



Emission Factor Supporting Documentation for the Final Mercury and Air Toxics Standards

Emission Factor Supporting Documentation for the
Final Mercury and Air Toxics Standards

Introduction and compilation By:
Marc Houyoux
Emission Inventory and Analysis Group
Air Quality Assessment Division

With technical contributions by:
Barrett Parker and Ron Myers
Measurement Policy Group
Sector Policies and Programs Division

And additional contributions by:
David Bullock and Shelly Johnson
Research Triangle Institute
Research Triangle Park, North Carolina

Contractor contributions prepared for:
Alison Eyth
Work Assignment Contracting Officer Representative
Air Quality Assessment Division

Contract No. EP-D-11-084
Work Order No. 0-04

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Air Quality Assessment Division
Emissions Inventory and Analysis Group
Research Triangle Park, North Carolina

I. Background

The U.S. Environmental Protection Agency (EPA) is finalizing the National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units (EGUs) under Clean Air Act (CAA or the Act) section 112(d), referred to in this document as the Mercury and Air Toxics Standards (MATS). A key piece to several aspects of the technical documentation includes Hazardous Air Pollutant (HAP) emission inventory estimates for U.S. EGUs at the facility, unit, and national resolutions.

This memorandum addresses the development of HAP emission factors used to create the emissions estimates for (a) the non-mercury case study units and (b) the current base nationwide emissions inventory. Additional information on the non-mercury case study emissions is available in the revised “Non-Hg Case Study Chronic Inhalation Risk Assessment”. Additional information on the current base nationwide emissions inventory is available in “Memorandum: Emissions Overview: Hazardous Air Pollutants in Support of the Final Mercury and Air Toxics Standard”.

For both the non-mercury case studies and the current base nationwide emissions inventory, stack test data were used wherever available. These stack tests were usually performed in groups of three per stack, which were averaged to create a unit-specific emission factor (EF), and it is these EFs that were used create emissions for the tested units. In addition, EFs and emissions were needed for units that did not have stack testing submitted to EPA. This document describes the approaches taken to analyze, group, and eliminate outliers from the test data, and finally to compute average EFs for mercury (Hg), acid gases, and non-Hg metals.

The EFs for Hg, acid gases, and metals used to develop the national inventory are available in the Excel[®] spreadsheet “MATS_Final_Current_Base_HAP_inven.xlsx”, called the “inventory spreadsheet” in the remainder of this document. The EFs for the non-Hg cases studies are available in the spreadsheet “Case_Study_Emis_MATS_Final.xlsx”, called the “case study spreadsheet” here.

These emission factors are an interim result based on analysis available at the time of the final MATS rule. Continued analysis and inclusion of additional data is ongoing and will result in improvements and possible changes to these emission factors. Future EPA approved emission factors will be published in WebFIRE when complete and will be subject to public review and comment. Further, no conclusions should be made on the most effective control technologies based on the Hg or hydrogen chloride bins, because analysis to resolve that particular question was not included in the work done to produce these emission factors. Nevertheless, these emission factors represent scientifically credible approaches and the best available factors based on the ICR data at the time of the MATS final rule.

II. Emissions bins

Emissions bins are groups of units with test-based EFs that are used to create one average EF per bin. Different criteria can be used to bin the test data into such groups. The bins used for this work are available in the emission inventory spreadsheet (listed in Section I), in the tab “3-Bin_Key”. The tables shown in the spreadsheet are replicated in Section V below, which includes the emission factors assigned to each bin. The bins for Hg, hydrogen chloride (HCl), hydrogen fluoride (HF), and

hydrogen cyanide (HCN) were based on the combination of fuel type, boiler type, and emission control scheme. These bins are the same as the bins used for the emission modification factors in the Integrated Planning Model (IPM)¹, used to estimate future-year emissions. These same bins were also used for development of Hg speciation factors². The bins for metals were developed using procedures to group data based on their statistically significant differences only, and these efforts are described in Attachment A. In the inventory spreadsheet tab “3-Bin_Key”, metal EFs are repeated for many of the rows, indicating that the bin resolution is coarser for these pollutants. For example, rather than 22 different bins for arsenic, there are 5 bins as observed by the 5 different EF values listed in the arsenic column of that spreadsheet.

III. Outlier Methodology

EPA used a statistical approach to identify outliers to be excluded from the dataset to develop the best emission factor for each bin. The following sections describe the outlier identification process and the outlier identification results.

1. Outlier identification: The outlier identification methodology is consistent with *Recommended Procedures for Development of Emissions Factors and Use of the WebFIRE Emissions Factor Database*, December 17, 2010. For each control scheme bin, the outliers are identified by Dixon tests and Rosner tests. The identification process is conceptually described in Figure 1 below. The detailed process is described in paragraphs 2 through 5, below. The process steps were implemented using the software ProUCL 4.1[®] and R statistical language.
2. Determine the distributions: Within each control scheme bin, R programs (scripted in statistical language R) and ProUCL 4.1 normality tests were used to determine whether the distribution was normal or log-normal. Detailed process steps are listed below.
 - a. Shapiro-Wilk tests (R program): Normality tests could not be run in ProUCL when the sample size was smaller than 4. In this case, R programs were used to determine the normality or log-normality by applying Shapiro-Wilk normality tests. When a bin was of neither distribution, it was treated as a log-normally distribution in the remaining steps.
 - b. Shapiro-Wilk tests (ProUCL): When there were more than 4 samples, Shapiro-Wilk tests (95% confidence level) were conducted to determine the normality or log-normality of the data set. When neither distribution was determined by Shapiro-Wilk tests, the p-value for log-normality check was recorded.
 - c. Lilliefors tests (ProUCL): If step “b” did not determine the distribution, Lilliefors tests (95% confidence level) were conducted to determine the log-normality of the data set.
 - d. Lognormal QQ plot review (ProUCL): If Lilliefors tests still did not determine the log-normal distribution, the lognormal QQ plot was reviewed to determine the log-normality fitting.

¹ IPM is a multi-regional, dynamic, deterministic linear program model of the U.S. power sector that determines the least cost solution to meeting a set of environmental constraints while still meeting specified electric demand. For more detail on IPM see: <http://www.epa.gov/airmarkets/progsregs/epa-ipm/index.html>

² See “EGU Mercury Speciation Profiles for the Clean Air Mercury Rule (CAMR)”

3. Data transformation: Depending on the distribution, the data was transformed in some cases. If the distribution was normal, the unit-level emission factors were used as-is. If the distribution was not normal, then the data were log transformed.
4. Outlier Tests (using ProUCL): The two methods to determine outliers were part of the ProUCL software. If the data set had between 3 and 24 values, the Dixon outlier test was used. If the data set had more than 24 values, then the Rosner outlier test was used.
5. Outliers identified: The ProUCL results provided lists of outliers at 1, 5 and 10% confidence levels. All outliers identified at the 5% confidence level were identified as outliers for our data sets. Once the outliers were identified, they were removed from the analysis, and the process was re-run for the remaining values in the data sets. The details of distributions and outliers determined for each bin are presented in Tables 1 through 4.

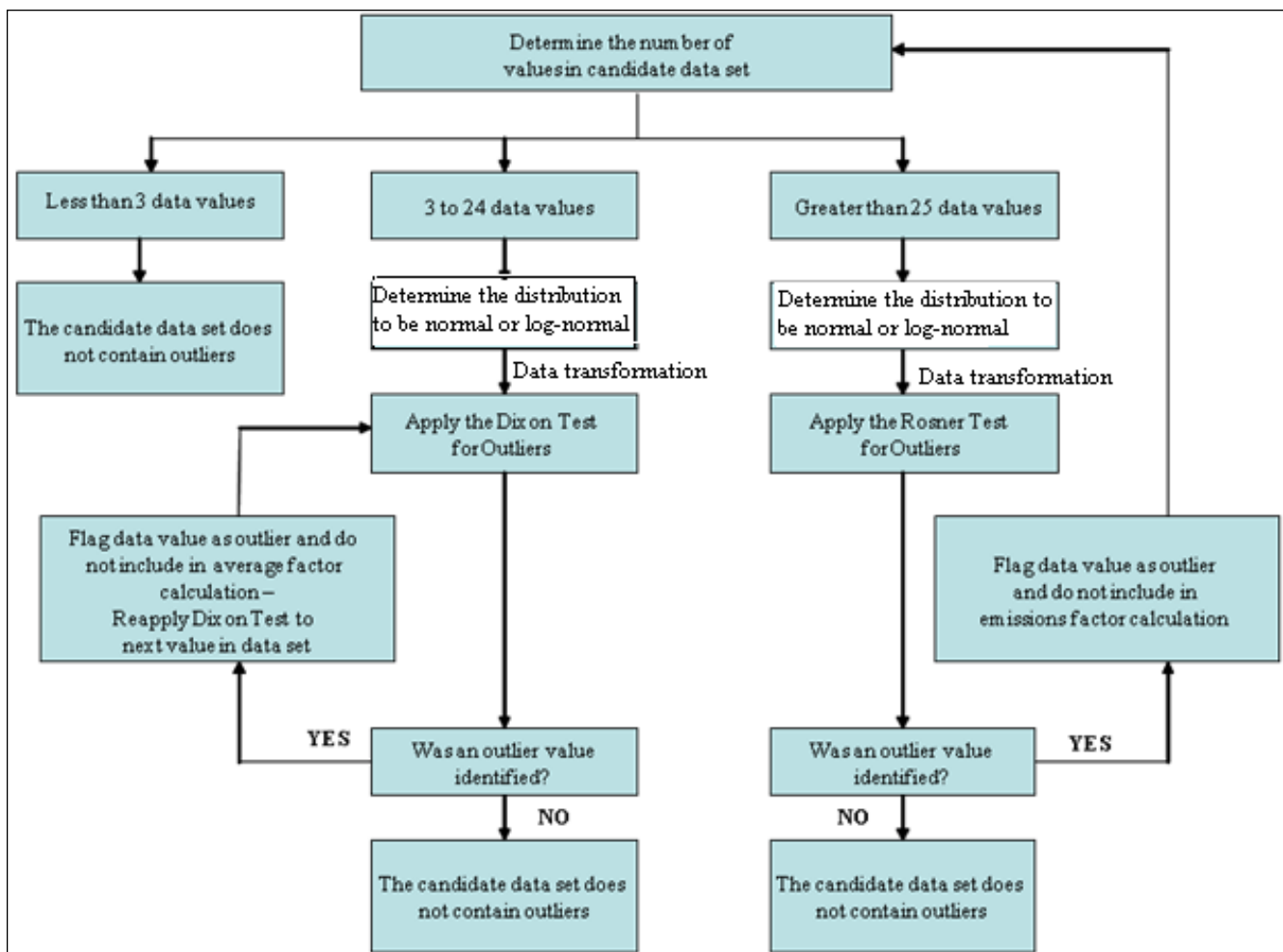


Figure 1. Outlier identification process.

IV. Outlier Identification Results for Mercury and Acid Gases

The two subsections below document the outlier results for Hg and the acid gases. The outlier results for the metals were documented in a different way and are therefore included as attachments to this document. These attachments cover the results for antimony, arsenic, beryllium, cadmium, cobalt, chromium, lead, manganese, nickel, and selenium. Attachment A contains the materials prepared to

document the metal emissions for coal emissions. The data and documentation for the metal emission factors for oil units are available in the spreadsheet “93eguilm07oct2011.xlsx”.

IV.A Mercury

The Hg emission factors were developed based on data provided from the PART III ICR collection. Data from all units provided under Part III were included in the analysis. The emission factors were analyzed for outliers based on the unit’s bin. Once the outliers were identified, they were removed from the respective bin and the arithmetic mean of the factors was calculated. Table 1 presents the results for the outlier analysis for Hg.

Table 1. Hg distributions and outliers.

Control scheme	N	Distribution ***	Lognormally distributed? (SW test at 95% confidence)	Normally distributed? (SW test at 95% confidence)	Lognormally distributed? (Lilliefors test at 95% confidence)	Lognormally distributed? (QQ Lognormal plot)	P **	Outlier Checks
50	6	Log-Normal	Y	N				
51	25	Log-Normal	Y	N				
52	9	Log-Normal	Y	N				
53	9	Neither	N	N	Y	Y	2E-02	For 5% significance level, -14.24526836 is an outlier.
54	42	Log-Normal	Y	N				
55	30	Log-Normal	Y	N				
56	3	Normal						
57	6	Log-Normal	Y	N				
58	4	Normal	-	-				For 5% significance level, 2.34E-08 is an outlier.
59	2	N <3: NA						
60	4	Log-Normal	-	-				
61	13	Log-Normal	Y	N				
62	2	N <3: NA						
63	2	N <3: NA						
64	3	Neither	-	-				For 5% significance level, -11.887 is an outlier.
65	25	Log-Normal	Y	N				
66	10	Normal	N	Y				
67	3	Normal	-	-				For 5% significance level, 3.173E-06 is an outlier.
68	14	Neither	N	N	N	N	3E-03	
69	5	Normal	N	Y				For 5% significance level, 1.44E-06 is an outlier.
70	20	Normal	Y	Y				
71	1	N <3: NA						
72	2	N <3: NA						

Control scheme	N	Distribution ***	Lognormally distributed? (SW test at 95% confidence)	Normally distributed? (SW test at 95% confidence)	Lognormally distributed? (Lilliefors test at 95% confidence)	Lognormally distributed? (QQ Lognormal plot)	P **	Outlier Checks
73	6	Log-Normal	Y	N				For 5% significance level, -15.05438322 is an outlier.
74	10	Normal	N	Y				
75	48	Log-Normal	Y	N				
76	1	N <3: NA						
77	3	Normal	-	-				
78	6	Log-Normal	Y	Y				

* SW test= Shapiro-Wilk test.

** p-value of the Shapiro-Wilk test on lognormality is recorded, if a bin with more than 4 values is of neither distributions (Lognormal nor normal).

*** If it is “neither” distribution, the bin is assumed to be lognormal distributed to identify the outliers.

IV.B Acid Gases

The acid gases emission factors were developed based on data provided from the PART III ICR collection. Data from all units provided under Part III were included in the analysis. The unit-specific emission factors were analyzed according to the process described in Section III. Tables 2 through 4 present the results for acid gases.

Table 2. HF distributions and outliers.

Control scheme	N	Distribution ***	Lognormally distributed? (SW test at 95% confidence)	Normally distributed? (SW test at 95% confidence)	Lognormally distributed? (Lilliefors test at 95% confidence)	Lognormally distributed? (QQ Lognormal plot)	P **	Outlier Checks
1	96	Neither	N	N	N	N	0E+00	For 5% significance level, there are 8 Potential Outliers: -2.565, -2.597, -2.685, -2.685, -2.881, -2.881, -3.919, -4.807
2	45	Log-Normal	N	N	N	Y	4E-04	For 5% Significance Level, there is 1 Potential Outlier; Therefore, Observation -5.084 is a Potential Statistical Outlier
4	29	Log-Normal	N	N	N	Y	6E-05	For 5% significance level, there are 4 Potential Outliers: -8.686, -8.632, -3.137, -6.859
5	13	Neither	N	N	N	N	4E-07	For 5% significance level, -2.961 is an outlier.
6	4	Normal		-				
7	4	Log-Normal		-				For 5% significance level, -2.961 is an outlier.
8	13	Log-Normal	N	N	Y	Y	2E-02	
9	1	N <3: NA						
10	1	N <3: NA						
11	2	N <3: NA						
12	2	N <3: NA						

Control scheme	N	Distribution ^{***}	Lognormally distributed? (SW test at 95% confidence)	Normally distributed? (SW test at 95% confidence)	Lognormally distributed? (Lilliefors test at 95% confidence)	Lognormally distributed? (QQ Lognormal plot)	P ^{**}	Outlier Checks
13	15	Log-Normal	N	N	Y	Y	1E-02	
14	16	Normal	N	Y				
15	10	Log-Normal	Y	N				
16	15	Log-Normal	Y	N				
17	1	N <3: NA						
18	1	N <3: NA						
19	6	Normal	N	Y				
20	58	Log-Normal	N	N	N	Y		For 5% significance level, there are 4 Potential Outliers: -11.46, -6.085, -11.11, -6.52
21	1	N <3: NA						
22	2	N <3: NA						
23	3	Neither	-	-				For 5% significance level, -6.754 is an outlier.

* SW test= Shapiro-Wilk test.

** P-value of the Shapiro-Wilk test on lognormality is recorded, if a bin with more than 4 values is of neither distributions (Lognormal nor normal).

*** If it is "neither" distribution, the bin is assumed to be lognormal distributed to identify the outliers.

Table 3. HCN distributions and outliers.

Control scheme	N	Distribution ^{***}	Lognormally distributed? (SW test at 95% confidence)	Normally distributed? (SW test at 95% confidence)	Lognormally distributed? (Lilliefors test at 95% confidence)	Lognormally distributed? (QQ Lognormal plot)	P ^{**}	Outlier Checks
1	89	Log-Normal	Y	N				
2	40	Log-Normal	Y	N				
4	27	Log-Normal	Y	N				
5	8	Normal	N	Y				
6	4	Normal	-	-				
7	4	Log-Normal	-	-				
8	10	Log-Normal	N	N	Y	Y	4E-02	For 5% significance level, -12.05535643 is an outlier.
9	1	N <3: NA						
10	1	N <3: NA						
11	2	N <3: NA						
12	2	N <3: NA						
13	14	Log-Normal	N	N	Y	Y	1E-03	For 5% significance level, -3.50449819 is

Control scheme	N	Distribution ^{***}	Lognormally distributed? (SW test at 95% confidence)	Normally distributed? (SW test at 95% confidence)	Lognormally distributed? (Lilliefors test at 95% confidence)	Lognormally distributed? (QQ Lognormal plot)	P ^{**}	Outlier Checks
								an outlier.
14	13	Log-Normal	Y	N				
15	9	Normal	Y	Y				
16	13	Log-Normal		N				
17	1	N <3: NA						
18	1	N <3: NA						
19	6	Log-Normal	N	N	Y	N	NA	
20	57	Log-Normal	Y	N				
21	1	N <3: NA						
22	2	N <3: NA						
23	4	Log-Normal	-	-				

* SW test= Shapiro-Wilk test.

** P-value of the Shapiro-Wilk test on lognormality is recorded, if a bin with more than 4 values is of neither distributions (Lognormal nor normal).

*** If it is “neither” distribution, the bin is assumed to be lognormal distributed to identify the outliers.

Table 4. HCl distributions and outliers.

Control scheme	N	Distribution ***	Lognormally distributed? (SW test at 95% confidence)	Normally distributed? (SW test at 95% confidence)	Lognormally distributed? (Lilliefors test at 95% confidence)	Lognormally distributed? (QQ Lognormal plot)	P **	Outlier Checks
1	96	Log-Normal	N	N	N	N	0E+00	For 5% significance level, there are 8 Potential Outliers; Therefore, Potential Statistical Outliers are -2.28, -2.28, -4.334, -4.375, -4.375, -4.401, -4.462, -4.494
2	43	Log-Normal	N	N	N	Y	3E-04	
4	29	Log-Normal	N	N	Y	Y	2E-03	
5	13	Normal	N	N	N	N	8E-04	
6	4	Normal		-				
7	4	Log-Normal		-				
8	13	Log-Normal	N	N	N	N	2E-03	
9	1	N <3: NA						
10	1	N <3: NA						
11	2	N <3: NA						
12	2	N <3: NA						
13	15	Log-Normal	N	N	N	Y	2E-02	
14	16	Log-Normal	N	N	N	Y	3E-02	For 1% significance level, -5.09126489 is an outlier. For 5% significance level, 0.004646 is an outlier.
15	10	Normal	Y	N				
16	14	Log-Normal	Y	N	Y			
17	1	N <3: NA						
18	1	N <3: NA						
19	6	Log-Normal	N	N	N	N	N/A	
20	59	Log-Normal	Y	N	Y	Y	5E-02	For 5% significance level, there are 2 Potential Outliers; Therefore, Potential Statistical Outliers are -11.49, -3.693
21	1	N <3: NA						
22	2	N <3: NA						
23	3	Log-Normal	-	-				

* SW test= Shapiro-Wilk test.

** P-value of the Shapiro-Wilk test on lognormality is recorded, if a bin with more than 4 values is of neither distributions (Lognormal nor normal).

*** If it is "neither" distribution, the bin is assumed to be lognormal distributed to identify the outliers.

V. Development of emission factors

Once the outliers were excluded from the datasets for each pollutant, emission factors were computed using an arithmetic average for each bin. The use of arithmetic average is based on EPA guidance in AP-42. Based on past analysis as well as analysis done for this effort³, the arithmetic mean for emissions factors provides the single best value for predicting national emissions estimates. Further, when no other method is available for a given unit, average emission factors are the best available information for estimating emissions from such units.

Tables 6 through 8 provide the average emission factors for Hg, acid gases, and non-Hg metals, respectively. These data are also available in spreadsheet form in the worksheet “3-Bin_Key” in the inventory spreadsheet described in Section I. Furthermore, the unit level data used to compute the emission factors for Hg are available in the worksheet “8-Mercury_EFs” of the inventory spreadsheet and for acid gases in the worksheet “8-Acid_Gas_EFs”. Also in the inventory spreadsheet, the worksheets “8-As_EFs”, “8-Cr_EFs” and “8-Ni_EFs” include the data for arsenic, chromium, and nickel emission factors. All data available for the other metal emission factors calculation are available only in Attachment A and the spreadsheet “93eguoilmet 07oct2011.xlsx”, both of which include additional information for arsenic, chromium, and nickel that is unavailable in the inventory spreadsheet alone. The emission factors used in the non-Hg case studies for the units that did not have test data are available in the spreadsheet “Case_Study_Emis_MATS_Final.xlsx”. This spreadsheet includes the calculation of hexavalent chromium from total chromium, which was done only for the non-Hg case study emissions.

³ Response to comments for the Mercury and Air Toxics Standard final rule, non-Hg case studies for the appropriate and necessary finding.

Table 6. Average emission factors for Hg

Bin Number	Fuel Type	Boiler Type	Control Scheme	Hg (lb/MMBtu)
50	Bituminous	Conventional	Activated Carbon Injection	1.94E-06
51	Bituminous	Conventional	Dry FGD + Fabric Filter	1.14E-07
52	Bituminous	Conventional	Fabric Filter + Wet FGD	8.03E-07
53	Bituminous	Conventional	Fabric Filter	4.37E-08
54	Bituminous	Conventional	ESP + Wet FGD	1.25E-06
55	Bituminous	Conventional	Cold-side ESP	5.64E-06
56	Bituminous	Conventional	No Hg Control (includes hot-side ESP's)	1.10E-05
57	Bituminous	Fluidized Bed	Dry FGD + Fabric Filter	5.80E-08
58	Bituminous	Fluidized Bed	Fabric Filter	1.15E-08
59	Bituminous	Fluidized Bed	Cold-side ESP	1.73E-06
60	Coal Refuse	Fluidized Bed	Dry FGD + Fabric Filter	3.78E-07
61	Coal Refuse	Fluidized Bed	Fabric Filter	1.63E-07
62	Lignite	Conventional	Activated Carbon Injection	3.90E-06
63	Lignite	Fluidized Bed	Activated Carbon Injection	4.67E-06
64	Lignite	Fluidized Bed	Fabric Filter	1.08E-05
65	Subbituminous	Conventional	Activated Carbon Injection	1.30E-06
66	Subbituminous	Conventional	Dry FGD + Fabric Filter	4.69E-06
67	Subbituminous	Conventional	Fabric Filter + Wet FGD	1.47E-07
68	Subbituminous	Conventional	Fabric Filter	3.03E-06
69	Subbituminous	Conventional	Wet FGD	3.32E-06
70	Subbituminous	Conventional	Cold-side ESP	3.28E-06
71	Subbituminous	Conventional	No Hg Control (includes hot-side ESP's)	5.25E-06
72	IGCC	IGCC	No Hg Control	8.18E-07
73	No. 2 Fuel Oil	Conventional	No Hg Control	1.14E-07
74	No. 6 Fuel Oil	Conventional	Cold-Side ESP	6.23E-08
75	No. 6 Fuel Oil	Conventional	No Hg Control (includes hot-side ESP's)	1.12E-07
76	Petroleum Coke	Conventional	Wet FGD	6.48E-08
77	Petroleum Coke	Fluidized Bed	Dry FGD + Fabric Filter	5.96E-08
78	Petroleum Coke	Fluidized Bed	Fabric Filter	9.63E-07

Table 7. Average emission factors for acid gases

Bin Number	Fuel Type	Boiler Type	Control Scheme	Hydrogen Cyanide (lb/MMBtu)	Hydrogen Chloride (lb/MMBtu)	Hydrogen Fluoride (lb/MMBtu)
1	Bituminous	Conventional	Wet FGD	2.31E-04	5.83E-04	1.80E-04
2	Bituminous	Conventional	Dry FGD	3.45E-04	6.48E-03	1.09E-04
3	Bituminous	Conventional	Sorbent/Carbon Injection	No emission data were available*		
4	Bituminous	Conventional	No Acid Gas Control	4.79E-04	5.95E-02	6.19E-03
5	Bituminous	Fluidized Bed	Dry FGD	1.03E-03	2.76E-02	6.50E-05
6	Bituminous	Fluidized Bed	No Acid Gas Control	2.06E-03	1.03E-02	7.38E-05
7	Coal Refuse	Fluidized Bed	Dry FGD	4.26E-04	3.53E-02	3.10E-04
8	Coal Refuse	Fluidized Bed	No Acid Gas Control	6.00E-04	1.07E-02	1.10E-03
9	Lignite	Conventional	Wet FGD	1.59E-05	1.20E-04	9.35E-05
10	Lignite	Conventional	Sorbent/Carbon Injection	2.01E-05	7.49E-04	2.63E-03
11	Lignite	Fluidized Bed	Dry FGD	2.14E-05	6.13E-05	6.96E-05
12	Lignite	Fluidized Bed	No Acid Gas Control	1.31E-05	3.67E-04	8.80E-06
13	Subbituminous	Conventional	Wet FGD	1.02E-04	2.16E-03	3.05E-03
14	Subbituminous	Conventional	Dry FGD	1.86E-04	1.92E-04	2.73E-04
15	Subbituminous	Conventional	Sorbent/Carbon Injection	1.13E-04	8.85E-04	1.02E-03
16	Subbituminous	Conventional	No Acid Gas Control	1.52E-03	3.20E-03	1.01E-03
17	IGCC	IGCC	PM Scrubber	5.19E-05	8.12E-05	8.32E-05
18	IGCC	IGCC	No Acid Gas Control	3.21E-05	2.84E-04	1.71E-04
19	No. 2 Fuel Oil	Conventional	No Acid Gas Control	2.21E-05	3.69E-04	1.10E-04
20	No. 6 Fuel Oil	Conventional	No Acid Gas Control	3.29E-04	9.07E-04	2.02E-04
21	Petroleum Coke	Conventional	Wet FGD	8.13E-05	1.87E-05	4.95E-05
22	Petroleum Coke	Fluidized Bed	Dry FGD	1.10E-03	2.34E-04	6.74E-05
23	Petroleum Coke	Fluidized Bed	No Acid Gas Control	2.42E-03	3.78E-03	1.51E-04

* Sources with this configuration were defaulted to the next most conservative (higher) emission factor set, which is bin 4.

Table 8. Average emission factors for metals

Bin No.	Fuel Type	Boiler Type	Control Scheme	Antimony lb/MMBtu	Arsenic lb/MMBtu	Beryllium lb/MMBtu	Cadmium lb/MMBtu	Chromium lb/MMBtu	Cobalt lb/MMBtu	Lead lb/MMBtu	Manganese lb/MMBtu	Nickel lb/MMBtu	Selenium lb/MMBtu
100	Bituminous	Conventional	Fabric Filter + Wet FGD	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.75E-06	5.10E-07	2.25E-06	1.01E-05	2.74E-05	9.24E-06
101	Bituminous	Conventional	Fabric Filter	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.89E-05	1.58E-06	2.25E-06	1.01E-05	2.74E-05	3.69E-05
102	Bituminous	Conventional	ESP + Wet FGD	4.22E-07	2.52E-06	1.18E-07	2.20E-07	4.75E-06	5.10E-07	2.25E-06	1.01E-05	2.74E-05	9.24E-06
103	Bituminous	Conventional	ESP	1.45E-06	1.25E-05	4.16E-07	3.81E-07	4.89E-05	1.58E-06	6.61E-06	1.01E-05	2.74E-05	3.69E-05
104	Bituminous	Fluidized Bed	Fabric Filter	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.89E-05	1.58E-06	2.25E-06	1.01E-05	2.74E-05	3.69E-05
105	Bituminous	Fluidized Bed	ESP	1.45E-06	1.25E-05	4.16E-07	3.81E-07	4.89E-05	1.58E-06	6.61E-06	1.01E-05	2.74E-05	3.69E-05
106	Coal Refuse	Fluidized Bed	Fabric Filter	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.89E-05	1.58E-06	2.25E-06	1.01E-05	2.74E-05	3.69E-05
107	Lignite	Conventional	Fabric Filter + Wet FGD	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.75E-06	5.10E-07	2.25E-06	1.01E-05	2.74E-05	9.24E-06
108	Lignite	Conventional	Fabric Filter	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.89E-05	1.58E-06	2.25E-06	1.01E-05	2.74E-05	3.69E-05
109	Lignite	Fluidized Bed	Fabric Filter	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.89E-05	1.58E-06	2.25E-06	1.01E-05	2.74E-05	3.69E-05
110	Subbituminous	Conventional	Fabric Filter + Wet FGD	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.75E-06	5.10E-07	2.25E-06	1.01E-05	2.74E-05	9.24E-06
111	Subbituminous	Conventional	Fabric Filter	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.89E-05	1.58E-06	2.25E-06	1.01E-05	2.74E-05	3.69E-05
112	Subbituminous	Conventional	ESP + Wet FGD	4.22E-07	2.52E-06	1.18E-07	2.20E-07	4.75E-06	5.10E-07	2.25E-06	1.01E-05	2.74E-05	9.24E-06
113	Subbituminous	Conventional	ESP	1.45E-06	1.25E-05	4.16E-07	3.81E-07	4.89E-05	1.58E-06	6.61E-06	1.01E-05	2.74E-05	3.69E-05
114	Subbituminous	Conventional	Wet FGD/PM Scrubber	4.22E-07	2.52E-06	1.18E-07	2.20E-07	4.75E-06	5.10E-07	2.25E-06	1.01E-05	2.74E-05	9.24E-06
115	IGCC	IGCC	PM Scrubber	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.75E-06	5.10E-07	2.25E-06	1.01E-05	2.74E-05	3.69E-05
116	IGCC	IGCC	No PM Control	4.22E-07	9.72E-07	1.18E-07	2.20E-07	4.75E-06	5.10E-07	2.25E-06	1.01E-05	2.74E-05	3.69E-05
117	No. 2 Fuel Oil	Conventional	No PM Control	3.30E-05	2.55E-06	1.62E-07	3.62E-07	5.70E-06	1.71E-05	1.30E-05	9.42E-06	3.46E-04	2.02E-06
118	No. 6 Fuel Oil	Conventional	ESP	3.30E-05	2.55E-06	1.62E-07	3.62E-07	5.70E-06	1.71E-05	1.30E-05	9.42E-06	3.46E-04	2.02E-06
119	No. 6 Fuel Oil	Conventional	No PM Control (includes multiclones)	3.30E-05	2.55E-06	1.62E-07	3.62E-07	5.70E-06	1.71E-05	1.30E-05	9.42E-06	3.46E-04	2.02E-06
120	Petroleum coke	Conventional	ESP + Wet FGD + Wet ESP	1.59E-06	4.81E-05	1.17E-07	4.86E-07	2.76E-06	1.00E-06	3.83E-06	4.66E-06	1.59E-05	1.54E-06
121	Petroleum coke	Fluidized Bed	Fabric Filter	1.59E-06	4.81E-05	1.17E-07	4.86E-07	2.76E-06	1.00E-06	3.83E-06	4.66E-06	1.59E-05	1.54E-06

ATTACHMENT A

Documentation and calculations for metal emission factors

Compiled from original PDF documentation developed by OAQPS/SPPD/MPG and labeled:

Coal_Fired_Utility_Boiler_Antimony.pdf

Coal_Fired_Utility_Boiler_Arsenic.pdf

Coal_Fired_Utility_Boiler_Beryllium.pdf

Coal_Fired_Utility_Boiler_Cadmium.pdf

Coal_Fired_Utility_Boiler_Chromium.pdf

Coal_Fired_Utility_Boiler_Cobalt.pdf

Coal_Fired_Utility_Boiler_Lead.pdf

Coal_Fired_Utility_Boiler_Manganese.pdf

Coal_Fired_Utility_Boiler_Nickel.pdf

Coal_Fired_Utility_Boiler_Selenium.pdf

Coal Fired Utility Boiler Antimony Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Antimony Emissions Factor are presented on the following page with two sets of columns. The left set of columns presents SCC, Submittal ID, emissions factors, the natural log of the emissions factor and the control measure employed. The right set of columns contains the same information but excluding the boilers with ESP control. The site specific emissions factors presented are as determined using the f factor method rather than the emissions factor determined by dividing the hourly emissions by the coal feed and associated proximate analysis. Subsequent pages provide the assessments as performed using EPA's statistical software ProUCL. The assessments provide support for the development of a separate national emissions factors for ESP, and for combining data for Fabric Filter, Dry Scrubbing and Wet Scrubbing controls. Separate emissions factors were developed since there is a statistical difference between ESP and Fabric Filter controls. A combined factor for Fabric Filter, Dry Scrubbing controls and Wet Scrubbing controls are supported by analyses that show that there is no significant difference in the average emissions factors for these categories.

The resulting calculated arsenic emissions factors are:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP controls	1.45×10^{-6}	44	Highly Representative
Fabric Filter, Dry Scrubbing & Wet Scrubbing controls	4.22×10^{-7}	91	Highly Representative

Antimony EF Development Data

All Data					Fabric Filter, Wet Scrubber & Dry Scrubber Data				
SCC	submittal ID	lb / mmBtuO2	Ln Sb #/mmBtu	Controls	SCC	submittal ID	lb / mmBtuO2	Ln Sb #/mmBtu	Controls
10100202	1972	9.79E-09	-18.441904	Wet	10100202	1972	9.79E-09	-18.4419	Wet
10100202	1488	1.62E-08	-17.938255	Dry	10100202	1488	1.62E-08	-17.93825	Dry
10100202	1190	3.04E-08	-17.308823	FF	10100202	1190	3.04E-08	-17.30882	FF
10100222	1726	3.75E-08	-17.098925	Dry	10100222	1726	3.75E-08	-17.09892	Dry
10100212	1648	4.04E-08	-17.024436	Wet	10100212	1648	4.04E-08	-17.02444	Wet
10300222	1276	4.14E-08	-16.999985	Wet	10300222	1276	4.14E-08	-16.99998	Wet
10100202	1189	4.33E-08	-16.955113	FF	10100202	1189	4.33E-08	-16.95511	FF
10100202	550002	4.57E-08	-16.901262	Dry	10100202	550002	4.57E-08	-16.90126	Dry
10100223	23151	4.63E-08	-16.888124	Wet	10100223	23151	4.63E-08	-16.88812	Wet
10100212	1647	4.67E-08	-16.879522	Wet	10100212	1647	4.67E-08	-16.87952	Wet
10100202	1909	4.96E-08	-16.819275	Dry	10100202	1909	4.96E-08	-16.81928	Dry
10100202	947	4.98E-08	-16.815251	Dry	10100202	947	4.98E-08	-16.81525	Dry
10100202	1611	5.03E-08	-16.805261	Dry	10100202	1611	5.03E-08	-16.80526	Dry
10100222	845	5.44E-08	-16.726902	FF	10100222	845	5.44E-08	-16.7269	FF
10100211	900	6.19E-08	-16.597746	Wet	10100211	900	6.19E-08	-16.59775	Wet
10100202	1738	6.90E-08	-16.489159	Wet	10100202	1738	6.90E-08	-16.48916	Wet
10100202	560	7.07E-08	-16.46482	Dry	10100202	560	7.07E-08	-16.46482	Dry
10100223	23152	7.15E-08	-16.453568	Wet	10100223	23152	7.15E-08	-16.45357	Wet
10100202	1597	9.18E-08	-16.203654	FF	10100202	1597	9.18E-08	-16.20365	FF
10100205	13461	9.38E-08	-16.182101	Dry	10100205	13461	9.38E-08	-16.1821	Dry
10100202	1942	9.42E-08	-16.177846	Dry	10100202	1942	9.42E-08	-16.17785	Dry
10100223	23153	1.08E-07	-16.041135	Wet	10100223	23153	1.08E-07	-16.04113	Wet
10100223	2315	1.09E-07	-16.031918	Wet	10100223	2315	1.09E-07	-16.03192	Wet
10100202	1129	1.14E-07	-15.985689	Dry	10100202	1129	1.14E-07	-15.98569	Dry
10100212	565	1.21E-07	-15.927475	Dry	10100212	565	1.21E-07	-15.92748	Dry
10100202	1606	1.24E-07	-15.902984	FF	10100202	1606	1.24E-07	-15.90298	FF
10100222	10040004	1.29E-07	-15.863453	ESP	10100205	1349	1.32E-07	-15.84046	Dry
10100226	2278	1.31E-07	-15.848069	ESP	10100202	2021	1.41E-07	-15.77451	Dry
10100205	1349	1.32E-07	-15.840464	Dry	10100202	2055	1.50E-07	-15.71263	Wet
10100222	2274	1.36E-07	-15.810611	ESP	10100202	1118	1.56E-07	-15.67341	Wet
10100202	2021	1.41E-07	-15.774506	Dry	10100202	1743	1.63E-07	-15.62952	Wet
10100223	2302	1.47E-07	-15.732833	ESP	10100201	2319	1.65E-07	-15.61732	Wet
10100202	2055	1.50E-07	-15.712631	Wet	10100202	1249	1.65E-07	-15.61732	Dry
10100202	2161	1.50E-07	-15.712631	ESP	10100202	1133	1.88E-07	-15.48824	Dry
10100202	1902	1.51E-07	-15.705986	ESP	10100202	1119	1.90E-07	-15.47624	Wet
10100202	1118	1.56E-07	-15.67341	Wet	10100222	1568	1.94E-07	-15.45541	Dry
10100202	1154	1.60E-07	-15.648092	ESP	10100203	1052	1.97E-07	-15.44006	Dry
10100202	1743	1.63E-07	-15.629516	Wet	10100224	1120	2.02E-07	-15.415	Wet
10100201	2319	1.65E-07	-15.61732	Wet	10100202	1638	2.07E-07	-15.39055	Wet
10100202	1249	1.65E-07	-15.61732	Dry	10100226	1938	2.21E-07	-15.3251	Dry
10100202	1133	1.88E-07	-15.488237	Dry	10100202	1637	2.23E-07	-15.31609	Wet
10100202	1119	1.90E-07	-15.476242	Wet	10100221	2170	2.35E-07	-15.26168	FF
10100222	1568	1.94E-07	-15.455408	Dry	10100202	1515	2.47E-07	-15.21388	Wet
10100203	1052	1.97E-07	-15.440062	Dry	10100222	2259	2.58E-07	-15.17031	Wet
10100224	1120	2.02E-07	-15.414998	Wet	10100221	1835	2.64E-07	-15.14725	FF

Antimony EF Development Data

All Data					Fabric Filter, Wet Scrubber & Dry Scrubber Data				
SCC	submittal ID	lb / mmBtuO2	Ln Sb #/mmBtu	Controls	SCC	submittal ID	lb / mmBtuO2	Ln Sb #/mmBtu	Controls
10100202	1638	2.07E-07	-15.390547	Wet	10100202	1117	2.69E-07	-15.12855	Wet
10100226	1938	2.21E-07	-15.325103	Dry	10100202	1117	2.69E-07	-15.12855	Wet
10100202	1637	2.23E-07	-15.316094	Wet	10100205	1346111	2.69E-07	-15.12855	Dry
10100221	2170	2.35E-07	-15.261675	FF	10100202	736	2.97E-07	-15.03035	FF
10100212	1021	2.40E-07	-15.243662	ESP	10100202	735	3.00E-07	-15.01966	FF
10100203	894	2.43E-07	-15.230204	ESP	10100218	1563	3.08E-07	-14.99317	Dry
10100202	1515	2.47E-07	-15.213878	Wet	10100218	524	3.11E-07	-14.98347	FF
10100222	2259	2.58E-07	-15.170306	Wet	10100202	2095	3.17E-07	-14.96436	FF
10100221	1835	2.64E-07	-15.147247	FF	10100205	134611	3.21E-07	-14.95182	Dry
10100202	1117	2.69E-07	-15.128554	Wet	10100202	2239	3.24E-07	-14.94252	Wet
10100202	1117	2.69E-07	-15.128554	Wet	10100202	698	3.32E-07	-14.91813	Dry
10100205	1346111	2.69E-07	-15.128554	Dry	10100202	1563	3.70E-07	-14.80976	Dry
10100202	736	2.97E-07	-15.030353	FF	10100222	1449	3.74E-07	-14.79901	Dry
10100202	735	3.00E-07	-15.019657	FF	10100218	1563	3.79E-07	-14.78573	Dry
10100218	1563	3.08E-07	-14.993166	Dry	10100212	1177	3.86E-07	-14.76743	Wet
10100218	524	3.11E-07	-14.983473	FF	10100202	2022	4.07E-07	-14.71445	Dry
10100202	2095	3.17E-07	-14.964364	FF	10100203	1735	4.17E-07	-14.69022	Dry
10100205	134611	3.21E-07	-14.951825	Dry	10100203	1734	4.53E-07	-14.60704	Dry
10100202	2239	3.24E-07	-14.942522	Wet	10100223	1327	4.71E-07	-14.56841	Wet
10100202	698	3.32E-07	-14.918131	Dry	10100202	541	4.92E-07	-14.52479	Wet
10100202	10040002	3.53E-07	-14.856798	ESP	10100226	1398	4.95E-07	-14.51871	Dry
10100212	731	3.68E-07	-14.814716	ESP	10100218	2088	5.36E-07	-14.43913	FF
10100202	1563	3.70E-07	-14.809763	Dry	10100202	734	5.36E-07	-14.43822	FF
10100212	3197	3.73E-07	-14.801687	ESP	10100222	1832	5.82E-07	-14.3568	FF
10100222	1449	3.74E-07	-14.79901	Dry	10100223	1307	6.03E-07	-14.32135	Wet
10100218	1563	3.79E-07	-14.78573	Dry	10100202	1176	6.04E-07	-14.31969	Wet
10100212	1177	3.86E-07	-14.767428	Wet	10100222	1833	6.12E-07	-14.30653	FF
10100222	1854	3.95E-07	-14.74438	ESP	10100202	1187	6.20E-07	-14.29355	Wet
10100202	1004	4.06E-07	-14.716913	ESP	10100205	1346	6.28E-07	-14.28073	Dry
10100202	2022	4.07E-07	-14.714453	Dry	10100202	1185	6.49E-07	-14.24783	Wet
10100204	1113	4.15E-07	-14.694987	ESP	10100202	1244	6.66E-07	-14.22137	FF
10100203	1735	4.17E-07	-14.690223	Dry	10100218	1310	6.78E-07	-14.20412	FF
10100203	1734	4.53E-07	-14.607035	Dry	10100202	1826	7.52E-07	-14.10053	Wet
10100223	1327	4.71E-07	-14.568408	Wet	10100202	63254	7.60E-07	-14.08995	FF
10100202	541	4.92E-07	-14.524787	Wet	10100222	1841	8.16E-07	-14.01885	FF
10100226	1398	4.95E-07	-14.518708	Dry	10100202	18261	8.20E-07	-14.01396	Wet
10100201	902	5.12E-07	-14.484941	ESP	10100222	2206	1.05E-06	-13.76672	Dry
10100218	2088	5.36E-07	-14.439132	FF	10100202	1507	1.08E-06	-13.73855	Dry
10100202	734	5.36E-07	-14.438222	FF	10100202	1330	1.11E-06	-13.71115	Wet
10100202	979	5.47E-07	-14.418817	ESP	10100226	1558	1.17E-06	-13.65851	Wet
10100202	2276	5.59E-07	-14.397116	ESP	10100222	879456	1.45E-06	-13.44395	FF
10100202	1906	5.67E-07	-14.382907	ESP	10100202	8761	1.45E-06	-13.44395	Dry
10100222	1832	5.82E-07	-14.356795	FF	10100202	966	1.50E-06	-13.41005	Wet
10100223	1307	6.03E-07	-14.321349	Wet	10100202	1654	1.50E-06	-13.41005	FF
10100202	1176	6.04E-07	-14.319692	Wet	10100202	1915	2.47E-06	-12.91129	Wet

Antimony EF Development Data

All Data					Fabric Filter, Wet Scrubber & Dry Scrubber Data				
SCC	submittal ID	lb / mmBtuO2	Ln Sb #/mmBtu	Controls	SCC	submittal ID	lb / mmBtuO2	Ln Sb #/mmBtu	Controls
10100222	1833	6.12E-07	-14.306534	FF	10100202	8761	2.77E-06	-12.79666	Dry
10100202	1187	6.20E-07	-14.293546	Wet					
10100205	1346	6.28E-07	-14.280726	Dry					
10100202	1185	6.49E-07	-14.247833	Wet					
10100202	1244	6.66E-07	-14.221367	FF					
10100218	1310	6.78E-07	-14.204119	FF					
10100223	2009	7.00E-07	-14.172186	ESP					
10100202	1989	7.00E-07	-14.172186	ESP					
10100222	2011	7.47E-07	-14.107201	ESP					
10100202	1826	7.52E-07	-14.10053	Wet					
10100202	63254	7.60E-07	-14.089947	FF					
10100211	1642	7.76E-07	-14.069113	ESP					
10100226	1141	8.10E-07	-14.026232	ESP					
10100223	2070	8.13E-07	-14.022535	ESP					
10100222	1841	8.16E-07	-14.018851	FF					
10100202	18261	8.20E-07	-14.013961	Wet					
10100222	21351	8.20E-07	-14.013961	ESP					
10100222	2135	8.86E-07	-13.936549	ESP					
10100223	12861	9.60E-07	-13.856333	ESP					
10100212	632	9.91E-07	-13.824551	ESP					
10100222	2206	1.05E-06	-13.76672	Dry					
10100222	2013	1.07E-06	-13.747852	ESP					
10100202	1507	1.08E-06	-13.73855	Dry					
10100202	975	1.10E-06	-13.7202	ESP					
10100202	1330	1.11E-06	-13.711151	Wet					
10100226	1558	1.17E-06	-13.658507	Wet					
10100212	2103	1.29E-06	-13.560868	ESP					
10100222	879456	1.45E-06	-13.443947	FF					
10100202	8761	1.45E-06	-13.443947	Dry					
10100202	2195	1.47E-06	-13.430248	ESP					
10100201	903	1.48E-06	-13.423468	ESP					
10100202	966	1.50E-06	-13.410045	Wet					
10100202	1654	1.50E-06	-13.410045	FF					
10100202	993	1.53E-06	-13.390243	ESP					
10100203	892	1.55E-06	-13.377256	ESP					
10100202	1636	1.73E-06	-13.267389	ESP					
10100223	828	2.17E-06	-13.040783	ESP					
10100202	1845	2.28E-06	-12.991335	ESP					
10100202	1915	2.47E-06	-12.911292	Wet					
10100202	8761	2.77E-06	-12.796663	Dry					
10100203	1809	2.91E-06	-12.747357	ESP					
10100212	22791	3.54E-06	-12.551105	ESP					
10100204	1111	5.27E-06	-12.15348	ESP					
10100212	2279	1.06E-05	-11.452493	ESP					
10100202	1471	1.15E-05	-11.373164	ESP					

Outlier Tests for Selected Variables

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for Ln Sb #/mmBtu (dry)

Mean -15.38

Standard Deviation 1.133

Number of data 34

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-15.38	1.116	-12.8	34	2.317	2.97	3.3
2	-15.46	1.053	-17.94	1	2.353	2.95	3.29
3	-15.38	0.97	-13.44	33	2	2.94	3.27
4	-15.45	0.918	-13.74	32	1.861	2.91	3.25
5	-15.5	0.876	-13.77	31	1.982	2.91	3.24

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for Ln Sb #/mmBtu (esp)

Mean -14.13

Standard Deviation 1.113

Number of data 44

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-14.13	1.1	-11.37	44	2.503	3.08	3.43
2	-14.19	1.041	-11.45	43	2.631	3.07	3.41
3	-14.26	0.96	-12.15	42	2.189	3.06	3.4
4	-14.31	0.912	-12.55	41	1.924	3.05	3.39
5	-14.35	0.879	-12.75	40	1.824	3.04	3.38

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for Ln Sb #/mmBtu (ff)

Number of data = 21

10% critical value: 0.391

5% critical value: 0.44

1% critical value: 0.524

1. Data Value -13.41004545 is a Potential Outlier (Upper)

Test Statistic: 0.184

For 10% significance level, -13.41004545 is not an outlier.

For 5% significance level, -13.41004545 is not an outlier.

For 1% significance level, -13.41004545 is not an outlier.

2. Data Value -17.30882323 is a Potential Outlier (Lower)

Test Statistic: 0.177

For 10% significance level, -17.30882323 is not an outlier.

For 5% significance level, -17.30882323 is not an outlier.

For 1% significance level, -17.30882323 is not an outlier.

