APPENDIX A-TRACER DATA SPREAD SHEETS

TEST G OCONEE U1 NORMAL MODE TEST 8/7/01

E TIME IS ELAPSED TIME

	ROOM AVGS	TIME AVGS	E TIME	TIME(HR)	CONC
CR1			10	0.16666667	2.87
CR2			10.5	0.175	2.85
CR3			11	0.18333333	2.76
CR4			11.5	0.19166667	2.75
CR5			12	0.2	2.74
CR6	**MEAN**		12.5	0.20833333	2.8
CR7	**2.76**		13	0.21666667	2.86
CR8	**SD**		13.5	0.225	2.71
CR9	**0.07**		14	0.23333333	2.69
CR10	**%SD**		14.5	0.24166667	2.7
CR11	**2.5%**		15	0.25	2.73
CRUP			15.5	0.25833333	2.67
CR1			40	0.66666667	2.21
CR2			40.5	0.675	2.24
CR3			41	0.68333333	2.15
CR4			41.5	0.69166667	2.15
CR5			42	0.7	2.1
CR6	**MEAN**		42.5	0.70833333	2.17
CR7	**2.14**		43	0.71666667	2.18
CR8	**SD**		43.5	0.725	2.1
CR9	**0.05**		44	0.73333333	2.06
CR10	**%SD**		44.5	0.74166667	2.11
CR11	**2.5%**		45	0.75	2.08
CRUP			45.5	0.75833333	2.11
CR1			70	1.16666667	1.72
CR2			70.5	1.175	1.7
CR3			71	1.18333333	1.66
CR4			71.5	1.19166667	1.67
CR5			72	1.2	1.63
CR6	**MEAN**		72.5	1.20833333	1.69
CR7	**1.65**		73	1.21666667	1.66
CR8	**SD**		73.5	1.225	1.63
CR9	**0.04**		74	1.23333333	1.59
CR10	**%SD**		74.5	1.24166667	1.63
CR11	**2.4%**		75	1.25	1.62
CRUP			75.5	1.25833333	1.61

TEST G OCONEE U1 NORMAL MODE TEST 8/7/01						
CR1			100	1.66666667	1.32	
CR2			100.5	1.675	1.33	
CR3			101	1.68333333	1.27	
CR4			101.5	1.69166667	1.28	
CR5			102	1.7	1.26	
CR6			102.5	1.70833333	1.31	
CR7	**MEAN**		103	1.71666667	1.3	
CR8	**1.27**		103.5	1.725	1.25	
CR9	**SD**		104	1.73333333	1.2	
CR10	**0.04**		104.5	1.74166667	1.26	
CR11	**%SD**		105	1.75	1.24	
CRUP	**2.9%**		105.5	1.75833333	1.26	
CR1			130	2.16666667	1.01	
CR2			130.5	2.175	1.03	
CR3			131	2.18333333	0.99	
CR4			131.5	2.19166667	0.977	
CR5			132	2.2	0.942	
CR6	**MEAN**		132.5	2.20833333	1.01	
CR7	**0.98**		133	2.21666667	1.00	
CR8	**SD**		133.5	2.225	0.964	
CR9	**0.03**		134	2.23333333	0.927	
CR10	**%SD**		134.5	2.24166667	0.961	
CR11	**3.2%**		135	2.25	0.951	
CRUP			135.5	2.25833333	0.977	
CR1			160	2.66666667	0.771	
CR2			160.5	2.675	0.787	
CR3			161.5	2.69166667	0.75	
CR4			162	2.7	0.769	
CR5			162.5	2.70833333	0.738	
CR6			163	2.71666667	0.766	
CR7	**MEAN**		163.5	2.725	0.764	
CR8	**0.75**		164	2.73333333	0.754	
CR9	**SD**		164.5	2.74166667	0.718	
CR10	**0.02**		165	2.75	0.755	
CR11	**%SD**		165.5	2.75833333	0.74	
CRUP	**2.5%**		166	2.76666667	0.736	

TEST H OCONEE U3, 1 FAN PRESSURIZATION TEST 8/8/01

MEAN CRE CONC	1.49 PPM
SD	0.01
%SD	0.9%

TIME	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	CR11	CRUP	MEAN
10	1.49	1.50	1.49	1.48	1.48	1.51	1.49	1.45	1.49	1.48	1.48	1.46	1.48
25	1.48	1.50	1.49	1.49	1.48	1.49	1.48	1.50	1.48	1.47	1.50	1.47	1.49
40	1.49	1.49	1.48	1.51	1.51	1.50	1.49	1.50	1.48	1.48	1.47	1.49	1.49
55	1.50	1.49	1.49	1.50	1.48	1.50	1.51	1.49	1.49	1.48	1.47	1.48	1.49
70	1.47	1.45	1.47	1.48	1.47	1.49	1.48	1.48	1.48	1.48	1.48	1.50	1.48
MEAN	1.49	1.49	1.48	1.49	1.48	1.50	1.49	1.48	1.48	1.48	1.48	1.48	
SD	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.02	
%SD	0.8%	1.4%	0.6%	0.9%	1.0%	0.6%	0.8%	1.4%	0.4%	0.3%	0.8%	1.1%	

TIME	RET	S	BFIL	BFAN	R3
10	1.47	1.50	1.46	1.49	1.46
25	1.46	1.49	1.57	1.46	1.49
40	1.46	1.52	1.41	1.53	1.46
55	1.45	1.51	1.44	1.48	1.45
70	1.43	1.51	1.40	1.47	1.41
MEAN	1.45	1.51	1.46	1.49	1.45
SD	0.02	0.01	0.08	0.03	0.03
%SD	1.0%	0.8%	5.4%	1.8%	2.0%

TEST I OCONEE U3, 2 FAN PRESSURIZATION TEST 8/9-10/01

MEAN CRE CONC	0.968 PPM
SD	0.009
%SD	1.0%

TIME	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	CR11	CRUP	MEAN
10	0.991	0.987	0.984	0.980	0.961	0.969	0.968	0.966	0.971	0.969	0.980	0.964	0.974
25	0.975	0.975	0.975	0.979	0.969	0.968	0.965	0.971	0.967	0.959	0.980	0.969	0.971
40	0.971	0.958	0.967	0.964	1.000	0.974	0.966	0.963	0.968	0.970	0.972	0.958	0.969
55	0.965	0.966	0.968	0.969	0.969	0.965	0.968	0.975	0.973	0.972	0.967	0.960	0.968
70	0.968	0.950	0.958	0.960	0.952	0.953	0.974	0.951	0.963	0.958	0.966	0.959	0.959
MEAN	0.974	0.967	0.970	0.970	0.970	0.966	0.968	0.965	0.968	0.966	0.973	0.962	
SD	0.010	0.014	0.010	0.009	0.018	0.008	0.003	0.009	0.004	0.007	0.007	0.005	
%SD	1.0%	1.5%	1.0%	0.9%	1.9%	0.8%	0.4%	1.0%	0.4%	0.7%	0.7%	0.5%	

TIME	RET	S	AFIL	AFAN	BFIL	BFAN	R3
10	0.966	0.953	0.927	0.892	0.960	0.970	0.951
25	0.933	0.944	0.892	0.898	0.909	0.978	0.945
40	0.962	0.941	0.936	0.914	0.943	0.944	0.949
55	0.938	0.948	0.898	0.924	0.937	0.963	0.964
70	0.952	0.947	0.872	0.876	0.962	0.954	0.946
MEAN	0.950	0.947	0.900	0.901	0.938	0.962	0.951
SD	0.014	0.005	0.027	0.019	0.022	0.013	0.008
%SD	1.5%	0.5%	3.0%	2.1%	2.3%	1.4%	0.8%

TEST J OCONEE U1/U2 NORMAL MODE TEST 8/10/01

E TIME IS ELAPSED TIME

	ROOM AVGS	TIME AVGS	E TIME	TIME(HR)	CONC
CR1			10	0.16666667	2.78
CR2			10.5	0.175	2.71
CR3			11	0.18333333	2.69
CR4			11.5	0.19166667	2.66
CR5			12	0.2	2.68
CR6	MEAN	TIME AVGS	12.5	0.20833333	2.67
CR7	2.67	0.21	13	0.21666667	2.64
CR8	SD		14	0.23333333	2.67
CR9	0.05		14.5	0.24166667	2.67
CR10	%SD		15.5	0.25833333	2.58
CRUP	1.8%		15	0.25	2.65
CR1			40	0.66666667	2.25
CR2			40.5	0.675	2.15
CR3			41	0.68333333	2.14
CR4			41.5	0.69166667	2.09
CR5			42	0.7	2.10
CR6	MEAN	TIME AVGS	42.5	0.70833333	2.15
CR7	2.12	0.71	43	0.71666667	2.09
CR8	SD		43.5	0.725	2.07
CR9	0.06		44	0.73333333	2.16
CR10	%SD		44.5	0.74166667	2.04
CRUP	2.7%		45	0.75	2.10
CR1			70	1.16666667	1.73
CR2			70.5	1.175	1.67
CR3			71	1.18333333	1.66
CR4			71.5	1.19166667	1.64
CR5			72	1.2	1.67
CR6	MEAN	TIME AVGS	72.5	1.20833333	1.67
CR7	1.66	1.21	73	1.21666667	1.64
CR8	SD		73.5	1.225	1.66
CR9	0.04		74	1.23333333	1.67
CR10	%SD		75	1.25	1.56
CRUP	2.4%		74.5	1.24166667	1.66

TEST J OCONEE U1/U2 NORMAL MODE TEST 8/10/01

CR1			100	1.66666667	1.39
CR2			100.5	1.675	1.31
CR3			101	1.68333333	1.3
CR4			101.5	1.69166667	1.28
CR5			102	1.7	1.31
CR6	**MEAN**	**TIME AVGS**	102.5	1.70833333	1.31
CR7	**1.31**	**1.71**	103	1.71666667	1.28
CR8	**SD**		103.5	1.725	1.34
CR9	**0.03**		104	1.73333333	1.32
CR10	**%SD**		104.5	1.74166667	1.28
CRUP	**2.5%**		105	1.75	1.29
CR1			130	2.16666667	1.08
CR2			130.5	2.175	1.04
CR3			131	2.18333333	1.02
CR4			131.5	2.19166667	1.02
CR5			132.5	2.20833333	1
CR6	**MEAN**	**TIME AVGS**	133	2.21666667	1.03
CR7	**1.02**	**2.21**	133.5	2.225	1.00
CR8	**SD**		134.5	2.24166667	1.02
CR9	**0.03**		134	2.23333333	1.01
CR10	**%SD**		136	2.26666667	0.983
CRUP	**2.5%**		135	2.25	1.01
CR1			160	2.66666667	0.854
CR2			160.5	2.675	0.829
CR3			161	2.68333333	0.803
CR4			161.5	2.69166667	0.791
CR5			162	2.7	0.789
CR6	**MEAN**	**TIME AVGS**	162.5	2.70833333	0.809
CR7	**0.81**	**2.71**	163	2.71666667	0.78
CR8	**SD**		163.5	2.725	0.826
CR9	**0.02**		164	2.73333333	0.822
CR10	**%SD**		164.5	2.74166667	0.784
CRUP	**2.9%**		165	2.75	0.792
CR1			190	3.16666667	0.656
CR2			190.5	3.175	0.64
CR3			191	3.18333333	0.633
CR4			191.5	3.19166667	0.623
CR5			192	3.2	0.614
CR6	**MEAN**	**TIME AVGS**	192.5	3.20833333	0.64
CR7	**0.63**	**3.21**	193	3.21666667	0.62
CR8	**SD**		193.5	3.225	0.629
CR9	**0.01**		194	3.23333333	0.642
CR10	**%SD**		194.5	3.24166667	0.612
CRUP	**2.2%**		195	3.25	0.618

