AP42 Section: 9.10.1.2 Sugarbeet Processing

Title: Emission Factor Documentation for AP-42 Section 9.10.1.2

Sugarbeet Processing

Draft Report - includes excerpts from source tests

March 1995

Emission Factor Documentation for AP-42 Section 9.10.1.2

SUGARBEET PROCESSING

Draft Report

For U. S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Factor and Inventory Group

EPA Contract 68-D2-0159
Work Assignment No. II-03

MRI Project No. 4602-03

March 1995

Emission Factor Documentation for AP-42
Section 9.10.1.2

SUGARBEET PROCESSING

Draft Report

For U. S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Factor and Inventory Group
Research Triangle Park, NC 27711

Attn: Mr. Dallas Safriet (MD-14)
Emission Factor and Inventory Group

EPA Contract 68-D2-0159
Work Assignment No. II-03

MRI Project No. 4602-03

March 1995

NOTICE

This document is a preliminary draft. It has not been formally released by the U. S. Environmental Protection Agency and should not at this stage be construed to represent Agency policy. It is being circulated for comments on its technical merit and policy implications.

PREFACE

This report was prepared by Midwest Research Institute (MRI) for the Office of Air Quality Planning and Standards (OAQPS), U. S. Environmental Protection Agency (EPA), under Contract No. 68-D2-0159, Work Assignment No. II-03. Mr. Dallas Safriet was the Work Assignment Manager.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

DRAFT
3829/460203
3/14/95

EMISSION FACTOR DOCUMENTATION FOR AP-42 SECTION 9.10.1.2
SUGARBEET PROCESSING

1. INTRODUCTION

The document *Compilation of Air Pollutant Emission Factors* (AP-42) has been published by the U. S. Environmental Protection Agency (EPA) since 1972. Supplements to AP-42 have been routinely published to add new emission source categories and to update existing emission factors. AP-42 is routinely updated by EPA to respond to new emission factor needs of EPA, State and local air pollution control programs, and industry.

An emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. Emission factors usually are expressed as the weight of pollutant divided by the unit weight, volume, distance, or duration of the activity that emits the pollutant. The emission factors presented in AP-42 may be appropriate to use in a number of situations, such as making source-specific emission estimates for areawide inventories for dispersion modeling, developing control strategies, screening sources for compliance purposes, establishing operating permit fees, and making permit applicability determinations. The purpose of this report is to provide background information from test reports and other information to support preparation of AP-42 Section 9.10.1.2, Sugarbeet Processing.

This background report consists of five sections. Section 1 includes the introduction to the report. Section 2 gives a description of the sugarbeet processing industry. It includes a characterization of the industry, a description of the different process operations, a characterization of emission sources and pollutants emitted, and a description of the technology used to control emissions resulting from these sources. Section 3 is a review of emission data collection (and emission measurement) procedures. It describes the literature search, the screening of emission data reports, and the quality rating system for both emission data and emission factors. Section 4 details how the new AP-42 section was developed. It includes the review of specific data sets and a description of how candidate emission factors were developed. Section 5 presents the AP-42 Section 9.10.1.2, Sugarbeet Processing.

2. INDUSTRY DESCRIPTION[1,2]

Sugarbeet processing is the production of sugar (sucrose) from sugarbeets. Byproducts of sugarbeet processing include pulp and molasses. Most of the molasses produced is processed further to remove the remaining sucrose. The pulp and most of the remaining molasses are mixed together, dried, and sold as livestock feed. The four-digit standard industrial classification (SIC) code for sugarbeet processing is 2063. The six-digit source classification code (SCC) for sugarbeet processing is 3-02-016; there are two eight-digit SCC's: 3-02-016-01 (dryers) and 3-02-016-99 (other not classified).

2.1 INDUSTRY CHARACTERIZATION[3]

In 1991, approximately 3,925,000 short tons of beet sugar were produced at 36 plants located in 14 States. Table 2-1 shows the number of sugarbeet processing plants by State. No new sugarbeet processing facilities have been built since the mid-1970's. In comparison to 1974, 20 fewer facilities are currently operating. However, the 36 facilities currently operating have been modified to produce more sugar more efficiently than the 56 facilities operating in 1974.

TABLE 2-1. SUGARBEET PROCESSING PLANTS BY STATE, 1991

State	Number of plants
California	8
Colorado	2
Idaho	3
Michigan	5
Minnesota	4
Montana	2
Nebraska	3
New Mexico[a]	
North Dakota	3
Ohio	1
Oregon	1
Texas	1
Wyoming	3
Washington[a]	

[a]State-produced small quantities of sugarbeets, but not sugarbeet processing plants are located in the State.