Rosner's Outlier Test for Ln Sb #/mmBtu (wet)

Mean -15.29

Standard Deviation 1.196

Number of data 36

Number of suspected outliers 5

			Potential	Obs.	Test	Critical	Critical
#	Mean	sd	outlier	Number	value	value (5%)	value (1%)
1	-15.29	1.18	-18.44	1	2.67	2.99	3.33
2	-15.2	1.083	-12.91	36	2.115	2.98	3.32
3	-15.27	1.022	-13.41	35	1.819	2.97	3.3
4	-15.33	0.983	-17.02	2	1.728	2.95	3.29
5	-15.27	0.95	-17	3	1.819	2.94	3.27

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2'(esp)

Background Data: 'lb/mmBtuO2'(ff)

Raw Statistics

	ESP	Fabric Filter
Number of Valid Observations	44	21
Number of Distinct Observations	43	20
Minimum	1.2900E-7	3.0400E-8
Maximum	1.1500E-5	1.5000E-6
Mean	1.4472E-6	4.8590E-7
Median	7.6150E-7	3.1700E-7
SD	2.3448E-6	4.0981E-7
SE of Mean	3.5349E-7	8.9428E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	63	1.858	1.669	0.034
Welch-Satterthwaite (Unequal Variance)	48.3	2.636	1.677	0.006

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	5.498E-12
Variance of Background	1.679E-13

Numerator DF	Denominator DF	F-Test Value	P-Value
43	20	32.737	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2'(ff)

Background Data: 'lb/mmBtuO2'(wet)

Raw Statistics

	Fabric Filte	Wet Scrubber
Number of Valid Observations	21	36
Number of Distinct Observations	20	35
Minimum	3.0400E-8	9.7900E-9
Maximum	1.5000E-6	2.4700E-6
Mean	4.8590E-7	4.1872E-7
Median	3.1700E-7	2.3500E-7
SD	4.0981E-7	4.9907E-7
SE of Mean	8.9428E-8	8.3178E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	55	0.522	1.673	0.302
Welch-Satterthwaite (Unequal Variance)	48.7	0.550	1.677	0.292

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.679E-13		
Variance of Background	2.491E-13		
Numerator DF	Denominator DF	F-Test Value	P-Value
35	20	1.483	0.353

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2'(wet)

Background Data: 'lb/mmBtuO2'(ff)

Raw Statistics

	Wet Scrubt Fabric Filter	
Number of Valid Observations	36	21
Number of Distinct Observations	35	20
Minimum	9.7900E-9	3.0400E-8
Maximum	2.4700E-6	1.5000E-6
Mean	4.1872E-7	4.8590E-7
Median	2.3500E-7	3.1700E-7
SD	4.9907E-7	4.0981E-7
SE of Mean	8.3178E-8	8.9428E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	55	-0.522	1.673	0.698
Welch-Satterthwaite (Unequal Variance)	48.7	-0.550	1.677	0.708

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2.491E-13
Variance of Background	1.679E-13

Numerator DF	Denominator DF	F-Test Value	P-Value
35	20	1.483	0.353

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2'(ff)

Background Data: 'lb/mmBtuO2'(dry)

Raw Statistics

	Fabric Filte	Dry Scrubber
Number of Valid Observations	21	34
Number of Distinct Observations	20	34
Minimum	3.0400E-8	1.6200E-8
Maximum	1.5000E-6	2.7700E-6
Mean	4.8590E-7	3.8482E-7
Median	3.1700E-7	2.0900E-7
SD	4.0981E-7	5.3033E-7
SE of Mean	8.9428E-8	9.0951E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	53	0.746	1.674	0.230
Welch-Satterthwaite (Unequal Variance)	50.2	0.792	1.676	0.216

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.679E-13
Variance of Background	2.812E-13

Numerator DF	Denominator DF	F-Test Value	P-Value
33	20	1.675	0.227

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2'(dry)

Background Data: 'lb/mmBtuO2'(ff)

Raw Statistics

	Dry Scrubb Fabric Filter	
Number of Valid Observations	34	21
Number of Distinct Observations	34	20
Minimum	1.6200E-8	3.0400E-8
Maximum	2.7700E-6	1.5000E-6
Mean	3.8482E-7	4.8590E-7
Median	2.0900E-7	3.1700E-7
SD	5.3033E-7	4.0981E-7
SE of Mean	9.0951E-8	8.9428E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	53	-0.746	1.674	0.770
Welch-Satterthwaite (Unequal Variance)	50.2	-0.792	1.676	0.784

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2.812E-13
Variance of Background	1.679E-13

Numerator DF	Denominator DF	F-Test Value	P-Value
33	20	1.675	0.227

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

Outlier Tests for Selected Variables

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for Ln Sb #/mmBtu xesp

Mean -15.25

Standard Deviation 1.148

Number of data 91

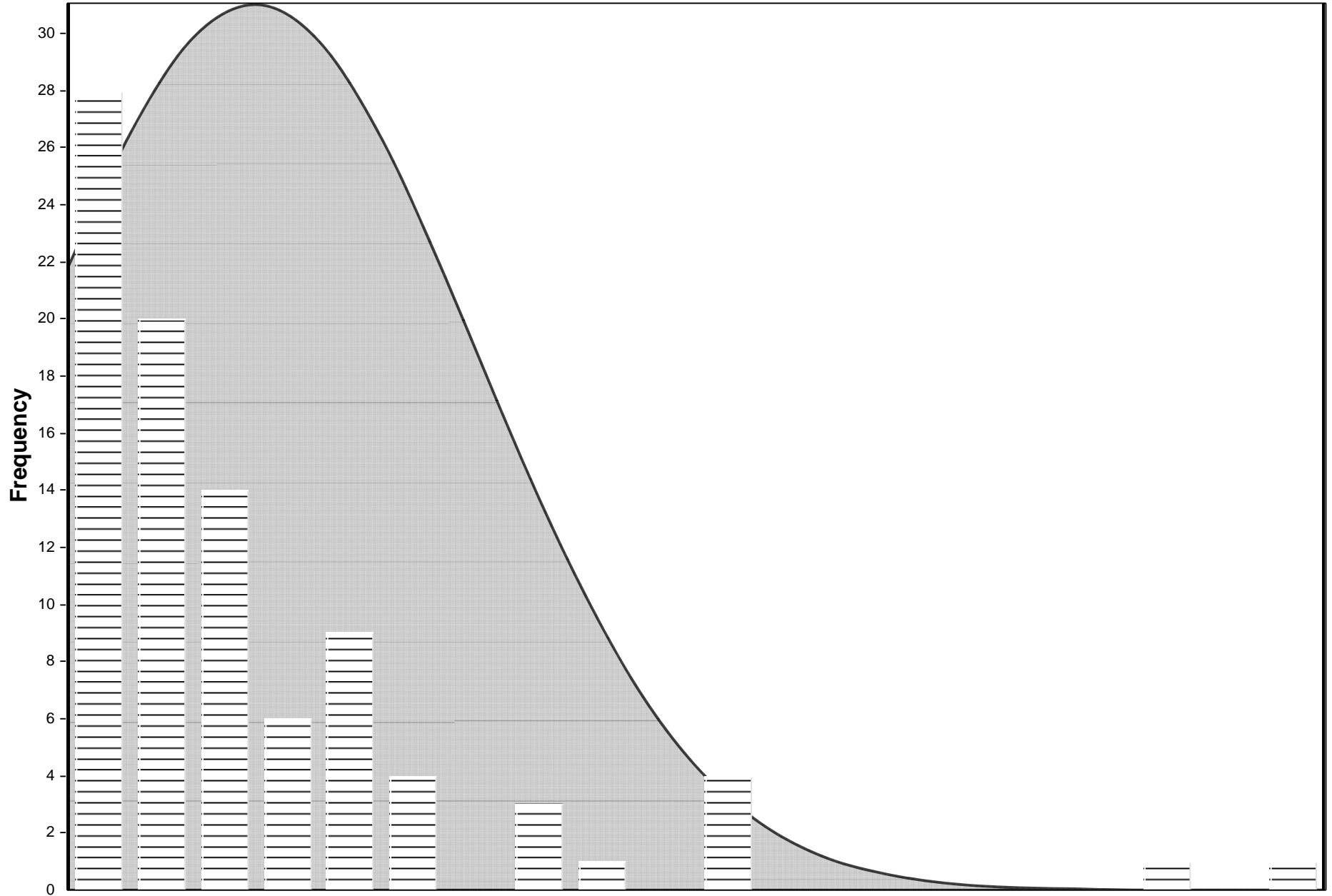
Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-15.25	1.142	-18.44	1	2.793	3.353	3.723
2	-15.22	1.104	-17.94	2	2.466	3.344	3.714
3	-15.19	1.071	-12.8	91	2.231	3.344	3.714
4	-15.21	1.046	-12.91	90	2.201	3.343	3.704
5	-15.24	1.022	-17.31	3	2.025	3.334	3.704

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Histogram for 'lb/mmBtuO2' xesp



▣ 'lb/mmBtuO2' xesp

Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Confidence Coefficient 0.95

'lb/mmBtuO2' xesp

Raw Statistics

Number of Valid Observations 91

Number of Distinct Observations 85

Minimum 9.7900E-9

Maximum 2.7700E-6

Mean of Raw Data 4.2156E-7

Standard Deviation of Raw Data 4.8865E-7

Kstar 0.981

Mean of Log Transformed Data -15.25

Standard Deviation of Log Transformed Data 1.148

Normal Distribution Test Results

Correlation Coefficient R 0.847

Approximate Shapiro Wilk Test Statistic 0.729

Approximate Shapiro Wilk P Value 0

Lilliefors Test Statistic 0.2

Lilliefors Critical (0.95) Value 0.0929

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R 0.983

A-D Test Statistic 0.588

A-D Critical (0.95) Value 0.783

K-S Test Statistic 0.0711

K-S Critical(0.95) Value 0.0965

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R 0.994

Approximate Shapiro Wilk Test Statistic 0.978

Approximate Shapiro Wilk P Value 0.466

Lilliefors Test Statistic 0.0564

Lilliefors Critical (0.95) Value 0.0929

Data appear Lognormal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Confidence Coefficient 0.95

'lb/mmBtuO2' (dry)

Raw Statistics

Number of Valid Observations 34

Number of Distinct Observations 34

Minimum 1.6200E-8

Maximum 2.7700E-6

Mean of Raw Data 3.8482E-7

Standard Deviation of Raw Data 5.3033E-7

Kstar 0.885

Mean of Log Transformed Data -15.38

Standard Deviation of Log Transformed Data 1.133

Normal Distribution Test Results

Correlation Coefficient R 0.774

Shapiro Wilk Test Statistic 0.626

Shapiro Wilk Critical (0.95) Value 0.933

Approximate Shapiro Wilk P Value 9.913E-10

Lilliefors Test Statistic 0.272

Lilliefors Critical (0.95) Value 0.152

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R 0.947

A-D Test Statistic 0.675

A-D Critical (0.95) Value 0.778

K-S Test Statistic 0.13

K-S Critical(0.95) Value 0.156

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R 0.993

Shapiro Wilk Test Statistic 0.988

Shapiro Wilk Critical (0.95) Value 0.933

Approximate Shapiro Wilk P Value 0.966

Lilliefors Test Statistic 0.0759

Lilliefors Critical (0.95) Value 0.152

Data appear Lognormal at (0.05) Significance Level

'lb/mmBtuO2' (esp)

Raw Statistics

Number of Valid Observations 44

Number of Distinct Observations	43						
Minimum	1.2900E-7						
Maximum	1.1500E-5						
Mean of Raw Data	1.4472E-6						
Standard Deviation of Raw Data	2.3448E-6						
Kstar	0.82						
Mean of Log Transformed Data	-14.13						
Standard Deviation of Log Transformed Data	1.112						
Normal Distribution Test Results							
Correlation Coefficient R	0.718						
Shapiro Wilk Test Statistic	0.535						
Shapiro Wilk Critical (0.95) Value	0.944						
Approximate Shapiro Wilk P Value	2.665E-15						
Lilliefors Test Statistic	0.301						
Lilliefors Critical (0.95) Value	0.134						
Data not Normal at (0.05) Significance Level							
Gamma Distribution Test Results							
Correlation Coefficient R	0.916						
A-D Test Statistic	1.645						
A-D Critical (0.95) Value	0.784						
K-S Test Statistic	0.155						
K-S Critical(0.95) Value	0.138						
Data not Gamma Distributed at (0.05) Significance Level							
Lognormal Distribution Test Results							
Correlation Coefficient R	0.983						
Shapiro Wilk Test Statistic	0.955						
Shapiro Wilk Critical (0.95) Value	0.944						
Approximate Shapiro Wilk P Value	0.128						
Lilliefors Test Statistic	0.0735						
Lilliefors Critical (0.95) Value	0.134						
Data appear Lognormal at (0.05) Significance Level							
'lb/mmBtuO2' (ff)							
Raw Statistics							
Number of Valid Observations	21						
Number of Distinct Observations	20						
Minimum	3.0400E-8						
Maximum	1.5000E-6						
Mean of Raw Data	4.8590E-7						
Standard Deviation of Raw Data	4.0981E-7						
Kstar	1.136						
Mean of Log Transformed Data	-14.97						
Standard Deviation of Log Transformed Data	1.095						
Normal Distribution Test Results							

Correlation Coefficient R	0.932						
Shapiro Wilk Test Statistic	0.865						
Shapiro Wilk Critical (0.95) Value	0.908						
Approximate Shapiro Wilk P Value	0.00625						
Lilliefors Test Statistic	0.184						
Lilliefors Critical (0.95) Value	0.193						

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.975						
A-D Test Statistic	0.346						
A-D Critical (0.95) Value	0.763						
K-S Test Statistic	0.135						
K-S Critical(0.95) Value	0.194						

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.964						
Shapiro Wilk Test Statistic	0.924						
Shapiro Wilk Critical (0.95) Value	0.908						
Approximate Shapiro Wilk P Value	0.0987						
Lilliefors Test Statistic	0.163						
Lilliefors Critical (0.95) Value	0.193						

Data appear Lognormal at (0.05) Significance Level

'lb/mmBtuO2' (wet)

Raw Statistics

Number of Valid Observations	36						
Number of Distinct Observations	35						
Minimum	9.7900E-9						
Maximum	2.4700E-6						
Mean of Raw Data	4.1872E-7						
Standard Deviation of Raw Data	4.9907E-7						
Kstar	0.896						
Mean of Log Transformed Data	-15.29						
Standard Deviation of Log Transformed Data	1.196						

Normal Distribution Test Results

Correlation Coefficient R	0.845						
Shapiro Wilk Test Statistic	0.731						
Shapiro Wilk Critical (0.95) Value	0.935						
Approximate Shapiro Wilk P Value	6.1962E-8						
Lilliefors Test Statistic	0.229						
Lilliefors Critical (0.95) Value	0.148						

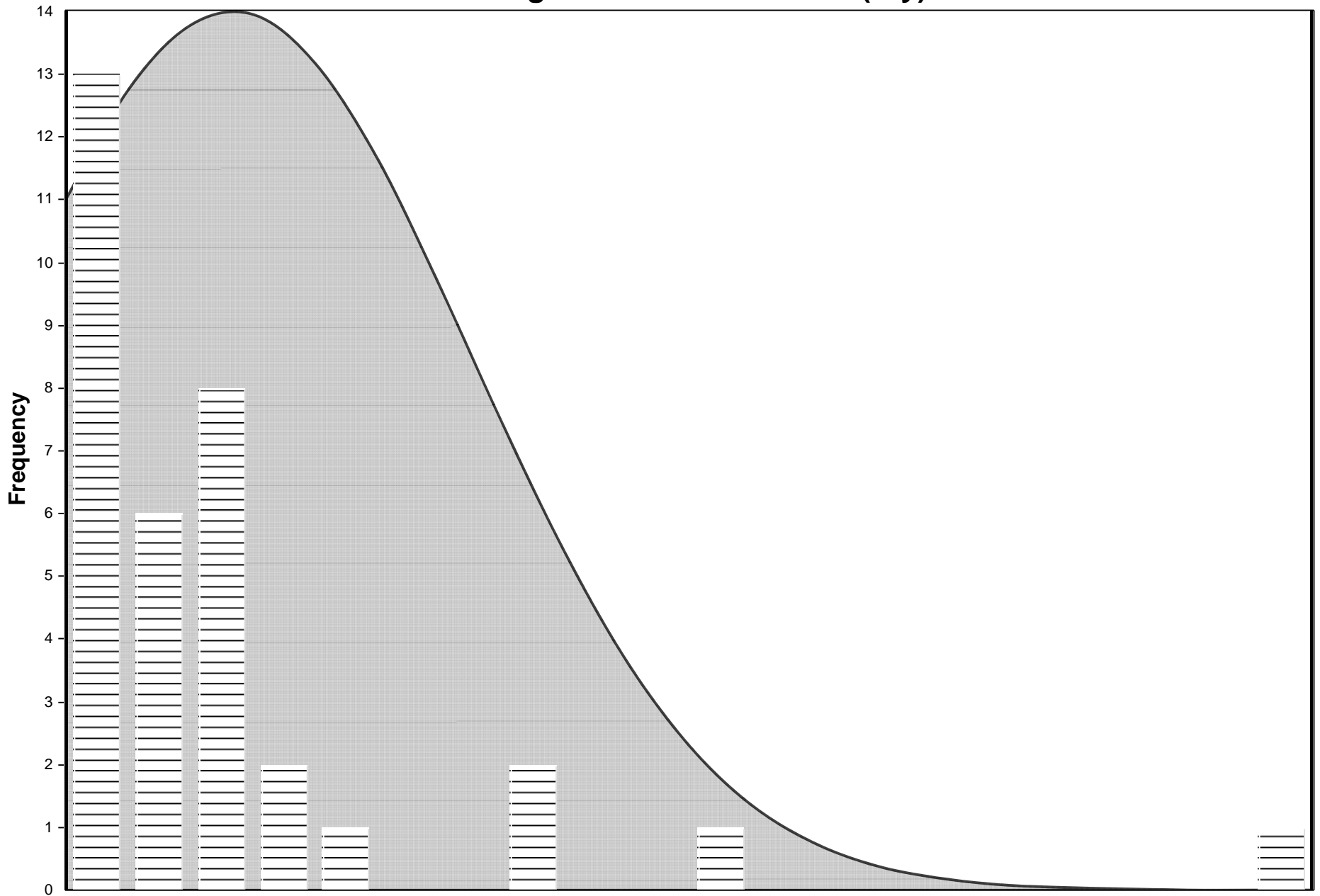
Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.985						
---------------------------	-------	--	--	--	--	--	--

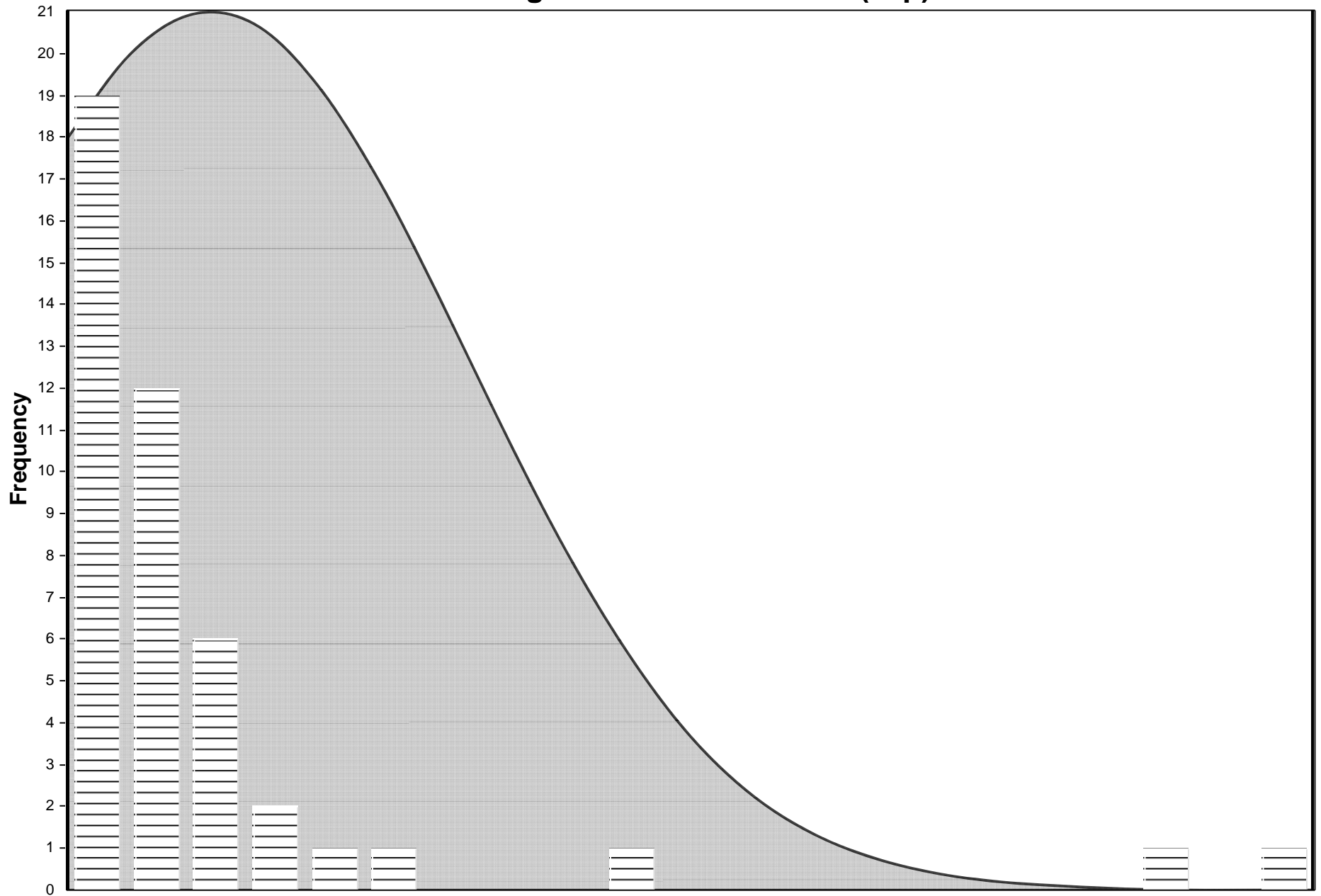
A-D Test Statistic	0.38						
A-D Critical (0.95) Value	0.778						
K-S Test Statistic	0.131						
K-S Critical(0.95) Value	0.151						
Data appear Gamma Distributed at (0.05) Significance Level							
Lognormal Distribution Test Results							
Correlation Coefficient R	0.991						
Shapiro Wilk Test Statistic	0.983						
Shapiro Wilk Critical (0.95) Value	0.935						
Approximate Shapiro Wilk P Value	0.895						
Lilliefors Test Statistic	0.0848						
Lilliefors Critical (0.95) Value	0.148						
Data appear Lognormal at (0.05) Significance Level							

Histogram for 'lb/mmBtuO2' (dry)



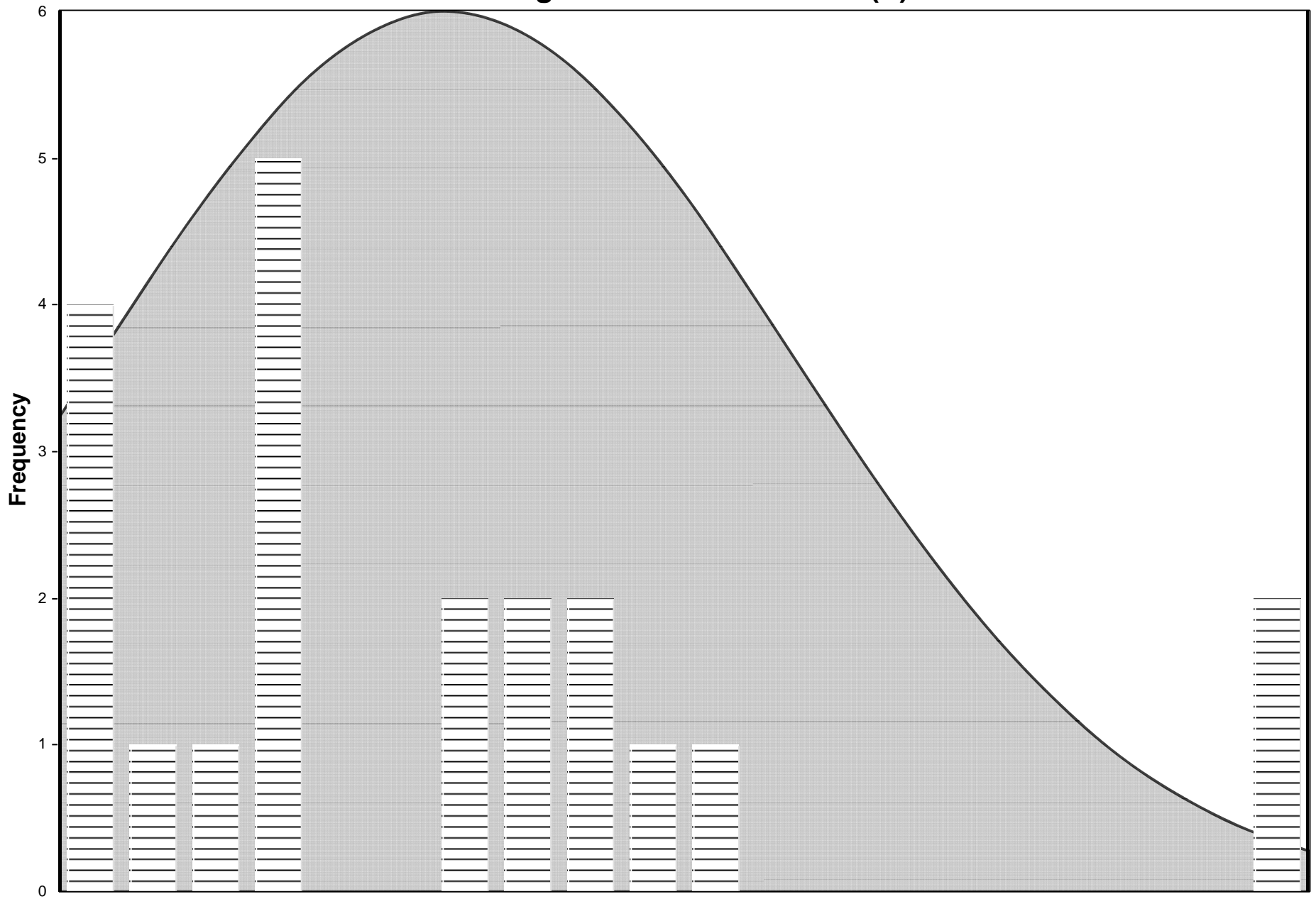
▣ 'lb/mmBtuO2' (dry)

Histogram for 'lb/mmBtuO2' (esp)



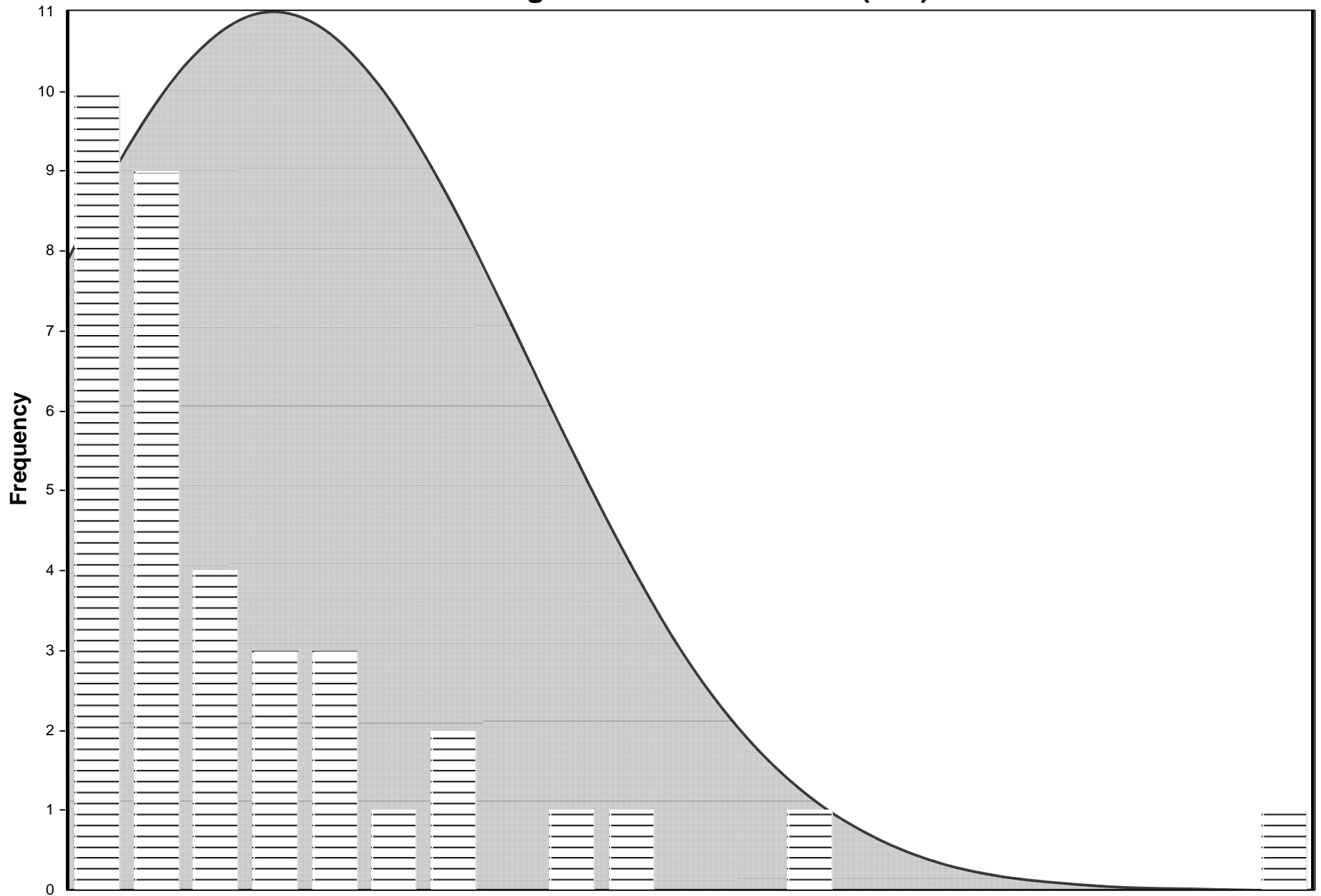
▣ 'lb/mmBtuO2' (esp)

Histogram for 'lb/mmBtuO2' (ff)



▣ 'lb/mmBtuO2' (ff)

Histogram for 'lb/mmBtuO2' (wet)



▣ 'lb/mmBtuO2' (wet)

Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
'lb/mmBtuO2' (dry)	34	1.6200E-8	2.7700E-6	3.8482E-7	2.0900E-7	2.812E-13	5.3033E-7	2.3566E-7	3.236	12.43	N/A
'lb/mmBtuO2' (esp)	44	1.2900E-7	1.1500E-5	1.4472E-6	7.6150E-7	5.498E-12	2.3448E-6	6.8718E-7	3.439	12.26	N/A
'lb/mmBtuO2' (ff)	21	3.0400E-8	1.5000E-6	4.8590E-7	3.1700E-7	1.679E-13	4.0981E-7	3.8933E-7	1.278	1.544	N/A
'lb/mmBtuO2' (wet)	36	9.7900E-9	2.4700E-6	4.1872E-7	2.3500E-7	2.491E-13	4.9907E-7	2.5137E-7	2.48	7.586	N/A

Percentiles for Raw Full Data Sets

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
'lb/mmBtuO2' (dry)	34	4.2830E-8	4.9660E-8	8.4560E-8	9.9150E-8	2.0900E-7	4.0000E-7	4.3140E-7	9.2340E-7	1.2095E-6	2.3344E-6
'lb/mmBtuO2' (esp)	44	1.3765E-7	1.5030E-7	3.0900E-7	3.7175E-7	7.6150E-7	1.4725E-6	1.5380E-6	2.7210E-6	5.0105E-6	1.1113E-5
'lb/mmBtuO2' (ff)	21	4.3300E-8	5.4400E-8	1.2400E-7	2.3500E-7	3.1700E-7	6.6600E-7	6.7800E-7	8.1600E-7	1.4500E-6	1.4900E-6
'lb/mmBtuO2' (wet)	36	4.1150E-8	4.6500E-8	7.1500E-8	1.0875E-7	2.3500E-7	6.0325E-7	6.2000E-7	9.6500E-7	1.2525E-6	2.1305E-6

Summary Statistics for Raw Full Dataset

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
'lb/mmBtuO2' xesp	91	9.7900E-9	2.7700E-6	4.2156E-7	2.6900E-7	2.388E-13	4.8865E-7	2.9281E-7	2.564	8.238	N/A

Percentiles for Raw Full Dataset

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
'lb/mmBtuO2' xesp	91	4.0900E-8	4.6700E-8	9.1800E-8	1.1150E-7	2.6900E-7	5.5900E-7	6.2000E-7	1.0500E-6	1.4500E-6	2.5000E-6

Coal Fired Utility Boiler Arsenic Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Arsenic Emissions Factor are presented on the following page with four sets of columns for ESP only, Fabric Filter only, Dry Scrubbing with either ESP or Fabric Filter and Wet Scrubbing with either ESP or Fabric Filter. Each set of columns includes the Submission ID for each test data, the site specific emissions factor as determined using the f factor method and the natural log of the site specific emissions factor. Subsequent pages provide the assessments as performed using EPA's statistical software ProUCL. The assessments provide support for the development of separate national emissions factors for ESP, Fabric Filter, Dry Scrubbing and Wet Scrubbing controls. Separate emissions factors were developed since there is a statistical difference between ESP and Fabric Filter controls, Fabric Filter and Dry Scrubbing controls, Fabric Filter and Wet Scrubbing controls and Dry Scrubbing and Wet Scrubbing controls.

The resulting calculated arsenic emissions factors are:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP controls	1.25×10^{-5}	45	Highly Representative
Fabric Filter controls	9.72×10^{-7}	21	Highly Representative
Dry Scrubbing controls	1.61×10^{-6}	35	Highly Representative
Wet Scrubbing controls	2.52×10^{-6}	36	Highly Representative

Outlier Tests for Selected Variables

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 1

Rosner's Outlier Test for ESP LN#/mmBtu

Mean -12.93

Standard Deviation 1.705

Number of data 45

Number of suspected outliers 1

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-12.93	1.686	-8.199	1	2.808	3.09	3.44

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for FF LN #/mmBtu

Number of data = 21

10% critical value: 0.391

5% critical value: 0.44

1% critical value: 0.524

1. Data Value -12.40208753 is a Potential Outlier (Upper)

Test Statistic: 0.231

For 10% significance level, -12.40208753 is not an outlier.

For 5% significance level, -12.40208753 is not an outlier.

For 1% significance level, -12.40208753 is not an outlier.

2. Data Value -15.62339941 is a Potential Outlier (Lower)

Test Statistic: 0.184

For 10% significance level, -15.62339941 is not an outlier.

For 5% significance level, -15.62339941 is not an outlier.

For 1% significance level, -15.62339941 is not an outlier.

Rosner's Outlier Test for Dry S LN #/mmBtu

Mean -14.71

Standard Deviation			1.376					
Number of data			35					
Number of suspected outliers			1					
			Potential	Obs.	Test	Critical	Critical	
#	Mean	sd	outlier	Number	value	value (5%)	value (1%)	
1	-14.71	1.356	-10.67	7	2.979	2.98	3.32	

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for Wet S LN #/mmBtu

Mean		-13.99					
Standard Deviation		1.709					
Number of data		36					
Number of suspected outliers		1					

			Potential	Obs.	Test	Critical	Critical	
#	Mean	sd	outlier	Number	value	value (5%)	value (1%)	
1	-13.99	1.685	-17.57	25	2.124	2.99	3.33	

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Greater Than or Equal to Background Mean (Form 2)
Alternative Hypothesis	Site or AOC Mean Less Than the Background Mean

Area of Concern Data: ESP #/mmBtu

Background Data: FF #/mmBtu

Raw Statistics

	Site	Background
Number of Valid Observations	45	21
Number of Distinct Observations	44	21
Minimum	1.7300E-7	1.6400E-7
Maximum	2.7500E-4	4.1100E-6
Mean	1.2469E-5	9.7210E-7
Median	1.9000E-6	6.1200E-7
SD	4.1184E-5	1.0448E-6
SE of Mean	6.1393E-6	2.2799E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background >= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	64	1.274	-1.669	0.896
Welch-Satterthwaite (Unequal Variance)	44.1	1.871	-1.680	0.966

Pooled SD: 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site >= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site >= Background

Test of Equality of Variances

Variance of Site	1.6961E-9		
Variance of Background	1.092E-12		
Numerator DF	Denominator DF	F-Test Value	P-Value
44	20	1553.794	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Greater Than or Equal to Background Mean (Form 2)
Alternative Hypothesis	Site or AOC Mean Less Than the Background Mean

Area of Concern Data: FF #/mmBtu

Background Data: Dry S #/mmBtu

Raw Statistics

	Site	Background
Number of Valid Observations	21	35
Number of Distinct Observations	21	32
Minimum	1.6400E-7	6.0800E-8
Maximum	4.1100E-6	2.3300E-5
Mean	9.7210E-7	1.6076E-6
Median	6.1200E-7	3.7100E-7
SD	1.0448E-6	4.5160E-6
SE of Mean	2.2799E-7	7.6334E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background >= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	54	-0.633	-1.674	0.265
Welch-Satterthwaite (Unequal Variance)	39.8	-0.798	-1.684	0.215

Pooled SD: 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site >= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site >= Background

Test of Equality of Variances

Variance of Site	1.092E-12
Variance of Background	2.039E-11

Numerator DF	Denominator DF	F-Test Value	P-Value
34	20	18.683	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Greater Than or Equal to Background Mean (Form 2)
Alternative Hypothesis	Site or AOC Mean Less Than the Background Mean

Area of Concern Data: FF #/mmBtu

Background Data: Wet S #/mmBtu

Raw Statistics

	Site	Background
Number of Valid Observations	21	36
Number of Distinct Observations	21	35
Minimum	1.6400E-7	2.3400E-8
Maximum	4.1100E-6	2.3100E-5
Mean	9.7210E-7	2.5234E-6
Median	6.1200E-7	1.1160E-6
SD	1.0448E-6	4.3111E-6
SE of Mean	2.2799E-7	7.1851E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background >= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	55	-1.616	-1.673	0.056
Welch-Satterthwaite (Unequal Variance)	41.7	-2.058	-1.682	0.023

Pooled SD: 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Do Not Reject H0, Conclude Site >= Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site < Background

Test of Equality of Variances

Variance of Site	1.092E-12		
Variance of Background	1.859E-11		
Numerator DF	Denominator DF	F-Test Value	P-Value
35	20	17.026	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Greater Than or Equal to Background Mean (Form 2)
Alternative Hypothesis	Site or AOC Mean Less Than the Background Mean

Area of Concern Data: Dry S #/mmBtu

Background Data: Wet S #/mmBtu

Raw Statistics

	Site	Background
Number of Valid Observations	35	36
Number of Distinct Observations	32	35
Minimum	6.0800E-8	2.3400E-8
Maximum	2.3300E-5	2.3100E-5
Mean	1.6076E-6	2.5234E-6
Median	3.7100E-7	1.1160E-6
SD	4.5160E-6	4.3111E-6
SE of Mean	7.6334E-7	7.1851E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background >= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	69	-0.874	-1.667	0.193
Welch-Satterthwaite (Unequal Variance)	68.6	-0.874	-1.667	0.193

Pooled SD: 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site >= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site >= Background

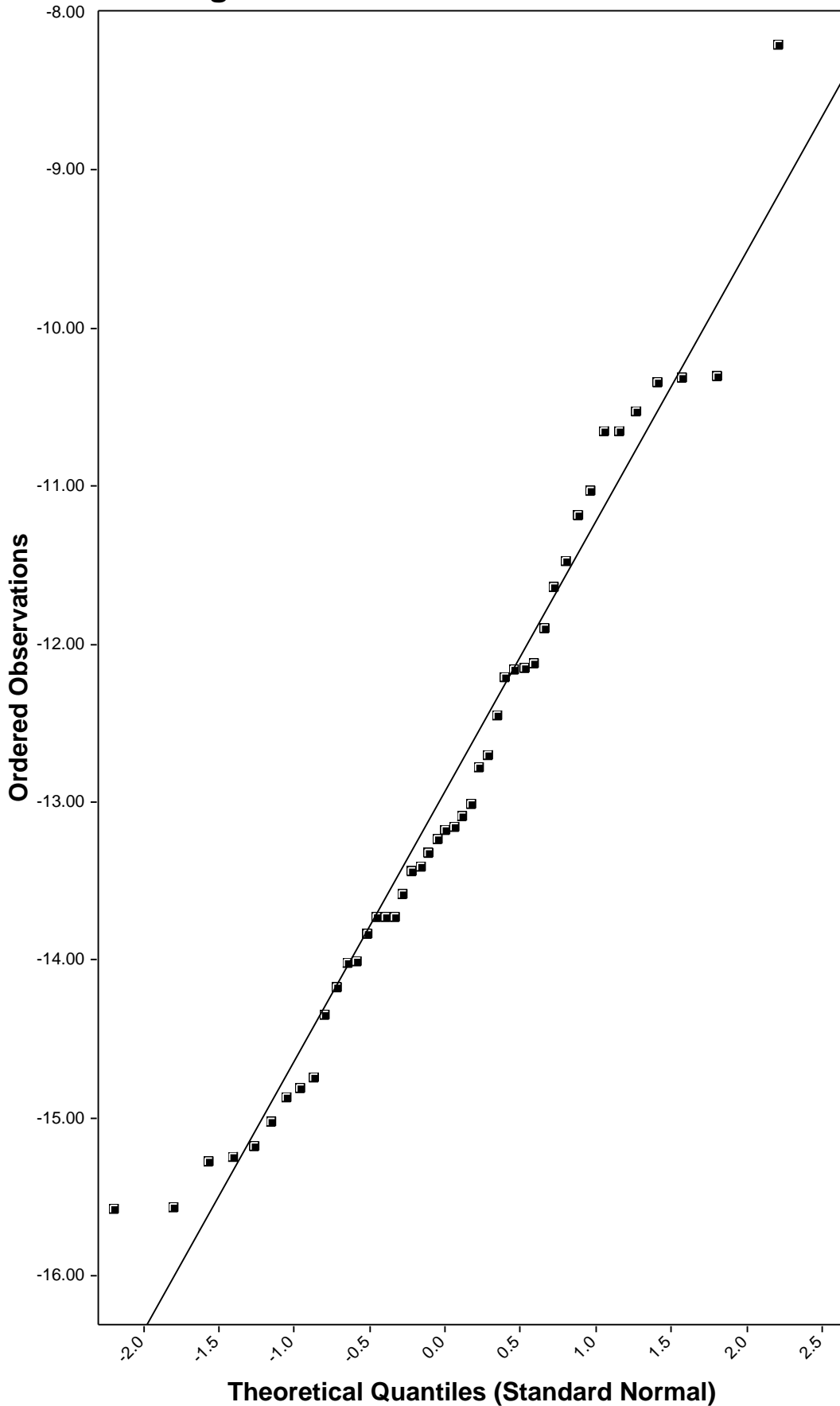
Test of Equality of Variances

Variance of Site	2.039E-11		
Variance of Background	1.859E-11		
Numerator DF	Denominator DF	F-Test Value	P-Value
34	35	1.097	0.785

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

Lognormal Q-Q Plot for ESP #/mmBtu



ESP #/mmBtu

ESP #/mmBtu

n = 45

Mean = -12.93

Sd = 1.705

Slope = 1.71

Intercept = -12.93

Correlation, R = 0.983

Shapiro-Wilk Test

Exact Test Statistic = 0.959

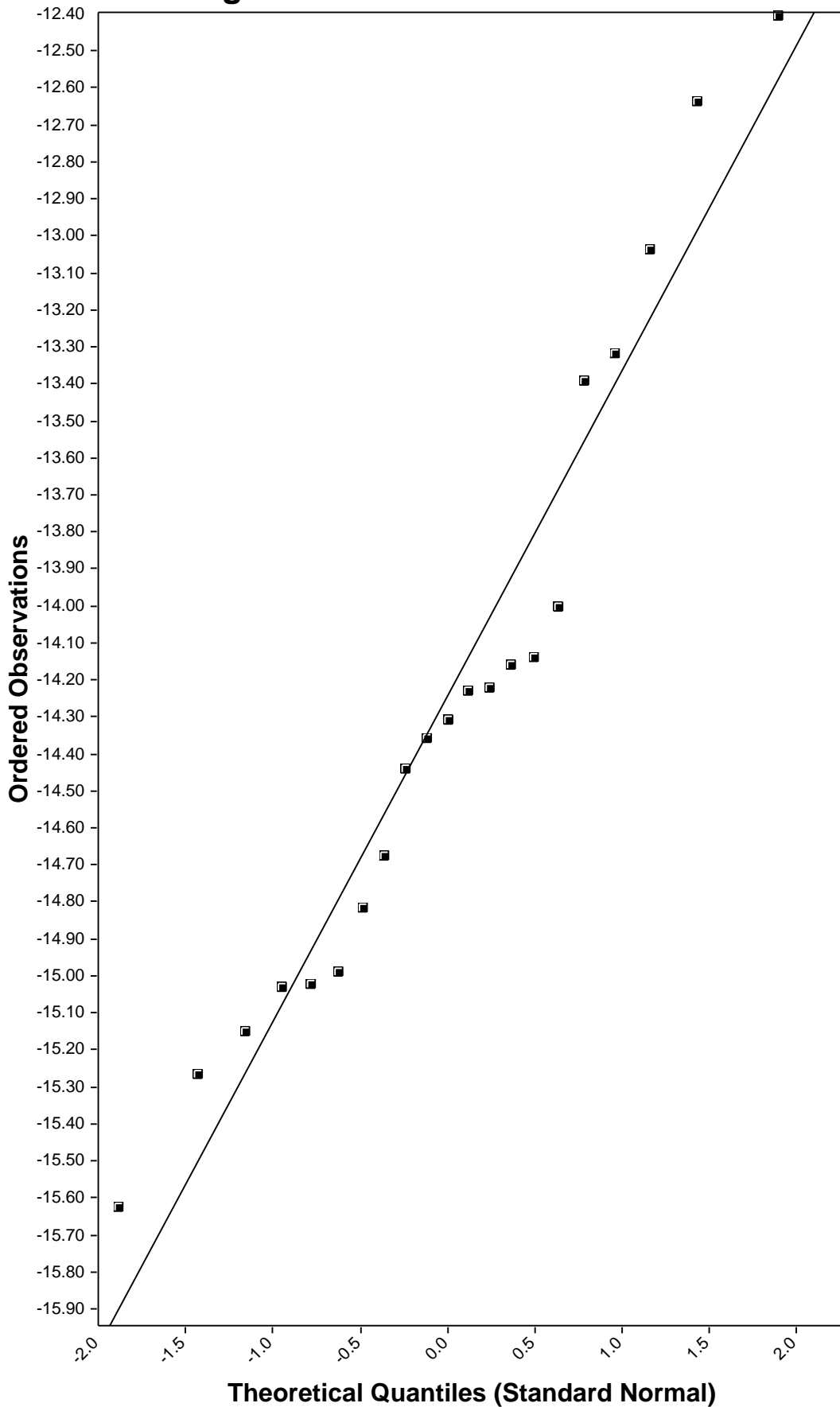
Critical Value(0.05) = 0.945

Data Appear Lognormal

Approx. Test Value = 0.959

p-Value = 0.175

Lognormal Q-Q Plot for FF #/mmBtu



FF #/mmBtu

n = 21

Mean = -14.25

Sd = 0.872

Slope = 0.881

Intercept = -14.25

Correlation, R = 0.975

Shapiro-Wilk Test

Exact Test Statistic = 0.945

Critical Value(0.05) = 0.908

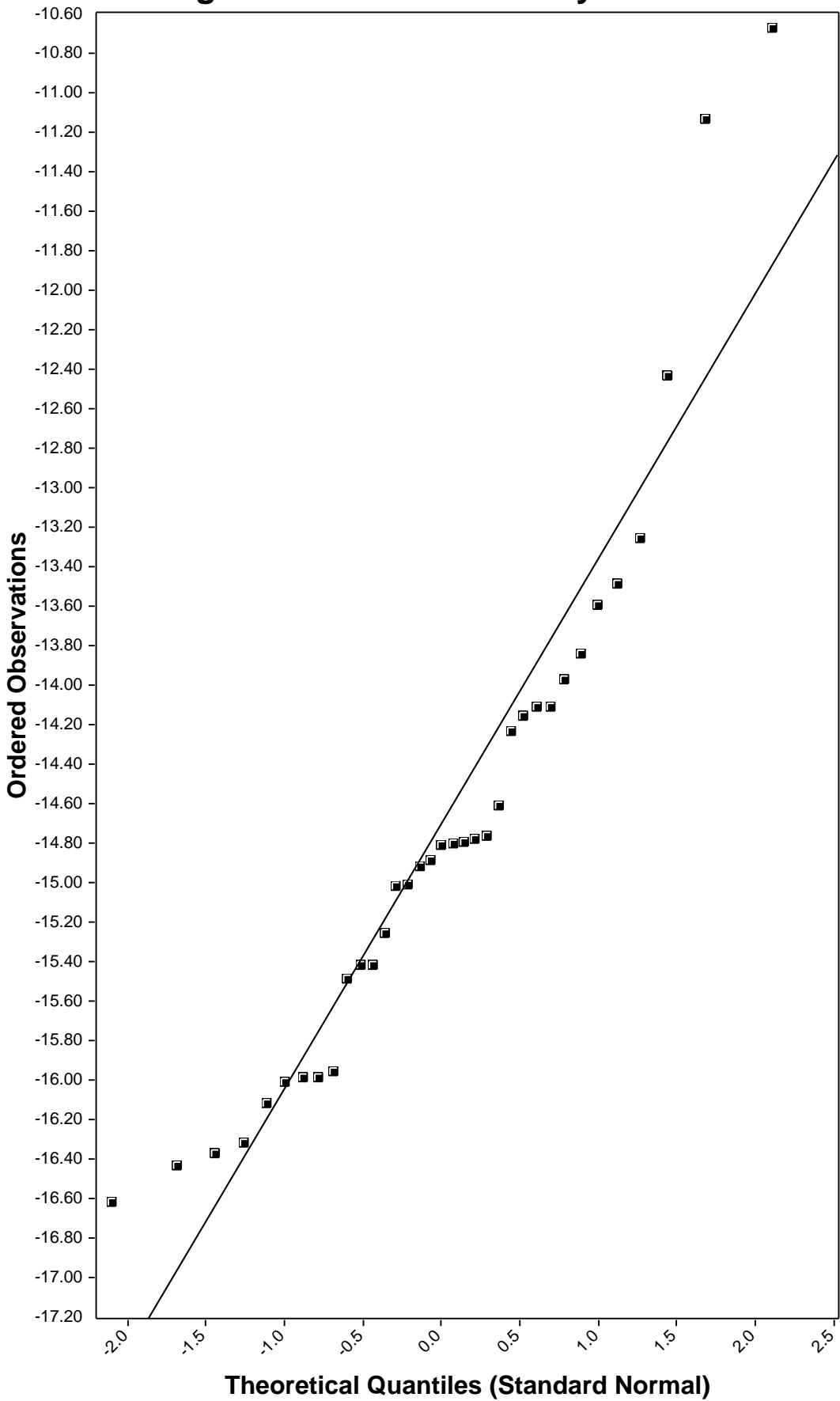
Data Appear Lognormal

Approx. Test Value = 0.945

p-Value = 0.273

■ FF #/mmBtu

Lognormal Q-Q Plot for Dry S #/mmBtu



Dry S #/mmBtu

n = 35

Mean = -14.71

Sd = 1.376

Slope = 1.344

Intercept = -14.71

Correlation, R = 0.953

Shapiro-Wilk Test

Exact Test Statistic = 0.908

Critical Value(0.05) = 0.934

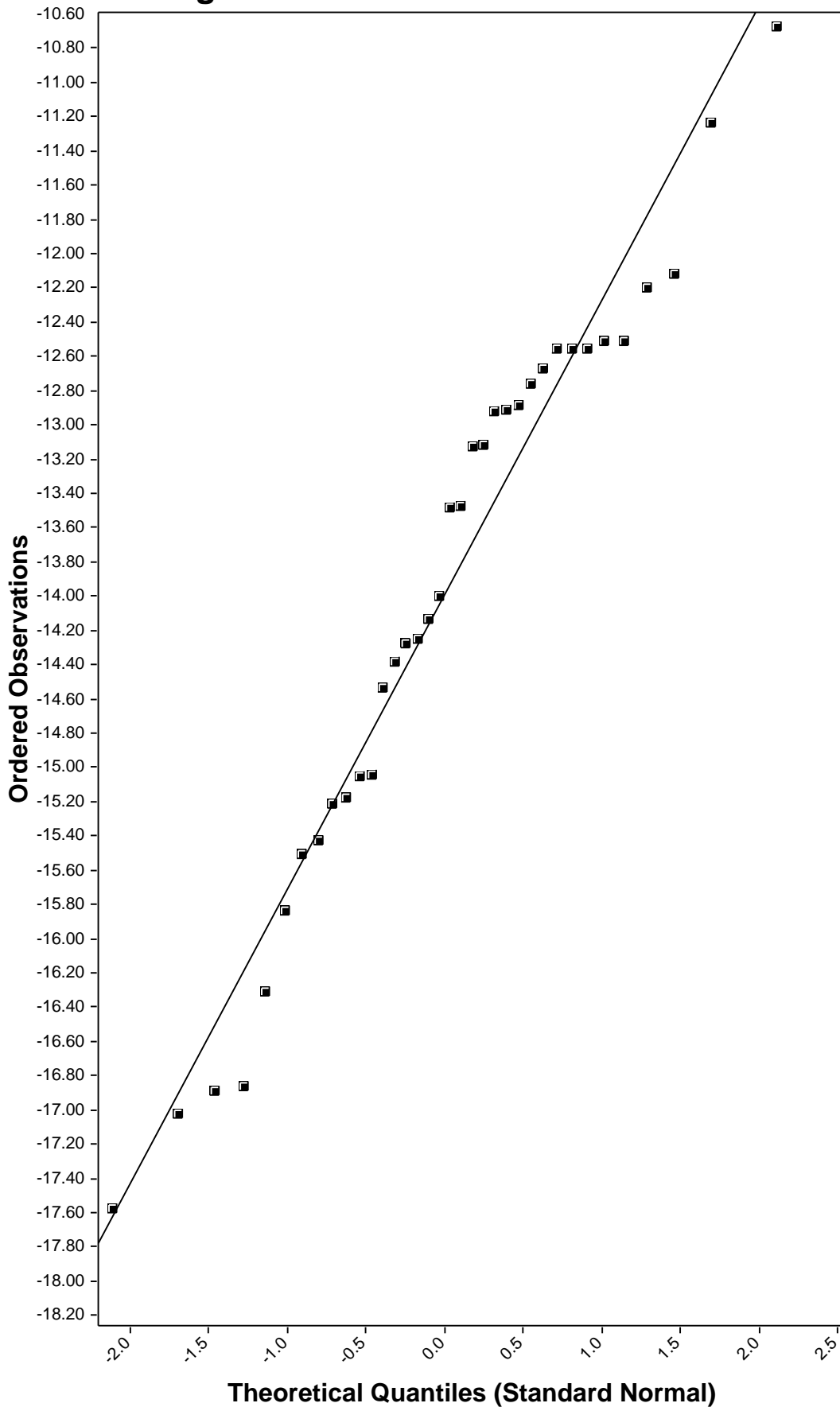
Data Not Lognormal

Approx. Test Value = 0.908

p-Value = 0.00689

■ Dry S #/mmBtu

Lognormal Q-Q Plot for Wet S #/mmBtu



Wet S #/mmBtu

n = 36

Mean = -13.99

Sd = 1.709

Slope = 1.72

Intercept = -13.99

Correlation, R = 0.983

Shapiro-Wilk Test

Exact Test Statistic = 0.957

Critical Value(0.05) = 0.935

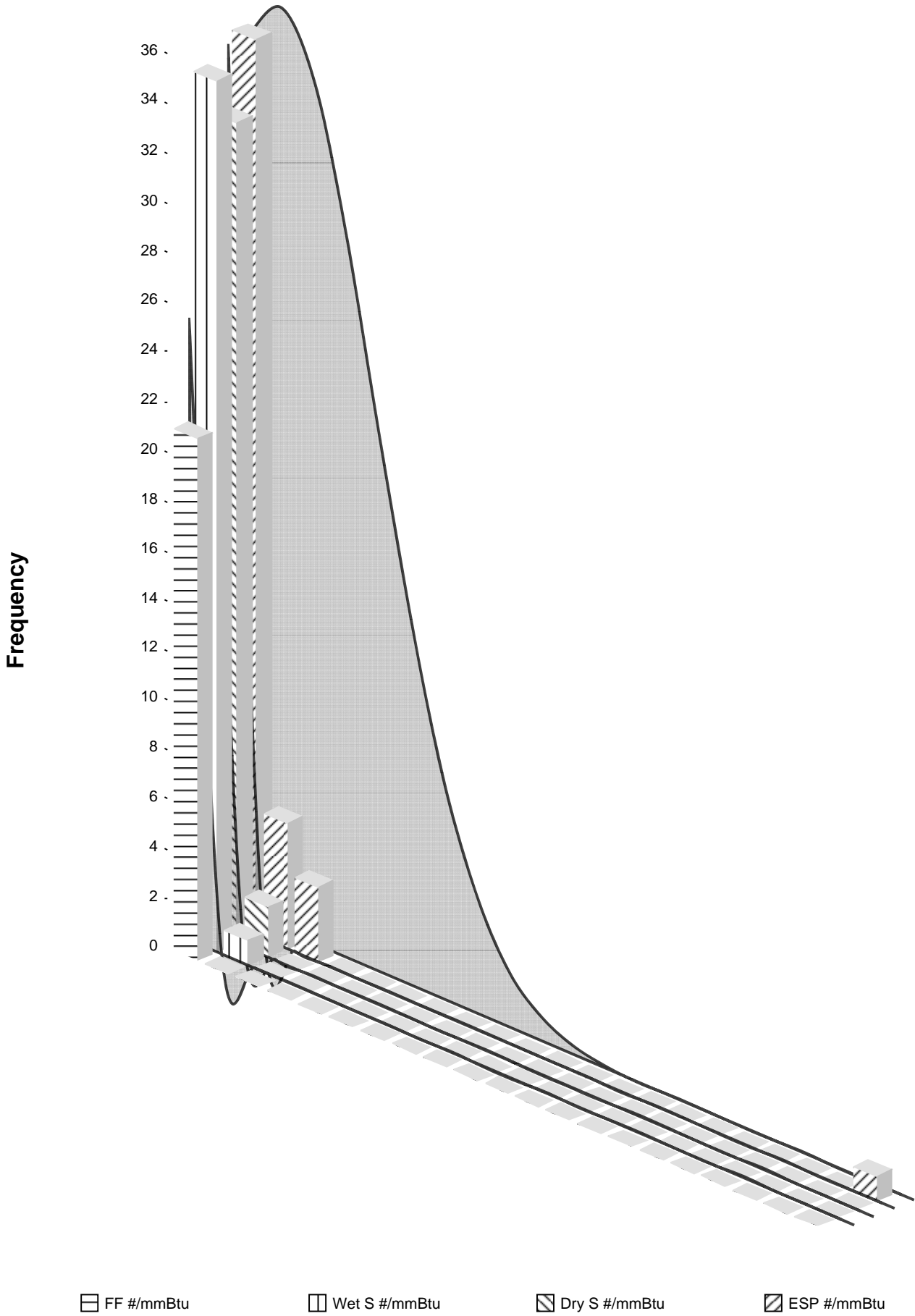
Data Appear Lognormal

Approx. Test Value = 0.957

p-Value = 0.228

Wet S #/mmBtu

Histograms for FF #/mmBtu, Wet S ...