TEST K OCONEE U1/U2, 1 FAN PRESSURIZATION TEST 8/11/01

MEAN CRE CONC	1.53 PPM
SD	0.01
%SD	0.9%

TIME	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	CRUP	MEAN
10	1.53	1.51	1.53	1.51	1.52	1.53	1.52	1.53	1.51	1.53	1.52	1.52
25	1.53	1.54	1.53	1.52	1.53	1.53	1.54	1.53	1.54	1.55	1.52	1.53
40	1.54	1.53	1.52	1.54	1.53	1.54	1.53	1.52	1.52	1.53	1.53	1.53
55	1.54	1.53	1.54	1.56	1.53	1.54	1.54	1.54	1.52	1.53	1.53	1.54
70	1.53	1.50	1.49	1.51	1.51	1.52	1.51	1.52	1.52	1.50	1.49	1.51
MEAN	1.53	1.52	1.52	1.53	1.52	1.53	1.53	1.53	1.52	1.53	1.52	
SD	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02	
%SD	0.4%	1.1%	1.3%	1.4%	0.6%	0.5%	0.9%	0.5%	0.7%	1.2%	1.1%	

TIME	RET	S	BFIL	BFAN	R3
10	1.55	1.49	1.49	1.50	1.50
25	1.55	1.48	1.49	1.51	1.51
40	1.53	1.49	1.55	1.52	1.51
55	1.55	1.47	1.52	1.52	1.47
70	1.51	1.47	1.49	1.51	1.48
MEAN	1.54	1.48	1.51	1.51	1.49
SD	0.02	0.01	0.03	0.01	0.02
%SD	1.2%	0.7%	1.9%	0.6%	1.2%

TEST LOCONEE U1/U2, 2 FAN PRESSURIZATION TEST 8/12/01

MEAN CRE CONC	0.831 PPM
SD	0.006
%SD	0.7%

TIME	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	CRUP	MEAN
10	0.830	0.831	0.832	0.829	0.836	0.823	0.826	0.828	0.832	0.838	0.831	0.831
25	0.831	0.832	0.827	0.831	0.840	0.836	0.830	0.843	0.827	0.838	0.841	0.834
40	0.829	0.831	0.831	0.827	0.841	0.842	0.835	0.830	0.829	0.824	0.828	0.832
55	0.837	0.835	0.830	0.820	0.834	0.830	0.824	0.823	0.829	0.830	0.828	0.829
70	0.814	0.829	0.828	0.822	0.839	0.840	0.833	0.829	0.834	0.830	0.819	0.829
MEAN	0.828	0.832	0.830	0.826	0.838	0.834	0.830	0.831	0.830	0.832	0.829	
SD	0.009	0.002	0.002	0.005	0.003	0.008	0.005	0.007	0.003	0.006	0.008	
%SD	1.0%	0.3%	0.2%	0.6%	0.3%	0.9%	0.6%	0.9%	0.3%	0.7%	1.0%	

TIME	RET	S	AFIL	AFAN	BFIL	BFAN	R3
10	0.844	0.815	0.766	0.799	0.837	0.854	0.837
25	0.827	0.818	0.767	0.804	0.850	0.854	0.822
40	0.837	0.830	0.779	0.778	0.863	0.838	0.818
55	0.826	0.817	0.774	0.767	0.892	0.848	0.812
70	0.833	0.815	0.774	0.774	0.857	0.854	0.813
MEAN	0.833	0.819	0.774	0.784	0.866	0.850	0.820
SD	0.007	0.006	0.005	0.016	0.018	0.007	0.010
%SD	0.9%	0.8%	0.6%	2.1%	2.1%	0.8%	1.2%

APPENDIX B-ANSI/ASME UNCERTAINTY CALCULATIONS

TEST G

8/7/01

UNIT 3 CRE HVAC in NORMAL MODE, AHU 3-13 Operating

EXPLANATION OF TRACER DATA SPREAD SHEETS

The tracer data sheets on the following pages contain two pages of data for the concentration decay test. The first column contains the sample location identifier. The second column contains concentration mean and standard deviation values for the entire CRE for a given sample interval. The third column displays mean sampling times in minutes and hours for each sample level and sampling interval.

The fourth column contains elapsed time in minutes at which each sample is taken, while the fifth column merely converts this time to hours. The sixth column provides the measured concentration for each sample point, while the seventh column provides the natural logarithm of each concentration in column six.

The EXCEL regression is provided on the next page and uses the time in hours and the natural logarithm of the concentration values to calculate a value for the air exchange rate.

A plot of the average measured concentration in the CRE at each time versus the regression calculation of concentration decay is displayed on the same page.

Following that is the ANSI Error Analysis Spreadsheet for the test.

TEST G OCONEE U3 NORMAL MODE TEST 8/7/01

	E TIME IS ELAPSED TIME					
	ROOM AVGS	TIME AVGS	E TIME	TIME(HR)	CONC	LN CONC
CR1			10	0.16666667	2.87	1.054312
CR2			10.5	0.175	2.85	1.047319
CR3			11	0.18333333	2.76	1.015231
CR4			11.5	0.19166667	2.75	1.011601
CR5			12	0.2	2.74	1.007958
CR6	**MEAN**	**MEAN**	12.5	0.20833333	2.8	1.029619
CR7	**2.76**	**0.21**	13	0.21666667	2.86	1.050822
CR8	**SD**		13.5	0.225	2.71	0.996949
CR9	**0.07**		14	0.23333333	2.69	0.989541
CR10	**%SD**		14.5	0.24166667	2.7	0.993252
CR11	**2.5%**		15	0.25	2.73	1.004302
CRUP			15.5	0.25833333	2.67	0.982078
CR1			40	0.66666667	2.21	0.792993
CR2			40.5	0.675	2.24	0.806476
CR3			41	0.68333333	2.15	0.765468
CR4			41.5	0.69166667	2.15	0.765468
CR5			42	0.7	2.1	0.741937
CR6	**MEAN**	MEAN	42.5	0.70833333	2.17	0.774727
CR7	**2.14**	0.71	43	0.71666667	2.18	0.779325
CR8	**SD**		43.5	0.725	2.1	0.741937
CR9	**0.05**		44	0.73333333	2.06	0.722706
CR10	**%SD**		44.5	0.74166667	2.11	0.746688
CR11	**2.5%**		45	0.75	2.08	0.732368
CRUP			45.5	0.75833333	2.11	0.746688
CR1			70	1.16666667	1.72	0.542324
CR2			70.5	1.175	1.7	0.530628
CR3			71	1.18333333	1.66	0.506818
CR4			71.5	1.19166667	1.67	0.512824
CR5			72	1.2	1.63	0.48858
CR6	**MEAN**	**MEAN**	72.5	1.20833333	1.69	0.524729
CR7	**1.65**	**1.21**	73	1.21666667	1.66	0.506818
CR8	**SD**		73.5	1.225	1.63	0.48858
CR9	**0.04**		74	1.23333333	1.59	0.463734
CR10	**%SD**		74.5	1.24166667	1.63	0.48858
CR11	**2.4%**		75	1.25	1.62	0.482426
CRUP			75.5	1.25833333	1.61	0.476234

TEST G OCONEE U3 NORMAL MODE TEST 8/7/01						
CR1			100	1.66666667	1.32	0.277632
CR2			100.5	1.675	1.33	0.285179
CR3			101	1.68333333	1.27	0.239017
CR4			101.5	1.69166667	1.28	0.24686
CR5			102	1.7	1.26	0.231112
CR6			102.5	1.70833333	1.31	0.270027
CR7	**MEAN**	MEAN	103	1.71666667	1.3	0.262364
CR8	**1.27**	1.75	103.5	1.725	1.25	0.223144
CR9	**SD**		104	1.73333333	1.2	0.182322
CR10	**0.04**		104.5	1.74166667	1.26	0.231112
CR11	**%SD**		105	1.75	1.24	0.215111
CRUP	**2.9%**		105.5	1.75833333	1.26	0.231112
CR1			130	2.16666667	1.01	0.00995
CR2			130.5	2.175	1.03	0.029559
CR3			131	2.18333333	0.99	-0.01005
CR4			131.5	2.19166667	0.977	-0.023269
CR5			132	2.2	0.942	-0.05975
CR6	**MEAN**	**MEAN**	132.5	2.20833333	1.01	0.00995
CR7	**0.98**	**2.21**	133	2.21666667	1.00	0
CR8	**SD**		133.5	2.225	0.964	-0.036664
CR9	**0.03**		134	2.23333333	0.927	-0.075802
CR10	**%SD**		134.5	2.24166667	0.961	-0.039781
CR11	**3.2%**		135	2.25	0.951	-0.050241
CRUP			135.5	2.25833333	0.977	-0.023269
CR1			160	2.66666667	0.771	-0.260067
CR2			160.5	2.675	0.787	-0.239527
CR3			161.5	2.69166667	0.75	-0.287682
CR4			162	2.7	0.769	-0.262664
CR5			162.5	2.70833333	0.738	-0.303811
CR6			163	2.71666667	0.766	-0.266573
CR7	**MEAN**	MEAN	163.5	2.725	0.764	-0.269187
CR8	**0.75**	2.72	164	2.73333333	0.754	-0.282363
CR9	**SD**		164.5	2.74166667	0.718	-0.331286
CR10	**0.02**		165	2.75	0.755	-0.281038
CR11	**%SD**		165.5	2.75833333	0.74	-0.301105
CRUP	**2.5%**		166	2.76666667	0.736	-0.306525

TEST G OCONEE U3 NORMAL MODE TEST 8/7/01

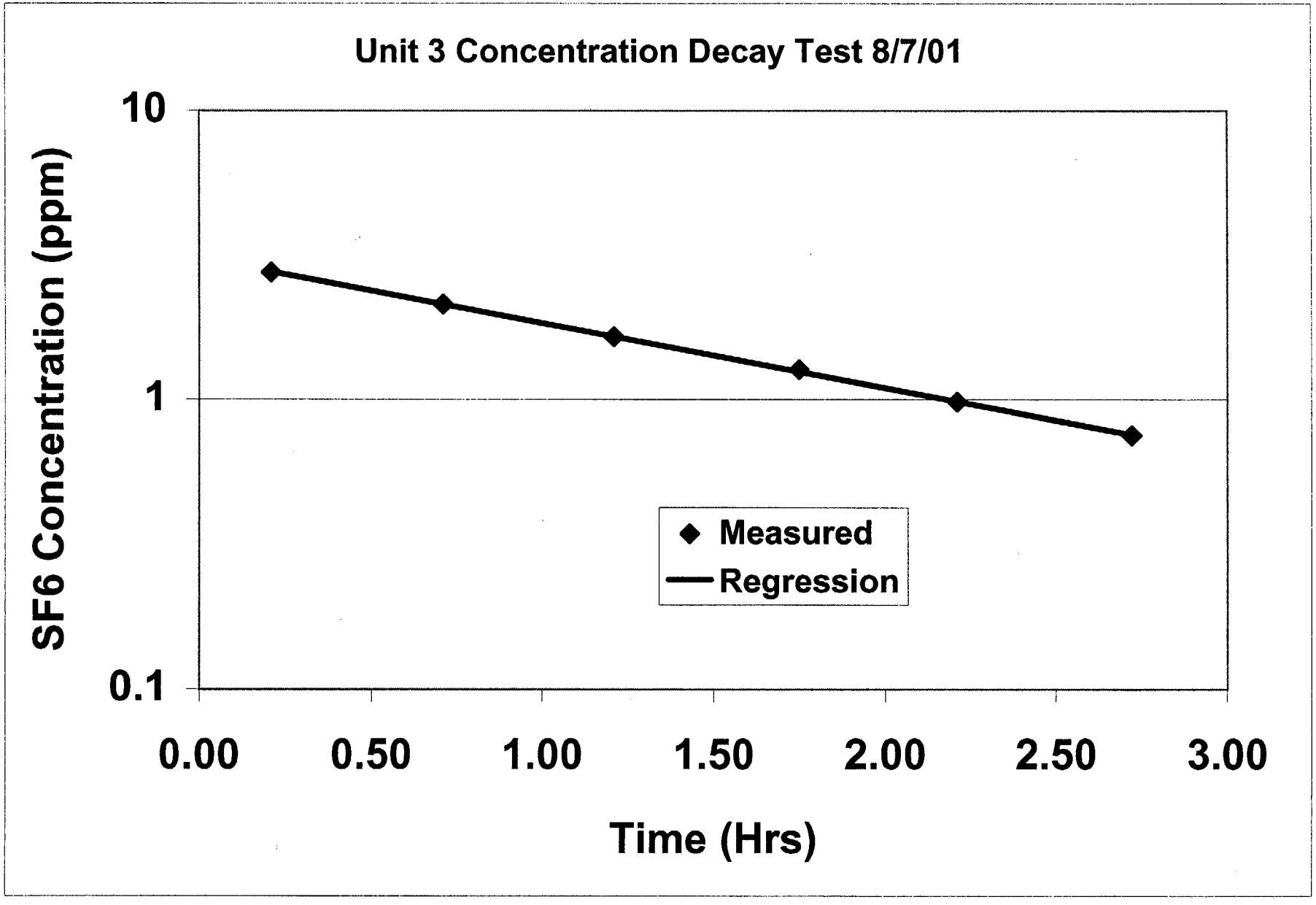
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99911822
R Square	0.99823721
Adjusted R Square	0.99821203
Standard Error	0.01893052
Observations	72