2.2 PROCESS DESCRIPTION[1,2,4,5]

Figures 2-1 and 2-2 are flow diagrams for a typical sugarbeet processing plant. Figure 2-1 shows the preprocessing operations and the livestock feed production operations, and Figure 2-2 shows the beet sugar production operations. Mechanically harvested sugarbeets are shipped to processing plants, where they are typically received by high-speed conveying and screening systems. The screening systems remove loose dirt from the beets and pinch the beet tops and leaves to facilitate separation from the beet roots. The conveyors transport the beets to storage areas and then to the final cleaning and trash removal operations that precede the processing operations. The beets are usually conveyed to the final cleaning phase using flumes, which use water to both move and clean the beets. Although most plants use flumes, some plants use dry conveyors in the final cleaning stage. The disadvantage of flume conveying is that some sugar leaches into the flume water from damaged surfaces of the beets. The flumes carry the beets to the beet feeder, which regulates the flow of beets through the system and prevents stoppages in the system. From the feeder, the flumes carry the beets through several cleaning devices, which may include rock catchers, sand separators, magnetic metal separators, water spray nozzles, and trash catchers. After cleaning, the beets are separated from the water, usually with a beet wheel, and are transported by drag chain, chain and bucket elevator, inclined belt conveyor, or beet pump to the processing operations.

Sugarbeet processing operations comprise several steps, including diffusion, juice purification, evaporation, crystallization, dried-pulp manufacture, and sugar recovery from molasses. Descriptions of these operations are presented in the following paragraphs.

Prior to removal of the sucrose from the beet by diffusion, the cleaned and washed beets are sliced into long, thin strips, called cossettes. The cossettes are conveyed to a continuous diffuser, in which hot water is used to extract sucrose from the cossettes. The diffuser is usually slanted upwards and conveys the cossettes up the slope as water is introduced at the top of the diffuser and flows countercurrent to the cossettes. The water temperature in the diffuser is typically maintained between 50° and 80°C (122° and 176°F). This temperature is dependant on several factors, including the denaturization temperature of the cossettes, the thermal behavior of the beet cell wall, potential enzymatic reactions, bacterial activity, and pressability of the beet pulp. Formalin, a 40 percent solution of formaldehyde, is sometimes added to the diffuser water as a disinfectant. Sulfur dioxide and chlorine are also sometimes used as disinfectants. The sugar-enriched water that flows from the

