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KA 307-90-01

June 3, 1991

Mr. C. H. Fancy
Florida Department of
Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RECEIVED

JUN 04 1991

Division of Air
Resources Management

Subject: Florida Crushed Stone Company
Hernando County, Florida
Supplemental Information Related to
the Use of Tire Derived Fuel

Dear Mr. Fancy:

Your office recently received from the Florida Crushed Stone Company a request to allow the use of tire derived fuel as a supplement to the coal presently used to fire the portland cement kiln operated by the company in Hernando County, Florida. Prior to submitting the request to use tire derived fuel to your office, two reports were submitted to your office detailing the emission rates of several organic or inorganic compounds from the Florida Crushed Stone CPL plant; one report when the cement plant was fired entirely by coal (the baseline test) and the second test when tire derived fuel was used to supplement approximately 15 percent of the heat input normally provided by coal. Also, under cover of my letter dated May 13, 1991, we provided additional information related to the two tests as requested through your office by EPA Region IV.

Information provided in the two test reports and in the request to utilize tire derived fuel showed that there was no measurable difference in emissions from the CPL plant under the two sets of conditions and further showed that the use of tire derived fuel resulted in no measurable difference in other plant operating parameters. A question has been raised, however, regarding an apparent increase in benzene emissions when tire derived fuel was used. As summarized in the recent request to use tire derived fuel, the benzene emissions measured during baseline conditions average 0.1005 pounds per hour while benzene emissions measured when tire derived fuel was being used as a supplement to coal averaged 0.1712 pounds per hour.

Mr. C. H. Fańcy
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In recently promulgated requirements by EPA for burning waste derived fuels in boilers and industrial furnaces, a statistical procedure is given for determining if there is a statistical difference in two sets of measurements. The statistical procedure involves the use of the t-test to calculate the probability of the two sets of measurements being from different populations; i.e., being different. In the case of benzene emissions during the baseline and tire derived fuel tests, the statistical procedure can be used to determine if the two sets of benzene emission measurements are from the same or different populations. On the attached sheet, I have set forth the calculations necessary to compare the benzene emissions from two sets of tests. The data demonstrate that at the 95 percent confidence level it cannot be concluded that there is a difference in benzene emissions (i.e., that the increase in benzene during the tire derived fuel test is significant).

In addition to the attached calculations, I have also attached a reference to the statistical procedure outlined by EPA.

If there are any questions regarding this information, please do not hesitate to contact me.

Very truly yours,

KOGLER & ASSOCIATES


John B. Koogler, Ph.D., P.E.

JBK:wa
Enc.

cc: Mr. Thomas Mountain, FCS
Mr. Randy Thompson, GeoTech
Mr. Larry Sellars, Holland & Knight



STATISTICAL COMPARISON OF BENZENE
EMISSIONS DURING BASELINE AND TDF TESTS

FLORIDA CRUSHED STONE COMPANY
HERNANDO COUNTY, FLORIDA

SEPTEMBER 1990

BASELINE TEST

Run	Benzene (lb/hr)
1	0.1088
2	0.1301
3	0.0627
Avg	$\bar{x}_1 = 0.1005$ $s_1 = 0.0345$ $n_1 = 3$

TDF TEST

Run	Benzene (lb/hr)
1	0.1013
2	0.2229
3	0.1894
Avg	$\bar{x}_2 = 0.1712$ $s_2 = 0.0628$ $n_2 = 3$

Where:

\bar{x} = average emission rate
s = standard deviation
n = number of observations



$$\sigma_t = \left[\frac{(3-1)(0.0345)^2 + (3-1)(0.0628)^2}{3 + 3 - 2} \right]^{1/2}$$

$$= 0.0507$$

$$t \text{ measured} = \frac{0.1712 - 0.1005}{0.0507 \left(\frac{1}{3} + \frac{1}{3}\right)^{1/2}}$$

$$= 1.71$$

$$t \text{ critical} = 2.13 \text{ at } 95\% \text{ C.L. for } n_1 + n_2 - 2 \text{ degrees of freedom}$$

$t \text{ measured} < t \text{ critical}$; therefore, reject the hypothesis at the 95% C.L. that samples are from two different populations.

EPA/530-SW-91-010

**Methods Manual For
Compliance With The
BIF Regulations**

**U.S. Environmental Protection Agency
Office of Solid Waste
Waste Treatment Branch
401 M Street, SW
Washington, D.C. 20460**

Work Assignment Manager: Mr. Shiva Garg

December 1990

A.2 Comparison of Enrichment Factor Groups

To determine if the enrichment factors measured in the quarterly tests are significantly different from the enrichment factors determined in the initial Step 2 tests, the t-test is used. In this test, the value t_{meas} :

$$t_{\text{meas}} = \frac{\overline{EF}_1 - \overline{EF}_2}{\sigma_t \left(\frac{1}{n_1} + \frac{1}{n_2} \right)^{\frac{1}{2}}} \quad (6)$$

Table A-1 t-Distribution

n-1 or n_1+n_2-2	$t_{.95}$	$t_{.99}$
1	6.31	31.82
2	2.92	6.96
3	2.35	4.54
4	2.13	3.75
5	2.02	3.36
6	1.94	3.14
7	1.90	3.00
8	1.86	2.90
9	1.83	2.82
10	1.81	2.76
11	1.80	2.72
12	1.78	2.68
13	1.77	2.65
14	1.76	2.62
15	1.75	2.60
16	1.75	2.58
17	1.74	2.57
18	1.73	2.55
19	1.73	2.54
20	1.72	2.53
25	1.71	2.48
30	1.70	2.46
40	1.68	2.42
60	1.67	2.39
120	1.66	2.36
∞	1.645	2.33

$$\sigma_t = \left(\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2} \right)^{\frac{1}{2}} \quad (7)$$

is compared to t_{crit} at the desired confidence level. The 95% confidence level is used in this method. Values of t_{crit} are shown in Table A-1 for various degrees of freedom (degrees of freedom = $n_1 + n_2 - 2$) at the 95% and 99% confidence levels. If t_{meas} is greater than t_{crit} , it can be concluded with 95% confidence that the two groups are not from the same population.