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April 20, 1998

TO: Clair Fancy

FAX NUMBER: 922-6979

TELEPHONE NO.: 488-1344

FROM: Mary Smallwood

CLIENT NAME: Ogden Martin

CLIENT NO.: 29050-0002

NO. OF PAGES: 2 (INCLUDING THIS COVER PAGE)

COMMENTS:

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If there are any problems or complications, please notify us immediately at (850) 681-9027.

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April 20, 1998

Clair Fancy
Bureau of Air Regulation
Department of Environmental Protection
2600 Blairstone Road, MS 5505
Tallahassee, FL 32399-2400

Re: Lake County Resource Recovery Facility - Test Burn of Biomedical Waste

Dear Clair:

Thank you for meeting with me last Friday to discuss the protocol for testing of the Lake County Resource Recovery Facility with respect to biomedical waste. The purpose of this letter is to reiterate my understanding of the results of that meeting. Ogden Martin Systems of Lake, the operator of the facility, had requested permission to burn biomedical waste during a scheduled test on April 21, 1998. After reviewing the various permit conditions, it was agreed that the construction and operation permits allowed such a test burn to occur. We understand that conducting the test does not necessarily authorize the continued processing of biomedical waste at the facility.

In particular, it was agreed that biomedical waste could be tested in both Unit 1 and Unit 2 at the permit authorized throughput. The test results will be provided to the Department and maybe used in reviewing any subsequent permit modifications.

Again, Ogden appreciates your assistance in resolving this matter prior to the scheduled test date.

Sincerely,

RUDEN, McCLOSKY, SMITH,
SCHUSTER & RUSSELL, P.A.

Mary

Mary F. Smallwood

MFS/cc
cc: Len Kozlov
Kurt Rieke
Jason Gorrie

TAL:17979:1

MUNICIPAL SOLID WASTE POLLUTANTS TEST DATA

Report Run Date: 19-Jul-00

1	NAME	AIRS_ID	TYPE	STATUS	EU_NO	EU_DESCRIPTION	POLLUTANT	TEST_DATE	RESULT	TEST_ALLOW	ACTUAL	UNIT	AUDIT TYPE
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	PM	09-Jan-97	P	0.015	0.0002	22	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	PM	09-Jan-97	P	0.02	0.0002	20	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	CO	09-Jan-97	P	100	20.6	31	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	30-Jun-95	P	0.0003	0.000004	02	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	30-Jun-95	P	0.0003	0.000004	02	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	01-Feb-96	P	70	15.4	20	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	01-Feb-96	P	0.00034	0.000007	22	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	10-Jan-97	P	70	32.2	28	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	10-Jan-97	P	0.00034	0.000013	22	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	10-Jan-97	P	999990	0.00279	PH	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	10-Jan-97	P	999990	0.024	PH	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	SO2	15-Jan-97	P	60	4.8	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	CO	15-Jan-97	P	100	20.6	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H106	15-Jan-97	P	50	28.9	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	PM	15-Jan-97	P	0.015	0.0002	02	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	PM	28-Jan-98	P	0.015	0.00744	02	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H106	28-Jan-98	P	50	27.1	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	NOX	28-Jan-98	P	385	322	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	CO	28-Jan-98	P	100	19.2	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	SO2	28-Jan-98	P	60	16.5	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	SO2	21-Apr-98	P	60	2.2	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	21-Apr-98	P	0.0003	0.000007	02	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	CO	21-Apr-98	P	100	21.7	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	NOX	21-Apr-98	P	385	269	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H106	21-Apr-98	P	50	11	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	PM	21-Apr-98	P	0.015	0.0013	02	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	PM	23-Apr-98	P	0.015	0.0013	02	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H106	23-Apr-98	P	50	11	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	NOX	23-Apr-98	P	385	269.3	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	CO	23-Apr-98	P	100	21.7	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	SO2	23-Apr-98	P	60	2.2	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	23-Apr-98	P	0.0003	0.000007	02	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	SO2	29-Jan-99	P	60	0.421	04	3
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H114	29-Jan-99	F	70	258	28	3
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	CO	29-Jan-99	P	100	24	04	3
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	NOX	29-Jan-99	P	385	315	04	3
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	2	MSW INCINERATOR #2, 288 TPD C	H106	29-Jan-99	P	50	15	04	3
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	1	MSW INCINERATOR UNIT #1	VOC	30-Jan-96	P	70	4.67	04	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	1	MSW INCINERATOR UNIT #1	PB	31-Jan-96	P	0.00031	0.000001	22	2
OGDEN MARTIN SYSTEMS	OGDEN MARTIN SYSTEM	0690046	3	A	1	MSW INCINERATOR UNIT #1	PB	08-Jan-97	P	0.00031	0	22	2

POLLUTANTS & THEIR RESPECTIVE LIMITS: AS EXTRACTED FROM REGULATIONS

1. **PARTICULATE MATTER** in gases discharge limit is 27 mg/day within a large facility and **70 mg/day within a small facility**

2. **OPACITY** limit is **10% (6-minute average) within a small or a large facility**

3. **CADMIUM** limit is **0.040 mg/day for a larger facility** and **0.10 mg/day for a small facility** ***corrected to 7% OXYGEN.***

4. **LEAD** limit is 0.49 mg/day for a large facility and **1.6 mg/day for a small facility** ***corrected to 7% OXYGEN.***

5. **MERCURY** limit is **70 micrograms per dry standard cubic meter of flue gas** ***corrected to 7% O_2***, or **20% by weight of the mercury in the flue gas upstream of the mercury control device (80% reduction by weight),** ***whichever occurs first***.