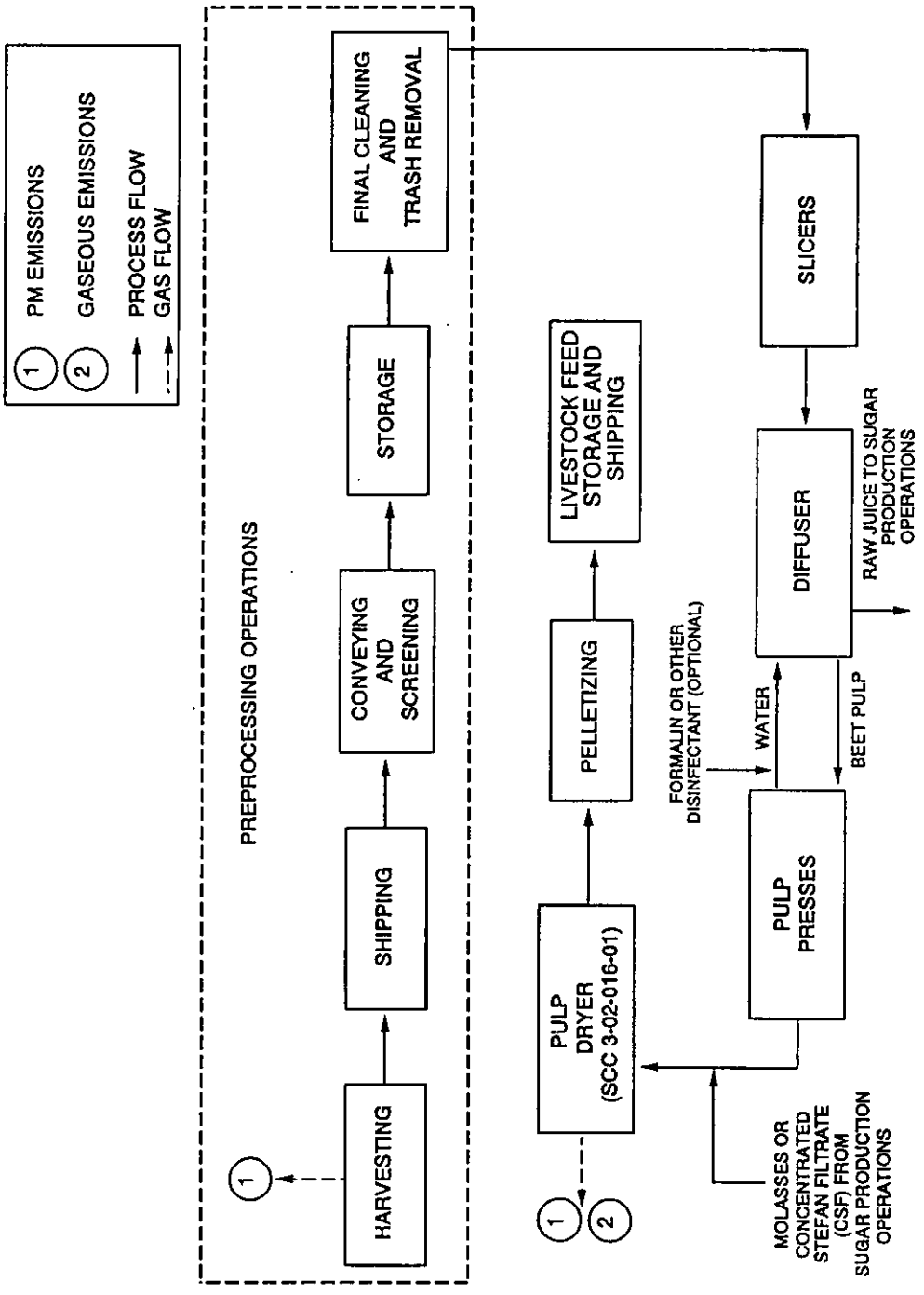


Figure 2-1. Preprocessing and livestock feed production operations at a sugarbeet processing plant.

