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**SUMMARY REPORT ON THE EFFECT OF FPC-1 ON THE  
EMISSIONS OF SULFUR DIOXIDE IN OIL FIRED BOILERS**

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## **ABSTRACT**

The following report is a summary of earlier testing conducted at several field locations to determine the effect of FPC-1 on the emission levels of sulfur dioxide (SO<sub>2</sub>) in oil fired boilers. All tests were conducted by Eugene S. Adams, PE, of Adams Industrial Sales, Charlotte, North Carolina.

## **INTRODUCTION**

Preliminary testing in oil fired boilers documented the ability of FPC-1 catalyst to reduce the rate of acid build up and the subsequent acid corrosion of cold end boiler components. These tests prompted UHI Corporation engineers to investigate the possibility of the catalyst having a positive effect on SO<sub>2</sub> emissions, since SO<sub>2</sub> is an important precursor in the formation of both corrosive internal boiler acid and the serious pollution problem, acid rain. Mr. Eugene S. Adams conducted the initial SO<sub>2</sub> reduction tests in oil fired boilers operating at the Armtex Plant, Mt. Pilot, N.C., Holly Farms, Temperance, Va., and Westpoint Pepperrel, Eastown, and Clinton, N.C. plants. Later more conclusive tests were conducted with Holly Farms and Dayco Corporation, also in North Carolina. The first series of tests used a single data point comparison of actual sulfur yield to theoretical sulfur yield at each test site. The second series of tests were multiple data point studies over an extended period of time beginning May 11, 1984, and ending July 12, 1984.

## **METHODOLOGY**

EPA methods 3 and 6 for determining SO<sub>2</sub> emissions concentrations were used at all test sites. Along with these recommended procedures, analytical equipment required by the EPA for SO<sub>2</sub> testing was also used. This equipment included;

- Neotronics O<sub>2</sub> - CO Analyzer Model PLO 961
- IMC Instrument Model 6100 Digital Thermometer
- Hays - Republic Model 00612 Orsat
- Nutech Model 220 -200 WM Method "6" Sampling Train
- Nutech Model 218 - 200 Integrated Bag Sampler
- Nutech Model S - 200 Gas Meter
- S.K.C., Inc. Detector Tubes Model 800 - 242

EPA methods 3 and 6 require oil samples be taken and analyzed at each location with each data point or series of data points taken. These samples were taken by Mr. Adams and analyzed for sulfur and BTU content of the oil by Chem Bac Laboratories, Charlotte, NC.

By determining the percent sulfur content of the oil used, the theoretical yield of SO<sub>2</sub> by percent can be tabulated using EPA tables. This theoretical number can then be compared to the actual percent SO<sub>2</sub> yield recorded during catalyst testing.

## **RESULTS**

The sulfur content of the fuel determines the volume of sulfur emitted from the stack during normal boiler operation. The EPA uses the “percent sulfur in the fuel number” to determine the permissible SO<sub>2</sub> level from EPA tables. The actual SO<sub>2</sub> yield is important, in that, this number can only vary from the theoretical number if a change in the combustion process occurs.

This study verifies that the addition of the FPC-1 catalyst created a significant change in the combustion of the # 6 fuel oil tested as manifested by the reductions in the actual SO<sub>2</sub> yield over the expected theoretical yield.

Tables I and II summarize the data accumulated during testing and make comparison of the actual to the theoretical SO<sub>2</sub> yield.

## **CONCLUSION**

The addition of the FPC-1 catalyst to fuel creates a change in the combustion process which in turn has caused a significant reduction in the emission of SO<sub>2</sub> from those oil fired boilers tested. Preliminary single data point testing at four locations showed SO<sub>2</sub> reductions ranging from **14%** to **31%** and a mean reduction of **23.9%**. Extended multiple data point tests at three locations document reductions ranging from **4%** to **51%** with a mean reduction of **30.7%**.

**TABLE I**

**EFFECT OF FPC CATALYST ON SO<sub>2</sub> EMISSIONS  
IN OIL FIRED BOILERS (#6)**

Site	Sulfur in Oil,(wt.%)	Theoretical SO <sub>2</sub> Emissions (lbs./MM BTU)	Actual SO <sub>2</sub> Emissions (lbs./MM BTU)	% Change
Armtex	2.86	3.16	2.19	-31
Holly Farms	2.50	2.79	2.04	-27
Pepperell E	2.27	2.51	1.95	-22
Pepperell C	2.19	2.42	2.09	-14
Average	2.46	2.72	2.07	-23.9

Note: The above are single data points taken at each location.

**TABLE II**COMPARISON OF SO<sub>2</sub> LEVELS  
WITH FPC-1 CATALYST (#6)

<u>Date</u>	(% wt.) <u>SULFUR</u> <u>IN OIL</u>	(lbs.SO <sub>2</sub> /MM BTU) <u>Theoretical Yield</u>	(lbs.SO <sub>2</sub> /MM BTU) <u>Actual Yield</u>	<u>DIFF.</u>
5/11	2.64	2.999	1.928	-35.7
5/21	2.12	2.358	2.005	-15.0
5/23	2.37	2.592	1.817	-29.9
5/25	2.74	3.075	2.040	-33.7
5/29	2.89	3.237	2.019	-37.6
6/05	2.36	2.599	1.944	-25.2
6/15	2.27	2.480	1.199	-51.2
6/19	2.14	2.304	1.385	-39.9
7/05	2.08	2.358	1.760	-25.4
7/07	2.54	2.758	1.884	-31.7
7/10	1.69	1.877	1.797	- 4.3
7/12	2.19	2.341	1.707	-27.1