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	14.20550426	14.20550426	39639.806	3.93751E-98
Residual	70	0.025085524	0.000358365		
Total	71	14.23058979			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.12809917	0.004418797	255.2955258	1.11E-105	1.119286163	1.136912175
TIME(HR)	-0.5188421	0.00260597	-199.0974789	3.938E-98	-0.524039502	-0.51364462


Unit 3 Concentration Decay Test 8/7/01
SF6 Concentration (ppm)
10
1
0.1
0.00
0.50
1.00
1.50
2.00
2.50
3.00
Time (Hrs)
Measured
Regression

Inleakage Error Analysis-Concentration Decay Test

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
B are bias errors in measurement
S are random errors in measurement
t95 is Student's t at 95 % confidence

Date	8/7-8/01	**Test**	G
Location	Oconee U3		
Ventilation	AHU 3-13		
CRE Volume	54000	Cu. Ft.	

Test Parameters

Injection Concentration	10000	ppm
Injection Duration	30.00	min
Injection Flow Rate	15.00	SLPM
Calibration Point Value	2.16	ppm
Background	<0.3	ppb

	A	
Regression Value =	0.5188	
Number of Values =	72	
RMS Error =	0.002606	(From Spread Sheet)

Bias Errors	Analyzer SN100		Analyzer SN123	
	Numeric Value	Bias Error	Numeric Value	Bias Error
Calibration Gas Error		2.00%		2.00%
Analyzer Exponent (n)	0.9697		1.0436	
Analyzer Exponent U95	0.9902		1.0611	
Analyzer Exponent L95	0.9492		1.0261	
Analyzer Error		1.99%		1.83%

USE LARGER ANALYZER ERROR IN BIAS CALC

Volumetric Error 2%

Inleakage Error Analysis-Concentration Decay Test

Date	8/7-8/01	**Test**	G
Location	Oconee U3		
Ventilation	AHU 3-13		
CRE Volume	54000	Cu. Ft.	

Inleakage Error

	Squared Sum		
Bias Error	0.001195169	Number Observations	72
Random Error	0.00002699	Student t	1.993462

Urss **0.035**

Inleakage	**467**	**SCFM**
Max-95	**483**	**SCFM**
Min-95	**451**	**SCFM**

TEST H

8/8/01

AHU 3-13 and Fan 3A Operating

Inleakage Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/8-9/01	**Test**	H
Location	OCONEE		
M/U FAN	3A		
Time	24:00-01:00		

Test Parameters

Injection Concentration	10270 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	3.87 SLPM
Calibration Point Value (ppb)	2.16 ppb

Measured Data

		Concentration (ppm)			
Sample #	Time	Makeup	Return	CFM	Delta ppm
1	0.0	1.46	1.47	-4.4	-0.01
2	10.0	1.49	1.49	-1.4	0.00
3	20.0	1.47	1.46	9.4	0.01
4	30.0	1.46	1.46	-2.2	0.00
5	40.0	1.48	1.44	26.4	0.04
6	50.0	1.46	1.45	8.8	0.01
7	60.0	1.45	1.43	15.8	0.02

Random Error

	Makeup	Return	CFM	Delta ppm
Average	1.47	1.46	7.4	0.01
Std Dev.	0.01	0.02	11.13	0.02
% Dev.	0.86%	1.36%	150.48%	149.46%

Inleakage Measurement & Error Analysis

Date	8/8-9/01	**Test**	H
Location	OCONEE		
M/U AHU	3A		
Time	24:00-01:00		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.29%
Calibration Gas Error			2.00%
Analyzer sn123			
Analyzer Exponent (n)	0.9816		
Analyzer Exponent U95	0.9985		
Analyzer Exponent L95	0.9647		
Analyzer Exponent Error		1.66%	
Analyzer Error			2.31%

Inleakage Error

	Squared Sum		
Bias Error	0.001198465	Degrees of Freedom	6
Random Error	13.55804878	Student t factor	2.446914

Urss **3.682**

Inleakage	**7**	**SCFM**
Max-95	**35**	**SCFM**
Min-95	**-20**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/8-9/01	**Test**	HF1
Location	OCONEE		
M/U AHU	3A		
Time	21:25		

Test Parameters

Injection Concentration	10270 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	3.87 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.50	936.3
2	A2	1.51	930.1
3	A3	1.36	1032.7
4	B1	1.43	982.1
5	B2	1.50	936.3
6	B3	1.31	1072.1
7	C1	1.45	968.6
8	C2	1.38	1017.7
9	C3	1.48	948.9

Random Error

	Makeup	CFM
Average	1.44	978.3
Std Dev.	0.07	50.11
% Dev.	4.96%	5.12%

Flowrate Error Analysis

Date	8/8-9/01	**Test**	HF4
Location	OCONEE		
M/U AHU	3A		
Time	0:00		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.29%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0453		
Analyzer Exponent U95	1.0649		
Analyzer Exponent L95	1.0257		
Analyzer Exponent Error		2.05%	
Analyzer Error			-0.80%

Flowrate Error

	Squared Sum		
Bias Error	0.000730569	Degrees of Freedom	8
Random Error	0.038390454	Student t factor	2.306006
Urss	**0.198**		

Flowrate	**960**	**SCFM**
Max-95	**1150**	**SCFM**
Min-95	**770**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/8-9/01	**Test**	HF5
Location	OCONEE		
M/U AHU	3A		
Time	0:10		

Test Parameters

Injection Concentration	10270 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	3.87 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.35	1040.3
2	A2	1.46	961.9
3	A3	1.39	1010.4
4	B1	1.43	982.1
5	B2	1.50	936.3
6	B3	1.54	912.0
7	C1	1.48	948.9
8	C2	1.62	866.9
9	C3	1.62	866.9

Random Error

	Makeup	CFM
Average	1.49	944.0
Std Dev.	0.09	59.53
% Dev.	6.31%	6.31%

Flowrate Error Analysis

Date	8/8-9/01	**Test**	HF5
Location	OCONEE		
M/U AHU	3A		
Time	0:10		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.29%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0453		
Analyzer Exponent U95	1.0649		
Analyzer Exponent L95	1.0257		
Analyzer Exponent Error		2.05%	
Analyzer Error			-0.76%

Flowrate Error

	Squared Sum		
Bias Error	0.000725269	Degrees of Freedom	8
Random Error	0.021146559	Student t factor	2.306006

Urss **0.148**

Flowrate	**944**	**SCFM**
Max-95	**1084**	**SCFM**
Min-95	**804**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/8-9/01	**Test**	HF6
Location	OCONEE		
M/U AHU	3A		
Time	0:20		

Test Parameters

Injection Concentration	10270 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	3.87 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.42	989.0
2	A2	1.43	982.1
3	A3	1.58	888.9
4	B1	1.40	1003.2
5	B2	1.56	900.3
6	B3	1.46	961.9
7	C1	1.46	961.9
8	C2	1.46	961.9
9	C3	1.50	936.3

Random Error

	Makeup	CFM
Average	1.47	952.5
Std Dev.	0.06	38.83
% Dev.	4.17%	4.08%

Flowrate Error Analysis

Date	8/8-9/01	**Test**	HF6
Location	OCONEE		
M/U AHU	3A		
Time	0:20		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.29%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0453		
Analyzer Exponent U95	1.0649		
Analyzer Exponent L95	1.0257		
Analyzer Exponent Error		2.05%	
Analyzer Error			-0.78%

Flowrate Error

	Squared Sum		
Bias Error	0.00072812	Degrees of Freedom	8
Random Error	0.008839245	Student t factor	2.306006

Urss **0.098**

Flowrate	**953**	**SCFM**
Max-95	**1046**	**SCFM**
Min-95	**859**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/8-9/01	**Test**	HF7
Location	OCONEE		
M/U AHU	3A		
Time	0:30		

Test Parameters

Injection Concentration	10270 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	3.87 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.51	930.1
2	A2	1.46	961.9
3	A3	1.44	975.3
4	B1	1.45	968.6
5	B2	1.47	955.4
6	B3	1.49	942.6
7	C1	1.40	1003.2
8	C2	1.51	930.1
9	C3	1.38	1017.7

Random Error

	Makeup	CFM
Average	1.46	964.1
Std Dev.	0.05	30.40
% Dev.	3.11%	3.15%

Flowrate Error Analysis

Date	8/8-9/01	**Test**	HF7
Location	OCONEE		
M/U AHU	3A		
Time	0:30		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.29%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0453		
Analyzer Exponent U95	1.0649		
Analyzer Exponent L95	1.0257		
Analyzer Exponent Error		2.05%	
Analyzer Error			-0.81%

Flowrate Error

	Squared Sum		
Bias Error	0.00073207	Degrees of Freedom	8
Random Error	0.005288409	Student t factor	2.306006
Urss	**0.078**		

Flowrate	**964**	**SCFM**
Max-95	**1039**	**SCFM**
Min-95	**889**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/8-9/01	**Test**	HF8
Location	OCONEE		
M/U AHU	3A		
Time	0:40		

Test Parameters

Injection Concentration	10270 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	3.87 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.41	996.0
2	A2	1.47	955.4
3	A3	1.45	968.6
4	B1	1.50	936.3
5	B2	1.42	989.0
6	B3	1.44	975.3
7	C1	1.45	968.6
8	C2	1.65	851.2
9	C3	1.53	917.9

Random Error

	Makeup	CFM
Average	1.48	948.9
Std Dev.	0.07	44.69
% Dev.	5.00%	4.71%

Flowrate Error Analysis

Date	8/8-9/01	**Test**	HF8
Location	OCONEE		
M/U AHU	3A		
Time	0:40		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.29%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0453		
Analyzer Exponent U95	1.0649		
Analyzer Exponent L95	1.0257		
Analyzer Exponent Error		2.05%	
Analyzer Error			-0.77%

Flowrate Error

	Squared Sum		
Bias Error	0.000726921	Degrees of Freedom	8
Random Error	0.011795692	Student t factor	2.306006

Urss **0.112**

Flowrate	**949**	**SCFM**
Max-95	**1055**	**SCFM**
Min-95	**843**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	08/10/01	**Test**	HF9
Location	OCONEE		
M/U AHU	1A		
Time	0:50	8/8-9/01	
		OCONEE	
Test Parameters		3A	

Injection Concentration	10270 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	3.87 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.40	1003.2
2	A2	1.56	900.3
3	A3	1.41	996.0
4	B1	1.42	989.0
5	B2	1.46	961.9
6	B3	1.49	942.6
7	C1	1.40	1003.2
8	C2	1.49	942.6
9	C3	1.54	912.0

Random Error

	Makeup	CFM
Average	1.46	959.7
Std Dev.	0.06	39.28
% Dev.	4.14%	4.09%

Flowrate Error Analysis

Date	8/10/2001	**Test**	HF9
Location	OCONEE		
M/U AHU	1A		
Time	0:50		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.29%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0453		
Analyzer Exponent U95	1.0649		
Analyzer Exponent L95	1.0257		
Analyzer Exponent Error		2.05%	
Analyzer Error			-0.80%