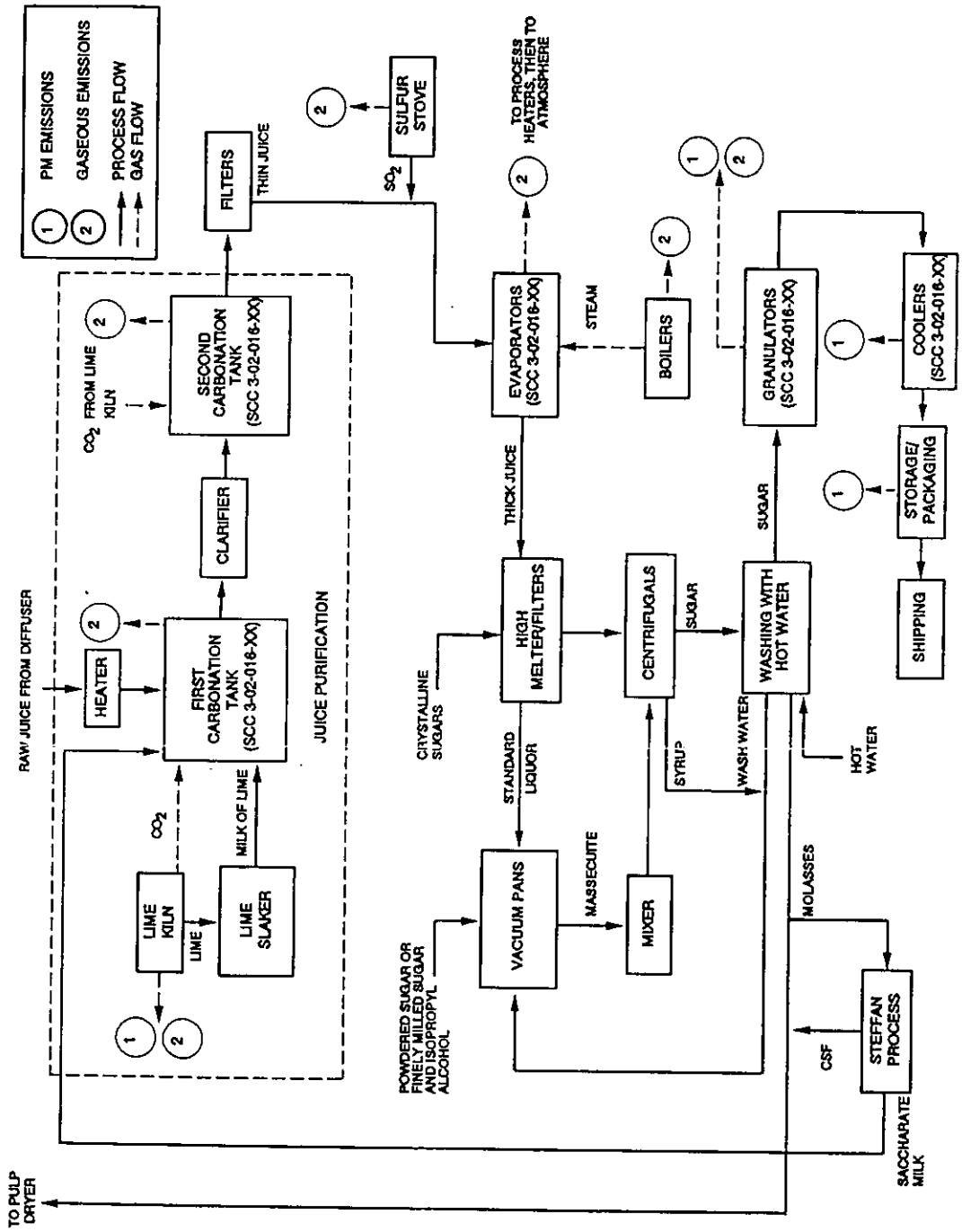


Figure 2-2. Sugar production operations at a sugarbeet processing plant.

outlet of the diffuser is called raw juice and contains between 10 and 15 percent sugar. This raw juice proceeds to the juice purification operations. The processed cossettes, or pulp, leaving the diffuser are conveyed to the dried-pulp manufacture operations.

In the juice purification stage, non-sucrose impurities in the raw juice are removed so that the pure sucrose can be crystallized. First, the juice passes through screens to remove any small cossette particles. Then the mixture is heated to 80° to 85°C (176° to 185°F) and proceeds to the first carbonation tank. In the first carbonation tank, milk of lime [$CA(OH)_2$] is added to the mixture to adsorb or adhere to the impurities in the mixture, and carbon dioxide (CO_2) gas is bubbled through the mixture to precipitate the lime as insoluble calcium carbonate crystals. Lime kilns are used to produce the CO_2 and lime used in carbonation; the lime is converted to milk of lime in a lime slaker. The small, insoluble crystals (produced during carbonation) settle out in a clarifier, after which the juice is again treated with CO_2 (in the second carbonation tank) to remove the remaining lime and impurities. The pH of the juice is lower during this second carbonation, causing large, easily filterable, calcium carbonate crystals to form. After filtration, a small amount of sulfur dioxide (SO_2) is added to the juice to inhibit reactions that lead to darkening of the juice. The SO_2 is produced by burning elemental sulfur in a sulfur stove or is purchased in liquid form. Following the addition of SO_2, the juice (known as thin juice) proceeds to the evaporators.

The evaporation process, which increases the sucrose concentration in the juice by removing water, is typically performed in a series of five evaporators. Steam from large boilers is used to heat the first evaporator, and the steam from the water evaporated in the first evaporator is used to heat the second evaporator. This transfer of heat continues through the five evaporators, and as the temperature decreases (due to heat loss) from evaporator to evaporator, the pressure inside each evaporator is also decreased, allowing the juice to boil at the lower temperatures provided in each subsequent evaporator. Some steam is released from the first three evaporators, and this steam is used as a heat source for various process heaters throughout the plant. After evaporation, the percentage of sucrose in the "thick juice" is 50-65 percent. Crystalline sugars, produced later in the process, are added to the juice and dissolved in the high melter. This mixture is then filtered, yielding a clear liquid known as standard liquor, which proceeds to the crystallization operation.

Sugar is crystallized by low-temperature pan boiling. The standard liquor is boiled in vacuum pans until it becomes supersaturated. To begin crystal formation, the liquor is either "shocked" using

a small quantity of powdered sugar or is "seeded" by adding a mixture of finely milled sugar and isopropyl alcohol. The seed crystals are carefully grown through control of the vacuum, temperature, feed-liquor additions, and steam. When the crystals reach the desired size, the mixture of liquor and crystals, known as massecuite or fillmass, is discharged to the mixer. From the mixer, the massecuite is poured into high-speed centrifugals, in which the liquid is centrifuged into the outer shell, and the crystals are left in the inner centrifugal basket. The sugar crystals are then washed with pure hot water and are sent to the granulator, which is a rotary drum dryer, and then to the cooler. Some facilities refer to the granulator as the sugar dryer. The wash water, which contains a small quantity of sucrose, is pumped to the vacuum pans for processing. After cooling, the sugar is screened and then either packaged or stored in large bins for future packaging.