6. **SULFUR DIOXIDE** limit is **31 ppm for a large facility** and **80 ppm for a small facility** ***corrected to 7% O_2.***

7. **HYDROGEN CHLORIDE** limit is **31 ppm for a large facility** and **250 ppm for a small facility** ***corrected to 7% O_2***

8. **DIOXINS/FURANS** limit is **60 ng for ESP based** and **30 ng for non-ESP based** ***corrected to 7% O_2.***

9. **DIOXIN/FURANS – STATE PLAN** – limit is **125 ng for small facility**

10. **CARBON MONOXIDE:**

i.	Water Wall:	100 ppm	4 Hours Averaging Time
ii.	Refractory:	100 ppm	4 Hours Averaging Time
iii.	Rotary Ref.:	100 ppm	24 Hours Averaging Time
iv.	Rotary Water Wall:	250 ppm	24 Hours Averaging Time
v.	Modular Starved:	50 ppm	4 Hours Averaging Time
vi.	Modular Excess:	50 ppm	4 Hours Averaging Time
vii.	Refuse Derived Fuel:	200 ppm	24 Hours Averaging Time
viii.	Circulating Fluidized:	100 ppm	4 Hours Averaging Time
ix.	Buddling Fluidized	100 ppm	4 Hours Averaging Time
x.	Pulverized Coal/Refuse:	150 ppm	4 Hours Averaging Time
xi.	Spreader Stoker/Refuse:	200 ppm	24 Hours Averaging Time

11. **NITROGEN OXIDES**:

i.	Water Wall:	200 ppm
ii.	Rotary Water Wall:	250 ppm
iii.	Refuse Derived:	250 ppm
iv.	Fluidized Bed:	240 ppm
v.	Refractory:	NA
vi.	Other:	200 ppm

TREND ANALYSIS OF THE MERCURY DATA OF OGDEN MARTIN SYSTEMS OF LAKE INC

Trend analysis is used to test different aspects of the shape of a function relating a ***quantitative*** independent variable (permitted/allowable/permissible emission in this case) and the dependent variable (actual emissions observed/recorded) during the mercury testing. The interest is in the shape of the function relating the levels of this quantitative independent variable to the dependent variable.

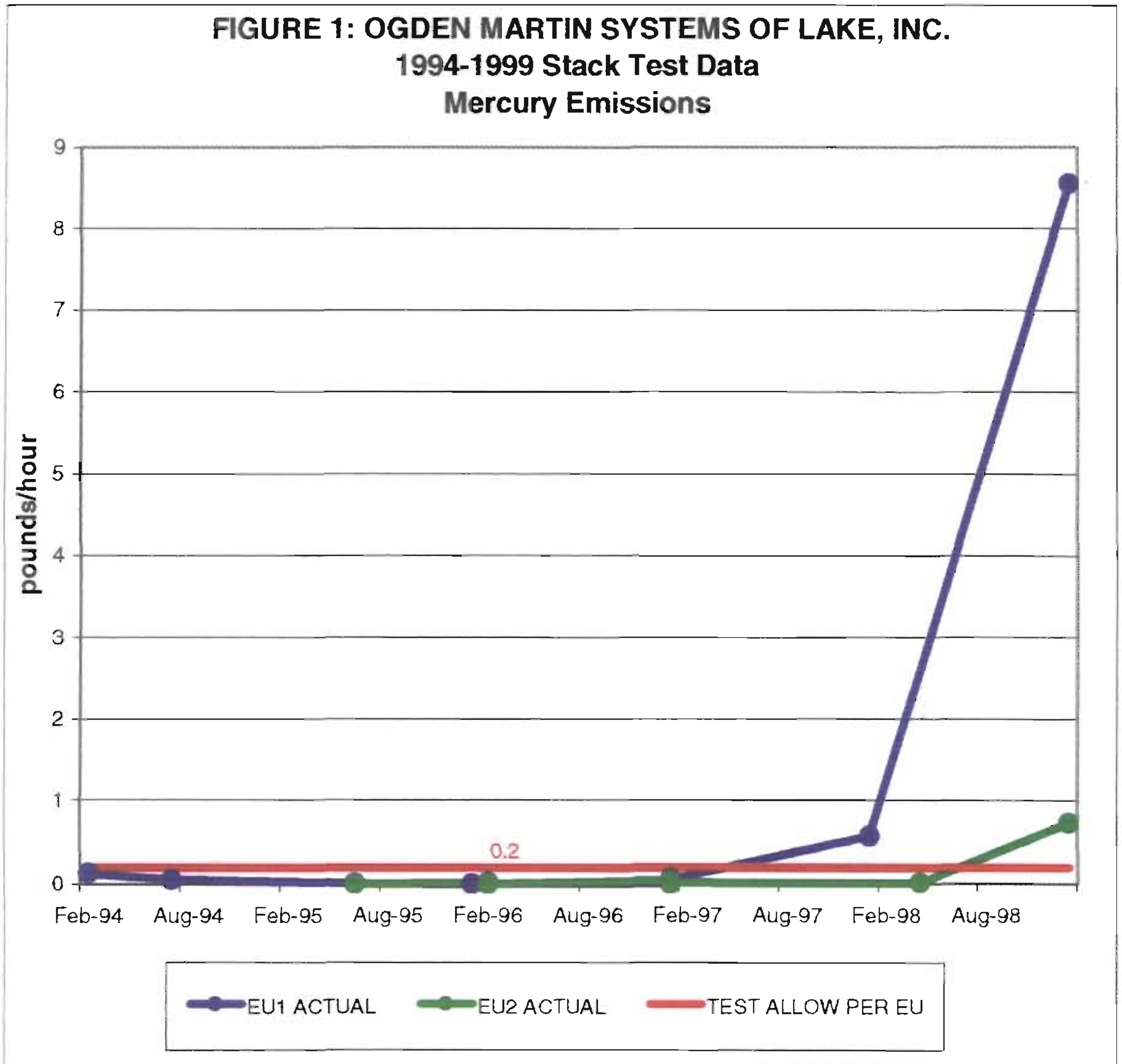
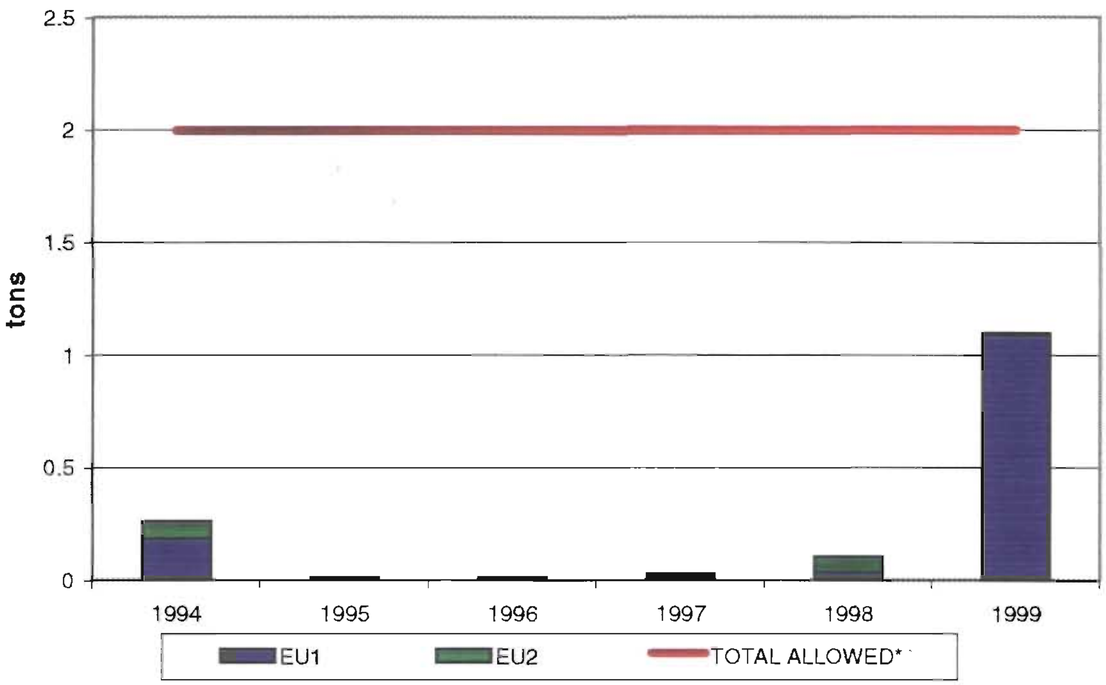