FF #/mmBtu

Wet S #/mmBtu

Dry S #/mmBtu

ESP #/mmBtu

Coal Fired Utility Boiler Beryllium Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Beryllium Emissions Factor are presented on the following page with three sets of columns. The left set of columns contains data from all facilities and presents SCC, Submittal ID, emissions factors, the natural log of the emissions factor and the control measure employed. The middle set of columns contains the same information but excludes the one data set which was identified as a potential outlier. The right set of columns contains the same information but excluding the potential outlier data and boilers with ESP control. The site specific emissions factors presented are as determined using the f factor method rather than the emissions factor determined by dividing the hourly emissions by the coal feed and associated proximate analysis. Subsequent pages provide the assessments as performed using EPA's statistical software ProUCL. The assessments provide support for the development of a separate national emissions factors for ESP, and for combining data for Fabric Filter, Dry Scrubbing and Wet Scrubbing controls. Separate emissions factors were developed since there is a statistical difference between ESP and Fabric Filter controls. A combined factor for Fabric Filter, Dry Scrubbing controls and Wet Scrubbing controls are supported by analyses that show that there is no significant difference in the average emissions factors for these categories.

The resulting calculated arsenic emissions factors are:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP controls	4.16×10^{-7}	43	Highly Representative
Fabric Filter, Dry Scrubbing & Wet Scrubbing controls	1.18×10^{-7}	87	Highly Representative

Beryllium Emissions Test Data

All Data					Data less Potential Outlier					Data less ESP & Potential Outliers				
submittal SCC	lb / ID	LN mmBtuO2	#/mmBtu	Controls	submittal SCC	lb / ID	LN # / mmBtu	Controls	submittal SCC	lb / ID	LN # / mmBtu	Controls		
10100201	902	6.82E-07	-14.1982	ESP	10100201	902	6.82E-07	-14.1982	ESP	10100202	2095	5.17E-08	-16.7778	FF
10100201	903	2.60E-06	-12.86	ESP	10100201	903	2.60E-06	-12.86	ESP	10100202	1597	3.85E-08	-17.0726	FF
10100202	1154	1.37E-07	-15.8033	ESP	10100202	1154	1.37E-07	-15.8033	ESP	10100202	1244	1.67E-07	-15.6077	FF
10100202	1902	4.56E-08	-16.9034	ESP	10100202	1902	4.56E-08	-16.9034	ESP	10100202	1606	4.95E-08	-16.8213	FF
10100202	2276	1.02E-07	-16.0983	ESP	10100202	2276	1.02E-07	-16.0983	ESP	10100202	735	7.50E-08	-16.406	FF
10100202	1636	1.25E-06	-13.5924	ESP	10100202	1636	1.25E-06	-13.5924	ESP	10100202	63254	2.14E-07	-15.3573	FF
10100202	1906	2.95E-07	-15.0363	ESP	10100202	1906	2.95E-07	-15.0363	ESP	10100202	1189	1.07E-08	-18.353	FF
10100202	1845	1.04E-06	-13.7763	ESP	10100202	1845	1.04E-06	-13.7763	ESP	10100202	1190	1.76E-08	-17.8554	FF
10100202	10040002	1.87E-07	-15.4922	ESP	10100202	10040002	1.87E-07	-15.4922	ESP	10100202	1654	1.88E-08	-17.7894	FF
10100202	1004	1.20E-07	-15.9358	ESP	10100202	1004	1.20E-07	-15.9358	ESP	10100202	734	1.34E-07	-15.8245	FF
10100202	2195	3.66E-07	-14.8206	ESP	10100202	2195	3.66E-07	-14.8206	ESP	10100202	736	7.42E-08	-16.4166	FF
10100202	1471	2.39E-07	-15.2468	ESP	10100202	1471	2.39E-07	-15.2468	ESP	10100218	1310	4.84E-07	-14.5412	FF
10100202	993	9.09E-07	-13.9109	ESP	10100202	993	9.09E-07	-13.9109	ESP	10100218	2088	1.37E-07	-15.8033	FF
10100202	979	9.51E-08	-16.1683	ESP	10100202	979	9.51E-08	-16.1683	ESP	10100218	524	6.20E-08	-16.5961	FF
10100202	975	1.17E-06	-13.6585	ESP	10100202	975	1.17E-06	-13.6585	ESP	10100221	2170	5.89E-08	-16.648	FF
10100202	1989	2.68E-07	-15.1323	ESP	10100202	1989	2.68E-07	-15.1323	ESP	10100221	1835	6.60E-08	-16.5335	FF
10100202	2161	4.99E-08	-16.8132	ESP	10100202	2161	4.99E-08	-16.8132	ESP	10100222	1832	1.46E-07	-15.7397	FF
10100203	894	4.98E-08	-16.8153	ESP	10100203	894	4.98E-08	-16.8153	ESP	10100222	1833	1.53E-07	-15.6928	FF
10100203	892	4.96E-07	-14.5167	ESP	10100203	892	4.96E-07	-14.5167	ESP	10100222	1841	3.59E-08	-17.1425	FF
10100203	1809	1.04E-06	-13.7763	ESP	10100203	1809	1.04E-06	-13.7763	ESP	10100222	879456	3.09E-07	-14.9899	FF
10100204	1111	2.22E-06	-13.018	ESP	10100204	1111	2.22E-06	-13.018	ESP	10100222	845	4.24E-08	-16.9761	FF
10100204	1113	2.92E-07	-15.0465	ESP	10100204	1113	2.92E-07	-15.0465	ESP	10100202	1133	3.22E-09	-19.5544	Dry
10100211	1642	2.23E-07	-15.3161	ESP	10100211	1642	2.23E-07	-15.3161	ESP	10100202	1129	2.85E-08	-17.372	Dry
10100212	1021	5.99E-08	-16.63	ESP	10100212	1021	5.99E-08	-16.63	ESP	10100202	1942	2.46E-08	-17.5205	Dry
10100212	3197	3.10E-08	-17.2893	ESP	10100212	3197	3.10E-08	-17.2893	ESP	10100202	1611	5.03E-08	-16.8053	Dry
10100212	2103	2.01E-07	-15.42	ESP	10100212	2103	2.01E-07	-15.42	ESP	10100202	1909	5.89E-08	-16.6474	Dry
10100212	2279	1.64E-08	-17.9267	ESP	10100212	2279	1.64E-08	-17.9267	ESP	10100202	560	1.69E-08	-17.896	Dry
10100212	22791	2.24E-08	-17.6122	ESP	10100212	22791	2.24E-08	-17.6122	ESP	10100202	2021	1.29E-07	-15.8635	Dry
10100212	632	6.57E-07	-14.2356	ESP	10100212	632	6.57E-07	-14.2356	ESP	10100202	1249	1.17E-08	-18.2637	Dry
10100212	731	9.20E-08	-16.201	ESP	10100212	731	9.20E-08	-16.201	ESP	10100202	1563	9.26E-08	-16.195	Dry
10100222	2013	3.24E-07	-14.9425	ESP	10100222	2013	3.24E-07	-14.9425	ESP	10100202	1488	4.39E-09	-19.2439	Dry
10100222	2011	1.87E-07	-15.4922	ESP	10100222	2011	1.87E-07	-15.4922	ESP	10100202	1507	5.56E-08	-16.7051	Dry
10100222	21351	2.87E-07	-15.0638	ESP	10100222	21351	2.87E-07	-15.0638	ESP	10100202	550002	2.00E-06	-13.1224	Dry
10100222	2135	2.65E-07	-15.1435	ESP	10100222	2135	2.65E-07	-15.1435	ESP	10100202	8761	6.02E-08	-16.6256	Dry
10100222	2274	5.62E-08	-16.6943	ESP	10100222	2274	5.62E-08	-16.6943	ESP	10100202	8761	1.57E-08	-17.9696	Dry
10100222	1854	1.65E-09	-20.2225	ESP	10100222	10040004	3.18E-08	-17.2638	ESP	10100202	947	1.11E-08	-18.3163	Dry
10100222	10040004	3.18E-08	-17.2638	ESP	10100223	2009	2.35E-07	-15.2637	ESP	10100202	698	9.78E-08	-16.1403	Dry
10100223	2009	2.35E-07	-15.2637	ESP	10100223	2302	6.87E-08	-16.4935	ESP	10100202	2022	7.67E-07	-14.0808	Dry

Beryllium Emissions Test Data

All Data					Data less Potential Outlier					Data less ESP & Potential Outliers				
submittal SCC	lb / ID	LN #/mmBtu	Controls		submittal SCC	lb / ID	LN # / mmBtu	Controls		submittal SCC	lb / ID	LN # / mmBtu	Controls	
10100223	2302	6.87E-08	-16.4935	ESP	10100223	2070	2.02E-08	-17.7176	ESP	10100203	1735	1.04E-07	-16.0765	Dry
10100223	2070	2.02E-08	-17.7176	ESP	10100223	828	8.88E-07	-13.9343	ESP	10100203	1734	1.66E-07	-15.6083	Dry
10100223	828	8.88E-07	-13.9343	ESP	10100223	12861	2.41E-07	-15.2385	ESP	10100203	1052	2.04E-08	-17.7077	Dry
10100223	12861	2.41E-07	-15.2385	ESP	10100226	1141	2.44E-07	-15.2261	ESP	10100205	1349	1.59E-08	-17.9569	Dry
10100226	1141	2.44E-07	-15.2261	ESP	10100226	2278	8.28E-08	-16.3068	ESP	10100205	1346	1.55E-07	-15.6798	Dry
10100226	2278	8.28E-08	-16.3068	ESP	10100202	2095	5.17E-08	-16.7778	FF	10100205	13461	8.96E-08	-16.2279	Dry
10100202	2095	5.17E-08	-16.7778	FF	10100202	1597	3.85E-08	-17.0726	FF	10100205	134611	3.95E-07	-14.7444	Dry
10100202	1597	3.85E-08	-17.0726	FF	10100202	1244	1.67E-07	-15.6077	FF	10100205	1346111	1.78E-07	-15.5415	Dry
10100202	1244	1.67E-07	-15.6077	FF	10100202	1606	4.95E-08	-16.8213	FF	10100212	565	1.49E-08	-18.0219	Dry
10100202	1606	4.95E-08	-16.8213	FF	10100202	735	7.50E-08	-16.406	FF	10100218	1563	7.76E-08	-16.3717	Dry
10100202	735	7.50E-08	-16.406	FF	10100202	63254	2.14E-07	-15.3573	FF	10100218	1563	8.46E-08	-16.2853	Dry
10100202	63254	2.14E-07	-15.3573	FF	10100202	1189	1.07E-08	-18.353	FF	10100222	1568	4.85E-08	-16.8417	Dry
10100202	1189	1.07E-08	-18.353	FF	10100202	1190	1.76E-08	-17.8554	FF	10100222	1449	3.07E-08	-17.299	Dry
10100202	1190	1.76E-08	-17.8554	FF	10100202	1654	1.88E-08	-17.7894	FF	10100222	1726	3.28E-08	-17.2328	Dry
10100202	1654	1.88E-08	-17.7894	FF	10100202	734	1.34E-07	-15.8245	FF	10100222	2206	4.54E-09	-19.2103	Dry
10100202	734	1.34E-07	-15.8245	FF	10100202	736	7.42E-08	-16.4166	FF	10100226	1398	7.41E-08	-16.4179	Dry
10100202	736	7.42E-08	-16.4166	FF	10100218	1310	4.84E-07	-14.5412	FF	10100226	1938	7.99E-08	-16.3421	Dry
10100218	1310	4.84E-07	-14.5412	FF	10100218	2088	1.37E-07	-15.8033	FF	10100201	2319	4.14E-08	-17	Wet
10100218	2088	1.37E-07	-15.8033	FF	10100218	524	6.20E-08	-16.5961	FF	10100202	1176	1.51E-07	-15.706	Wet
10100218	524	6.20E-08	-16.5961	FF	10100221	2170	5.89E-08	-16.648	FF	10100202	1972	6.16E-09	-18.9052	Wet
10100221	2170	5.89E-08	-16.648	FF	10100221	1835	6.60E-08	-16.5335	FF	10100202	1915	1.78E-08	-17.8441	Wet
10100221	1835	6.60E-08	-16.5335	FF	10100222	1832	1.46E-07	-15.7397	FF	10100202	1117	1.45E-08	-18.0491	Wet
10100222	1832	1.46E-07	-15.7397	FF	10100222	1833	1.53E-07	-15.6928	FF	10100202	1118	9.45E-09	-18.4773	Wet
10100222	1833	1.53E-07	-15.6928	FF	10100222	1841	3.59E-08	-17.1425	FF	10100202	1119	1.01E-08	-18.4107	Wet
10100222	1841	3.59E-08	-17.1425	FF	10100222	879456	3.09E-07	-14.9899	FF	10100202	2239	1.57E-08	-17.9696	Wet
10100222	879456	3.09E-07	-14.9899	FF	10100222	845	4.24E-08	-16.9761	FF	10100202	1330	1.51E-07	-15.706	Wet
10100222	845	4.24E-08	-16.9761	FF	10100202	1133	3.22E-09	-19.5544	Dry	10100202	1117	1.45E-08	-18.0491	Wet
10100202	1133	3.22E-09	-19.5544	Dry	10100202	1129	2.85E-08	-17.372	Dry	10100202	1637	4.31E-08	-16.9597	Wet
10100202	1129	2.85E-08	-17.372	Dry	10100202	1942	2.46E-08	-17.5205	Dry	10100202	1638	4.33E-08	-16.9551	Wet
10100202	1942	2.46E-08	-17.5205	Dry	10100202	1611	5.03E-08	-16.8053	Dry	10100202	1826	2.04E-07	-15.4051	Wet
10100202	1611	5.03E-08	-16.8053	Dry	10100202	1909	5.89E-08	-16.6474	Dry	10100202	2055	4.38E-08	-16.9436	Wet
10100202	1909	5.89E-08	-16.6474	Dry	10100202	560	1.69E-08	-17.896	Dry	10100202	18261	2.87E-07	-15.0638	Wet
10100202	560	1.69E-08	-17.896	Dry	10100202	2021	1.29E-07	-15.8635	Dry	10100202	966	4.88E-07	-14.533	Wet
10100202	2021	1.29E-07	-15.8635	Dry	10100202	1249	1.17E-08	-18.2637	Dry	10100202	1738	1.94E-08	-17.758	Wet
10100202	1249	1.17E-08	-18.2637	Dry	10100202	1563	9.26E-08	-16.195	Dry	10100202	1743	2.92E-08	-17.3491	Wet
10100202	1563	9.26E-08	-16.195	Dry	10100202	1488	4.39E-09	-19.2439	Dry	10100202	1185	1.62E-07	-15.6357	Wet
10100202	1488	4.39E-09	-19.2439	Dry	10100202	1507	5.56E-08	-16.7051	Dry	10100202	1187	1.42E-07	-15.7674	Wet
10100202	1507	5.56E-08	-16.7051	Dry	10100202	550002	2.00E-06	-13.1224	Dry	10100202	1515	6.16E-08	-16.6026	Wet

Outlier Tests for Selected Variables

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for LN #/mmBtu (dry)

Mean -16.82

Standard Deviation 1.394

Number of data 34

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-16.82	1.373	-13.12	12	2.693	2.97	3.3
2	-16.93	1.25	-14.08	17	2.281	2.95	3.29
3	-17.02	1.159	-19.55	1	2.186	2.94	3.27
4	-16.94	1.08	-19.24	10	2.133	2.91	3.25
5	-16.86	1.009	-19.21	32	2.327	2.91	3.24

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for LN #/mmBtu (esp)

Mean -15.55

Standard Deviation 1.466

Number of data 44

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-15.55	1.449	-20.22	36	3.224	3.08	3.43
2	-15.44	1.292	-12.86	2	1.999	3.07	3.41
3	-15.5	1.242	-13.02	21	2.002	3.06	3.4
4	-15.56	1.193	-17.93	27	1.98	3.05	3.39
5	-15.51	1.146	-17.72	40	1.931	3.04	3.38

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation -20.22 is a Potential Statistical Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for LN #/mmBtu (ff)

Number of data = 21

10% critical value: 0.391

5% critical value: 0.44

1% critical value: 0.524

1. Data Value -14.54118093 is a Potential Outlier (Upper

Test Statistic: 0.251

For 10% significance level, -14.54118093 is not an outlier.

For 5% significance level, -14.54118093 is not an outlier.

For 1% significance level, -14.54118093 is not an outlier.

2. Data Value -18.3530221 is a Potential Outlier (Lower

Test Statistic: 0.188

For 10% significance level, -18.3530221 is not an outlier.

For 5% significance level, -18.3530221 is not an outlier.

For 1% significance level, -18.3530221 is not an outlier.

Rosner's Outlier Test for LN #/mmBtu (wet)

Mean -16.91

Standard Deviation 1.267

Number of data 32

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-16.91	1.247	-14.53	16	1.908	2.94	3.27
2	-16.99	1.21	-19.29	24	1.9	2.92	3.25
3	-16.91	1.151	-18.91	3	1.732	2.91	3.24
4	-16.84	1.107	-15.06	15	1.607	2.89	3.22
5	-16.91	1.072	-15.13	28	1.655	2.88	3.2

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: trim lb/mmBtuO2(esp)

Background Data: trim lb/mmBtuO2(ff)

Raw Statistics

	ESP	Fabric Filter
Number of Valid Observations	43	21
Number of Distinct Observations	41	21
Minimum	1.6400E-8	1.0700E-8
Maximum	2.6000E-6	4.8400E-7
Mean	4.1597E-7	1.1168E-7
Median	2.3500E-7	6.6000E-8
SD	5.6094E-7	1.1319E-7
SE of Mean	8.5543E-8	2.4700E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	62	2.452	1.670	0.009
Welch-Satterthwaite (Unequal Variance)	48.6	3.418	1.677	0.001

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	3.147E-13		
Variance of Background	1.281E-14		
Numerator DF	Denominator DF	F-Test Value	P-Value
42	20	24.559	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: trim lb/mmBtuO2(ff)

Background Data: trim lb/mmBtuO2(dry)

Raw Statistics

	Fabric Filte	Dry Scrubber
Number of Valid Observations	21	34
Number of Distinct Observations	21	34
Minimum	1.0700E-8	3.2200E-9
Maximum	4.8400E-7	2.0000E-6
Mean	1.1168E-7	1.4703E-7
Median	6.6000E-8	5.7250E-8
SD	1.1319E-7	3.5639E-7
SE of Mean	2.4700E-8	6.1121E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	53	-0.440	1.674	0.669
Welch-Satterthwaite (Unequal Variance)	42.8	-0.536	1.681	0.703

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.281E-14		
Variance of Background	1.270E-13		
Numerator DF	Denominator DF	F-Test Value	P-Value
33	20	9.914	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: trim lb/mmBtuO2(dry)

Background Data: trim lb/mmBtuO2(ff)

Raw Statistics

	Dry Scrubber	Fabric Filter
Number of Valid Observations	34	21
Number of Distinct Observations	34	21
Minimum	3.2200E-9	1.0700E-8
Maximum	2.0000E-6	4.8400E-7
Mean	1.4703E-7	1.1168E-7
Median	5.7250E-8	6.6000E-8
SD	3.5639E-7	1.1319E-7
SE of Mean	6.1121E-8	2.4700E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	53	0.440	1.674	0.331
Welch-Satterthwaite (Unequal Variance)	42.8	0.536	1.681	0.297

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.270E-13		
Variance of Background	1.281E-14		
Numerator DF	Denominator DF	F-Test Value	P-Value
33	20	9.914	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: trim lb/mmBtuO2(ff)

Background Data: trim lb/mmBtuO2(wet)

Raw Statistics

	Fabric Filte	Wet Scrubber
Number of Valid Observations	21	32
Number of Distinct Observations	21	30
Minimum	1.0700E-8	4.2100E-9
Maximum	4.8400E-7	4.8800E-7
Mean	1.1168E-7	9.0455E-8
Median	6.6000E-8	4.3550E-8
SD	1.1319E-7	1.0783E-7
SE of Mean	2.4700E-8	1.9062E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	51	0.687	1.675	0.248
Welch-Satterthwaite (Unequal Variance)	41.4	0.680	1.683	0.250

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.281E-14		
Variance of Background	1.163E-14		
Numerator DF	Denominator DF	F-Test Value	P-Value
20	31	1.102	0.789

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Confidence Coefficient 95%

Substantial Difference (S) 0.000

Selected Null Hypothesis Site or AOC Mean Less Than or Equal to Background Mean (Form 1)

Alternative Hypothesis Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: trim lb/mmBtuO2(wet)

Background Data: trim lb/mmBtuO2(ff)

Raw Statistics

	Wet Scrubber	Fabric Filter
Number of Valid Observations	32	21
Number of Distinct Observations	30	21
Minimum	4.2100E-9	1.0700E-8
Maximum	4.8800E-7	4.8400E-7
Mean	9.0455E-8	1.1168E-7
Median	4.3550E-8	6.6000E-8
SD	1.0783E-7	1.1319E-7
SE of Mean	1.9062E-8	2.4700E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	51	-0.687	1.675	0.752
Welch-Satterthwaite (Unequal Variance)	41.4	-0.680	1.683	0.750

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

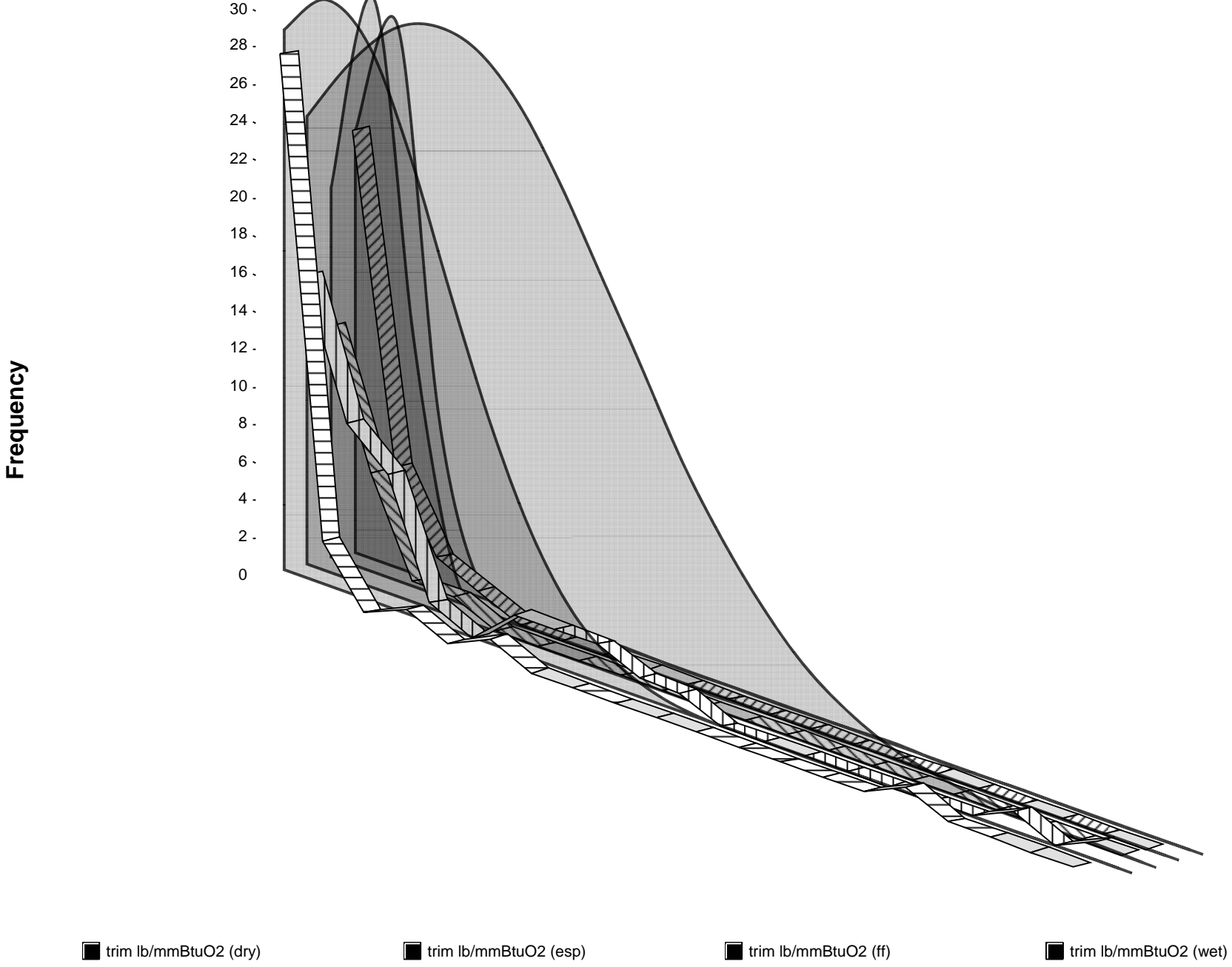
Variance of Site	1.163E-14
Variance of Background	1.281E-14

Numerator DF	Denominator DF	F-Test Value	P-Value
20	31	1.102	0.789

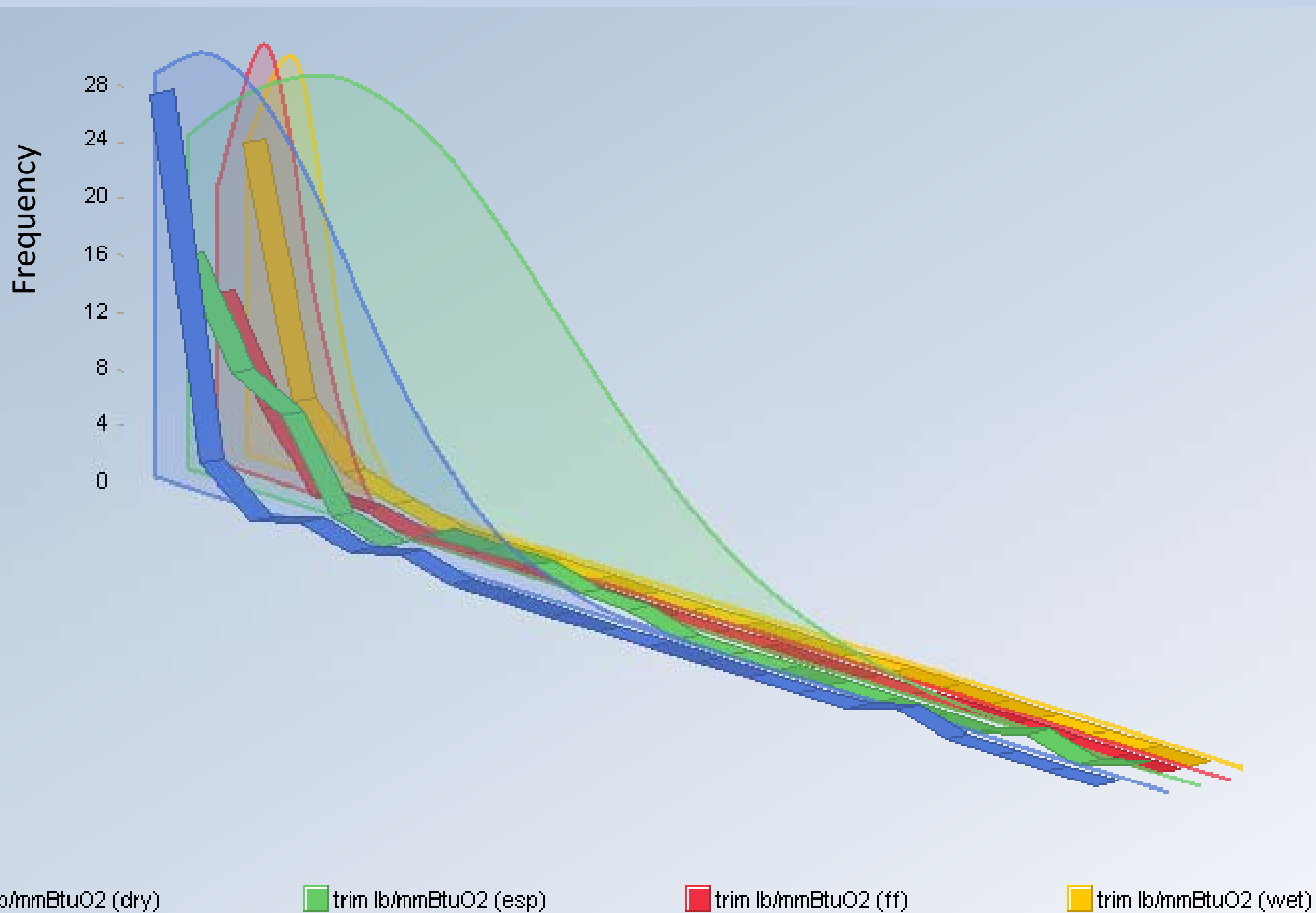
Conclusion with Alpha = 0.05

* Two variances appear to be equal

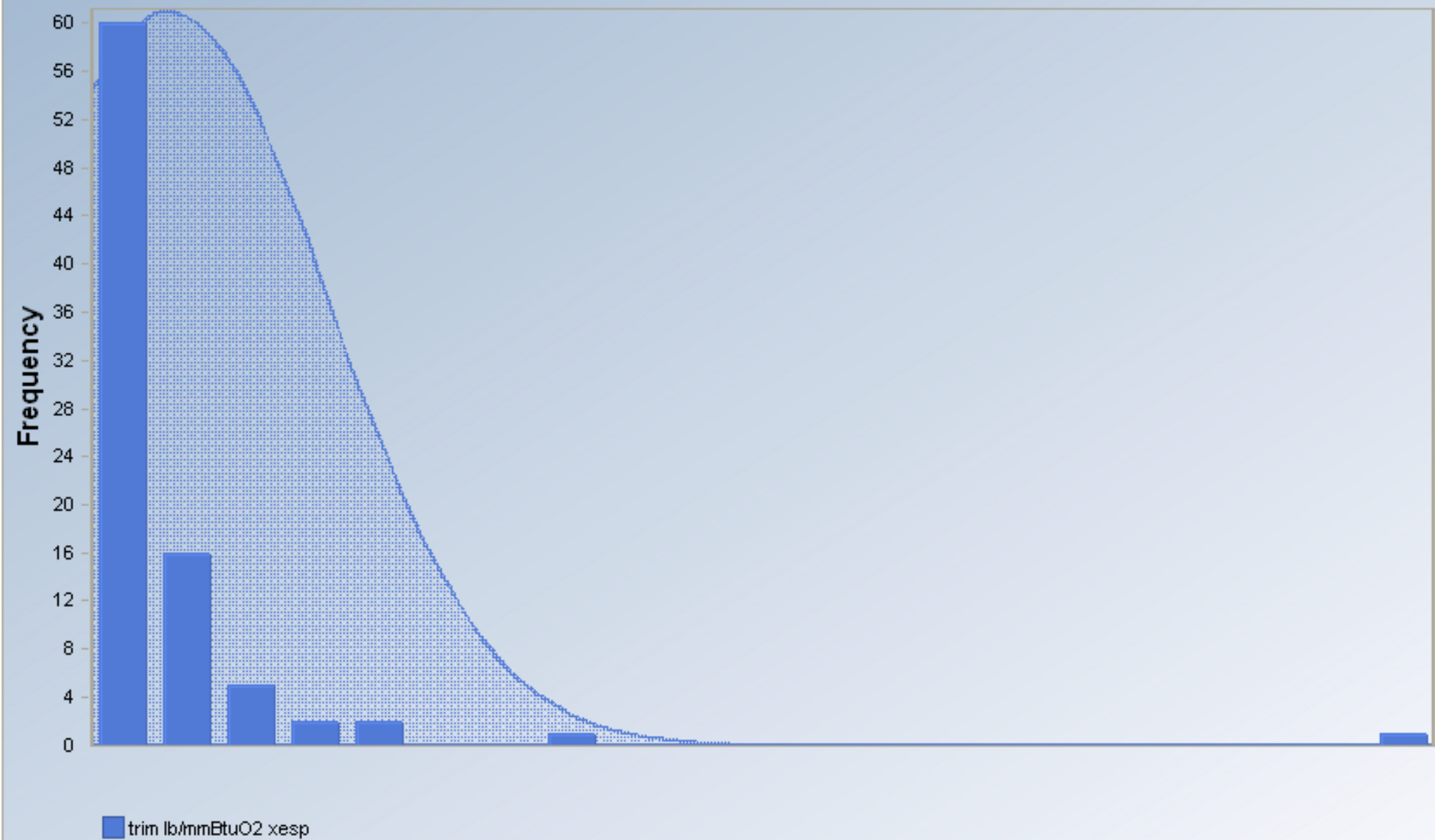
Histograms for trim lb/mmBtuO2 (dry), ...



Histogram of Beryllium Test Data



Histogram for Beryllium Data (FF, Dry Scrubber & Wet Scrubber)



Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
trim lb/mmBtuO2 (dry)	34	3.2200E-9	2.0000E-6	1.4703E-7	5.7250E-8	1.270E-13	3.5639E-7	5.9970E-8	4.679	23.62	N/A
trim lb/mmBtuO2 (esp)	43	1.6400E-8	2.6000E-6	4.1597E-7	2.3500E-7	3.147E-13	5.6094E-7	2.4655E-7	2.433	6.446	N/A
trim lb/mmBtuO2 (ff)	21	1.0700E-8	4.8400E-7	1.1168E-7	6.6000E-8	1.281E-14	1.1319E-7	6.9978E-8	2.131	5.235	N/A
trim lb/mmBtuO2 (wet)	32	4.2100E-9	4.8800E-7	9.0455E-8	4.3550E-8	1.163E-14	1.0783E-7	4.8184E-8	2.018	4.899	N/A

Percentiles for Raw Full Data Sets

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
trim lb/mmBtuO2 (dry)	34	4.4875E-9	1.1280E-8	1.5820E-8	1.7775E-8	5.7250E-8	9.6500E-8	1.1400E-7	1.7440E-7	5.2520E-7	1.5931E-6
trim lb/mmBtuO2 (esp)	43	2.3260E-8	3.4560E-8	5.7680E-8	7.5750E-8	2.3500E-7	4.3100E-7	6.7200E-7	1.0400E-6	1.2420E-6	2.4404E-6
trim lb/mmBtuO2 (ff)	21	1.7600E-8	1.8800E-8	3.8500E-8	4.2400E-8	6.6000E-8	1.4600E-7	1.5300E-7	2.1400E-7	3.0900E-7	4.4900E-7
trim lb/mmBtuO2 (wet)	32	7.9695E-9	9.6050E-9	1.4500E-8	1.5400E-8	4.3550E-8	1.4425E-7	1.5100E-7	2.0580E-7	2.7655E-7	4.2569E-7

Summary Statistics for Raw Full Dataset

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
trim lb/mmBtuO2 xesp	87	3.2200E-9	2.0000E-6	1.1769E-7	5.8900E-8	5.653E-14	2.3777E-7	6.4047E-8	6.236	46.75	N/A

Percentiles for Raw Full Dataset

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
trim lb/mmBtuO2 xesp	87	7.1470E-9	1.0940E-8	1.6100E-8	1.8650E-8	5.8900E-8	1.3550E-7	1.5100E-7	2.0920E-7	3.6920E-7	9.3962E-7

Coal Fired Utility Boiler Cadmium Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Cadmium Emissions Factor are presented on the following page with two sets of columns. The left set of columns contains data from all facilities and presents SCC, Submittal ID, emissions factors, the natural log of the emissions factor and the control measure employed. The right set of columns contains the same information but excluding boilers with ESP control. The site specific emissions factors presented are as determined using the f factor method rather than the emissions factor determined by dividing the hourly emissions by the coal feed and associated proximate analysis. Subsequent pages provide the assessments as performed using EPA's statistical software ProUCL. The assessments provide support for the development of a separate national emissions factors for ESP, and for combining data for Fabric Filter, Dry Scrubbing and Wet Scrubbing controls. Separate emissions factors were developed since there is a statistical difference between ESP and Fabric Filter controls. A combined factor for Fabric Filter, Dry Scrubbing controls and Wet Scrubbing controls are supported by analyses that show that there is no significant difference in the average emissions factors for these categories.

The resulting calculated cadmium emissions factors are:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP controls	3.81×10^{-7}	44	Highly Representative
Fabric Filter, Dry Scrubbing & Wet Scrubbing controls	2.20×10^{-7}	91	Highly Representative

Cadmium Test Data

All Data					FF, Dry Scrubbed & Wet Scrubbed				
submittal	lb/mmBtu	LN			submittal	lb/mmBtu	LN		
SCC	ID	O2	#/mmBtu	Controlls	SCC	ID	O2	#/mmBtu	Controlls
10100226	1938	2.48E-07	-15.2112	Dry	10100226	1938	2.48E-07	-15.2112	Dry
10100222	1726	3.28E-08	-17.2328	Dry	10100222	1726	3.28E-08	-17.2328	Dry
10100202	550002	7.95E-07	-14.0449	Dry	10100202	550002	7.95E-07	-14.0449	Dry
10100203	1735	1.56E-07	-15.6754	Dry	10100203	1735	1.56E-07	-15.6754	Dry
10100203	1734	2.20E-07	-15.3274	Dry	10100203	1734	2.20E-07	-15.3274	Dry
10100226	1398	3.58E-07	-14.8427	Dry	10100226	1398	3.58E-07	-14.8427	Dry
10100202	1909	3.53E-07	-14.8568	Dry	10100202	1909	3.53E-07	-14.8568	Dry
10100205	1349	6.60E-08	-16.5336	Dry	10100205	1349	6.60E-08	-16.5336	Dry
10100222	1568	4.16E-07	-14.6926	Dry	10100222	1568	4.16E-07	-14.6926	Dry
10100202	1611	2.73E-08	-17.4164	Dry	10100202	1611	2.73E-08	-17.4164	Dry
10100202	1563	1.06E-07	-16.0598	Dry	10100202	1563	1.06E-07	-16.0598	Dry
10100218	1563	7.81E-08	-16.3653	Dry	10100218	1563	7.81E-08	-16.3653	Dry
10100218	1563	1.07E-07	-16.0504	Dry	10100218	1563	1.07E-07	-16.0504	Dry
10100205	1346	6.57E-08	-16.5382	Dry	10100205	1346	6.57E-08	-16.5382	Dry
10100202	1133	7.86E-08	-16.3592	Dry	10100202	1133	7.86E-08	-16.3592	Dry
10100202	1129	1.17E-07	-15.9582	Dry	10100202	1129	1.17E-07	-15.9582	Dry
10100222	2206	2.48E-08	-17.5124	Dry	10100222	2206	2.48E-08	-17.5124	Dry
10100202	1942	9.07E-07	-13.9131	Dry	10100202	1942	9.07E-07	-13.9131	Dry
10100205	13461	6.02E-08	-16.6256	Dry	10100205	13461	6.02E-08	-16.6256	Dry
10100205	134611	1.15E-07	-15.9783	Dry	10100205	134611	1.15E-07	-15.9783	Dry
10100205	1346111	7.18E-08	-16.4494	Dry	10100205	1346111	7.18E-08	-16.4494	Dry
10100202	1488	4.65E-08	-16.8838	Dry	10100202	1488	4.65E-08	-16.8838	Dry
10100202	1507	1.85E-07	-15.5029	Dry	10100202	1507	1.85E-07	-15.5029	Dry
10100222	1449	8.54E-08	-16.2759	Dry	10100222	1449	8.54E-08	-16.2759	Dry
10100202	560	8.11E-07	-14.025	Dry	10100202	560	8.11E-07	-14.025	Dry
10100212	565	3.28E-07	-14.9303	Dry	10100212	565	3.28E-07	-14.9303	Dry
10100202	8761	1.75E-06	-13.2559	Dry	10100202	8761	1.75E-06	-13.2559	Dry
10100202	8761	1.06E-07	-16.0598	Dry	10100202	8761	1.06E-07	-16.0598	Dry
10100202	947	8.02E-08	-16.3387	Dry	10100202	947	8.02E-08	-16.3387	Dry
10100202	1249	5.39E-08	-16.7361	Dry	10100202	1249	5.39E-08	-16.7361	Dry
10100202	698	2.05E-07	-15.4003	Dry	10100202	698	2.05E-07	-15.4003	Dry
10100202	2022	4.79E-07	-14.5516	Dry	10100202	2022	4.79E-07	-14.5516	Dry
10100203	1052	1.42E-07	-15.7674	Dry	10100203	1052	1.42E-07	-15.7674	Dry
10100202	2021	2.29E-07	-15.2895	Dry	10100202	2021	2.29E-07	-15.2895	Dry
10100202	1176	1.52E-07	-15.6994	Wet	10100202	1176	1.52E-07	-15.6994	Wet
10100224	1120	2.44E-07	-15.2261	Wet	10100224	1120	2.44E-07	-15.2261	Wet
10100202	1117	1.12E-07	-16.0048	Wet	10100202	1117	1.12E-07	-16.0048	Wet
10100202	1118	4.37E-08	-16.9459	Wet	10100202	1118	4.37E-08	-16.9459	Wet
10100202	1119	7.84E-08	-16.3614	Wet	10100202	1119	7.84E-08	-16.3614	Wet
10100202	1915	4.91E-08	-16.8294	Wet	10100202	1915	4.91E-08	-16.8294	Wet
10100202	1738	1.46E-07	-15.7397	Wet	10100202	1738	1.46E-07	-15.7397	Wet
10100202	1743	5.23E-08	-16.7663	Wet	10100202	1743	5.23E-08	-16.7663	Wet
10100202	2239	6.35E-08	-16.5722	Wet	10100202	2239	6.35E-08	-16.5722	Wet
10100202	1826	1.88E-07	-15.4868	Wet	10100202	1826	1.88E-07	-15.4868	Wet
10100202	18261	1.84E-07	-15.5083	Wet	10100202	18261	1.84E-07	-15.5083	Wet
10100202	1117	1.12E-07	-16.0048	Wet	10100202	1117	1.12E-07	-16.0048	Wet
10100212	1177	3.34E-07	-14.9121	Wet	10100212	1177	3.34E-07	-14.9121	Wet
10100202	1330	4.89E-07	-14.5309	Wet	10100202	1330	4.89E-07	-14.5309	Wet

Cadmium Test Data

All Data					FF, Dry Scrubbed & Wet Scrubbed				
submittal	lb/mmBtu	LN			submittal	lb/mmBtu	LN		
SCC	ID	O2	#/mmBtu	Controlls	SCC	ID	O2	#/mmBtu	Controlls
10100202	1637	4.04E-07	-14.7219	Wet	10100202	1637	4.04E-07	-14.7219	Wet
10100202	1638	1.29E-07	-15.8635	Wet	10100202	1638	1.29E-07	-15.8635	Wet
10100202	966	3.15E-07	-14.9707	Wet	10100202	966	3.15E-07	-14.9707	Wet
10100202	2055	3.17E-07	-14.9644	Wet	10100202	2055	3.17E-07	-14.9644	Wet
10100211	900	8.97E-08	-16.2268	Wet	10100211	900	8.97E-08	-16.2268	Wet
10100202	1185	4.89E-07	-14.5309	Wet	10100202	1185	4.89E-07	-14.5309	Wet
10100202	1187	2.51E-07	-15.1978	Wet	10100202	1187	2.51E-07	-15.1978	Wet
10300222	1276	8.39E-08	-16.2936	Wet	10300222	1276	8.39E-08	-16.2936	Wet
10100212	1647	1.99E-08	-17.7325	Wet	10100212	1647	1.99E-08	-17.7325	Wet
10100212	1648	1.79E-08	-17.8385	Wet	10100212	1648	1.79E-08	-17.8385	Wet
10100202	1972	1.98E-08	-17.7376	Wet	10100202	1972	1.98E-08	-17.7376	Wet
10100202	541	1.24E-07	-15.903	Wet	10100202	541	1.24E-07	-15.903	Wet
10100223	23151	8.50E-08	-16.2806	Wet	10100223	23151	8.50E-08	-16.2806	Wet
10100223	23152	1.07E-07	-16.0504	Wet	10100223	23152	1.07E-07	-16.0504	Wet
10100223	23153	2.95E-07	-15.0363	Wet	10100223	23153	2.95E-07	-15.0363	Wet
10100223	2315	2.40E-07	-15.2426	Wet	10100223	2315	2.40E-07	-15.2426	Wet
10100201	2319	7.36E-08	-16.4246	Wet	10100201	2319	7.36E-08	-16.4246	Wet
10100222	2259	8.75E-08	-16.2516	Wet	10100222	2259	8.75E-08	-16.2516	Wet
10100223	1307	2.22E-07	-15.3206	Wet	10100223	1307	2.22E-07	-15.3206	Wet
10100223	1327	1.18E-07	-15.9526	Wet	10100223	1327	1.18E-07	-15.9526	Wet
10100202	1515	2.28E-07	-15.2939	Wet	10100202	1515	2.28E-07	-15.2939	Wet
10100226	1558	5.71E-07	-14.3759	Wet	10100226	1558	5.71E-07	-14.3759	Wet
10100222	1841	9.80E-08	-16.1383	FF	10100222	1841	9.80E-08	-16.1383	FF
10100222	879456	2.73E-07	-15.1138	FF	10100222	879456	2.73E-07	-15.1138	FF
10100202	2095	1.52E-07	-15.6994	FF	10100202	2095	1.52E-07	-15.6994	FF
10100202	1597	1.93E-08	-17.7632	FF	10100202	1597	1.93E-08	-17.7632	FF
10100202	1606	3.62E-08	-17.1342	FF	10100202	1606	3.62E-08	-17.1342	FF
10100202	1244	4.90E-07	-14.5281	FF	10100202	1244	4.90E-07	-14.5281	FF
10100222	1832	1.54E-07	-15.6863	FF	10100222	1832	1.54E-07	-15.6863	FF
10100222	1833	1.63E-07	-15.6295	FF	10100222	1833	1.63E-07	-15.6295	FF
10100202	1189	6.75E-08	-16.5111	FF	10100202	1189	6.75E-08	-16.5111	FF
10100202	1190	2.28E-07	-15.2939	FF	10100202	1190	2.28E-07	-15.2939	FF
10100202	735	1.03E-07	-16.0858	FF	10100202	735	1.03E-07	-16.0858	FF
10100218	2088	1.62E-07	-15.6357	FF	10100218	2088	1.62E-07	-15.6357	FF
10100222	845	8.19E-08	-16.3178	FF	10100222	845	8.19E-08	-16.3178	FF
10100218	1310	1.69E-07	-15.5934	FF	10100218	1310	1.69E-07	-15.5934	FF
10100202	63254	4.44E-07	-14.6274	FF	10100202	63254	4.44E-07	-14.6274	FF
10100221	2170	4.17E-07	-14.6905	FF	10100221	2170	4.17E-07	-14.6905	FF
10100221	1835	4.80E-07	-14.5489	FF	10100221	1835	4.80E-07	-14.5489	FF
10100202	1654	1.49E-07	-15.7193	FF	10100202	1654	1.49E-07	-15.7193	FF
10100218	524	2.39E-07	-15.2468	FF	10100218	524	2.39E-07	-15.2468	FF
10100202	734	5.50E-07	-14.4134	FF	10100202	734	5.50E-07	-14.4134	FF
10100202	736	7.42E-08	-16.4166	FF	10100202	736	7.42E-08	-16.4166	FF
10100223	2009	5.57E-07	-14.4007	ESP					
10100226	1141	3.93E-07	-14.7495	ESP					
10100202	1154	1.70E-07	-15.5875	ESP					
10100212	1021	2.67E-07	-15.1377	ESP					
10100202	993	3.17E-07	-14.9644	ESP					

Cadmium Test Data

All Data					FF, Dry Scrubbed & Wet Scrubbed				
SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controlls	SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controlls
10100202	1902	1.39E-07	-15.7888	ESP					
10100204	1111	1.45E-06	-13.4439	ESP					
10100204	1113	1.55E-06	-13.3773	ESP					
10100222	21351	1.84E-07	-15.5083	ESP					
10100222	2135	5.99E-07	-14.328	ESP					
10100212	3197	8.56E-08	-16.2736	ESP					
10100202	975	4.06E-07	-14.7169	ESP					
10100202	1471	2.66E-07	-15.1398	ESP					
10100202	1845	1.03E-06	-13.786	ESP					
10100222	1854	8.72E-08	-16.2551	ESP					
10100202	1636	1.87E-07	-15.4922	ESP					
10100203	894	8.87E-08	-16.238	ESP					
10100222	2274	7.06E-07	-14.1637	ESP					
10100202	2276	2.90E-07	-15.0534	ESP					
10100223	2070	9.12E-08	-16.2102	ESP					
10100203	892	4.72E-07	-14.5663	ESP					
10100223	828	2.14E-07	-15.3573	ESP					
10100222	2013	4.17E-07	-14.6902	ESP					
10100222	2011	1.93E-07	-15.4606	ESP					
10100223	12861	2.40E-07	-15.2426	ESP					
10100202	1989	2.83E-07	-15.0778	ESP					
10100212	2103	2.94E-07	-15.0397	ESP					
10100202	2195	3.66E-07	-14.8206	ESP					
10100202	2161	3.49E-08	-17.1708	ESP					
10100211	1642	2.63E-07	-15.1511	ESP					
10100203	1809	9.54E-07	-13.8626	ESP					
10100202	979	7.93E-08	-16.35	ESP					
10100201	902	4.93E-07	-14.5228	ESP					
10100201	903	1.36E-06	-13.508	ESP					
10100202	1004	1.19E-07	-15.9441	ESP					
10100212	2279	1.70E-08	-17.8916	ESP					
10100212	22791	6.95E-08	-16.4823	ESP					
10100226	2278	7.72E-07	-14.0743	ESP					
10100202	10040002	7.60E-08	-16.3925	ESP					
10100223	2302	1.85E-07	-15.5029	ESP					
10100222	10040004	7.84E-08	-16.3614	ESP					
10100202	1906	3.45E-07	-14.8797	ESP					
10100212	632	3.69E-07	-14.8125	ESP					
10100212	731	2.13E-07	-15.3625	ESP					

Outlier Tests for Selected Variables

User Selected Options

From File C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\E

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for LN #/mmBtu (dry)

Mean -15.73

Standard Deviation 1.041

Number of data 34

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-15.73	1.025	-13.26	27	2.408	2.97	3.3
2	-15.8	0.96	-13.91	18	1.966	2.95	3.29
3	-15.86	0.912	-14.02	25	2.01	2.94	3.27
4	-15.92	0.863	-14.04	3	2.171	2.91	3.25
5	-15.98	0.803	-17.51	17	1.907	2.91	3.24

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for LN #/mmBtu (esp)

Mean -15.21

Standard Deviation 0.983

Number of data 44

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-15.21	0.972	-17.89	36	2.762	3.08	3.43
2	-15.15	0.902	-17.17	29	2.245	3.07	3.41
3	-15.1	0.855	-13.38	8	2.011	3.06	3.4
4	-15.14	0.821	-13.44	7	2.065	3.05	3.39
5	-15.18	0.785	-13.51	34	2.133	3.04	3.38

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for LN #/mmBtu (ff)

Number of data = 21

10% critical value: 0.391

5% critical value: 0.44

1% critical value: 0.524

1. Data Value -14.41342565 is a Potential Outlier (Upper)

Test Statistic: 0.065

For 10% significance level, -14.41342565 is not an outlier.

For 5% significance level, -14.41342565 is not an outlier.

For 1% significance level, -14.41342565 is not an outlier.

2. Data Value -17.76316074 is a Potential Outlier (Lower)

Test Statistic: 0.390

For 10% significance level, -17.76316074 is not an outlier.

For 5% significance level, -17.76316074 is not an outlier.

For 1% significance level, -17.76316074 is not an outlier.

