		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Probe VELOCITY (ft/s)
					ACTUAL	DESIRED		INLET (T _{m,in}), °F	OUTLET (T _{m,out}), °F				
Start	0	12:25		3.0			691.83						
	1:15(15)	13:40	~ 380				747.2	96	86	280		12	213
	105	14:10		3.2			769.5	96	87	283		13	314
	123	14:28		3.0			780.7	96	87			13	
	133	14:38					787.1					19	
	158	15:03					802.0	100	88	313		19	336
	177	15:22		2.8			813.6	98	87	288		19 1/2	278
Stop		16:40					823.17						
							691.83						
							131.34						

VOLUME OF LIQUID WATER COLLECTED	1
FINAL	
INITIAL	
LIQUID COLLECTED	
TOTAL VOLUME COLLECTED	

IMPINGER VOLUME ml	2	3	4	SILICA GEL WEIGHT, g

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

Pre Leak Check
0.15 at 10" Hg
Post Leak Check .02 at 18" Hg

CROSS SECTION

PARTICULATE FIELD DATA

PLANT Mills Creek SNOX road AMBIENT TEMPERATURE _____ METER NO. _____
 DATE 7/24/93 BAROMETRIC PRESSURE _____ C FACTOR _____
 LOCATION outlet of bag house ASSUMED MOISTURE, % _____ PROCESS WEIGHT RATE _____
 OPERATOR Lowell PROBE LENGTH, in. _____
 STACK NO. _____ NOZZLE DIAMETER, in. _____
 RUN NO. N-19-HES-724 STACK DIAMETER, in. _____
 SAMPLE BOX NO. _____ PROBE HEATER SETTING _____
 METER NO. C-10702 HEATER BOX SETTING _____

WEIGHT OF PARTICULATE COLLECTED, g		
SAMPLE	FILTER	PROBE W
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	probe temp OF STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p), (V _s), (V _f)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY (V _p)
							INLET (T _{m in}), °F	OUTLET (T _{m out}), °F				
	0/14:05	269	380			848.200						
	10/14:15	269	382			855.3	92	86	235		15.0	
	25/14:20	309	382			965.9	98	90	248		15.0	
	60/15:05	271	383			890.5	101	94	286		15.0	
	90/15:28	299	383			911.9	97	93	280		15.0	
	120/16:05	253	383			933.7	101	96	280		15.0	
	160/16:45	267	384			962.0	102	96	269		15.0	
	180/16:55	282				976.437						
						848.200						
						282.7						
TOTAL												
AVERAGE												

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
FINAL	1	2	3	4				
INITIAL								
LIQUID COLLECTED								
TOTAL VOLUME COLLECTED								

leak rate before 0.07 cfm at 25" Hg
 leak rate after 0.072 cfm at 22" Hg
 COMMENTS

D-204

STACK SAMPLING DATA SHEET

CLIENT Battelle DOE
 TEST UNIT SR Reactor Outlet
 PROJECT NO. 93-028-01
 CONTROL BOX OPERATOR RPC
 BAROMETRIC PRESSURE 29.35

TEST DATE 7-24-93 (Sat.)
 TEST NO. N-20-H-724
 NOZZLE (SIZE, IN) 0.485
 STATIC PRESSURE 16.2 H₂O
 PORT DIRECTION PORT #3

ORIFICE CORRECTION 1.95
 METER CORRECTION 0.9921
 CALIBRATION DATE 07-16-93
 PITOT CORRECTION 0.84
 CONTROL BOX NO. Battelle 077
 HOT BOX NO. 2
 COLD BOX NO. 2
 PROBE NO. 13-1
 FILTER NO.
 STACK DIA.

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pilot A P (in. H ₂ O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
90	1425	759.715		1.40	1.40	93	83	9.0	151	~250°F	168°F	~250°F	Single 70
				1.40	1.40	101	93	9.5	156				Non Tech
				1.50	1.50	107	87	10.0	159				Sampling for 4 hours
				1.50	1.50	115	95	10.0	159				
				1.50	1.50	116	95	10.0	159				
				1.50	1.50	117	95	10.0	159				
				1.50	1.50	115	96	10.0	159				Empty AH
				1.50	1.50	118	97	10.0	155				
				1.50	1.50	118	98	10.0	156				Reading on
				1.50	1.50	119	100	10.0	159				Worm
				1.50	1.50	117	99	10.0	156				
				1.50	1.50	120	99	10.0	155				
				1.50	1.50	116	100	10.0	156				Filter # Quartz
				1.50	1.50	120	101	10.0	159				#93-H62
				1.50	1.50	120	101	10.0	159				#93-H63
				1.50	1.50	120	100	10.0	160				Estimates:
				1.50	1.50	120	100	10.0	161				MW= 29.2
				1.50	1.50	120	100	10.0	165				%H ₂ O= 9

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	0.0152
After	11.0	0.0214

	1	2
CO ₂	13.5	13.5
O ₂	6.0	6.0
CO	0	0
N ₂	80.5	80.5

PITOT LEAK CHECK

POS.	NEG.
0%	0%
15300	16300

Impinger No.	Impinger Contents	Final	Initial	Difference	
1.	100ml D.I. H ₂ O	236.1	249.5	13.4	Act
2.	100ml D.I. H ₂ O	479.3	498.0	18.7	Non
3.	Empty	411.6	435.4	23.8	
4.	Silica Gel	477.6	491.5	13.9	
5.					

265.39 lbs
KEYSTONE
 ENVIRONMENTAL DESIGN INC.

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STACK DIA.

Filter #	Quarter
#	93 H62
#	93 H62

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.

STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE

TEST UNIT SNLX Tower COT/ht

PROJECT NO. 93C024-21

CONTROL BOX OPERATOR TM

BAROMETRIC PRESSURE 29.35

TEST DATE 7-24-93 (Sat.)

TEST NO. N-24-H-724

NOZZLE (SIZE, N) 0.5" H₂O

STATIC PRESSURE 0.5" H₂O

PORT DIRECTION B

ORIFICE CORRECTION 1.673

METER CORRECTION 0.7912

CALIBRATION DATE 5-19-93

PITOT CORRECTION 0.84

CONTROL BOX NO. 4

HOT BOX NO. 1

COLD BOX NO. 1

PROBE NO. 72

FILTER NO. 93" (depth)

STACK DIA. 50"

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H ₂ O)	Orifice Δ H		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H ₂ O)	Act. (in. H ₂ O)	In (°F)	Out (°F)						
50"	14:15	588.810	1.0	1.5	1.5	90	80	7.0	200	~200°F	~68°F	~200°F	Single Point Not Isokinetic Sampling for 4 hours
			1.0	1.5	1.5	94	81	7.0	200				
			1.0	1.5	1.5	96	81	7.0	201				
			1.0	1.5	1.5	102	83	7.0	200				
			1.0	1.5	1.5	106	84	7.0	200				
	15:15		1.0	1.5	1.5	112	85	7.0	202				Target Alt = 14'
			1.0	1.5	1.5	118	87	7.0	204				
			1.0	1.5	1.5	118	87	7.0	204				
			1.0	1.5	1.5	122	87	7.0	205				
			1.0	1.5	1.5	125	91	7.0	204				
16:15			1.0	1.5	1.5	125	92	7.0	205				Filter #100000 # 93-H661 # 93-H665
			1.0	1.5	1.5	125	92	7.0	203				
			1.0	1.5	1.5	125	92	7.0	202				
			1.0	1.5	1.5	125	93	7.0	200				
			1.0	1.5	1.5	126	96	7.0	200				
			1.0	1.5	1.5	126	95	7.0	200				
			1.0	1.5	1.5	126	95	7.0	200				

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	5.02
After	2.0	5.02

	1	2
CO ₂	13.0	
O ₂	8.0	
CO	0	
N ₂	79.0	

PITOT LEAK CHECK

POS.	NEG.
OK	OK

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 ml D.F. H ₂ O	714.7	519.8	194.9
2.	100 ml D.F. H ₂ O	578.8	540.6	38.2
3.	Empty	453.5	444.8	8.7
4.	200 g of Ice Gd	676.3	641.0	35.3
5.				

277.19 total
KEYSTONE
 ENVIRONMENTAL SCIENCE, INC.
 Actual Moisture = 8.0%

D-207

STACK SAMPLING DATA SHEET

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CLIENT Rothelle DOE

TEST UNIT SNOW TONEL OUTLET

PROJECT NO. 93-028-01

CONTROL BOX OPERATOR TM

BAROMETRIC PRESSURE 29.35

TEST DATE 7-24-93 (Sat.)

TEST NO. N-21-H-724

NOZZLE (SIZE, N)

STATIC PRESSURE

PORT DIRECTION

ORIFICE CORRECTION

METER CORRECTION

CALIBRATION DATE

PITOT CORRECTION

CONTROL BOX NO.

HOT BOX NO. 1

COLD BOX NO. 1

PROBE NO. 7-2

FILTER NO.

STACK DIA. 50" (dark) x 95" (white)

Traverse Point	Time	Dry Gas Meter Reading (scf)	Pitot a P (in. H2O)	Orifice ΔH		Meter Temperature		Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				Req'd. (in. H2O)	Act. (in. H2O)	In (°F)	Out (°F)						
	17:15		1.0	1.5	1.5	126	96	7.0	201	~250°F	46°F	~250°F	Single Point
			1.0	1.5	1.5	126	96	7.0	201				Non Isotonic
			1.0	1.5	1.5	125	95	7.0	200				Sampling for 4 holes
			1.0	1.5	1.5	127	95	7.0	200				
			1.0	1.5	1.5	127	95	7.0	200				
			1.0	1.5	1.5	127	95	7.0	200				Temp ΔH = 1.4
	18:15	754.851	1.0	1.5	1.5	127	95	7.0	201				Readings every 10 minutes
	A=240 min	A=166.041		(ΔH) _{avg} = 1.5		(T _{meter}) _{avg} = 104°F			(T _{stack}) _{avg} = 201°F				Filter #0404, #93-H65, #93-H65
													Estimates:
													MW = 29.2
													%H2O = 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before		
After		

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

PITOT LEAK CHECK

POS.	NEG.

Impinger

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE
Environmental Services, Inc.

D-208

D-9: Cascade Impactors

PARTICULATE FIELD DATA

PLANT Valley, Ohio SH&P AMBIENT TEMPERATURE 80°
 DATE July 19, 1993 BAROMETRIC PRESSURE _____
 LOCATION Outlet of roughout ASSUMED MOISTURE, % 7
 OPERATOR Lernard, Hugo PROBE LENGTH, in. _____
 STACK NO. 1 NOZZLE DIAMETER, in. _____
 RUN NO. N-19-IMP-719 STACK DIAMETER, in. _____
 SAMPLE BOX NO. _____ PROBE HEATER SETTING _____
 METER BOX NO. _____ HEATER BOX SETTING _____

METER ΔH	_____	
C FACTOR	_____	
PROCESS WEIGHT RATE	_____	
WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	STATIC PRESSURE (in H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (ΔP _s) (ΔP _p)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
					ACTUAL	DESIRED		INLET (T _{m in}), °F	OUTLET (T _{m out}), °F				
	0/20:42		381				360.463						
	20/21:02		381				371.7						
	40/21:22		380				385.2						
	60/21:42		379				399.0						
	70/21:52		377				405.2						
	80/22:02		378				410.1						
	90/22:12		379				416.0						
	100/22:22		380				451.25						
	110/22:32		380				426.52						
	120/22:42	off					431.875						
							360.463						
							71.512						
TOTAL													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT					
	1	2	3	4		TIME	CO ₂	O ₂	CO	N ₂	
FINAL						1					
INITIAL						2					
LIQUID COLLECTED						3					
TOTAL VOLUME COLLECTED						4

PARTICULATE FIELD DATA

Page #1

PLANT Wills, Ohio SNOT process

AMBIENT TEMPERATURE _____

METER NO. _____

DATE 7/21/93

BAROMETRIC PRESSURE _____

C FACTOR _____

LOCATION outlet of bag house

ASSUMED MOISTURE, % _____

PROCESS WEIGHT RATE _____

OPERATOR Leonard

PROBE LENGTH, in. _____

WEIGHT OF PARTICULATE COLLECTED, mg

STACK NO. _____

NOZZLE DIAMETER, in. _____

SAMPLE FILTER PROBE WASI

RUN NO. N-19-IMP-721

STACK DIAMETER, in. _____

FINAL WEIGHT

SAMPLE BOX NO. _____

PROBE HEATER SETTING _____

TARE WEIGHT

METER BOX NO. _____

HEATER BOX SETTING _____

WEIGHT GAIN

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _P), (V _S), ft/s	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H ₂ O ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (T _{m in}), °F OUTLET (T _{m out}), °F		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY ft/s
	0/17:15		383			436.877						
	10/17:25		383			436.8						
	20/17:35		382			441.6						
	40/18:15		382			461.8						
	60/18:35		381			471.5	111.281					
	80/19:00		383			484.1						
	100/19:15		379			491.6						
	120/20:00		380			514.0						
	145/21:00		380			543.159						
	225/17:32	7/22/93	384			676.211	85	85	45.435		5.5	
	241/17:54		384			684.3	84	84			5.5	
	317/19:10					721.646						
	317/12:30	on 7/23/93	383			721.873						
TOTAL												