FIGURE 2: OGDEN MARTIN SYSTEMS OF LAKE, INC.
1994-1999 AOR Data
Mercury Emissions



*Draft (6/96) amount allowed for the facility. Amount allowed per EU is 1 ton/year.

Consider the Figures 1 and 2 above, what will be the effect of the magnitude of the permissible emission on the actual emission? Trend analysis can be used to test the effects of one or more components of the trend.

Each of the components is tested using specific comparisons. The linear component of the trend test whether there is an overall increase (or decrease) in the dependent variable, as the independent variable increases or decreases.

In this case, the independent variable, which is the permissible emission, is fixated and it is expressed as the horizontal line (red line). Figure 1 shows that the actual emissions are consistent expect for the significant rise around February of 1999. The effect is more pronounced in the rise of EU1 (blue line) compare to EU2, (green line) with each surpassing the permissible emission respectively.

The test of the linear component of trend is to test the extent of the sharp increase and whether these respective sharp increases are significantly related. Looking at Figure 2, the significant is more distinct with the histogram. Figure 2 expresses the relationship of the AOR data of mercury emissions from EU1, EU2 and combined EUs, as well as the total permissible emission at the facility. The amount permissible per EU is half of the facility's total because there are only two emission units.

Figure 2 confirms the reflections express by Figure 1. Superimposing Figure 1 over Figure 2, there is a sharp increase in February 1994 but not enough to exceed the allowable emission per source unit, and this is more evident in EU1. In about February 1998 through 1999, there was a significant increase, which is also more evident in EU1 and enough to exceed the permissible emission per source unit.

Now back to Figure 1, a test of the linear component of the trend is to show the significant effect of the increase in actual emissions. If these were linear relationships between the permissible emission and the actual emission, then no components of trend other than the linear will be present. This is not the case. The slopes of the functions remain roughly steady for a period with significant spikes as the magnitude of the actual emissions on occasions, as the permissible emission remains constant.

The quadratic component of trend is used to test if the slope increases or decreases as permissible emission increases or decreases, which is not the case because the permissible emission remains constant. The cubic components test whether the slope changes twice (decreasing and then increasing or increasing and then decreasing) as the permissible emission increases or decreases. Again, just as with the quadratic component, the permissible emission is unchanging.