Flowrate Error

	Squared Sum		
Bias Error	0.000730569	Degrees of Freedom	8
Random Error	0.008906103	Student t factor	2.306006
Urss	**0.098**		

Flowrate	**960**	**SCFM**
Max-95	**1054**	**SCFM**
Min-95	**866**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/8-9/01	**Test**	HF10
Location	OCONEE		
M/U AHU	3A		
Time	1:00		

Test Parameters

Injection Concentration	10270 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	3.87 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.40	1003.2
2	A2	1.37	1025.1
3	A3	1.36	1032.7
4	B1	1.35	1040.3
5	B2	1.54	912.0
6	B3	1.56	900.3
7	C1	1.37	1025.1
8	C2	1.48	948.9
9	C3	1.65	851.2

Random Error

	Makeup	CFM
Average	1.45	966.3
Std Dev.	0.11	69.67
% Dev.	7.47%	7.21%

Flowrate Error Analysis

Date	8/8-9/01	**Test**	HF10
Location	OCONEE		
M/U AHU	3A		
Time	1:00		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.29%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0453		
Analyzer Exponent U95	1.0649		
Analyzer Exponent L95	1.0257		
Analyzer Exponent Error		2.05%	
Analyzer Error			-0.81%

Flowrate Error

	Squared Sum		
Bias Error	0.00073283	Degrees of Freedom	8
Random Error	0.02764354	Student t factor	2.306006
Urss	**0.168**		

Flowrate	**966**	**SCFM**
Max-95	**1129**	**SCFM**
Min-95	**804**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/8-9/01	**Test**	7 Test Avg
Location	OCONEE		
M/U AHU	3A		
Time	24:00-01:00		

Test Parameters

Injection Concentration	10270 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	3.87 SLPM
Calibration Point Value (ppb)	2.16 ppb

Measured Data

		Concentration (ppm)	
Sample #	Time	Supply	CFM
1	2230.0	1.46	959.7
2	2230.5	1.49	944.0
3	2231.0	1.47	952.5
4	2232.0	1.46	964.1
5	2232.5	1.48	948.9
6	2233.0	1.46	959.7
7	2233.0	1.45	966.3

Random Error

	Supply	CFM
Average	1.47	954.8
Std Dev.	0.01	7.65
% Dev.	0.80%	0.80%

Flowrate Error Analysis

Date	8/8-9/01	**Test**	7 Test Avg
Location	OCONEE		
M/U AHU	3A		
Time	24:00-01:00		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.29%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0453		
Analyzer Exponent U95	1.0649		
Analyzer Exponent L95	1.0257		
Analyzer Exponent Error		2.05%	
Analyzer Error			-0.79%

Flowrate Error

	Squared Sum		
Bias Error	0.000728889	Degrees of Freedom	6
Random Error	0.000384668	Student t factor	2.446914

Urss **0.033**

Flowrate	**955**	**SCFM**
Max-95	**987**	**SCFM**
Min-95	**923**	**SCFM**

TEST I

8/9/01

AHU 3-13 and Fans 3A & 3B Operating

Inleakage Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/9-10/2001	**Test**	I
Location	OCONEE		
M/U FAN	3A & 3B		
Time	22:45-23:45		

Test Parameters

Injection Concentration	10210 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.73 SLPM
Calibration Point Value (ppb)	2.16 ppb

Measured Data

		Concentration (ppm)			
Sample #	Time	Makeup	Return	CFM	Delta ppm
1	0.0	0.941	0.966	-46.5	-0.025
2	10.0	0.935	0.958	-43.8	-0.023
3	20.0	0.952	0.933	37.1	0.019
4	30.0	0.982	0.962	36.3	0.020
5	40.0	0.943	0.931	23.3	0.012
6	50.0	0.938	0.938	0.2	0.000
7	60.0	0.913	0.927	-28.5	0.011

Random Error

	Makeup	Return	CFM	Delta ppm
Average	0.9435	0.9450	-2.8	0.002
Std Dev.	0.02	0.02	36.66	0.02
% Dev.	2.21%	1.73%		889.45%

Inleakage Measurement & Error Analysis

Date	8/9-10/2001	**Test**	I
Location	OCONEE		
M/U AHU	3A & 3B		
Time	22:45-23:45		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
Analyzer sn123			
Analyzer Exponent (n)	1.0476		
Analyzer Exponent U95	1.0729		
Analyzer Exponent L95	1.0222		
Analyzer Exponent Error		2.66%	
Analyzer Error			3.35%

Inleakage Error

	Squared Sum		
Bias Error	0.001735936	Degrees of Freedom	6
Random Error	#VALUE!	Student t factor	2.446914

Urss **#VALUE!**

Inleakage	**-3**	**SCFM**
Max-95	**#VALUE!**	**SCFM**
Min-95	**#VALUE!**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/9-10/2001	**Test**	IF4
Location	OCONEE		
M/U AHU	3A & 3B		
Time	22:45		

Test Parameters

Injection Concentration	10210 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.73 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.959	1779.4
2	A2	0.929	1836.9
3	A3	0.940	1815.4
4	B1	0.907	1881.5
5	B2	1.000	1706.5
6	C1	0.891	1915.2
7	C2	0.938	1819.3
8	C3	0.966	1766.5

Random Error

	Makeup	CFM
Average	0.941	1813.0
Std Dev.	0.03	65.85
% Dev.	3.64%	3.63%

Flowrate Error Analysis

Date	8/9-10/2001	**Test**	IF4
Location	OCONEE		
M/U AHU	3A & 3B		
Time	22:45		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0476		
Analyzer Exponent U95	1.0729		
Analyzer Exponent L95	1.0222		
Analyzer Exponent Error		2.66%	
Analyzer Error			-2.21%

Flowrate Error

	Squared Sum		
Bias Error	0.00109836	Degrees of Freedom	7
Random Error	0.00737601	Student t factor	2.364623

Urss **0.092**

Flowrate	**1813**	**SCFM**
Max-95	**1980**	**SCFM**
Min-95	**1646**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/9-10/2001	**Test**	IF5
Location	OCONEE		
M/U AHU	3A & 3B		
Time	22:55		

Test Parameters

Injection Concentration	10210 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.73 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.945	1805.8
2	A2	0.982	1737.8
3	A3	0.932	1831.0
4	B1	0.970	1759.3
5	B2	0.933	1829.0
6	B3	0.954	1788.8
7	C1	0.904	1887.7
8	C2	0.889	1919.5
9	C3	0.906	1883.5

Random Error

	Makeup	CFM
Average	0.935	1825.1
Std Dev.	0.03	61.17
% Dev.	3.35%	3.35%

Flowrate Error Analysis

Date	8/9-10/2001	**Test**	IF5
Location	OCONEE		
M/U AHU	3A & 3B		
Time	22:55		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0476		
Analyzer Exponent U95	1.0729		
Analyzer Exponent L95	1.0222		
Analyzer Exponent Error		2.66%	
Analyzer Error			-2.22%

Flowrate Error

	Squared Sum		
Bias Error	0.001106197	Degrees of Freedom	8
Random Error	0.005972551	Student t factor	2.306006

Urss **0.084**

Flowrate	**1825**	**SCFM**
Max-95	**1979**	**SCFM**
Min-95	**1672**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/9-10/2001	**Test**	IF6
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:05		

Test Parameters

Injection Concentration	10210 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.73 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.010	1689.6
2	A2	0.925	1844.8
3	A3	0.939	1817.3
4	B1	0.937	1821.2
5	B2	0.967	1764.7
6	B3	0.879	1941.4
7	C1	0.919	1856.9
8	C2	0.945	1805.8
9	C3	1.050	1625.2

Random Error

	Makeup	CFM
Average	0.952	1791.9
Std Dev.	0.05	93.47
% Dev.	5.35%	5.22%

Flowrate Error Analysis

Date	8/9-10/2001	**Test**	IF6
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:05		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0476		
Analyzer Exponent U95	1.0729		
Analyzer Exponent L95	1.0222		
Analyzer Exponent Error		2.66%	
Analyzer Error			-2.17%

Flowrate Error

	Squared Sum		
Bias Error	0.001084741	Degrees of Freedom	8
Random Error	0.014467606	Student t factor	2.306006
Urss	**0.125**		

Flowrate	**1792**	**SCFM**
Max-95	**2015**	**SCFM**
Min-95	**1568**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/9-10/2001	**Test**	IF7
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:15		

Test Parameters

Injection Concentration	10210 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.73 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.080	1580.1
2	A2	0.987	1729.0
3	A3	1.020	1673.0
4	B1	0.967	1764.7
5	B2	0.944	1807.7
6	B3	0.959	1779.4
7	C1	0.900	1896.1
8	C2	0.995	1715.1
9	C3	0.987	1729.0

Random Error

	Makeup	CFM
Average	0.982	1737.6
Std Dev.	0.05	88.05
% Dev.	5.12%	5.07%

Flowrate Error Analysis

Date	8/9-10/2001	**Test**	IF7
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:15		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0476		
Analyzer Exponent U95	1.0729		
Analyzer Exponent L95	1.0222		
Analyzer Exponent Error		2.66%	
Analyzer Error			-2.09%

Flowrate Error

	Squared Sum		
Bias Error	0.001049844	Degrees of Freedom	8
Random Error	0.013655066	Student t factor	2.306006

Urss **0.121**

Flowrate	**1738**	**SCFM**
Max-95	**1948**	**SCFM**
Min-95	**1527**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/9-10/2001	**Test**	IF8
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:25		

Test Parameters

Injection Concentration	10210 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.73 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.960	1777.6
2	A2	0.979	1743.1
3	A3	1.000	1706.5
4	B1	0.962	1773.9
5	B2	0.909	1877.3
6	B3	0.913	1869.1
7	C1	0.926	1842.8
8	C2	1.010	1689.6
9	C3	0.828	2061.0

Random Error

	Makeup	CFM
Average	0.943	1809.6
Std Dev.	0.06	113.93
% Dev.	5.96%	6.30%

Flowrate Error Analysis

Date	8/9-10/2001	**Test**	IF8
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:25		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0476		
Analyzer Exponent U95	1.0729		
Analyzer Exponent L95	1.0222		
Analyzer Exponent Error		2.66%	
Analyzer Error			-2.20%

Flowrate Error

	Squared Sum		
Bias Error	0.001096186	Degrees of Freedom	8
Random Error	0.021079007	Student t factor	2.306006
Urss	**0.149**		

Flowrate	**1810**	**SCFM**
Max-95	**2079**	**SCFM**
Min-95	**1540**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/9-10/2001	**Test**	IF9
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:45		

Test Parameters

Injection Concentration	10210 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.73 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.040	1640.8
2	A2	0.921	1852.9
3	A3	0.891	1915.2
4	B1	0.982	1737.8
5	B2	0.884	1930.4
6	B3	0.913	1869.1
7	C1	0.896	1904.6
8	C2	0.841	2029.1
9	C3	0.848	2012.4

Random Error

	Makeup	CFM
Average	0.913	1869.3
Std Dev.	0.06	123.66
% Dev.	6.93%	6.62%

Flowrate Error Analysis

Date	8/9-10/2001	**Test**	IF9
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:45		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0476		
Analyzer Exponent U95	1.0729		
Analyzer Exponent L95	1.0222		
Analyzer Exponent Error		2.66%	
Analyzer Error			-2.29%

Flowrate Error

	Squared Sum		
Bias Error	0.001134866	Degrees of Freedom	8
Random Error	0.023270936	Student t factor	2.306006

Urss **0.156**

Flowrate	**1869**	**SCFM**
Max-95	**2161**	**SCFM**
Min-95	**1577**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/9-10/2001	**Test**	IF10
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:35		

Test Parameters

Injection Concentration	10210 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.73 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.971	1757.4
2	A2	0.953	1790.6
3	A3	0.983	1736.0
4	B1	0.965	1768.4
5	B2	0.921	1852.9
6	B3	0.943	1809.6
7	C1	0.909	1877.3
8	C2	0.941	1813.5
9	C3	0.857	1991.2