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT						COMMENTS	
	1	2	3	4		TIME	CO ₂	O ₂	CO	N ₂			
FINAL						1							
INITIAL						2							
LIQUID COLLECTED						3							
TOTAL VOLUME COLLECTED						4							

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PARTICULATE FIELD DATA

Page # 2

PLANT Niles, Ohio SNOC process AMBIENT TEMPERATURE _____ METER ΔH_p _____

DATE 7/23/93 BAROMETRIC PRESSURE _____ C FACTOR _____

LOCATION outlet of baghouse ASSUMED MOISTURE, % _____ PROCESS WEIGHT RATE _____

OPERATOR Fernand PROBE LENGTH, in. _____ WEIGHT OF PARTICULATE COLLECTED, mg

STACK NO. _____ NOZZLE DIAMETER, in. _____

RUN NO. N-19-IMP-721 STACK DIAMETER, in. _____

SAMPLE BOX NO. _____ PROBE HEATER SETTING _____

METER BOX NO. _____ HEATER BOX SETTING _____

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (ΔP _s) (1/ΔP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER	INLET (T _{m in}), °F	OUTLET (T _{m out}), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
	327/12:40		384			722.9	83	82				5.5	
	357/13:10		383			742.9	86	83				5.5	
	377/13:30		388			752.8	84	83				5.5	
	442/14:35		383			784.3	86	84				5.5	
	557/16:30					840.5							
	579/16:43	off 7/23/93				847.477							
	570/17:25	7/24/93				976.808							
	633/18:28					1006.4	89	88				5.5	
	680/19:25					1033.0							
	725/20:00	off				1046.528							
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g	ORSAT MEASUREMENT	TIME	CO	O	CO	N ₂
FINAL	1	2	3	4				
INITIAL								
LIQUID COLLECTED								
TOTAL VOLUME COLLECTED								

COMMENTS:

D-212

**D-10: Calculations of Flue Gas Sampling
Parameters and Particulate Matter Concentration**

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK		1 7/18 1010 2041	2 7/19 1042 2030	3 7/21 1323 2055
	FROM TO			
DN	SAMPLING NOZZLE DIAMETER, IN.	0.247	0.215	0.215
TT	NET TIME OF TEST, MIN.	384	384	384
PB	BAROMETRIC PRESSURE, IN. HG	29.60	28.95	29.17
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.50	1.20	1.00
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	256.1	245.5	227.7
TM	AVG. GAS METER TEMPERATURE, F	105	110	90
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	216.4	200.9	194.5
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	473.0	550.0	396.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF	20.8	24.2	17.4
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	8.77	10.74	8.22
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.89	0.92
CO2	STACK GAS CO2, VOL PERCENT DRY	14.7	14.6	14.3
O2	STACK GAS O2, VOL PERCENT DRY	4.0	4.2	4.5
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.3	81.2	81.2
EA	STACK GAS EXCESS AIR, PERCENT	22.9	24.4	26.6
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.5	30.5	30.5
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.4	29.2	29.4
CP	PITOT TUBE COEFFICIENT	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F	397	395	399
NP	NET SAMPLING POINTS	45	43	42

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK	FROM TO	1	2	3
		7/18 1010 2041	7/19 1042 2030	7/21 1323 2055
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	-0.47	-0.47	-0.47
PS	STACK GAS ABS. PRESSURE, IN. HG	29.13	28.48	28.70
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3798	3925	3909
AS	STACK AREA, SQ. IN.	4776.	4776.	4776.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	64208	63612	65404
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	125959	130180	129644
I	ISOKINETIC RATE, PERCENT	87.5	108.2	101.9
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	0.0	11764.7	0.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.000	0.902	0.000
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.000	0.441	0.000
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.000	0.967	0.000
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.000	0.472	0.000
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	0.00	491.59	0.00

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO. TEST DATE	1 7/18	2 7/19	3 7/21
VOLUME OF GAS SAMPLED, NCF (DRY)	216.4	200.9	194.5
MOISTURE FRACTION VOLUME, PERCENT	8.8	10.7	8.2
AVERAGE STACK TEMPERATURE, F	397	395	399
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	64208	63612	65404
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	125959	130180	129644
ISOKINETIC RATE, PERCENT	87.5	108.2	101.9
EXCESS AIR, PERCENT	22.9	24.4	26.6
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	11764.7	0.0
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.000	0.902	0.000
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.000	0.441	0.000
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.000	0.967	0.000
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.000	0.472	0.000
PARTICULATE EMISSIONS, LB/HR	0.0	491.6	0.0

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO. TEST DATE	1 7/18	2 7/19	3 7/21
VOLUME OF GAS SAMPLED, NCM	6.13	5.69	5.51
MOISTURE FRACTION VOLUME, PERCENT	8.8	10.7	8.2
AVERAGE STACK TEMPERATURE, C	202	201	203
STACK VOLUMETRIC FLOW RATE, NCMM	1818	1801	1852
STACK VOLUMETRIC FLOW RATE, CMM	3566	3686	3671
ISOKINETIC RATE, PERCENT	87.5	108.2	101.9
EXCESS AIR, PERCENT	22.9	24.4	26.6
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	11764.7	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	2063.5	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	1008.3	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	2211.8	0.0
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	0.0	1080.7	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	223.0	0.0

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK		4 7/22 925 1709	5 7/23 918 1637	6 7/24 855 1646
		FROM		
		TO		
DN	SAMPLING NOZZLE DIAMETER, IN.	0.215	0.215	0.215
TT	NET TIME OF TEST, MIN.	384	384	384
PB	BAROMETRIC PRESSURE, IN. HG	29.15	29.16	29.14
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.50	1.20	1.20
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	217.1	229.9	225.3
TM	AVG. GAS METER TEMPERATURE, F	115	110	110
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	177.5	189.5	185.6
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	409.0	324.0	412.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF	18.0	14.2	18.1
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	9.20	6.99	8.89
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.93	0.91
CO2	STACK GAS CO2, VOL PERCENT DRY	15.2	15.8	15.6
O2	STACK GAS O2, VOL PERCENT DRY	3.5	2.8	3.0
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.3	81.4	81.4
EA	STACK GAS EXCESS AIR, PERCENT	19.5	15.0	16.2
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.6	30.6	30.6
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.4	29.8	29.5
CP	PITOT TUBE COEFFICIENT	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F	397	401	391
NP	NET SAMPLING POINTS	42	42	42

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK		4 7/22 925 1709	5 7/23 918 1637	6 7/24 855 1646
		FROM		
		TO		
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	-0.47	-0.47	-0.47
PS	STACK GAS ABS. PRESSURE, IN. HG	28.68	28.69	28.67
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3765	3750	3688
AS	STACK AREA, SQ. IN.	4776.	4776.	4776.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	62417	63397	61742
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	124883	124372	122325
I	ISOKINETIC RATE, PERCENT	97.4	102.4	103.0
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	9879.6	0.0	11916.6
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.857	0.000	0.989
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.428	0.000	0.499
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.882	0.000	0.989
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.441	0.000	0.499
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	458.48	0.00	523.10

SNOX, BAGHOUSE INLET, LOCATION 18

R/TN NO. TEST DATE	4 7/22	5 7/23	6 7/24
VOLUME OF GAS SAMPLED, NCF (DRY)	177.5	189.5	185.6
MOISTURE FRACTION VOLUME, PERCENT	9.2	7.0	8.9
AVERAGE STACK TEMPERATURE, F	397	401	391
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	62417	63397	61742
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	124883	124372	122325
ISOKINETIC RATE, PERCENT	97.4	102.4	103.0
EXCESS AIR, PERCENT	19.5	15.0	16.2
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	9879.6	0.0	11916.6
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.857	0.000	0.989
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.428	0.000	0.499
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.882	0.000	0.989
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.441	0.000	0.499
PARTICULATE EMISSIONS, LB/HR	458.5	0.0	523.1

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO. TEST DATE	4 7/22	5 7/23	6 7/24
VOLUME OF GAS SAMPLED, NCM	5.03	5.37	5.26
MOISTURE FRACTION VOLUME, PERCENT	9.2	7.0	8.9
AVERAGE STACK TEMPERATURE, C	202	205	199
STACK VOLUMETRIC FLOW RATE, NCMM	1767	1795	1748
STACK VOLUMETRIC FLOW RATE, CMM	3536	3521	3463
ISOKINETIC RATE, PERCENT	97.4	102.4	103.0
EXCESS AIR, PERCENT	19.5	15.0	16.2
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	9879.6	0.0	11916.6
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	1961.4	0.0	2262.3
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	980.3	0.0	1141.8
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	2017.8	0.0	2262.3
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	1008.4	0.0	1141.8
PARTICULATE EMISSIONS, KG/HR	208.0	0.0	237.3

SNOX, BAGHOUSE OUTLET, LOCATION 19

	RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK	FROM TO	1 7/18 1020 1810	2 7/19 958 1840	3 7/21 1308 1925
DN	SAMPLING NOZZLE DIAMETER, IN.		0.247	0.247	0.247
TT	NET TIME OF TEST, MIN.		380	480	367
PB	BAROMETRIC PRESSURE, IN. HG		29.15	28.95	29.11
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O		1.60	0.90	1.50
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)		258.4	325.3	237.4
TM	AVG. GAS METER TEMPERATURE, F		95	97	102
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)		221.8	273.1	201.0
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML		490.0	715.0	411.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF		21.5	31.4	18.1
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT		8.85	10.32	8.25
MD	MOLECULAR FRACTION OF DRY GAS		0.91	0.90	0.92
CO2	STACK GAS CO2, VOL PERCENT DRY		14.0	14.6	14.5
O2	STACK GAS O2, VOL PERCENT DRY		4.8	4.2	4.3
CO	STACK GAS CO, VOL PERCENT DRY		0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY		81.2	81.2	81.2
EA	STACK GAS EXCESS AIR, PERCENT		28.9	24.4	25.1
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS		30.4	30.5	30.5
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS		29.3	29.2	29.5
CP	PITOT TUBE COEFFICIENT		0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F		383	376	378
NP	NET SAMPLING POINTS		48	49	48

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK		1 7/18 1020 1810	2 7/19 958 1840	3 7/21 1308 1925
		FROM		
		TO		
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	-0.44	-0.44	-0.44
PS	STACK GAS ABS. PRESSURE, IN. HG	28.71	28.51	28.67
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3437	3428	3340
AS	STACK AREA, SQ. IN.	4776.	4776.	4776.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	58212	57145	57177
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	113996	113691	110768
I	ISOKINETIC RATE, PERCENT	99.9	99.2	95.5
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	0.0	21.3	0.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.000	0.001	0.000
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.000	0.001	0.000
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.000	0.001	0.000
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.000	0.001	0.000
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	0.00	0.59	0.00

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO. TEST DATE	1 7/18	2 7/19	3 7/21
VOLUME OF GAS SAMPLED, NCF (DRY)	221.8	273.1	201.0
MOISTURE FRACTION VOLUME, PERCENT	8.9	10.3	8.3
AVERAGE STACK TEMPERATURE, F	383	376	378
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	58212	57145	57177
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	113996	113691	110768
ISOKINETIC RATE, PERCENT	99.9	99.2	95.5
EXCESS AIR, PERCENT	28.9	24.4	25.1
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	21.3	0.0
PARTICULATE LOADING, GR/NCF AT STACK 02 (DRY)	0.000	0.001	0.000
PARTICULATE LOADING, GR/ACF AT STACK 02 (WET)	0.000	0.001	0.000
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.000	0.001	0.000
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.000	0.001	0.000
PARTICULATE EMISSIONS, LB/HR	0.0	0.6	0.0

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO. TEST DATE	1 7/18	2 7/19	3 7/21
VOLUME OF GAS SAMPLED, NCM	6.28	7.73	5.69
MOISTURE FRACTION VOLUME, PERCENT	8.9	10.3	8.3
AVERAGE STACK TEMPERATURE, C	195	191	192
STACK VOLUMETRIC FLOW RATE, NCMM	1648	1618	1619
STACK VOLUMETRIC FLOW RATE, CMM	3228	3219	3136
ISOKINETIC RATE, PERCENT	99.9	99.2	95.5
EXCESS AIR, PERCENT	28.9	24.4	25.1
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	21.3	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	2.7	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	1.4	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	2.9	0.0
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	0.0	1.5	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	0.3	0.0