Trend analysis is computed as a set of orthogonal comparison using a particular set of coefficients[1]. Coefficients for the linear, quadratic, and cubic components are given below:

<u>2 means</u>
Lin –1 1

<u>3 means</u>
Lin –1 0 1
Quad 1 -2 1

<u>4 means</u>
Lin –3 -1 1 3
Quad 1 -1 -1 1
Cubic -1 3 -3 1

<u>5 means</u>
Lin -2 -1 0 1 2
Quad 2 -1 -1 -1 2
Cubic -1 2 0 -2 1

<u>6 means</u>
Lin -5 -3 -1 1 3 5
Quad 5 -1 -4 -4 -1 5
Cubic -5 7 4 -4 -7 5

<u>7 means</u>
Lin -3 -2 -1 0 1 2 3
Quad 5 0 -3 -4 -3 0 5
Cubic -1 1 1 0 -1 -1 1

<u>8 means</u>
Lin -7 -5 -3 -1 1 3 5 7
Quad 7 1 -3 -5 -5 -3 1 7
Cubic -7 5 7 3 -3 -7 -5 7

<u>9 means</u>
Lin -4 3 -2 -1 0 1 2 3 4
Quad 28 7 -8 -17 -20 -17 -8 7 28
Cubic -14 7 13 9 0 -9 -13 -7 14

<u>10 means∑</u>
Lin -9 -7 -5 -3 -1 1 3 5 7 9
Quad 6 2 -1 -3 -4 -4 -3 -1 2 6
Cubic -42 14 35 31 12 -12 -31 -35 -14 42

From the ANOVA of the EU1, EU2 together and allowable emission per unit, the MSE (mean square error) is found to be 2.145 for the magnitude of the actual emissions against permissible emission. There are five groups with varying counts as shown in Table 1 below. For five groups from the illustrations above, the coefficient for the linear components will be:

-2, -1, 0, 1, 2

Applying the comparison formula[2],

TABLE 1: EMISSION TESTS DATA

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[1] A coefficient is a constant used to multiply another value. For instance, in the linear transformation of $Y = 3X + 7$, the coefficient "3" is multiplied by the variable X. In the Linear combination of means, it follows that: $L = (2)M_1 + (-1)M_2 + (-1)M_3$ the three numbers in parentheses are coefficients.

[2] The method of computing planned comparisons among means is generalized as:

$$t = L/S_L \qquad \text{Where } L = \Sigma M_i a_i \text{ and } S_L = \sqrt{[\Sigma \{(a_i^2/n_i) MSE\}]}$$

a_i is the coefficient applied to the i^{th} mean; n_i is the sample size of the i^{th} group; M_i is the i^{th} mean
MSE = SSE/dfe and is obtained from ANOVA; The "t" is based on dfe = N – a degrees of freedom where "N" is the total number of subjects and "a" is the number of groups

	EU1 ACTUAL	TEST ALLOWED PER EU	EU2 ACTUAL	TEST ALLOWED PER EU	EU TOTAL	TOTAL ALLOWED
	0.1297	**0.2**		**0.2**	0.1297	0.4
	0.0559	**0.2**		**0.2**	0.0559	0.4
	0.00998	**0.2**	**0.0027**	**0.2**	0.01268	0.4
	0.00103	**0.2**		**0.2**	0.00103	0.4
	0.0241	**0.2**	**0.0241**	**0.2**	0.0482	0.4
	0.0024	**0.2**	**0.0024**	**0.2**	0.0048	0.4
	0.0043	**0.2**	**0.0478**	**0.2**	0.0521	0.4
	0.06146	**0.2**	**0.0027**	**0.2**	0.06416	0.4
	0.0031	**0.2**	**0.0028**	**0.2**	0.0059	0.4
	0.0608	**0.2**	**0.024**	**0.2**	0.0848	0.4
	0.5771	**0.2**		**0.2**	0.5771	0.4
		0.2	**0.016**	**0.2**	0.016	0.4
	8.5538	**0.2**	**0.7371**	**0.2**	9.2909	0.4
MEAN	0.729513	0.2	0.066123	0.2	0.795636154	0.4
COUNT	12	13	9		13	13

$L = M_i a_i$ therefore:

$$= (0.2)(-2) + (0.729513)(-1) + (0.066123)(0) + (0.4)(1) + (0.795636154)(2)$$

$$= (-0.4) + (-0.729513) + (0) + (0.4) + (1.5912722) = \mathbf{0.8617592}$$

$S_L = \sqrt{[\sum \{(a_i^2/n_i)\, MSE\}]}$ therefore:

$$= \sqrt{\sum ((-2)^2/12) + ((-1)^2/9) + ((0)^2/9) + ((1)^2/13) + ((2)^2/13)}$$

$$= \sqrt{0.829} = \mathbf{0.9105}$$

$$t = 0.8617592 / 0.9105 = \mathbf{0.9465}$$

The degrees of freedom for the t is equal to the degrees of freedom error in ANOVA which is:

$$N - a = 60 - 5 = 55$$

From the t-test for paired two samples for means (EU1 + EU2) the estimated probability value for two tails is **0.5872**.

Therefore, the increase in the actual emissions is significant when compared to permissible emission even though the linear transformation was not observed..

Similarly, using the quadratic component of the trend , the increasing slope can be tested to see if the flattening out is significant. However, in this case, it is not possible to use the available data up to 1999, otherwise the quadratic components can be applied. The same condition applies to the cubic components.

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE AOR DATA

TEST ALLOW PER EU	TOTAL ALLOWED AT FACILITY	YEAR	EU1	EU2	EU1 + EU2	TOTAL ALLOWED*
0.2	0.4	1994	0.183	0.075	0.258	2
0.2	0.4	1995	0.0057	0.0071	0.0128	2
0.2	0.4	1996	0.006	0.0074	0.0134	2
0.2	0.4	1997	0.0172	0.0112	0.0284	2
0.2	0.4	1998	0.0342	0.0702	0.1044	2
0.2	0.4	1999	1.09	0.0069	1.0969	2

