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Shirco,Inc

2451 Stemmons Freeway • Dallas, Texas 75207 • (AC 214) 630-7511

November 9, 1978

Mr. Richard Helfand
Mitre Corporation
1820 Dolley Madison Blvd.
McLean, VA 22101

Dear Mr. Helfand:

Enclosed is general literature on the Shirco Incineration Systems. Also enclosed are excerpts from the pertinent pages of the emissions tests for Plano, Texas. Both controlled and uncontrolled emissions data is presented. The data for Richardson, Texas is included in the general data report.

We will be conducting emissions tests on several other installations in the coming months and I will be happy to forward the results if you desire.

I hope these data will be of help to you in your New Source Performance Standards studies for the EPA.

Sincerely,

SHIRCO, INC.

Frank Richmond

Frank Richmond, P.E.
Technical Sales

FDR:jm

Enc.

METCO

SOURCE EMISSIONS SURVEY
NORTH TEXAS MUNICIPAL WATER DISTRICT
ROWLETT CREEK PLANT
PLANO, TEXAS
FILE NUMBER 78-05

INTRODUCTION

Mullins Environmental Testing Co., Inc., Dallas, Texas, conducted a source emissions survey for Shirco, Inc. at the North Texas Municipal Water District's Rowlett Creek Plant, located at Plano, Texas, on May 22, 1978. The purpose of these tests was to determine the concentrations of particulate matter at the inlet to the scrubber on the South Unit and on the North Unit.

The sampling followed the procedures set forth in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60.

SUMMARY OF RESULTS

The principal conclusions are as follows:

1. The concentration of particulate matter in the inlet duct to the scrubber on the North Unit was equal to 2.7 pounds per hour, based on the one test using both the "front-half" and "back-half" collections from the EPA-type sampling train.

2. The concentration of particulate matter in the inlet duct to the scrubber on the South Unit was equal to 1.8 pounds per hour, based on the one test using both the "front-half" and "back-half" collections from the EPA-type sampling train.

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SUMMARY OF RESULTS

	South Inlet		North Inlet
Run Number	1		1
Stack Flow Rate - ACFM	5550		5304
Stack Flow Rate - DSCFM*	2257		2165
% Water Vapor - % Vol.	19.4		18.7
% CO_2 - % Vol.	1.2		1.0
% O_2 - % Vol.	18.7		18.6
% Excess Air @ Sampling Point	740		687
Particulates			
Probe, Cyclone & Filter Catch grains/dscf*	0.0881		0.0560
grains/cf @ Stack Conditions	0.0357		0.0228
lbs/hr	1.7		1.0
Total Catch			
grains/dscf*	0.0915		0.1459
grains/cf @ Stack Conditions	0.0371		0.0593
lbs/hr	1.8		2.7
lbs/ton of sludge	8.8		13.5

* 29.92 "Hg, 68°F

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DISCUSSION OF RESULTS

North and South Inlet Ducts:

Since only one test was taken at each location, no statistical analyses can be made. However, it is interesting to note that considerably more particulate matter existed in "back-half" collection of the test on the North Inlet than on the South Inlet. This tends to indicate that more of the particulate matter is below 0.3 micron in size.

DESCRIPTION OF PROCESS OPERATION

Sludge Source

The sludge incinerated during these tests consisted of mixed primary and excess activated sludge solids wasted from the biological treatment elements of the Rowlett Creek Plant. These solids, after polymer addition, were concentrated by means of air floation, dosed with additional flocculating polymers, and dewatered on coil type vacuum filters. The filter cake was then transported via conveyor belts to one or both of the two incinerators which comprise the system. These incinerators are designated "North" and "South", respectively.

Infrared Furnace

A sectional view of the infrared furnace is shown in Figure 1. The sludge filter cake is conveyed to the furnace, drops into it, and is leveled by means of an internal roller into a layer approximately 1" thick, spanning the width of the belt. The sludge layer then moves under infrared heating elements, which provide supplementary energy to effect the drying and incineration processes. Ash is discharged from the end

of the furnace into storage containers.

Gas flow is counter-current to the sludge flow, with combustion air being introduced into the ash discharge end of the unit and preheated by its passage over the outgoing ash. A continuous oxygen analyzer samples the combustion gases within the furnace and controls the flow of combustion air to limit excess air levels to 20%-50% maximum.

Exhaust gases from each incinerator are cleansed by a Koch Engineering multi-venturi tray-type scrubber prior to discharge into the atmosphere.