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO.	TEST DATE	4	5	6
SAMPLING TIME, 24 HOUR CLOCK	FROM	7/22	7/23	7/24
	TO	907	901	900
		1750	1514	1702
DN	SAMPLING NOZZLE DIAMETER, IN.	0.247	0.247	0.247
TT	NET TIME OF TEST, MIN.	480	360	480
PB	BAROMETRIC PRESSURE, IN. HG	29.20	29.16	29.14
PM	AVG. ORIFICE PRESSURE DROP, IN. H ₂ O	1.50	1.60	1.50
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	307.2	233.3	313.6
TM	AVG. GAS METER TEMPERATURE, F	100	100	105
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	261.8	196.6	261.6
VW	TOTAL H ₂ O COLLECTED IN IMPINGERS AND SILICA GEL, ML	613.0	331.0	606.0
VWGAS	VOLUME OF H ₂ O VAPOR COLLECTED, NCF	27.0	14.6	26.6
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	9.34	6.89	9.24
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.93	0.91
CO ₂	STACK GAS CO ₂ , VOL PERCENT DRY	14.7	14.7	14.3
O ₂	STACK GAS O ₂ , VOL PERCENT DRY	4.0	4.0	4.5
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N ₂	STACK GAS N ₂ , VOL PERCENT DRY	81.3	81.3	81.2
EA	STACK GAS EXCESS AIR, PERCENT	22.9	22.9	26.6
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.5	30.5	30.5
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.3	29.7	29.3
CP	PITOT TUBE COEFFICIENT	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F	380	381	380
NP	NET SAMPLING POINTS	47	48	50

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK	FROM TO	4	5	6
		7/22 907 1750	7/23 901 1514	7/24 900 1702
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	-0.44	-0.44	-0.44
PS	STACK GAS ABS. PRESSURE, IN. HG	28.76	28.72	28.70
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3316	3288	3306
AS	STACK AREA, SQ. IN.	4776.	4776.	4776.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	56136	56981	55895
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	109977	109038	109649
I	ISOKINETIC RATE, PERCENT	96.8	95.5	97.2
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	42.6	0.0	276.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.003	0.000	0.016
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.001	0.000	0.008
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.003	0.000	0.018
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.001	0.000	0.009
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	1.21	0.00	7.78

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO. TEST DATE	4 7/22	5 7/23	6 7/24
VOLUME OF GAS SAMPLED, NCF (DRY)	261.8	196.6	261.6
MOISTURE FRACTION VOLUME, PERCENT	9.3	6.9	9.2
AVERAGE STACK TEMPERATURE, F	380	381	380
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	56136	56981	55895
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	109977	109038	109649
ISOKINETIC RATE, PERCENT	96.8	95.5	97.2
EXCESS AIR, PERCENT	22.9	22.9	26.6
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	42.6	0.0	276.0
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.003	0.000	0.016
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.001	0.000	0.008
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.003	0.000	0.018
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.001	0.000	0.009
PARTICULATE EMISSIONS, LB/HR	1.2	0.0	7.8

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO. TEST DATE	4 7/22	5 7/23	6 7/24
VOLUME OF GAS SAMPLED, NCM	7.41	5.57	7.41
MOISTURE FRACTION VOLUME, PERCENT	9.3	6.9	9.2
AVERAGE STACK TEMPERATURE, C	193	193	193
STACK VOLUMETRIC FLOW RATE, NCMM	1589	1613	1582
STACK VOLUMETRIC FLOW RATE, CMM	3114	3087	3104
ISOKINETIC RATE, PERCENT	96.8	95.5	97.2
EXCESS AIR, PERCENT	22.9	22.9	26.6
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	42.6	0.0	276.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	5.7	0.0	37.2
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	2.9	0.0	18.9
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	6.1	0.0	40.6
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	3.1	0.0	20.7
PARTICULATE EMISSIONS, KG/HR	0.5	0.0	3.5

SNOX, SCR OUTLET, LOCATION 20, MULTI-METALS

	RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK	FROM TO	1 7/19 1008 2040	2 7/22 908 1746	3 7/24 902 1736
DN	SAMPLING NOZZLE DIAMETER, IN.		0.441	0.440	0.441
TT	NET TIME OF TEST, MIN.		360	480	480
PB	BAROMETRIC PRESSURE, IN. HG		29.10	29.38	29.35
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O		0.90	1.42	1.20
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)		190.6	326.2	291.4
TM	AVG. GAS METER TEMPERATURE, F		105	108	107
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)		164.2	282.7	252.5
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML		420.4	629.2	543.9
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF		18.5	27.7	23.9
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT		10.12	8.91	8.65
MD	MOLECULAR FRACTION OF DRY GAS		0.90	0.91	0.91
CO2	STACK GAS CO2, VOL PERCENT DRY		13.0	13.0	13.0
O2	STACK GAS O2, VOL PERCENT DRY		6.0	6.0	6.0
CO	STACK GAS CO, VOL PERCENT DRY		0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY		81.0	81.0	81.0
EA	STACK GAS EXCESS AIR, PERCENT		39.0	39.0	39.0
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS		30.3	30.3	30.3
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS		29.1	29.2	29.3
CP	PITOT TUBE COEFFICIENT		0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F		656	664	664
NP	NET SAMPLING POINTS		72	95	96

SNOX, SCR OUTLET, LOCATION 20, MULTI-METALS

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK	FROM TO	1	2	3
		7/19 1008 2040	7/22 908 1746	7/24 902 1736
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	1.25	1.25	1.18
PS	STACK GAS ABS. PRESSURE, IN. HG	30.35	30.63	30.53
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	1124	1408	1304
AS	STACK AREA, SQ. IN.	34560.	34560.	34560.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	108361	137904	127759
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	269641	337900	313065
I	ISOKINETIC RATE, PERCENT	95.3	97.1	93.2
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	1356.1	1651.5	2140.4
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O ₂ , GR/NCF (DRY)	0.127	0.090	0.131
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O ₂ , GR/ACF (WET)	0.051	0.037	0.053
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O ₂ , GR/NCF (DRY)	0.153	0.108	0.157
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O ₂ , GR/ACF (WET)	0.061	0.044	0.064
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	118.09	106.33	142.91

SNOX, SCR OUTLET, LOCATION 20, MULTI-METALS

RUN NO. TEST DATE	1 7/19	2 7/22	3 7/24
VOLUME OF GAS SAMPLED, NCF (DRY)	164.2	282.7	252.5
MOISTURE FRACTION VOLUME, PERCENT	10.1	8.9	8.7
AVERAGE STACK TEMPERATURE, F	656	664	664
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	108361	137904	127759
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	269641	337900	313065
ISOKINETIC RATE; PERCENT	95.3	97.1	93.2
EXCESS AIR, PERCENT	39.0	39.0	39.0
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	1356.1	1651.5	2140.4
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.127	0.090	0.131
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.051	0.037	0.053
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.153	0.108	0.157
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.061	0.044	0.064
PARTICULATE EMISSIONS, LB/HR	118.1	106.3	142.9

SNOX, SCR OUTLET, LOCATION 20, MULTI-METALS

RUN NO. TEST DATE	1 7/19	2 7/22	3 7/24
VOLUME OF GAS SAMPLED, NCM	4.65	8.01	7.15
MOISTURE FRACTION VOLUME, PERCENT	10.1	8.9	8.7
AVERAGE STACK TEMPERATURE, C	346	351	351
STACK VOLUMETRIC FLOW RATE, NCMM	3068	3905	3617
STACK VOLUMETRIC FLOW RATE, CMM	7635	9568	8865
ISOKINETIC RATE, PERCENT	95.3	97.1	93.2
EXCESS AIR, PERCENT	39.0	39.0	39.0
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	1356.1	1651.5	2140.4
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	291.0	205.9	298.7
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	116.9	84.0	121.9
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	349.6	247.3	358.8
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	140.5	100.9	146.4
PARTICULATE EMISSIONS, KG/HR	53.6	48.2	64.8

SNOX, SCR OUTLET, LOCATION 20, MODIFIED METHOD 5

	RUN NO.	1	2	3
	TEST DATE	7/18	7/21	7/23
	SAMPLING TIME, 24 HOUR CLOCK	FROM	1300	904
		TO	19	1543
DN	SAMPLING NOZZLE DIAMETER, IN.	0.448	0.441	0.441
TT	NET TIME OF TEST, MIN.	360	360	360
PB	BAROMETRIC PRESSURE, IN. HG	29.30	29.28	29.38
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.26	0.90	1.10
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	217.6	198.2	205.1
TM	AVG. GAS METER TEMPERATURE, F	110	104	106
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	187.3	172.2	178.2
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	414.3	356.2	366.5
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF	18.2	15.7	16.1
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	8.86	8.34	8.29
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.92	0.92
CO2	STACK GAS CO2, VOL PERCENT DRY	13.0	12.5	12.1
O2	STACK GAS O2, VOL PERCENT DRY	6.0	6.5	7.0
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.0	81.0	80.9
EA	STACK GAS EXCESS AIR, PERCENT	39.0	43.7	48.8
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.3	30.3	30.2
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.2	29.2	29.2
CP	PITOT TUBE COEFFICIENT	0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F	668	663	558
NP	NET SAMPLING POINTS	4	4	4

SNOX, SCR OUTLET, LOCATION 20, MODIFIED METHOD 5

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK		1 7/18 FROM 1030 TO 1940	2 7/21 1300 19	3 7/23 904 1543
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	1.25	1.25	1.10
PS	STACK GAS ABS. PRESSURE, IN. HG	30.55	30.53	30.48
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	1402	1106	1263
AS	STACK AREA, SQ. IN.	34560.	34560.	35460.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	136558	108771	140443
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	336507	265429	311030
I	ISOKINETIC RATE, PERCENT	83.5	99.5	81.8
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	0.0	0.0	0.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.000	0.000	0.000
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.000	0.000	0.000
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.000	0.000	0.000
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.000	0.000	0.000
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	0.00	0.00	0.00

SNOX, SCR OUTLET, LOCATION 20, MODIFIED METHOD 5

RUN NO. TEST DATE	1 7/18	2 7/21	3 7/23
VOLUME OF GAS SAMPLED, NCF (DRY)	187.3	172.2	178.2
MOISTURE FRACTION VOLUME, PERCENT	8.9	8.3	8.3
AVERAGE STACK TEMPERATURE, F	668	663	558
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	136558	108771	140443
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	336507	265429	311030
ISOKINETIC RATE, PERCENT	83.5	99.5	81.8
EXCESS AIR, PERCENT	39.0	43.7	48.8
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	0.0	0.0
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.000	0.000	0.000
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.000	0.000	0.000
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.000	0.000	0.000
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.000	0.000	0.000
PARTICULATE EMISSIONS, LB/HR	0.0	0.0	0.0

SNOX, SCR OUTLET, LOCATION 20, MODIFIED METHOD 5

RUN NO. TEST DATE	1 7/18	2 7/21	3 7/23
VOLUME OF GAS SAMPLED, NCM	5.30	4.88	5.05
MOISTURE FRACTION VOLUME, PERCENT	8.9	8.3	8.3
AVERAGE STACK TEMPERATURE, C	353	350	292
STACK VOLUMETRIC FLOW RATE, NCMM	3866	3080	3976
STACK VOLUMETRIC FLOW RATE, CMM	9528	7516	8807
ISOKINETIC RATE; PERCENT	83.5	99.5	81.8
EXCESS AIR, PERCENT	39.0	43.7	48.8
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	0.0	0.0	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	0.0	0.0

SNOX, CONDENSER OUTLET, LOCATION 21, MODIFIED METHOD 5

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK		1 7/18 1015 1925	2 7/21 1300 1934	3 7/23 904 1525
DN	SAMPLING NOZZLE DIAMETER, IN.	0.197	0.197	0.195
TT	NET TIME OF TEST, MIN.	357	364	364
PB	BAROMETRIC PRESSURE, IN. HG	29.30	29.28	29.38
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.18	1.29	1.24
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	228.9	233.3	241.1
TM	AVG. GAS METER TEMPERATURE, F	108	103	105
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	191.5	196.8	198.9
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	373.1	389.6	383.3
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF	16.4	17.1	16.9
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	7.89	8.01	7.81
MD	MOLECULAR FRACTION OF DRY GAS	0.92	0.92	0.92
CO2	STACK GAS CO2, VOL PERCENT DRY	13.8	12.1	13.8
O2	STACK GAS O2, VOL PERCENT DRY	5.0	7.0	5.0
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.2	80.9	81.2
EA	STACK GAS EXCESS AIR, PERCENT	30.4	48.7	30.4
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.4	30.2	30.4
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.4	29.2	29.4
CP	PITOT TUBE COEFFICIENT	0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F	197	197	199
NP	NET SAMPLING POINTS	4	4	4

SNOX, CONDENSER OUTLET, LOCATION 21, MODIFIED METHOD 5

RUN NO.		1	2	3
TEST DATE		7/18	7/21	7/23
SAMPLING TIME, 24 HOUR CLOCK	FROM	1015	1300	904
	TO	1925	1934	1525
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	0.07	0.06	0.05
PS	STACK GAS ABS. PRESSURE, IN. HG	29.37	29.34	29.43
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3753	3934	3838
AS	STACK AREA, SQ. IN.	4032.	4032.	4032.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	71179	74443	72790
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	105081	110150	107473
I	ISOKINETIC RATE, PERCENT	99.7	96.1	101.3
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	0.0	0.0	0.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.000	0.000	0.000
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.000	0.000	0.000
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.000	0.000	0.000
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.000	0.000	0.000
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	0.00	0.00	0.00