YEAR	TEST ALLOW PER EU	EU1	TEST ALLOW PER EU	EU2	TOTAL ALLOWED AT FACILITY	EU1 + EU2	TOTAL ALLOWED*
1994	**0.2**	0.183	**0.2**	0.075	0.4	0.258	2
1995	**0.2**	0.0057	**0.2**	0.0071	0.4	0.0128	2
1996	**0.2**	0.006	**0.2**	0.0074	0.4	0.0134	2
1997	**0.2**	0.0172	**0.2**	0.0112	0.4	0.0284	2
1998	**0.2**	0.0342	**0.2**	0.0702	0.4	0.1044	2
1999	**0.2**	1.09	**0.2**	0.0069	0.4	1.0969	2

YEAR	TEST ALLOW PER EU	EU1	EU2	TOTAL ALLOWED AT FACILITY	EU1 + EU2
1994	**0.2**	0.183	0.075	0.4	0.258
1995	**0.2**	0.0057	0.0071	0.4	0.0128
1996	**0.2**	0.006	0.0074	0.4	0.0134
1997	**0.2**	0.0172	0.0112	0.4	0.0284
1998	**0.2**	0.0342	0.0702	0.4	0.1044
1999	**0.2**	1.09	0.0069	0.4	1.0969

1994-1999 AOR DATA			
YEAR	EU1	EU2	EU1 + EU2
1994	0.183	0.075	0.258
1995	0.0057	0.0071	0.0128
1996	0.006	0.0074	0.0134
1997	0.0172	0.0112	0.0284
1998	0.0342	0.0702	0.1044
1999	1.09	0.0069	1.0969

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE AOR DATA

SUMMARY OF THE ANALYSIS AND DESCRIPTIVE STATISTICS FOR OGDEN MARTIN, LAKE COUNTY MERCURY AOR REPORT									
TEST ALLOW PER EU		*EU1*		*EU2*		*TOTAL ALLOWED AT FACILITY PER TEST*		*EU1 + EU2*	
Mean	0.2	Mean	0.2226833	Mean	0.029633333	Mean	0.4	Mean	0.252317
Standard Error	1.3603E-09	Standard Error	0.1756508	Standard Error	0.013616722	Standard Error	2.7206E-09	Standard Error	0.173188
Median	0.2	Median	0.0257	Median	0.0093	Median	0.4	Median	0.0664
Mode	0.2	Mode	#N/A	Mode	#N/A	Mode	0.4	Mode	#N/A
Standard Deviation	3.332E-09	Standard Deviation	0.4302548	Standard Deviation	0.03335402	Standard Deviation	6.664E-09	Standard Deviation	0.424222
Sample Variance	1.1102E-17	Sample Variance	0.1851192	Sample Variance	0.001112491	Sample Variance	4.4409E-17	Sample Variance	0.179964
Kurtosis	-3.3333333	Kurtosis	5.4611796	Kurtosis	-1.82207092	Kurtosis	-3.3333333	Kurtosis	4.953789
Skewness	1.36930639	Skewness	2.3224738	Skewness	0.967650442	Skewness	1.36930639	Skewness	2.202973
Range	0	Range	1.0843	Range	0.0681	Range	0	Range	1.0841
Minimum	0.2	Minimum	0.0057	Minimum	0.0069	Minimum	0.4	Minimum	0.0128
Maximum	0.2	Maximum	1.09	Maximum	0.075	Maximum	0.4	Maximum	1.0969
Sum	1.2	Sum	1.3361	Sum	0.1778	Sum	2.4	Sum	1.5139
Count	6	Count	6	Count	6	Count	6	Count	6
Largest(1)	0.2	Largest(1)	1.09	Largest(1)	0.075	Largest(1)	0.4	Largest(1)	1.0969
Smallest(1)	0.2	Smallest(1)	0.0057	Smallest(1)	0.0069	Smallest(1)	0.4	Smallest(1)	0.0128
Confidence Level(95.0%)	3.4967E-09	Confidence Level(95.0%)	0.4515239	Confidence Level(95.0%)	0.03500284	Confidence Level(95.0%)	6.9934E-09	Confidence Level(95.0%)	0.445193

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE AOR DATA

Anova: Single Factor - Emission Unit 1 (EU1)

Assumed that each of the populations is normally distributed with the same variance (s2).

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
TEST				
ALLOW PER				
EU	6	1.2	0.2	1.11022E-17
EU1	6	1.3361	0.2226833	0.185119154

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups (MSB)	0.0015436	1	0.0015436	0.016676835	0.899808271	4.964590516
Within Groups (MSE)	0.92559577	10	0.0925596			
Total (TSS)	0.92713937	11				

Analysis of Variance is used to test hypothesis about differences between 2 or more means. When there are more than two means, it is possible to compare each mean with each other mean using t-tests. However, conducting multiple t-tests can lead to severe inflation. Analysis of variance can be used to test differences among several means for significance without increasing the Type I error rate.

LEGEND:

SS: Sum of squares;

df: Degree of Freedom = g-1 where G is the # of groups.

MS: Mean Square

F: Ratio of MSB to MSE i.e F=MSB/MSE & for null hypothesis to be true F will be ≤ 1

P-Value: Probability of a larger F

F Crit: From Statistical Tables used to test ANOVA of different groups

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE AOR DATA

Anova: Single Factor - Emission Unit 2 (EU2)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
TEST ALLOW PER EU	6	1.2	0.2	1.11022E-17
EU2	6	0.1778	0.0296333	0.001112491

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.0870744	1	0.0870744	156.5395665	1.97094E-07	4.964590516
Within Groups	0.00556245	10	0.0005562			
Total	0.09263686	11				

Fcrit of EU1 = Fcrit of EU1

However, it is shown from the results that F of EU1 is not equal to F of EU2.