Sludge Charging Rate

The mean sludge charging rates over time to the incinerators during each of the tests is given below. These values in terms of pounds of dry solids per hour were computed as the product of the volumetric flow rate of sludge cake at the incinerator, measured directly, and the average percent solids of the sludge cake as determined by laboratory analysis.

North Incinerator Scrubber Inlet

Test Number	Sludge Charging Rate (lbs/hr)	tons/hr
1	400	0.200

South Incinerator Scrubber Inlet

Test Number	Sludge Charging Rate (lbs/hr)	tons/hr
1	410	0.205

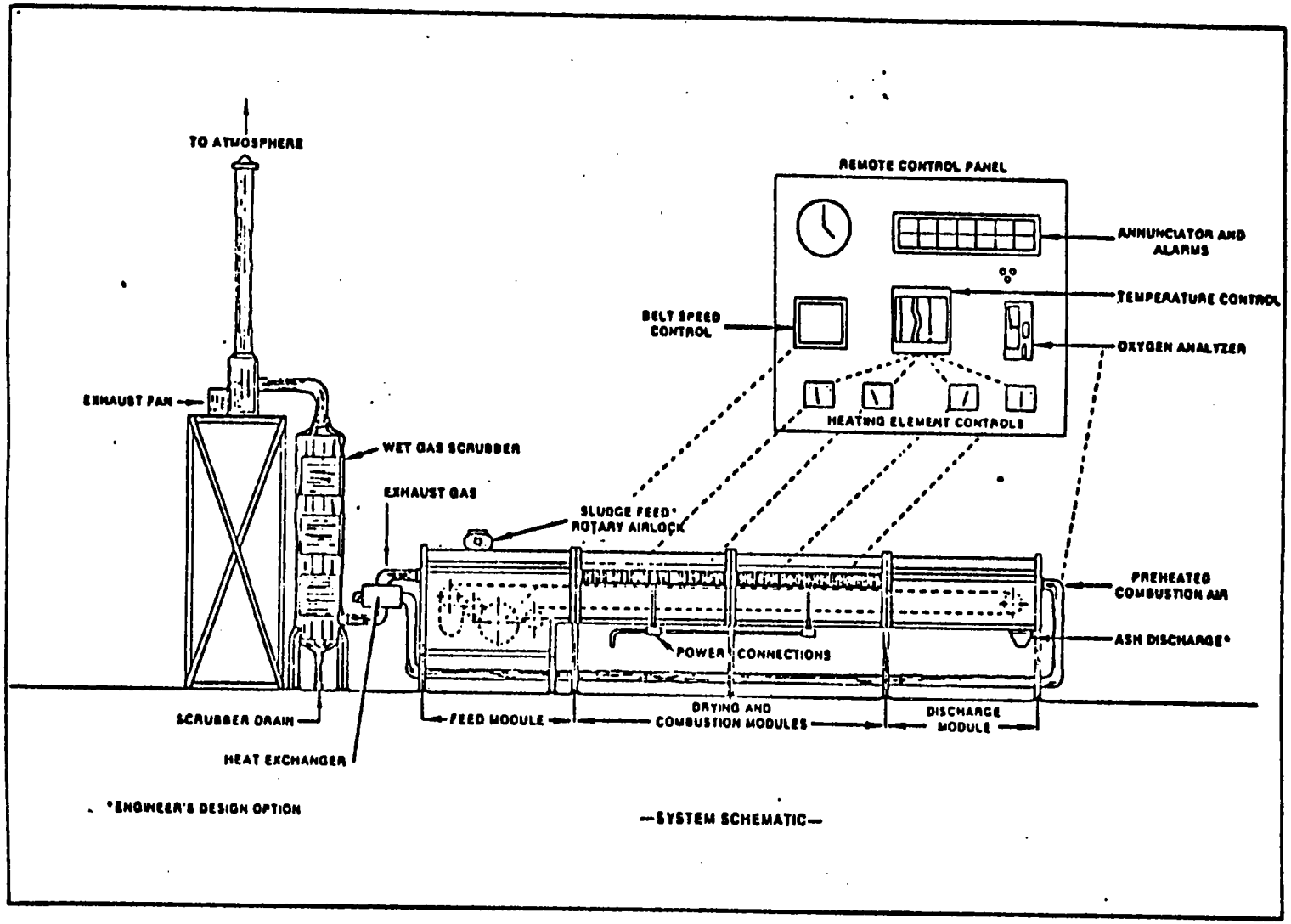

FIGURE 1

Diagram of the Shirco Incinerator

DESCRIPTION OF SAMPLING LOCATION

The sampling location on the inlets to the scrubber on the South Unit and the North Unit is approximately 5 feet above the ground. The sampling port is located 9 feet 5 inches (9.13 stack diameters) downstream from an elbow in the duct and 3 feet (2.91 stack diameters) upstream of the inlet to the scrubber.