SNOX, CONDENSER OUTLET, LOCATION 21, MODIFIED METHOD 5

RUN NO. TEST DATE	1 7/18	2 7/21	3 7/23
VOLUME OF GAS SAMPLED, NCF (DRY)	191.5	196.8	198.9
MOISTURE FRACTION VOLUME, PERCENT	7.9	8.0	7.8
AVERAGE STACK TEMPERATURE, F	197	197	199
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	71179	74443	72790
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	105081	110150	107473
ISOKINETIC RATE, PERCENT	99.7	96.1	101.3
EXCESS AIR, PERCENT	30.4	48.7	30.4
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	0.0	0.0
PARTICULATE LOADING, GR/NCF AT STACK 02 (DRY)	0.000	0.000	0.000
PARTICULATE LOADING, GR/ACF AT STACK 02 (WET)	0.000	0.000	0.000
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.000	0.000	0.000
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.000	0.000	0.000
PARTICULATE EMISSIONS, LB/HR	0.0	0.0	0.0

SNOX, CONDENSER OUTLET, LOCATION 21, MODIFIED METHOD 5

RUN NO. TEST DATE	1 7/18	2 7/21	3 7/23
VOLUME OF GAS SAMPLED, NCM	5.42	5.57	5.63
MOISTURE FRACTION VOLUME, PERCENT	7.9	8.0	7.8
AVERAGE STACK TEMPERATURE, C	91	91	92
STACK VOLUMETRIC FLOW RATE, NCMM	2015	2108	2061
STACK VOLUMETRIC FLOW RATE, CMM	2975	3119	3043
ISOKINETIC RATE, PERCENT	99.7	96.1	101.3
EXCESS AIR, PERCENT	30.4	48.7	30.4
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	0.0	0.0	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	0.0	0.0

SNOX, CONDENSER OUTLET, LOCATION 21, MULTI-METALS

RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK		1 7/19 1003 1902	2 7/22 906 1755	3 7/24 900 1754
	FROM TO			
DN	SAMPLING NOZZLE DIAMETER, IN.	0.197	0.197	0.197
TT	NET TIME OF TEST, MIN.	504	504	504
PB	BAROMETRIC PRESSURE, IN. HG	29.10	29.38	29.35
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.23	0.88	1.15
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	328.6	271.9	326.1
TM	AVG. GAS METER TEMPERATURE, F	110	112	107
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	272.1	226.3	267.7
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	608.3	455.9	527.5
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF	26.7	20.0	23.2
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	8.95	8.14	7.97
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.92	0.92
CO2	STACK GAS CO2, VOL PERCENT DRY	13.0	13.0	11.2
O2	STACK GAS O2, VOL PERCENT DRY	6.0	6.0	8.0
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.0	81.0	80.8
EA	STACK GAS EXCESS AIR, PERCENT	39.0	39.0	60.0
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.3	30.3	30.1
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.2	29.3	29.1
CP	PITOT TUBE COEFFICIENT	0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F	199	199	200
NP	NET SAMPLING POINTS	4	4	4

SNOX, CONDENSER OUTLET, LOCATION 21, MULTI-METALS

RUN NO.		1	2	3
TEST DATE		7/19	7/22	7/24
SAMPLING TIME, 24 HOUR CLOCK	FROM	1003	906	900
	TO	1902	1755	1754
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	0.06	0.06	0.06
PS	STACK GAS ABS. PRESSURE, IN. HG	29.16	29.44	29.41
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3878	3187	3651
AS	STACK AREA, SQ. IN.	4032.	4032.	4032.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	71918	60259	68934
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	108596	89225	102224
I	ISOKINETIC RATE, PERCENT	99.3	98.6	101.9
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	385.1	174.8	303.5
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.022	0.012	0.017
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.014	0.008	0.012
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.026	0.014	0.024
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.017	0.010	0.016
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	13.44	6.14	10.31

SNOX, CONDENSER OUTLET, LOCATION 21, MULTI-METALS

RUN NO. TEST DATE	1 7/19	2 7/22	3 7/24
VOLUME OF GAS SAMPLED, NCF (DRY)	272.1	226.3	267.7
MOISTURE FRACTION VOLUME, PERCENT	9.0	8.1	8.0
AVERAGE STACK TEMPERATURE, F	199	199	200
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	71918	60259	68934
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	108596	89225	102224
ISOKINETIC RATE, PERCENT	99.3	98.6	101.9
EXCESS AIR, PERCENT	39.0	39.0	60.0
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	385.1	174.8	303.5
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.022	0.012	0.017
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.014	0.008	0.012
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.026	0.014	0.024
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.017	0.010	0.016
PARTICULATE EMISSIONS, LB/HR	13.4	6.1	10.3

SNOX, CONDENSER OUTLET, LOCATION 21, MULTI-METALS

RUN NO. TEST DATE	1 7/19	2 7/22	3 7/24
VOLUME OF GAS SAMPLED, NCM	7.70	6.41	7.58
MOISTURE FRACTION VOLUME, PERCENT	9.0	8.1	8.0
AVERAGE STACK TEMPERATURE, C	92	92	93
STACK VOLUMETRIC FLOW RATE, NCMM	2036	1706	1952
STACK VOLUMETRIC FLOW RATE, CMM	3075	2526	2894
ISOKINETIC RATE, PERCENT	99.3	98.6	101.9
EXCESS AIR, PERCENT	39.0	39.0	60.0
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	385.1	174.8	303.5
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	49.9	27.2	39.9
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	33.0	18.4	26.9
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	59.9	32.7	55.4
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	39.7	22.1	37.4
PARTICULATE EMISSIONS, KG/HR	6.1	2.8	4.7

APPENDIX E

QA/QC

QA/QC

E-1. Sampling Completeness

The goal for data completeness in this study was defined in the QAPP as at least 85 percent. One aspect of achieving this goal is the completeness of sampling activities. Table E-1 shows the percent completeness of sampling of flue gas, solid and liquid streams at the SNOX process. Footnotes to the table identify the causes of any incomplete sampling efforts; any such deviations from plan are also discussed in Section 3.2.4 of this report.

TABLE E-1. COMPLETENESS OF SAMPLE COLLECTION AT SNOX PROCESS

Type of Sample	Completeness (percent)
Flue Gas	
Multi-Metals (Method 29)	100
Modified Method 5 (Method 23)	100
HEST Sampler	100
Canisters (VOC)	100
VOST (VOC)	100
TO-5 (Aldehydes)	100
Method 26A (Anions)	100
APHA 401 (Ammonia)	100
APHA 808 (Cyanide)	100
Filter Carbon	100
Filter Radionuclides	100
Particle Size Distribution	
Impactors	100
Cyclones	100
Solid Samples	
Boiler Feed Coal	100
Baghouse Ash	100
SO ₂ Catalyst Waste	100
Liquid Samples	
Sulfuric Acid	100

E-2. Analytical

E-2.1 Elements (ICP)

Accuracy, precision, and completeness for elemental analysis conducted by CTE are provided in Table E-2. Accuracy was determined by evaluating the recovery of a known amount of a standard solution spiked into a digested sample. Precision was determined by evaluating the relative percent difference of duplicate instrument analyses of a single digested sample. A completeness of 100 percent was achieved for ICP analysis of elements.

Method detection limits (DL) for elements in gas samples were calculated using the following equation:

$$DL (\mu\text{g}/\text{Nm}^3) = \text{Instrument Detection Limit } (\mu\text{g}/\text{mL}) \times \frac{\text{Digested Sample Volume (mL)}}{\text{Gas Sample Volume (Nm}^3\text{)}}$$

For example, the detection limit for cadmium in the filter from N-19-MUM-724 was calculated as follows:

$$DL = \frac{0.005 \mu\text{g}}{\text{mL}} \times \frac{150 \text{ mL}}{0.4231 \text{ g}} = 2 \mu\text{g}/\text{g}$$

This detection limit in $\mu\text{g}/\text{g}$ units was then converted to units of $\mu\text{g}/\text{Nm}^3$ as follows:

$$DL = 2 \mu\text{g}/\text{g} \times \frac{0.4231 \text{ g}}{6.776 \text{ Nm}^3} = 0.12 \mu\text{g}/\text{Nm}^3$$

TABLE E-2. ACCURACY, PRECISION, AND COMPLETENESS FOR ELEMENT ANALYSIS

Analyte Compounds	Accuracy		Precision			Completeness (%)	
	How Measured	Target (%)	Actual (%) ^(a)	How Measured	Target (%)		Actual (%) ^(a)
LIQUID	Spike Recovery	75-125		RPD of Duplicate Analysis	<20		100
Aluminum			84, 95			1.4, 18	
Antimony			85-105			1, 14	
Arsenic			85-113			0-17	
Boron			NA			NA ^(d)	
Barium			43-101			2.7, 3.1	
Beryllium			106-110			ND ^(e)	
Cadmium			99-102			ND	
Cobalt			95-99			ND	
Chromium			101-103			ND	
Copper			85-102			ND, 25	
Potassium			82-100			3.8, 11	
Lead			103-120			2-14	
Manganese			90-102			ND, 8.2	
Mercury			106			0-17	
Molybdenum			98-111			ND	
Sodium			115 ^(b)			10, 16	
Selenium			73-114			4, 13	
Nickel			98-109			ND	
Silicon			NA			NA	
Titanium			101-104			9.5, 17	
Vanadium			102-106			ND	
SOLID	Spike Recovery	75-125		RPD	<20		100
Antimony			80-95			6-11	
Arsenic			78-105			6-10	
Aluminum			NA			1.9-19	
Barium			13-131			0.2-11	
Boron			NA			NA	
Beryllium			94-102			7.4-8.7	
Cadmium			94-101			ND	
Cobalt			95-104			10-30	
Chromium			95-103			1.8-10.3	
Copper			84-98			2.2-123	
Potassium			71-94			3.2-12	
Lead			97-111			4, 4	
Manganese			91-104			0.6-7.9	
Mercury			88-112 ^(e)			NA	
Molybdenum			92-103			ND	
Selenium			79-99			1	

TABLE E-2. (Continued)

Analyte Compounds	Accuracy			Precision			Completeness (%)
	How Measured	Target (%)	Actual (%) ^(a)	How Measured	Target (%)	Actual (%) ^(a)	
Sodium			45-230			3.1-25	
Nickel			94-105			9.1-19.9	
Silicon			NA			NA	
Titanium			25-100			3.1-7.8	
Vanadium			94-100			3.6-8	
GAS	Spike Recovery ^(b) Reference Standards ^(c)	75-125		RSD of Standard Analysis	≤20		100
Antimony			83-119			1-17	
Arsenic			76-115			1-21	
Aluminum			45-127			1.1-4.6	
Barium			87-104			2.4-7.9	
Beryllium			72-108			0-2.2	
Boron			NA			NA	
Cadmium			76-147			ND	
Chromium			87-143			2-8	
Cobalt			81-130 ^(d)			0-18	
Copper			78-114			0-4.4	
Lead			85-109			1-10	
Manganese			89-136			1.8-3.5	
Mercury			80-144			0-36	
Molybdenum			97-144			ND	
Nickel			61-122			0.6-32	
Potassium			26-104			1.8-200	
Selenium			75-117			1-14	
Silicon			NA			NA	
Sodium			35-93			1.3-10	
Titanium			29-102			0-2.2	
Vanadium			86-114			ND-2.6	

(a) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

(b) Excludes outlier of 12 percent recovery.

(c) ND = Analyte not detected in sample therefore RPD could not be calculated.

(d) NA = Data not available or analysis not conducted.

(e) Recovery from standard reference material.

(f) Excludes outlier of 12 percent recovery.

E-2.2 Mercury

Accuracy, precision, and completeness results for CVAA analysis of mercury in gas impinger samples conducted by Battelle are presented in Table E-3. Accuracy was determined by evaluating the recovery of mercury spiked into digested sample matrix. Precision was determined by calculating the relative percent difference of duplicate instrument analyses of a single sample. Accuracy and precision obtained met the target objectives in all cases. A completeness of 100 percent was obtained for all mercury analyses.

TABLE E-3. ACCURACY, PRECISION, AND COMPLETENESS FOR MERCURY ANALYSIS^(a)

Analyte/Surrogate Compounds	Accuracy			Precision			Completeness
	How Measured	Target (%)	Actual (%) ^(b)	How Measured	Target (%)	Actual (%) ^(b)	
Mercury	Spike Recovery	75-125	92-108	RPD ^(c) of Duplicate Analysis	<20	0-5	100

(a) Represents results from analysis of gas samples only.

(b) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

(c) RPD = relative percent deviation.

E-2.3 Ammonia/Cyanide

A summary of the accuracy, precision, and completeness obtained for the ammonia/cyanide analysis is provided in Table E-4. Accuracy was determined by calculating the recovery of a known amount of analyte spiked into a sample. Precision was determined by duplicate instrument analysis of a single sample. The accuracy and precision obtained met the target quality objectives in all cases, except for the precision associated with the duplicate analysis of a sample containing ammonia at a level less than the detection limit. A completeness of 100 percent was achieved for all samples.