Random Error

	Makeup	CFM
Average	0.938	1819.1
Std Dev.	0.04	77.70
% Dev.	4.09%	4.27%

Flowrate Error Analysis

Date	8/9-10/2001	**Test**	IF10
Location	OCONEE		
M/U AHU	3A & 3B		
Time	23:35		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0476		
Analyzer Exponent U95	1.0729		
Analyzer Exponent L95	1.0222		
Analyzer Exponent Error		2.66%	
Analyzer Error			-2.21%

Flowrate Error

	Squared Sum		
Bias Error	0.001102282	Degrees of Freedom	8
Random Error	0.009702224	Student t factor	2.306006

Urss **0.104**

Flowrate	**1819**	**SCFM**
Max-95	**2008**	**SCFM**
Min-95	**1630**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/9-10/2001	**Test**	7 Test Avg
Location	OCONEE		
M/U AHU	3A & 3B		
Time			

Test Parameters

Injection Concentration	10210 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.73 SLPM
Calibration Point Value (ppb)	2.16 ppb

Measured Data

		Concentration (ppm)	
Sample #	Time	Supply	CFM
1	2230.0	0.941	1813.0
2	2230.5	0.935	1825.1
3	2231.0	0.952	1791.9
4	2232.0	0.982	1737.6
5	2232.5	0.943	1809.6
6	2233.0	0.938	1819.1
7	2233.0	0.913	1869.3

Random Error

	Supply	CFM
Average	0.949	1798.9
Std Dev.	0.02	32.30
% Dev.	1.84%	1.80%

Flowrate Error Analysis

Date	8/9-10/2001	**Test**	7 Test Avg
Location	OCONEE		
M/U AHU	3A & 3B		
Time	0:00		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn123			
Analyzer Exponent (n)	1.0476		
Analyzer Exponent U95	1.0729		
Analyzer Exponent L95	1.0222		
Analyzer Exponent Error		2.66%	
Analyzer Error			-2.19%

Flowrate Error

	Squared Sum		
Bias Error	0.001089247	Degrees of Freedom	6
Random Error	0.001930626	Student t factor	2.446914

Urss **0.055**

Flowrate	**1799**	**SCFM**
Max-95	**1898**	**SCFM**
Min-95	**1700**	**SCFM**

TEST J

8/10/01

UNIT 1 & 2 CRE HVAC in NORMAL MODE, AHU 1-11 Operating

EXPLANATION OF TRACER DATA SPREAD SHEETS

The tracer data sheets on the following pages contain two pages of data for the concentration decay test. The first column contains the sample location identifier. The second column contains concentration mean and standard deviation values for the entire CRE for a given sample interval. The third column displays mean sampling times in minutes and hours for each sample level and sampling interval.

The fourth column contains elapsed time in minutes at which each sample is taken, while the fifth column merely converts this time to hours. The sixth column provides the measured concentration for each sample point, while the seventh column provides the natural logarithm of each concentration in column six.

The EXCEL regression is provided on the next page and uses the time in hours and the natural logarithm of the concentration values to calculate a value for the air exchange rate.

A plot of the average measured concentration in the CRE at each time versus the regression calculation of concentration decay is displayed on the same page.

Following that is the ANSI Error Analysis Spreadsheet for the test.

TEST J OCONEE U1/U2 NORMAL MODE TEST 8/10/01

E TIME IS ELAPSED TIME

	ROOM AVGS	TIME AVGS	E TIME	TIME(HR)	CONC	LN CONC
CR1			10	0.16666667	2.78	1.022451
CR2			10.5	0.175	2.71	0.996949
CR3			11	0.18333333	2.69	0.989541
CR4			11.5	0.19166667	2.66	0.978326
CR5			12	0.2	2.68	0.985817
CR6	MEAN	TIME AVGS	12.5	0.20833333	2.67	0.982078
CR7	2.67	0.21	13	0.21666667	2.64	0.970779
CR8	SD		14	0.23333333	2.67	0.982078
CR9	0.05		14.5	0.24166667	2.67	0.982078
CR10	%SD		15.5	0.25833333	2.58	0.947789
CRUP	1.8%		15	0.25	2.65	0.97456
CR1			40	0.66666667	2.25	0.81093
CR2			40.5	0.675	2.15	0.765468
CR3			41	0.68333333	2.14	0.760806
CR4			41.5	0.69166667	2.09	0.737164
CR5			42	0.7	2.10	0.741937
CR6	MEAN	TIME AVGS	42.5	0.70833333	2.15	0.765468
CR7	2.12	0.71	43	0.71666667	2.09	0.737164
CR8	SD		43.5	0.725	2.07	0.727549
CR9	0.06		44	0.73333333	2.16	0.770108
CR10	%SD		44.5	0.74166667	2.04	0.71295
CRUP	2.7%		45	0.75	2.10	0.741937
CR1			70	1.16666667	1.73	0.548121
CR2			70.5	1.175	1.67	0.512824
CR3			71	1.18333333	1.66	0.506818
CR4			71.5	1.19166667	1.64	0.494696
CR5			72	1.2	1.67	0.512824
CR6	MEAN	TIME AVGS	72.5	1.20833333	1.67	0.512824
CR7	1.66	1.21	73	1.21666667	1.64	0.494696
CR8	SD		73.5	1.225	1.66	0.506818
CR9	0.04		74	1.23333333	1.67	0.512824
CR10	%SD		75	1.25	1.56	0.444686
CRUP	2.4%		74.5	1.24166667	1.66	0.506818

TEST J OCONEE U1/U2 NORMAL MODE TEST 8/10/01

CR1			100	1.66666667	1.39	0.329304
CR2			100.5	1.675	1.31	0.270027
CR3			101	1.68333333	1.3	0.262364
CR4			101.5	1.69166667	1.28	0.24686
CR5			102	1.7	1.31	0.270027
CR6	**MEAN**	**TIME AVGS**	102.5	1.70833333	1.31	0.270027
CR7	**1.31**	**1.71**	103	1.71666667	1.28	0.24686
CR8	**SD**		103.5	1.725	1.34	0.29267
CR9	**0.03**		104	1.73333333	1.32	0.277632
CR10	**%SD**		104.5	1.74166667	1.28	0.24686
CRUP	**2.5%**		105	1.75	1.29	0.254642
CR1			130	2.16666667	1.08	0.076961
CR2			130.5	2.175	1.04	0.039221
CR3			131	2.18333333	1.02	0.019803
CR4			131.5	2.19166667	1.02	0.019803
CR5			132.5	2.20833333	1	0
CR6	**MEAN**	**TIME AVGS**	133	2.21666667	1.03	0.029559
CR7	**1.02**	**2.21**	133.5	2.225	1.00	-0.005013
CR8	**SD**		134.5	2.24166667	1.02	0.019803
CR9	**0.03**		134	2.23333333	1.01	0.00995
CR10	**%SD**		136	2.26666667	0.983	-0.017146
CRUP	**2.5%**		135	2.25	1.01	0.00995
CR1			160	2.66666667	0.854	-0.157824
CR2			160.5	2.675	0.829	-0.187535
CR3			161	2.68333333	0.803	-0.219401
CR4			161.5	2.69166667	0.791	-0.234457
CR5			162	2.7	0.789	-0.236989
CR6	**MEAN**	**TIME AVGS**	162.5	2.70833333	0.809	-0.211956
CR7	**0.81**	**2.71**	163	2.71666667	0.78	-0.248461
CR8	**SD**		163.5	2.725	0.826	-0.191161
CR9	**0.02**		164	2.73333333	0.822	-0.196015
CR10	**%SD**		164.5	2.74166667	0.784	-0.243346
CRUP	**2.9%**		165	2.75	0.792	-0.233194
CR1			190	3.16666667	0.656	-0.421594
CR2			190.5	3.175	0.64	-0.446287
CR3			191	3.18333333	0.633	-0.457285
CR4			191.5	3.19166667	0.623	-0.473209
CR5			192	3.2	0.614	-0.48776
CR6	**MEAN**	**TIME AVGS**	192.5	3.20833333	0.64	-0.446287
CR7	**0.63**	**3.21**	193	3.21666667	0.62	-0.478036
CR8	**SD**		193.5	3.225	0.629	-0.463624
CR9	**0.01**		194	3.23333333	0.642	-0.443167
CR10	**%SD**		194.5	3.24166667	0.612	-0.491023
CRUP	**2.2%**		195	3.25	0.618	-0.481267

TEST J OCONEE U1/U2 NORMAL MODE TEST 8/10/01

SUMMARY OUTPUT

SUMMARY OUTPUT

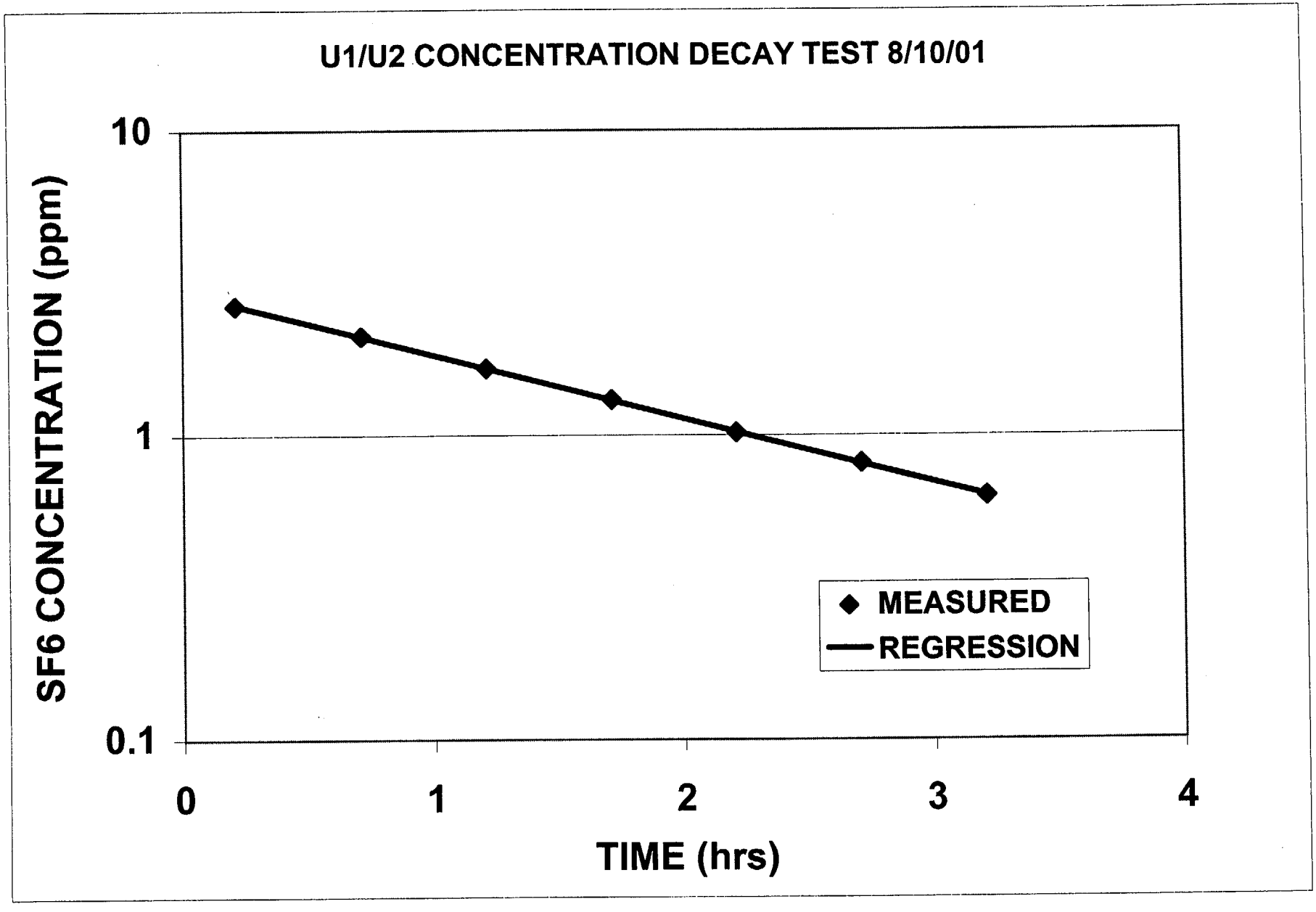
Regression Statistics	
Multiple R	0.99923508
R Square	0.99847075
Adjusted R Square	0.99845036
Standard Error	0.01914524
Observations	77

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	17.94893525	17.94893525	48968.506	2.4059E-107
Residual	75	0.027490529	0.00036654		
Total	76	17.97642578			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.08967782	0.004320781	252.1946515	1.34E-111	1.081070385	1.098285263
TIME(HR)	-0.4827273	0.002181441	-221.2882876	2.41E-107	-0.487072999	-0.47838169

TIME	MEASURED	REGRESSION	DIFF
0.21	2.67	2.69	-0.6%
0.71	2.12	2.11	0.4%
1.21	1.66	1.66	0.1%
1.71	1.31	1.30	0.6%
2.21	1.02	1.02	-0.3%
2.71	0.81	0.80	0.8%
3.21	0.63	0.63	-0.2%


U1/U2 CONCENTRATION DECAY TEST 8/10/01
SF6 CONCENTRATION (ppm)
10
1
0.1
0
1
2
3
4
TIME (hrs)
MEASURED
REGRESSION

Inleakage Error Analysis-Concentration Decay Test

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
B are bias errors in measurement
S are random errors in measurement
t95 is Student's t at 95 % confidence

Date	8/10-11/01	**Test**	J
Location	Oconee U1/U2		
Ventilation	AHU 1-11		
CRE Volume	108000	Cu. Ft.	