The liquid that was separated from the sugar crystals in the centrifugals is called syrup. This syrup serves as feed liquor for the "second boiling" and is introduced back into the vacuum pans along with standard liquor and recycled wash water. The process is repeated once again, resulting in the production of molasses, which can be further desugarized using the Steffan process. Molasses that is not desugarized can be used in the production of livestock feed.

The Steffan process is used to recover some of the sugar remaining in molasses. The process involves the addition of lime to produce saccharate (sugar and lime compounds) precipitates, which are broken up by the addition of carbon dioxide gas, thus freeing the sugar and creating a calcium carbonate precipitate. The product of the Steffan process is called saccharate milk and is used as feed for the juice purification operations. Byproducts of the Steffan process include concentrated Steffan filtrate (CSF), which can be added to beet pulp prior to drying or can be used to produce monosodium glutamate. A relatively new process called deep molasses desugarization is used by some plants to remove additional sugar from molasses.

Wet pulp from the diffusion process is another product of sugarbeet processing. The pulp is first pressed, typically in vertical single-screw presses, to reduce the moisture content from about 95 percent to about 80 percent. The water removed by the presses is collected and used as diffusion water. After pressing, CSF or molasses is added to the pulp, which is then dried by hot air in a horizontal rotating drum known as a pulp dryer. The pulp dryer, which can be fired by oil, natural gas, or coal, typically provides entrance temperatures between 482° and 927°C (900° and 1700°F). As the pulp is dried, the gas temperature decreases and the pulp temperature increases. The exit

temperature of the flue gas is typically between 88° and 138°C (190° and 280°F). The resulting product is typically pelletized and is sold as livestock feed.

2.3 EMISSIONS[1,4,5]

Particulate matter (PM), combustion products, and volatile organic compounds (VOC) are the primary pollutants emitted from the sugarbeet processing industry. The pulp dryers, sugar granulators and coolers, sugar conveying and sacking equipment, lime kilns and handling equipment, carbonation tanks, sulfur stoves, evaporators, and boilers, as well as several fugitive sources are potential emission sources. Potential emissions from lime kilns and boilers are addressed in AP-42 Section 11.15 (Lime Manufacturing) and Sections 1.1 through 1.4 (Combustion), respectively, and are not included in this discussion. Potential sources of PM emissions include the pulp dryer, sugar granulators and coolers, sugar conveying and sacking equipment, sulfur stove, and fugitive sources. Fugitive sources include unpaved roads, coal handling, and pulp loading operations. The sulfur stove is a potential source of SO_2 emissions, and the pulp dryers and evaporators are a potential source of nitrogen oxides (NO_x), SO_2, CO_2, carbon monoxide (CO), and VOC. However, only the first three of five evaporators (in a typical five-stage system) release exhaust gases, and the gases are used as a heat source for various process heaters before release to the atmosphere. Emissions from carbonation tanks are primarily VOC and may include CO_2 and other combustion gases.

2.4 EMISSION CONTROL TECHNOLOGY

Particulate matter emissions from pulp dryers are typically controlled by a cyclone or multiclone system, sometimes followed by a secondary device such as a wet scrubber or fabric filter. Wet scrubbers also provide some degree of control of some gaseous pollutants. Particulate matter emissions from granulators are typically controlled with wet scrubbers, and PM emissions from sugar conveying and sacking as well as lime dust handling operations are controlled by hood systems that duct the emissions to fabric filtration systems. Emissions from carbonation tanks and evaporators are not typically controlled.

REFERENCES FOR SECTION 2

1. R.A. McGinnis, *Beet-Sugar Technology, Third Edition*, Beet Sugar Development Foundation, Fort Collins, CO, 1982.

2. *The Beet Sugar Story*, United States Beet Sugar Association, Washington, D.C., 1959.

3. *Directory of American Beet Sugar Companies*, United States Beet Sugar Association, Washington, D.C., 1991.

4. *Particulate, Aldehyde, and Semi-volatile Organic Compound (SVOC) Testing Report for the Pulp Dryer Stacks, 1st and 2nd Carbonation Tank Vents, and the Evaporator Heater Vents*, The Amalgamated Sugar Company, Nampa, ID, May 14, 1993.