Rosner's Outlier Test for LN #/mmBtu (wet)

Mean -15.86

Standard Deviation 0.895

Number of data 36

Number of suspected outliers 5

	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-15.86	0.883	-17.84	24	2.247	2.99	3.33
2	-15.8	0.84	-17.74	25	2.308	2.98	3.32
3	-15.74	0.781	-17.73	23	2.549	2.97	3.3
4	-15.68	0.708	-14.38	36	1.844	2.95	3.29
5	-15.72	0.679	-16.95	4	1.802	2.94	3.27

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: lb/mmBtuO2(esp)

Background Data: lb/mmBtuO2(ff)

Raw Statistics

	Site	Background
Number of Valid Observations	44	21
Number of Distinct Observations	44	21
Minimum	1.7000E-8	1.9300E-8
Maximum	1.5500E-6	5.5000E-7
Mean	3.8115E-7	2.1667E-7
Median	2.6650E-7	1.6200E-7
SD	3.7399E-7	1.6292E-7
SE of Mean	5.6381E-8	3.5552E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	63	1.924	1.669	0.029
Welch-Satterthwaite (Unequal Variance)	62.7	2.468	1.669	0.008

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1.399E-13		
Variance of Background	2.654E-14		
Numerator DF	Denominator DF	F-Test Value	P-Value
43	20	5.270	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: lb/mmBtuO2(ff)

Background Data: lb/mmBtuO2(dry)

Raw Statistics

	Site	Background
Number of Valid Observations	21	34
Number of Distinct Observations	21	33
Minimum	1.9300E-8	2.4800E-8
Maximum	5.5000E-7	1.7500E-6
Mean	2.1667E-7	2.6189E-7
Median	1.6200E-7	1.1600E-7
SD	1.6292E-7	3.4818E-7
SE of Mean	3.5552E-8	5.9713E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	53	-0.557	1.674	0.710
Welch-Satterthwaite (Unequal Variance)	50.1	-0.651	1.676	0.741

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2.654E-14		
Variance of Background	1.212E-13		
Numerator DF	Denominator DF	F-Test Value	P-Value
33	20	4.568	0.001

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: lb/mmBtuO2(dry)

Background Data: lb/mmBtuO2(ff)

Raw Statistics

	Site	Background
Number of Valid Observations	34	21
Number of Distinct Observations	33	21
Minimum	2.4800E-8	1.9300E-8
Maximum	1.7500E-6	5.5000E-7
Mean	2.6189E-7	2.1667E-7
Median	1.1600E-7	1.6200E-7
SD	3.4818E-7	1.6292E-7
SE of Mean	5.9713E-8	3.5552E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	53	0.557	1.674	0.290
Welch-Satterthwaite (Unequal Variance)	50.1	0.651	1.676	0.259

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.212E-13		
Variance of Background	2.654E-14		
Numerator DF	Denominator DF	F-Test Value	P-Value
33	20	4.568	0.001

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: lb/mmBtuO2(ff)

Background Data: lb/mmBtuO2(wet)

Raw Statistics

	Site	Background
Number of Valid Observations	21	36
Number of Distinct Observations	21	34
Minimum	1.9300E-8	1.7900E-8
Maximum	5.5000E-7	5.7100E-7
Mean	2.1667E-7	1.8154E-7
Median	1.6200E-7	1.2650E-7
SD	1.6292E-7	1.4249E-7
SE of Mean	3.5552E-8	2.3749E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	55	0.852	1.673	0.199
Welch-Satterthwaite (Unequal Variance)	37.6	0.822	1.686	0.208

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2.654E-14
Variance of Background	2.030E-14

Numerator DF	Denominator DF	F-Test Value	P-Value
20	35	1.307	0.476

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: lb/mmBtuO2(wet)

Background Data: lb/mmBtuO2(ff)

Raw Statistics

	Site	Background
Number of Valid Observations	36	21
Number of Distinct Observations	34	21
Minimum	1.7900E-8	1.9300E-8
Maximum	5.7100E-7	5.5000E-7
Mean	1.8154E-7	2.1667E-7
Median	1.2650E-7	1.6200E-7
SD	1.4249E-7	1.6292E-7
SE of Mean	2.3749E-8	3.5552E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	55	-0.852	1.673	0.801
Welch-Satterthwaite (Unequal Variance)	37.6	-0.822	1.686	0.792

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

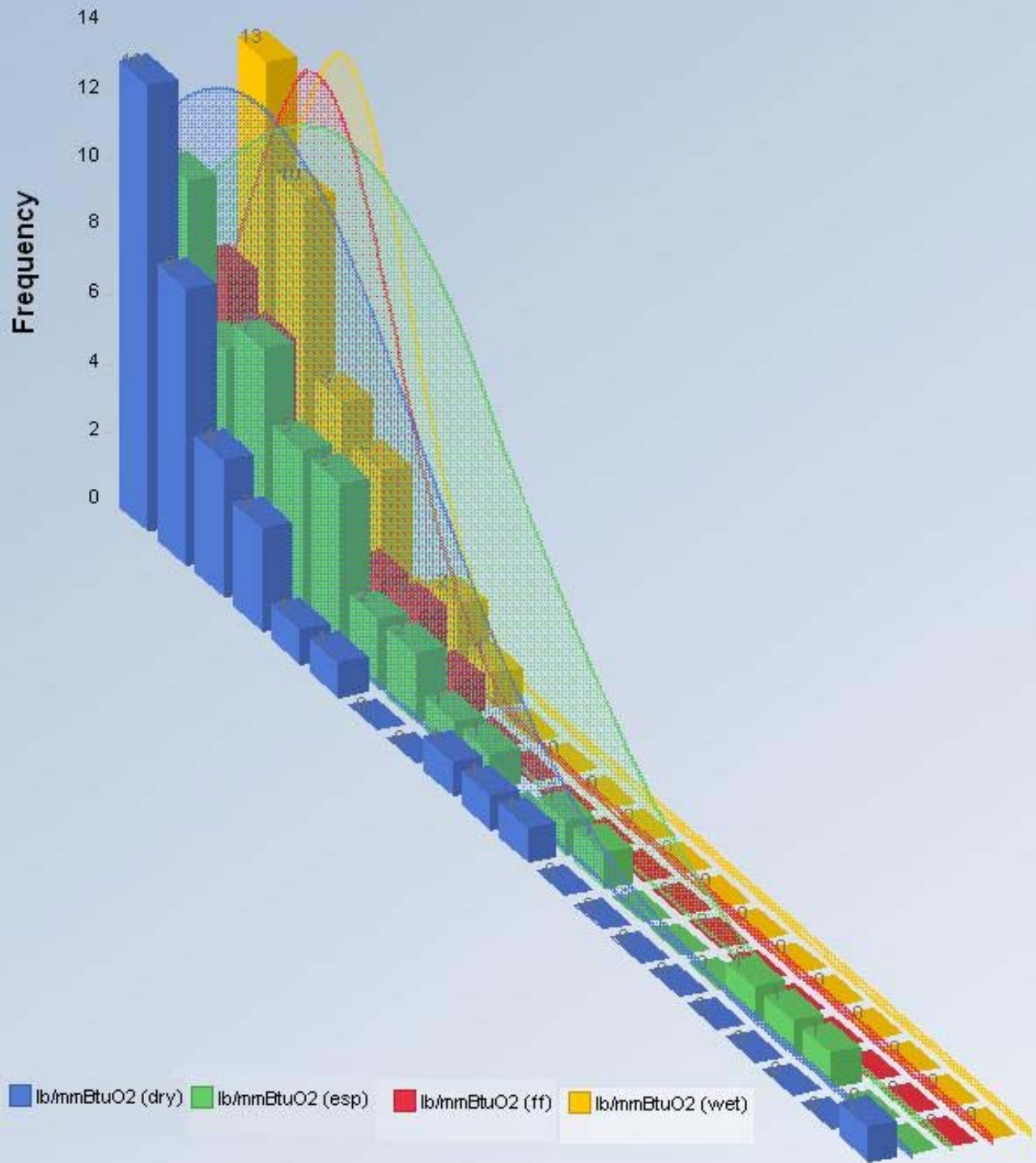
Test of Equality of Variances

Variance of Site	2.030E-14		
Variance of Background	2.654E-14		
Numerator DF	Denominator DF	F-Test Value	P-Value
20	35	1.307	0.476

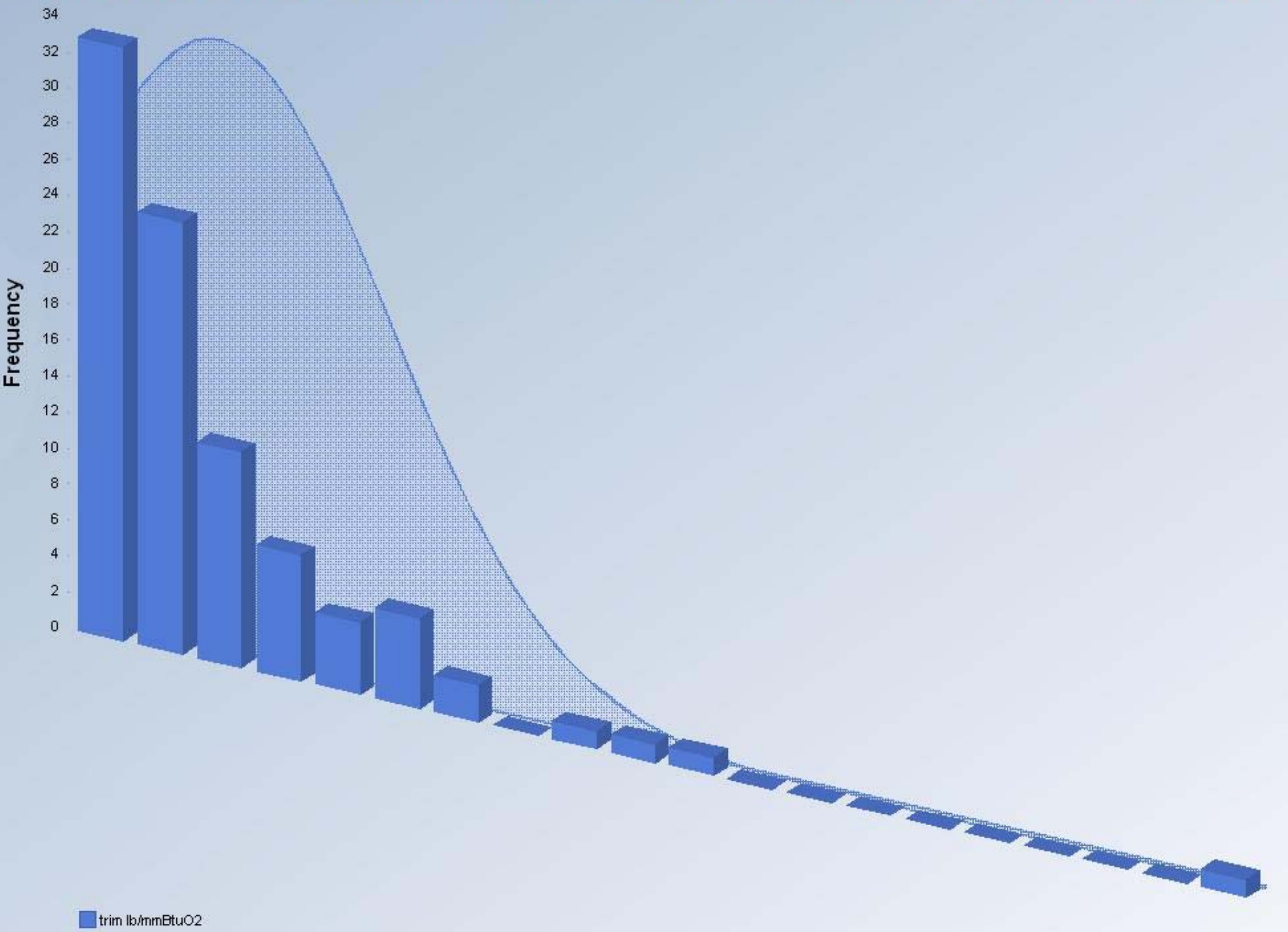
Conclusion with Alpha = 0.05

- * Two variances appear to be equal

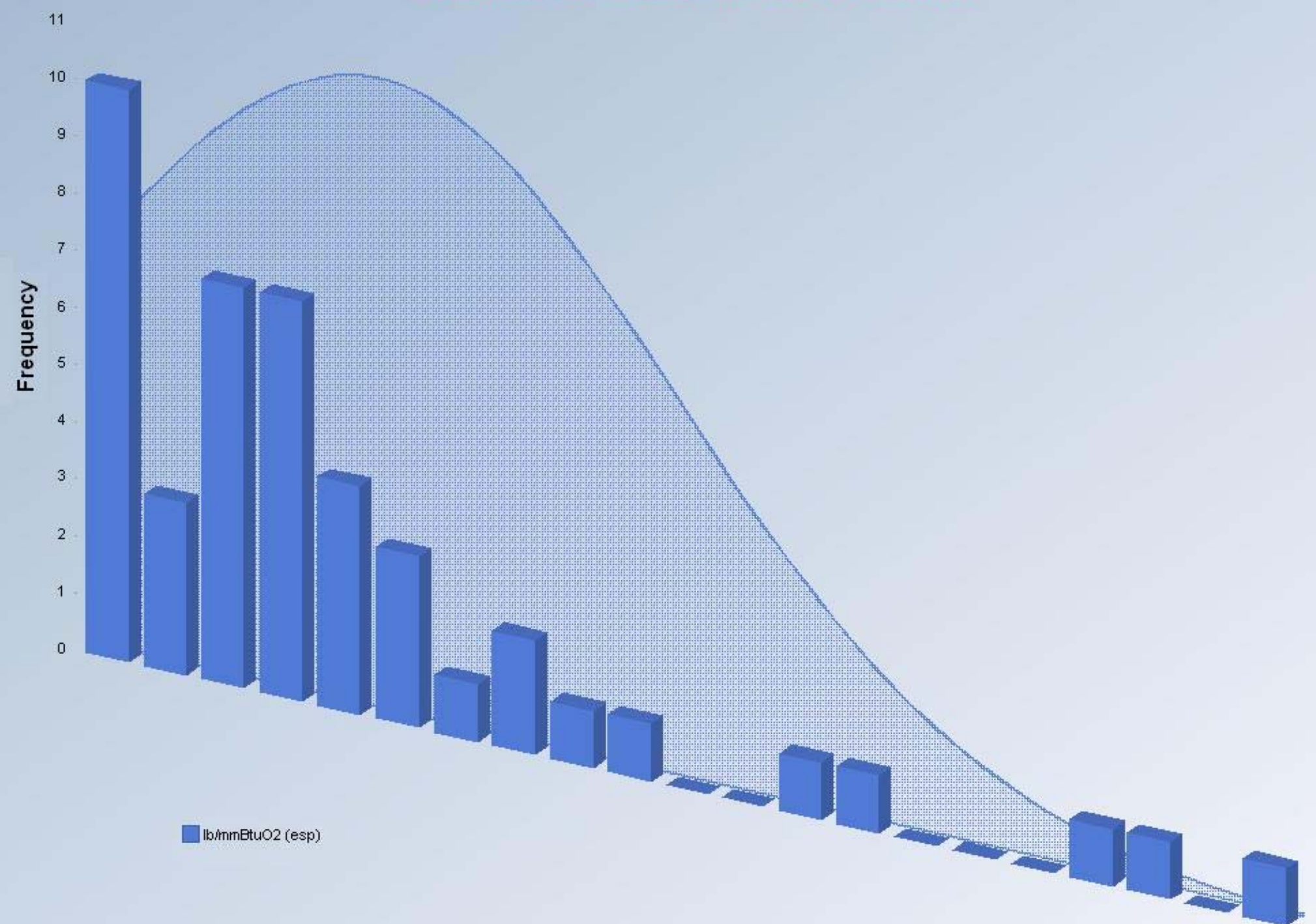
Histograms for Cadmium by Controls (ESP, FF, Dry & Wet)



Histogram for Cadmium Emissions Factors with FF, Dry Scrubbed & Wet Scrubbed Controls



Histogram for Cadmium with ESP Control



Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	0.95

Ib/mmBtuO2 (dry)

Raw Statistics

Number of Valid Observations	34
Number of Distinct Observations	33
Minimum	2.4800E-8
Maximum	1.7500E-6
Mean of Raw Data	2.6189E-7
Standard Deviation of Raw Data	3.4818E-7
Kstar	0.942
Mean of Log Transformed Data	-15.73
Standard Deviation of Log Transformed Data	1.041

Normal Distribution Test Results

Correlation Coefficient R	0.793
Shapiro Wilk Test Statistic	0.651
Shapiro Wilk Critical (0.95) Value	0.933
Approximate Shapiro Wilk P Value	3.1322E-9
Lilliefors Test Statistic	0.251
Lilliefors Critical (0.95) Value	0.152

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.961
A-D Test Statistic	1.155
A-D Critical (0.95) Value	0.775
K-S Test Statistic	0.171
K-S Critical(0.95) Value	0.155

Data not Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.988
Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical (0.95) Value	0.933
Approximate Shapiro Wilk P Value	0.51
Lilliefors Test Statistic	0.119
Lilliefors Critical (0.95) Value	0.152

Data appear Lognormal at (0.05) Significance Level

Ib/mmBtuO2 (esp)

Raw Statistics

Number of Valid Observations	44
------------------------------	----

Number of Distinct Observations	44						
Minimum	1.7000E-8						
Maximum	1.5500E-6						
Mean of Raw Data	3.8115E-7						
Standard Deviation of Raw Data	3.7399E-7						
Kstar	1.237						
Mean of Log Transformed Data	-15.21						
Standard Deviation of Log Transformed Data	0.983						

Normal Distribution Test Results

Correlation Coefficient R	0.881						
Shapiro Wilk Test Statistic	0.775						
Shapiro Wilk Critical (0.95) Value	0.944						
Approximate Shapiro Wilk P Value	2.0402E-8						
Lilliefors Test Statistic	0.212						
Lilliefors Critical (0.95) Value	0.134						

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.981						
A-D Test Statistic	0.513						
A-D Critical (0.95) Value	0.771						
K-S Test Statistic	0.0957						
K-S Critical(0.95) Value	0.136						

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.989						
Shapiro Wilk Test Statistic	0.976						
Shapiro Wilk Critical (0.95) Value	0.944						
Approximate Shapiro Wilk P Value	0.641						
Lilliefors Test Statistic	0.0844						
Lilliefors Critical (0.95) Value	0.134						

Data appear Lognormal at (0.05) Significance Level

Ib/mmBtuO2 (ff)

Raw Statistics

Number of Valid Observations	21						
Number of Distinct Observations	21						
Minimum	1.9300E-8						
Maximum	5.5000E-7						
Mean of Raw Data	2.1667E-7						
Standard Deviation of Raw Data	1.6292E-7						
Kstar	1.532						
Mean of Log Transformed Data	-15.66						
Standard Deviation of Log Transformed Data	0.878						

Normal Distribution Test Results

Correlation Coefficient R	0.939						
Shapiro Wilk Test Statistic	0.873						
Shapiro Wilk Critical (0.95) Value	0.908						
Approximate Shapiro Wilk P Value	0.00906						
Lilliefors Test Statistic	0.234						
Lilliefors Critical (0.95) Value	0.193						

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.965						
A-D Test Statistic	0.362						
A-D Critical (0.95) Value	0.756						
K-S Test Statistic	0.142						
K-S Critical(0.95) Value	0.192						

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.976						
Shapiro Wilk Test Statistic	0.95						
Shapiro Wilk Critical (0.95) Value	0.908						
Approximate Shapiro Wilk P Value	0.341						
Lilliefors Test Statistic	0.138						
Lilliefors Critical (0.95) Value	0.193						

Data appear Lognormal at (0.05) Significance Level

Ib/mmBtuO2 (wet)

Raw Statistics

Number of Valid Observations	36						
Number of Distinct Observations	34						
Minimum	1.7900E-8						
Maximum	5.7100E-7						
Mean of Raw Data	1.8154E-7						
Standard Deviation of Raw Data	1.4249E-7						
Kstar	1.527						
Mean of Log Transformed Data	-15.86						
Standard Deviation of Log Transformed Data	0.895						

Normal Distribution Test Results

Correlation Coefficient R	0.942						
Shapiro Wilk Test Statistic	0.88						
Shapiro Wilk Critical (0.95) Value	0.935						
Approximate Shapiro Wilk P Value	7.7296E-4						
Lilliefors Test Statistic	0.172						
Lilliefors Critical (0.95) Value	0.148						

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.991						
---------------------------	-------	--	--	--	--	--	--

A-D Test Statistic	0.235						
A-D Critical (0.95) Value	0.764						
K-S Test Statistic	0.0857						
K-S Critical(0.95) Value	0.149						
Data appear Gamma Distributed at (0.05) Significance Level							
Lognormal Distribution Test Results							
Correlation Coefficient R	0.984						
Shapiro Wilk Test Statistic	0.956						
Shapiro Wilk Critical (0.95) Value	0.935						
Approximate Shapiro Wilk P Value	0.218						
Lilliefors Test Statistic	0.0861						
Lilliefors Critical (0.95) Value	0.148						
Data appear Lognormal at (0.05) Significance Level							

Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
lb/mmBtuO2 (dry)	34	2.4800E-8	1.7500E-6	2.6189E-7	1.1600E-7	1.212E-13	3.4818E-7	1.0267E-7	2.871	9.761	N/A
lb/mmBtuO2 (esp)	44	1.7000E-8	1.5500E-6	3.8115E-7	2.6650E-7	1.399E-13	3.7399E-7	2.2090E-7	1.832	2.967	N/A
lb/mmBtuO2 (ff)	21	1.9300E-8	5.5000E-7	2.1667E-7	1.6200E-7	2.654E-14	1.6292E-7	1.1875E-7	0.883	-0.509	N/A
lb/mmBtuO2 (wet)	36	1.7900E-8	5.7100E-7	1.8154E-7	1.2650E-7	2.030E-14	1.4249E-7	1.1238E-7	1.149	0.729	N/A

Percentiles for Raw Full Data Sets

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
lb/mmBtuO2 (dry)	34	3.0875E-8	4.8720E-8	6.5880E-8	7.3375E-8	1.1600E-7	3.0800E-7	3.5500E-7	7.0020E-7	8.4460E-7	1.4718E-6
lb/mmBtuO2 (esp)	44	7.0475E-8	7.8670E-8	9.0200E-8	1.3400E-7	2.6650E-7	4.3075E-7	5.1860E-7	8.9940E-7	1.3105E-6	1.5070E-6
lb/mmBtuO2 (ff)	21	3.6200E-8	6.7500E-8	8.1900E-8	9.8000E-8	1.6200E-7	2.7300E-7	4.1700E-7	4.8000E-7	4.9000E-7	5.3800E-7
lb/mmBtuO2 (wet)	36	1.9875E-8	4.6400E-8	7.3600E-8	8.2525E-8	1.2650E-7	2.4575E-7	2.9500E-7	3.6900E-7	4.8900E-7	5.4230E-7

Summary Statistics for Raw Full Dataset

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
trim lb/mmBtuO2	91	1.7900E-8	1.7500E-6	2.1967E-7	1.4600E-7	5.950E-14	2.4393E-7	1.2157E-7	3.416	17.11	N/A

Percentiles for Raw Full Dataset

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
trim lb/mmBtuO2	91	2.6050E-8	4.6500E-8	7.1800E-8	7.8500E-8	1.4600E-7	2.6200E-7	3.2800E-7	4.8000E-7	5.6050E-7	9.9130E-7

Coal Fired Utility Boiler Chromium Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Chromium Emissions Factor are presented on the following page with two sets of columns for all of the test data. The left set of columns present all the data while the right set of columns does not include data identified as a potential outliers. Each set of columns includes the Submission ID for each test data, the site specific emissions factor as determined using the f factor method, the type of control (ESP only, Fabric Filter only, Dry Scrubbing with either ESP or Fabric Filter and Wet Scrubbing with either ESP or Fabric Filter) and the natural log of the site specific emissions factor. Subsequent pages provide the assessments as performed using EPA's statistical software ProUCL. The assessments provide support for the development of national emissions factors for the ESPs and Fabric Filters combined, Dry Scrubbing and Wet Scrubbing controls. A single emissions factor was developed for ESP and Fabric Filter controlled sources since there was no statistical difference in the means of the two categories. Separate emissions factors were developed for Dry Scrubbing and Wet Scrubbing controls since there is a statistical difference between them and the combined ESP and Fabric Filter data, and there is a statistical difference between them.

The resulting calculated chromium emissions factors are:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP and Fabric filter controls	4.89×10^{-5}	65	Highly Representative
Dry Scrubbing controls	1.53×10^{-6}	31	Highly Representative
Wet Scrubbing controls	4.75×10^{-6}	35	Highly Representative

**Utility Boiler
Method 29 Chromium**

submittal_id	'lb/mmBtuO2'	Control	LN #/mmBtu	submittal_id	'lb/mmBtuO2'	Control	LN #/mmBtu
1189	1.98E-07	Fabric Filter	-15.43499881	1189	1.98E-07	PM Control	-15.43499881
1190	7.52E-07	Fabric Filter	-14.10052951	1190	7.52E-07	PM Control	-14.10052951
63254	3.84E-06	Fabric Filter	-12.47003819	63254	3.84E-06	PM Control	-12.47003819
1244	2.89E-04	Fabric Filter	-8.149613899	1244	2.89E-04	PM Control	-8.149613899
735	5.17E-04	Fabric Filter	-7.566741066	735	5.17E-04	PM Control	-7.566741066
734	1.50E-04	Fabric Filter	-8.805379551	734	1.50E-04	PM Control	-8.805379551
736	1.91E-04	Fabric Filter	-8.565455871	736	1.91E-04	PM Control	-8.565455871
1597	5.71E-07	Fabric Filter	-14.37587663	1597	5.71E-07	PM Control	-14.37587663
1606	8.96E-06	Fabric Filter	-11.62274033	1606	8.96E-06	PM Control	-11.62274033
1654	1.26E-06	Fabric Filter	-13.58439884	1654	1.26E-06	PM Control	-13.58439884
2095	7.04E-07	Fabric Filter	-14.16648748	2095	7.04E-07	PM Control	-14.16648748
1310	4.99E-05	Fabric Filter	-9.905489555	1310	4.99E-05	PM Control	-9.905489555
524	1.57E-06	Fabric Filter	-13.36443494	524	1.57E-06	PM Control	-13.36443494
2088	3.11E-06	Fabric Filter	-12.68088783	2088	3.11E-06	PM Control	-12.68088783
2170	1.77E-07	Fabric Filter	-15.54935745	2170	1.77E-07	PM Control	-15.54935745
1835	4.17E-07	Fabric Filter	-14.68913805	1835	4.17E-07	PM Control	-14.68913805
1832	4.55E-07	Fabric Filter	-14.60296842	1832	4.55E-07	PM Control	-14.60296842
1833	5.68E-07	Fabric Filter	-14.38114442	1833	5.68E-07	PM Control	-14.38114442
845	1.16E-06	Fabric Filter	-13.66709055	845	1.16E-06	PM Control	-13.66709055
560	1.09E-06	Dry Scrubber	-13.72933286	560	1.09E-06	Dry Scrubber	-13.72933286
1507	1.66E-07	Dry Scrubber	-15.61127805	1507	1.66E-07	Dry Scrubber	-15.61127805
8761	2.48E-06	Dry Scrubber	-12.907252	8761	2.48E-06	Dry Scrubber	-12.907252
8761	2.08E-06	Dry Scrubber	-13.08314266	8761	2.08E-06	Dry Scrubber	-13.08314266
1611	2.51E-07	Dry Scrubber	-15.1978129	1611	2.51E-07	Dry Scrubber	-15.1978129
1563	3.78E-06	Dry Scrubber	-12.48578655	1563	3.78E-06	Dry Scrubber	-12.48578655
947	2.90E-07	Dry Scrubber	-15.05338491	947	2.90E-07	Dry Scrubber	-15.05338491
1249	8.23E-07	Dry Scrubber	-14.01030964	1249	8.23E-07	Dry Scrubber	-14.01030964
1133	5.45E-07	Dry Scrubber	-14.42286941	1133	5.45E-07	Dry Scrubber	-14.42286941
1129	2.87E-07	Dry Scrubber	-15.0652296	1129	2.87E-07	Dry Scrubber	-15.0652296
1942	1.47E-06	Dry Scrubber	-13.43024816	1942	1.47E-06	Dry Scrubber	-13.43024816
698	4.00E-05	Dry Scrubber	-10.1266311	2021	7.52E-06	Dry Scrubber	-11.79794442
2022	2.40E-04	Dry Scrubber	-8.334871635	1488	4.40E-07	Dry Scrubber	-14.63649111
2021	7.52E-06	Dry Scrubber	-11.79794442	1909	1.40E-07	Dry Scrubber	-15.78162341
1488	4.40E-07	Dry Scrubber	-14.63649111	1052	2.27E-06	Dry Scrubber	-12.99573073
1909	1.40E-07	Dry Scrubber	-15.78162341	1346	1.02E-06	Dry Scrubber	-13.79570793
1052	2.27E-06	Dry Scrubber	-12.99573073	13461	9.97E-07	Dry Scrubber	-13.81851507
1346	1.02E-06	Dry Scrubber	-13.79570793	134611	1.86E-06	Dry Scrubber	-13.19493407
13461	9.97E-07	Dry Scrubber	-13.81851507	1346111	1.22E-06	Dry Scrubber	-13.6166597
134611	1.86E-06	Dry Scrubber	-13.19493407	1349	1.51E-06	Dry Scrubber	-13.40340091
1346111	1.22E-06	Dry Scrubber	-13.6166597	565	1.80E-06	Dry Scrubber	-13.22772389
1349	1.51E-06	Dry Scrubber	-13.40340091	1563	9.49E-07	Dry Scrubber	-13.86785704
565	1.80E-06	Dry Scrubber	-13.22772389	1563	1.51E-06	Dry Scrubber	-13.40340091
1563	9.49E-07	Dry Scrubber	-13.86785704	1449	1.50E-06	Dry Scrubber	-13.41004545
1563	1.51E-06	Dry Scrubber	-13.40340091	2206	3.81E-06	Dry Scrubber	-12.47788137
1449	1.50E-06	Dry Scrubber	-13.41004545	1568	2.43E-06	Dry Scrubber	-12.9276193
2206	3.81E-06	Dry Scrubber	-12.47788137	1398	1.24E-06	Dry Scrubber	-13.60039918
1568	2.43E-06	Dry Scrubber	-12.9276193	1841	2.19E-06	PM Control	-13.03160901
1398	1.24E-06	Dry Scrubber	-13.60039918	879456	3.43E-05	PM Control	-10.2803652
1841	2.19E-06	Fabric Filter	-13.03160901	1726	3.22E-07	Dry Scrubber	-14.94871429
879456	3.43E-05	Fabric Filter	-10.2803652	1938	2.19E-06	Dry Scrubber	-13.03160901
1726	3.22E-07	Dry Scrubber	-14.94871429	2319	2.26E-06	Wet Scrubber	-13.00014574
1938	2.19E-06	Dry Scrubber	-13.03160901	1515	2.60E-07	Wet Scrubber	-15.16258421
2319	2.26E-06	Wet Scrubber	-13.00014574	1972	2.76E-07	Wet Scrubber	-15.10286497
1515	2.60E-07	Wet Scrubber	-15.16258421	541	5.69E-05	Wet Scrubber	-9.774215217
1972	2.76E-07	Wet Scrubber	-15.10286497	1647	1.36E-07	Wet Scrubber	-15.81061095
541	5.69E-05	Wet Scrubber	-9.774215217	1648	5.14E-07	Wet Scrubber	-14.48104257

**Utility Boiler
Method 29 Chromium**

submittal_id	'lb/mmBtuO2'	Control	LN #/mmBtu	submittal_id	'lb/mmBtuO2'	Control	LN #/mmBtu
1647	1.36E-07	Wet Scrubber	-15.81061095	2259	6.89E-07	Wet Scrubber	-14.18802457
1648	5.14E-07	Wet Scrubber	-14.48104257	2315	3.73E-06	Wet Scrubber	-12.49910232
2259	6.89E-07	Wet Scrubber	-14.18802457	23151	1.48E-06	Wet Scrubber	-13.42346847
2315	3.73E-06	Wet Scrubber	-12.49910232	23152	1.14E-06	Wet Scrubber	-13.6844823
23151	1.48E-06	Wet Scrubber	-13.42346847	23153	3.72E-06	Wet Scrubber	-12.50178689
23152	1.14E-06	Wet Scrubber	-13.6844823	1327	1.50E-06	Wet Scrubber	-13.41004545
23153	3.72E-06	Wet Scrubber	-12.50178689	1176	4.62E-06	Wet Scrubber	-12.28511585
1307	2.08E-04	Wet Scrubber	-8.477972478	902	5.07E-06	PM Control	-12.19216974
1327	1.50E-06	Wet Scrubber	-13.41004545	903	1.57E-05	PM Control	-11.06184985
1176	4.62E-06	Wet Scrubber	-12.28511585	2276	1.62E-04	PM Control	-8.727914223
902	5.07E-06	ESP	-12.19216974	975	2.36E-05	PM Control	-10.65426385
903	1.57E-05	ESP	-11.06184985	1154	2.04E-06	PM Control	-13.10256075
2276	1.62E-04	ESP	-8.727914223	1845	1.33E-04	PM Control	-8.92516143
975	2.36E-05	ESP	-10.65426385	1636	1.10E-05	PM Control	-11.41761529
1154	2.04E-06	ESP	-13.10256075	1989	4.00E-06	PM Control	-12.4292162
1845	1.33E-04	ESP	-8.92516143	993	1.06E-05	PM Control	-11.45465656
1636	1.10E-05	ESP	-11.41761529	2195	8.82E-06	PM Control	-11.63848869
1989	4.00E-06	ESP	-12.4292162	2161	4.91E-07	PM Control	-14.52682171
993	1.06E-05	ESP	-11.45465656	979	5.84E-06	PM Control	-12.05077976
2195	8.82E-06	ESP	-11.63848869	1004	3.29E-06	PM Control	-12.62462299
2161	4.91E-07	ESP	-14.52682171	1471	1.75E-06	PM Control	-13.25589477
979	5.84E-06	ESP	-12.05077976	10040002	2.91E-06	PM Control	-12.74735748
1004	3.29E-06	ESP	-12.62462299	1902	1.35E-06	PM Control	-13.51540597
1471	1.75E-06	ESP	-13.25589477	1906	5.97E-06	PM Control	-12.02876363
10040002	2.91E-06	ESP	-12.74735748	894	2.05E-06	PM Control	-13.09767076
1902	1.35E-06	ESP	-13.51540597	892	1.13E-05	PM Control	-11.39070783
1906	5.97E-06	ESP	-12.02876363	1809	1.81E-05	PM Control	-10.91959862
894	2.05E-06	ESP	-13.09767076	1111	1.25E-04	PM Control	-8.987196821
892	1.13E-05	ESP	-11.39070783	1113	1.51E-05	PM Control	-11.10081581
1809	1.81E-05	ESP	-10.91959862	1642	1.80E-06	PM Control	-13.22772389
1111	1.25E-04	ESP	-8.987196821	3197	1.68E-06	PM Control	-13.29671676
1113	1.51E-05	ESP	-11.10081581	632	2.81E-06	PM Control	-12.78232607
1642	1.80E-06	ESP	-13.22772389	2103	6.78E-07	PM Control	-14.20411855
3197	1.68E-06	ESP	-13.29671676	2279	2.61E-06	PM Control	-12.85643668
632	2.81E-06	ESP	-12.78232607	22791	7.85E-06	PM Control	-11.75542262
2103	6.78E-07	ESP	-14.20411855	1021	5.70E-07	PM Control	-14.37712454
2279	2.61E-06	ESP	-12.85643668	731	1.04E-05	PM Control	-11.47092113
22791	7.85E-06	ESP	-11.75542262	2274	1.61E-05	PM Control	-11.03669129
1021	5.70E-07	ESP	-14.37712454	2013	4.78E-06	PM Control	-12.25107001
731	1.04E-05	ESP	-11.47092113	2011	3.25E-06	PM Control	-12.63685556
2274	1.61E-05	ESP	-11.03669129	1854	1.54E-06	PM Control	-13.38372814
2013	4.78E-06	ESP	-12.25107001	2135	1.56E-04	PM Control	-8.765654551
2011	3.25E-06	ESP	-12.63685556	21351	8.35E-04	PM Control	-7.088078833
1854	1.54E-06	ESP	-13.38372814	10040004	2.18E-06	PM Control	-13.03618568
2135	1.56E-04	ESP	-8.765654551	2009	4.81E-06	PM Control	-12.24481347
21351	8.35E-04	ESP	-7.088078833	12861	3.14E-06	PM Control	-12.67128776
10040004	2.18E-06	ESP	-13.03618568	828	2.20E-05	PM Control	-10.7244681
2009	4.81E-06	ESP	-12.24481347	2070	1.03E-06	PM Control	-13.78595176
12861	3.14E-06	ESP	-12.67128776	2302	3.32E-06	PM Control	-12.61554578
828	2.20E-05	ESP	-10.7244681	1141	4.46E-06	PM Control	-12.32036179
2070	1.03E-06	ESP	-13.78595176	2278	2.65E-04	PM Control	-8.235780732
2302	3.32E-06	ESP	-12.61554578	1735	1.18E-06	Dry Scrubber	-13.64746925
1141	4.46E-06	ESP	-12.32036179	1734	4.76E-07	Dry Scrubber	-14.55780823
2278	2.65E-04	ESP	-8.235780732	1558	4.23E-06	Wet Scrubber	-12.37330856
550002	8.67E-04	Dry Scrubber	-7.050471581	1117	9.62E-06	Wet Scrubber	-11.55166629
1735	1.18E-06	Dry Scrubber	-13.64746925	1118	5.86E-06	Wet Scrubber	-12.04736095

**Utility Boiler
Method 29 Chromium**

submittal_id	'lb/mmBtuO2'	Control	LN #/mmBtu	submittal_id	'lb/mmBtuO2'	Control	LN #/mmBtu
1734	4.76E-07	Dry Scrubber	-14.55780823	1119	6.75E-06	Wet Scrubber	-11.90596805
1558	4.23E-06	Wet Scrubber	-12.37330856	1117	9.62E-06	Wet Scrubber	-11.55166629
1117	9.62E-06	Wet Scrubber	-11.55166629	1826	7.10E-07	Wet Scrubber	-14.15800087
1118	5.86E-06	Wet Scrubber	-12.04736095	18261	1.67E-06	Wet Scrubber	-13.30268693
1119	6.75E-06	Wet Scrubber	-11.90596805	1330	2.14E-06	Wet Scrubber	-13.05470473
1117	9.62E-06	Wet Scrubber	-11.55166629	1915	5.21E-07	Wet Scrubber	-14.4675158
1826	7.10E-07	Wet Scrubber	-14.15800087	1738	1.14E-05	Wet Scrubber	-11.3818972
18261	1.67E-06	Wet Scrubber	-13.30268693	1743	1.40E-06	Wet Scrubber	-13.47903832
1330	2.14E-06	Wet Scrubber	-13.05470473	966	8.65E-06	Wet Scrubber	-11.65795124
1915	5.21E-07	Wet Scrubber	-14.4675158	1185	3.60E-06	Wet Scrubber	-12.53457671
1738	1.14E-05	Wet Scrubber	-11.3818972	1187	1.54E-06	Wet Scrubber	-13.38372814
1743	1.40E-06	Wet Scrubber	-13.47903832	2239	8.88E-07	Wet Scrubber	-13.93429409
966	8.65E-06	Wet Scrubber	-11.65795124	2055	5.82E-06	Wet Scrubber	-12.0542103
1185	3.60E-06	Wet Scrubber	-12.53457671	1637	8.89E-07	Wet Scrubber	-13.9331686
1187	1.54E-06	Wet Scrubber	-13.38372814	1638	9.02E-07	Wet Scrubber	-13.91891379
2239	8.88E-07	Wet Scrubber	-13.93429409	900	3.49E-06	Wet Scrubber	-12.56560882
2055	5.82E-06	Wet Scrubber	-12.0542103	1177	5.29E-06	Wet Scrubber	-12.14969231
1637	8.89E-07	Wet Scrubber	-13.9331686	1120	3.58E-06	Wet Scrubber	-12.54014776
1638	9.02E-07	Wet Scrubber	-13.91891379	1276	4.23E-07	Wet Scrubber	-14.67589366
900	3.49E-06	Wet Scrubber	-12.56560882				
1177	5.29E-06	Wet Scrubber	-12.14969231				
1120	3.58E-06	Wet Scrubber	-12.54014776				
1276	4.23E-07	Wet Scrubber	-14.67589366				

Outlier Tests for Selected Variables

User Selected Options

From File C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_Assess\Coa

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for C2 (dry scrubber)

Mean -13.31

Standard Deviation 1.813

Number of data 34

Number of suspected outliers 5

			Potential	Obs.	Test	Critical	Critical
#	Mean	sd	outlier	Number	value	value (5%)	value (1%)
1	-13.31	1.786	-7.05	32	3.507	2.97	3.3
2	-13.5	1.458	-8.335	13	3.545	2.95	3.29
3	-13.66	1.142	-10.13	12	3.097	2.94	3.27
4	-13.78	0.958	-15.78	16	2.09	2.91	3.25
5	-13.71	0.898	-11.8	14	2.131	2.91	3.24

For 5% significance level, there are 3 Potential Outliers

Therefore, Potential Statistical Outliers are

-7.05, -8.335, -10.13

For 1% Significance Level, there are 2 Potential Outliers

Therefore, Potential Statistical Outliers are

-7.05, -8.335

Rosner's Outlier Test for C2 (esp)

Mean -11.88

Standard Deviation 1.688

Number of data 44

Number of suspected outliers 5

			Potential	Obs.	Test	Critical	Critical
#	Mean	sd	outlier	Number	value	value (5%)	value (1%)
1	-11.88	1.669	-7.088	36	2.87	3.08	3.43
2	-11.99	1.536	-8.236	44	2.443	3.07	3.41
3	-12.08	1.437	-8.728	3	2.331	3.06	3.4
4	-12.16	1.353	-8.766	35	2.51	3.05	3.39
5	-12.24	1.254	-8.925	6	2.647	3.04	3.38

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for C2 (fabric filter)

Number of data = 21
 10% critical value: 0.391
 5% critical value: 0.44
 1% critical value: 0.524

1. Data Value -7.566741066 is a Potential Outlier (Upper)

Test Statistic: 0.140

For 10% significance level, -7.566741066 is not an outlier.
 For 5% significance level, -7.566741066 is not an outlier.
 For 1% significance level, -7.566741066 is not an outlier.

2. Data Value -15.54935745 is a Potential Outlier (Lower)

Test Statistic: 0.123

For 10% significance level, -15.54935745 is not an outlier.
 For 5% significance level, -15.54935745 is not an outlier.
 For 1% significance level, -15.54935745 is not an outlier.

Rosner's Outlier Test for C2 (wet scrubber)

Mean	-12.96
Standard Deviation	1.473
Number of data	36
Number of suspected outliers	5

			Potential	Obs.	Test	Critical	Critical
#	Mean	sd	outlier	Number	value	value (5%)	value (1%)
1	-12.96	1.452	-8.478	12	3.084	2.99	3.33
2	-13.08	1.275	-9.774	4	2.595	2.98	3.32
3	-13.18	1.155	-15.81	5	2.276	2.97	3.3
4	-13.1	1.074	-15.16	2	1.919	2.95	3.29
5	-13.04	1.024	-15.1	3	2.017	2.94	3.27

For 5% Significance Level, there is 1 Potential Outlier
 Therefore, Observation -8.478 is a Potential Statistical Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: C0(fabric filter)

Background Data: C0(esp)

Raw Statistics

	Site	Background
Number of Valid Observations	21	44
Number of Distinct Observations	21	44
Minimum	1.7700E-7	4.9100E-7
Maximum	5.1700E-4	8.3500E-4
Mean	5.9863E-5	4.3636E-5
Median	1.5700E-6	4.7950E-6
SD	1.3006E-4	1.3386E-4
SE of Mean	2.8382E-5	2.0181E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	63	0.461	1.669	0.323
Welch-Satterthwaite (Unequal Variance)	40.5	0.466	1.683	0.322

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.6916E-8
Variance of Background	1.7920E-8

Numerator DF	Denominator DF	F-Test Value	P-Value
43	20	1.059	0.919

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: C0(esp)

Background Data: C0(fabric filter)

Raw Statistics

	Site	Background
Number of Valid Observations	44	21
Number of Distinct Observations	44	21
Minimum	4.9100E-7	1.7700E-7
Maximum	8.3500E-4	5.1700E-4
Mean	4.3636E-5	5.9863E-5
Median	4.7950E-6	1.5700E-6
SD	1.3386E-4	1.3006E-4
SE of Mean	2.0181E-5	2.8382E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	63	-0.461	1.669	0.677
Welch-Satterthwaite (Unequal Variance)	40.5	-0.466	1.683	0.678

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.7920E-8
Variance of Background	1.6916E-8

Numerator DF	Denominator DF	F-Test Value	P-Value
43	20	1.059	0.919

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_Assess\Coal_Chromium
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: C3(dry scrubber)

Background Data: C3(pm control)

Raw Statistics

	Site	Background
Number of Valid Observations	31	65
Number of Distinct Observations	30	65
Minimum	1.4000E-7	1.7700E-7
Maximum	7.5200E-6	8.3500E-4
Mean	1.5370E-6	4.8879E-5
Median	1.2200E-6	3.8400E-6
SD	1.4656E-6	1.3185E-4
SE of Mean	2.6324E-7	1.6354E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	94	-1.994	1.661	0.975
Welch-Satterthwaite (Unequal Variance)	64.0	-2.894	1.669	0.997

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2.148E-12		
Variance of Background	1.7384E-8		
Numerator DF	Denominator DF	F-Test Value	P-Value
64	30	8093.048	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_Assess\Coal_Chromium
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: C3(pm control)

Background Data: C3(dry scrubber)

Raw Statistics

	Site	Background
Number of Valid Observations	65	31
Number of Distinct Observations	65	30
Minimum	1.7700E-7	1.4000E-7
Maximum	8.3500E-4	7.5200E-6
Mean	4.8879E-5	1.5370E-6
Median	3.8400E-6	1.2200E-6
SD	1.3185E-4	1.4656E-6
SE of Mean	1.6354E-5	2.6324E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	94	1.994	1.661	0.025
Welch-Satterthwaite (Unequal Variance)	64.0	2.894	1.669	0.003

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1.7384E-8		
Variance of Background	2.148E-12		
Numerator DF	Denominator DF	F-Test Value	P-Value
64	30	8093.048	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_Assess\Coal_Chromium
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: C3(wet scrubber)

Background Data: C3(pm control)

Raw Statistics

	Site	Background
Number of Valid Observations	35	65
Number of Distinct Observations	34	65
Minimum	1.3600E-7	1.7700E-7
Maximum	5.6900E-5	8.3500E-4
Mean	4.7491E-6	4.8879E-5
Median	2.1400E-6	3.8400E-6
SD	9.5665E-6	1.3185E-4
SE of Mean	1.6170E-6	1.6354E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	98	-1.973	1.661	0.974
Welch-Satterthwaite (Unequal Variance)	65.2	-2.685	1.669	0.995

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	9.152E-11		
Variance of Background	1.7384E-8		
Numerator DF	Denominator DF	F-Test Value	P-Value
64	34	189.958	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_Assess\Coal_Chromium
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: C3(pm control)

Background Data: C3(wet scrubber)

Raw Statistics

	Site	Background
Number of Valid Observations	65	35
Number of Distinct Observations	65	34
Minimum	1.7700E-7	1.3600E-7
Maximum	8.3500E-4	5.6900E-5
Mean	4.8879E-5	4.7491E-6
Median	3.8400E-6	2.1400E-6
SD	1.3185E-4	9.5665E-6
SE of Mean	1.6354E-5	1.6170E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	98	1.973	1.661	0.026
Welch-Satterthwaite (Unequal Variance)	65.2	2.685	1.669	0.005

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1.7384E-8		
Variance of Background	9.152E-11		
Numerator DF	Denominator DF	F-Test Value	P-Value
64	34	189.958	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

Outlier Tests for Selected Variables

User Selected Options

From File C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_Assess\Coa

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for C5 (dry scrubber)

Mean -13.78

Standard Deviation 0.958

Number of data 31

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-13.78	0.943	-15.78	14	2.125	2.92	3.25
2	-13.71	0.898	-11.8	12	2.131	2.91	3.24
3	-13.78	0.837	-15.61	2	2.191	2.89	3.22
4	-13.71	0.773	-15.2	5	1.922	2.88	3.2
5	-13.66	0.729	-15.07	10	1.93	2.86	3.18

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for C5 (pm control)

Mean -12.06

Standard Deviation 1.995

Number of data 65

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-12.06	1.98	-7.088	57	2.509	3.23	3.59
2	-12.13	1.909	-7.567	5	2.392	3.22	3.585
3	-12.21	1.834	-8.15	4	2.212	3.22	3.58
4	-12.27	1.773	-8.236	65	2.276	3.21	3.57
5	-12.34	1.709	-8.565	7	2.207	3.205	3.565

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for C5 (wet scrubber)

		Mean	-13.08							
		Standard Deviation	1.275							
		Number of data	35							
		Number of suspected outliers	5							
			Potential	Obs.	Test	Critical	Critical			
	#	Mean	outlier	Number	value	value (5%)	value (1%)			
	1	-13.08	-9.774	4	2.633	2.98	3.32			
	2	-13.18	-15.81	5	2.276	2.97	3.3			
	3	-13.1	-15.16	2	1.919	2.95	3.29			
	4	-13.04	-15.1	3	2.017	2.94	3.27			
	5	-12.97	-14.68	35	1.761	2.92	3.25			
For 5% Significance Level, there is no Potential Outlier										
For 1% Significance Level, there is no Potential Outlier										

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_Assess\Coal_Chromium
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: C3(dry scrubber)

Background Data: C3(wet scrubber)

Raw Statistics

	Site	Background
Number of Valid Observations	31	35
Number of Distinct Observations	30	34
Minimum	1.4000E-7	1.3600E-7
Maximum	7.5200E-6	5.6900E-5
Mean	1.5370E-6	4.7491E-6
Median	1.2200E-6	2.1400E-6
SD	1.4656E-6	9.5665E-6
SE of Mean	2.6324E-7	1.6170E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	64	-1.849	1.669	0.965
Welch-Satterthwaite (Unequal Variance)	35.8	-1.961	1.688	0.971

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

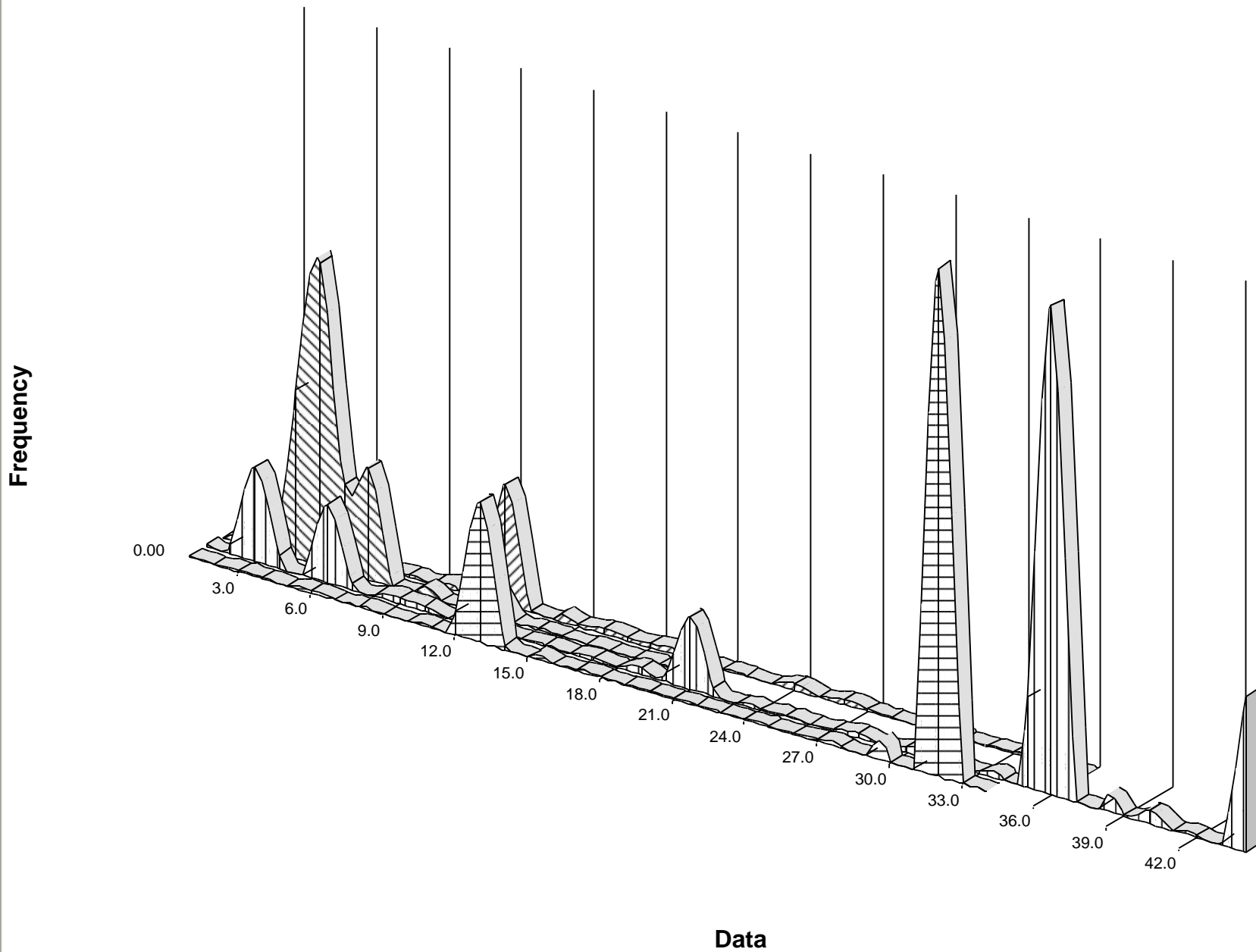
Test of Equality of Variances

Variance of Site	2.148E-12		
Variance of Background	9.152E-11		
Numerator DF	Denominator DF	F-Test Value	P-Value
34	30	42.604	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

Histograms for C0 (dry scrubber), C0 ...



☐ C0 (dry scrubber)

☐ C0 (esp)

☐ C0 (fabric filter)

☐ C0 (wet scrubber)

Coal Fired Utility Boiler Cobalt Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Cobalt Emissions Factor are presented on the following page with three sets of columns. The left set of columns contains data from all facilities and presents SCC, Submittal ID, emissions factors, the natural log of the emissions factor and the control measure employed. The middle set of columns contains the same information except that the control identifier for ESP's and FF's are merged to ESP-FF since the analysis indicated that there was no statistical difference in average emissions. The right set of columns contains the same information except that the Wet Scrubber and Dry Scrubber controls are merged since the analysis indicated that there was a statistical difference between the particulate controls (ESP & FF) but there was no statistical difference between the acid gas controls (Wet Scrubber & Dry Scrubber). The site specific emissions factors presented are as determined using the f factor method rather than the emissions factor determined by dividing the hourly emissions by the coal feed and associated proximate analysis. Subsequent pages provide the assessments as performed using EPA's statistical software ProUCL. The assessments provide support for developing a combined national emissions factors for ESP and Fabric Filters, and for developing a combined national emissions factor for Dry Scrubbing and Wet Scrubbing controls. Separate emissions factors were developed for the reasons cited earlier.