SAMPLING AND ANALYTICAL PROCEDURES

The sampling followed the procedures outlined in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60.

A preliminary velocity traverse was made at the one port on each inlet duct in order to determine the uniformity and magnitude of the flow prior to testing.

Six traverse points were sampled from the one port on each inlet duct and each traverse point was sampled for five-minutes duration using a heated, glass-lined probe.

On all the tests conducted, the sampling train was leak-checked at the nozzle at 15 inches of mercury vacuum before each test, and leak-checked at the nozzle after each test at the highest vacuum reading recorded during the test. This was performed to predetermine the possibility of a diluted sample.

Also before and after each test, the pitot tube lines were checked for leaks under both a vacuum and pressure. The lines were also checked for clearance and the manometer zeroed before each test.

Particulate emissions were calculated from gravimetric analysis using both the "front-half" and "back-half" collections from the EPA-type sampling train.

DESCRIPTION OF TESTS

Personnel from Mullins Environmental Testing Co., Inc., arrived at the plant at 8:45 a.m. on Monday, May 22, 1978. The equipment was set up on the inlet to the scrubber on the North Unit. The particulate test on the North Inlet Duct began at 11:35 a.m. and continued without difficulty until its completion at 12:05 p.m. A particle size was taken on the North Inlet duct from 12:58 p.m. until 1:13 p.m. The equipment was moved over to the inlet to the scrubber on the South Unit. The particulate test on the South Inlet Duct began at 3:05 p.m. and continued without difficulty until its completion at 3:35 p.m. A particle size was taken on the South Inlet Duct from 4:10 p.m. until 4:30 p.m. The samples were recovered before securing for the night at 5:30 p.m.

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SOURCE EMISSIONS SURVEY
NORTH TEXAS MUNICIPAL WATER DISTRICT
ROWLETT CREEK PLANT
PLANO, TEXAS
FILE NUMBER 78-05

INTRODUCTION

Mullins Environmental Testing Co., Inc., Dallas, Texas, conducted a source emissions survey for Shirco, Inc. at the North Texas Municipal Water District's Rowlett Creek Plant, located at Plano, Texas, on May 23 and 24, 1978. The purpose of these tests was to determine the concentrations of particulate matter being emitted to the atmosphere via the exhaust stacks from the North Unit and the South Unit.

The sampling followed the procedures set forth in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60.

SUMMARY OF RESULTS

The principal conclusions are as follows:

1. The emissions of particulate matter from the exhaust stack on the North Unit were equal to 0.189 pounds per hour (0.918 pounds per ton of dry solids), based on averaging the three tests using the "front-half" collections from the EPA-type sampling train. The average emissions were 71% of permitted emissions.

2. The emissions of particulate matter from the exhaust stack on the South Unit were equal to 0.293 pounds per hour (1.270 pounds per ton of dry solids), based on averaging the second and third tests using the "front-half" collections from the EPA-type sampling train. The average emissions were 98% of permitted emissions.

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SUMMARY OF RESULTS

North Unit Stack

Run Number	1	2	3
Stack Flow Rate - ACFM	2784	2738	2728
Stack Flow Rate - DSCFM*	2538	2455	2471
% Water Vapor - % Vol.	3.7	5.0	3.9
% CO_2 - % Vol.	1.6	2.7	1.8
% O_2 - % Vol.	18.2	17.1	18.2
% Excess Air @ Sampling Point	596	412	607
Particulates			
Probe, Cyclone & Filter Catch grains/dscf*	0.0026	.008 0.0116	0.0126
grains/cf @ Stack Conditions	0.0023	0.0104	0.0114
lbs/hr	0.057	0.244	0.267
Total Catch			
grains/dscf*	--	--	--
grains/cf @ Stack Conditions	--	--	--
lbs/hr	--	--	--
Sludge Feed Rate-lbs/hr Dry Solids	392	442	393
Emission Rate-lbs/Ton of Dry Solids	0.291	1.104	1.359