The method detection limits for ammonia and cyanide in gas samples were calculated using the following equation:

$$DL (\mu\text{g}/\text{Nm}^3) = \frac{\text{Instrument Detection Limit } (\mu\text{g}/\text{sample})}{\text{Gas Sample Volume } (\text{Nm}^3)}$$

No example calculation is provided since ammonia and cyanide were detected in all samples.

TABLE E-4. ACCURACY, PRECISION, AND COMPLETENESS FOR AMMONIA AND CYANIDE ANALYSIS

Analyte	Accuracy			Precision			Analytical Completeness (%)
	How Measured	Target (%)	Actual (%) ^(a)	How Measured	Target (%)	Actual (%) ^(a)	
	Spike Recovery			RPD of Duplicate Analysis			
Ammonia		75-125	100-104		<20	0-12 ^(b)	100
Cyanide		75-125	85-105		<20	2,2	100

(a) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

(b) RPD results of 12 at 0.078 and 0.088 $\mu\text{gN}/\text{mL}$ level (0.094 and 0.106 $\mu\text{g NH}_3/\text{mL}$).

E-2.4 Anions

Accuracy, precision, and completeness results for anion analysis are presented in Table E-5. Accuracy was determined by evaluating the recovery of target analytes spiked into sample matrix as well as analysis of a standard reference material (SRM). Precision was determined by calculating the relative percent difference of duplicate analysis of a single sample. Accuracy and precision obtained met the target objectives in all cases. A completeness of 100 percent was obtained for all anion analyses.

Detection limits for anion analyses of gas samples by ion chromatography were determined by the observation of a calibration standard which when analyzed provided an approximate 3:1 signal-to-noise ratio.

Species which interfered with the chromatographical analysis of a sample, i.e. a species which overloaded the column or eluted near the retention window of interest, were corrected for by sample dilution which in turn required a proportional increase in the detection limit for the sample. The method detection limit is calculated as follows:

$$DL (\mu\text{g}/\text{Nm}^3) = \frac{\text{Lowest Level Calibration Std } (\mu\text{g}/\text{mL}) \times \text{Sample Dilution Factor} \times \text{Extraction Volume (mL)}}{\text{Gas Sample Volume (Nm}^3\text{)}}$$

For example, in the analysis of chloride in filter sample N-21-FCI-722, a large interfering peak in the chromatogram required a dilution of 1:100 to determine the chloride level. The detection limit for the sample was then determined as follows:

$$0.010 \mu\text{g}/\text{mL} \times 100 \times 20 \text{ mL} / 1.199 \text{ Nm}^3 = 17 \mu\text{g}/\text{Nm}^3$$

TABLE E-5. ACCURACY, PRECISION, AND COMPLETENESS FOR ANION ANALYSIS

Analyte/Surrogate Compounds	Accuracy			Precision			Completeness
	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	
<u>Gas (Impinger Solution)</u>	Spike Recovery			RPD of Duplicate Analysis			100
Chloride		75-125	NA		<20	9.4	
Fluoride		75-125	NA		<20	0.7,5.7	
	SRM Analysis						
Chloride		143-171 ppm	154,154 ppm				
Fluoride		1.55-2.02 ppm	1.84-1.92 ppm				
<u>Gas (Filter)</u>	Spike Recovery			RPD of Duplicate Analysis			100
Chloride		75-125	98,125		<20	1.2,15	
Fluoride		75-125	99-108		<20	0.1,1.3	
Sulfate		75-125	100		<20	0.9,0.2	
Phosphate		75-125	114		<20	1.1	
	SRM Analysis						
Chloride		143-171 ppm	161,166 ppm				
Fluoride		1.55-2.02 ppm	1.72-1.96 ppm				
Sulfate		70.1-93.9 ppm	83.8,88.8 ppm				
Phosphate		0.555-0.779 ppm	0.589 ppm				
<u>Solids/Liquids</u>	Spike Recovery			RPD of Duplicate Analysis			100
Chloride		75-125	95		<20	4.6,14	
Fluoride		75-125	106,111		<20	105	
Sulfate		75-125	86		<20	0.47-3.1,45	
Phosphate		75-125	78-113		<20	0.0	
	SRM Analysis						
Chloride		143-171 ppm	155-175 ppm				
Fluoride		1.55-2.02 ppm	1.62-1.77 ppm				
Sulfate		70.1-93.9 ppm	76.5-84.4 ppm				
Phosphate		0.555-0.779 ppm	0.648-0.730 ppm				

NA = not analyzed or data not available.

E-2.5 VOC

E-2.5.1 Gas Samples (VOST). A summary of the accuracy, precision, and completeness obtained for analysis of VOC in VOST samples is shown in Table E-6. To determine accuracy, each sample was spiked with four surrogate compounds prior to analysis. Recovery of the surrogate spike was then considered as the analytical accuracy. As shown, the surrogate spike recovery met the original objectives of 26-160 percent in most cases.

A method detection limit of 25 ng/sample was determined by calculating ten times the standard deviation of replicate analyses of a 50 ng standard. Detection limits for individual samples were then calculated by dividing 25 ng/sample by the associated gas sample volume.

TABLE E-6. ACCURACY, PRECISION, AND COMPLETENESS FOR VOC VOST ANALYSIS

Analyte/Spike Compounds	Accuracy			Precision			Completeness
	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	
	Surrogate Spike Recovery						100
d ₄ -1,2-Dichloroethane		26-160	42-128		<20	NA	
d ₈ -Toluene		26-160	63-164, 503 ^(a)		<20	NA	
d ₆ -Benzene		26-160	77-139		<20	NA	
p-Bromofluorobenzene		26-160	26-112		<20	NA	

(a) Interference in sample may have contributed to high percent recovery.

E-2.5.2 Gas Samples (Canister). A summary of the precision, accuracy and completion obtained for analysis of VOC in canister samples is shown in Table E-7. Information on accuracy was obtained from a canister spiked with four target compounds. The concentrations of the four components were established by reference to the 41 component calibration cylinder. This cylinder has been recently audited by US EPA and shown to be within ± 10 percent of the stated values for 15 compounds common to both mixtures. The contents of the spiked canister were directed through the sampling train and into a second canister. Both canisters were analyzed to determine the amount recovered. Analytical precision was determined by repeated analyses (3 times) of a 1/100 dilution mixture from the 41 component calibration cylinder. The four components used during the field spike experiment are reported. A completeness of 100 percent was achieved for canister analyses.

Detection limits for VOC in canister samples were calculated as follows:

$$DL \text{ (ppb)} = \frac{\text{Concentration of Stds (ppb)}}{\text{Average of Range of Std Peak Areas (all)}} \times 3 \times (\text{Peak Area Noise})$$

The calibration cylinder contained the 41 target components each at a nominal concentration of 200 ppb. The cylinder was dynamically diluted to the 6 ppb level. Using the selective ion monitoring mode of the GC/MS, area counts from 850,000 to 1,700,000 were obtained for the target compounds. The peak area noise was approximately 35,000 area units. No changes in electron multiplier gain was made during the study so the above responses hold throughout the time period. With these results, the actual detection limit achieved was calculated as follows:

$$DL \text{ (ppb)} = \frac{6 \text{ ppb}}{((1,700,000 + 850,000)/2)} \times 3 (35,000) = 0.5 \text{ ppb}$$

The detection limit in ppb units was then converted to $\mu\text{g}/\text{Nm}^3$ units by multiplying by a conversion factor. For example, 1 ppb of trichlorofluoromethane at 0°C and 760 mm is equal to $6.11 \mu\text{g}/\text{Nm}^3$; therefore the converted detection limit was $3.06 \mu\text{g}/\text{Nm}^3$.

TABLE E-7. ACCURACY, PRECISION, AND COMPLETENESS FOR VOC CANISTER ANALYSES

Analyte/Spike Compounds	Accuracy			Precision			Completeness (%)
	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	
	Spike of Sampling Train with Canister			RSD ^(a) of Replicate Analysis of Standard Cylinder			100
Benzene	25.6 $\mu\text{g}/\text{Nm}^3$	75-125	108		< 20	± 14	
Toluene	23.0 $\mu\text{g}/\text{Nm}^3$	75-125	122		< 20	± 7	
Ethylbenzene	25.6 $\mu\text{g}/\text{Nm}^3$	75-125	109		< 20	± 8	
Styrene	19.2 $\mu\text{g}/\text{Nm}^3$	75-125	102		< 20	± 16	

(a) RSD = relative standard deviation.

E-2.6 PAH/SVOC

Accuracy, precision, and completeness results for PAH/SVOC analysis of gas and solid samples are presented in Table E-8. Accuracy was determined by recovery of perdeuterated PAH spike compounds added to the samples prior to extraction. In most cases, spike recoveries met the target objective of 50 to 150 percent. Precision was determined by evaluating the relative standard deviation of calibration standard analyses. The average relative standard deviation (RSD) for three calibration standards, 0.05 ng/ μ L, 0.1 ng/ μ L, and 0.5 ng/ μ L is presented in Table E-8. As shown, this average RSD is below the target 30 percent in all cases. Individual RSD for these three standards were also below the 30 percent target. A completeness of 96 percent (23 samples analyzed/24 samples received) was achieved due to the loss of the XAD-2 resin from sample N-20-MM5-718 during sample preparation. A completeness of 100 percent was achieved for the solid samples.

The estimated detection limit for PAH is 0.01 ng on column and for SVOC is 0.05 ng on column with a 1- μ L injection. At these concentration levels, the signal-to-noise ratio is about 3. The detection limit for PAH/SVOC was calculated using the following equation:

$$DL = \frac{\text{Estimated Detection Limit Concentration} \times \text{Final Volume of Extract Analyzed}}{\text{Gas Sample Volume} \times \text{Fraction of Extract Analyzed}}$$

For example, the detection limit for hexachloroethane in N-18-MM5-X-718 was calculated as follows:

$$\frac{0.05 \text{ ng}/\mu\text{L} \times 2000 \mu\text{L}}{5.8014 \times 1.0} = 17.2 \text{ ng}/\text{Nm}^3$$

TABLE E-8. ACCURACY, PRECISION, AND COMPLETENESS FOR PAH/SVOC ANALYSIS
OF GAS AND SOLID SAMPLES

Analyte/Surrogate Compounds	Accuracy			Precision			Completeness
	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	
	Recovery of Perdeuterated PAH Spike						
GAS							96
d ₁₂ -Chrysene		50-150	55-115				
d ₁₂ -Benzo(k)fluoranthene		50-150	43-143				
SOLID							100
d ₁₂ -Chrysene		50-150	53-56				
d ₁₂ -Benzo(k)fluoranthene		50-150	47-56				
				RSD of Calibration Standard Analysis	< 30		
GAS/SOLID							
Benzylchloride						15.9	
Acetophenone						15.1	
Hexachloroethane						11.3	
Naphthalene						7.5	
Hexachlorobutadiene						11.2	
2-Chloroacetophenone						8.2	
1-Methylnaphthalene						7.4	
2-Methylnaphthalene						5.3	
Hexachlorocyclopenta- diene						12.3	
Biphenyl						6.6	
Acenaphthylene						5.2	
2,6-Dinitrotoluene						7.9	
Acenaphthene						6.4	
Dibenzofuran						6.9	
2,4-Dinitrotoluene						8.8	
Fluorene						6.1	
Hexachlorobenzene						6.5	
Pentachlorophenol						11.2	
Phenanthrene						11.6	
Anthracene						6.7	
Fluoranthene						13.2	
				RSD of Calibration Standard Analysis			

TABLE E-8. (Continued)

Analyte/Surrogate Compounds	Accuracy			Precision			Completeness
	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	
Pyrene						9.2	
Benz(a)anthracene						8.6	
Chrysene						6.0	
Benzo(b&k)fluoranthene						8.0	
Benzo(e)pyrene						7.5	
Benzo(a)pyrene						9.2	
Indeno(1,2,3-c,d)pyrene						10.5	
Dibenzo(a,h)anthracene						11.1	
Benzo(g,h,i)perylene						6.5	

E-2.7 Aldehydes

Accuracy, precision, and completeness results for analysis of aldehydes in gas samples are presented in Table E-9. Accuracy was determined by recovery of analytes spiked into water. As shown, except for a 179 percent recovery of formaldehyde spiked into water at or near the method detection limit, all recoveries met the target objective of 50 to 150 percent. The precision was determined by the relative standard deviation of standard analyses and also met the target objectives. Completeness of 100 percent was obtained for both gas and liquid samples.

Method detection limits for aldehydes in gas samples were calculated using the following equation:

$$DL(\mu g/Nm^3) = A_{\min} \times \frac{C_{std}(\mu g/mL)}{A_{STD}} \times \frac{V_{e-avg}(mL)}{V_{sampled}(Nm^3)} \times \frac{MW_{neat}}{MW_{DER}}$$

where:

DL = Detection Limit

$A_{\min}$ = Minimum detectable peak area of carbonyl

A_{std} = Peak area of carbonyl derivative in standard solution

C_{std} = Concentration of carbonyl derivative in standard solution

V_{e-avg} = Average final volume of DNPH-acetonitrile solution

$V_{sampled}$ = Average volume of air sampled

MW_{neat} = Molecular weight of neat carbonyl compound

MW_{DER} = Molecular weight of carbonyl derivative.