The resulting calculated cobalt emissions factors are:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP and FF controls	1.58×10^{-6}	65	Highly Representative
Dry Scrubbing & Wet Scrubbing controls	5.10×10^{-7}	66	Highly Representative

Cobalt Data

All Cobalt Data					Cobalt Data merged ESP/FF					Cobalt Data Merged Dry/Wet				
SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controls	SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controls	SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controls
10100202	1176	4.10E-07	-14.7071	Wet	10100222	1726	4.82E-08	-16.8479	Dry	10100212	1647	1.43E-08	-18.063	AcidCon
10100202	1185	1.15E-07	-15.9783	Wet	10100202	1611	5.03E-08	-16.8053	Dry	10100202	1189	2.93E-08	-17.3457	ESP-FF
10100202	1187	1.83E-07	-15.5138	Wet	10100212	565	5.63E-08	-16.6926	Dry	10100212	1648	3.74E-08	-17.1016	AcidCon
10300222	1276	1.85E-07	-15.5029	Wet	10100202	560	5.82E-08	-16.6594	Dry	10100222	1726	4.82E-08	-16.8479	AcidCon
10100202	1117	4.90E-07	-14.5289	Wet	10100202	1133	5.94E-08	-16.6385	Dry	10100202	1611	5.03E-08	-16.8053	AcidCon
10100202	1118	3.21E-07	-14.9518	Wet	10100202	1249	7.70E-08	-16.3795	Dry	10100202	1190	5.44E-08	-16.7269	ESP-FF
10100202	1119	3.40E-07	-14.8943	Wet	10100202	947	8.37E-08	-16.296	Dry	10100212	565	5.63E-08	-16.6926	AcidCon
10100202	1915	8.48E-08	-16.283	Wet	10100202	1942	9.11E-08	-16.2113	Dry	10100202	560	5.82E-08	-16.6594	AcidCon
10100224	1120	1.97E-07	-15.4401	Wet	10100205	1349	1.20E-07	-15.9358	Dry	10100221	2170	5.89E-08	-16.648	ESP-FF
10100202	1117	4.90E-07	-14.5289	Wet	10100202	8761	1.74E-07	-15.5642	Dry	10100202	1133	5.94E-08	-16.6385	AcidCon
10100212	1177	3.34E-07	-14.9121	Wet	10100203	1052	1.76E-07	-15.5528	Dry	10100202	2239	6.03E-08	-16.6239	AcidCon
10100202	1637	1.43E-07	-15.7604	Wet	10100202	1909	1.84E-07	-15.5083	Dry	10100202	1515	6.16E-08	-16.6026	AcidCon
10100202	1638	1.54E-07	-15.6863	Wet	10100202	1563	2.79E-07	-15.0921	Dry	10100202	2161	6.67E-08	-16.5231	ESP-FF
10100202	1826	4.09E-07	-14.7096	Wet	10100203	1734	2.88E-07	-15.0588	Dry	10100222	2259	6.71E-08	-16.5171	AcidCon
10100202	1330	4.05E-07	-14.7194	Wet	10100218	1563	2.91E-07	-15.0499	Dry	10100201	2319	7.68E-08	-16.3821	AcidCon
10100202	1738	9.53E-07	-13.8637	Wet	10100222	1449	3.01E-07	-15.0162	Dry	10100202	1249	7.70E-08	-16.3795	AcidCon
10100202	1743	2.94E-07	-15.0397	Wet	10100205	13461	3.01E-07	-15.0162	Dry	10100202	947	8.37E-08	-16.296	AcidCon
10100202	2239	6.03E-08	-16.6239	Wet	10100202	1129	3.53E-07	-14.8575	Dry	10100202	1915	8.48E-08	-16.283	AcidCon
10100202	2055	1.93E-07	-15.4606	Wet	10100202	1507	3.94E-07	-14.7469	Dry	10100202	1942	9.11E-08	-16.2113	AcidCon
10100202	18261	4.10E-07	-14.7071	Wet	10100218	1563	4.37E-07	-14.6433	Dry	10100223	1327	1.13E-07	-15.9959	AcidCon
10100202	966	5.64E-07	-14.3882	Wet	10100205	1346	4.42E-07	-14.632	Dry	10100202	1185	1.15E-07	-15.9783	AcidCon
10100211	900	1.26E-07	-15.887	Wet	10100226	1398	5.88E-07	-14.3465	Dry	10100205	1349	1.20E-07	-15.9358	AcidCon
10100212	1647	1.43E-08	-18.063	Wet	10100202	8761	6.30E-07	-14.2775	Dry	10100212	1021	1.26E-07	-15.8904	ESP-FF
10100212	1648	3.74E-08	-17.1016	Wet	10100205	1346111	6.40E-07	-14.2618	Dry	10100211	900	1.26E-07	-15.887	AcidCon
10100223	1307	9.99E-06	-11.5139	Wet	10100203	1735	6.77E-07	-14.2056	Dry	10100222	10040004	1.28E-07	-15.8712	ESP-FF
10100223	1327	1.13E-07	-15.9959	Wet	10100202	2021	6.88E-07	-14.1895	Dry	10100202	1637	1.43E-07	-15.7604	AcidCon
10100201	2319	7.68E-08	-16.3821	Wet	10100226	1938	7.14E-07	-14.1528	Dry	10100202	1597	1.45E-07	-15.7465	ESP-FF
10100222	2259	6.71E-08	-16.5171	Wet	10100222	2206	8.24E-07	-14.0091	Dry	10100222	1832	1.46E-07	-15.7397	ESP-FF
10100202	1515	6.16E-08	-16.6026	Wet	10100205	134611	1.25E-06	-13.5924	Dry	10100222	1833	1.53E-07	-15.6928	ESP-FF
10100202	1972	1.05E-06	-13.7667	Wet	10100202	2022	3.08E-06	-12.6906	Dry	10100202	1638	1.54E-07	-15.6863	AcidCon
10100223	2315	6.91E-07	-14.1851	Wet	10100202	550002	9.14E-06	-11.6029	Dry	10100202	8761	1.74E-07	-15.5642	AcidCon
10100223	23151	4.41E-07	-14.6342	Wet	10100202	1189	2.93E-08	-17.3457	ESP-FF	10100203	1052	1.76E-07	-15.5528	AcidCon
10100223	23152	2.57E-07	-15.1742	Wet	10100202	1190	5.44E-08	-16.7269	ESP-FF	10100202	1187	1.83E-07	-15.5138	AcidCon
10100223	23153	5.27E-07	-14.4561	Wet	10100221	2170	5.89E-08	-16.648	ESP-FF	10100202	1909	1.84E-07	-15.5083	AcidCon

Cobalt Data

All Cobalt Data					Cobalt Data merged ESP/FF					Cobalt Data Merged Dry/Wet				
SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controls	SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controls	SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controls
10100202	541	6.55E-07	-14.2386	Wet	10100202	2161	6.67E-08	-16.5231	ESP-FF	10300222	1276	1.85E-07	-15.5029	AcidCon
10100226	1558	3.19E-07	-14.9581	Wet	10100212	1021	1.26E-07	-15.8904	ESP-FF	10100222	2274	1.89E-07	-15.4815	ESP-FF
10100222	1726	4.82E-08	-16.8479	Dry	10100222	10040004	1.28E-07	-15.8712	ESP-FF	10100202	2055	1.93E-07	-15.4606	AcidCon
10100226	1938	7.14E-07	-14.1528	Dry	10100202	1597	1.45E-07	-15.7465	ESP-FF	10100224	1120	1.97E-07	-15.4401	AcidCon
10100203	1735	6.77E-07	-14.2056	Dry	10100222	1832	1.46E-07	-15.7397	ESP-FF	10100202	1654	1.99E-07	-15.43	ESP-FF
10100203	1734	2.88E-07	-15.0588	Dry	10100222	1833	1.53E-07	-15.6928	ESP-FF	10100221	1835	2.32E-07	-15.2744	ESP-FF
10100202	550002	9.14E-06	-11.6029	Dry	10100222	2274	1.89E-07	-15.4815	ESP-FF	10100222	1854	2.45E-07	-15.222	ESP-FF
10100222	1449	3.01E-07	-15.0162	Dry	10100202	1654	1.99E-07	-15.43	ESP-FF	10100202	1606	2.57E-07	-15.1742	ESP-FF
10100202	560	5.82E-08	-16.6594	Dry	10100221	1835	2.32E-07	-15.2744	ESP-FF	10100223	23152	2.57E-07	-15.1742	AcidCon
10100212	565	5.63E-08	-16.6926	Dry	10100222	1854	2.45E-07	-15.222	ESP-FF	10100202	1563	2.79E-07	-15.0921	AcidCon
10100202	1133	5.94E-08	-16.6385	Dry	10100202	1606	2.57E-07	-15.1742	ESP-FF	10100202	1004	2.88E-07	-15.0603	ESP-FF
10100202	1129	3.53E-07	-14.8575	Dry	10100202	1004	2.88E-07	-15.0603	ESP-FF	10100203	1734	2.88E-07	-15.0588	AcidCon
10100226	1398	5.88E-07	-14.3465	Dry	10100212	3197	3.00E-07	-15.0195	ESP-FF	10100218	1563	2.91E-07	-15.0499	AcidCon
10100202	1942	9.11E-08	-16.2113	Dry	10100202	2095	3.43E-07	-14.8855	ESP-FF	10100202	1743	2.94E-07	-15.0397	AcidCon
10100202	1611	5.03E-08	-16.8053	Dry	10100222	1841	3.61E-07	-14.8344	ESP-FF	10100212	3197	3.00E-07	-15.0195	ESP-FF
10100202	1909	1.84E-07	-15.5083	Dry	10100222	845	3.86E-07	-14.7674	ESP-FF	10100222	1449	3.01E-07	-15.0162	AcidCon
10100202	2021	6.88E-07	-14.1895	Dry	10100212	22791	3.97E-07	-14.7392	ESP-FF	10100205	13461	3.01E-07	-15.0162	AcidCon
10100202	1249	7.70E-08	-16.3795	Dry	10100202	2195	4.00E-07	-14.7318	ESP-FF	10100226	1558	3.19E-07	-14.9581	AcidCon
10100202	1563	2.79E-07	-15.0921	Dry	10100222	21351	4.10E-07	-14.7071	ESP-FF	10100202	1118	3.21E-07	-14.9518	AcidCon
10100218	1563	2.91E-07	-15.0499	Dry	10100218	2088	4.11E-07	-14.7047	ESP-FF	10100212	1177	3.34E-07	-14.9121	AcidCon
10100218	1563	4.37E-07	-14.6433	Dry	10100202	1471	4.14E-07	-14.6974	ESP-FF	10100202	1119	3.40E-07	-14.8943	AcidCon
10100203	1052	1.76E-07	-15.5528	Dry	10100223	12861	4.16E-07	-14.6926	ESP-FF	10100202	2095	3.43E-07	-14.8855	ESP-FF
10100205	1349	1.20E-07	-15.9358	Dry	10100202	1902	4.44E-07	-14.6274	ESP-FF	10100202	1129	3.53E-07	-14.8575	AcidCon
10100205	1346	4.42E-07	-14.632	Dry	10100223	2070	4.53E-07	-14.6074	ESP-FF	10100222	1841	3.61E-07	-14.8344	ESP-FF
10100222	2206	8.24E-07	-14.0091	Dry	10100223	2302	5.02E-07	-14.5047	ESP-FF	10100222	845	3.86E-07	-14.7674	ESP-FF
10100205	13461	3.01E-07	-15.0162	Dry	10100202	10040002	6.09E-07	-14.3114	ESP-FF	10100202	1507	3.94E-07	-14.7469	AcidCon
10100205	134611	1.25E-06	-13.5924	Dry	10100211	1642	6.40E-07	-14.2618	ESP-FF	10100212	22791	3.97E-07	-14.7392	ESP-FF
10100205	1346111	6.40E-07	-14.2618	Dry	10100203	894	6.47E-07	-14.2509	ESP-FF	10100202	2195	4.00E-07	-14.7318	ESP-FF
10100202	1507	3.94E-07	-14.7469	Dry	10100212	731	7.00E-07	-14.1715	ESP-FF	10100202	1330	4.05E-07	-14.7194	AcidCon
10100202	8761	6.30E-07	-14.2775	Dry	10100222	2011	7.63E-07	-14.086	ESP-FF	10100202	1826	4.09E-07	-14.7096	AcidCon
10100202	8761	1.74E-07	-15.5642	Dry	10100202	979	9.02E-07	-13.9187	ESP-FF	10100222	21351	4.10E-07	-14.7071	ESP-FF
10100202	2022	3.08E-06	-12.6906	Dry	10100202	1154	9.17E-07	-13.9022	ESP-FF	10100202	1176	4.10E-07	-14.7071	AcidCon
10100202	947	8.37E-08	-16.296	Dry	10100218	1310	1.13E-06	-13.6933	ESP-FF	10100202	18261	4.10E-07	-14.7071	AcidCon
10100222	1841	3.61E-07	-14.8344	FF	10100202	63254	1.16E-06	-13.6671	ESP-FF	10100218	2088	4.11E-07	-14.7047	ESP-FF

Cobalt Data

All Cobalt Data					Cobalt Data merged ESP/FF					Cobalt Data Merged Dry/Wet				
SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controls	SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controls	SCC	submittal ID	lb/mmBtu O2	LN #/mmBtu	Controls
10100222	879456	1.86E-06	-13.1949	FF	10100204	1113	1.18E-06	-13.65	ESP-FF	10100202	1471	4.14E-07	-14.6974	ESP-FF
10100202	1244	4.11E-06	-12.4028	FF	10100212	632	1.23E-06	-13.6085	ESP-FF	10100223	12861	4.16E-07	-14.6926	ESP-FF
10100222	1832	1.46E-07	-15.7397	FF	10100202	2276	1.27E-06	-13.5765	ESP-FF	10100218	1563	4.37E-07	-14.6433	AcidCon
10100222	1833	1.53E-07	-15.6928	FF	10100202	1989	1.28E-06	-13.5687	ESP-FF	10100223	23151	4.41E-07	-14.6342	AcidCon
10100221	1835	2.32E-07	-15.2744	FF	10100202	1906	1.40E-06	-13.479	ESP-FF	10100205	1346	4.42E-07	-14.632	AcidCon
10100202	1597	1.45E-07	-15.7465	FF	10100212	2279	1.41E-06	-13.4711	ESP-FF	10100202	1902	4.44E-07	-14.6274	ESP-FF
10100218	1310	1.13E-06	-13.6933	FF	10100223	2009	1.42E-06	-13.4649	ESP-FF	10100223	2070	4.53E-07	-14.6074	ESP-FF
10100202	1189	2.93E-08	-17.3457	FF	10100222	2013	1.70E-06	-13.2849	ESP-FF	10100202	1117	4.90E-07	-14.5289	AcidCon
10100202	1190	5.44E-08	-16.7269	FF	10100203	1809	1.84E-06	-13.2057	ESP-FF	10100202	1117	4.90E-07	-14.5289	AcidCon
10100202	2095	3.43E-07	-14.8855	FF	10100222	879456	1.86E-06	-13.1949	ESP-FF	10100223	2302	5.02E-07	-14.5047	ESP-FF
10100202	1606	2.57E-07	-15.1742	FF	10100202	734	1.91E-06	-13.1707	ESP-FF	10100223	23153	5.27E-07	-14.4561	AcidCon
10100221	2170	5.89E-08	-16.648	FF	10100212	2103	2.01E-06	-13.1174	ESP-FF	10100202	966	5.64E-07	-14.3882	AcidCon
10100202	735	5.08E-06	-12.1904	FF	10100226	2278	2.16E-06	-13.0454	ESP-FF	10100226	1398	5.88E-07	-14.3465	AcidCon
10100202	1654	1.99E-07	-15.43	FF	10100226	1141	2.20E-06	-13.0271	ESP-FF	10100202	10040002	6.09E-07	-14.3114	ESP-FF
10100202	63254	1.16E-06	-13.6671	FF	10100201	902	2.82E-06	-12.7788	ESP-FF	10100202	8761	6.30E-07	-14.2775	AcidCon
10100218	2088	4.11E-07	-14.7047	FF	10100202	1636	2.83E-06	-12.7752	ESP-FF	10100205	1346111	6.40E-07	-14.2618	AcidCon
10100222	845	3.86E-07	-14.7674	FF	10100202	736	2.99E-06	-12.7194	ESP-FF	10100211	1642	6.40E-07	-14.2618	ESP-FF
10100218	524	3.40E-06	-12.5917	FF	10100223	828	3.30E-06	-12.6216	ESP-FF	10100203	894	6.47E-07	-14.2509	ESP-FF
10100202	734	1.91E-06	-13.1707	FF	10100202	993	3.35E-06	-12.6066	ESP-FF	10100202	541	6.55E-07	-14.2386	AcidCon
10100202	736	2.99E-06	-12.7194	FF	10100218	524	3.40E-06	-12.5917	ESP-FF	10100203	1735	6.77E-07	-14.2056	AcidCon
10100222	2013	1.70E-06	-13.2849	ESP	10100202	1244	4.11E-06	-12.4028	ESP-FF	10100202	2021	6.88E-07	-14.1895	AcidCon
10100222	2011	7.63E-07	-14.086	ESP	10100202	975	4.78E-06	-12.2511	ESP-FF	10100223	2315	6.91E-07	-14.1851	AcidCon
10100223	2009	1.42E-06	-13.4649	ESP	10100222	2135	4.96E-06	-12.2141	ESP-FF	10100212	731	7.00E-07	-14.1715	ESP-FF
10100226	1141	2.20E-06	-13.0271	ESP	10100202	1845	5.00E-06	-12.2061	ESP-FF	10100226	1938	7.14E-07	-14.1528	AcidCon
10100202	1154	9.17E-07	-13.9022	ESP	10100202	735	5.08E-06	-12.1904	ESP-FF	10100222	2011	7.63E-07	-14.086	ESP-FF
10100212	1021	1.26E-07	-15.8904	ESP	10100203	892	6.30E-06	-11.975	ESP-FF	10100222	2206	8.24E-07	-14.0091	AcidCon
10100212	3197	3.00E-07	-15.0195	ESP	10100204	1111	7.00E-06	-11.8696	ESP-FF	10100202	979	9.02E-07	-13.9187	ESP-FF
10100202	1902	4.44E-07	-14.6274	ESP	10100201	903	8.70E-06	-11.6522	ESP-FF	10100202	1154	9.17E-07	-13.9022	ESP-FF
10100202	1636	2.83E-06	-12.7752	ESP	10100212	1647	1.43E-08	-18.063	Wet	10100202	1738	9.53E-07	-13.8637	AcidCon
10100203	1809	1.84E-06	-13.2057	ESP	10100212	1648	3.74E-08	-17.1016	Wet	10100202	1972	1.05E-06	-13.7667	AcidCon
10100226	2278	2.16E-06	-13.0454	ESP	10100202	2239	6.03E-08	-16.6239	Wet	10100218	1310	1.13E-06	-13.6933	ESP-FF
10100202	1845	5.00E-06	-12.2061	ESP	10100202	1515	6.16E-08	-16.6026	Wet	10100202	63254	1.16E-06	-13.6671	ESP-FF
10100222	1854	2.45E-07	-15.222	ESP	10100222	2259	6.71E-08	-16.5171	Wet	10100204	1113	1.18E-06	-13.65	ESP-FF
10100222	10040004	1.28E-07	-15.8712	ESP	10100201	2319	7.68E-08	-16.3821	Wet	10100212	632	1.23E-06	-13.6085	ESP-FF

Outlier Tests for Selected Variables

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for LN #/mmBtu (dry)

Mean -15.05

Standard Deviation 1.23

Number of data 31

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-15.05	1.21	-11.6	31	2.848	2.92	3.25
2	-15.16	1.069	-12.69	30	2.314	2.91	3.24
3	-15.25	0.978	-13.59	29	1.694	2.89	3.22
4	-15.31	0.942	-16.85	1	1.634	2.88	3.2
5	-15.25	0.909	-16.81	2	1.708	2.86	3.18

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for LN #/mmBtu (esp)

Mean -13.83

Standard Deviation 1.158

Number of data 44

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-13.83	1.145	-16.52	1	2.349	3.08	3.43
2	-13.77	1.094	-11.65	44	1.938	3.07	3.41
3	-13.82	1.055	-15.89	2	1.96	3.06	3.4
4	-13.77	1.016	-15.87	3	2.066	3.05	3.39
5	-13.72	0.971	-11.87	43	1.906	3.04	3.38

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for LN #/mmBtu (ff)

Number of data = 21

10% critical value: 0.391

5% critical value: 0.44

1% critical value: 0.524

1. Data Value -12.19039596 is a Potential Outlier (Upper)

Test Statistic: 0.090

For 10% significance level, -12.19039596 is not an outlier.

For 5% significance level, -12.19039596 is not an outlier.

For 1% significance level, -12.19039596 is not an outlier.

2. Data Value -17.34567832 is a Potential Outlier (Lower)

Test Statistic: 0.147

For 10% significance level, -17.34567832 is not an outlier.

For 5% significance level, -17.34567832 is not an outlier.

For 1% significance level, -17.34567832 is not an outlier.

Rosner's Outlier Test for LN #/mmBtu (wet)

Mean -15.21

Standard Deviation 1.144

Number of data 36

Number of suspected outliers 5

			Potential	Obs.	Test	Critical	Critical
#	Mean	sd	outlier	Number	value	value (5%)	value (1%)
1	-15.21	1.128	-11.51	36	3.28	2.99	3.33
2	-15.32	0.966	-18.06	1	2.842	2.98	3.32
3	-15.24	0.852	-17.1	2	2.187	2.97	3.3
4	-15.18	0.798	-16.62	3	1.807	2.95	3.29
5	-15.14	0.767	-16.6	4	1.912	2.94	3.27

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation -11.51 is a Potential Statistical Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2'(esp)

Background Data: 'lb/mmBtuO2'(ff)

Raw Statistics

	ESP	Fabric Filter
Number of Valid Observations	44	21
Number of Distinct Observations	44	21
Minimum	6.6700E-8	2.9300E-8
Maximum	8.7000E-6	5.0800E-6
Mean	1.7749E-6	1.1626E-6
Median	1.0485E-6	3.6100E-7
SD	2.0113E-6	1.5057E-6
SE of Mean	3.0321E-7	3.2856E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	63	1.237	1.669	0.110
Welch-Satterthwaite (Unequal Variance)	51.3	1.369	1.675	0.088

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	4.045E-12
Variance of Background	2.267E-12

Numerator DF	Denominator DF	F-Test Value	P-Value
43	20	1.784	0.163

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2'(ff)

Background Data: 'lb/mmBtuO2'(esp)

Raw Statistics

	Fabric Filte	ESP
Number of Valid Observations	21	44
Number of Distinct Observations	21	44
Minimum	2.9300E-8	6.6700E-8
Maximum	5.0800E-6	8.7000E-6
Mean	1.1626E-6	1.7749E-6
Median	3.6100E-7	1.0485E-6
SD	1.5057E-6	2.0113E-6
SE of Mean	3.2856E-7	3.0321E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	63	-1.237	1.669	0.890
Welch-Satterthwaite (Unequal Variance)	51.3	-1.369	1.675	0.912

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2.267E-12		
Variance of Background	4.045E-12		
Numerator DF	Denominator DF	F-Test Value	P-Value
43	20	1.784	0.163

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' com(esp-ff)

Background Data: 'lb/mmBtuO2' com(dry)

Raw Statistics

	Site	Background
Number of Valid Observations	65	31
Number of Distinct Observations	65	30
Minimum	2.9300E-8	4.8200E-8
Maximum	8.7000E-6	9.1400E-6
Mean	1.5771E-6	7.2565E-7
Median	7.6300E-7	3.0100E-7
SD	1.8734E-6	1.6611E-6
SE of Mean	2.3237E-7	2.9834E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	94	2.157	1.661	0.017
Welch-Satterthwaite (Unequal Variance)	66.0	2.252	1.668	0.014

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	3.510E-12
Variance of Background	2.759E-12

Numerator DF	Denominator DF	F-Test Value	P-Value
64	30	1.272	0.475

Conclusion with Alpha = 0.05

* Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' com(esp-ff)

Background Data: 'lb/mmBtuO2' com(wet)

Raw Statistics

	Site	Background
Number of Valid Observations	65	35
Number of Distinct Observations	65	33
Minimum	2.9300E-8	1.4300E-8
Maximum	8.7000E-6	1.0500E-6
Mean	1.5771E-6	3.1918E-7
Median	7.6300E-7	2.9400E-7
SD	1.8734E-6	2.5032E-7
SE of Mean	2.3237E-7	4.2312E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	98	3.944	1.661	0.000
Welch-Satterthwaite (Unequal Variance)	68.2	5.326	1.668	0.000

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	3.510E-12
Variance of Background	6.266E-14

Numerator DF	Denominator DF	F-Test Value	P-Value
64	34	56.010	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' com(dry)

Background Data: 'lb/mmBtuO2' com(wet)

Raw Statistics

	Site	Background
Number of Valid Observations	31	35
Number of Distinct Observations	30	33
Minimum	4.8200E-8	1.4300E-8
Maximum	9.1400E-6	1.0500E-6
Mean	7.2565E-7	3.1918E-7
Median	3.0100E-7	2.9400E-7
SD	1.6611E-6	2.5032E-7
SE of Mean	2.9834E-7	4.2312E-8

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	64	1.431	1.669	0.079
Welch-Satterthwaite (Unequal Variance)	31.2	1.349	1.696	0.094

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2.759E-12		
Variance of Background	6.266E-14		
Numerator DF	Denominator DF	F-Test Value	P-Value
30	34	44.034	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' com(wet)

Background Data: 'lb/mmBtuO2' com(dry)

Raw Statistics

	Site	Background
Number of Valid Observations	35	31
Number of Distinct Observations	33	30
Minimum	1.4300E-8	4.8200E-8
Maximum	1.0500E-6	9.1400E-6
Mean	3.1918E-7	7.2565E-7
Median	2.9400E-7	3.0100E-7
SD	2.5032E-7	1.6611E-6
SE of Mean	4.2312E-8	2.9834E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	64	-1.431	1.669	0.921
Welch-Satterthwaite (Unequal Variance)	31.2	-1.349	1.696	0.906

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	6.266E-14
Variance of Background	2.759E-12

Numerator DF	Denominator DF	F-Test Value	P-Value
30	34	44.034	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' acd(esp-ff)

Background Data: 'lb/mmBtuO2' acd(acidcon)

Raw Statistics

	ESP-FF	Wet/Dry Scrub
Number of Valid Observations	65	66
Number of Distinct Observations	65	63
Minimum	2.9300E-8	1.4300E-8
Maximum	8.7000E-6	9.1400E-6
Mean	1.5771E-6	5.1010E-7
Median	7.6300E-7	2.9750E-7
SD	1.8734E-6	1.1611E-6
SE of Mean	2.3237E-7	1.4292E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	129	3.925	1.657	0.000
Welch-Satterthwaite (Unequal Variance)	106.6	3.911	1.659	0.000

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

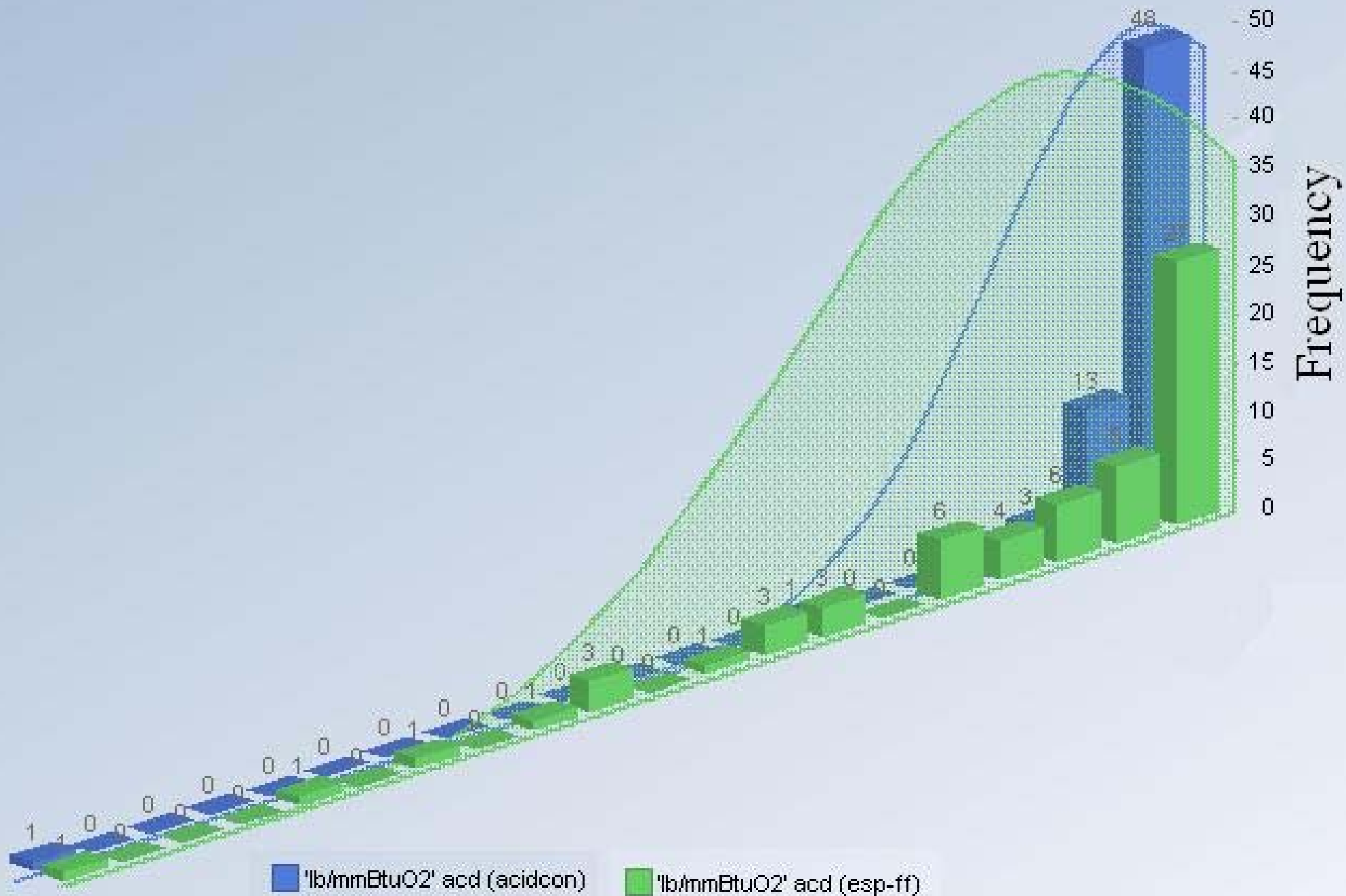
Test of Equality of Variances

Variance of Site	Variance of Background	F-Test Value	P-Value
3.510E-12	1.348E-12	2.603	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

Histograms for Cobalt (ESP/FF, Wet/Dry Scrub)



Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
mBtuO2' acd (acidcon)	66	1.4300E-8	9.1400E-6	5.1010E-7	2.9750E-7	1.348E-12	1.1611E-6	2.7947E-7	6.673	48.77	N/A
/mmBtuO2' acd (esp-ff)	65	2.9300E-8	8.7000E-6	1.5771E-6	7.6300E-7	3.510E-12	1.8734E-6	9.0437E-7	1.843	3.308	N/A

Percentiles for Raw Full Data Sets

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
mBtuO2' acd (acidcon)	66	5.1800E-8	5.9850E-8	8.4800E-8	1.1625E-7	2.9750E-7	4.9000E-7	5.8800E-7	7.0250E-7	1.0258E-6	5.2010E-6
/mmBtuO2' acd (esp-ff)	65	7.8560E-8	1.4540E-7	2.5460E-7	3.4300E-7	7.6300E-7	2.0100E-6	2.8220E-6	4.5120E-6	5.0640E-6	7.6120E-6

Coal Fired Utility Boiler Lead Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Lead Emissions Factor are presented on the following page with two sets of columns. The left set of columns contains data from all facilities and presents SCC, Submittal ID, emissions factors, the natural log of the emissions factor and the control measure employed. At the bottom of this column, data identified as statistical outliers are highlighted and were not included in further assessments. The right set of columns contains the same information except that the ESP controlled data are excluded since the analysis indicated that there were no statistical difference between the Fabric Filter controls and the acid gas controls (Wet Scrubber & Dry Scrubber). The site specific emissions factors presented are as determined using the f factor method rather than the emissions factor determined by dividing the hourly emissions by the coal feed and associated proximate analysis. Subsequent pages provide the assessments as performed using EPA's statistical software ProUCL. The assessments provide support for developing a national emissions factor for ESP controlled boilers, and for developing a combined national emissions factor for Fabric Filter, Dry Scrubbing and Wet Scrubbing controls. Separate emissions factors were developed for the reasons cited earlier.

The resulting calculated lead emissions factors are:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP controls	6.61×10^{-6}	43	Highly Representative
Fabric Filter, Dry Scrubbing & Wet Scrubbing controls	2.25×10^{-6}	89	Highly Representative

Lead Emissions Data

All Lead Emissions Test Data

Lead Emissions Data less ESP & Outlier

All Lead Emissions Test Data					Lead Emissions Data less ESP & Outlier				
SCC	submittal ID	lb/mmBtu	LN #/mmBtu	Controls	SCC	submittal ID	lb/mmBtu	LN #/mmBtu	Controls
10100202	1611	9.98E-08	-16.120098	Dry	10100202	1611	9.98E-08	-16.1201	Dry
10100202	947	1.32E-07	-15.840464	Dry	10100202	947	1.32E-07	-15.84046	Dry
10100222	1726	1.55E-07	-15.679841	Dry	10100222	1726	1.55E-07	-15.67984	Dry
10100202	1249	2.33E-07	-15.272227	Dry	10100202	1249	2.33E-07	-15.27223	Dry
10100202	1133	2.61E-07	-15.159959	Dry	10100202	1133	2.61E-07	-15.15996	Dry
10100202	1488	2.94E-07	-15.039686	Dry	10100202	1488	2.94E-07	-15.03969	Dry
10100202	1942	3.17E-07	-14.964364	Dry	10100202	1942	3.17E-07	-14.96436	Dry
10100202	1129	3.53E-07	-14.856703	Dry	10100202	1129	3.53E-07	-14.8567	Dry
10100205	13461	5.39E-07	-14.43355	Dry	10100205	13461	5.39E-07	-14.43355	Dry
10100203	1052	5.78E-07	-14.363692	Dry	10100203	1052	5.78E-07	-14.36369	Dry
10100222	1449	6.81E-07	-14.199704	Dry	10100222	1449	6.81E-07	-14.1997	Dry
10100205	1346	7.89E-07	-14.0525	Dry	10100205	1346	7.89E-07	-14.0525	Dry
10100222	1568	8.44E-07	-13.985113	Dry	10100222	1568	8.44E-07	-13.98511	Dry
10100202	560	9.59E-07	-13.857375	Dry	10100202	560	9.59E-07	-13.85737	Dry
10100202	2021	1.00E-06	-13.815511	Dry	10100202	2021	1.00E-06	-13.81551	Dry
10100202	8761	1.02E-06	-13.795708	Dry	10100202	8761	1.02E-06	-13.79571	Dry
10100212	565	1.07E-06	-13.747852	Dry	10100212	565	1.07E-06	-13.74785	Dry
10100205	1346111	1.21E-06	-13.62489	Dry	10100205	1346111	1.21E-06	-13.62489	Dry
10100202	8761	1.32E-06	-13.537879	Dry	10100202	8761	1.32E-06	-13.53788	Dry
10100205	1349	1.55E-06	-13.377256	Dry	10100205	1349	1.55E-06	-13.37726	Dry
10100203	1734	1.79E-06	-13.232588	Dry	10100203	1734	1.79E-06	-13.23259	Dry
10100205	134611	1.99E-06	-13.127376	Dry	10100205	134611	1.99E-06	-13.12738	Dry
10100203	1735	2.06E-06	-13.093101	Dry	10100203	1735	2.06E-06	-13.0931	Dry
10100222	2206	2.06E-06	-13.092805	Dry	10100222	2206	2.06E-06	-13.0928	Dry
10100226	1398	2.18E-06	-13.036186	Dry	10100226	1398	2.18E-06	-13.03619	Dry
10100202	698	2.86E-06	-12.764689	Dry	10100202	698	2.86E-06	-12.76469	Dry
10100218	1563	3.33E-06	-12.612538	Dry	10100218	1563	3.33E-06	-12.61254	Dry
10100202	1563	3.35E-06	-12.60655	Dry	10100202	1563	3.35E-06	-12.60655	Dry
10100226	1938	3.88E-06	-12.459675	Dry	10100226	1938	3.88E-06	-12.45968	Dry
10100202	2022	4.82E-06	-12.242737	Dry	10100202	2022	4.82E-06	-12.24274	Dry
10100202	550002	8.93E-06	-11.626094	Dry	10100202	550002	8.93E-06	-11.62609	Dry
10100202	1909	1.07E-05	-11.445267	Dry	10100202	1909	1.07E-05	-11.44527	Dry
10100218	1563	2.00E-05	-10.819778	Dry	10100218	1563	2.00E-05	-10.81978	Dry
10100212	1021	2.89E-07	-15.056398	ESP	10100221	1835	1.32E-07	-15.84039	FF
10100222	10040004	3.12E-07	-14.980263	ESP	10100222	1832	2.91E-07	-15.04994	FF
10100212	2103	4.78E-07	-14.553655	ESP	10100222	1833	3.21E-07	-14.95182	FF
10100202	2161	4.97E-07	-14.514676	ESP	10100202	1597	3.97E-07	-14.73933	FF
10100212	22791	6.39E-07	-14.263347	ESP	10100202	736	4.29E-07	-14.66211	FF
10100226	2278	6.59E-07	-14.232542	ESP	10100221	2170	4.36E-07	-14.6459	FF
10100202	1902	6.67E-07	-14.220476	ESP	10100202	1606	6.52E-07	-14.24322	FF
10100202	1004	7.02E-07	-14.169332	ESP	10100202	2095	6.59E-07	-14.23254	FF
10100202	2195	7.32E-07	-14.127485	ESP	10100222	845	9.24E-07	-13.89455	FF
10100212	3197	7.78E-07	-14.066539	ESP	10100202	1189	1.07E-06	-13.74785	FF
10100223	2070	9.71E-07	-13.844939	ESP	10100202	735	1.17E-06	-13.65426	FF
10100212	2279	1.18E-06	-13.653721	ESP	10100218	2088	1.43E-06	-13.45784	FF
10100202	979	1.31E-06	-13.545483	ESP	10100218	1310	1.59E-06	-13.35178	FF
10100202	10040002	1.40E-06	-13.479038	ESP	10100202	63254	2.12E-06	-13.06409	FF
10100223	12861	1.47E-06	-13.430248	ESP	10100202	1244	2.17E-06	-13.04126	FF

Lead Emissions Data

All Lead Emissions Test Data

Lead Emissions Data less ESP & Outlier

All Lead Emissions Test Data					Lead Emissions Data less ESP & Outlier				
SCC	submittal ID	lb/mmBtu	LN #/mmBtu	Controls	SCC	submittal ID	lb/mmBtu	LN #/mmBtu	Controls
10100211	1642	1.81E-06	-13.222184	ESP	10100202	734	2.30E-06	-12.98245	FF
10100203	894	2.13E-06	-13.059389	ESP	10100202	1654	2.38E-06	-12.94841	FF
10100212	731	2.13E-06	-13.057731	ESP	10100202	1190	2.87E-06	-12.7612	FF
10100202	2276	2.14E-06	-13.054705	ESP	10100222	879456	3.80E-06	-12.48051	FF
10100222	2011	2.25E-06	-13.00458	ESP	10100222	1841	3.88E-06	-12.45968	FF
10100202	1154	2.33E-06	-12.969642	ESP	10100218	524	6.96E-06	-11.87533	FF
10100222	2274	2.48E-06	-12.907252	ESP	10100202	1972	9.05E-08	-16.21792	Wet
10100204	1113	3.06E-06	-12.697096	ESP	10100222	2259	1.42E-07	-15.76744	Wet
10100202	1989	3.93E-06	-12.446871	ESP	10100212	1648	1.83E-07	-15.51378	Wet
10100222	2013	4.03E-06	-12.421744	ESP	10100202	1743	2.20E-07	-15.32964	Wet
10100226	1141	4.12E-06	-12.399657	ESP	10100223	1327	2.35E-07	-15.26368	Wet
10100222	1854	4.60E-06	-12.289454	ESP	10300222	1276	2.36E-07	-15.25943	Wet
10100201	902	4.93E-06	-12.220172	ESP	10100202	2239	2.70E-07	-15.12484	Wet
10100223	2009	6.30E-06	-11.974961	ESP	10100201	2319	2.79E-07	-15.09205	Wet
10100212	632	6.90E-06	-11.883989	ESP	10100202	1515	3.18E-07	-14.96121	Wet
10100202	1906	7.21E-06	-11.840042	ESP	10100202	541	3.21E-07	-14.95182	Wet
10100203	1809	7.78E-06	-11.763954	ESP	10100223	23152	3.23E-07	-14.94561	Wet
10100202	993	7.99E-06	-11.73732	ESP	10100223	23151	3.79E-07	-14.78573	Wet
10100202	1636	9.36E-06	-11.579065	ESP	10100202	1637	3.91E-07	-14.75456	Wet
10100202	975	9.61E-06	-11.552706	ESP	10100202	1118	4.00E-07	-14.7318	Wet
10100223	828	9.93E-06	-11.51995	ESP	10100224	1120	5.11E-07	-14.4869	Wet
10100201	903	1.31E-05	-11.242898	ESP	10100202	1915	5.14E-07	-14.48104	Wet
10100202	1845	1.41E-05	-11.169336	ESP	10100202	1187	5.20E-07	-14.46944	Wet
10100204	1111	1.81E-05	-10.919599	ESP	10100202	1176	5.57E-07	-14.4007	Wet
10100222	21351	1.89E-05	-10.876349	ESP	10100202	1638	5.605E-07	-14.39451	Wet
10100203	892	2.18E-05	-10.733601	ESP	10100223	23153	5.87E-07	-14.34824	Wet
10100223	2302	2.26E-05	-10.697561	ESP	10100202	1185	6.78E-07	-14.20412	Wet
10100202	1471	5.86E-05	-9.7447759	ESP	10100202	1119	7.83E-07	-14.06013	Wet
10100221	1835	1.32E-07	-15.840394	FF	10100223	1307	9.25E-07	-13.89347	Wet
10100222	1832	2.91E-07	-15.049943	FF	10100202	2055	9.82E-07	-13.83367	Wet
10100222	1833	3.21E-07	-14.951825	FF	10100212	1647	1.01E-06	-13.80556	Wet
10100202	1597	3.97E-07	-14.73933	FF	10100223	2315	1.05E-06	-13.76672	Wet
10100202	736	4.29E-07	-14.662105	FF	10100202	1117	1.12E-06	-13.70218	Wet
10100221	2170	4.36E-07	-14.645895	FF	10100202	1117	1.12E-06	-13.70218	Wet
10100202	1606	6.52E-07	-14.243221	FF	10100202	1330	1.20E-06	-13.63319	Wet
10100202	2095	6.59E-07	-14.232542	FF	10100202	1738	4.03E-06	-12.42174	Wet
10100222	845	9.24E-07	-13.894554	FF	10100202	1826	4.77E-06	-12.25316	Wet
10100202	1189	1.07E-06	-13.747852	FF	10100226	1558	4.77E-06	-12.25316	Wet
10100202	735	1.17E-06	-13.654257	FF	10100202	18261	7.95E-06	-11.74234	Wet
10100218	2088	1.43E-06	-13.457836	FF	10100212	1177	8.57E-06	-11.66724	Wet
10100218	1310	1.59E-06	-13.351777	FF	10100202	966	3.70E-05	-10.20459	Wet
10100202	63254	2.12E-06	-13.064094	FF					
10100202	1244	2.17E-06	-13.041257	FF					
10100202	734	2.30E-06	-12.982453	FF					
10100202	1654	2.38E-06	-12.94841	FF					
10100202	1190	2.87E-06	-12.761199	FF					
10100222	879456	3.80E-06	-12.480509	FF					
10100222	1841	3.88E-06	-12.459675	FF					

Lead Emissions Data

All Lead Emissions Test Data

Lead Emissions Data less ESP & Outlier

All Lead Emissions Test Data					Lead Emissions Data less ESP & Outlier				
submittal		LN			submittal		LN		
SCC	ID	lb/mmBtu	#/mmBtu	Controls	SCC	ID	lb/mmBtu	#/mmBtu	Controls
10100218	524	6.96E-06	-11.875331	FF					
10100202	1972	9.05E-08	-16.217916	Wet					
10100222	2259	1.42E-07	-15.767439	Wet					
10100212	1648	1.83E-07	-15.51378	Wet					
10100202	1743	2.20E-07	-15.329638	Wet					
10100223	1327	2.35E-07	-15.26368	Wet					
10300222	1276	2.36E-07	-15.259434	Wet					
10100202	2239	2.70E-07	-15.124844	Wet					
10100201	2319	2.79E-07	-15.092054	Wet					
10100202	1515	3.18E-07	-14.961214	Wet					
10100202	541	3.21E-07	-14.951825	Wet					
10100223	23152	3.23E-07	-14.945614	Wet					
10100223	23151	3.79E-07	-14.78573	Wet					
10100202	1637	3.91E-07	-14.754558	Wet					
10100202	1118	4.00E-07	-14.731801	Wet					
10100224	1120	5.11E-07	-14.486896	Wet					
10100202	1915	5.14E-07	-14.481043	Wet					
10100202	1187	5.20E-07	-14.469437	Wet					
10100202	1176	5.57E-07	-14.400701	Wet					
10100202	1638	5.6046E-07	-14.394507	Wet					
10100223	23153	5.87E-07	-14.348241	Wet					
10100202	1185	6.78E-07	-14.204119	Wet					
10100202	1119	7.83E-07	-14.060133	Wet					
10100223	1307	9.25E-07	-13.893472	Wet					
10100202	2055	9.82E-07	-13.833675	Wet					
10100212	1647	1.01E-06	-13.80556	Wet					
10100223	2315	1.05E-06	-13.76672	Wet					
10100202	1117	1.12E-06	-13.702182	Wet					
10100202	1117	1.12E-06	-13.702182	Wet					
10100202	1330	1.20E-06	-13.633189	Wet					
10100202	1738	4.03E-06	-12.421744	Wet					
10100202	1826	4.77E-06	-12.253164	Wet					
10100226	1558	4.77E-06	-12.253164	Wet					
10100202	18261	7.95E-06	-11.742339	Wet					
10100212	1177	8.57E-06	-11.667243	Wet					
10100202	966	3.70E-05	-10.204593	Wet					
10100202	1507	1.38E-04	-8.8882569	Dry					
10100222	2135	2.81E-03	-5.8745708	ESP					
10100211	900	1.19E-01	-2.1286318	Wet					

Outlier Tests for Selected Variables

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for LN #/mmBtu (dry)

Mean -13.55

Standard Deviation 1.498

Number of data 34

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-13.55	1.476	-8.888	8	3.16	2.97	3.3
2	-13.69	1.27	-10.82	27	2.262	2.95	3.29
3	-13.78	1.179	-11.45	2	1.982	2.94	3.27
4	-13.86	1.118	-16.12	5	2.023	2.91	3.25
5	-13.78	1.054	-11.63	1	2.048	2.91	3.24

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation -8.888 is a Potential Statistical Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for LN #/mmBtu (esp)

Mean -12.57

Standard Deviation 1.652

Number of data 44

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-12.57	1.633	-5.875	35	4.099	3.08	3.43
2	-12.72	1.304	-9.745	12	2.284	3.07	3.41
3	-12.79	1.233	-15.06	24	1.834	3.06	3.4
4	-12.74	1.195	-14.98	32	1.875	3.05	3.39
5	-12.68	1.155	-10.7	39	1.72	3.04	3.38

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation -5.875 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation -5.875 is a Potential Statistical Outlier

Dixon's Outlier Test for LN #/mmBtu (ff)

Number of data = 21

10% critical value: 0.391

5% critical value: 0.44

1% critical value: 0.524

1. Data Value -11.87533108 is a Potential Outlier (Upper)

Test Statistic: 0.197

For 10% significance level, -11.87533108 is not an outlier.

For 5% significance level, -11.87533108 is not an outlier.

For 1% significance level, -11.87533108 is not an outlier.

2. Data Value -15.84039383 is a Potential Outlier (Lower)

Test Statistic: 0.264

For 10% significance level, -15.84039383 is not an outlier.

For 5% significance level, -15.84039383 is not an outlier.

For 1% significance level, -15.84039383 is not an outlier.

Rosner's Outlier Test for LN #/mmBtu (wet)

Mean -13.79

Standard Deviation 2.371

Number of data 36

Number of suspected outliers 5

	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-13.79	2.338	-2.129	23	4.99	2.99	3.33
2	-14.13	1.292	-10.2	17	3.035	2.98	3.32
3	-14.24	1.114	-11.67	24	2.311	2.97	3.3
4	-14.32	1.033	-11.74	16	2.496	2.95	3.29
5	-14.4	0.938	-12.25	14	2.289	2.94	3.27

For 5% significance level, there are 2 Potential Outliers

Therefore, Potential Statistical Outliers are

-2.129, -10.2

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation -2.129 is a Potential Statistical Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' trim(esp)

Background Data: 'lb/mmBtuO2' trim(ff)

Raw Statistics

	Site	Background
Number of Valid Observations	43	21
Number of Distinct Observations	42	21
Minimum	2.8900E-7	1.3200E-7
Maximum	5.8600E-5	6.9600E-6
Mean	6.6117E-6	1.7134E-6
Median	2.4800E-6	1.1700E-6
SD	1.0102E-5	1.6465E-6
SE of Mean	1.5406E-6	3.5929E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	62	2.199	1.670	0.016
Welch-Satterthwaite (Unequal Variance)	46.4	3.096	1.679	0.002

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	1.021E-10		
Variance of Background	2.711E-12		
Numerator DF	Denominator DF	F-Test Value	P-Value
42	20	37.648	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' trim(ff)

Background Data: 'lb/mmBtuO2' trim(dry)

Raw Statistics

	Site	Background
Number of Valid Observations	21	33
Number of Distinct Observations	21	32
Minimum	1.3200E-7	9.9800E-8
Maximum	6.9600E-6	2.0000E-5
Mean	1.7134E-6	2.4653E-6
Median	1.1700E-6	1.0700E-6
SD	1.6465E-6	3.9349E-6
SE of Mean	3.5929E-7	6.8498E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	52	-0.828	1.675	0.794
Welch-Satterthwaite (Unequal Variance)	46.4	-0.972	1.679	0.832

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2.711E-12		
Variance of Background	1.548E-11		
Numerator DF	Denominator DF	F-Test Value	P-Value
32	20	5.712	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' trim(dry)

Background Data: 'lb/mmBtuO2' trim(ff)

Raw Statistics

	Site	Background
Number of Valid Observations	33	21
Number of Distinct Observations	32	21
Minimum	9.9800E-8	1.3200E-7
Maximum	2.0000E-5	6.9600E-6
Mean	2.4653E-6	1.7134E-6
Median	1.0700E-6	1.1700E-6
SD	3.9349E-6	1.6465E-6
SE of Mean	6.8498E-7	3.5929E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	52	0.828	1.675	0.206
Welch-Satterthwaite (Unequal Variance)	46.4	0.972	1.679	0.168

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.548E-11		
Variance of Background	2.711E-12		
Numerator DF	Denominator DF	F-Test Value	P-Value
32	20	5.712	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' trim(ff)

Background Data: 'lb/mmBtuO2' trim(wet)

Raw Statistics

	Site	Background
Number of Valid Observations	21	35
Number of Distinct Observations	21	33
Minimum	1.3200E-7	9.0500E-8
Maximum	6.9600E-6	3.7000E-5
Mean	1.7134E-6	2.3713E-6
Median	1.1700E-6	5.5700E-7
SD	1.6465E-6	6.3766E-6
SE of Mean	3.5929E-7	1.0778E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	54	-0.462	1.674	0.677
Welch-Satterthwaite (Unequal Variance)	41.1	-0.579	1.683	0.717

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background

* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	2.711E-12
Variance of Background	4.066E-11

Numerator DF	Denominator DF	F-Test Value	P-Value
34	20	14.999	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' trim(wet)

Background Data: 'lb/mmBtuO2' trim(ff)

Raw Statistics

	Site	Background
Number of Valid Observations	35	21
Number of Distinct Observations	33	21
Minimum	9.0500E-8	1.3200E-7
Maximum	3.7000E-5	6.9600E-6
Mean	2.3713E-6	1.7134E-6
Median	5.5700E-7	1.1700E-6
SD	6.3766E-6	1.6465E-6
SE of Mean	1.0778E-6	3.5929E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	54	0.462	1.674	0.323
Welch-Satterthwaite (Unequal Variance)	41.1	0.579	1.683	0.283

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	4.066E-11		
Variance of Background	2.711E-12		
Numerator DF	Denominator DF	F-Test Value	P-Value
34	20	14.999	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Confidence Coefficient 0.95

'Ib/mmBtuO2' trim (dry)

Raw Statistics

Number of Valid Observations	33
Number of Distinct Observations	32
Minimum	9.9800E-8
Maximum	2.0000E-5
Mean of Raw Data	2.4653E-6
Standard Deviation of Raw Data	3.9349E-6
Kstar	0.716
Mean of Log Transformed Data	-13.69
Standard Deviation of Log Transformed Data	1.27

Normal Distribution Test Results

Correlation Coefficient R	0.747
Shapiro Wilk Test Statistic	0.583
Shapiro Wilk Critical (0.95) Value	0.931
Approximate Shapiro Wilk P Value	3.049E-10
Lilliefors Test Statistic	0.286
Lilliefors Critical (0.95) Value	0.154

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.948
A-D Test Statistic	0.816
A-D Critical (0.95) Value	0.787
K-S Test Statistic	0.146
K-S Critical(0.95) Value	0.159

Data follow Appr. Gamma Distribution at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.995
Shapiro Wilk Test Statistic	0.985
Shapiro Wilk Critical (0.95) Value	0.931
Approximate Shapiro Wilk P Value	0.93
Lilliefors Test Statistic	0.0626
Lilliefors Critical (0.95) Value	0.154

Data appear Lognormal at (0.05) Significance Level

'Ib/mmBtuO2' trim (esp)

Raw Statistics

Number of Valid Observations	43
------------------------------	----

Number of Distinct Observations	42						
Minimum	2.8900E-7						
Maximum	5.8600E-5						
Mean of Raw Data	6.6117E-6						
Standard Deviation of Raw Data	1.0102E-5						
Kstar	0.714						
Mean of Log Transformed Data	-12.72						
Standard Deviation of Log Transformed Data	1.304						
Normal Distribution Test Results							
Correlation Coefficient R	0.764						
Shapiro Wilk Test Statistic	0.615						
Shapiro Wilk Critical (0.95) Value	0.943						
Approximate Shapiro Wilk P Value	7.107E-13						
Lilliefors Test Statistic	0.266						
Lilliefors Critical (0.95) Value	0.135						
Data not Normal at (0.05) Significance Level							
Gamma Distribution Test Results							
Correlation Coefficient R	0.95						
A-D Test Statistic	0.855						
A-D Critical (0.95) Value	0.789						
K-S Test Statistic	0.138						
K-S Critical(0.95) Value	0.14						
Data follow Appr. Gamma Distribution at (0.05) Significance Level							
Lognormal Distribution Test Results							
Correlation Coefficient R	0.992						
Shapiro Wilk Test Statistic	0.973						
Shapiro Wilk Critical (0.95) Value	0.943						
Approximate Shapiro Wilk P Value	0.485						
Lilliefors Test Statistic	0.0809						
Lilliefors Critical (0.95) Value	0.135						
Data appear Lognormal at (0.05) Significance Level							
'lb/mmBtuO2' trim (ff)							
Raw Statistics							
Number of Valid Observations	21						
Number of Distinct Observations	21						
Minimum	1.3200E-7						
Maximum	6.9600E-6						
Mean of Raw Data	1.7134E-6						
Standard Deviation of Raw Data	1.6465E-6						
Kstar	1.123						
Mean of Log Transformed Data	-13.72						
Standard Deviation of Log Transformed Data	1.02						
Normal Distribution Test Results							

A-D Test Statistic	3.627						
A-D Critical (0.95) Value	0.809						
K-S Test Statistic	0.318						
K-S Critical(0.95) Value	0.157						
Data not Gamma Distributed at (0.05) Significance Level							
Lognormal Distribution Test Results							
Correlation Coefficient R	0.949						
Shapiro Wilk Test Statistic	0.907						
Shapiro Wilk Critical (0.95) Value	0.934						
Approximate Shapiro Wilk P Value	0.00638						
Lilliefors Test Statistic	0.18						
Lilliefors Critical (0.95) Value	0.15						
Data not Lognormal at (0.05) Significance Level							

Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Confidence Coefficient 0.95

'lb/mmBtuO2' cmb

Raw Statistics

Number of Valid Observations	89
Number of Distinct Observations	82
Minimum	9.0500E-8
Maximum	3.7000E-5
Mean of Raw Data	2.2509E-6
Standard Deviation of Raw Data	4.6955E-6
Kstar	0.682
Mean of Log Transformed Data	-13.87
Standard Deviation of Log Transformed Data	1.23

Normal Distribution Test Results

Correlation Coefficient R	0.639
Approximate Shapiro Wilk Test Statistic	0.451
Approximate Shapiro Wilk P Value	0
Lilliefors Test Statistic	0.323
Lilliefors Critical (0.95) Value	0.0939

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.882
A-D Test Statistic	3.481
A-D Critical (0.95) Value	0.799
K-S Test Statistic	0.173
K-S Critical(0.95) Value	0.0989

Data not Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.991
Approximate Shapiro Wilk Test Statistic	0.973
Approximate Shapiro Wilk P Value	0.247
Lilliefors Test Statistic	0.0728
Lilliefors Critical (0.95) Value	0.0939

Data appear Lognormal at (0.05) Significance Level

Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
'lb/mmBtuO2' trim (dry)	33	9.9800E-8	2.0000E-5	2.4653E-6	1.0700E-6	1.548E-11	3.9349E-6	1.1994E-6	3.332	12.61	N/A
'lb/mmBtuO2' trim (esp)	43	2.8900E-7	5.8600E-5	6.6117E-6	2.4800E-6	1.021E-10	1.0102E-5	2.7294E-6	3.598	16.52	N/A
'lb/mmBtuO2' trim (ff)	21	1.3200E-7	6.9600E-6	1.7134E-6	1.1700E-6	2.711E-12	1.6465E-6	1.2587E-6	1.815	4.088	N/A
'lb/mmBtuO2' trim (wet)	35	9.0500E-8	3.7000E-5	2.3713E-6	5.5700E-7	4.066E-11	6.3766E-6	4.7739E-7	5.026	27.3	N/A

Percentiles for Raw Full Data Sets

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
'lb/mmBtuO2' trim (dry)	33	1.4580E-7	2.3860E-7	3.3140E-7	5.3900E-7	1.0700E-6	2.1800E-6	3.1420E-6	4.6320E-6	9.6380E-6	1.7024E-5
'lb/mmBtuO2' trim (esp)	43	4.7990E-7	6.4300E-7	7.5040E-7	1.0755E-6	2.4800E-6	7.8850E-6	9.5100E-6	1.7300E-5	2.1510E-5	4.3480E-5
'lb/mmBtuO2' trim (ff)	21	2.9100E-7	3.2100E-7	4.2900E-7	4.3600E-7	1.1700E-6	2.3000E-6	2.3800E-6	3.8000E-6	3.8800E-6	6.3440E-6
'lb/mmBtuO2' trim (wet)	35	1.7070E-7	2.2600E-7	2.7720E-7	3.1950E-7	5.5700E-7	1.0850E-6	1.1360E-6	4.7700E-6	8.1360E-6	2.7334E-5

Summary Statistics for Raw Full Dataset

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
'lb/mmBtuO2' cmb	89	9.0500E-8	3.7000E-5	2.2509E-6	9.2500E-7	2.205E-11	4.6955E-6	9.2661E-7	5.474	36.14	N/A

Percentiles for Raw Full Dataset

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
'lb/mmBtuO2' cmb	89	1.4720E-7	2.3460E-7	3.1980E-7	3.7900E-7	9.2500E-7	2.1200E-6	2.5720E-6	4.7700E-6	8.3220E-6	2.2040E-5

Coal Fired Utility Boiler Manganese Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Manganese Emissions Factor are presented on the following page with two sets of columns. The left set of columns contains data from all facilities and presents SCC, Submittal ID, emissions factors, the natural log of the emissions factor and the control measure employed. The site specific emissions factors presented are as determined using the f factor method rather than the emissions factor determined by dividing the hourly emissions by the coal feed and associated proximate analysis. The one data set which was identified as a statistical outlier is highlighted. The right set of columns contains the same information except that the data for Fabric Filter and ESP controlled sources are identified using a combined nomenclature for subsequent analysis as combined data. The data were merged since the preceding analysis indicated that there was no statistical difference between the particulate controls (ESP & FF). Subsequent pages provide the assessments as performed using EPA's statistical software ProUCL. The assessments provide support for developing a single combined national emissions factors for ESP, Fabric Filters, Dry Scrubber and Wet Scrubber controlled facilities. A combined emissions factor for ESP, Fabric Filters, Dry Scrubber and Wet Scrubber controlled facilities since there was no statistical difference in the means of emissions from ESP and Fabric Filter controlled facilities and there was no statistical difference between the combined ESP and Fabric Filter controlled facilities the Dry Scrubber controlled and the Wet Scrubber controlled facilities.