* 29.92 "Hg, 68°F

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SUMMARY OF RESULTS

South Unit Stack

Run Number	2	3	4
Stack Flow Rate - ACFM	1923	2294	2371
Stack Flow Rate - DSCFM*	1757	2111	2165
% Water Vapor - % Vol.	3.2	2.6	3.3
% CO_2 - % Vol.	3.2	2.2	2.0
% O_2 - % Vol.	16.2	17.6	18.0
% Excess Air @ Sampling Point	314	482	563
Particulates			
Probe, Cyclone & Filter Catch grains/dscf*	0.0235	0.0128	0.0173
grains/cf @ Stack Conditions	0.0214	0.0117	0.0157
lbs/hr	0.354	0.232	0.321
Total Catch			
grains/dscf*	--	--	--
grains/cf @ Stack Conditions	--	--	--
lbs/hr	--	--	--
Sludge Feed Rate-lbs/hr Dry Solids	481	435	310
Emission Rate-lbs/Ton of Dry Solids	1.472	1.067	2.071

* 29.92 "Hg, 68°F

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DISCUSSION OF RESULTS

North Unit Stack:

The three tests for particulates taken on the exhaust stack of the North Unit appeared to be valid representations of the actual emissions during the testing. The indicative parameters calculated from the field data were in close agreement. The moisture percentages were in close agreement except on the second test, when the excess air content decreased significantly. The measured flow rates (Q_s) were within 2.0 percent of the mean valve. The rates of sampling for the three tests were well within the specified limits of the isokinetic rate, the greatest deviation being 1.7 percent.

The calculated emissions of particulates (pounds per hour) showed a range of -69.0 percent to +41.0 percent variation from the mean valve.

South Unit Stack:

The first test for particulates taken on the exhaust stack of the South Unit was aborted due to upset conditions in

the furnace. As indicated in the "Description of Process of Operation" section of this report, an upset also occurred during the final test. The second and third tests for particulates taken on the stack appeared to be valid representations of the actual emissions during the testing. The indicative parameters calculated from the field data were in close agreement. The moisture percentages were within 10.3 percent of the mean value. The measured flow rates (Q_s) were within 9.2 percent of the mean value. The rates of sampling for the last three tests were well within the specified limits of the isokinetic rate, the greatest deviation being 2.5 percent.

The calculated emissions of particulates (pounds per hour) showed a range of -20.8 percent to +20.8 percent variation from the mean value.

DESCRIPTION OF PROCESS OPERATION

Sludge Source

The sludge incinerated during these tests consisted of mixed primary and excess activated sludge solids wasted from the biological treatment elements of the Rowlett Creek Plant. These solids, after polymer addition, were concentrated by means of air floation, dosed with additional flocculating polymers, and dewatered on coil type vacuum filters. Measured properties of the dewatered sludge are shown in Appendix G. The filter cake was then transported via conveyor belts to one or both of the two incinerators which comprise the system. These incinerators are designated "North" and "South", respectively.

Infrared Furnace

A sectional view of the infrared furnace is shown in Figure 1. The sludge filter cake is conveyed to the furnace, drops into it, and is leveled by means of an internal roller into a layer approximately 1" thick, spanning the width of the belt. The sludge layer then moves under infrared heating elements, which provide supplementary energy to effect the drying and incineration processes. Ash is discharged from the end

of the furnace into storage containers.

Gas flow is counter-current to the sludge flow, with combustion air being introduced into the ash discharge end of the unit and preheated by its passage over the outgoing ash. A continuous oxygen analyzer samples the combustion gases within the furnace and controls the flow of combustion air to limit excess air levels to 20%-50% maximum. Stack sampling results indicate much higher excess air levels at stack conditions because of air leakage through the sludge inlet port and absorption of carbon dioxide in the wet scrubbing process.

Exhaust gases from each incinerator are cleansed by a Koch Engineering multi-venturi tray-type scrubber prior to discharge into the atmosphere. During the course of the tests, the scrubbers operated at a nominal differential pressure of 8 to 9 inches of water. The scrubbing water flow rate ranged from 90 to 100 gallons per minute per scrubber.