Significant is the fact that while F of EU1 $\leq$ 1; F of EU is considerably $\geq$ 1

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE AOR DATA

Anova: Single Factor for EU1, EU2 together

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
TEST ALLOW PER EU	6	1.2	0.2	1.11022E-17
EU1	6	1.3361	0.2226833	0.185119154
EU2	6	0.1778	0.0296333	0.001112491

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups (MSB)	0.13361527	2	0.0668076	1.076202234	0.365802673	**3.682316674**
Within Groups (MSE)	0.93115822	15	0.0620772			
Total	1.0647735	17				

1. The results shows that both Fcrit of EU1 = Fcrit of EU2.
2. This confirms that though both units are within the same facility they are independent of each other and that any exceedances in emission, observes in one cannot be related to the other.
3. As a further proof that this is the case, F of both shows a significance and though the observed statistics is within the critical region, i.e. Fcrit for EU1 & EU2 together < Fcrit of EU1 and EU2 individually, the null hypothesis can be rejected because there is no indication of growth when dependent.
4. Accountability of any exceedances will have to be related to the specific unit.
5. F-test two-sample for variances also shows marked F critical of varying proportion. Here the independent variables are independently sampled with the allowance permitted for each unit or when both are consdered together.
6. The test shows that when an independent variable such as EU1 or EU2 appears to have an effect, it is very important to be able to state with confidence that the effect was really due to the variable and not just due to chance as in this case.

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE AOR DATA

F-Test Two-Sample for Variances: EU1		
	TEST ALLOW PER EU	*EU1*
Mean	0.2	0.222683333
Variance	1.1102E-17	0.185119154
Observations	6	6
df	5	5
F	5.9973E-17	
P(F<=f) one-tail	0	
F Critical one-tail	**0.19800694**	

F-Test Two-Sample for Variances: EU2		
	TEST ALLOW PER EU	*EU2*
Mean	0.2	0.029633333
Variance	1.11022E-17	0.001112491
Observations	6	6
df	5	5
F	9.97962E-15	
P(F<=f) one-tail	0	
F Critical one-tail	**0.198006944**	

F-Test Two-Sample for Variances EU1 + EU2		
	TOTAL ALLOWED AT FACILITY	*EU1 + EU2*
Mean	0.4	0.252317
Variance	4.44E-17	0.179964
Observations	6	6
df	5	5
F	2.47E-16	
P(F<=f) one-tai	0	
F Critical one-t	**0.198007**	

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE AOR DATA

t-Test: Paired Two Sample for Means (EU1)

	TEST ALLOW PER EU	*EU1*
Mean	0.2	0.222683333
Variance	1.1102E-17	0.185119154
Observations	6	6
Pearson Correlation	0	
Hypothesized Mean Difference	0	
df	5	
t Stat	-0.1291388	
P(T<=t) one-tail	0.45114089	
t Critical one-tail	2.01504918	
P(T<=t) two-tail	0.90228179	
t Critical two-tail	2.57057764	

t-Test: Paired Two Sample for Means (EU2)

	TEST ALLOW PER EU	*EU2*
Mean	0.2	0.029633333
Variance	1.11022E-17	0.001112491
Observations	6	6
Pearson Correlation	7.20952E-09	
Hypothesized Mean Difference	0	
df	5	
t Stat	12.5115773	
P(T<=t) one-tail	2.8936E-05	
t Critical one-tail	2.015049176	
P(T<=t) two-tail	5.7872E-05	
t Critical two-tail	2.570577635	

t-Test: Paired Two Sample for Means (EU1 + EU2)

	TOTAL ALLOWED AT FACILITY	*EU1 + EU2*
Mean	0.4	0.252317
Variance	4.44E-17	0.179964
Observations	6	6
Pearson Correlation	9.07E-09	
Hypothesized Mean Difference	0	
df	5	
t Stat	0.852735	
P(T<=t) one-tail	0.216373	
t Critical one-tail	2.015049	
P(T<=t) two-tail	0.432745	
t Critical two-tail	2.570578	

The t rather than the z (normal) distribution is used because the standard error has to be estimated from the data. If the hypothesis is true, t will have a t-distribution with 5 degrees of freedom. The t critical value for one-tail and two-tail are in the critical region when because of the values of P one-tail respectively. This provides a good statistical evidence to the hypothesis that the effects of the emission exceedance from any one unit can be better managed as an independent unit within the facility, and that it will not be a sound compliance practice to target the facility as a whole for non compliancee, rather it should be the independent unit responsible for the exceedance. The following tests can also be perform, and this will not change the statistical inference: t-test: 2 samples assuming equal variances, t-test: 2 samples assuming unequal variances,, and the z-test: 2 samples for mean.

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE AOR DATA

Anova: Single Factor - EU1, EU2, EU1 + EU2

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
TEST ALLOW PER EU	6	1.2	0.2	1.11022E-17
EU1	6	1.3361	0.2226833	0.185119154
EU2	6	0.1778	0.0296333	0.001112491
TOTAL ALLOWED AT FACILITY	6	2.4	0.4	4.44089E-17
EU1 + EU2	6	1.5139	0.2523167	0.179964146

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups (MSB)	0.42052045	4	0.1051301	1.435435838	0.251591909	2.758710593
Within Groups (MSE)	1.83097895	25	0.0732392			
Total	2.2514994	29				