Test Parameters

Injection Concentration	10210	ppm
Injection Duration	60.00	min
Injection Flow Rate	15.00	SLPM
Calibration Point Value	2.16	ppm
Background	<3	ppb

	A	
Regression Value =	0.4827	
Number of Values =	72	
RMS Error =	0.002606	(From Spread Sheet)

Bias Errors	Analyzer SN100		Analyzer SN123	
	Numeric Value	Bias Error	Numeric Value	Bias Error
Calibration Gas Error		2.00%		2.00%
Analyzer Exponent (n)	0.9703		1.0520	
Analyzer Exponent U95	0.9918		1.0666	
Analyzer Exponent L95	0.9488		1.0374	
Analyzer Error		2.09%		1.54%

USE LARGER ANALYZER ERROR IN BIAS CALC

Volumetric Error 2%

Inleakage Error Analysis-Concentration Decay Test

Date	8/10-11/01	**Test**	J
Location	Oconee U1/U2		
Ventilation	AHU 1-11		
CRE Volume	108000	Cu. Ft.	

Inleakage Error

	Squared Sum		
Bias Error	0.0012352	Number Observations	72
Random Error	0.00002699	Student t	1.993462

Urss **0.036**

Inleakage	**869**	**ACFM**
Max-95	**900**	**ACFM**
Min-95	**838**	**ACFM**

TEST K

8/11/01

AHU 1-11 and Fan 1B Operating

Inleakage Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/11-12/2001	**Test**	K
Location	OCONEE		
M/U FAN	1B		
Time			

Test Parameters

Injection Concentration	10130 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.72 SLPM
Calibration Point Value (ppb)	2.16 ppb

Measured Data

		Concentration (ppm)			
Sample #	Time	Makeup	Return	CFM	Delta ppm
1	0.0	1.56	1.55	5.4	0.01
2	10.0	1.54	1.55	-7.9	-0.01
3	20.0	1.52	1.53	-8.1	-0.01
4	30.0	1.53	1.50	19.7	0.03
5	40.0	1.55	1.55	2.3	0.00
6	50.0	1.53	1.53	-3.2	0.00
7	60.0	1.53	1.51	13.0	0.02

Random Error

	Makeup	Return	CFM	Delta ppm
Average	1.54	1.53	3.0	0.00
Std Dev.	0.01	0.02	10.52	0.01
% Dev.	0.97%	1.33%	354.88%	349.21%

Inleakage Measurement & Error Analysis

Date	8/11-12/2001	**Test**	K
Location	OCONEE		
M/U AHU	1B		
Time	0		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
Analyzer sn100			
Analyzer Exponent (n)	0.9618		
Analyzer Exponent U95	0.9800		
Analyzer Exponent L95	0.9436		
Analyzer Exponent Error		1.75%	
Analyzer Error			2.35%

Inleakage Error

	Squared Sum		
Bias Error	0.001164524	Degrees of Freedom	6
Random Error	75.40713632	Student t factor	2.446914

Urss **8.684**

Inleakage	**3**	**SCFM**
Max-95	**29**	**SCFM**
Min-95	**-23**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/11-12/2001	**Test**	KF4
Location	OCONEE		
M/U AHU	1B		
Time	1:20		

Test Parameters

Injection Concentration	10130 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.72 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.48	1141.6
2	A2	1.56	1083.0
3	A3	1.41	1198.2
4	B1	1.55	1090.0
5	B2	1.54	1097.1
6	B3	1.42	1189.8
7	C1	1.60	1056.0
8	C2	1.70	993.8
9	C3	1.76	960.0

Random Error

	Makeup	CFM
Average	1.56	1084.6
Std Dev.	0.12	80.43
% Dev.	7.53%	7.42%

Flowrate Error Analysis

Date	8/11-12/2001	**Test**	KF4
Location	OCONEE		
M/U AHU	1B		
Time	1:20		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9618		
Analyzer Exponent U95	0.9800		
Analyzer Exponent L95	0.9436		
Analyzer Exponent Error		1.75%	
Analyzer Error			-0.57%

Flowrate Error

	Squared Sum		
Bias Error	0.000644951	Degrees of Freedom	8
Random Error	0.029245341	Student t factor	2.306006

Urss **0.173**

Flowrate	**1085**	**SCFM**
Max-95	**1272**	**SCFM**
Min-95	**897**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/11-12/2001	**Test**	KF5
Location	OCONEE		
M/U AHU	1B		
Time	1:30		

Test Parameters

Injection Concentration	10130 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.72 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.49	1133.9
2	A2	1.55	1090.0
3	A3	1.44	1173.3
4	B1	1.50	1126.4
5	B2	1.54	1097.1
6	B3	1.52	1111.5
7	C1	1.54	1097.1
8	C2	1.63	1036.5
9	C3	1.64	1030.2

Random Error

	Makeup	CFM
Average	1.54	1097.9
Std Dev.	0.06	45.23
% Dev.	4.15%	4.12%

Flowrate Error Analysis

Date	8/11-12/2001	**Test**	KF5
Location	OCONEE		
M/U AHU	1B		
Time	1:30		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9618		
Analyzer Exponent U95	0.9800		
Analyzer Exponent L95	0.9436		
Analyzer Exponent Error		1.75%	
Analyzer Error			-0.59%

Flowrate Error

	Squared Sum		
Bias Error	0.00064744	Degrees of Freedom	8
Random Error	0.009024261	Student t factor	2.306006

Urss **0.098**

Flowrate	**1098**	**SCFM**
Max-95	**1206**	**SCFM**
Min-95	**990**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/11-12/2001	**Test**	KF6
Location	OCONEE		
M/U AHU	1B		
Time	1:40		

Test Parameters

Injection Concentration	10130 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.72 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.46	1157.2
2	A2	1.48	1141.6
3	A3	1.42	1189.8
4	B1	1.56	1083.0
5	B2	1.62	1042.9
6	B3	1.44	1173.3
7	C1	1.52	1111.5
8	C2	1.58	1069.3
9	C3	1.59	1062.6

Random Error

	Makeup	CFM
Average	1.52	1112.3
Std Dev.	0.07	53.08
% Dev.	4.75%	4.77%

Flowrate Error Analysis

Date	8/11-12/2001	**Test**	KF6
Location	OCONEE		
M/U AHU	1B		
Time	1:40		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9618		
Analyzer Exponent U95	0.9800		
Analyzer Exponent L95	0.9436		
Analyzer Exponent Error		1.75%	
Analyzer Error			-0.62%

Flowrate Error

	Squared Sum		
Bias Error	0.00065021	Degrees of Freedom	8
Random Error	0.012110049	Student t factor	2.306006
Urss	**0.113**		

Flowrate	**1112**	**SCFM**
Max-95	**1238**	**SCFM**
Min-95	**987**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/11-12/2001	**Test**	KF7
Location	OCONEE		
M/U AHU	1B		
Time	1:50		

Test Parameters

Injection Concentration	10130 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.72 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.55	1090.0
2	A2	1.51	1118.9
3	A3	1.48	1141.6
4	B1	1.50	1126.4
5	B2	1.57	1076.1
6	B3	1.44	1173.3
7	C1	1.58	1069.3
8	C2	1.56	1083.0
9	C3	1.55	1090.0

Random Error

	Makeup	CFM
Average	1.53	1106.7
Std Dev.	0.05	34.69
% Dev.	3.07%	3.13%

Flowrate Error Analysis

Date	8/11-12/2001	**Test**	KF7
Location	OCONEE		
M/U AHU	1B		
Time	1:50		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9618		
Analyzer Exponent U95	0.9800		
Analyzer Exponent L95	0.9436		
Analyzer Exponent Error		1.75%	
Analyzer Error			-0.61%

Flowrate Error

	Squared Sum		
Bias Error	0.000649116	Degrees of Freedom	8
Random Error	0.005223811	Student t factor	2.306006

Urss **0.077**

Flowrate	**1107**	**SCFM**
Max-95	**1191**	**SCFM**
Min-95	**1022**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/11-12/2001	**Test**	KF8
Location	OCONEE		
M/U AHU	1B		
Time	2:00		

Test Parameters

Injection Concentration	10130 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.72 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.54	1097.1
2	A2	1.50	1126.4
3	A3	1.45	1165.2
4	B1	1.54	1097.1
5	B2	1.63	1036.5
6	B3	1.47	1149.3
7	C1	1.57	1076.1
8	C2	1.62	1042.9
9	C3	1.66	1017.8

Random Error

	Makeup	CFM
Average	1.55	1087.7
Std Dev.	0.07	51.33
% Dev.	4.71%	4.72%

Flowrate Error Analysis

Date	8/11-12/2001	**Test**	KF8
Location	OCONEE		
M/U AHU	1B		
Time	2:00		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9618		
Analyzer Exponent U95	0.9800		
Analyzer Exponent L95	0.9436		
Analyzer Exponent Error		1.75%	
Analyzer Error			-0.58%

Flowrate Error

	Squared Sum		
Bias Error	0.000645525	Degrees of Freedom	8
Random Error	0.011844281	Student t factor	2.306006

Urss **0.112**

Flowrate	**1088**	**SCFM**
Max-95	**1209**	**SCFM**
Min-95	**966**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/11-12/2001	**Test**	KF9
Location	OCONEE		
M/U AHU	1B		
Time	2:10		

Test Parameters

Injection Concentration	10130 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.72 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.47	1149.3
2	A2	1.48	1141.6
3	A3	1.42	1189.8
4	B1	1.53	1104.3
5	B2	1.60	1056.0
6	B3	1.45	1165.2
7	C1	1.60	1056.0
8	C2	1.64	1030.2
9	C3	1.54	1097.1

Random Error

	Makeup	CFM
Average	1.53	1107.5
Std Dev.	0.08	55.19
% Dev.	4.99%	4.98%

Flowrate Error Analysis

Date	8/11-12/2001	**Test**	KF9
Location	OCONEE		
M/U AHU	1B		
Time	2:10		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9618		
Analyzer Exponent U95	0.9800		
Analyzer Exponent L95	0.9436		
Analyzer Exponent Error		1.75%	
Analyzer Error			-0.61%

Flowrate Error

	Squared Sum		
Bias Error	0.000649271	Degrees of Freedom	8
Random Error	0.013206688	Student t factor	2.306006

Urss **0.118**

Flowrate	**1107**	**SCFM**
Max-95	**1238**	**SCFM**
Min-95	**977**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/11-12/2001	**Test**	KF10
Location	OCONEE		
M/U AHU	1B		
Time	2:20		

Test Parameters

Injection Concentration	10130 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.72 SLPM
Calibration Point Value (ppb)	2.16 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	1.51	1118.9
2	A2	1.52	1111.5
3	A3	1.42	1189.8
4	B1	1.57	1076.1
5	B2	1.54	1097.1
6	B3	1.48	1141.6
7	C1	1.53	1104.3
8	C2	1.59	1062.6
9	C3	1.59	1062.6