5. *Emission Performance Testing of Four Boilers, Three Dryers, and One Cooler--Holly Sugar Corporation, Santa Maria, California*, Western Environmental Services, Redondo Beach, CA, June 1991.

3. GENERAL DATA REVIEW AND ANALYSIS PROCEDURES

3.1 LITERATURE SEARCH AND SCREENING

Data for this investigation were obtained from a number of sources within the Office of Air Quality Planning and Standards (OAQPS) and from outside organizations. The AP-42 background files located in the Emission Factor and Inventory Group (EFIG) were reviewed for information on the industry, processes, and emissions. The Factor Information and Retrieval (FIRE), Crosswalk/Air Toxic Emission Factor Data Base Management System (XATEF), and VOC/PM Speciation Data Base Management System (SPECIATE) data bases were searched by SCC code for identification of the potential pollutants emitted and emission factors for those pollutants. A general search of the Air CHIEF CD-ROM also was conducted to supplement the information from these data bases.

Information on the industry, including number of plants, plant location, and annual production capacities, was obtained from the *Directory of American Beet Sugar Companies* and other sources. The Aerometric Information Retrieval System (AIRS) data base also was searched for data on the number of plants, plant location, and estimated annual emissions of criteria pollutants. A number of sources of information were investigated specifically for emission test reports and data. A search of the Test Method Storage and Retrieval (TSAR) data base was conducted to identify test reports for sources within the sugarbeet processing industry. However, no test reports were located using the TSAR data base. The EPA library was searched for additional test reports. Using information obtained on plant locations, individual facilities and State and Regional offices were contacted about the availability of test reports. Publications lists from the Office of Research and Development (ORD) and Control Technology Center (CTC) were also searched for reports on emissions from the sugarbeet processing industry. In addition, representative trade associations, including the United States Beet Sugar Association and the American Society of Beet Sugar Technologists, were contacted for assistance in obtaining information about the industry and emissions. The trade associations suggested contacting individual sugarbeet processing companies to request test data. All of the test reports that were located were provided by individual companies.

To screen out unusable test reports, documents, and information from which emission factors could not be developed, the following general criteria were used:

1. Emission data must be from a primary reference:

a. Source testing must be from a referenced study that does not reiterate information from previous studies.

b. The document must constitute the original source of test data. For example, a technical paper was not included if the original study was contained in the previous document. If the exact source of the data could not be determined, the document was eliminated.

2. The referenced study should contain test results based on more than one test run. If results from only one run are presented, the emission factors must be down rated.

3. The report must contain sufficient data to evaluate the testing procedures and source operating conditions (e.g., one-page reports were generally rejected).

A final set of reference materials was compiled after a thorough review of the pertinent reports, documents, and information according to these criteria.

3.2 DATA QUALITY RATING SYSTEM[1]

As part of the analysis of the emission data, the quantity and quality of the information contained in the final set of reference documents were evaluated. The following data were excluded from consideration:

1. Test series averages reported in units that cannot be converted to the selected reporting units;

2. Test series representing incompatible test methods (i.e., comparison of EPA Method 5 front half with EPA Method 5 front and back half);

3. Test series of controlled emissions for which the control device is not specified;

4. Test series in which the source process is not clearly identified and described; and

5. Test series in which it is not clear whether the emissions were measured before or after the control device.

Test data sets that were not excluded were assigned a quality rating. The rating system used was that specified by EFIG for preparing AP-42 sections. The data were rated as follows:

A—Multiple tests that were performed on the same source using sound methodology and reported in enough detail for adequate validation. These tests do not necessarily conform to the methodology specified in EPA reference test methods, although these methods were used as a guide for the methodology actually used.

B—Tests that were performed by a generally sound methodology but lack enough detail for adequate validation.

C—Tests that were based on an untested or new methodology or that lacked a significant amount of background data.

D—Tests that were based on a generally unacceptable method but may provide an order-of-magnitude value for the source.

The following criteria were used to evaluate source test reports for sound methodology and adequate detail:

1. Source operation. The manner in which the source was operated is well documented in the report. The source was operating within typical parameters during the test.

2. Sampling procedures. The sampling procedures conformed to a generally acceptable methodology. If actual procedures deviated from accepted methods, the deviations are well documented. When this occurred, an evaluation was made of the extent to which such alternative procedures could influence the test results.

3. Sampling and process data. Adequate sampling and process data are documented in the report, and any variations in the sampling and process operation are noted. If a large spread between

test results cannot be explained by information contained in the test report, the data are suspect and are given a lower rating.