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

EMISSION DATA (1994 - 1999)						Conversion To PH	
AIRS_ID	EU_NO	TEST_	TEST_ALLO	ACTUAL	UNIT	TEST_ALLOW	ACTUAL
0690046	2	30-Jun-95	0.0003	0.000004	02	0.1996	0.0027
0690046	2	01-Feb-96	70	15.4	20	0.2	0.0241
0690046	2	01-Feb-96	0.00034	0.000007	22	0.2	0.0024
0690046	2	10-Jan-97	70	32.2	28	0.2	0.0478
0690046	2	10-Jan-97	0.00034	0.000013	22	0.2	0.0027
0690046	2	10-Jan-97	999990	0.00279	PH	0.2	0.0028
0690046	2	10-Jan-97	999990	0.024	PH	0.2	0.024
0690046	2	21-Apr-98	0.0003	0.000007	02	0.2	0.016
0690046	2	29-Jan-99	70	258	28	0.2	0.7371
0690046	1	27-Jan-98	80	89	13	0.2	0.0024
0690046	1	23-Apr-98	80	89.6	13	0.2	0.0024
0690046	1	04-Feb-94	0.0003	0.000195	02	0.2	0.1297
0690046	1	26-Jul-94	0.0003	0.000084	02	0.2	0.0559
0690046	1	21-Jun-95	0.00034	0.000015	02	0.2	0.00998
0690046	1	30-Jan-96	0.00034	0.000005	22	0.2	0.00103
0690046	1	10-Jan-97	999990	0.0043	PH	0.2	0.0043
0690046	1	10-Jan-97	70	41.4	28	0.2	0.06146
0690046	1	10-Jan-97	0.00034	0.000018	22	0.2	0.0031
0690046	1	10-Jan-97	999990	0.0608	PH	0.2	0.0608
0690046	1	28-Jan-98	70	202	03	0.2	0.5771
0690046	1	29-Jan-99	70	2994	03	0.2	8.5538

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

TEST DATE	TEST ALLOW	EU1 ACTUAL	TEST ALLOW	EU2 ACTUAL	TOTAL ALLOWED
Feb-94	**0.2**	**0.1297**	**0.2**	**0**	0.4
Jul-94	**0.2**	**0.0559**	**0.2**	**0**	0.4
Jun-95	**0.2**	**0.00998**	**0.2**	**0.0027**	0.4
Jan-96	**0.2**	**0.00103**	**0.2**	**0**	0.4
Feb-96	**0.2**	**0.0241**	**0.2**	**0.0241**	0.4
Feb-96	**0.2**	**0.0024**	**0.2**	**0.0024**	0.4
Jan-97	**0.2**	**0.0043**	**0.2**	**0.0478**	0.4
Jan-97	**0.2**	**0.06146**	**0.2**	**0.0027**	0.4
Jan-97	**0.2**	**0.0031**	**0.2**	**0.0028**	0.4
Jan-97	**0.2**	**0.0608**	**0.2**	**0.024**	0.4
Jan-98	**0.2**	**0.5771**	**0.2**	**0**	0.4
Apr-98	**0.2**	**0**	**0.2**	**0.016**	0.4
Jan-99	**0.2**	**8.5538**	**0.2**	**0.7371**	0.4

EMISSION TEST DATA

TEST DATE	TEST ALLOW	EU1 ACTUAL	EU2 ACTUAL	TOTAL ALLOWED	EU TOTAL
Feb-94	**0.2**	**0.1297**		0.4	0.1297
Jul-94	**0.2**	**0.0559**		0.4	0.0559
Jun-95	**0.2**	**0.00998**	**0.0027**	0.4	0.01268
Jan-96	**0.2**	**0.00103**		0.4	0.00103
Feb-96	**0.2**	**0.0241**	**0.0241**	0.4	0.0482
Feb-96	**0.2**	**0.0024**	**0.0024**	0.4	0.0048
Jan-97	**0.2**	**0.0043**	**0.0478**	0.4	0.0521
Jan-97	**0.2**	**0.06146**	**0.0027**	0.4	0.06416
Jan-97	**0.2**	**0.0031**	**0.0028**	0.4	0.0059
Jan-97	**0.2**	**0.0608**	**0.024**	0.4	0.0848
Jan-98	**0.2**	**0.5771**		0.4	0.5771
Apr-98	**0.2**		**0.016**	0.4	0.016
Jan-99	**0.2**	**8.5538**	**0.7371**	0.4	9.2909

AOR DATA

YEAR	EU1	EU2	TOTAL ALLOWED*
1994	0.183	0.075	2
1995	0.0057	0.0071	2
1996	0.006	0.0074	2
1997	0.0172	0.0112	2
1998	0.0342	0.0702	2
1999	1.09	0.0069	2

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

SUMMARY OF THE ANALYSIS AND DESCRIPTIVE STATISTICS FOR OGDEN MARTIN, LAKE COUNTY MERCURY EMISSION UNITS

EU1 ACTUAL		*EU2 ACTUAL*		*TEST ALLOW PER EU*		*EU TOTAL*		*TOTAL ALLOWED*	
Mean	0.790305833	**Mean**	0.095511111	**Mean**	0.2	Mean	35274.3449	Mean	0.4
Standard Error	0.707287153	**Standard Error**	0.080358648	**Standard Error**	1.19305E-09	Standard Error	143.9584618	Standard Error	2.3861E-09
Median	0.04	**Median**	0.016	**Median**	0.2	Median	35431.0031	Median	0.4
Mode	#N/A	**Mode**	0.0027	**Mode**	0.2	Mode	#N/A	Mode	0.4
Standard Deviation	2.450114567	**Standard Deviation**	0.241075945	**Standard Deviation**	4.30159E-09	Standard Devia	519.0496156	Standard Devia	8.60319E-09
Sample Variance	6.003061394	**Sample Variance**	0.058117611	**Sample Variance**	1.85037E-17	Sample Varianc	269412.5035	Sample Varianc	7.40149E-17
Kurtosis	11.86558233	**Kurtosis**	8.897270279	**Kurtosis**	#DIV/0!	Kurtosis	-0.30650034	Kurtosis	#DIV/0!
Skewness	3.438317847	**Skewness**	2.977321476	**Skewness**	#DIV/0!	Skewness	-0.12499529	Skewness	#DIV/0!
Range	8.55277	**Range**	0.7347	**Range**	0	Range	1803.4241	Range	0
Minimum	0.00103	**Minimum**	0.0024	**Minimum**	0.2	Minimum	34366.1297	Minimum	0.4
Maximum	8.5538	**Maximum**	0.7371	**Maximum**	0.2	Maximum	36169.5538	Maximum	0.4
Sum	9.48367	**Sum**	0.8596	**Sum**	2.6	Sum	458566.4837	Sum	5.2
Count	12	**Count**	9	**Count**	13	Count	13	Count	13
Largest(1)	8.5538	**Largest(1)**	0.7371	**Largest(1)**	0.2	Largest(1)	36169.5538	Largest(1)	0.4
Smallest (1)	0.00103	**Smallest(1)**	0.0024	**Smallest(1)**	0.2	Smallest(1)	34366.1297	Smallest(1)	0.4
Confidence Level(95.0%)	1.556729314	**Confidence Level(95.0%)**	0.185307495	**Confidence Level(95.0%)**	2.59943E-09	Confidence Lev	313.6585382	Confidence Lev	5.19886E-09