Random Error

	Makeup	CFM
Average	1.53	1105.9
Std Dev.	0.05	40.64
% Dev.	3.58%	3.68%

Flowrate Error Analysis

Date	8/11-12/2001	**Test**	KF10
Location	OCONEE		
M/U AHU	1B		
Time	2:20		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9618		
Analyzer Exponent U95	0.9800		
Analyzer Exponent L95	0.9436		
Analyzer Exponent Error		1.75%	
Analyzer Error			-0.61%

Flowrate Error

	Squared Sum		
Bias Error	0.000648962	Degrees of Freedom	8
Random Error	0.007183243	Student t factor	2.306006

Urss **0.088**

Flowrate	**1106**	**SCFM**
Max-95	**1204**	**SCFM**
Min-95	**1008**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/11-12/2001	**Test**	7 Test Avg
Location	OCONEE		
M/U AHU	1B		
Time	01:20-02:20		

Test Parameters

Injection Concentration	10130 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.72 SLPM
Calibration Point Value (ppb)	2.16 ppb

Measured Data

		Concentration (ppm)	
Sample #	Test	Supply	CFM
1	KF4	1.56	1084.6
2	KF5	1.54	1097.9
3	KF6	1.52	1112.3
4	KF7	1.53	1106.7
5	KF8	1.55	1087.7
6	KF9	1.53	1107.5
7	KF10	1.53	1105.9

Random Error

	Supply	CFM
Average	1.54	1099.3
Std Dev.	0.02	11.36
% Dev.	1.04%	1.03%

Flowrate Error Analysis

Date	8/11-12/2001	**Test**	7 Test Avg
Location	OCONEE		
M/U AHU	1B		
Time	01:20-02:20		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.06%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9618		
Analyzer Exponent U95	0.9800		
Analyzer Exponent L95	0.9436		
Analyzer Exponent Error		1.75%	
Analyzer Error			-0.60%

Flowrate Error

	Squared Sum		
Bias Error	0.000647716	Degrees of Freedom	6
Random Error	0.000639378	Student t factor	2.446914
Urss	**0.036**		

Flowrate	**1099**	**SCFM**
Max-95	**1139**	**SCFM**
Min-95	**1060**	**SCFM**

TEST L

8/12/01

AHU 1-11 and Fans 1A & 1B Operating

Inleakage Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/12-13/2001	**Test**	L
Location	OCONEE		
M/U FAN	1A & 1B		
Time	00:10-01:10		

Test Parameters

Injection Concentration	9980 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.84 SLPM
Calibration Point Value (ppb)	1.092 ppb

Measured Data

		Concentration (ppm)			
Sample #	Time	Makeup	Return	CFM	Delta ppm
1	0.0	0.809	0.830	-53.7	-0.02
2	10.0	0.811	0.813	-5.5	0.00
3	20.0	0.820	0.819	3.7	0.00
4	30.0	0.832	0.826	14.4	0.01
5	40.0	0.814	0.822	-21.7	-0.01
6	50.0	0.813	0.821	-19.6	-0.01
7	60.0	0.792	0.824	-82.8	-0.03

Random Error

	Makeup	Return	CFM	Delta ppm
Average	0.813	0.822	-23.3	-0.01
Std Dev.	0.01	0.01	34.01	0.01
% Dev.	1.47%	0.66%		

Inleakage Measurement & Error Analysis

Date	8/12-13/2001	**Test**	L
Location	OCONEE		
M/U AHU	1A & 1B		
Time	00:10-01:10		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.03%
Calibration Gas Error			2.00%
Analyzer sn100			
Analyzer Exponent (n)	0.9684		
Analyzer Exponent U95	0.9877		
Analyzer Exponent L95	0.9491		
Analyzer Exponent Error		1.87%	
Analyzer Error			2.41%

Inleakage Error

	Squared Sum		
Bias Error	0.00118752	Degrees of Freedom	6
Random Error	#VALUE!	Student t factor	2.446914

Urss **#VALUE!**

Inleakage	**-23**	**SCFM**
Max-95	**#VALUE!**	**SCFM**
Min-95	**#VALUE!**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/12-13/2001	**Test**	LF1
Location	OCONEE		
M/U AHU	1A & 1B		
Time	18:35		

Test Parameters

Injection Concentration	9980 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.84 SLPM
Calibration Point Value (ppb)	1.092 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.801	2130.9
2	A2	0.775	2202.4
3	A3	0.793	2152.4
4	B1	0.837	2039.2
5	B2	0.863	1977.8
6	B3	0.819	2084.0
7	C1	0.843	2024.7
8	C2	0.881	1937.4
9	C3	0.851	2005.7

Random Error

	Makeup	CFM
Average	0.829	2058.3
Std Dev.	0.03	87.18
% Dev.	4.20%	4.24%

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/12-13/2001	**Test**	LF4
Location	OCONEE		
M/U AHU	1A & 1B		
Time	0:10		

Test Parameters

Injection Concentration	9980 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.84 SLPM
Calibration Point Value (ppb)	1.092 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.777	2196.7
2	A2	0.777	2196.7
3	A3	0.743	2297.2
4	B1	0.817	2089.1
5	B2	0.861	1982.4
6	B3	0.757	2254.7
7	C1	0.811	2104.6
8	C2	0.895	1907.1
9	C3	0.842	2027.1

Random Error

	Makeup	CFM
Average	0.809	2110.1
Std Dev.	0.05	130.07
% Dev.	6.24%	6.16%

Flowrate Error Analysis

Date	8/12-13/2001	**Test**	LF4
Location	OCONEE		
M/U AHU	1A & 1B		
Time	0:10		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.03%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9684		
Analyzer Exponent U95	0.9877		
Analyzer Exponent L95	0.9491		
Analyzer Exponent Error		1.87%	
Analyzer Error			-0.56%

Flowrate Error

	Squared Sum		
Bias Error	0.000638182	Degrees of Freedom	8
Random Error	0.020206043	Student t factor	2.306006

Urss **0.144**

Flowrate	**2110**	**SCFM**
Max-95	**2415**	**SCFM**
Min-95	**1805**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/12-13/2001	**Test**	LF5
Location	OCONEE		
M/U AHU	1A & 1B		
Time	0:20		

Test Parameters

Injection Concentration	9980 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.84 SLPM
Calibration Point Value (ppb)	1.092 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.777	2196.7
2	A2	0.799	2136.2
3	A3	0.746	2288.0
4	B1	0.807	2115.0
5	B2	0.851	2005.7
6	B3	0.764	2234.1
7	C1	0.803	2125.6
8	C2	0.887	1924.3
9	C3	0.864	1975.5

Random Error

	Makeup	CFM
Average	0.811	2104.9
Std Dev.	0.05	121.96
% Dev.	5.85%	5.79%

Flowrate Error Analysis

Date	8/12-13/2001	**Test**	LF5
Location	OCONEE		
M/U AHU	1A & 1B		
Time	0:20		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.03%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9684		
Analyzer Exponent U95	0.9877		
Analyzer Exponent L95	0.9491		
Analyzer Exponent Error		1.87%	
Analyzer Error			-0.56%

Flowrate Error

	Squared Sum		
Bias Error	0.000637666	Degrees of Freedom	8
Random Error	0.017852545	Student t factor	2.306006

Urss **0.136**

Flowrate	**2105**	**SCFM**
Max-95	**2391**	**SCFM**
Min-95	**1819**	**SCFM**

Flowrate Error Analysis

Date	8/12-13/2001	**Test**	LF6
Location	OCONEE		
M/U AHU	1A & 1B		
Time	0:30		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.03%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9684		
Analyzer Exponent U95	0.9877		
Analyzer Exponent L95	0.9491		
Analyzer Exponent Error		1.87%	
Analyzer Error			-0.53%

Flowrate Error

	Squared Sum		
Bias Error	0.000635278	Degrees of Freedom	8
Random Error	0.03440622	Student t factor	2.306006

Urss **0.187**

Flowrate	**2080**	**SCFM**
Max-95	**2470**	**SCFM**
Min-95	**1691**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/12-13/2001	**Test**	LF7
Location	OCONEE		
M/U AHU	1A & 1B		
Time	0:40		

Test Parameters

Injection Concentration	9980 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.84 SLPM
Calibration Point Value (ppb)	1.092 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.749	2278.8
2	A2	0.807	2115.0
3	A3	0.791	2157.8
4	B1	0.849	2010.4
5	B2	0.854	1998.6
6	B3	0.785	2174.3
7	C1	0.837	2039.2
8	C2	0.909	1877.7
9	C3	0.905	1886.0

Random Error

	Makeup	CFM
Average	0.832	2052.0
Std Dev.	0.05	134.03
% Dev.	6.51%	6.53%

Flowrate Error Analysis

Date	8/12-13/2001	**Test**	LF7
Location	OCONEE		
M/U AHU	1A & 1B		
Time	0:40		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.03%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9684		
Analyzer Exponent U95	0.9877		
Analyzer Exponent L95	0.9491		
Analyzer Exponent Error		1.87%	
Analyzer Error			-0.51%

Flowrate Error

	Squared Sum		
Bias Error	0.000632603	Degrees of Freedom	8
Random Error	0.022685166	Student t factor	2.306006

Urss **0.153**

Flowrate	**2052**	**SCFM**
Max-95	**2365**	**SCFM**
Min-95	**1739**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/12-13/2001	**Test**	LF8
Location	OCONEE		
M/U AHU	1A & 1B		
Time	0:50		

Test Parameters

Injection Concentration	9980 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.84 SLPM
Calibration Point Value (ppb)	1.092

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.758	2251.8
2	A2	0.811	2104.6
3	A3	0.709	2407.4
4	B1	0.847	2015.1
5	B2	0.844	2022.3
6	B3	0.798	2138.9
7	C1	0.849	2010.4
8	C2	0.892	1913.5

Random Error

	Makeup	CFM
Average	0.814	2098.1
Std Dev.	0.06	157.92
% Dev.	7.16%	7.53%

Flowrate Error Analysis

Date	8/12-13/2001	**Test**	LF8
Location	OCONEE		
M/U AHU	1A & 1B		
Time	0:50		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.03%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9684		
Analyzer Exponent U95	0.9877		
Analyzer Exponent L95	0.9491		
Analyzer Exponent Error		1.87%	
Analyzer Error			-0.55%

Flowrate Error

	Squared Sum		
Bias Error	0.000637001	Degrees of Freedom	7
Random Error	0.031678246	Student t factor	2.364623

Urss **0.180**

Flowrate	**2098**	**SCFM**
Max-95	**2475**	**SCFM**
Min-95	**1721**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/12-13/2001	**Test**	LF9
Location	OCONEE		
M/U AHU	1A & 1B		
Time	1:00		

Test Parameters

Injection Concentration	9980 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.84 SLPM
Calibration Point Value (ppb)	1.092 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.784	2177.1
2	A2	0.819	2084.0
3	A3	0.755	2260.7
4	B1	0.841	2029.5
5	B2	0.850	2008.0
6	B3	0.746	2288.0
7	C1	0.790	2160.5
8	C2	0.883	1933.0
9	C3	0.852	2003.3

Random Error

	Makeup	CFM
Average	0.813	2098.6
Std Dev.	0.05	123.22
% Dev.	5.80%	5.87%

Flowrate Error Analysis

Date	8/12-13/2001	**Test**	LF9
Location	OCONEE		
M/U AHU	1A & 1B		
Time	1:00		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.03%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9684		
Analyzer Exponent U95	0.9877		
Analyzer Exponent L95	0.9491		
Analyzer Exponent Error		1.87%	
Analyzer Error			-0.55%

Flowrate Error

	Squared Sum		
Bias Error	0.000637043	Degrees of Freedom	8
Random Error	0.018333626	Student t factor	2.306006

Urss **0.138**

Flowrate	**2099**	**SCFM**
Max-95	**2388**	**SCFM**
Min-95	**1810**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/12-13/2001	**Test**	LF10
Location	OCONEE		
M/U AHU	1A & 1B		
Time	1:10		