4. Analysis and calculations. The test reports contain original raw data sheets. The nomenclature and equations used were compared to those (if any) specified by EPA to establish equivalency. The depth of review of the calculations was dictated by the reviewer's confidence in the ability and conscientiousness of the tester, which in turn was based on factors such as consistency of results and completeness of other areas of the test report.

3.3 EMISSION FACTOR QUALITY RATING SYSTEM[1]

The quality of the emission factors developed from analysis of the test data was rated using the following general criteria:

A—Excellent: Developed only from A-rated test data taken from many randomly chosen facilities in the industry population. The source category is specific enough so that variability within the source category population may be minimized.

B—Above average: Developed only from A-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industries. The source category is specific enough so that variability within the source category population may be minimized.

C—Average: Developed only from A- and B-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. In addition, the source category is specific enough so that variability within the source category population may be minimized.

D—Below average: The emission factor was developed only from A- and B-rated test data from a small number of facilities, and there is reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source category population. Limitations on the use of the emission factor are noted in the emission factor table.

E—Poor: The emission factor was developed from C- and D-rated test data, and there is reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population. Limitations on the use of these factors are footnoted.

The use of these criteria is somewhat subjective and depends to an extent upon the individual reviewer. Details of the rating of each candidate emission factor are provided in Section 4.

REFERENCE FOR SECTION 3

1. *Technical Procedures for Developing AP-42 Emission Factors and Preparing AP-42 Sections*, EPA-454/B-93-050, Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC, October 1993.

4. AP-42 SECTION DEVELOPMENT

4.1 INTRODUCTION

This section describes how the AP-42 section on sugarbeet processing was developed. First, descriptions of data sets used for developing emission factors are presented, followed by a discussion of how emission factors were developed from the data. Finally, the development of the AP-42 section on sugarbeet processing is summarized.

4.2 REVIEW OF SPECIFIC DATA SETS

Twenty-five emission test reports were reviewed in the process of gathering data for developing emission factors. Data from one of the reports, Reference 18, were not used for emission factor development because the process data are presented without units. The other references are described in the following paragraphs.

4.2.1 Reference 1

This report documents a compliance test conducted at the Minnesota Beet Sugar Cooperative in Renville, Minnesota, on January 21, 1988. One of four stacks venting emissions from a fuel oil-fired pulp dryer (dryer A) followed by four cyclones (one for each stack) was tested for filterable PM, condensible PM, and carbon dioxide (CO_2) emissions. Particulate matter and CO_2 emissions were quantified using EPA Method 5 (including front- and back-half analysis) and EPA Method 3 (with an Orsat gas analyzer), respectively. Process data, including hourly wet beet pulp feed rates to the dryer, are included in the report. Because only one of four stacks venting dryer emissions was tested, the measured emissions were multiplied by four to estimate total dryer emissions. This calculation assumes that emissions from each of the four identical stacks are similar.

The data from this report are assigned a B rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. However, the assumption that emissions from each of the four identical stacks are similar may or may not be accurate. Pertinent test data, process data, and emission factor calculations are provided in Appendix A.

4.2.2 Reference 2

This report documents a compliance test conducted at the Minnesota Beet Sugar Cooperative in Renville, Minnesota, on December 14, 1988. One of four stacks venting emissions from a fuel oil-fired pulp dryer (dryer B) followed by four cyclones (one for each stack) was tested for filterable PM, condensible PM, and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Method 5 (including front- and back-half analysis) and EPA Method 3 (with an Orsat gas analyzer), respectively. Process data, including hourly wet beet pulp feed rates to the dryer, are included in the report. Because only one of four stacks venting dryer emissions was tested, the measured emissions were multiplied by four to estimate total dryer emissions. This calculation assumes that emissions from each of the four identical stacks are similar.

The data from this report are assigned a B rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. However, the assumption that emissions from each of the four identical stacks are similar may or may not be accurate. Pertinent test data, process data, and emission factor calculations are provided in Appendix B.

4.2.3 Reference 3

This report documents a compliance test conducted at the Minnesota Beet Sugar Cooperative in Renville, Minnesota, on November 18, 1986. A stack venting emissions from both the sugar dryer (granulator) and cooler followed by two wet scrubbers (in parallel) was tested for filterable PM and CO_2 emissions. The scrubber water flow rate is about six gallons per minute, and the pressure drop across the scrubber was not specified in the report. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 and 3 (with an Orsat gas analyzer), respectively. Because very small amounts (0.03 percent volume) of CO_2 were detected during all test runs, CO_2 emissions are assumed to be negligible. Process data, including an average sugar production rate, are included in the report.