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

Anova: Single Factor - Emission Unit 1 (EU1)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
TEST ALLOW PER EU	13	2.6	0.2	1.85037E-17
EU1	12	9.48367	0.790305833	6.003061394

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups (MSB)	2.174396496	1	2.174396496	0.757357805	0.393149101	4.279343102
Within Groups (MSE)	66.03367533	23	2.871029362			
Total (TSS)	68.20807183	24				

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

Anova: Single Factor - Emission Unit 2 (EU2)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
TEST ALLOW PER EU	13	2.6	0.2	1.85037E-17
EU2	9	0.8596	0.095511111	0.058117611

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.058063526	1	0.058063526	2.497673448	0.129700792	4.351250027
Within Groups	0.464940889	20	0.023247044			
Total	0.523004415	21				

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

Anova: Single Factor for EU1, EU2 together

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
TEST ALLOW PER EU	13	2.6	0.2	1.85037E-17
EU1	12	9.48367	0.790305833	6.003061394
EU2	9	0.8596	0.095511111	0.058117611

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups (MSB)	3.169799947	2	1.584899974	0.738840926	0.485890485	3.304819529
Within Groups (MSE)	66.49861622	31	2.145116652			
Total	69.66841617	33				

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

Anova: Single Factor - EU1, EU2, EU1 + EU2

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
TEST ALLOW PER EU	13	2.6	0.2	1.85037E-17
EU1	12	9.48367	0.790305833	6.003061394
EU2	9	0.8596	0.095511111	0.058117611
TOTAL ALLOWED AT FACILITY	13	5.2	0.4	7.40149E-17
EU1 + EU2	13	10.34327	0.795636154	6.538429621

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups (MSB)	4.881864615	4	1.220466154	0.463063909	0.762500442	2.539685795
Within Groups (MSE)	144.9597717	55	2.635632212			
Total	149.8416363	59				

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

F-Test Two-Sample for Variances: EU1

	TEST ALLOW PER EU	*EU1*
Mean	0.2	0.790305833
Variance	1.85037E-17	6.003061394
Observations	13	12
df	12	11
F	3.08238E-18	
P(F<=f) one-tail	0	
F Critical one-tail	0.368007846	

F-Test Two-Sample for Variances: EU2

	TEST ALLOW PER EU	*EU2*
Mean	0.2	0.095511111
Variance	1.85037E-17	0.058117611
Observations	13	9
df	12	8
F	3.18384E-16	
P(F<=f) one-tail	0	
F Critical one-tail	0.351054297	

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

F-Test Two-Sample for Variances EU1 + EU2		
	TOTAL ALLOWED AT FACILITY	*EU1 + EU2*
Mean	0.4	0.795636154
Variance	7.40149E-17	6.538429621
Observations	13	13
df	12	12
F	1.132E-17	
P(F<=f) one-tail	0	
F Critical one-tail	0.372212483	

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

t-Test: Paired Two Sample for Means (EU1)

	TEST ALLOW PER EU	*EU1*
Mean	0.2	0.729513077
Variance	1.85037E-17	5.550851148
Observations	13	13
Pearson Correlation	4.67775E-09	
Hypothesized Mean Difference	0	
df	12	
t Stat	-0.810342423	
P(T<=t) one-tail	0.216760077	
t Critical one-tail	1.782286745	
P(T<=t) two-tail	0.433520154	
t Critical two-tail	2.178812792	

t-Test: Paired Two Sample for Means (EU2)

	TEST ALLOW PER EU	*EU2*
Mean	0.2	0.066123077
Variance	1.85037E-17	0.040850237
Observations	13	13
Pearson Correlation	0	
Hypothesized Mean Difference	0	
df	12	
t Stat	2.388251772	
P(T<=t) one-tail	0.017122094	
t Critical one-tail	1.782286745	
P(T<=t) two-tail	0.034244188	
t Critical two-tail	2.178812792	

DESCRIPTIVE STATISTICS OF THE OGDEN MARTIN LAKE COUNTY MERCURY TEST RESULTS ON THE TEST EMISSION DATA PER UNIT

t-Test: Paired Two Sample for Means (EU1 + EU2)

	TOTAL ALLOWED AT FACILITY	*EU1 + EU2*
Mean	0.4	0.795636154
Variance	7.40149E-17	6.538429621
Observations	13	13
Pearson Correlation	0	
Hypothesized Mean Difference	0	
df	12	
t Stat	-0.55786732	
P(T<=t) one-tail	0.293595944	
t Critical one-tail	1.782286745	
P(T<=t) two-tail	0.587191888	
t Critical two-tail	2.178812792	