Test Parameters

Injection Concentration	9980 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.84 SLPM
Calibration Point Value (ppb)	1.092 ppm

Measured Data

		Concentration (ppm)	
Sample #	Location	Makeup	CFM
1	A1	0.747	2284.9
2	A2	0.774	2205.2
3	A3	0.727	2347.8
4	B1	0.798	2138.9
5	B2	0.840	2031.9
6	B3	0.752	2269.7
7	C1	0.763	2237.0
8	C2	0.872	1957.4
9	C3	0.858	1989.3

Random Error

	Makeup	CFM
Average	0.792	2154.2
Std Dev.	0.05	140.47
% Dev.	6.64%	6.52%

Flowrate Error Analysis

Date	8/12-13/2001	**Test**	LF10
Location	OCONEE		
M/U AHU	1A & 1B		
Time	1:10		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.03%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9684		
Analyzer Exponent U95	0.9877		
Analyzer Exponent L95	0.9491		
Analyzer Exponent Error		1.87%	
Analyzer Error			-0.60%

Flowrate Error

	Squared Sum		
Bias Error	0.000642667	Degrees of Freedom	8
Random Error	0.022611225	Student t factor	2.306006

Urss **0.152**

Flowrate	**2154**	**SCFM**
Max-95	**2483**	**SCFM**
Min-95	**1826**	**SCFM**

Flowrate Measurement & Error Analysis

This analysis uses the ANSI/ASME Standard Uncertainty Model

Urss = [(B^2) + (t95*S)^2]^0.5

where, Urss is the measurement uncertainty (Root Sum Square)
t95 is Student's t at 95 % confidence
B are bias errors in measurement
S are random errors in measurement

Date	8/12-13/2001	**Test**	7 Test Avg
Location	OCONEE		
M/U AHU	1A & 1B		
Time	00:10-01:10		

Test Parameters

Injection Concentration	9980 ppm
Injection Flowmeter Max Value	5.00 SLPM
Injection Flow Rate	4.84 SLPM
Calibration Point Value (ppb)	1.092 ppb

Measured Data

		Concentration (ppm)	
Sample #	Time	Supply	CFM
1	2230.0	0.809	2110.1
2	2230.5	0.811	2104.9
3	2231.0	0.820	2080.4
4	2232.0	0.832	2052.0
5	2232.5	0.814	2098.1
6	2233.0	0.813	2098.6
7	2233.0	0.792	2154.2

Random Error

	Supply	CFM
Average	0.816	2090.5
Std Dev.	0.01	21.43
% Dev.	1.04%	1.03%

Flowrate Error Analysis

Date	8/12-13/2001	**Test**	7 Test Avg
Location	OCONEE		
M/U AHU	1A & 1B		
Time	00:10-01:10		

Bias Errors

	Numeric Value		Bias Error
Injection Concentration Err			1.00%
Injection Flowrate % FS Err		1.00%	
Injection Flowrate Error			1.03%
Calibration Gas Error			2.00%
sn100			
Analyzer Exponent (n)	0.9684		
Analyzer Exponent U95	0.9877		
Analyzer Exponent L95	0.9491		
Analyzer Exponent Error		1.87%	
Analyzer Error			-0.54%

Flowrate Error

	Squared Sum		
Bias Error	0.000636256	Degrees of Freedom	6
Random Error	0.000629315	Student t factor	2.446914

Urss **0.036**

Flowrate	**2090**	**SCFM**
Max-95	**2165**	**SCFM**
Min-95	**2016**	**SCFM**

APPENDIX C-STATISTICAL COMPARISON OF MEAN VALUES

COMPARING MEANS: OCONEE TEST H 8/8/01

ENTER UP TO FIFTEEN VALUES

N1	Column A Makeup	N2	Column B Return
1	1.46	1	1.47
2	1.49	2	1.49
3	1.47	3	1.46
4	1.46	4	1.46
5	1.48	5	1.44
6	1.46	6	1.45
7	1.45	7	1.43

MEANA	1.4671	MEANB	1.4571
STDEVA	0.014	STDEVB	0.020
% A	0.9%	% B	1.4%
NA=	7	NB=	7
	Sp=	0.017	
	dF=	12	
t CALC		1.098	
t STATISTIC		2.179	

If t CALC > t STATISTIC then means are different at the 95% confidence level

Use when population variances are unequal

	dF	10.728496
X	6.89E-09	
Y	1.23E-10	dF=X/(Y+Z)
Z	5.19E-10	

COMPARING MEANS: OCONEE TEST I 8/9/01

ENTER UP TO FIFTEEN VALUES

N1	Column A Makeup	N2	Column B Return
1	0.941	1	0.966
2	0.935	2	0.958
3	0.952	3	0.933
4	0.982	4	0.962
5	0.943	5	0.931
6	0.938	6	0.938
7	0.913	7	0.927

MEANA	0.9434	MEANB	0.9450
STDEVA	0.021	STDEVB	0.016
% A	2.2%	% B	1.7%
NA=	7	NB=	7
	Sp=	0.019	
	dF=	12	
t CALC		0.157	
t STATISTIC		2.179	

If t CALC > t STATISTIC then means are different at the 95% confidence level

COMPARING MEANS: OCONEE TEST K 8/11/01

ENTER UP TO FIFTEEN VALUES

N1	Column A Makeup	N2	Column B Return
1	1.56	1	1.55
2	1.54	2	1.55
3	1.52	3	1.53
4	1.53	4	1.50
5	1.55	5	1.55
6	1.53	6	1.53
7	1.53	7	1.51

MEANA	1.5371	MEANB	1.5314
STDEVA	0.014	STDEVB	0.020
% A	0.9%	% B	1.3%
NA=	7	NB=	7
	Sp=	0.017	
	dF=	12	
t CALC		0.615	
t STATISTIC		2.179	

If t CALC > t STATISTIC then means are different at the 95% confidence level

COMPARING MEANS: OCONEE TEST L 8/12/01

ENTER UP TO FIFTEEN VALUES

N1	Column A Makeup	N2	Column B Return
1	0.809	1	0.830
2	0.811	2	0.813
3	0.820	3	0.819
4	0.832	4	0.826
5	0.814	5	0.822
6	0.813	6	0.821
7	0.792	7	0.824

MEANA	0.8130	MEANB	0.8221
STDEVA	0.012	STDEVB	0.005
% A	1.5%	% B	0.7%
NA=	7	NB=	7
	Sp=	0.009	
	dF=	12	
t CALC		1.831	
t STATISTIC		2.179	

If t CALC > t STATISTIC then means are different at the 95% confidence level

MINIMUM DETECTABLE INCREMENT OCONEE TEST H 8/8/01

	Increment
	0.01
Column A	Col A + Incr
1.46	1.47
1.49	1.50
1.47	1.48
1.46	1.47
1.48	1.49
1.46	1.47
1.45	1.46

Incr. Conc.	1.4771
	0.014
	0.9%

t CALCULATOR WHEN STATISTICS ARE KNOWN FOR TWO MEANS

MEANA	1.4771	MEANB	1.4571
STDEVA	0.014	STDEVB	0.020
% A	0.9%	% B	1.4%

ENTER NUMBER IN EACH SAMPLE SET

NA=	7	NB=	7	dF=	12

Sp=	0.017
t CALC	2.195
t STATISTIC	2.179

If t CALC > t STATISTIC then means are different at the 95% confidence level

MINIMUM DETECTABLE INCREMENT OCONEE TEST I 8/9/01

	Increment
	0.024
Column A	Col A + Incr
0.941	0.965
0.935	0.959
0.952	0.976
0.982	1.006
0.943	0.967
0.938	0.962
0.913	0.937

Incr. Conc.	0.9674
	0.021
	2.1%

t CALCULATOR WHEN STATISTICS ARE KNOWN FOR TWO MEANS

MEANA	0.9674	MEANB	0.9450
STDEVA	0.021	STDEVB	0.016
% A	2.1%	% B	1.7%

ENTER NUMBER IN EACH SAMPLE SET

NA=	7	NB=	7	dF=	12

Sp=	0.019
t CALC	2.241
t STATISTIC	2.179

If t CALC > t STATISTIC then means are different at the 95% confidence level

MINIMUM DETECTABLE INCREMENT OCONEE TEST K 8/11/01

	Increment
	0.02
Column A	Col A + Incr
1.56	1.58
1.54	1.56
1.52	1.54
1.53	1.55
1.55	1.57
1.53	1.55
1.53	1.55

Incr. Conc.	1.5571
	0.014
	0.9%

t CALCULATOR WHEN STATISTICS ARE KNOWN FOR TWO MEANS

MEANA	1.5571	MEANB	1.5314
STDEVA	0.014	STDEVB	0.020
% A	0.9%	% B	1.3%

ENTER NUMBER IN EACH SAMPLE SET

NA=	7	NB=	7	dF=	12

Sp=	0.017
t CALC	2.767
t STATISTIC	2.179

If t CALC > t STATISTIC then means are different at the 95% confidence level

MINIMUM DETECTABLE INCREMENT OCONEE TEST L 8/12/01

	Increment
	0.021
Column A	Col A + Incr
0.809	0.830
0.811	0.832
0.820	0.841
0.832	0.853
0.814	0.835
0.813	0.834
0.792	0.813

Incr. Conc.	0.8340
	0.012
	1.4%

t CALCULATOR WHEN STATISTICS ARE KNOWN FOR TWO MEANS

MEANA	0.8340	MEANB	0.8221
STDEVA	0.012	STDEVB	0.005
% A	1.4%	% B	0.7%

ENTER NUMBER IN EACH SAMPLE SET

NA=	7	NB=	7	dF=	12

Sp=	0.009
t CALC	2.375
t STATISTIC	2.179

If t CALC > t STATISTIC then means are different at the 95% confidence level

APPENDIX D-CRE DIFFERENTIAL PRESSURE DATA

TEST H

DIFFERENTIAL PRESSURE: 8/8/01

UNIT 3 HVAC in EMERGENCY MODE

1 BOOSTER FAN OPERATING

Location	Differential Pressure (in. w.g.)
Turbine Building	+ 0.23
Unit 3 Cable Room	+0.22
Mechanical Equipment Room	+0.24
Unit 3 Control Room Lobby	+0.23
Unit 3 East Penetration Room	+0.23
Outside	+0.21

TEST I

DIFFERENTIAL PRESSURE: 8/9/01

UNIT 3 HVAC in EMERGENCY MODE

2 BOOSTER FANS OPERATING

Location	Differential Pressure (in. w.g.)
Turbine Building	>+ 0.5
Unit 3 Cable Room	>+ 0.5
Mechanical Equipment Room	>+ 0.5
Unit 3 Control Room Lobby	>+ 0.5
Unit 3 East Penetration Room	>+ 0.5
Outside	>+ 0.5

TEST K

DIFFERENTIAL PRESSURE: 8/11/01

UNITS 1 & 2 CRE HVAC in EMERGENCY MODE

1 BOOSTER FAN OPERATING

Location	Differential Pressure (in. w.g.)
Unit 1 Control Room Lobby	+0.32
Turbine Building	+ 0.21
Unit 2 Control Room Lobby	+0.25
Unit 2 Cable Room	+0.21
Unit 2 East Penetration Room	+0.24
Unit 1 Cable Room	+0.20
Unit 1 East Penetration Room	+0.23
Mechanical Equipment Room	+0.26

TEST L

DIFFERENTIAL PRESSURE: 8/12/01

UNITS 1 & 2 CRE HVAC in EMERGENCY MODE

2 BOOSTER FANS OPERATING

Location	Differential Pressure (in. w.g.)
Unit 1 Control Room Lobby	>+0.5
Turbine Building	>+0.5
Unit 2 Control Room Lobby	>+0.5
Unit 2 Cable Room	>+0.5
Unit 2 East Penetration Room	>+0.5
Unit 1 Cable Room	>+0.5
Unit 1 East Penetration Room	>+0.5
Mechanical Equipment Room	>+0.5

ATTACHMENT 3

Duke Energy Corporation
Electronic Files
Alternate Source Term Response