Sludge Charging Rate

The mean sludge charging rates over time to the incinerators during each of the tests is given below. These values in

terms of pounds of dry solids per hour were computed as the product of the volumetric flow rate of sludge cake at the incinerator, measured directly, and the average percent solids of the sludge cake as determined by laboratory analysis. Refer to Appendix G for complete data on the properties of the sludge cake. The variations in the charging rates tabulated below are primarily the result of alterations of the incinerator inlet sludge metering belt speed which were made in an effort to optimize the overall incinerator performance for existing sludge conditions. However, even at a constant set belt speed, slight variations of the computed sludge charging rate occur due to constantly changing sludge cake quality and inherent minor speed variations allowed by the metering belt controller.

North Incinerator Stack

Test Number	Sludge Charging Rate (lbs/hr)	tons/hr
1	392	0.196
2	442	0.221
3	393	0.197

South Incinerator Stack

Test Number	Sludge Charging Rate (lbs/hr)	tons/hr
2	481	0.241
3	435	0.218
4	310	0.155

Furnace Operation

During all three stack test runs, the North incinerator operated normally. During the second run on the South incinerator, its combustion oxygen analyzer operated in a marginally acceptable manner. The instrument was replaced with a spare which operated satisfactorily during the third and fourth runs. However, approximately midway through the fourth run on the South furnace the circuit breaker tripped on one of its infrared heating element power supplies. This circuit breaker required approximately 20 minutes to reset, during which time the furnace temperatures dropped on the order of 300°F. This decrease in temperature, coupled with the deterioration in sludge properties which occured late in the afternoon, resulted in both increased emissions and decreased charging rate. Therefore, the fourth run of the South incinerator was not representative of normal operation.