Actual detection limits were calculated as follows:

$$4300 \times \frac{2 \mu g/mL}{334293} \times \frac{31.7 mL}{0.0455 Nm^3} \times \frac{30.03}{210} = 2.6 \mu g/Nm^3$$

TABLE E-9. ACCURACY, PRECISION, AND COMPLETENESS FOR ALDEHYDE ANALYSES

Analyte/Spike Compounds	Accuracy			Precision			Completeness (%)
	How Measured	Target (%) ^(a)	Actual (%) ^(a)	How Measured	Target (%)	Actual (%)	
GAS	Spike Recovery			RSD of Standard Analysis			100
Formaldehyde		50-150	114-122 ^(b)		± 15	0.45	
Acetaldehyde		50-150	85-100		± 15	0.57	
Acrolein		50-150	NA ^(c)		± 15	0.32	
Propionaldehyde		50-150	81-95		± 15	0.59	

(a) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

(b) Excludes 179 percent recovery for spike at detection limit of method.

(c) NA = Not analyzed.

E-2.8 Radionuclides

Accuracy, precision, and completeness results for radionuclide analysis are presented in Table E-10. Accuracy was determined by evaluating the recovery of cesium-137 spiked into sample matrix. Precision was determined by evaluating results of duplicate sample analyses. The precision achieved met the target objective of ± 3 standard deviations; relative percent differences (RPD) are provided in Table E-10 for comparability with other analytical data. A completeness of 100 percent was obtained for all radionuclides analyses.

The method detection limit for radionuclides was calculated using the following equation:

$$MDC = \frac{4.65 \sqrt{BKG} + 2.71}{(2.22)(EFF)(AVOL)(CTIME)(Ab)(D)}$$

where:

MDC	=	Minimal detectable concentration
BKG	=	Background counts
EFF	=	Counting efficiency
AVOL	=	Aliquot volume (g or L)
CTIME	=	Count time (min)
Ab	=	Abundance of emission
D	=	Decay correction
2.22	=	Conversion from dpm to pCi
4.65, 2.71	=	Constants.

This equation is derived from the following reference:

"Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements", L. A. Currie, NUREG/CR-4007, U.S. Nuclear Regulatory Commission, September 1984.

TABLE E-10. ACCURACY, PRECISION, AND COMPLETENESS FOR RADIONUCLIDE ANALYSIS

Analyte/Surrogate Compounds	Accuracy			Precision			Completeness
	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	
	Spike Recovery			RPD of Duplicate Analysis ^(b)			100
Cs-137		NA	100-109				
Pb-210				—		5	
Pb-212				—		14	
Ra-226				—		1	
Ra-228				—		20	
Th-234				—		10	
U-234				—		49	
U-235				—		33	

(a) Precision not provided for radionuclides not detected in both sample and duplicate.

(b) All duplicate results agreed to within ± 3 standard deviations target objective; RPD provided for comparability with other analytical data.

NA = Not available.

E-3. Method Detection Limit

Approximate emission detection limits obtained for gas samples in which analytes were not detected are listed in Table E-11.

TABLE E-11. EMISSION DETECTION LIMITS

Element	Actual Emission Detection Limit ($\mu\text{g}/\text{Nm}^3$) ^(a)	Target Emission Detection Limit ($\mu\text{g}/\text{Nm}^3$)
Mo	NC	1.5
B	NC	1.2
Sb	1.0	0.3
As	NC	0.06
Ba	NC	0.3
Be	NC	0.3
Cd	0.2	0.3
Cr	NC	1.2
Pb	NC	0.06
Mn	NC	0.3
Hg	NC	0.03
Ni	NC	1.2
Se	NC	0.12
V	NC	0.6
Cu	NC	0.6
Co	0.3	0.9
Ammonia	NC	750
Cyanide	NC	191
Anions		
F ⁻	NC	3
Cl ⁻	15	3
PO ₄ ⁼	6	30
SO ₄ ⁼	NC	7.5
PAH/SVOC	0.4-20	0.1-10 ng/Nm ^{3(b)}
Aldehydes	2	2
VOC - Canister	4	6
VOC - VOST	6	1.3-7.5

(a) Approximate emission detection limit obtained in sample analyses. Values for PAH/SVOC are in ng/Nm³.

(b) Calculated target emission detection limit will range from 0.1 to 10 ng/Nm³ depending upon SVOC compound and matrix.

NC = Not calculated because analyte concentration was above method detection limit in samples.

APPENDIX F
ANALYTICAL PROTOCOL

F-1. Element Analytical Protocols

Elements in flue gas, solid, and liquid samples were analyzed by various methods (ICP, GFAA, PIXE, CVAA) according to the procedures described in the QAPP. Specific deviations from those procedures were as follows:

- (1) Samples sent to CTE for analysis instead of Battelle. In order to meet the reporting deadline, it was necessary to send process solid, process liquid, PSDS filter, and gas samples (excluding impinger samples for mercury analysis) to Commercial Testing and Engineering Company (CTE) in Denver, Colorado for analysis. CTE followed the Quality Assurance Plan for element determinations with the following exceptions:
 - The analyses of solid samples by CTE for mercury were accomplished by a double gold film amalgamation. No spike samples were performed due to the use of a solid sample matrix. However, recoveries for solid reference materials were within the limits established for this program.
 - Silicon, aluminum, titanium, potassium, and sodium, in solid samples (boiler feed coal, SO₂ catalyst waste, and baghouse ash) were determined by X-ray fluorescence spectroscopy, in accordance with ASTM 04326, instead of ICP.
- (2) The H₂O₂ reagent blank was lost during sample preparation. Train blanks are not corrected for this reagent blank. Samples results, by process of subtracting train blank results, are corrected for contributions from this reagent.
- (3) Filter reagent blanks analyzed for elements had unexplained outlying results in several cases. Duplicate Pallflex 102 mm filter reagent blanks were analyzed. Results for one of these reagent blanks were as expected with element concentrations equivalent or significantly below sample results. The second Pallflex 102 mm filter reagent blank had extremely high concentrations of aluminum, potassium, and sodium which were considered outliers and not considered in blank corrections.

Likewise in the analysis of triplicate Pallflex 86 mm filter reagent blanks, outlying results were obtained for aluminum and sodium in one blank and for potassium in a second blank. Again, these outlying results were not included in reagent blank corrections.

- (4) Problems with Si and B determinations of Method 29 samples by CTE. Boric acid was used to complex excess hydrofluoric acid after microwave digestion by CTE. Hydrofluoric acid may also react with glassware or the glass mixing chamber of the ICP analyzer, and may interfere with silicon results. Thus CTE has not reported Si and B results for some samples.
- (5) The Method 29 filter was analyzed separately from the combined acetone/acid probe rinses for ICP and GFAA analyses. This deviation was required to allow evaluation of the particle size distribution of elements in the flue gas emissions.

F-2. Ammonia/Cyanide Protocols

Samples were analyzed for ammonia and cyanide according to the procedures stated in the QAPP.

F-3. Analytical Protocol for Anions

F-3.1 Summary of Method for Anion Analysis by Ion Chromatography

Anions of interest are separated and measured using a Dionex DX300 ion chromatography system comprised of a guard column, separator column, MicroMembrane suppressor, and conductivity detector. The separator column selectively separates ions based upon their affinity for an ion-exchange resin. The suppressor converts the eluted ions to acids which are then measured by a conductivity meter. Identification of the ions is made by their retention time on the column. Quantification is done by comparing peak height or area responses to those of calibration standards.

F-3.2 Deviations from Method 26A

- (1) The analysis of EPA Performance Evaluation Samples (WP029) was used instead of EPA "Audit Samples" designated in Section 7.7.1 of Method 26A.

There is no effect on results because of this deviation from Method 26A. The acceptable range for either must be analytically achieved to assure method accuracy. The target values are documented by the EPA and the analysis results are recorded in the project laboratory record book.

- (2) Calibration standards were prepared in deionized water instead of 0.1 N H₂SO₄ as stated in Section 5.2 of Method 26A.

As the majority of the analyses required dilution in deionized water to conform to the analytical range of the detector, deionized water was the appropriate solvent for the calibration standards. There should be no adverse effect on results from this alteration.

F-3.3 Deviations from Method 300.0

- (1) The instrument calibration is verified approximately each hour of operation with the analysis of an Instrument Calibration Verifier (ICV) which has a tolerance of 20 percent from the known value. Section 9.4 of Method 300.0 states that the tolerance should be 10 percent. Although 10 percent is achievable precision (see RPD's of duplicates), ICV's require 20 percent because they are analyzed around the clock where temperature changes contribute to a small amount of instrumental drift above 10 percent.

F-3.4 Deviations from the OAPP

- (1) The Custody During Lab Analysis (5.1.3.3) section states that quality control samples will be documented in a bound lab record book and assigned an LRB number. The ion chromatography lab uses a sample log for all incoming samples

from which a unique 4-digit number is assigned. Copies of logged samples will be entered into a bound LRB. The chain-of-custody-form copies will serve as a record of the personnel involved and the times involved in sample-handling transactions.

- (2) Data Quality Objectives (Table 5-4) should state that a standard reference material (EPA WP029) will be used as an accuracy determiner when the matrix spike is not applicable, i.e., the spiked sample is unmeasurable because of column and/or detector overload or because of matrix dilution necessary for linear range detection.
- (3) The target values for the WP029 samples were achieved with each calibrated sample run except one. The result of WP29 chloride for Niles, Run #3, Solids, was 176 ppm. The acceptable range is 143-171 ppm. The oversight was discovered too late to be corrected. Considering the fact that all of the other QC analyses for this sample run and specifically those surrounding this analysis were within the control limits, the run was not invalidated.

F-4. Analytical Protocol for VOC

F-4.1 VOST Samples

Analysis of VOST sorbent traps for VOC was conducted as described in the QAPP, according to the provisions of SW-846 Method 5041, using thermal desorption GC/MS. Each sampled pair of VOST traps was placed in a heated desorption unit and purged with organic-free nitrogen or helium. The purge gas flow transferred VOC desorbed from the VOST traps to a cold trap for focussing. Heating of the cold trap released collected VOC in a small volume onto the inlet of the GC column. The VOC were then determined by temperature programmed chromatography with detection by low resolution mass spectrometry. Internal standards were used to quantify the VOC. The one deviation from plan was that hexane was not determined in VOST samples.

F-4.2 Canister Samples

Canister samples were analyzed with a gas chromatograph equipped with a mass spectrometric detector. Upon receipt, the initial pressure of each can was recorded and the can was filled with zero air to facilitate sample extraction. The initial and final pressures were used to determine the dilution correction factor. Since acidic gases have been shown to strip the analytical column of bonded liquid phase within a short time period sampled air from the canister was first directed through a sodium bicarbonate trap to reduce the content of acidic gases. The use of alkaline water was originally specified in the Analytical Management Plan but was shown prior to the field study to partly remove several of the target compounds when challenged with the 41 component calibration mixture. The effluent from the sodium bicarbonate trap was then directed to an adsorbent trap (Carbopak B/ Carbosieve S-III) to preconcentrate the target VOC species. A six port valve and thermal desorption step were used to inject the adsorbed material onto the analytical column. The column was temperature programmed from -50 to 200°C to resolve the VOC. Selective ion monitoring was used to quantify the target species. However, sufficient acidic gases were still present in the injected sample that prohibited the operation of the mass spectrometer until 11 minutes into the run. As a result, the first six species on the 41 component target list were not analyzed. A method detection level of 0.5 ppb was achieved with a sample volume of 60 cm³.

F-4.3 Liquid VOC Samples

Volatile organic compounds (VOC) in liquid samples were analyzed by Zande Environmental Laboratories using purge and trap gas chromatography/mass spectrometry. EPA SW846 Method 8240 was followed for the analysis of these samples. All samples were initially analyzed within 14 days of receipt at the laboratory.

Calibration curves were generated and the appropriate Calibration Check Compounds (CCC) and System Performance Compounds (SPCC) were within the limits stated in Method 8240. The system was initially tuned with 4-bromofluorobenzene prior to analysis of the initial calibration curve. An attempt to tune the system every 12 hours of operation was

made, but the 12 hour window was exceeded by 10 minutes in one instance and 20 minutes in another. A couple of tunes also failed to meet the abundance ratio criteria found in Method 8240. Continuing calibration standards were analyzed every twelve hours and in all instances but two met the continuing calibration criteria required by Method 8240. There were no target analytes present in any of the samples.