The resulting calculated manganese emissions factors is:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP, FF, Dry Scrubber & Wet Scrubber controls	1.01×10^{-5}	134	Highly Representative

Manganese Emissions Data					Manganese Emissions Data				
submittal		LN			submittal		LN		
SCC	ID	lb/mmBtu	#/mmBtu	Controls	SCC	ID	lb/mmBtu	#/mmBtu	Controls
10100202	1611	1.48E-07	-15.7261	Dry	10100202	1611	1.48E-07	-15.7261	Dry
10100202	1507	1.80E-07	-15.5303	Dry	10100202	1507	1.80E-07	-15.5303	Dry
10100202	1909	2.10E-07	-15.3762	Dry	10100202	1909	2.10E-07	-15.3762	Dry
10100202	1488	3.81E-07	-14.7805	Dry	10100202	1488	3.81E-07	-14.7805	Dry
10100222	1726	3.88E-07	-14.7623	Dry	10100222	1726	3.88E-07	-14.7623	Dry
10100202	947	4.65E-07	-14.5812	Dry	10100202	947	4.65E-07	-14.5812	Dry
10100212	565	4.78E-07	-14.5537	Dry	10100212	565	4.78E-07	-14.5537	Dry
10100202	560	5.35E-07	-14.441	Dry	10100202	560	5.35E-07	-14.441	Dry
10100205	1346	7.90E-07	-14.0512	Dry	10100205	1346	7.90E-07	-14.0512	Dry
10100205	13461	8.00E-07	-14.0387	Dry	10100205	13461	8.00E-07	-14.0387	Dry
10100202	1942	8.48E-07	-13.9804	Dry	10100202	1942	8.48E-07	-13.9804	Dry
10100205	1346111	1.19E-06	-13.6416	Dry	10100205	1346111	1.19E-06	-13.6416	Dry
10100222	1449	1.26E-06	-13.5844	Dry	10100222	1449	1.26E-06	-13.5844	Dry
10100226	1398	1.27E-06	-13.5765	Dry	10100226	1398	1.27E-06	-13.5765	Dry
10100202	1129	1.39E-06	-13.4859	Dry	10100202	1129	1.39E-06	-13.4859	Dry
10100205	134611	1.45E-06	-13.4439	Dry	10100205	134611	1.45E-06	-13.4439	Dry
10100218	1563	1.59E-06	-13.3518	Dry	10100218	1563	1.59E-06	-13.3518	Dry
10100202	8761	1.79E-06	-13.2333	Dry	10100202	8761	1.79E-06	-13.2333	Dry
10100218	1563	2.12E-06	-13.0641	Dry	10100218	1563	2.12E-06	-13.0641	Dry
10100222	1568	2.67E-06	-12.8334	Dry	10100222	1568	2.67E-06	-12.8334	Dry
10100202	1563	2.68E-06	-12.8297	Dry	10100202	1563	2.68E-06	-12.8297	Dry
10100205	1349	2.86E-06	-12.7647	Dry	10100205	1349	2.86E-06	-12.7647	Dry
10100202	1133	3.04E-06	-12.7034	Dry	10100202	1133	3.04E-06	-12.7034	Dry
10100203	1734	3.34E-06	-12.6108	Dry	10100203	1734	3.34E-06	-12.6108	Dry
10100202	698	3.70E-06	-12.5072	Dry	10100202	698	3.70E-06	-12.5072	Dry
10100203	1052	4.01E-06	-12.4267	Dry	10100203	1052	4.01E-06	-12.4267	Dry
10100203	1735	5.11E-06	-12.185	Dry	10100203	1735	5.11E-06	-12.185	Dry
10100222	2206	6.55E-06	-11.936	Dry	10100222	2206	6.55E-06	-11.936	Dry
10100226	1938	7.77E-06	-11.7648	Dry	10100226	1938	7.77E-06	-11.7648	Dry
10100202	8761	1.46E-05	-11.1345	Dry	10100202	8761	1.46E-05	-11.1345	Dry
10100202	1249	2.38E-05	-10.6458	Dry	10100202	1249	2.38E-05	-10.6458	Dry
10100202	2021	3.72E-05	-10.1992	Dry	10100202	2021	3.72E-05	-10.1992	Dry
10100202	550002	7.11E-05	-9.55142	Dry	10100202	550002	7.11E-05	-9.55142	Dry
10100202	2022	8.42E-05	-9.38232	Dry	10100202	2022	8.42E-05	-9.38232	Dry
10100202	2161	6.88E-07	-14.1895	ESP	10100202	2161	6.88E-07	-14.1895	ESP-FF
10100212	2103	7.34E-07	-14.1248	ESP	10100212	2103	7.34E-07	-14.1248	ESP-FF
10100212	1021	1.09E-06	-13.7291	ESP	10100212	1021	1.09E-06	-13.7291	ESP-FF
10100222	21351	1.47E-06	-13.4302	ESP	10100222	21351	1.47E-06	-13.4302	ESP-FF
10100212	3197	1.48E-06	-13.4235	ESP	10100212	3197	1.48E-06	-13.4235	ESP-FF
10100202	1004	2.18E-06	-13.0362	ESP	10100202	1004	2.18E-06	-13.0362	ESP-FF
10100202	1902	2.19E-06	-13.0316	ESP	10100202	1902	2.19E-06	-13.0316	ESP-FF
10100203	894	2.27E-06	-12.9957	ESP	10100203	894	2.27E-06	-12.9957	ESP-FF
10100223	12861	2.36E-06	-12.9568	ESP	10100223	12861	2.36E-06	-12.9568	ESP-FF
10100222	10040004	2.37E-06	-12.9526	ESP	10100222	10040004	2.37E-06	-12.9526	ESP-FF
10100212	632	2.46E-06	-12.9153	ESP	10100212	632	2.46E-06	-12.9153	ESP-FF
10100202	2195	2.88E-06	-12.7577	ESP	10100202	2195	2.88E-06	-12.7577	ESP-FF

Manganese Emissions Data					Manganese Emissions Data				
submittal		LN			submittal		LN		
SCC	ID	lb/mmBtu	#/mmBtu	Controls	SCC	ID	lb/mmBtu	#/mmBtu	Controls
10100212	22791	2.95E-06	-12.7342	ESP	10100212	22791	2.95E-06	-12.7342	ESP-FF
10100223	2302	2.99E-06	-12.7202	ESP	10100223	2302	2.99E-06	-12.7202	ESP-FF
10100202	10040002	4.44E-06	-12.3249	ESP	10100202	10040002	4.44E-06	-12.3249	ESP-FF
10100202	1154	4.54E-06	-12.3026	ESP	10100202	1154	4.54E-06	-12.3026	ESP-FF
10100202	1906	4.70E-06	-12.2679	ESP	10100202	1906	4.70E-06	-12.2679	ESP-FF
10100222	2274	4.84E-06	-12.2386	ESP	10100222	2274	4.84E-06	-12.2386	ESP-FF
10100201	902	5.35E-06	-12.1384	ESP	10100201	902	5.35E-06	-12.1384	ESP-FF
10100212	2279	5.69E-06	-12.0771	ESP	10100212	2279	5.69E-06	-12.0771	ESP-FF
10100222	2011	5.91E-06	-12.0389	ESP	10100222	2011	5.91E-06	-12.0389	ESP-FF
10100202	993	5.92E-06	-12.0372	ESP	10100202	993	5.92E-06	-12.0372	ESP-FF
10100211	1642	6.54E-06	-11.9376	ESP	10100211	1642	6.54E-06	-11.9376	ESP-FF
10100203	892	7.75E-06	-11.7678	ESP	10100203	892	7.75E-06	-11.7678	ESP-FF
10100222	1854	8.86E-06	-11.634	ESP	10100222	1854	8.86E-06	-11.634	ESP-FF
10100203	1809	9.16E-06	-11.6007	ESP	10100203	1809	9.16E-06	-11.6007	ESP-FF
10100226	2278	1.07E-05	-11.4453	ESP	10100226	2278	1.07E-05	-11.4453	ESP-FF
10100223	2009	1.12E-05	-11.3996	ESP	10100223	2009	1.12E-05	-11.3996	ESP-FF
10100202	1989	1.17E-05	-11.3559	ESP	10100202	1989	1.17E-05	-11.3559	ESP-FF
10100204	1113	1.17E-05	-11.3559	ESP	10100204	1113	1.17E-05	-11.3559	ESP-FF
10100202	975	1.21E-05	-11.3223	ESP	10100202	975	1.21E-05	-11.3223	ESP-FF
10100202	979	1.29E-05	-11.2583	ESP	10100202	979	1.29E-05	-11.2583	ESP-FF
10100201	903	1.33E-05	-11.2277	ESP	10100201	903	1.33E-05	-11.2277	ESP-FF
10100202	1471	1.36E-05	-11.2054	ESP	10100202	1471	1.36E-05	-11.2054	ESP-FF
10100222	2013	1.59E-05	-11.0492	ESP	10100222	2013	1.59E-05	-11.0492	ESP-FF
10100202	1845	1.90E-05	-10.8711	ESP	10100202	1845	1.90E-05	-10.8711	ESP-FF
10100223	2070	2.01E-05	-10.8148	ESP	10100223	2070	2.01E-05	-10.8148	ESP-FF
10100223	828	2.18E-05	-10.7336	ESP	10100223	828	2.18E-05	-10.7336	ESP-FF
10100226	1141	2.64E-05	-10.5421	ESP	10100226	1141	2.64E-05	-10.5421	ESP-FF
10100202	2276	2.85E-05	-10.4656	ESP	10100202	2276	2.85E-05	-10.4656	ESP-FF
10100202	1636	3.08E-05	-10.388	ESP	10100202	1636	3.08E-05	-10.388	ESP-FF
10100212	731	3.10E-05	-10.3823	ESP	10100212	731	3.10E-05	-10.3823	ESP-FF
10100204	1111	3.25E-05	-10.3343	ESP	10100204	1111	3.25E-05	-10.3343	ESP-FF
10100222	2135	3.83E-05	-10.1701	ESP	10100222	2135	3.83E-05	-10.1701	ESP-FF
10100202	1189	2.52E-07	-15.1938	FF	10100202	1189	2.52E-07	-15.1938	ESP-FF
10100221	2170	3.66E-07	-14.8198	FF	10100221	2170	3.66E-07	-14.8198	ESP-FF
10100221	1835	4.11E-07	-14.7054	FF	10100221	1835	4.11E-07	-14.7054	ESP-FF
10100202	1190	6.52E-07	-14.2432	FF	10100202	1190	6.52E-07	-14.2432	ESP-FF
10100222	1832	8.68E-07	-13.9571	FF	10100222	1832	8.68E-07	-13.9571	ESP-FF
10100222	1833	8.78E-07	-13.9456	FF	10100222	1833	8.78E-07	-13.9456	ESP-FF
10100202	1597	1.03E-06	-13.786	FF	10100202	1597	1.03E-06	-13.786	ESP-FF
10100202	2095	1.74E-06	-13.2616	FF	10100202	2095	1.74E-06	-13.2616	ESP-FF
10100218	524	1.75E-06	-13.2559	FF	10100218	524	1.75E-06	-13.2559	ESP-FF
10100222	1841	1.83E-06	-13.2112	FF	10100222	1841	1.83E-06	-13.2112	ESP-FF
10100202	1606	2.09E-06	-13.0783	FF	10100202	1606	2.09E-06	-13.0783	ESP-FF
10100222	845	2.31E-06	-12.9783	FF	10100222	845	2.31E-06	-12.9783	ESP-FF
10100202	1654	2.75E-06	-12.8039	FF	10100202	1654	2.75E-06	-12.8039	ESP-FF
10100218	2088	4.37E-06	-12.3407	FF	10100218	2088	4.37E-06	-12.3407	ESP-FF

Manganese Emissions Data					Manganese Emissions Data				
submittal		LN			submittal		LN		
SCC	ID	lb/mmBtu	#/mmBtu	Controls	SCC	ID	lb/mmBtu	#/mmBtu	Controls
10100202	63254	7.05E-06	-11.8625	FF	10100202	63254	7.05E-06	-11.8625	ESP-FF
10100218	1310	2.06E-05	-10.7902	FF	10100218	1310	2.06E-05	-10.7902	ESP-FF
10100222	879456	2.21E-05	-10.7199	FF	10100222	879456	2.21E-05	-10.7199	ESP-FF
10100202	734	2.34E-05	-10.6628	FF	10100202	734	2.34E-05	-10.6628	ESP-FF
10100202	736	2.53E-05	-10.5847	FF	10100202	736	2.53E-05	-10.5847	ESP-FF
10100202	1244	5.41E-05	-9.82468	FF	10100202	1244	5.41E-05	-9.82468	ESP-FF
10100202	735	6.62E-05	-9.62283	FF	10100202	735	6.62E-05	-9.62283	ESP-FF
10100202	1972	2.59E-07	-15.1664	Wet	10100202	1972	2.59E-07	-15.1664	Wet
10100202	1515	6.23E-07	-14.2887	Wet	10100202	1515	6.23E-07	-14.2887	Wet
10100212	1648	8.95E-07	-13.9264	Wet	10100212	1648	8.95E-07	-13.9264	Wet
10100202	2239	9.22E-07	-13.8967	Wet	10100202	2239	9.22E-07	-13.8967	Wet
10100202	1185	1.04E-06	-13.7763	Wet	10100202	1185	1.04E-06	-13.7763	Wet
10100202	1187	1.05E-06	-13.7667	Wet	10100202	1187	1.05E-06	-13.7667	Wet
10100202	1915	1.09E-06	-13.7293	Wet	10100202	1915	1.09E-06	-13.7293	Wet
10100202	1826	1.19E-06	-13.6416	Wet	10100202	1826	1.19E-06	-13.6416	Wet
10100202	18261	1.47E-06	-13.4302	Wet	10100202	18261	1.47E-06	-13.4302	Wet
10100201	2319	1.60E-06	-13.3455	Wet	10100201	2319	1.60E-06	-13.3455	Wet
10100202	1118	1.75E-06	-13.2559	Wet	10100202	1118	1.75E-06	-13.2559	Wet
10100223	23152	1.88E-06	-13.1842	Wet	10100223	23152	1.88E-06	-13.1842	Wet
10100223	23153	1.98E-06	-13.1324	Wet	10100223	23153	1.98E-06	-13.1324	Wet
10300222	1276	2.11E-06	-13.0688	Wet	10300222	1276	2.11E-06	-13.0688	Wet
10100202	1330	2.24E-06	-13.009	Wet	10100202	1330	2.24E-06	-13.009	Wet
10100202	1743	2.37E-06	-12.9526	Wet	10100202	1743	2.37E-06	-12.9526	Wet
10100211	900	2.48E-06	-12.9073	Wet	10100211	900	2.48E-06	-12.9073	Wet
10100212	1647	2.59E-06	-12.8639	Wet	10100212	1647	2.59E-06	-12.8639	Wet
10100223	23151	2.92E-06	-12.7439	Wet	10100223	23151	2.92E-06	-12.7439	Wet
10100202	2055	3.03E-06	-12.7069	Wet	10100202	2055	3.03E-06	-12.7069	Wet
10100202	1176	3.37E-06	-12.6006	Wet	10100202	1176	3.37E-06	-12.6006	Wet
10100222	2259	4.52E-06	-12.307	Wet	10100222	2259	4.52E-06	-12.307	Wet
10100212	1177	4.55E-06	-12.3004	Wet	10100212	1177	4.55E-06	-12.3004	Wet
10100223	2315	4.77E-06	-12.2532	Wet	10100223	2315	4.77E-06	-12.2532	Wet
10100202	541	6.22E-06	-11.9877	Wet	10100202	541	6.22E-06	-11.9877	Wet
10100202	1738	7.30E-06	-11.8276	Wet	10100202	1738	7.30E-06	-11.8276	Wet
10100202	1119	9.27E-06	-11.5887	Wet	10100202	1119	9.27E-06	-11.5887	Wet
10100202	966	1.10E-05	-11.4176	Wet	10100202	966	1.10E-05	-11.4176	Wet
10100202	1117	1.30E-05	-11.2506	Wet	10100202	1117	1.30E-05	-11.2506	Wet
10100202	1117	1.30E-05	-11.2506	Wet	10100202	1117	1.30E-05	-11.2506	Wet
10100226	1558	1.70E-05	-10.9823	Wet	10100226	1558	1.70E-05	-10.9823	Wet
10100223	1327	2.28E-05	-10.6888	Wet	10100223	1327	2.28E-05	-10.6888	Wet
10100224	1120	3.15E-05	-10.3655	Wet	10100224	1120	3.15E-05	-10.3655	Wet
10100202	1637	4.97E-05	-9.90951	Wet	10100202	1637	4.97E-05	-9.90951	Wet
10100202	1638	1.31E-04	-8.94031	Wet	10100202	1638	1.31E-04	-8.94031	Wet
10100223	1307	3.67E-04	-7.91015	Wet					

Outlier Tests for Selected Variables

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for LN #/mmBtu (dry)

Mean -13.08

Standard Deviation 1.59

Number of data 34

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-13.08	1.567	-9.382	34	2.359	2.97	3.3
2	-13.19	1.473	-9.551	33	2.471	2.95	3.29
3	-13.3	1.341	-10.2	32	2.316	2.94	3.27
4	-13.4	1.235	-10.65	31	2.233	2.91	3.25
5	-13.5	1.143	-11.13	30	2.066	2.91	3.24

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for LN #/mmBtu (esp)

Mean -11.95

Standard Deviation 1.069

Number of data 44

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-11.95	1.057	-14.19	42	2.122	3.08	3.43
2	-11.9	1.023	-14.12	26	2.179	3.07	3.41
3	-11.84	0.974	-13.73	3	1.938	3.06	3.4
4	-11.8	0.939	-13.43	28	1.741	3.05	3.39
5	-11.76	0.913	-13.42	19	1.827	3.04	3.38

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for LN #/mmBtu (ff)

Number of data = 21

10% critical value: 0.391

5% critical value: 0.44

1% critical value: 0.524

1. Data Value -9.622830095 is a Potential Outlier (Upper)

Test Statistic: 0.189

For 10% significance level, -9.622830095 is not an outlier.

For 5% significance level, -9.622830095 is not an outlier.

For 1% significance level, -9.622830095 is not an outlier.

2. Data Value -15.19383675 is a Potential Outlier (Lower)

Test Statistic: 0.106

For 10% significance level, -15.19383675 is not an outlier.

For 5% significance level, -15.19383675 is not an outlier.

For 1% significance level, -15.19383675 is not an outlier.

Rosner's Outlier Test for LN #/mmBtu (wet)

Mean -12.4

Standard Deviation 1.519

Number of data 36

Number of suspected outliers 5

			Potential	Obs.	Test	Critical	Critical
#	Mean	sd	outlier	Number	value	value (5%)	value (1%)
1	-12.4	1.498	-7.91	36	2.997	2.99	3.33
2	-12.53	1.329	-8.94	35	2.7	2.98	3.32
3	-12.63	1.191	-9.91	34	2.287	2.97	3.3
4	-12.72	1.106	-15.17	1	2.216	2.95	3.29
5	-12.64	1.031	-10.37	33	2.205	2.94	3.27

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation -7.91 is a Potential Statistical Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2'(esp)

Background Data: 'lb/mmBtuO2'(ff)

Raw Statistics

	ESP	Fabric Filter
Number of Valid Observations	44	21
Number of Distinct Observations	43	21
Minimum	6.8800E-7	2.5200E-7
Maximum	3.8300E-5	6.6200E-5
Mean	1.0530E-5	1.1431E-5
Median	6.2300E-6	2.0900E-6
SD	9.9899E-6	1.8391E-5
SE of Mean	1.5060E-6	4.0133E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	63	-0.256	1.669	0.601
Welch-Satterthwaite (Unequal Variance)	25.8	-0.210	1.706	0.582

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	9.980E-11		
Variance of Background	3.382E-10		
Numerator DF	Denominator DF	F-Test Value	P-Value
20	43	3.389	0.001

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2'(ff)

Background Data: 'lb/mmBtuO2'(esp)

Raw Statistics

	Site	Background
Number of Valid Observations	21	44
Number of Distinct Observations	21	43
Minimum	2.5200E-7	6.8800E-7
Maximum	6.6200E-5	3.8300E-5
Mean	1.1431E-5	1.0530E-5
Median	2.0900E-6	6.2300E-6
SD	1.8391E-5	9.9899E-6
SE of Mean	4.0133E-6	1.5060E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	63	0.256	1.669	0.399
Welch-Satterthwaite (Unequal Variance)	25.8	0.210	1.706	0.418

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	3.382E-10		
Variance of Background	9.980E-11		
Numerator DF	Denominator DF	F-Test Value	P-Value
20	43	3.389	0.001

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' comb(esp-f)

Background Data: 'lb/mmBtuO2' comb(dry)

Raw Statistics

	Site	Background
Number of Valid Observations	65	34
Number of Distinct Observations	64	34
Minimum	2.5200E-7	1.4800E-7
Maximum	6.6200E-5	8.4200E-5
Mean	1.0821E-5	8.5269E-6
Median	5.3500E-6	1.6900E-6
SD	1.3150E-5	1.9117E-5
SE of Mean	1.6311E-6	3.2786E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	97	0.702	1.661	0.242
Welch-Satterthwaite (Unequal Variance)	49.8	0.626	1.676	0.267

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.729E-10		
Variance of Background	3.655E-10		
Numerator DF	Denominator DF	F-Test Value	P-Value
33	64	2.113	0.010

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' comb(dry)

Background Data: 'lb/mmBtuO2' comb(esp-ff)

Raw Statistics

	Site	Background
Number of Valid Observations	34	65
Number of Distinct Observations	34	64
Minimum	1.4800E-7	2.5200E-7
Maximum	8.4200E-5	6.6200E-5
Mean	8.5269E-6	1.0821E-5
Median	1.6900E-6	5.3500E-6
SD	1.9117E-5	1.3150E-5
SE of Mean	3.2786E-6	1.6311E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	97	-0.702	1.661	0.758
Welch-Satterthwaite (Unequal Variance)	49.8	-0.626	1.676	0.733

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	3.655E-10
Variance of Background	1.729E-10

Numerator DF	Denominator DF	F-Test Value	P-Value
33	64	2.113	0.010

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' comb(esp-f)

Background Data: 'lb/mmBtuO2' comb(wet)

Raw Statistics

	Site	Background
Number of Valid Observations	65	35
Number of Distinct Observations	64	34
Minimum	2.5200E-7	2.5900E-7
Maximum	6.6200E-5	1.3100E-4
Mean	1.0821E-5	1.0357E-5
Median	5.3500E-6	2.5900E-6
SD	1.3150E-5	2.3300E-5
SE of Mean	1.6311E-6	3.9384E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	98	0.128	1.661	0.449
Welch-Satterthwaite (Unequal Variance)	45.9	0.109	1.679	0.457

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.729E-10		
Variance of Background	5.429E-10		
Numerator DF	Denominator DF	F-Test Value	P-Value
34	64	3.139	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: 'lb/mmBtuO2' comb(wet)

Background Data: 'lb/mmBtuO2' comb(esp-ff)

Raw Statistics

	Site	Background
Number of Valid Observations	35	65
Number of Distinct Observations	34	64
Minimum	2.5900E-7	2.5200E-7
Maximum	1.3100E-4	6.6200E-5
Mean	1.0357E-5	1.0821E-5
Median	2.5900E-6	5.3500E-6
SD	2.3300E-5	1.3150E-5
SE of Mean	3.9384E-6	1.6311E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	98	-0.128	1.661	0.551
Welch-Satterthwaite (Unequal Variance)	45.9	-0.109	1.679	0.543

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

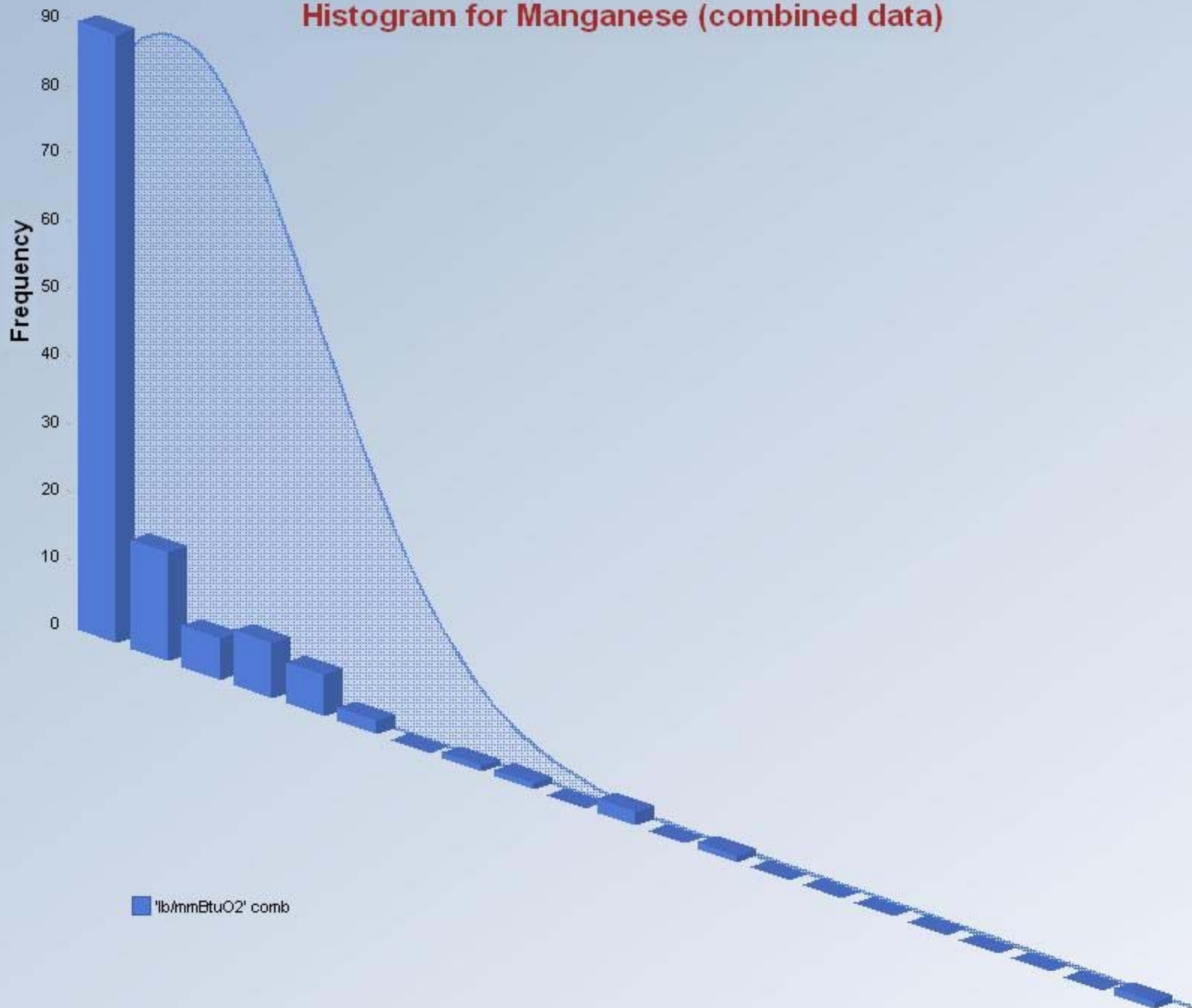
Test of Equality of Variances

Variance of Site	5.429E-10		
Variance of Background	1.729E-10		
Numerator DF	Denominator DF	F-Test Value	P-Value
34	64	3.139	0.000

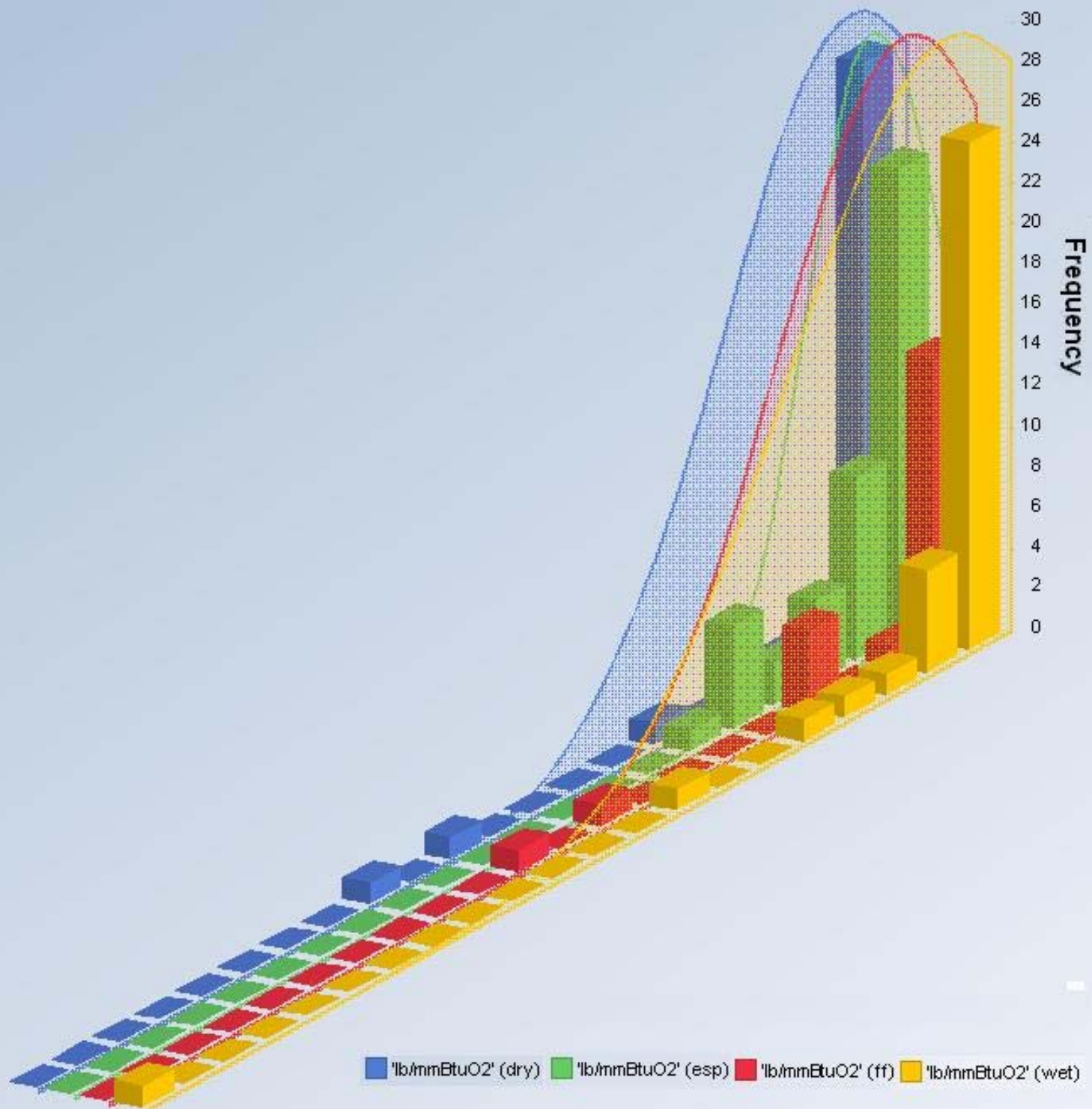
Conclusion with Alpha = 0.05

- * Two variances are not equal

Histogram for Manganese (combined data)



Histograms for Manganese by Controls



Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	0.95

'lb/mmBtuO2' (dry)

Raw Statistics

Number of Valid Observations	34
Number of Distinct Observations	34
Minimum	1.4800E-7
Maximum	8.4200E-5
Mean of Raw Data	8.5269E-6
Standard Deviation of Raw Data	1.9117E-5
Kstar	0.437
Mean of Log Transformed Data	-13.08
Standard Deviation of Log Transformed Data	1.59

Normal Distribution Test Results

Correlation Coefficient R	0.674
Shapiro Wilk Test Statistic	0.473
Shapiro Wilk Critical (0.95) Value	0.933
Approximate Shapiro Wilk P Value	1.701E-12
Lilliefors Test Statistic	0.369
Lilliefors Critical (0.95) Value	0.152

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.94
A-D Test Statistic	2.496
A-D Critical (0.95) Value	0.821
K-S Test Statistic	0.241
K-S Critical(0.95) Value	0.16

Data not Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.981
Shapiro Wilk Test Statistic	0.955
Shapiro Wilk Critical (0.95) Value	0.933
Approximate Shapiro Wilk P Value	0.21
Lilliefors Test Statistic	0.106
Lilliefors Critical (0.95) Value	0.152

Data appear Lognormal at (0.05) Significance Level

'lb/mmBtuO2' (esp)

Raw Statistics

Number of Valid Observations	44
------------------------------	----

Number of Distinct Observations	43						
Minimum	6.8800E-7						
Maximum	3.8300E-5						
Mean of Raw Data	1.0530E-5						
Standard Deviation of Raw Data	9.9899E-6						
Kstar	1.103						
Mean of Log Transformed Data	-11.95						
Standard Deviation of Log Transformed Data	1.069						

Normal Distribution Test Results

Correlation Coefficient R	0.917						
Shapiro Wilk Test Statistic	0.831						
Shapiro Wilk Critical (0.95) Value	0.944						
Approximate Shapiro Wilk P Value	1.8198E-6						
Lilliefors Test Statistic	0.178						
Lilliefors Critical (0.95) Value	0.134						

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.982						
A-D Test Statistic	0.483						
A-D Critical (0.95) Value	0.774						
K-S Test Statistic	0.104						
K-S Critical(0.95) Value	0.137						

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.989						
Shapiro Wilk Test Statistic	0.96						
Shapiro Wilk Critical (0.95) Value	0.944						
Approximate Shapiro Wilk P Value	0.204						
Lilliefors Test Statistic	0.0898						
Lilliefors Critical (0.95) Value	0.134						

Data appear Lognormal at (0.05) Significance Level

'lb/mmBtuO2' (ff)

Raw Statistics

Number of Valid Observations	21						
Number of Distinct Observations	21						
Minimum	2.5200E-7						
Maximum	6.6200E-5						
Mean of Raw Data	1.1431E-5						
Standard Deviation of Raw Data	1.8391E-5						
Kstar	0.46						
Mean of Log Transformed Data	-12.65						
Standard Deviation of Log Transformed Data	1.692						

Normal Distribution Test Results

Correlation Coefficient R	0.803						
Shapiro Wilk Test Statistic	0.651						
Shapiro Wilk Critical (0.95) Value	0.908						
Approximate Shapiro Wilk P Value	1.8549E-6						
Lilliefors Test Statistic	0.316						
Lilliefors Critical (0.95) Value	0.193						

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results							
--	--	--	--	--	--	--	--

Correlation Coefficient R	0.976						
A-D Test Statistic	1.197						
A-D Critical (0.95) Value	0.805						
K-S Test Statistic	0.243						
K-S Critical(0.95) Value	0.2						

Data not Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results							
--	--	--	--	--	--	--	--

Correlation Coefficient R	0.973						
Shapiro Wilk Test Statistic	0.935						
Shapiro Wilk Critical (0.95) Value	0.908						
Approximate Shapiro Wilk P Value	0.17						
Lilliefors Test Statistic	0.155						
Lilliefors Critical (0.95) Value	0.193						

Data appear Lognormal at (0.05) Significance Level

'lb/mmBtuO2' (wet)							
---------------------------	--	--	--	--	--	--	--

Raw Statistics							
Number of Valid Observations	35						
Number of Distinct Observations	34						
Minimum	2.5900E-7						
Maximum	1.3100E-4						
Mean of Raw Data	1.0357E-5						
Standard Deviation of Raw Data	2.3300E-5						
Kstar	0.559						
Mean of Log Transformed Data	-12.53						
Standard Deviation of Log Transformed Data	1.329						

Normal Distribution Test Results							
---	--	--	--	--	--	--	--

Correlation Coefficient R	0.636						
Shapiro Wilk Test Statistic	0.439						
Shapiro Wilk Critical (0.95) Value	0.934						
Approximate Shapiro Wilk P Value	1.874E-13						
Lilliefors Test Statistic	0.332						
Lilliefors Critical (0.95) Value	0.15						

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results							
--	--	--	--	--	--	--	--

Correlation Coefficient R	0.896						
---------------------------	-------	--	--	--	--	--	--

	A-D Test Statistic	2.233						
	A-D Critical (0.95) Value	0.803						
	K-S Test Statistic	0.215						
	K-S Critical(0.95) Value	0.156						
Data not Gamma Distributed at (0.05) Significance Level								
Lognormal Distribution Test Results								
	Correlation Coefficient R	0.979						
	Shapiro Wilk Test Statistic	0.963						
	Shapiro Wilk Critical (0.95) Value	0.934						
	Approximate Shapiro Wilk P Value	0.349						
	Lilliefors Test Statistic	0.125						
	Lilliefors Critical (0.95) Value	0.15						
Data appear Lognormal at (0.05) Significance Level								

Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	0.95

'lb/mmBtuO2'

Raw Statistics

Number of Valid Observations	134
Number of Distinct Observations	127
Minimum	1.4800E-7
Maximum	1.3100E-4
Mean of Raw Data	1.0118E-5
Standard Deviation of Raw Data	1.7708E-5
Kstar	0.609
Mean of Log Transformed Data	-12.5
Standard Deviation of Log Transformed Data	1.438

Normal Distribution Test Results

Correlation Coefficient R	0.742
Approximate Shapiro Wilk Test Statistic	0.579
Approximate Shapiro Wilk P Value	0
Lilliefors Test Statistic	0.287
Lilliefors Critical (0.95) Value	0.0765

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.967
A-D Test Statistic	3.761
A-D Critical (0.95) Value	0.808
K-S Test Statistic	0.155
K-S Critical(0.95) Value	0.0846

Data not Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.996
Approximate Shapiro Wilk Test Statistic	0.975
Approximate Shapiro Wilk P Value	0.218
Lilliefors Test Statistic	0.0798
Lilliefors Critical (0.95) Value	0.0765

Data not Lognormal at (0.05) Significance Level

Summary Statistics for Raw Full Dataset

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
'lb/mmBtuO2'	134	1.4800E-7	1.3100E-4	1.0118E-5	2.9700E-6	3.136E-10	1.7708E-5	3.2735E-6	3.826	19.04	N/A

Percentiles for Raw Full Dataset

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
'lb/mmBtuO2'	134	3.8555E-7	6.6280E-7	1.0900E-6	1.4550E-6	2.9700E-6	1.1575E-5	1.3420E-5	2.6070E-5	3.7585E-5	7.9877E-5

Coal Fired Utility Boiler Nickel Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Nickel Emissions Factor are presented on the following page with two sets of columns. The left set of columns contains data from all facilities and presents SCC, Submittal ID, emissions factors, the natural log of the emissions factor and the control measure employed. The one data set which was identified as a statistical outlier is highlighted. The right set of columns contains the same information except that the data for Fabric Filter and ESP controlled sources are identified using a combined nomenclature for subsequent analysis as combined data. The data were merged since the preceding analysis indicated that there was no statistical difference between the particulate controls (ESP & FF). The site specific emissions factors presented are as determined using the f factor method rather than the emissions factor determined by dividing the hourly emissions by the coal feed and associated proximate analysis. Subsequent pages provide the assessments as performed using EPA's statistical software ProUCL. The assessments provide support for developing a combined national emissions factors for ESP, Fabric Filters and Wet Scrubber controlled facilities, and for developing a separate national emissions factor for Dry Scrubbing controls. A combined emissions factor for ESP, Fabric Filters and Wet Scrubber controlled facilities since there was no statistical difference in the means of emissions from ESP and Fabric Filter controlled facilities and there was no statistical difference between the combined ESP and Fabric Filter controlled facilities and the Wet Scrubber controlled facilities. Separate emissions factors were developed for Dry Scrubbing controlled facilities since there was a statistical difference between the combined ESP and Fabric Filter controlled facilities and the Dry Scrubbing controlled facilities.

The resulting calculated nickel emissions factors are:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP, FF & Wet Scrubber control	2.74×10^{-5}	101	Highly Representative
Dry Scrubbing control	3.41×10^{-6}	33	Highly Representative

Nickel Source Test Data					Nickel Source Test Data				
SCC	submittal ID	lb/mmBtu	LN #/mmBtu	Controls	SCC comb	ID comb	comb	LN #/mmBtu comb	Controls comb
10100202	1611	1.20E-07	-15.9358	Dry	10100202	1611	1.20E-07	-15.9357741	Dry
10100202	1189	1.54E-07	-15.6863	FF	10100202	1507	2.24E-07	-15.3116198	Dry
10300222	1276	2.16E-07	-15.348	Wet	10100202	947	2.88E-07	-15.0603054	Dry
10100202	1507	2.24E-07	-15.3116	Dry	10100222	1726	3.13E-07	-14.9770626	Dry
10100202	947	2.88E-07	-15.0603	Dry	10100222	1449	4.33E-07	-14.6525281	Dry
10100202	1915	2.92E-07	-15.0465	Wet	10100202	560	4.74E-07	-14.5620585	Dry
10100221	2170	3.01E-07	-15.0166	FF	10100202	1942	5.56E-07	-14.4024975	Dry
10100222	1726	3.13E-07	-14.9771	Dry	10100202	1488	6.58E-07	-14.2340609	Dry
10100202	1190	3.25E-07	-14.9394	FF	10100202	1249	7.76E-07	-14.0691133	Dry
10100202	1471	3.70E-07	-14.8098	ESP	10100202	1129	8.04E-07	-14.0331508	Dry
10100212	1648	3.76E-07	-14.7937	Wet	10100212	565	8.59E-07	-13.9674969	Dry
10100202	1972	3.97E-07	-14.7393	Wet	10100203	1734	9.12E-07	-13.9072926	Dry
10100222	1449	4.33E-07	-14.6525	Dry	10100205	1346	9.48E-07	-13.8689113	Dry
10100202	560	4.74E-07	-14.5621	Dry	10100226	1398	1.02E-06	-13.7957079	Dry
10100221	1835	4.85E-07	-14.5384	FF	10100205	1349	1.26E-06	-13.5843988	Dry
10100202	1942	5.56E-07	-14.4025	Dry	10100218	1563	1.32E-06	-13.5378788	Dry
10100202	1597	5.70E-07	-14.3776	FF	10100202	1133	1.61E-06	-13.3387577	Dry
10100202	1488	6.58E-07	-14.2341	Dry	10100203	1735	1.69E-06	-13.2898003	Dry
10100202	1654	7.21E-07	-14.1426	FF	10100205	1346111	1.70E-06	-13.2848823	Dry
10100222	1832	7.32E-07	-14.1275	FF	10100222	1568	1.78E-06	-13.2388972	Dry
10100202	2239	7.62E-07	-14.0873	Wet	10100226	1938	1.99E-06	-13.1273759	Dry
10100202	1249	7.76E-07	-14.0691	Dry	10100205	134611	2.51E-06	-12.8952278	Dry
10100202	1515	7.88E-07	-14.0538	Wet	10100205	13461	3.14E-06	-12.6712878	Dry
10100202	1129	8.04E-07	-14.0332	Dry	10100202	1909	3.25E-06	-12.6368556	Dry
10100212	565	8.59E-07	-13.9675	Dry	10100203	1052	3.35E-06	-12.6065502	Dry
10100212	1647	8.67E-07	-13.9582	Wet	10100202	1563	4.23E-06	-12.3733086	Dry
10100212	3197	8.93E-07	-13.9287	ESP	10100218	1563	4.25E-06	-12.3685916	Dry
10100222	845	9.12E-07	-13.9076	FF	10100202	698	5.11E-06	-12.1843112	Dry
10100203	1734	9.12E-07	-13.9073	Dry	10100202	8761	7.67E-06	-11.7781939	Dry
10100205	1346	9.48E-07	-13.8689	Dry	10100202	8761	7.68E-06	-11.776891	Dry
10100202	1638	9.93E-07	-13.8225	Wet	10100222	2206	8.82E-06	-11.6384887	Dry
10100222	1833	9.99E-07	-13.8165	FF	10100202	2021	9.72E-06	-11.5413249	Dry
10100226	1398	1.02E-06	-13.7957	Dry	10100202	2022	3.41E-05	-10.2862132	Dry
10100202	1637	1.06E-06	-13.7572	Wet	10100202	1471	3.70E-07	-14.8097628	ESP-FF
10100202	2161	1.09E-06	-13.7293	ESP	10100212	3197	8.93E-07	-13.9286793	ESP-FF
10100223	2070	1.25E-06	-13.5924	ESP	10100202	2161	1.09E-06	-13.7293329	ESP-FF
10100205	1349	1.26E-06	-13.5844	Dry	10100223	2070	1.25E-06	-13.592367	ESP-FF
10100202	1826	1.30E-06	-13.5531	Wet	10100202	1902	1.47E-06	-13.4302482	ESP-FF
10100218	1563	1.32E-06	-13.5379	Dry	10100202	1154	1.83E-06	-13.2111946	ESP-FF
10100218	524	1.39E-06	-13.4862	FF	10100212	2103	1.89E-06	-13.1789337	ESP-FF
10100202	1902	1.47E-06	-13.4302	ESP	10100222	10040004	2.30E-06	-12.9826014	ESP-FF
10100202	1133	1.61E-06	-13.3388	Dry	10100203	894	2.37E-06	-12.9526206	ESP-FF
10100203	1735	1.69E-06	-13.2898	Dry	10100222	21351	2.41E-06	-12.9358838	ESP-FF
10100205	1346111	1.70E-06	-13.2849	Dry	10100222	1854	2.55E-06	-12.8794172	ESP-FF
10100223	23153	1.77E-06	-13.2445	Wet	10100211	1642	2.79E-06	-12.789469	ESP-FF
10100222	1568	1.78E-06	-13.2389	Dry	10100212	1021	2.79E-06	-12.789469	ESP-FF
10100201	2319	1.79E-06	-13.2333	Wet	10100202	10040002	3.07E-06	-12.693833	ESP-FF

Nickel Source Test Data					Nickel Source Test Data				
SCC	submittal ID	lb/mmBtu	LN #/mmBtu	Controls	SCC comb	ID comb	comb	LN #/mmBtu comb	Controls comb
10100223	1327	1.83E-06	-13.2112	Wet	10100226	1141	3.17E-06	-12.661779	ESP-FF
10100202	1154	1.83E-06	-13.2112	ESP	10100223	2009	3.63E-06	-12.5262779	ESP-FF
10100222	2259	1.88E-06	-13.1842	Wet	10100202	1004	3.79E-06	-12.4831445	ESP-FF
10100212	2103	1.89E-06	-13.1789	ESP	10100222	2013	3.83E-06	-12.4726458	ESP-FF
10100226	1938	1.99E-06	-13.1274	Dry	10100223	12861	4.43E-06	-12.327111	ESP-FF
10100222	10040004	2.30E-06	-12.9826	ESP	10100202	1906	4.65E-06	-12.2786433	ESP-FF
10100223	23152	2.36E-06	-12.9568	Wet	10100222	2011	4.97E-06	-12.2120907	ESP-FF
10100203	894	2.37E-06	-12.9526	ESP	10100201	902	5.14E-06	-12.1784575	ESP-FF
10100202	18261	2.41E-06	-12.9359	Wet	10100202	979	5.32E-06	-12.1440373	ESP-FF
10100222	21351	2.41E-06	-12.9359	ESP	10100202	1989	5.63E-06	-12.0874011	ESP-FF
10100205	134611	2.51E-06	-12.8952	Dry	10100212	2279	5.98E-06	-12.0273109	ESP-FF
10100223	23151	2.55E-06	-12.8794	Wet	10100212	632	6.35E-06	-11.9670557	ESP-FF
10100222	1854	2.55E-06	-12.8794	ESP	10100223	2302	7.31E-06	-11.8262673	ESP-FF
10100218	2088	2.64E-06	-12.8447	FF	10100202	2195	8.48E-06	-11.6778001	ESP-FF
10100202	1330	2.75E-06	-12.8039	Wet	10100203	1809	9.08E-06	-11.6094364	ESP-FF
10100211	1642	2.79E-06	-12.7895	ESP	10100212	22791	9.43E-06	-11.5713392	ESP-FF
10100212	1021	2.79E-06	-12.7895	ESP	10100202	993	1.11E-05	-11.4085654	ESP-FF
10100202	2095	2.93E-06	-12.7405	FF	10100202	1636	1.19E-05	-11.3389722	ESP-FF
10100223	2315	2.99E-06	-12.7202	Wet	10100203	892	1.47E-05	-11.1276631	ESP-FF
10100202	10040002	3.07E-06	-12.6938	ESP	10100201	903	1.58E-05	-11.0555006	ESP-FF
10100205	13461	3.14E-06	-12.6713	Dry	10100222	2274	2.00E-05	-10.8197783	ESP-FF
10100226	1141	3.17E-06	-12.6618	ESP	10100223	828	2.07E-05	-10.7853769	ESP-FF
10100202	1909	3.25E-06	-12.6369	Dry	10100212	731	2.22E-05	-10.7154183	ESP-FF
10100203	1052	3.35E-06	-12.6066	Dry	10100204	1113	3.09E-05	-10.3847544	ESP-FF
10100223	2009	3.63E-06	-12.5263	ESP	10100202	975	7.61E-05	-9.48346229	ESP-FF
10100202	1119	3.70E-06	-12.5072	Wet	10100202	1845	8.77E-05	-9.34158866	ESP-FF
10100202	1004	3.79E-06	-12.4831	ESP	10100202	2276	1.47E-04	-8.82507797	ESP-FF
10100222	2013	3.83E-06	-12.4726	ESP	10100226	2278	1.50E-04	-8.80487526	ESP-FF
10100202	1606	3.91E-06	-12.452	FF	10100222	2135	2.04E-04	-8.49739056	ESP-FF
10100202	1187	4.14E-06	-12.3948	Wet	10100204	1111	3.73E-04	-7.89393214	ESP-FF
10100211	900	4.19E-06	-12.3828	Wet	10100202	1189	1.54E-07	-15.6863132	ESP-FF
10100202	1563	4.23E-06	-12.3733	Dry	10100221	2170	3.01E-07	-15.0165529	ESP-FF
10100218	1563	4.25E-06	-12.3686	Dry	10100202	1190	3.25E-07	-14.9394407	ESP-FF
10100222	1841	4.39E-06	-12.3362	FF	10100221	1835	4.85E-07	-14.5383802	ESP-FF
10100226	1558	4.41E-06	-12.3316	Wet	10100202	1597	5.70E-07	-14.3776295	ESP-FF
10100223	12861	4.43E-06	-12.3271	ESP	10100202	1654	7.21E-07	-14.1426267	ESP-FF
10100202	1906	4.65E-06	-12.2786	ESP	10100222	1832	7.32E-07	-14.1274853	ESP-FF
10100222	2011	4.97E-06	-12.2121	ESP	10100222	845	9.12E-07	-13.9076258	ESP-FF
10100202	698	5.11E-06	-12.1843	Dry	10100222	1833	9.99E-07	-13.8165111	ESP-FF
10100201	902	5.14E-06	-12.1785	ESP	10100218	524	1.39E-06	-13.4862068	ESP-FF
10100202	1117	5.29E-06	-12.1497	Wet	10100218	2088	2.64E-06	-12.8447316	ESP-FF
10100202	1117	5.29E-06	-12.1497	Wet	10100202	2095	2.93E-06	-12.7405081	ESP-FF
10100202	2055	5.30E-06	-12.1478	Wet	10100202	1606	3.91E-06	-12.4519732	ESP-FF
10100202	979	5.32E-06	-12.144	ESP	10100222	1841	4.39E-06	-12.3361813	ESP-FF
10100202	1989	5.63E-06	-12.0874	ESP	10100222	879456	1.46E-05	-11.134489	ESP-FF
10100212	1177	5.97E-06	-12.0288	Wet	10100202	63254	1.81E-05	-10.9195986	ESP-FF
10100212	2279	5.98E-06	-12.0273	ESP	10100218	1310	3.73E-05	-10.1965172	ESP-FF