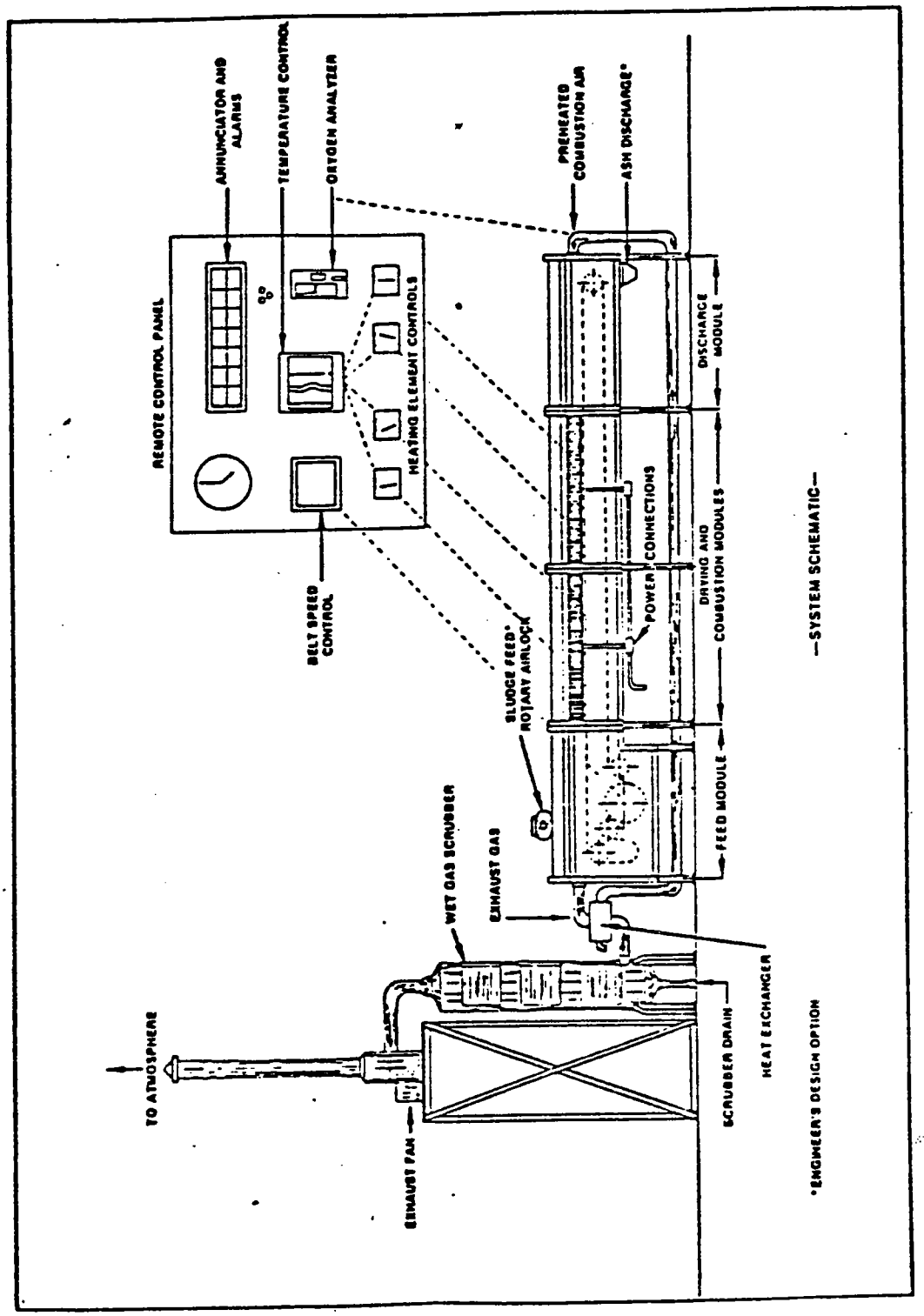

FIGURE 1

Diagram of the Shirco Incinerator

DESCRIPTION OF SAMPLING LOCATION

The sampling location on the exhaust stack of the North Unit is approximately 20 feet above the ground. The sampling ports are located 8 feet 9 inches (8.98 stack diameters) downstream from the inlet to the stack and 9 feet 1 inch (9.33 stack diameters) upstream from the outlet of the stack.

The sampling location on the exhaust stack of the South Unit is approximately 20 feet above the ground. The sampling ports are located 8 feet 6 inches (8.87 stack diameters) downstream from the inlet to the stack and 9 feet 3 1/2 inches (9.70 stack diameters) upstream from the outlet of the stack.

SAMPLING AND ANALYTICAL PROCEDURES

The sampling followed the procedures outlined in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60.

A preliminary velocity traverse was made at each of the two ports on each exhaust stack in order to determine the uniformity and magnitude of the flow prior to testing. Four traverse points were sampled from each of the two ports on each exhaust stack for a total of eight traverse points of each stack. Samples of eight-minutes duration were taken isokinetically at each of the four points on the traverse from each port on each stack using a heated, glass-lined probe.

On all the tests conducted, the sampling train was leak-checked at the nozzle at 15 inches of mercury vacuum before each test, and leak-checked at the nozzle after each test at the highest vacuum reading recorded during the test. This was performed to predetermine the possibility of a diluted sample.

Also before and after each test, the pitot tube lines were checked for leaks under both a vacuum and pressure. The lines

were also checked for clearance and the manometer zeroed before each test.

Particulate emissions were calculated from gravimetric analysis using the "front-half" collections from the EPA-type sampling train.

DESCRIPTION OF TESTS

Personnel from Mullins Environmental Testing Co., Inc. arrived at the plant at 9:00 a.m. on Tuesday, May 23, 1978. The equipment was already in place on the North Unit's exhaust stack. The equipment was prepared for testing and the first test on the North Unit's stack began at 10:01 a.m. The first test continued without difficulty until its completion at 11:06 a.m. The second test was delayed until 12:33 p.m. while adjustments were being made to the incinerator. The second test was completed at 1:38 p.m. and the third test began at 1:59 p.m. The third test was completed at 3:04 p.m. An attempt was made to change the operating parameters in the incinerator in order to take a fourth test on the North Unit. However, at 4:30 p.m., it was decided by plant personnel that a fourth test was not feasible. The samples were recovered and the equipment was moved onto the stack of the South Unit before securing for the night at 5:00 p.m.

On Wednesday, May 24, work began at 8:45 a.m. The equipment was prepared for testing and the first test on the South Unit began at 10:21 a.m. The first test was aborted at 11:17 a.m. due to

the filter being plugged. The incinerator also experienced operating problems during the first test and it was agreed to take an additional three tests. The second test began at 12:35 p.m. and continued without difficulty until its completion at 1:40 p.m. The third test was delayed until 2:51 p.m. due to plant operational problems. The third test was completed without difficulty at 3:56 p.m. The fourth test began at 4:15 p.m. and continued until its completion at 5:20 p.m.

The equipment was moved off the exhaust stack of the South Unit and loaded into the sampling van. The samples were recovered and taken to Mullins Environmental Testing Co.'s laboratory in Dallas for further analysis and evaluation.

Operations at the Shirco, Inc. sludge incinerator located at the North Texas Municipal Water District's Rowlett Creek Plant in Plano, Texas, were completed at 6:15 p.m. on Wednesday, May 24, 1978.

Billy L. Mullins, Jr.

Billy J. Mullins, Jr., P.E.
President