F-5. Analytical Protocol for PAH/SVOC

F-5.1 Gas and Solid Samples

The MM5 samples were prepared according to the Niles Analytical Plan. The MM5 filter and probe rinse filter were spiked with known amounts of d_{12} -chrysene and d_{12} -benzo(k)fluoranthene before Soxhlet extraction. The filters were then extracted with dichloromethane (DCM) for 18 hours. Note that in the QAPP the extraction time is indicated as 16 hours, but the actual extraction time for all the samples was 18 hours. The DCM extract was combined with the filtrate from the probe rinse and concentrated by Kuderna-Danish (K-D) evaporation. Note that the concentrated probe rinse extracts were acidic and contained water. Thus 50 mL of DCM and 50 mL of water were added to the concentrated probe rinse extract. The water layer was adjusted to pH of 7, and then extracted twice with 50 mL of DCM. The DCM extracts were combined, dried with sodium sulfate, and concentrated to 1 mL for combination with the corresponding filter extract. Cyclone samples collected at Location 18 were spiked with perdeuterated PAH and extracted with DCM for 18 hours. The DCM extracts were concentrated to 1 mL by K-D evaporation for silica gel column chromatography.

The XAD-2 samples were spiked with perdeuterated PAH and/or ^{13}C -labelled dioxin/furan and extracted with DCM. The condensate was adjusted to pH 7 and extracted with DCM according to the QAPP. The XAD-2 extract was combined with the module rinse and condensate, and concentrated to 1 mL for silica gel column chromatography.

Aliquots of the solid process samples were spiked with perdeuterated PAH and extracted with DCM for 18 hours. The DCM extracts were concentrated to 1 mL for silica gel column chromatography.

The DCM extract was solvent exchanged into hexane (C_6) and applied to a silica gel column. The column was packed with 5 percent water deactivated silica gel with C_6 . Three elution solvents, C_6 , C_6 /DCM (50/50), and methanol were applied to the column. The C_6 /DCM fractions were concentrated to 1 mL with K-D evaporation and further concentrated to 100 μ L with nitrogen evaporation for GC/MS analysis. Some of the C_6 /DCM fractions of XAD-2 extracts were diluted to 1 mL or more to minimize sample matrix effects for GC/MS analysis. The methanol fractions were concentrated to 1 mL, evaporated almost to dryness, and solvent exchanged into 1 mL of DCM, however these fractions were not analyzed. The only target analyte expected in this fraction is quinoline for which data are not provided.

A Finnigan TSQ-45 GC/MS/MS operated in GC/MS mode equipped with an INCOS 2300 data system was employed. Helium was the GC carrier gas and a 70 eV electron beam was used. The MS was operated in the selected ion monitoring mode. Ion peaks monitored by MS are the molecular ions and characteristic fragment ions of target analytes. Identification of the target analytes was based on the correct molecular ion, correct fragment ions, and the correct retention time relative to the internal standard. Quantification of each target analyte followed the method described in the QAPP.

F-5.2 Liquid SVOC Samples

Semivolatile organic compounds (SVOC) in liquid samples were extracted and analyzed by Battelle using liquid/liquid extraction, and analysis by gas chromatography/mass spectrometry. EPA SW846 Method 3560 and 8270 was followed for the analysis of these samples. All samples were initially extracted within 7 days of receipt at the laboratory and the extracts analyzed within 40 days.

One liter aliquots of each sample were fortified with the appropriate surrogate compounds to monitor extraction efficiency, serially extracted three times with methylene chloride, concentrated to 1 mL, fortified with internal standards and analyzed on an HP 5970 MSD. Every sample with the exception of blanks and spiked blanks formed emulsions during the base/neutral extraction. Due to the formation of emulsions, during the base/neutral extraction, each 60 mL aliquot of extract was collected in a centrifuge bottle, centrifuged, the organic removed and the remainder added back to the separatory funnel.

prior to the next addition of solvent. Once the samples were acidified, emulsions did not form and the samples were processed without centrifugation. No problems were encountered in the concentration step.

Calibration curves were generated and the appropriate Calibration Check Compounds (CCC) and System Performance Compounds (SPCC) were within the limits stated in Method 8270.

The system was initially tuned with decafluorotriphenylphosphine prior to analysis of the initial calibration curve. The system was also tuned every twelve hours of operation and met the required ion abundances. Continuing calibration standards were analyzed every twelve hours and in all instances met the continuing calibration criteria required by Method 8270 for CCCs and SPCCs. Method 8270 allows for 30 percent RSD on CCCs and this criteria was used. The QAPP incorrectly stated 25 percent RSD.

F-6. Analytical Protocol for Aldehydes

Gas samples (DNPH impinger solutions) and liquid process samples were analyzed for formaldehyde, acetaldehyde, acrolein, and propionaldehyde using high performance liquid chromatography with ultraviolet detection (HPLC/UV). Prior to the collection of the gas aldehydes, the DNPH reagent for the impinger samples was prepared by mixing 0.06 g of purified DNPH crystals per 250 mL of acetonitrile. Fifty (50) μ L of sulfuric acid was also added to each 250 mL of DNPH reagent.

After the gas samples had been collected and prior to analysis, the volume of DNPH impinger solution collected from each impinger was measured with a graduated cylinder. Next, a 4-mL aliquot from each sample was transferred to a 4-mL HPLC sample vial with a septa-seal top. The HPLC vials were used as the permanent storage vessel for the impinger samples. These HPLC vials were refrigerated before and after analysis.

For liquid samples (both process liquid samples and condensed water samples from the gas sampling trains), all samples were reacted with DNPH just prior to analysis. An aliquot of 2 mL of each liquid sample and 2 mL of DNPH reagent were mixed in a 4-mL HPLC sample vial with septa-seal top. The HPLC vials were used as the permanent storage vessel for the liquid samples. The liquid-DNPH solutions were allowed to react for at least 3

hours prior to analysis. This reaction time is necessary to assure that all of the aldehyde species present in the liquid will be converted to carbonyl-DNPH derivatives. After the waiting period, the samples were analyzed. For the liquid samples, standards were prepared by adding the neat aldehydes to HPLC water at concentrations above and below those found in the actual samples. The standard water samples were reacted with the DNPH in the same manner as the actual samples.

For the process liquid samples, additional sample preparation steps had to be implemented because of the potential for suspended solids in the samples. Prior to reaction with the DNPH solution, the process liquid samples were filtered through a 0.22 μm filter.

After the liquid samples were reacted with the DNPH, a white precipitate settled out in a few of the samples. To protect the HPLC system, the liquid above the precipitate was decanted off and placed into a new HPLC vial. It was this liquid that was analyzed on the samples in which precipitation occurred.

All of the samples were analyzed with a Waters HPLC system. An acetonitrile/ H_2O mixture (65/35) serves as the mobile phase. Column flow is 0.8 mL/min. Typically, the injection volume used for aldehyde samples was 30 μL .

F-7. Analytical Protocol for Radionuclides

Radiological analysis of both the gas (filter) samples and the solid samples was performed by the International Technology (IT) Corporation's Oak Ridge, Tennessee laboratory using a gamma scan method. The samples were prepared for gamma spectrometry using that laboratory's standard operating procedure OR-7003, Revision 0. Then the radioactivity counts were obtained using IT-Oak Ridge standard operating procedure OR-7212, Revision 0.

During the analysis procedures the following reports were prepared:

- (1) Gamma Spectroscopic Analysis Parameters
- (2) Summary of Positively Identified Nuclides
- (3) Summary of Unidentified Nuclides
- (4) Peak Search Report (Gross)
- (5) Peak Search Report (Net)

- (6) Summary of Nuclide Activity
- (7) Nuclide Line Activity Report
- (8) Full Combined Activity - MDA Report
- (9) Unidentified Energy Lines Report
- (10) Total Uranium Analysis Parameters and Summary
- (11) Full Combined Uranium Activity - MDA Report

For each sample the analysis results were summarized by reporting the activity in pico Curies per gram for the following isotopes as was called for in the QAPP:

Pb-210	Pb-211
Pb-212	Th-229
Ra-226	Th-230
Ra-228	U-234
Th-234	U-235

APPENDIX G

UNCERTAINTY ANALYSIS

UNCERTAINTY ANALYSIS

An error analysis was conducted to provide an estimate of the uncertainty of the reported values for average emission factors. Emission factors on three days are reported in Section 6 along with the arithmetic average, $\bar{E}$. Daily emission factors were calculated by:

$$E_i = \frac{2.205 * g * (s + v)}{(HHV * cf)} \quad (G-1)$$

where

E_i = daily emission factor, lb/10¹²Btu

g = daily flue gas flow rate, Nm³/hr

s = daily solid phase concentration of substance in flue gas, µg/Nm³

v = daily vapor phase concentration of substance in flue gas, µg/Nm³

HHV = daily higher heating value of feed coal, Btu/lb

cf = coal feed rate, klb/hr

A goal of the project was to determine a representative value for E , the average emission factor for a substance from the power plant. The reported value of $\bar{E}$ is an average from only three days of sampling. Daily variation in operation of the power plant contributes to uncertainty in the estimation of the long term average emission rates of substances.

G-1. Identification of Sources of Error

Two types of errors must be considered (ANSI/ASME PTC 19.1-1985, "Measurement Uncertainty", available from the American Society of Mechanical Engineers): random errors (or precision errors) and bias.

Three factors contribute to precision errors or variability in the reported daily emission factors. First, plant operating conditions change from day to day. Second, variability in collecting samples leads to errors in determining the five parameters in equation G-1 that are used to calculate the estimate of E_i . Third, variability in analyzing the collected samples for s , v , and HHV leads to errors in estimating E_i .

Bias in determining E_i can result from systematic errors in determining any of the five parameters in equation G-1. Bias errors are assumed to be constant throughout the measurement process. They can be significant, known and accounted for in calibrations; insignificant, known, and ignored in the uncertainty analysis; or estimated and included in the uncertainty analysis. The bias, when included in an uncertainty analysis, is estimated as a upper limit of the bias error.

G-2. Procedures for Estimating Uncertainty

The error analysis for this project was designed to provide uncertainty intervals around the reported average emission factors of the form

$$\text{Emission factor (lb/10}^{12} \text{ Btu)} = \bar{E} \pm (U^2 + B^2)^{1/2} \quad (\text{G-2})$$

where

$\bar{E}$ = arithmetic average of the daily emission factors E_i

U = an approximate 95% confidence bound accounting for random errors

B = possible bias due to systematic errors.

For cases in which the average emission factor is based upon three non-detected values, the uncertainty was taken to equal the reported "less than" value for the average emission factor. Otherwise, the estimates of precision and bias errors were made as follows.

Precision Errors

The 95% confidence bounds were calculated by

$$U = \frac{t \cdot S}{\sqrt{3}}$$

where

$t = 4.303$, the upper 97.5 percentile of Student's t distribution with two degrees of freedom

S = standard deviation of the three daily emission factors.

Thus,

$$U = 2.48 \cdot S.$$

The resulting confidence level is approximately 95 percent. This assumes that the distribution of daily emission factors for each substance approximates a normal distribution.

Battelle evaluated whether or not to use propagation of error methods, such as those described in the ANSI/ASME document cited above, to determine the statistical uncertainty of the average emission factors. Propagation methods are often used to establish the uncertainty of a function of several measured input parameters. Battelle believes that the approach described above is preferred over propagation of error methods because the objective of this error analysis is to estimate the uncertainty of the average of independent determinations of daily emission factors. Computing the standard deviation of the E_i accounts for the three sources of variability cited above: day-to-day variations in plant operations, sampling error, and measurement error. The propagation of errors method is an approximate solution that will produce similar results, provided that the correlations among the input parameters are taken into account. For example, one would expect a high degree of correlation between the measured solid and vapor phase concentrations on each day and between the daily coal feed rates and flue gas flow rates.

Bias

The potential bias on E due to systematic errors in any of the five measured parameters in equation G-1 was calculated by

$$B = (\sum B_j^2)^{1/2} \quad (G-3)$$

where $B_j = dE/dp_j \cdot \beta_j$ is the resulting bias in E caused by a systematic error of β_j in measuring parameter p_j ($j=1-5$ for g, s, v, HHV, and cf). These errors could not be specifically identified or confirmed; thus no correction was applied to the measured parameters. Battelle's estimates of the values of β_j are described below.

Flue gas flow rate. Determination of the flue gas flow rate, g, was assigned an upper limit of twelve percent for bias error. The bias for the gas flow measurement was estimated by comparing measured gas flows rates to flow rates calculated from the coal feed rate and the oxygen content at the various sampling points. The measured flow rate used to calculate emissions factors was taken to be the measured flow rate of flue gas at Location 18 corrected for additional flow from the two support burners ahead of Location 21 (see Section 6 for an explanation of this procedure). The average difference between the "measured" and calculated flue gas flow rates was eight percent. This value was assigned to the parameter β_1 .

Solid phase concentrations. Solid phase concentrations, s, were calculated by dividing the quantity of a substance determined in the laboratory analysis of a sample by the flue gas volume associated with that sample. The amount of sample collected from the flue gas stream approximates the actual concentration. Potential bias in the quantity of collected material is summarized in Table G-1.

Sources of analytical bias (Quality Assurance for Chemical Measurements; Taylor, John Keenan; Lewis Publishers, Inc., Chelsea, Michigan, 1987) are listed in Table G-2 along

with the estimate of the magnitude of the bias associated with each source. The estimates shown in Table G-2 were derived as follows:

Inefficiency Losses - Results for organic analyses are corrected for extraction recoveries. A bias of 2 percent is estimated for inorganic analyses based on matrix spike and SRM recovery results.