Nickel Source Test Data					Nickel Source Test Data				
SCC	submittal ID	lb/mmBtu	LN #/mmBtu	Controls	SCC comb	ID comb	lb/mmBtu comb	LN #/mmBtu comb	Controls comb
10100202	966	6.27E-06	-11.9797	Wet	10100202	734	1.32E-04	-8.93270864	ESP-FF
10100212	632	6.35E-06	-11.9671	ESP	10100202	736	2.23E-04	-8.40833879	ESP-FF
10100224	1120	6.43E-06	-11.9545	Wet	10100202	1244	2.25E-04	-8.39941016	ESP-FF
10100202	1118	6.71E-06	-11.9119	Wet	10100202	735	3.02E-04	-8.10508354	ESP-FF
10100223	2302	7.31E-06	-11.8263	ESP	10300222	1276	2.16E-07	-15.3479874	Wet
10100202	8761	7.67E-06	-11.7782	Dry	10100202	1915	2.92E-07	-15.046512	Wet
10100202	8761	7.68E-06	-11.7769	Dry	10100212	1648	3.76E-07	-14.7936767	Wet
10100202	2195	8.48E-06	-11.6778	ESP	10100202	1972	3.97E-07	-14.7393296	Wet
10100222	2206	8.82E-06	-11.6385	Dry	10100202	2239	7.62E-07	-14.0873193	Wet
10100203	1809	9.08E-06	-11.6094	ESP	10100202	1515	7.88E-07	-14.0537677	Wet
10100202	1185	9.10E-06	-11.6072	Wet	10100212	1647	8.67E-07	-13.9582269	Wet
10100212	22791	9.43E-06	-11.5713	ESP	10100202	1638	9.93E-07	-13.8225352	Wet
10100202	2021	9.72E-06	-11.5413	Dry	10100202	1637	1.06E-06	-13.7572416	Wet
10100202	993	1.11E-05	-11.4086	ESP	10100202	1826	1.30E-06	-13.5531463	Wet
10100202	1636	1.19E-05	-11.339	ESP	10100223	23153	1.77E-06	-13.244531	Wet
10100222	879456	1.46E-05	-11.1345	FF	10100201	2319	1.79E-06	-13.2332949	Wet
10100202	1176	1.47E-05	-11.1277	Wet	10100223	1327	1.83E-06	-13.2111946	Wet
10100203	892	1.47E-05	-11.1277	ESP	10100222	2259	1.88E-06	-13.1842388	Wet
10100201	903	1.58E-05	-11.0555	ESP	10100223	23152	2.36E-06	-12.9568489	Wet
10100202	63254	1.81E-05	-10.9196	FF	10100202	18261	2.41E-06	-12.9358838	Wet
10100222	2274	2.00E-05	-10.8198	ESP	10100223	23151	2.55E-06	-12.8794172	Wet
10100223	828	2.07E-05	-10.7854	ESP	10100202	1330	2.75E-06	-12.8039096	Wet
10100212	731	2.22E-05	-10.7154	ESP	10100223	2315	2.99E-06	-12.7202372	Wet
10100204	1113	3.09E-05	-10.3848	ESP	10100202	1119	3.70E-06	-12.5071777	Wet
10100202	2022	3.41E-05	-10.2862	Dry	10100202	1187	4.14E-06	-12.3948148	Wet
10100202	1743	3.60E-05	-10.232	Wet	10100211	900	4.19E-06	-12.3828098	Wet
10100218	1310	3.73E-05	-10.1965	FF	10100226	1558	4.41E-06	-12.3316359	Wet
10100202	541	4.36E-05	-10.0405	Wet	10100202	1117	5.29E-06	-12.1496923	Wet
10100202	975	7.61E-05	-9.48346	ESP	10100202	1117	5.29E-06	-12.1496923	Wet
10100202	1845	8.77E-05	-9.34159	ESP	10100202	2055	5.30E-06	-12.1478037	Wet
10100202	734	1.32E-04	-8.93271	FF	10100212	1177	5.97E-06	-12.0287636	Wet
10100223	1307	1.41E-04	-8.86675	Wet	10100202	966	6.27E-06	-11.9797342	Wet
10100202	2276	1.47E-04	-8.82508	ESP	10100224	1120	6.43E-06	-11.954536	Wet
10100226	2278	1.50E-04	-8.80488	ESP	10100202	1118	6.71E-06	-11.9119116	Wet
10100202	1738	1.65E-04	-8.70957	Wet	10100202	1185	9.10E-06	-11.6072361	Wet
10100222	2135	2.04E-04	-8.49739	ESP	10100202	1176	1.47E-05	-11.1276631	Wet
10100202	736	2.23E-04	-8.40834	FF	10100202	1743	3.60E-05	-10.2319916	Wet
10100202	1244	2.25E-04	-8.39941	FF	10100202	541	4.36E-05	-10.0404534	Wet
10100202	735	3.02E-04	-8.10508	FF	10100223	1307	1.41E-04	-8.86675067	Wet
10100204	1111	3.73E-04	-7.89393	ESP	10100202	1738	1.65E-04	-8.70956508	Wet
10100202	550002	5.57E-04	-7.49295	Dry					

Outlier Tests for Selected Variables

User Selected Options

From File WorkSheet.wst

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for LN #/mmBtu (dry)

Mean -13.19

Standard Deviation 1.58

Number of data 34

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-13.19	1.557	-7.493	34	3.658	2.97	3.3
2	-13.36	1.237	-10.29	33	2.485	2.95	3.29
3	-13.46	1.125	-15.94	1	2.202	2.94	3.27
4	-13.38	1.047	-15.31	2	1.846	2.91	3.25
5	-13.31	1.001	-11.54	32	1.771	2.91	3.24

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation -7.493 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation -7.493 is a Potential Statistical Outlier

Rosner's Outlier Test for LN #/mmBtu (esp)

Mean -11.83

Standard Deviation 1.527

Number of data 44

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-11.83	1.51	-7.894	44	2.606	3.08	3.43
2	-11.92	1.418	-8.497	43	2.413	3.07	3.41
3	-12	1.33	-8.805	42	2.404	3.06	3.4
4	-12.08	1.245	-8.825	41	2.613	3.05	3.39
5	-12.16	1.145	-9.342	40	2.461	3.04	3.38

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for LN #/mmBtu (ff)

Number of data = 21
 10% critical value: 0.391
 5% critical value: 0.44
 1% critical value: 0.524

1. Data Value -8.105083541 is a Potential Outlier (Upper)

Test Statistic: 0.044

For 10% significance level, -8.105083541 is not an outlier.
 For 5% significance level, -8.105083541 is not an outlier.
 For 1% significance level, -8.105083541 is not an outlier.

2. Data Value -15.68631323 is a Potential Outlier (Lower)

Test Statistic: 0.103

For 10% significance level, -15.68631323 is not an outlier.
 For 5% significance level, -15.68631323 is not an outlier.
 For 1% significance level, -15.68631323 is not an outlier.

Rosner's Outlier Test for LN #/mmBtu (wet)

Mean	-12.63
Standard Deviation	1.526
Number of data	36
Number of suspected outliers	5

			Potential	Obs.	Test	Critical	Critical
#	Mean	sd	outlier	Number	value	value (5%)	value (1%)
1	-12.63	1.504	-8.71	36	2.609	2.99	3.33
2	-12.75	1.389	-8.867	35	2.793	2.98	3.32
3	-12.86	1.232	-10.04	34	2.289	2.97	3.3
4	-12.95	1.145	-10.23	33	2.372	2.95	3.29
5	-13.03	1.052	-15.35	1	2.202	2.94	3.27

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: lb/mmBtuO2(esp)

Background Data: lb/mmBtuO2(ff)

Raw Statistics

	ESP	Fabric Filter
Number of Valid Observations	44	21
Number of Distinct Observations	43	21
Minimum	3.7000E-7	1.5400E-7
Maximum	3.7300E-4	3.0200E-4
Mean	2.9622E-5	4.6308E-5
Median	5.2300E-6	2.6400E-6
SD	6.8772E-5	9.1087E-5
SE of Mean	1.0368E-5	1.9877E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	63	-0.822	1.669	0.793
Welch-Satterthwaite (Unequal Variance)	31.3	-0.744	1.696	0.769

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	4.7296E-9
Variance of Background	8.2969E-9

Numerator DF	Denominator DF	F-Test Value	P-Value
20	43	1.754	0.122

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: lb/mmBtuO2 comb(esp-ff)

Background Data: lb/mmBtuO2 comb(dry)

Raw Statistics

	ESP/FF	Dry Scrubber
Number of Valid Observations	65	33
Number of Distinct Observations	64	33
Minimum	1.5400E-7	1.2000E-7
Maximum	3.7300E-4	3.4100E-5
Mean	3.5013E-5	3.4414E-6
Median	4.4300E-6	1.6100E-6
SD	7.6370E-5	6.0906E-6
SE of Mean	9.4725E-6	1.0602E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	96	2.365	1.661	0.010
Welch-Satterthwaite (Unequal Variance)	65.6	3.312	1.668	0.001

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	5.8323E-9
Variance of Background	3.709E-11

Numerator DF	Denominator DF	F-Test Value	P-Value
64	32	157.227	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: lb/mmBtuO2 comb(esp-ff)

Background Data: lb/mmBtuO2 comb(wet)

Raw Statistics

	ESP/FF	Wet Scrubber
Number of Valid Observations	65	36
Number of Distinct Observations	64	35
Minimum	1.5400E-7	2.1600E-7
Maximum	3.7300E-4	1.6500E-4
Mean	3.5013E-5	1.3736E-5
Median	4.4300E-6	2.8700E-6
SD	7.6370E-5	3.5527E-5
SE of Mean	9.4725E-6	5.9212E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	99	1.577	1.660	0.059
Welch-Satterthwaite (Unequal Variance)	96.8	1.905	1.661	0.030

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	5.8323E-9		
Variance of Background	1.2622E-9		
Numerator DF	Denominator DF	F-Test Value	P-Value
64	35	4.621	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: lb/mmBtuO2 comb(wet)

Background Data: lb/mmBtuO2 comb(esp-ff)

Raw Statistics

	Wet Scrubber	ESP/FF
Number of Valid Observations	36	65
Number of Distinct Observations	35	64
Minimum	2.1600E-7	1.5400E-7
Maximum	1.6500E-4	3.7300E-4
Mean	1.3736E-5	3.5013E-5
Median	2.8700E-6	4.4300E-6
SD	3.5527E-5	7.6370E-5
SE of Mean	5.9212E-6	9.4725E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	99	-1.577	1.660	0.941
Welch-Satterthwaite (Unequal Variance)	96.8	-1.905	1.661	0.970

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.2622E-9
Variance of Background	5.8323E-9

Numerator DF	Denominator DF	F-Test Value	P-Value
64	35	4.621	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\

Full Precision OFF

Confidence Coefficient 0.95

lb/mmBtuO2 comb2

Raw Statistics

Number of Valid Observations 101

Number of Distinct Observations 95

Minimum 1.5400E-7

Maximum 3.7300E-4

Mean of Raw Data 2.7429E-5

Standard Deviation of Raw Data 6.5417E-5

Kstar 0.378

Mean of Log Transformed Data -12.24

Standard Deviation of Log Transformed Data 1.763

Normal Distribution Test Results

Correlation Coefficient R 0.671

Approximate Shapiro Wilk Test Statistic 0.469

Approximate Shapiro Wilk P Value 0

Lilliefors Test Statistic 0.373

Lilliefors Critical (0.95) Value 0.0882

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R 0.958

A-D Test Statistic 8.456

A-D Critical (0.95) Value 0.847

K-S Test Statistic 0.25

K-S Critical(0.95) Value 0.0958

Data not Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R 0.979

Approximate Shapiro Wilk Test Statistic 0.942

Approximate Shapiro Wilk P Value 3.4288E-4

Lilliefors Test Statistic 0.12

Lilliefors Critical (0.95) Value 0.0882

Data not Lognormal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\

Full Precision OFF

Confidence Coefficient 0.95

lb/mmBtuO2 (dry)

Raw Statistics

Number of Valid Observations 33

Number of Distinct Observations 33

Minimum 1.2000E-7

Maximum 3.4100E-5

Mean of Raw Data 3.4414E-6

Standard Deviation of Raw Data 6.0906E-6

Kstar 0.714

Mean of Log Transformed Data -13.36

Standard Deviation of Log Transformed Data 1.237

Normal Distribution Test Results

Correlation Coefficient R 0.689

Shapiro Wilk Test Statistic 0.508

Shapiro Wilk Critical (0.95) Value 0.931

Approximate Shapiro Wilk P Value 1.551E-11

Lilliefors Test Statistic 0.293

Lilliefors Critical (0.95) Value 0.154

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R 0.896

A-D Test Statistic 0.934

A-D Critical (0.95) Value 0.787

K-S Test Statistic 0.153

K-S Critical(0.95) Value 0.159

Data follow Appr. Gamma Distribution at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R 0.995

Shapiro Wilk Test Statistic 0.991

Shapiro Wilk Critical (0.95) Value 0.931

Approximate Shapiro Wilk P Value 0.995

Lilliefors Test Statistic 0.0665

Lilliefors Critical (0.95) Value 0.154

Data appear Lognormal at (0.05) Significance Level

lb/mmBtuO2 (esp)

Raw Statistics

Number of Valid Observations 44

Number of Distinct Observations	43						
Minimum	3.7000E-7						
Maximum	3.7300E-4						
Mean of Raw Data	2.9622E-5						
Standard Deviation of Raw Data	6.8772E-5						
Kstar	0.443						
Mean of Log Transformed Data	-11.83						
Standard Deviation of Log Transformed Data	1.527						
Normal Distribution Test Results							
Correlation Coefficient R	0.663						
Shapiro Wilk Test Statistic	0.468						
Shapiro Wilk Critical (0.95) Value	0.944						
Approximate Shapiro Wilk P Value	1.110E-16						
Lilliefors Test Statistic	0.384						
Lilliefors Critical (0.95) Value	0.134						
Data not Normal at (0.05) Significance Level							
Gamma Distribution Test Results							
Correlation Coefficient R	0.945						
A-D Test Statistic	3.959						
A-D Critical (0.95) Value	0.823						
K-S Test Statistic	0.236						
K-S Critical(0.95) Value	0.142						
Data not Gamma Distributed at (0.05) Significance Level							
Lognormal Distribution Test Results							
Correlation Coefficient R	0.969						
Shapiro Wilk Test Statistic	0.937						
Shapiro Wilk Critical (0.95) Value	0.944						
Approximate Shapiro Wilk P Value	0.0251						
Lilliefors Test Statistic	0.127						
Lilliefors Critical (0.95) Value	0.134						
Data not Lognormal at (0.05) Significance Level							
Ib/mmBtuO2 (ff)							
Raw Statistics							
Number of Valid Observations	21						
Number of Distinct Observations	21						
Minimum	1.5400E-7						
Maximum	3.0200E-4						
Mean of Raw Data	4.6308E-5						
Standard Deviation of Raw Data	9.1087E-5						
Kstar	0.277						
Mean of Log Transformed Data	-12.41						
Standard Deviation of Log Transformed Data	2.402						
Normal Distribution Test Results							

Correlation Coefficient R	0.753						
Shapiro Wilk Test Statistic	0.571						
Shapiro Wilk Critical (0.95) Value	0.908						
Approximate Shapiro Wilk P Value	1.5896E-7						
Lilliefors Test Statistic	0.384						
Lilliefors Critical (0.95) Value	0.193						

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

Correlation Coefficient R	0.95						
A-D Test Statistic	1.77						
A-D Critical (0.95) Value	0.852						
K-S Test Statistic	0.273						
K-S Critical(0.95) Value	0.206						

Data not Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Correlation Coefficient R	0.958						
Shapiro Wilk Test Statistic	0.905						
Shapiro Wilk Critical (0.95) Value	0.908						
Approximate Shapiro Wilk P Value	0.0409						
Lilliefors Test Statistic	0.155						
Lilliefors Critical (0.95) Value	0.193						

Data not Lognormal at (0.05) Significance Level

Ib/mmBtuO2 (wet)

Raw Statistics

Number of Valid Observations	36						
Number of Distinct Observations	35						
Minimum	2.1600E-7						
Maximum	1.6500E-4						
Mean of Raw Data	1.3736E-5						
Standard Deviation of Raw Data	3.5527E-5						
Kstar	0.43						
Mean of Log Transformed Data	-12.63						
Standard Deviation of Log Transformed Data	1.526						

Normal Distribution Test Results

Correlation Coefficient R	0.612						
Shapiro Wilk Test Statistic	0.397						
Shapiro Wilk Critical (0.95) Value	0.935						
Approximate Shapiro Wilk P Value	1.343E-14						
Lilliefors Test Statistic	0.413						
Lilliefors Critical (0.95) Value	0.148						

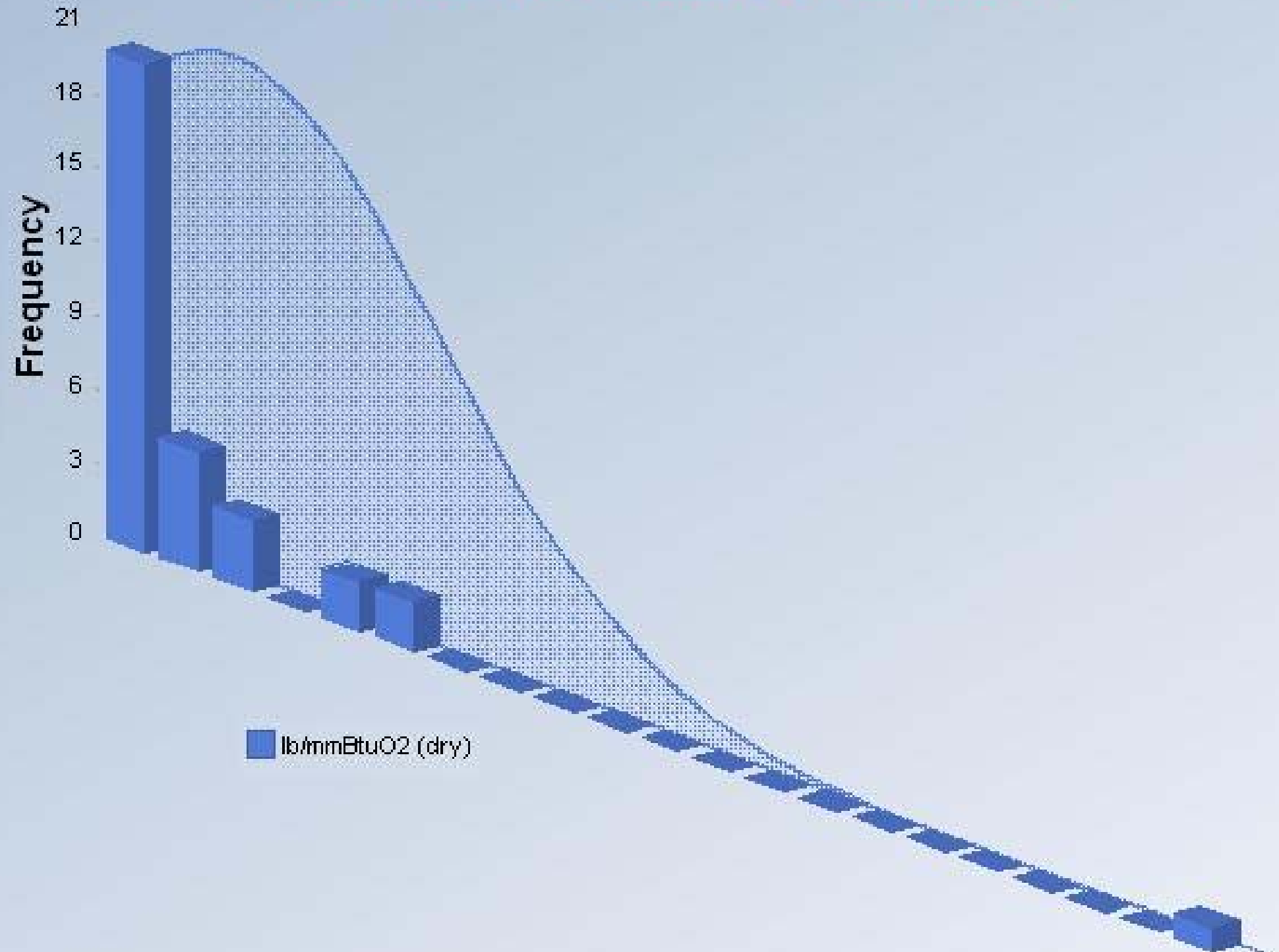
Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

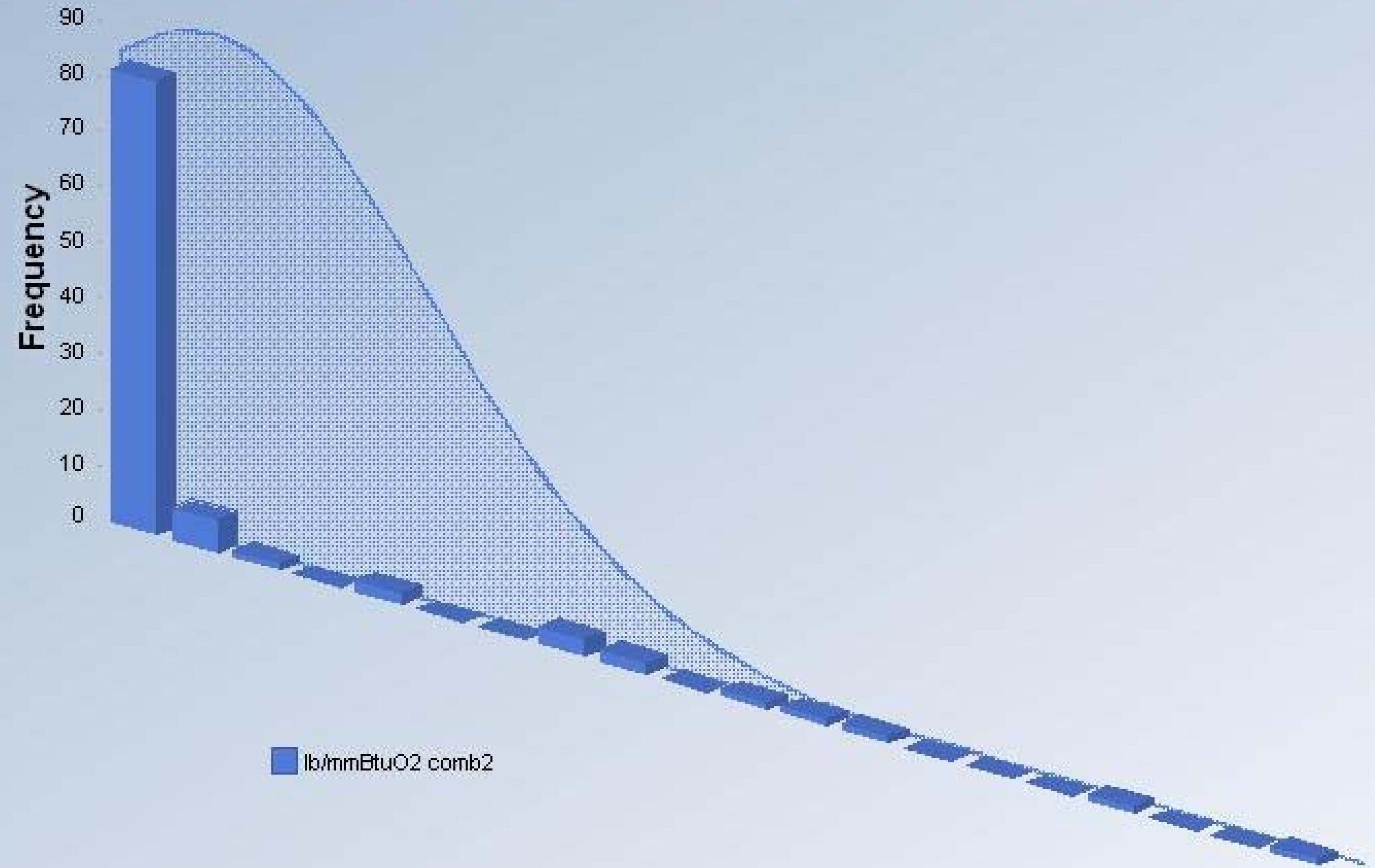
Correlation Coefficient R	0.896						
---------------------------	-------	--	--	--	--	--	--

A-D Test Statistic	3.331						
A-D Critical (0.95) Value	0.824						
K-S Test Statistic	0.298						
K-S Critical(0.95) Value	0.156						
Data not Gamma Distributed at (0.05) Significance Level							
Lognormal Distribution Test Results							
Correlation Coefficient R	0.973						
Shapiro Wilk Test Statistic	0.945						
Shapiro Wilk Critical (0.95) Value	0.935						
Approximate Shapiro Wilk P Value	0.0941						
Lilliefors Test Statistic	0.151						
Lilliefors Critical (0.95) Value	0.148						
Data appear Lognormal at (0.05) Significance Level							

Histogram for Nickel (Dry Scrubber)



Histogram for Nickel (ESP, FF, Wet Scrubber)



Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
lb/mmBtuO2 (dry)	33	1.2000E-7	3.4100E-5	3.4414E-6	1.6100E-6	3.709E-11	6.0906E-6	1.6842E-6	4.27	21.02	N/A
lb/mmBtuO2 (esp)	44	3.7000E-7	3.7300E-4	2.9622E-5	5.2300E-6	4.7296E-9	6.8772E-5	4.9963E-6	3.663	15.02	N/A
lb/mmBtuO2 (ff)	21	1.5400E-7	3.0200E-4	4.6308E-5	2.6400E-6	8.2969E-9	9.1087E-5	3.1950E-6	1.992	2.752	N/A
lb/mmBtuO2 (wet)	36	2.1600E-7	1.6500E-4	1.3736E-5	2.8700E-6	1.2622E-9	3.5527E-5	3.1060E-6	3.722	13.49	N/A

Percentiles for Raw Full Data Sets

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
lb/mmBtuO2 (dry)	33	2.6240E-7	3.3700E-7	5.9680E-7	7.7600E-7	1.6100E-6	3.3500E-6	4.2420E-6	7.6780E-6	9.1800E-6	2.6298E-5
lb/mmBtuO2 (esp)	44	1.1140E-6	1.5780E-6	2.3940E-6	2.7300E-6	5.2300E-6	1.4975E-5	2.0280E-5	8.4220E-5	1.4955E-4	3.0033E-4
lb/mmBtuO2 (ff)	21	3.0100E-7	3.2500E-7	5.7000E-7	7.2100E-7	2.6400E-6	1.8100E-5	3.7300E-5	2.2300E-4	2.2500E-4	2.8660E-4
lb/mmBtuO2 (wet)	36	3.5500E-7	5.7950E-7	9.9300E-7	1.2400E-6	2.8700E-6	6.0450E-6	6.4300E-6	2.5350E-5	6.7950E-5	1.5660E-4

Summary Statistics for Raw Full Dataset

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
lb/mmBtuO2 comb2	101	1.5400E-7	3.7300E-4	2.7429E-5	3.9100E-6	4.2793E-9	6.5417E-5	4.2254E-6	3.303	11.42	N/A

Percentiles for Raw Full Dataset

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
lb/mmBtuO2 comb2	101	3.7000E-7	7.2100E-7	1.0900E-6	1.7700E-6	3.9100E-6	1.1100E-5	1.5800E-5	8.7700E-5	1.6500E-4	3.0200E-4

Coal Fired Utility Boiler Selenium Emissions Factors in #/mmBtu

The results of the EPA Method 29 test results from the Utility Boiler Information Collection Request (ICR) were evaluated for the development of national emissions factors. The procedures employed are as described in the draft Emissions Factors Procedures Document. The data used for the development of the Selenium Emissions Factor are presented on the following five pages. The site specific emissions factors presented are as determined using the f factor method rather than the emissions factor determined by dividing the hourly emissions by the coal feed and associated proximate analysis. The left five columns contains information on each individual facility and presents Submittal ID, emissions factors, the measurement indicator flag, the control measures employed and the natural log of the emissions factor. The four columns on the right indicate control device groupings used in the progression of the emissions factor development process. The first two columns identify statistical outliers using the additional word “out” and are highlighted. In addition to identifying outlier data these columns identify where source groups were merged when analysis by the t-test indicated that there was no statistical difference between controls. Subsequent pages provide the assessments as performed using EPA’s statistical software ProUCL. The assessments provide support for developing a combined national emissions factors for ESP, Fabric Filters, ESP and Fabric Filter controls combined with either non catalytic reduction or catalytic reduction, and for developing a separate national emissions factor for units which employ wet or dry scrubbing controls. A combined emissions factor for ESP, Fabric Filters, ESP and Fabric Filter controls combined with either non catalytic reduction or catalytic reduction since there was no statistical difference between the means of emissions from the different groupings of controls without acid gas controls. There also was no statistical difference between the different groupings of controls combined with wet or dry scrubber controls. Separate emissions factors were developed for units without wet or dry scrubber controls and for facilities with wet or dry scrubber controls since there was a statistical difference between these control groupings.

The resulting calculated selenium emissions factors are:

	Emissions Factor lb/mmBtu	Number of Supporting Tests	Quality Indicator
ESP, FF, ESP/FF, ESP/catalytic reduction, ESP/non catalytic reduction, FF/catalytic reduction & FF/non catalytic reduction control	3.69×10^{-5}	106	Highly Representative
All controls combined with either dry scrubbing or wet scrubbing controls	9.24×10^{-6}	112	Highly Representative

Coal Fired Utility Boilers Selenium Data

Submittal ID	EF #/mmBtu	Flag	Controls	LN EF #/mmBtu	Contols-Out	Control-Comb1	Control-Comb2	Final Control Comb
1266	1.37E-08	ADL	Dry Scrub FF Catalytic Red	-18.10750	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1365	1.45E-08	ADL	Dry Scrub FF Catalytic Red	-18.05091	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1128	1.53E-08	DLL	Dry Scrub FF Catalytic Red	-17.99395	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
5000	1.61E-08	ADL	FF Non Catalytic Red	-17.94639	FF Non Catalytic Red	FF NH3	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
947	4.07E-08	DLL	Dry Scrub FF	-17.01645	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1942	4.67E-08	DLL	Dry Scrub FF	-16.87852	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
565	5.09E-08	DLL	Dry Scrub FF	-16.79275	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
779	5.31E-08	ADL	FF Non Catalytic Red	-16.75133	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
1539	6.61E-08	DLL	FF Non Catalytic Red	-16.53234	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
1488	7.87E-08	ADL	Dry Scrub FF Catalytic Red	-16.35773	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
77922	8.20E-08	DLL	FF Non Catalytic Red	-16.31693	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
2256	9.21E-08	BDL	FF	-16.20075	FF	FF	FF, FF/NH3	UnScrubbed
2256	9.21E-08	BDL	FF	-16.20075	FF	FF	FF, FF/NH3	UnScrubbed
1382	9.33E-08	ADL	Dry Scrub ESP	-16.18793	Dry Scrub ESP	Dry Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1249	1.18E-07	DLL	Dry Scrub FF	-15.95146	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2315	1.33E-07	DLL	Wet Scrub FF	-15.83660	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1349	1.35E-07	ADL	Dry Scrub FF	-15.81599	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
560	1.35E-07	ADL	Dry Scrub FF	-15.81446	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1052	1.42E-07	ADL	Dry Scrub FF	-15.77087	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1276	1.44E-07	BDL	Wet Scrub ESP	-15.75242	Final	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
23153	1.71E-07	DLL	Wet Scrub FF	-15.58066	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1972	1.79E-07	ADL	Wet Scrub FF	-15.53776	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
23151	1.92E-07	DLL	Wet Scrub FF	-15.46693	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
830	2.10E-07	ADL	Dry Scrub FF	-15.37487	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1449	2.13E-07	ADL	Dry Scrub FF	-15.36263	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
3197	2.15E-07	ADL	ESP	-15.35388	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1189	2.19E-07	DLL	FF	-15.33415	FF	FF	FF, FF/NH3	UnScrubbed
2198	2.29E-07	ADL	Dry Scrub FF	-15.29049	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
13461	2.34E-07	ADL	Dry Scrub FF	-15.26754	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1706	2.39E-07	ADL	Wet Scrub ESP	-15.24736	Wet Scrub ESP	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1156	2.86E-07	ADL	Dry Scrub FF Catalytic Red	-15.06710	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1346	2.97E-07	ADL	Dry Scrub FF	-15.02925	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
23152	3.17E-07	ADL	Wet Scrub FF	-14.96536	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1687	3.26E-07	ADL	Wet Scrub ESP	-14.93780	Wet Scrub ESP	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
2200	4.26E-07	ADL	Dry Scrub FF	-14.66924	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1346111	4.28E-07	ADL	Dry Scrub FF	-14.66395	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
941	4.34E-07	ADL	FF	-14.65046	FF	FF	FF, FF/NH3	UnScrubbed
1524	4.57E-07	ADL	Dry Scrub FF	-14.59891	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1654	4.66E-07	ADL	Wet Scrub FF	-14.57983	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1398	4.66E-07	BDL	Dry Scrub FF	-14.57919	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1568	4.85E-07	BDL	Dry Scrub FF	-14.53932	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1336	4.92E-07	ADL	Dry Scrub FF Catalytic Red	-14.52569	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
834	4.99E-07	ADL	Dry Scrub FF	-14.51111	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1611	5.03E-07	BDL	Dry Scrub FF Catalytic Red	-14.50288	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed

Coal Fired Utility Boilers Selenium Data

Submittal ID	EF #/mmBtu	Flag	Controls	LN EF #/mmBtu	Contols-Out	Control-Comb1	Control-Comb2	Final Control Comb
2199	5.04E-07	ADL	Dry Scrub FF	-14.50106	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
844	5.54E-07	ADL	FF	-14.40675	FF	FF	FF, FF/NH3	UnScrubbed
1129	5.71E-07	BDL	Dry Scrub FF	-14.37625	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1618	5.77E-07	ADL	ESP-FF	-14.36475	ESP-FF	ESP-FF	FF, FF/NH3	UnScrubbed
22261	5.84E-07	ADL	FF Non Catalytic Red	-14.35267	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
2090	6.00E-07	DLL	FF Non Catalytic Red	-14.32568	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
2090	6.00E-07	DLL	FF Non Catalytic Red	-14.32568	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
1726	6.30E-07	ADL	Dry Scrub FF Catalytic Red	-14.27732	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2112	6.40E-07	ADL	Dry Scrub FF Catalytic Red	-14.26153	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
698	6.58E-07	ADL	Dry Scrub FF	-14.23366	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2027	6.72E-07	ADL	Dry Scrub ESP Non Catalytic Red	-14.21232	Dry Scrub ESP Non Catalytic Red	Dry Scrub ESP Non Catalytic Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1430	6.84E-07	ADL	FF Non Catalytic Red	-14.19548	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
1133	7.51E-07	BDL	Dry Scrub FF	-14.10194	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1563	7.70E-07	BDL	Dry Scrub FF	-14.07684	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1515	8.89E-07	DLL	Wet Scrub FF	-13.93287	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
134611	8.93E-07	ADL	Dry Scrub FF	-13.92850	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1327	9.30E-07	DLL	Wet Scrub FF	-13.88823	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2028	9.46E-07	ADL	Dry Scrub ESP Non Catalytic Red	-13.87076	Dry Scrub ESP Non Catalytic Red	Dry Scrub ESP Non Catalytic Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
2226	9.55E-07	ADL	FF Non Catalytic Red	-13.86186	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
2319	9.77E-07	ADL	Wet Scrub FF Catalytic Red	-13.83846	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1190	9.86E-07	ADL	FF	-13.83007	FF	FF	FF, FF/NH3	UnScrubbed
1893	1.05E-06	BDL	FF	-13.76684	FF	FF	FF, FF/NH3	UnScrubbed
995	1.08E-06	DLL	Dry Scrub FF	-13.73514	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2170	1.18E-06	BDL	FF	-13.65224	FF	FF	FF, FF/NH3	UnScrubbed
535	1.22E-06	ADL	Dry Scrub FF	-13.61929	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2259	1.30E-06	ADL	Dry Scrub FF Catalytic Red	-13.55522	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2021	1.31E-06	ADL	Dry Scrub FF Non Catalytic Red	-13.54516	Dry Scrub FF Non Catalytic Red	Dry Scrub FF Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1835	1.32E-06	BDL	FF	-13.53781	FF	FF	FF, FF/NH3	UnScrubbed
536	1.32E-06	ADL	Dry Scrub FF	-13.53736	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2206	1.45E-06	ADL	Dry Scrub FF	-13.44665	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2088	1.45E-06	ADL	FF Non Catalytic Red	-13.44596	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
1884	1.49E-06	ADL	ESP-FF	-13.41441	ESP-FF	ESP-FF	FF, FF/NH3	UnScrubbed
1884	1.49E-06	ADL	ESP-FF	-13.41441	ESP-FF	ESP-FF	FF, FF/NH3	UnScrubbed
511	1.50E-06	BDL	Wet Scrub FF Catalytic Red	-13.41005	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1832	1.58E-06	DLL	FF	-13.36099	FF	FF	FF, FF/NH3	UnScrubbed
1532	1.69E-06	ADL	Dry Scrub FF	-13.28886	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2207	1.71E-06	ADL	Dry Scrub FF	-13.27999	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1310	1.76E-06	DLL	FF Non Catalytic Red	-13.24923	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
1974	1.85E-06	BDL	Dry Scrub FF	-13.20287	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1021	1.99E-06	ADL	ESP	-13.12806	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
942	2.06E-06	ADL	ESP	-13.09367	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1307	2.06E-06	ADL	Wet Scrub FF	-13.09189	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1997	2.11E-06	ADL	Dry Scrub FF Catalytic Red	-13.07080	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1833	2.24E-06	DLL	FF	-13.01095	FF	FF	FF, FF/NH3	UnScrubbed

Coal Fired Utility Boilers Selenium Data

Submittal ID	EF #/mmBtu	Flag	Controls	LN EF #/mmBtu	Contols-Out	Control-Comb1	Control-Comb2	Final Control Comb
1293	2.24E-06	BDL	FF Non Catalytic Red	-13.00725	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
524	2.28E-06	ADL	FF Non Catalytic Red	-12.99170	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
524	2.28E-06	ADL	FF Non Catalytic Red	-12.99170	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
2022	2.29E-06	ADL	Dry Scrub FF	-12.98655	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
736	2.35E-06	ADL	FF	-12.96066	FF	FF	FF, FF/NH3	UnScrubbed
1372	2.46E-06	DLL	ESP	-12.91664	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1058	2.60E-06	ADL	FF	-12.86083	FF	FF	FF, FF/NH3	UnScrubbed
1060	2.60E-06	ADL	FF	-12.86083	FF	FF	FF, FF/NH3	UnScrubbed
10040004	2.63E-06	ADL	ESP	-12.84814	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
734	2.68E-06	DLL	FF	-12.82878	FF	FF	FF, FF/NH3	UnScrubbed
1606	2.70E-06	ADL	FF	-12.82299	FF	FF	FF, FF/NH3	UnScrubbed
892	2.90E-06	ADL	ESP	-12.75006	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1651	2.97E-06	ADL	FF	-12.72708	FF	FF	FF, FF/NH3	UnScrubbed
2009	3.16E-06	ADL	ESP	-12.66584	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
2011	3.16E-06	ADL	ESP	-12.66339	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
985	3.23E-06	ADL	ESP Wet Scrub Cat Red	-12.64175	ESP Wet Scrub Cat Red-Out	ESP Wet Scrub Cat Red-Out	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
2278	3.39E-06	ADL	ESP	-12.59354	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1141	3.46E-06	ADL	ESP	-12.57376	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1534	3.65E-06	ADL	Wet Scrub FF	-12.52043	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
452145	3.85E-06	ADL	FF	-12.46759	FF	FF	FF, FF/NH3	UnScrubbed
452145	3.85E-06	ADL	FF	-12.46759	FF	FF	FF, FF/NH3	UnScrubbed
735	3.88E-06	ADL	FF	-12.45950	FF	FF	FF, FF/NH3	UnScrubbed
1989	4.36E-06	ADL	ESP	-12.34225	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
2070	4.60E-06	ADL	ESP	-12.28950	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1735	4.61E-06	ADL	Dry Scrub FF Non Catalytic Red	-12.28627	Dry Scrub FF Non Catalytic Red	Dry Scrub FF Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2013	4.78E-06	ADL	ESP	-12.25163	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
10040002	4.87E-06	ADL	FF Non Catalytic Red	-12.23245	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
731	5.07E-06	ADL	ESP	-12.19176	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1647	5.46E-06	ADL	Wet Scrub FF	-12.11844	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2025	5.61E-06	ADL	Wet Scrub FF Catalytic Red	-12.09111	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
894	6.31E-06	ADL	FF Cat Red	-11.97368	FF Cat Red	FF NH3	FF, FF/NH3	UnScrubbed
894	6.31E-06	ADL	FF Non Catalytic Red	-11.97368	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
894	6.31E-06	ADL	FF Non Catalytic Red	-11.97368	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
1734	6.32E-06	ADL	Dry Scrub FF	-11.97124	Dry Scrub FF	Dry Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1938	6.45E-06	ADL	ESP-FF	-11.95068	ESP-FF	ESP-FF	FF, FF/NH3	UnScrubbed
1938	6.45E-06	ADL	ESP-FF	-11.95068	ESP-FF	ESP-FF	FF, FF/NH3	UnScrubbed
2135	6.61E-06	ADL	ESP Non Catalytic Red	-11.92633	ESP Non Catalytic Red	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1602	6.92E-06	ADL	FF Cat Red	-11.88041	FF Cat Red	FF NH3	FF, FF/NH3	UnScrubbed
1151	6.99E-06	BDL	FF	-11.87035	FF	FF	FF, FF/NH3	UnScrubbed
1854	8.10E-06	ADL	ESP	-11.72414	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
966	8.43E-06	ADL	FF Wet Scrub Non Catalytic Red	-11.68418	FF Wet Scrub Non Catalytic Red	FF Wet Scrub Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
966	8.43E-06	ADL	FF Wet Scrub Non Catalytic Red	-11.68418	FF Wet Scrub Non Catalytic Red	FF Wet Scrub Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
966	8.43E-06	ADL	FF Wet Scrub Non Catalytic Red	-11.68418	FF Wet Scrub Non Catalytic Red	FF Wet Scrub Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
966	8.43E-06	ADL	FF Wet Scrub Non Catalytic Red	-11.68418	FF Wet Scrub Non Catalytic Red	FF Wet Scrub Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed

Coal Fired Utility Boilers Selenium Data

Submittal ID	EF #/mmBtu	Flag	Controls	LN EF #/mmBtu	Contols-Out	Control-Comb1	Control-Comb2	Final Control Comb
2239	8.73E-06	ADL	ESP Wet Scrub Cat Red	-11.64822	ESP Wet Scrub Cat Red	ESP Wet Scrub Cat Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1187	8.91E-06	ADL	ESP Wet Scrub Cat Red	-11.62850	ESP Wet Scrub Cat Red	ESP Wet Scrub Cat Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1535	9.35E-06	ADL	FF Wet Scrub Non Catalytic Red	-11.58007	FF Wet Scrub Non Catalytic Red	FF Wet Scrub Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2279	9.37E-06	ADL	ESP	-11.57817	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
2302	9.91E-06	ADL	ESP Catalytic Red	-11.52178	ESP Catalytic Red	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1585	1.05E-05	ADL	FF Cat Red	-11.46400	FF Cat Red	FF NH3	FF, FF/NH3	UnScrubbed
1244	1.05E-05	ADL	FF	-11.46034	FF	FF	FF, FF/NH3	UnScrubbed
2097	1.07E-05	ADL	FF	-11.44630	FF	FF	FF, FF/NH3	UnScrubbed
994	1.13E-05	ADL	ESP Wet Scrub Cat Red	-11.38834	ESP Wet Scrub Cat Red	ESP Wet Scrub Cat Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1185	1.14E-05	ADL	ESP Wet Scrub Cat Red	-11.38016	ESP Wet Scrub Cat Red	ESP Wet Scrub Cat Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
63254	1.15E-05	ADL	FF	-11.37678	FF	FF	FF, FF/NH3	UnScrubbed
1648	1.31E-05	ADL	Wet Scrub FF	-11.24546	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1847	1.36E-05	ADL	FF Wet Scrub Non Catalytic Red	-11.20524	FF Wet Scrub Non Catalytic Red	FF Wet Scrub Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1638	1.40E-05	ADL	Dry Scrub FF Catalytic Red	-11.17386	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1894	1.43E-05	ADL	Dry Scrub ESP Non Catalytic Red	-11.15180	Dry Scrub ESP Non Catalytic Red	Dry Scrub ESP Non Catalytic Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1894	1.43E-05	ADL	Dry Scrub ESP Non Catalytic Red	-11.15180	Dry Scrub ESP Non Catalytic Red	Dry Scrub ESP Non Catalytic Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1894	1.43E-05	ADL	ESP Wet Scrub Cat Red	-11.15180	ESP Wet Scrub Cat Red	ESP Wet Scrub Cat Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1894	1.43E-05	ADL	FF Wet Scrub Non Catalytic Red	-11.15180	FF Wet Scrub Non Catalytic Red	FF Wet Scrub Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
12861	1.45E-05	ADL	ESP	-11.14322	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
203612	1.45E-05	ADL	ESP Wet Scrub Cat Red	-11.13883	ESP Wet Scrub Cat Red	ESP Wet Scrub Cat Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1154	1.55E-05	ADL	FF	-11.07663	FF	FF	FF, FF/NH3	UnScrubbed
1637	1.60E-05	ADL	Dry Scrub FF Catalytic Red	-11.04489	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1738	1.60E-05	ADL	Wet Scrub FF Catalytic Red	-11.04254	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1558	1.64E-05	ADL	Venturi Wet Scrub	-11.02028	Venturi Wet Scrub	Venturi Wet Scrub		Scrubbed
18261	1.66E-05	ADL	Wet Scrub ESP	-11.00517	Wet Scrub ESP	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1915	1.68E-05	ADL	Dry Scrub ESP Non Catalytic Red	-10.99621	Dry Scrub ESP Non Catalytic Red	Dry Scrub ESP Non Catalytic Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
983	1.73E-05	ADL	ESP Wet Scrub Cat Red	-10.96707	ESP Wet Scrub Cat Red	ESP Wet Scrub Cat Red	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
541	1.73E-05	ADL	Wet Scrub FF Catalytic Red	-10.96473	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1984	1.85E-05	ADL	Wet Scrub ESP	-10.89864	Wet Scrub ESP	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1984	1.85E-05	ADL	Wet Scrub ESP	-10.89864	Wet Scrub ESP	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1984	1.85E-05	ADL	Wet Scrub ESP	-10.89864	Wet Scrub ESP	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1984	1.85E-05	ADL	Wet Scrub FF Catalytic Red	-10.89864	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1743	1.93E-05	ADL	Wet Scrub FF Catalytic Red	-10.85324	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1902	2.23E-05	ADL	ESP	-10.70884	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
2276	2.31E-05	ADL	ESP	-10.67492	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
22791	2.32E-05	ADL	FF Non Catalytic Red	-10.67181	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
21351	2.32E-05	ADL	ESP Non Catalytic Red	-10.67046	ESP Non Catalytic Red	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1176	2.33E-05	ADL	Wet Scrub ESP	-10.66850	Wet Scrub ESP	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1176	2.33E-05	ADL	Wet Scrub FF	-10.66850	Wet Scrub FF	Wet Scrub FF	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
900	2.37E-05	ADL	FF Wet Scrub Non Catalytic Red	-10.64834	FF Wet Scrub Non Catalytic Red	FF Wet Scrub Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
900	2.37E-05	ADL	FF Wet Scrub Non Catalytic Red	-10.64834	FF Wet Scrub Non Catalytic Red	FF Wet Scrub Non Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1642	2.38E-05	ADL	ESP	-10.64746	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1642	2.38E-05	ADL	ESP	-10.64746	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
828	2.38E-05	ADL	FF Cat Red	-10.64721	FF Cat Red	FF NH3	FF, FF/NH3	UnScrubbed

Coal Fired Utility Boilers Selenium Data

Submittal ID	EF #/mmBtu	Flag	Controls	LN EF #/mmBtu	Contols-Out	Control-Comb1	Control-Comb2	Final Control Comb
1118	2.64E-05	ADL	Wet Scrub FF Catalytic Red	-10.54386	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2103	2.68E-05	ADL	ESP	-10.52700	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1826	2.71E-05	ADL	Wet Scrub ESP	-10.51770	Wet Scrub ESP	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
2274	2.86E-05	ADL	ESP	-10.46249	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
2306	2.86E-05	ADL	ESP	-10.46066	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
2081	2.93E-05	ADL	Wet Scrub FF Catalytic Red	-10.43890	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1119	3.17E-05	ADL	Wet Scrub FF Catalytic Red	-10.35763	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1120	3.42E-05	ADL	Wet Scrub ESP	-10.28236	Wet Scrub ESP	Wet Scrub ESP	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
2161	3.57E-05	ADL	FF Non Catalytic Red	-10.23903	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
2195	4.08E-05	ADL	ESP Non Catalytic Red	-10.10793	ESP Non Catalytic Red	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1845	4.10E-05	ADL	FF	-10.10279	FF	FF	FF, FF/NH3	UnScrubbed
1117	4.51E-05	ADL	Wet Scrub FF Catalytic Red	-10.00646	Wet Scrub FF Catalytic Red	Wet Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
2055	5.10E-05	ADL	Dry Scrub FF Catalytic Red	-9.88290	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
1113	5.15E-05	ADL	ESP	-9.87398	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1597	5.29E-05	ADL	FF	-9.84661	FF	FF	FF, FF/NH3	UnScrubbed
908	5.40E-05	ADL	Dry Scrub FF Catalytic Red	-9.82670	Dry Scrub FF Catalytic Red	Dry Scrub FF Catalytic Red	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed
979	6.42E-05	ADL	ESP	-9.65368	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1004	6.59E-05	ADL	ESP Catalytic Red	-9.62740	ESP Catalytic Red	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
2179	7.29E-05	ADL	ESP	-9.52608	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
2179	7.29E-05	ADL	ESP	-9.52608	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
879456	7.67E-05	ADL	FF Non Catalytic Red	-9.47596	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
1330	8.35E-05	ADL	Dry Scrub ESP Non Catalytic Red	-9.39068	Dry Scrub ESP Non Catalytic Red-Out	Dry Scrub ESP Non Catalytic Red-Out	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1330	8.35E-05	ADL	ESP Wet Scrub Cat Red	-9.39068	ESP Wet Scrub Cat Red-Out	ESP Wet Scrub Cat Red-Out	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub	Scrubbed
1636	8.45E-05	ADL	ESP	-9.37921	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1636	8.45E-05	ADL	ESP	-9.37921	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1178	8.71E-05	ADL	ESP	-9.34856	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1809	9.20E-05	ADL	ESP Catalytic Red	-9.29351	ESP Catalytic Red	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1754	1.04E-04	ADL	ESP	-9.16750	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1286	1.17E-04	ADL	ESP	-9.05598	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
632	1.18E-04	ADL	FF Non Catalytic Red	-9.04546	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
975	1.18E-04	ADL	ESP	-9.04419	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1471	1.26E-04	ADL	ESP-FF	-8.98079	ESP-FF	ESP-FF	FF, FF/NH3	UnScrubbed
1471	1.26E-04	ADL	ESP-FF	-8.98079	ESP-FF	ESP-FF	FF, FF/NH3	UnScrubbed
993	1.36E-04	ADL	ESP	-8.90632	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1111	1.42E-04	ADL	ESP	-8.86304	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
1906	1.66E-04	ADL	ESP	-8.70254	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
981	1.90E-04	ADL	FF Non Catalytic Red	-8.56587	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
8761	2.39E-04	ADL	FF	-8.33900	FF	FF	FF, FF/NH3	UnScrubbed
1455	2.53E-04	ADL	ESP	-8.28252	ESP	ESP/ESP NH3	ESP, ESP/NH3	UnScrubbed
903	3.16E-04	ADL	FF Non Catalytic Red	-8.05882	FF Non Catalytic Red	FF NH3	FF, FF/NH3	UnScrubbed
876	3.32E-04	ADL	FF	-8.01169	FF	FF	FF, FF/NH3	UnScrubbed
1000000	1.34E-06	ADL	Dry Scrub FF	-13.52284	Dry Scrub FF-Out	Dry Scrub FF-Out	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	Scrubbed

Coal Fired Utility Boiler Selenium Emissions Factors by Control Types

From File: C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\Selenium\EF Data.wst

Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
ESP	38	2.15E-07	2.53E-04	4.75E-05	2.35E-05	3.43E-09	5.86E-05	3.07E-05	1.627	2.797	N/A
Dry Scrub, ESP	1	9.33E-08	9.33E-08	9.33E-08	9.33E-08	N/A	N/A	0	N/A	N/A	N/A
ESP, Wet Scrub	10	1.44E-07	3.42E-05	1.57E-05	1.85E-05	1.41E-10	1.19E-05	9.93E-06	-0.242	-0.955	N/A
Dry Scrub, ESP, Non catalytic red	6	6.72E-07	8.35E-05	2.18E-05	1.43E-05	9.65E-10	3.11E-05	1.18E-05	2.162	4.969	N/A
ESP, Catalytic red	3	9.91E-06	9.20E-05	5.59E-05	6.59E-05	1.76E-09	4.19E-05	3.87E-05	-1.009	N/A	N/A
ESP, Non catalytic red	3	6.61E-06	4.08E-05	2.35E-05	2.32E-05	2.92E-10	1.71E-05	2.46E-05	0.0886	N/A	N/A
ESP, Wet Scrub, Cat red	9	3.23E-06	8.35E-05	1.92E-05	1.14E-05	5.97E-10	2.44E-05	4.30E-06	2.838	8.306	N/A
FF	29	9.21E-08	3.32E-04	2.61E-05	2.68E-06	5.46E-09	7.39E-05	2.51E-06	3.615	12.73	N/A
ESP-FF	7	5.77E-07	1.26E-04	3.84E-05	6.45E-06	3.59E-09	5.99E-05	7.35E-06	1.223	-0.845	N/A
FF, Cat red	4	6.31E-06	2.38E-05	1.19E-05	8.71E-06	6.65E-11	8.16E-06	3.11E-06	1.713	2.872	N/A
FF, Non catalytic red	23	1.61E-08	3.16E-04	3.44E-05	2.24E-06	5.93E-09	7.70E-05	3.22E-06	2.851	8.337	N/A
Dry Scrub, FF	34	4.07E-08	4.18E-04	1.31E-05	4.92E-07	5.12E-09	7.16E-05	5.24E-07	5.829	33.98	N/A
Dry Scrub, FF, Catalytic red	15	1.37E-08	5.40E-05	9.41E-06	6.30E-07	3.32E-10	1.82E-05	9.13E-07	2.087	3.225	N/A
Dry Scrub, FF, Non catalytic red	2	1.31E-06	4.61E-06	2.96E-06	2.96E-06	5.45E-12	2.33E-06	2.45E-06	N/A	N/A	N/A
FF, Wet Scrub	13	1.33E-07	2.33E-05	3.91E-06	8.89E-07	4.71E-11	6.86E-06	1.06E-06	2.35	5.382	N/A
FF, Wet Scrub, Non catalytic red	9	8.43E-06	2.37E-05	1.32E-05	9.35E-06	4.10E-11	6.40E-06	1.36E-06	1.148	-0.268	N/A
FF, Wet Scrub, Catalytic red	11	9.77E-07	4.51E-05	1.92E-05	1.85E-05	1.83E-10	1.35E-05	1.60E-05	0.314	-0.155	N/A
Venturi Wet Scrub	1	1.64E-05	1.64E-05	1.64E-05	1.64E-05	N/A	N/A	0	N/A	N/A	N/A

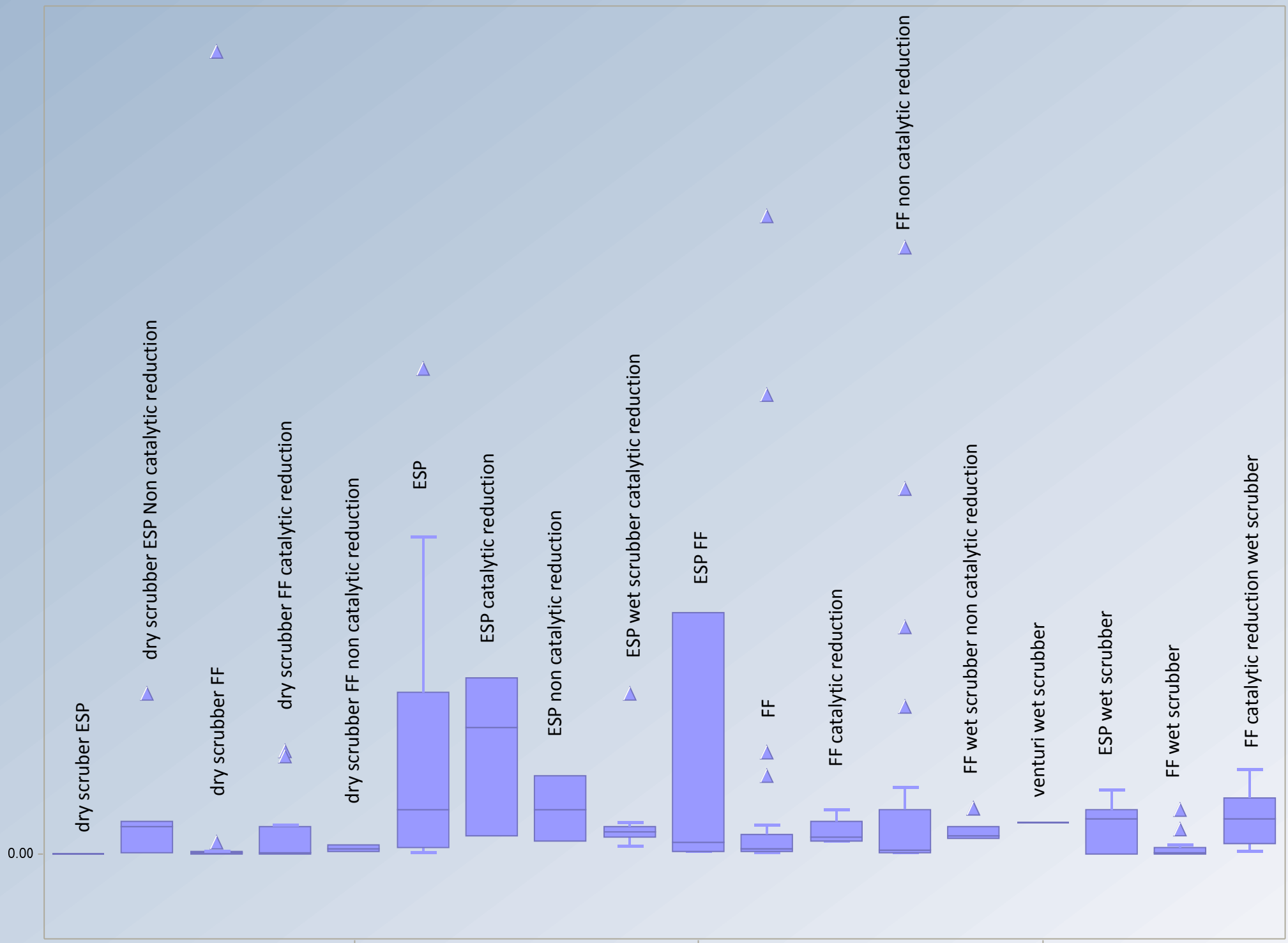
Coal Fired Utility Boiler Selenium Emissions Factors by Control Types

Percentiles for Raw Full Data Sets

Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
Dry Scrub, ESP	1	9.33E-08	9.33E-08	9.33E-08	9.33E-08	9.33E-08	9.33E-08	9.33E-08	9.33E-08	9.33E-08	9.33E-08
Dry Scrub, ESP, Non catalytic red	6	7.41E-07	8.09E-07	9.46E-07	4.28E-06	1.43E-05	1.62E-05	1.68E-05	5.02E-05	6.68E-05	8.02E-05
Dry Scrub, FF	34	4.94E-08	1.23E-07	1.83E-07	2.17E-07	4.92E-07	1.19E-06	1.37E-06	1.81E-06	3.70E-06	2.82E-04
Dry Scrub, FF, Catalytic red	15	1.43E-08	1.48E-08	6.60E-08	1.82E-07	6.30E-07	8.06E-06	1.44E-05	3.70E-05	5.19E-05	5.36E-05
Dry Scrub, FF, Non catalytic red	2	1.48E-06	1.64E-06	1.97E-06	2.14E-06	2.96E-06	3.79E-06	3.95E-06	4.28E-06	4.45E-06	4.58E-06
ESP	38	2.05E-06	2.58E-06	3.25E-06	3.69E-06	2.35E-05	8.16E-05	8.61E-05	1.23E-04	1.46E-04	2.21E-04
ESP, Catalytic red	3	1.55E-05	2.11E-05	3.23E-05	3.79E-05	6.59E-05	7.90E-05	8.16E-05	8.68E-05	8.94E-05	9.15E-05
ESP, Non catalytic red	3	8.27E-06	9.93E-06	1.32E-05	1.49E-05	2.32E-05	3.20E-05	3.38E-05	3.73E-05	3.90E-05	4.04E-05
ESP, Wet Scrub, Cat red	9	5.43E-06	7.63E-06	8.84E-06	8.91E-06	1.14E-05	1.45E-05	1.56E-05	3.05E-05	5.70E-05	7.82E-05
ESP-FF	7	8.51E-07	1.12E-06	1.49E-06	1.49E-06	6.45E-06	6.62E-05	1.02E-04	1.26E-04	1.26E-04	1.26E-04
FF	29	1.43E-07	3.91E-07	1.02E-06	1.18E-06	2.68E-06	1.05E-05	1.10E-05	4.34E-05	1.65E-04	3.06E-04
FF, Cat red	4	6.40E-06	6.49E-06	6.68E-06	6.77E-06	8.71E-06	1.38E-05	1.58E-05	1.98E-05	2.18E-05	2.34E-05
FF, Non catalytic red	23	5.44E-08	6.93E-08	5.90E-07	6.00E-07	2.24E-06	1.48E-05	3.07E-05	1.10E-04	1.83E-04	2.88E-04
Venturi Wet Scrub	1	1.64E-05	1.64E-05	1.64E-05	1.64E-05	1.64E-05	1.64E-05	1.64E-05	1.64E-05	1.64E-05	1.64E-05
ESP, Wet Scrub	10	1.87E-07	2.30E-07	3.09E-07	4.39E-06	1.85E-05	2.21E-05	2.41E-05	2.78E-05	3.10E-05	3.36E-05
FF, Wet Scrub	13	1.56E-07	1.73E-07	1.84E-07	1.92E-07	8.89E-07	3.65E-06	4.74E-06	1.16E-05	1.72E-05	2.21E-05
FF, Wet Scrub, Catalytic red	11	1.24E-06	1.50E-06	5.61E-06	1.08E-05	1.85E-05	2.79E-05	2.93E-05	3.17E-05	3.84E-05	4.38E-05
FF, Wet Scrub, Non catalytic red	9	8.43E-06	8.43E-06	8.43E-06	8.43E-06	9.35E-06	1.43E-05	1.81E-05	2.37E-05	2.37E-05	2.37E-05

Box Plots for Utility Boiler Selenium EF (#/mmBtu)

Observed Data



Outlier Tests for Selected Variables

User Selected Options

From File C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\E

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

No Outlier Test for LN EF #/mmBtu (dry scrub esp)

Dixon's Outlier Test for LN EF #/mmBtu (dry scrub esp non catalytic red)

Number of data = 6

10% critical value: 0.482

5% critical value: 0.56

1% critical value: 0.698

1. Data Value -9.390675269 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.333

For 10% significance level, -9.390675269 is not an outlier.

For 5% significance level, -9.390675269 is not an outlier.

For 1% significance level, -9.390675269 is not an outlier.

2. Data Value -14.21231575 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.071

For 10% significance level, -14.21231575 is not an outlier.

For 5% significance level, -14.21231575 is not an outlier.

For 1% significance level, -14.21231575 is not an outlier.

Rosner's Outlier Test for LN EF #/mmBtu (dry scrub ff)

Mean -14.41

Standard Deviation 1.65

Number of data 34

Number of suspected outliers 5

#	Mean	sd	ntial utlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-14.41	1.626	.779	34	4.079	2.97	3.3
2	-14.61	1.18	1.97	33	2.238	2.95	3.29
3	-14.7	1.098	7.02	1	2.115	2.94	3.27
4	-14.62	1.03	6.88	2	2.193	2.91	3.25
5	-14.54	0.956	6.79	3	2.35	2.91	3.24

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation -7.779 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation -7.779 is a Potential Statistical Outlier

Dixon's Outlier Test for LN EF #/mmBtu (dry scrub ff catalytic red)

Number of data = 15

10% critical value: 0.472

5% critical value: 0.525

1% critical value: 0.616

1. Data Value -9.826704017 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.149

For 10% significance level, -9.826704017 is not an outlier.

For 5% significance level, -9.826704017 is not an outlier.

For 1% significance level, -9.826704017 is not an outlier.

2. Data Value -18.1075005 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.016

For 10% significance level, -18.1075005 is not an outlier.

For 5% significance level, -18.1075005 is not an outlier.

For 1% significance level, -18.1075005 is not an outlier.

No Outlier Test for LN EF #/mmBtu (dry scrub ff non catalytic red)

Rosner's Outlier Test for LN EF #/mmBtu (esp)

Mean	-10.97
Standard Deviation	1.685
Number of data	38
Number of suspected outliers	5

#	Mean	sd	ntial tlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-10.97	1.663	5.35	1	2.635	3.01	3.36
2	-10.85	1.54	.283	38	1.67	3	3.34
3	-10.93	1.498	.703	37	1.483	2.99	3.33
4	-10.99	1.47	3.13	2	1.455	2.98	3.32
5	-10.93	1.444	3.09	3	1.501	2.97	3.3

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for LN EF #/mmBtu (esp catalytic red)

Number of data = 3

10% critical value: 0.886

5% critical value: 0.941

1% critical value: 0.988

1. Data Value -9.29351481 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.150

For 10% significance level, -9.29351481 is not an outlier.

For 5% significance level, -9.29351481 is not an outlier.

For 1% significance level, -9.29351481 is not an outlier.

2. Data Value -11.52177912 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.850

For 10% significance level, -11.52177912 is not an outlier.

For 5% significance level, -11.52177912 is not an outlier.

For 1% significance level, -11.52177912 is not an outlier.

Dixon's Outlier Test for LN EF #/mmBtu (esp non catalytic red)

Number of data = 3

10% critical value: 0.886

5% critical value: 0.941

1% critical value: 0.988

1. Data Value -10.10793455 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.309

For 10% significance level, -10.10793455 is not an outlier.

For 5% significance level, -10.10793455 is not an outlier.

For 1% significance level, -10.10793455 is not an outlier.

2. Data Value -11.92633195 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.691

For 10% significance level, -11.92633195 is not an outlier.

For 5% significance level, -11.92633195 is not an outlier.

For 1% significance level, -11.92633195 is not an outlier.

Dixon's Outlier Test for LN EF #/mmBtu (esp wet scrub cat red)

Number of data = 9

10% critical value: 0.441

5% critical value: 0.512

1% critical value: 0.635

1. Data Value -9.390675269 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.698

For 10% significance level, -9.390675269 is an outlier.

For 5% significance level, -9.390675269 is an outlier.

For 1% significance level, -9.390675269 is an outlier.

2. Data Value -12.64174573 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.593

For 10% significance level, -12.64174573 is an outlier.

For 5% significance level, -12.64174573 is an outlier.

For 1% significance level, -12.64174573 is not an outlier.

Dixon's Outlier Test for LN EF #/mmBtu (esp-ff)

Number of data = 7

10% critical value: 0.434

5% critical value: 0.507

1% critical value: 0.637

1. Data Value -8.980787974 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.000

For 10% significance level, -8.980787974 is not an outlier.

For 5% significance level, -8.980787974 is not an outlier.

For 1% significance level, -8.980787974 is not an outlier.

2. Data Value -14.36474903 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.177

For 10% significance level, -14.36474903 is not an outlier.

For 5% significance level, -14.36474903 is not an outlier.

For 1% significance level, -14.36474903 is not an outlier.

Rosner's Outlier Test for LN EF #/mmBtu (ff)

Mean	-12.62
Standard Deviation	1.954
Number of data	29
Number of suspected outliers	5

#	Mean	sd	initial outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-12.62	1.92	.012	29	2.399	2.89	3.22
2	-12.78	1.774	.339	28	2.506	2.88	3.2

3	-12.95	1.575	16.2	1	2.066	2.86	3.18
4	-12.82	1.462	16.2	2	2.31	2.84	3.16
5	-12.69	1.317	16.2	27	2.158	2.82	3.14

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Dixon's Outlier Test for LN EF #/mmBtu (ff cat red)

Number of data = 4

10% critical value: 0.679

5% critical value: 0.765

1% critical value: 0.889

1. Data Value -10.64720528 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.616

For 10% significance level, -10.64720528 is not an outlier.

For 5% significance level, -10.64720528 is not an outlier.

For 1% significance level, -10.64720528 is not an outlier.

2. Data Value -11.97367608 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.070

For 10% significance level, -11.97367608 is not an outlier.

For 5% significance level, -11.97367608 is not an outlier.

For 1% significance level, -11.97367608 is not an outlier.

Dixon's Outlier Test for LN EF #/mmBtu (ff non catalytic red)

Number of data = 23

10% critical value: 0.374

5% critical value: 0.421

1% critical value: 0.505

1. Data Value -8.058822814 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.116

For 10% significance level, -8.058822814 is not an outlier.

For 5% significance level, -8.058822814 is not an outlier.

For 1% significance level, -8.058822814 is not an outlier.

2. Data Value -17.94639244 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.159

For 10% significance level, -17.94639244 is not an outlier.

For 5% significance level, -17.94639244 is not an outlier.

For 1% significance level, -17.94639244 is not an outlier.

Dixon's Outlier Test for LN EF #/mmBtu (ff wet scrub non catalytic red)

Number of data = 9

10% critical value: 0.441

5% critical value: 0.512

1% critical value: 0.635

1. Data Value -10.64833781 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.000

For 10% significance level, -10.64833781 is not an outlier.

For 5% significance level, -10.64833781 is not an outlier.

For 1% significance level, -10.64833781 is not an outlier.

2. Data Value -11.68418494 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, -11.68418494 is not an outlier.

For 5% significance level, -11.68418494 is not an outlier.

For 1% significance level, -11.68418494 is not an outlier.

No Outlier Test for LN EF #/mmBtu (venturi wet scrub)

Dixon's Outlier Test for LN EF #/mmBtu (wet scrub esp)

Number of data = 10

10% critical value: 0.409

5% critical value: 0.477

1% critical value: 0.597

1. Data Value -10.28236236 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.047

For 10% significance level, -10.28236236 is not an outlier.

For 5% significance level, -10.28236236 is not an outlier.

For 1% significance level, -10.28236236 is not an outlier.

2. Data Value -15.75242166 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.096

For 10% significance level, -15.75242166 is not an outlier.

For 5% significance level, -15.75242166 is not an outlier.

For 1% significance level, -15.75242166 is not an outlier.

Dixon's Outlier Test for LN EF #/mmBtu (wet scrub ff)

Number of data = 13

10% critical value: 0.467

5% critical value: 0.521

1% critical value: 0.615

1. Data Value -10.66849782 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.295

For 10% significance level, -10.66849782 is not an outlier.

For 5% significance level, -10.66849782 is not an outlier.

For 1% significance level, -10.66849782 is not an outlier.

2. Data Value -15.83659981 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.065

For 10% significance level, -15.83659981 is not an outlier.

For 5% significance level, -15.83659981 is not an outlier.

For 1% significance level, -15.83659981 is not an outlier.

Dixon's Outlier Test for LN EF #/mmBtu (wet scrub ff catalytic red)

Number of data = 11

10% critical value: 0.517

5% critical value: 0.576

1% critical value: 0.679

1. Data Value -10.00645689 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.127

For 10% significance level, -10.00645689 is not an outlier.

For 5% significance level, -10.00645689 is not an outlier.

For 1% significance level, -10.00645689 is not an outlier.

2. Data Value -13.83845884 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.502

For 10% significance level, -13.83845884 is not an outlier.

For 5% significance level, -13.83845884 is not an outlier.

For 1% significance level, -13.83845884 is not an outlier.

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Selenium\EF
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: ESP - Catalytic reduction

Background Data: ESP

Raw Statistics

	ESP - Catalytic reduction	ESP
Number of Valid Observations	3	38
Number of Distinct Observations	3	33
Minimum	9.9100E-6	2.1500E-7
Maximum	9.2000E-5	2.5300E-4
Mean	5.5937E-5	4.7548E-5
Median	6.5900E-5	2.3450E-5
SD	4.1942E-5	5.8600E-5
SE of Mean	2.4215E-5	9.5062E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	39	0.242	1.685	0.405
Welch-Satterthwaite (Unequal Variance)	2.7	0.322	2.353	0.385

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.7591E-9		
Variance of Background	3.4340E-9		
Numerator DF	Denominator DF	F-Test Value	P-Value
37	2	1.952	0.793

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Selenium
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: ESP

Background Data: ESP - Non Catalytic Reduction

Raw Statistics

	ESP	ESP - Non Catalytic Reduction
Number of Valid Observations	38	3
Number of Distinct Observations	33	3
Minimum	2.1500E-7	6.6100E-6
Maximum	2.5300E-4	4.0800E-5
Mean	4.7548E-5	2.3537E-5
Median	2.3450E-5	2.3200E-5
SD	5.8600E-5	1.7097E-5
SE of Mean	9.5062E-6	9.8712E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	39	0.700	1.685	0.244
Welch-Satterthwaite (Unequal Variance)	7.1	1.752	1.895	0.061

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	3.4340E-9		
Variance of Background	2.923E-10		
Numerator DF	Denominator DF	F-Test Value	P-Value
37	2	11.747	0.163

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Sele
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: ESP - Catalytic reduction

Background Data: ESP - Non catalytic reduction

Raw Statistics

	ESP - Cat Red	ESP - Non Cat Red
Number of Valid Observations	3	3
Number of Distinct Observations	3	3
Minimum	9.9100E-6	6.6100E-6
Maximum	9.2000E-5	4.0800E-5
Mean	5.5937E-5	2.3537E-5
Median	6.5900E-5	2.3200E-5
SD	4.1942E-5	1.7097E-5
SE of Mean	2.4215E-5	9.8712E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	4	1.239	2.132	0.142
Welch-Satterthwaite (Unequal Variance)	2.6	1.239	2.353	0.157

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.7591E-9		
Variance of Background	2.923E-10		
Numerator DF	Denominator DF	F-Test Value	P-Value
2	2	6.018	0.285

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Sele
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: ESP - Catalytic reduction

Background Data: ESP - Non catalytic reduction

Raw Statistics

	ESP - Cat Red	ESP - Non Cat Red
Number of Valid Observations	3	3
Number of Distinct Observations	3	3
Minimum	9.9100E-6	6.6100E-6
Maximum	9.2000E-5	4.0800E-5
Mean	5.5937E-5	2.3537E-5
Median	6.5900E-5	2.3200E-5
SD	4.1942E-5	1.7097E-5
SE of Mean	2.4215E-5	9.8712E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	4	1.239	2.132	0.142
Welch-Satterthwaite (Unequal Variance)	2.6	1.239	2.353	0.157

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	1.7591E-9		
Variance of Background	2.923E-10		
Numerator DF	Denominator DF	F-Test Value	P-Value
2	2	6.018	0.285

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: ESP

Background Data: ESP - NH3 Injection

Raw Statistics

	ESP	ESP - NH3 Injection
Number of Valid Observations	38	6
Number of Distinct Observations	33	6
Minimum	2.1500E-7	6.6100E-6
Maximum	2.5300E-4	9.2000E-5
Mean	4.7548E-5	3.9737E-5
Median	2.3450E-5	3.2000E-5
SD	5.8600E-5	3.3697E-5
SE of Mean	9.5062E-6	1.3757E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	42	0.316	1.682	0.377
Welch-Satterthwaite (Unequal Variance)	10.6	0.467	1.796	0.325

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	3.4340E-9		
Variance of Background	1.1355E-9		
Numerator DF	Denominator DF	F-Test Value	P-Value
37	5	3.024	0.218

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: ESP

Background Data: ESP Wet Scrubber

Raw Statistics

	ESP	ESP Wet Scrubber
Number of Valid Observations	38	10
Number of Distinct Observations	33	8
Minimum	2.1500E-7	1.4400E-7
Maximum	2.5300E-4	3.4200E-5
Mean	4.7548E-5	1.5741E-5
Median	2.3450E-5	1.8500E-5
SD	5.8600E-5	1.1887E-5
SE of Mean	9.5062E-6	3.7590E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	46	1.694	1.679	0.048
Welch-Satterthwaite (Unequal Variance)	45.0	3.111	1.679	0.002

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Reject H0, Conclude Site > Background
- * Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	3.4340E-9		
Variance of Background	1.413E-10		
Numerator DF	Denominator DF	F-Test Value	P-Value
37	9	24.303	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data:ESP-FF

Background Data: FF

Raw Statistics

	ESP-FF	Fabric Filter
Number of Valid Observations	7	29
Number of Distinct Observations	4	26
Minimum	5.7700E-7	9.2100E-8
Maximum	1.2600E-4	3.3200E-4
Mean	3.8351E-5	2.6114E-5
Median	6.4500E-6	2.6800E-6
SD	5.9923E-5	7.3871E-5
SE of Mean	2.2649E-5	1.3718E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	34	0.406	1.691	0.344
Welch-Satterthwaite (Unequal Variance)	10.9	0.462	1.796	0.327

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	3.5907E-9		
Variance of Background	5.4569E-9		
Numerator DF	Denominator DF	F-Test Value	P-Value
28	6	1.520	0.633

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: ESP

Background Data: FF

Raw Statistics

	ESP	Fabric Filter
Number of Valid Observations	38	29
Number of Distinct Observations	33	26
Minimum	2.1500E-7	9.2100E-8
Maximum	2.5300E-4	3.3200E-4
Mean	4.7548E-5	2.6114E-5
Median	2.3450E-5	2.6800E-6
SD	5.8600E-5	7.3871E-5
SE of Mean	9.5062E-6	1.3718E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	65	1.325	1.669	0.095
Welch-Satterthwaite (Unequal Variance)	52.2	1.284	1.675	0.102

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	3.4340E-9		
Variance of Background	5.4569E-9		
Numerator DF	Denominator DF	F-Test Value	P-Value
28	37	1.589	0.186

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: FF

Background Data: FF - Catalytic Reduction

Raw Statistics

	FF	FF - Catalytic Reductio
Number of Valid Observations	29	4
Number of Distinct Observations	26	4
Minimum	9.2100E-8	6.3100E-6
Maximum	3.3200E-4	2.3800E-5
Mean	2.6114E-5	1.1883E-5
Median	2.6800E-6	8.7100E-6
SD	7.3871E-5	8.1571E-6
SE of Mean	1.3718E-5	4.0786E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	31	0.380	1.696	0.353
Welch-Satterthwaite (Unequal Variance)	30.9	0.994	1.696	0.164

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	5.4569E-9		
Variance of Background	6.654E-11		
Numerator DF	Denominator DF	F-Test Value	P-Value
28	3	82.011	0.004

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Selenium\EF Data
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: FF - Non Catalytic Reduction

Background Data: FF

Raw Statistics

	FF - Non Catalytic Reductor	FF
Number of Valid Observations	23	29
Number of Distinct Observations	20	26
Minimum	1.6100E-8	9.2100E-8
Maximum	3.1600E-4	3.3200E-4
Mean	3.4380E-5	2.6114E-5
Median	2.2400E-6	2.6800E-6
SD	7.7023E-5	7.3871E-5
SE of Mean	1.6060E-5	1.3718E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	50	0.393	1.676	0.348
Welch-Satterthwaite (Unequal Variance)	46.4	0.391	1.679	0.349

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	5.9326E-9		
Variance of Background	5.4569E-9		
Numerator DF	Denominator DF	F-Test Value	P-Value
22	28	1.087	0.824

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\Selenium\EF Data.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: FF - Non Catalytic Reduction

Background Data: FF - Catalytic reduction

Raw Statistics

	FF - Non Catalytic Reduction	FF - Catalytic reduction
Number of Valid Observations	23	4
Number of Distinct Observations	20	4
Minimum	1.6100E-8	6.3100E-6
Maximum	3.1600E-4	2.3800E-5
Mean	3.4380E-5	1.1883E-5
Median	2.2400E-6	8.7100E-6
SD	7.7023E-5	8.1571E-6
SE of Mean	1.6060E-5	4.0786E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	25	0.574	1.708	0.285
Welch-Satterthwaite (Unequal Variance)	24.2	1.358	1.711	0.094

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	5.9326E-9		
Variance of Background	6.654E-11		
Numerator DF	Denominator DF	F-Test Value	P-Value
22	3	89.159	0.003

Conclusion with Alpha = 0.05

- * Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Selenium
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: FF - NH3 Injection

Background Data: FF

Raw Statistics

	FF - NH3 Injection	FF
Number of Valid Observations	27	29
Number of Distinct Observations	23	26
Minimum	1.6100E-8	9.2100E-8
Maximum	3.1600E-4	3.3200E-4
Mean	3.1047E-5	2.6114E-5
Median	2.2800E-6	2.6800E-6
SD	7.1371E-5	7.3871E-5
SE of Mean	1.3735E-5	1.3718E-5

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	54	0.254	1.674	0.400
Welch-Satterthwaite (Unequal Variance)	53.9	0.254	1.674	0.400

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	5.0939E-9		
Variance of Background	5.4569E-9		
Numerator DF	Denominator DF	F-Test Value	P-Value
28	26	1.071	0.863

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: FF

Background Data: FF - dry Scruber

Raw Statistics

	FF	FF - dry Scruber
Number of Valid Observations	29	33
Number of Distinct Observations	26	32
Minimum	9.2100E-8	4.0700E-8
Maximum	3.3200E-4	6.3200E-6
Mean	2.6114E-5	8.3907E-7
Median	2.6800E-6	4.8500E-7
SD	7.3871E-5	1.1492E-6
SE of Mean	1.3718E-5	2.0005E-7

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	60	1.968	1.671	0.027
Welch-Satterthwaite (Unequal Variance)	28.0	1.842	1.701	0.038

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	5.4569E-9		
Variance of Background	1.321E-12		
Numerator DF	Denominator DF	F-Test Value	P-Value
28	32	4132.103	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: FF

Background Data: FF - Wet Scrubber

Raw Statistics

	FF	FF - Wet Scrubber
Number of Valid Observations	29	13
Number of Distinct Observations	26	13
Minimum	9.2100E-8	1.3300E-7
Maximum	3.3200E-4	2.3300E-5
Mean	2.6114E-5	3.9113E-6
Median	2.6800E-6	8.8900E-7
SD	7.3871E-5	6.8623E-6
SE of Mean	1.3718E-5	1.9032E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	40	1.074	1.684	0.145
Welch-Satterthwaite (Unequal Variance)	29.1	1.603	1.699	0.060

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	5.4569E-9		
Variance of Background	4.709E-11		
Numerator DF	Denominator DF	F-Test Value	P-Value
28	12	115.881	0.000

Conclusion with Alpha = 0.05

- * Two variances are not equal

Outlier Tests for Selected Variables

User Selected Options

From File C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Selen

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

No Outlier Test for LN EF #/mmBtu (EMPTY)

Rosner's Outlier Test for LN EF #/mmBtu (esp, esp/nh3)

Mean -10.91

Standard Deviation 1.611

Number of data 44

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-10.91	1.593	-15.35	1	2.789	3.08	3.43
2	-10.81	1.475	-8.283	44	1.712	3.07	3.41
3	-10.87	1.439	-13.13	2	1.571	3.06	3.4
4	-10.81	1.411	-13.09	3	1.616	3.05	3.39
5	-10.76	1.381	-12.92	4	1.565	3.04	3.38

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for LN EF #/mmBtu (esp/wet scrub, esp/dry scrub, esp/nh3/wet scrub, esp/nh3/dry scrub)

Mean -11.9

Standard Deviation 1.903

Number of data 26

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-11.9	1.866	-16.19	1	2.298	2.84	3.16
2	-11.73	1.725	-15.75	2	2.333	2.82	3.14
3	-11.56	1.54	-15.25	3	2.394	2.8	3.11
4	-11.4	1.354	-14.94	4	2.612	2.78	3.09
5	-11.24	1.139	-14.21	5	2.609	2.76	3.06

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for LN EF #/mmBtu (ff, ff/nh3)

Mean	-12.48
Standard Deviation	2.12
Number of data	62
Number of suspected outliers	5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-12.48	2.103	-8.012	62	2.123	3.212	3.572
2	-12.55	2.058	-8.059	61	2.183	3.202	3.564
3	-12.62	1.989	-8.339	60	2.154	3.202	3.562
4	-12.7	1.925	-8.566	59	2.147	3.192	3.552
5	-12.77	1.861	-16.75	1	2.14	3.184	3.544

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for LN EF #/mmBtu (ff/wet scrub, ff/dry scrub, ff/nh3/wet scrub, ff/nh3/dry scrub)

Mean	-13.54
Standard Deviation	2.192
Number of data	85
Number of suspected outliers	5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-13.54	2.179	-7.779	85	2.646	3.33	3.695
2	-13.61	2.111	-18.11	1	2.129	3.32	3.69
3	-13.56	2.064	-18.05	2	2.176	3.32	3.685
4	-13.5	2.015	-17.99	3	2.228	3.315	3.68
5	-13.45	1.964	-17.95	4	2.29	3.31	3.675

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Selenium\EF Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: ESP, ESP/NH3

Background Data: ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub

Raw Statistics

	ESP, ESP/NH3	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub
Number of Valid Observations	44	26
Number of Distinct Observations	39	21
Minimum	2.1500E-7	9.3300E-8
Maximum	2.5300E-4	8.3500E-5
Mean	4.6482E-5	1.7738E-5
Median	2.3500E-5	1.4300E-5
SD	5.5626E-5	2.1301E-5
SE of Mean	8.3859E-6	4.1775E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	68	2.522	1.668	0.007
Welch-Satterthwaite (Unequal Variance)	60.6	3.068	1.670	0.002

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	3.0942E-9		
Variance of Background	4.537E-10		
Numerator DF	Denominator DF	F-Test Value	P-Value
43	25	6.819	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\Selenium\EF Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: FF, FF/NH3

Background Data: FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub

Raw Statistics

	FF, FF/NH3	FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub
Number of Valid Observations	63	84
Number of Distinct Observations	51	77
Minimum	1.6100E-8	1.3700E-8
Maximum	3.3200E-4	4.1800E-4
Mean	2.9588E-5	1.1590E-5
Median	2.6800E-6	1.0285E-6
SD	7.0451E-5	4.6316E-5
SE of Mean	8.8759E-6	5.0535E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	145	1.866	1.655	0.032
Welch-Satterthwaite (Unequal Variance)	100.8	1.762	1.660	0.041

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	4.9633E-9
Variance of Background	2.1452E-9

Numerator DF	Denominator DF	F-Test Value	P-Value
62	83	2.314	0.000

Conclusion with Alpha = 0.05

* Two variances are not equal

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Seleniur
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: ESP, ESP/NH3

Background Data: FF, FF/NH3

Raw Statistics

	ESP, ESP/NH3	FF, FF/NH3
Number of Valid Observations	44	63
Number of Distinct Observations	39	51
Minimum	2.1500E-7	1.6100E-8
Maximum	2.5300E-4	3.3200E-4
Mean	4.6482E-5	2.9588E-5
Median	2.3500E-5	2.6800E-6
SD	5.5626E-5	7.0451E-5
SE of Mean	8.3859E-6	8.8759E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	105	1.327	1.659	0.094
Welch-Satterthwaite (Unequal Variance)	103.4	1.384	1.660	0.085

Pooled SD 0.000

Conclusion with Alpha = 0.050

- * Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background
- * Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background

Test of Equality of Variances

Variance of Site	3.0942E-9		
Variance of Background	4.9633E-9		
Numerator DF	Denominator DF	F-Test Value	P-Value
62	43	1.604	0.104

Conclusion with Alpha = 0.05

- * Two variances appear to be equal

t-Test Site vs Background Comparison for Full Data Sets without NDs				
User Selected Options				
From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\Selenium\EF Data.wst			
Full Precision	OFF			
Confidence Coefficient	95%			
Substantial Difference (S)	0			
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)			
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean			
Area of Concern Data: ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub				
Background Data: FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub				
Raw Statistics				
	ESP/Wet Scrub, ESP/Dry Scrub, ESP/NH3/Wet Scrub, ESP/NH3/Dry Scrub		FF/Wet Scrub, FF/Dry Scrub, FF/NH3/Wet Scrub, FF/NH3/Dry Scrub	
Number of Valid Observations	26		84	
Number of Distinct Observations	21		77	
Minimum	9.33E-08		1.37E-08	
Maximum	0.0000835		0.000418	
Mean	0.000017738		0.00001159	
Median	0.0000143		1.0285E-06	
SD	0.000021301		0.000046316	
SE of Mean	4.1775E-06		5.0535E-06	
Site vs Background Two-Sample t-Test				
H0: Mu of Site - Mu of Background <= 0				
		t-Test	Critical	
Method	DF	Value	t (0.050)	P-Value
Pooled (Equal Variance)	108	0.654	1.659	0.257
Welch-Satterthwaite (Unequa	92.2	0.938	1.662	0.175
Pooled SD 0.000				
Conclusion with Alpha = 0.050				
* Student t (Pooled) Test: Do Not Reject H0, Conclude Site <= Background				
* Welch-Satterthwaite Test: Do Not Reject H0, Conclude Site <= Background				
Test of Equality of Variances				
Variance of Site	4.537E-10			
Variance of Background	2.1452E-09			
Numerator DF	Denominator DF	F-Test Value		P-Value
83	25	4.728		0
Conclusion with Alpha = 0.05				
* Two variances are not equal				

Outlier Tests for Selected Variables

User Selected Options

From File C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\E

Full Precision OFF

Test for Suspected Outliers with Dixon test 1

Test for Suspected Outliers with Rosner test 5

Rosner's Outlier Test for LN EF #/mmBtu (Unscrubbed)

Mean -11.83

Standard Deviation 2.068

Number of data 106

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-11.83	2.058	-16.75	1	2.393	3.397	3.767
2	-11.78	2.02	-16.53	2	2.352	3.396	3.767
3	-11.73	1.975	-16.32	3	2.321	3.396	3.767
4	-11.69	1.931	-16.2	4	2.336	3.387	3.757
5	-11.65	1.888	-16.2	5	2.413	3.387	3.757

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for LN EF #/mmBtu (Scrubbed)

Mean -13.14

Standard Deviation 2.231

Number of data 112

Number of suspected outliers 5

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	-13.14	2.221	-7.779	112	2.414	3.414	3.784
2	-13.19	2.181	-18.11	1	2.255	3.411	3.784
3	-13.14	2.139	-18.05	2	2.293	3.411	3.784
4	-13.1	2.096	-17.99	3	2.335	3.404	3.774
5	-13.05	2.052	-17.95	4	2.385	3.404	3.774

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

From File	C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data\EF_Analysis\Sel
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: EF Unscrubbed

Background Data: EF Scrubbed

Raw Statistics

	Unscrubbed	Scrubbed
Number of Valid Observations	106	112
Number of Distinct Observations	86	96
Minimum	5.3100E-8	1.3700E-8
Maximum	3.3200E-4	4.1800E-4
Mean	3.6880E-5	1.2957E-5
Median	6.3100E-6	1.5950E-6
SD	6.5234E-5	4.1408E-5
SE of Mean	6.3361E-6	3.9127E-6

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	216	3.250	1.652	0.001
Welch-Satterthwaite (Unequal Variance)	176.1	3.212	1.654	0.001

Pooled SD 0.000

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background

* Welch-Satterthwaite Test: Reject H0, Conclude Site > Background

Test of Equality of Variances

Variance of Site	4.2555E-9		
Variance of Background	1.7147E-9		
Numerator DF	Denominator DF	F-Test Value	P-Value
105	111	2.482	0.000

Conclusion with Alpha = 0.05

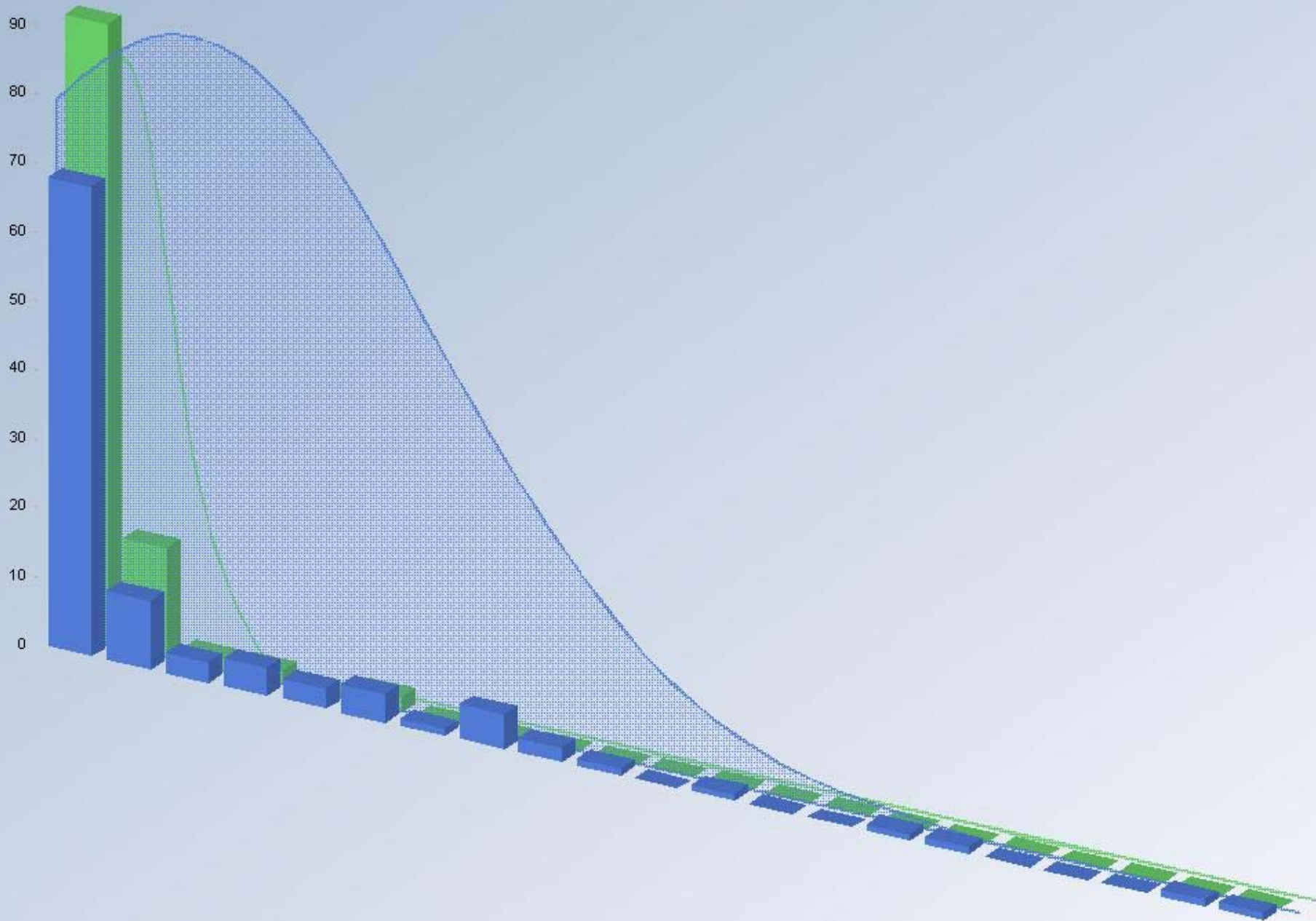
* Two variances are not equal

Final Recommended Coal Fired Utility Boiler Selenium Emissions Factors (#/mmBtu)

From File: C:\Documents and Settings\All Users\Desktop\EPA_Data Systems\Utility_Boiler_EF-Data_EF_Analysis\Selenium\EF Data.wst											
Summary Statistics for Raw Full Data Sets											
Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
EF #/mmBtu (unscrubbed)	106	5.31E-08	3.32E-04	3.69E-05	6.31E-06	4.26E-09	6.52E-05	8.40E-06	2.627	7.463	N/A
EF #/mmBtu (scrubbed)	112	1.37E-08	8.35E-05	9.24E-06	1.48E-06	2.24E-10	1.50E-05	2.09E-06	2.88	10.41	N/A
Percentiles for Raw Full Data Sets											
Variable	NumObs	5%ile	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
EF #/mmBtu (unscrubbed)	106	2.16E-07	5.92E-07	1.49E-06	2.24E-06	6.31E-06	3.95E-05	6.59E-05	1.18E-04	1.60E-04	3.13E-04
EF #/mmBtu (scrubbed)	112	4.90E-08	1.35E-07	2.48E-07	4.28E-07	1.48E-06	1.43E-05	1.66E-05	2.37E-05	3.28E-05	8.03E-05

Histograms for Coal Fired Boiler Selenium Scrubbed and Unscrubbed EF (#/mmBtu)

Frequency



EF #/mmBtu (unscrubbed)

EF #/mmBtu (scrubbed)

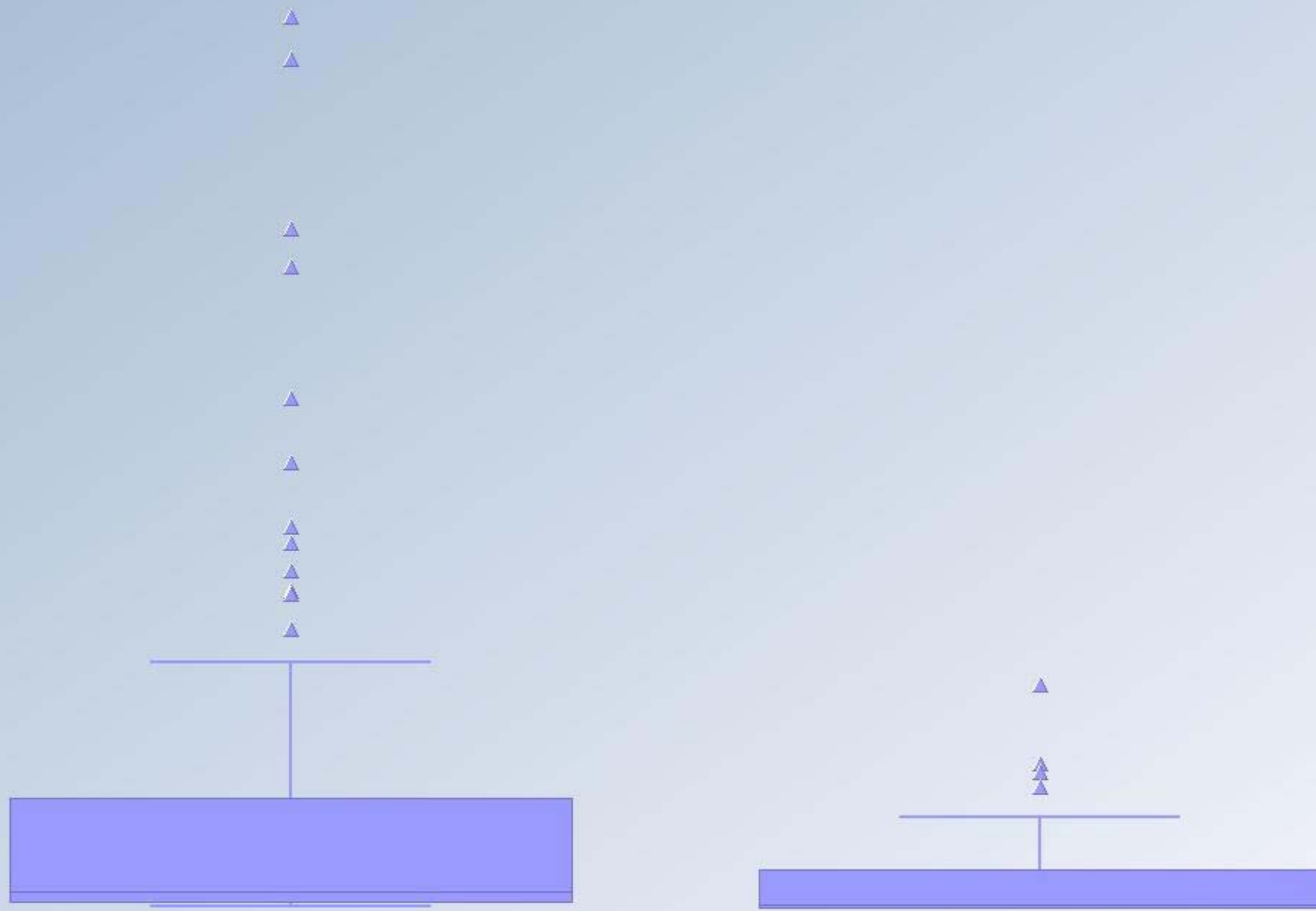
Box Plots for Coal Fired Utility Boiler Scrubbed and Unscrubbed EF (#/mmBtu)

Observed Data

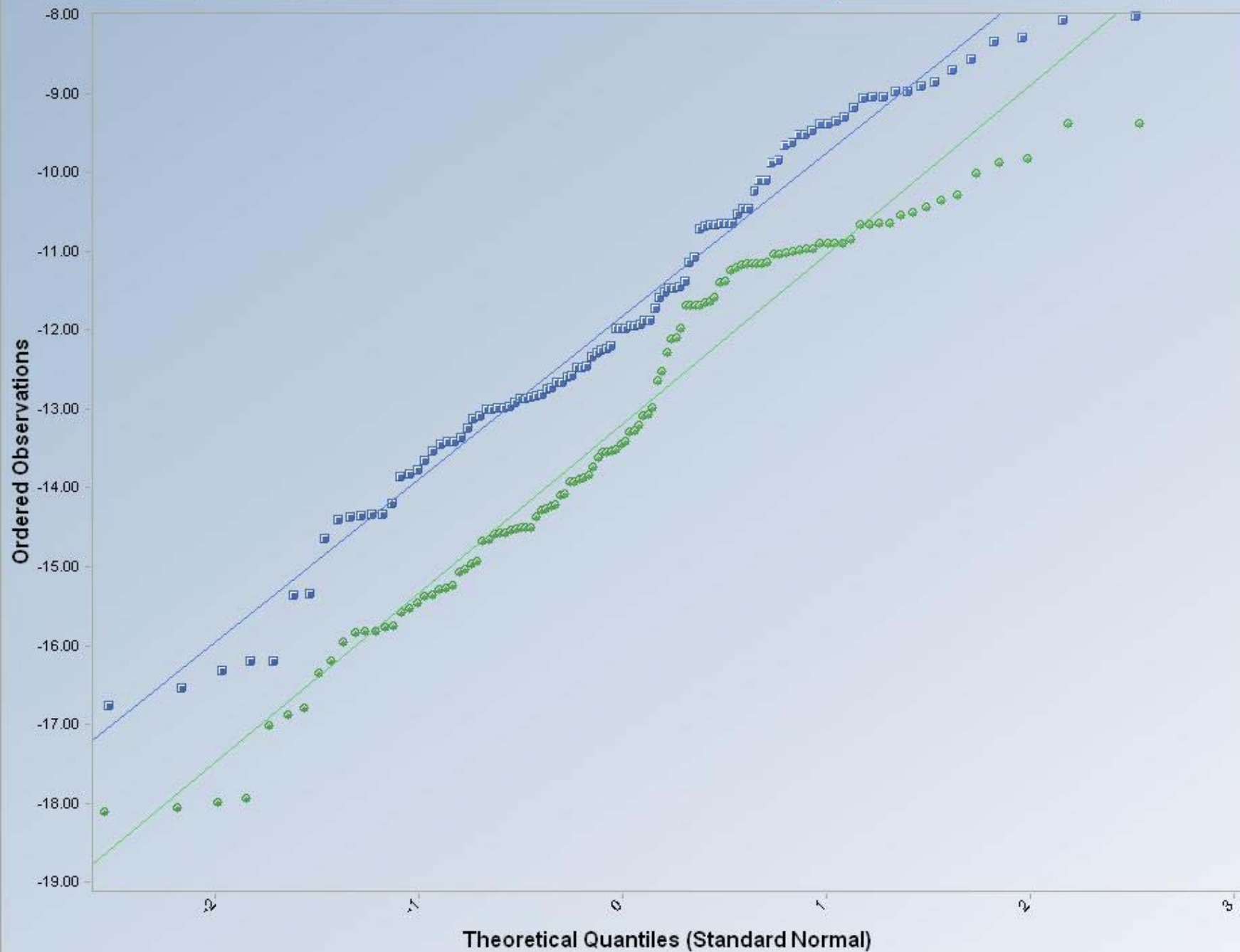
0.00

EF #/mmBtu (unscrubbed)

EF #/mmBtu (scrubbed)



Lognormal Q-Q Plots, Scrubbed & Unscrubbed Coal Fired Utility Boiler Selenium EF (#mmBtu)



EF #/mmBtu (aunscrubbed)

n = 106
Mean = -11.83
Sd = 2.068
Slope = 2.067
Intercept = -11.83
Correlation, R = 0.989
Shapiro-Wilk Test
Approx. Test Value = 0.959
p-Value = 0.013

EF #/mmBtu (scrubbed)

n = 112
Mean = -13.19
Sd = 2.171
Slope = 2.149
Intercept = -13.19
Correlation, R = 0.98
Shapiro-Wilk Test
Approx. Test Value = 0.937
p-Value = 0.000

EF #/mmBtu (aunscrubbed)

EF #/mmBtu (scrubbed)

United States
Environmental Protection
Agency

Office of Air Quality Planning and Standards
Air Quality Assessment Division
Research Triangle Park, NC

Publication No. EPA-454/R-11-012
November, 2011