Calibration - For most organic and inorganic analytes, routine calibration results were required to be within ± 25 percent of initial calibration. Battelle's estimate of the bias in calibration is 5 percent.

Interference Resolution - The estimate of bias is zero because interferences are typically corrected for in organic and inorganic analyses or data are flagged as being affected by interference.

Contamination Gains - Data are corrected for contamination gains derived from field sampling, sample handling, and sample shipping by subtracting train blank results from sample data; therefore, the bias estimate is zero.

Instrumental Shifts - Instrumental shifts are considered to be corrected for by calibration bias; therefore the estimate is zero.

Matrix Effects - Matrix effects are evaluated by use of matrix spike samples. The estimate is zero because no consistent bias was detected in analysis of either inorganic or organic matrix spike samples.

Theoretical - Battelle's extensive experience with the inorganic and organic analyses conducted on this program has not detected any consistent bias based on theoretical effects; therefore the estimate is zero.

Operator Bias - Many of the analyses were conducted by different operators and no consistent bias was detected; therefore the estimate is zero.

Tolerance Adjustments - Based on Battelle's laboratory analysis experience, consistent bias with tolerance adjustments is nonexistent; therefore the estimate is zero.

Uncorrected Blank - Most sample results are corrected for laboratory method blanks and reagent blanks (where applicable) or blank results are negligible. Therefore the estimated bias from uncorrected blanks is zero.

Based upon these estimates, a bias error of five percent for organic solid phase determinations was estimated. Seven percent was estimated for inorganic solid phase determinations.

Considering both sampling and analysis together, the estimates of β_j for solid substances were computed as the square root of the sum of the squares of the individual bias estimates (see Table G-4).

Vapor phase concentrations. Vapor phase concentrations, v , were calculated by dividing the quantity of a substance determined in the laboratory analysis of a sample by the flue gas volume associated with that sample. The amount of sample collected from the flue gas stream approximates the actual concentration. Potential bias in the quantity of collected material is summarized in Table G-3.

Sources of analytical bias and associated bias estimates for vapor phase samples are the same as those listed in Table G-2 for solid phase samples except for the bias associated with the inefficiency losses for inorganic analyses. This bias is estimated to be 1 percent rather than 2 percent because the difficulty with preparing liquid phase samples for inorganic analysis is typically less than that for solid phase samples.

Combining the errors for sampling and analysis, Battelle estimated the β_j for vapor substances as shown in Table G-5.

Higher heating value of coal. The bias for the coal heating value determination was estimated at 2 percent. This estimate is based on the fact that the coal heating value is determined by a well-proven ASTM procedure by laboratories doing many samples daily. Additionally, utilities keep careful watch over their boiler efficiency and heat rate values. As the heating value is a major input to boiler efficiency and heat rate calculations, a bias as large as 2 percent would be obvious. Hence, a 2 percent bias estimate was assigned to the heating value determinations.

Coal feed rate. The bias for the coal feed rate measurement for the Niles Station Boiler No. 2 was estimated at 2 percent. In general, keep careful watch over their fuel consumption and boiler efficiency. (The cost of fuel is typically 40 to 50 percent of the cost of generating electricity and, thus, is of major importance.) A bias as large as 2 percent in the fuel feed rate would be very obvious to the plant operators and action would be taken to correct any problem. Review of operations at Niles Station led to assignment of two percent for the parameter β_5 .

Summary. The estimated upper limits for bias terms β_j are listed in Table G-6. Because of the uncertainty in estimating values for the β_j themselves, a decision was made to combine the values for β_2 and β_3 into one term. Therefore the values of $\beta_{2/3}$ were assigned as follows: elements - 7 percent, anions - 7 percent, radionuclides -9 percent, particulate matter - 8 percent, SVOC - 7 percent, ammonia/cyanide - 6 percent, VOC 8 percent, and aldehydes -6 percent. Together with calculations of precision error, these terms were used to calculate uncertainty intervals for emission factors in Section 6.

G-3. Example Calculation

The following example calculation applies to calculating the uncertainty in the average emission factor for mercury.

Daily emission factors were calculated using Equation G-1:

$$E_1 = \frac{2.205 * 104,820 * 36.2}{12,249 * 25.8} = 26.5 \text{ lb}/10^{12} \text{ Btu}$$

$$E_2 = \frac{2.205 * 106,984 * 21.9}{12,218 * 26.5} = 16.0$$

$$E_3 = \frac{2.205 * 107,625 * 30.7}{12,306 * 26.8} = 22.1$$

The parameters used to calculate E_1 for July 19, 1993, are found as follows:

<u>Parameter</u>	<u>Value</u>	<u>Where Found</u>
g	104,820 dscm/hr	Table 3-13b as 2,099 Nm ³ /min at stack O ₂ or 2,099/1.2013 at 3% O ₂
s+v	36.2 µg/Nm ³	Table 5-8
HHV	12,249 Btu/lb	Table 5-52
cf	25.8 klb/hr	Table 2-4 as 91,700 lb/hr for Boiler 2 91,700 x 0.281 (Table 2-6) for SNOX

The average value $\bar{E}$ was calculated as

$$\bar{E} = \frac{(26.5 + 16.0 + 22.1)}{3} = 21.5 \text{ lb}/10^{12} \text{ Btu}$$

The standard deviation, S, of the daily emission factors was calculated as

$$S = \sqrt{\frac{1}{(N-1)} \sum_{i=1}^N (E_i - \bar{E})^2}$$

$$= \sqrt{\frac{1}{2}[(26.5 - 21.5)^2 + (16.0 - 21.5)^2 + (22.1 - 21.5)^2]} = 5.27 \text{ lb}/10^{12} \text{ Btu}$$

The parameter U was calculated as

$$U = 2.48 * S$$

$$= 2.48 * 5.27 = 13.1 \text{ lb}/10^{12} \text{ Btu}$$

The bias parameter B was calculated using Equation G-3. The B_j components were calculated as follows:

$$B_1 = \frac{dE}{dg} \beta_1$$

$$B_{23} = \frac{dE}{d(s+v)} \beta_{23}$$

(j = 2, s and j = 3, v were combined)

$$B_4 = \frac{dE}{dHHV} \beta_4$$

$$B_5 = \frac{dE}{dcf} \beta_5$$

where E, g, (s+v), HHV, and cf are each the average value.

Now,

$$\frac{dE}{dg} = \frac{2.205 * (s+v)}{HHV * cf}, j=1$$

$$\frac{dE}{d(s+v)} = \frac{2.205 * g}{HHV * cf}, j=2/3$$

$$\frac{dE}{dHHV} = \frac{-2.205 * g * (s+v)}{(HHV)^2 * cf}, j=4$$

$$\frac{dE}{dcf} = \frac{-2.205 * g * (s+v)}{HHV * cf^2}, j=5$$

From Table G-6, the β_j are:

$$\beta_1 = 8\% \text{ of } g$$

$$\beta_{2/3} = 7\% \text{ of } (s+v)$$

(see text on page G-7)

$$\beta_4 = 2\% \text{ of } HHV$$

$$\beta_5 = 2\% \text{ of } cf$$

The term B_1 was calculated as follows:

$$\frac{dE}{dg} = \frac{2.205 * 29.6}{12,258 * 26.4} = 2.02 \times 10^{-4} \text{ (lb/10}^{12} \text{ Btu)/(Nm}^3\text{/hr)}$$

where (s+v) = average of daily values (Table 5-8)

$$= (36.2 + 21.9 + 30.7)/3 = 29.6 \mu\text{g}/\text{Nm}^3$$

HHV = average of coal heating values

$$= (12,249 + 12,218 + 12,306)/3 = 12,258 \text{ Btu}/\text{lb}$$

cf = average of coal feed rate (Tables 2-4 and 2-6)

$$= (25.8 + 26.5 + 26.8) = 26.4 \text{ lb}/\text{hr}$$

$$\beta_1 = 2.02 \times 10^{-4} * 0.08 * 106,476 = 1.72 \text{ lb}/10^{12} \text{ Btu}$$

where g = average of daily values

$$= (104,820 + 106,984 + 107,625)/3 = 106,476 \text{ Nm}^3/\text{hr}$$

Then,

$$B = (1.72^2 + 1.50^2 + (-0.429)^2 + (-0.429)^2)^{1/2}$$

$$B = 2.36 \text{ lb}/10^{12} \text{ Btu}$$

Finally, the total uncertainty was calculated as

$$U = (13.1^2 + 2.36^2)^{1/2} = 13.3 \text{ lb}/10^{12} \text{ Btu}$$

TABLE G-1. BIAS ESTIMATES FOR FLUE GAS SAMPLING OF
SOLID SUBSTANCES

Analyte Class	Estimated Bias (percent)	Source of Bias; Documentation
Elements Anions SVOC Radionuclides Particulate Matter	5	Departure from isokinetic sampling; value is based on sampling data that show maximum departure of about 5 percent from isokinetic conditions. The bias for collection of solid phase material was assumed to be equal in magnitude to the departure from isokinetic conditions.
Elements Anions SVOC Radionuclides Particulate Matter	2	Flow measurement error; required by Method regulations and maintained so by gas meter calibrations. Also consistent with RTI audits of Battelle's gas meters.
Elements SVOC Particulate Matter	0	Loss of particulate matter in probe; value of zero results from recovery of particulate matter in probe wash.
Anions Radionuclides	5	Loss of particulate matter in probe; value is an estimate based on use of short probe, with no probe rinse. Consistent with losses of particles observed in long probe and flexible line.

Table G-2. BIAS ESTIMATES FOR LABORATORY ANALYSIS

Source of Bias ^(a)	Estimated Bias (percent)	
	Organic ^(b)	Inorganic ^(c)
Inefficiency Losses	0	2 (solid) 1 (vapor)
Calibration	5	5
Interference Resolution	0	0
Contamination Gains	0	0
Instrumental Shifts	0	0
Matrix Effects	0	0
Theoretical	0	0
Operator Bias	0	0
Tolerance Adjustments	0	0
Uncorrected Blank	0	0

(a) Quality Assurance for Chemical Measurements; Taylor, John Keenan; Lewis Publishers, Inc., Chelsea, Michigan, 1987.

(b) Organic analyses include SVOC, VOC, and aldehydes.

(c) Inorganic analyses include elements, anions, ammonia/cyanide, and radionuclides.

TABLE G-3. BIAS ESTIMATES FOR FLUE GAS SAMPLING OF
VAPOR SUBSTANCES

Analyte Class	Bias (percent)	Source of Bias; Documentation
Elements Ammonia/Cyanide Anions VOC SVOC Aldehydes	2	Flow measurement error; required by Method regulations and maintained so by gas meter calibrations. Also consistent with RTI audits of Battelle's gas meters.
Elements Ammonia/Cyanide Anions Aldehydes	2	Completeness of collection in impinger solutions; based on experience with similar systems, including DNPH for aldehydes.
VOC SVOC	5	Completeness of collection on solid sorbents; based on experience with similar systems, including XAD for PAH/SVOC.
Elements SVOC	0	Loss in probe; value of zero results from recovery of probe wash.
Ammonia/Cyanide Anions VOC Aldehydes	2	Loss in probe; value is maximum likely value given elevated temperature of probe, but no probe wash.

TABLE G-4. CALCULATION OF BIAS ERROR TERMS (β_2) FOR SOLID PHASE SAMPLES

Substance	Sampling Bias ^(a) Errors (percent)	Analytical Bias ^(a) Errors (percent)	β_2 ^(b) (percent)
Inorganic			
Elements	5,2	5,2	8
Anions	5,2,5	5,2	9
Radionuclides	5,2,5	5,2	9
Particulate Matter	5,2	5,2	8
Organic			
SVOC	5,2	5	7

(a) See text for origin of individual estimates.

(b) Computed as the square root of the sum of the squared error estimates for sampling and analysis.

TABLE G-5. CALCULATION OF BIAS ERROR TERMS (β_3) FOR VAPOR PHASE SAMPLES

Substance	Sampling Bias ^(a) (percent)	Analytical Bias ^(a) (percent)	β_3 ^(b) (percent)
Inorganic			
Elements	2,2	1,5	6
Anions	2,2,2	1,5	6
Ammonia/Cyanide	2,2,2	1,5	6
Organic			
SVOC	2,5	5	7
VOC	2,5,2	5	8
Aldehydes	2,2,2	5	6

(a) See text for origin of individual estimates.

(b) Computed as the square root of the sum of the squared error estimates for sampling and analysis.

TABLE G-6. ESTIMATED VALUES FOR BIAS TERMS IN THE
UNCERTAINTY ANALYSIS

Parameter	Substance	Upper Limit Bias Term β_j (percent)
g		8
s	Elements	8
	Anions	9
	Radionuclides	9
	Particulate Matter	8
	SVOC	7
v	Elements	6
	Anions	6
	Ammonia/Cyanide	6
	SVOC	7
	VOC	8
	Aldehydes	6
HHV		2
cf		2