The data from this report are assigned a B rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report (except for the

omission of the scrubber pressure drop). Pertinent test data, process data, and emission factor calculations are provided in Appendix C.

4.2.4 Reference 4

This report documents a compliance test conducted at the Minn-Dak Farmers Cooperative in Wahpeton, North Dakota, on October 18, 1983. Two stacks venting emissions from a lignite coal-fired pulp dryer followed by a bank of 28 cyclones were tested for filterable PM, sulfur dioxide (SO_2), and CO_2 emissions. The exhaust stream following the cyclones is split. Most of the exhaust is released through a stack, and a portion of the exhaust is used as a heat source for the flume water heater prior to release to the atmosphere. The two stacks tested were the main exhaust stack and the flume water heater stack, which vent all of the emissions from the dryer. Particulate matter, SO_2, and CO_2 emissions were quantified using EPA Methods 5 (including front- and back-half analysis), 6, and 3 (with an Orsat gas analyzer), respectively. Process data, including wet beet pulp feed rates to the dryer (during each test run), are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix D.

4.2.5 Reference 5

This report documents a test conducted at the Amalgamated Sugar Company in Nampa, Idaho, on October 14 through December 3, 1992. The purpose of the test was to satisfy the requirements of a consent order from the Idaho Department of Health and Welfare. Three coal-fired pulp dryers (north, central, and south dryers) were tested for filterable and condensible PM emissions, the north and central dryers were tested for aldehyde emissions, and the north dryer was tested for semi-volatile organic compound (SVOC) emissions. In addition, the B-side first carbonation tank and second carbonation heater vents (venting emissions from the B-side first evaporator) were tested for SVOC emissions, and the B-side second carbonation tank, A-side No. 2 thin juice heater vent (venting emissions from the A-side first evaporator), and B-side second carbonation heater vent (venting emissions from the B-side first evaporator) were tested for aldehyde emissions. Filterable PM, condensible PM, aldehyde, and SVOC emissions were quantified using

EPA Method 5, EPA Method 202, Modified EPA Method 5 (midget and standard impingers), and SW846 Method 0010, respectively. Table 4-1 shows a summary of the testing conducted, data ratings, and important details about the testing. Pertinent test data, process data, and emission factor calculations are provided in Appendix E.

4.2.6 Reference 6

This report documents a compliance test conducted at the Monitor Bay Sugar Company in Bay City, Michigan, on October 12, 1992. Two stacks, the north and south stacks, venting emissions from natural gas-fired pulp dryer No. 3 were tested for filterable PM and CO_2 emissions. Each stack was equipped with multiclones followed by a wet scrubber operating with a pressure drop of about 4 inches water column (in. w.c.). Particulate matter and CO_2 emissions were quantified using EPA Methods 5 and 3 (with an Orsat gas analyzer), respectively. Process data, including hourly wet beet pulp feed rates to the dryer, are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix F.

4.2.7 Reference 7

This report documents a compliance test conducted at the Monitor Bay Sugar Company in Bay City, Michigan, on October 13, 1992. Natural gas-fired pulp dryer No. 2, followed by multiclones and a wet scrubber operating with a pressure drop of about 4 in. w.c., was tested for filterable PM and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 and 3 (with an Orsat gas analyzer), respectively. Process data, including hourly wet beet pulp feed rates to the dryer, are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix G.

TABLE 4-1. REFERENCE 5; TESTS CONDUCTED AND DATA RATINGS

Source tested	Pollutant	No. of test runs	Data rating	Comments
North pulp dryer	Filterable PM	7	NR	Scrubber not typical
	Condensible PM	7	NR	
	Aldehydes	6	C	Incomplete data sets included in report
	SVOC[a]	6	C	Incomplete data sets included in report; production rates assumed similar to rates during aldehyde tests; some equipment problems occurred
Central pulp dryer	Filterable PM	3	A	Sum of emissions from east and west stacks; scrubber parameters--4-inch pressure drop, no water sprays, low impingement velocity
	Condensible PM	3	A	
	Aldehydes	3	C	Incomplete data sets included in report
South pulp dryer	Filterable PM	4	B	Emission from one of two stacks were sampled and doubled to represent both stacks; run 5 not used because scrubber was not operating typically; scrubber parameters--4-inch pressure drop, water sprays, high impingement velocity
	Condensible PM	4	B	
B-side first carbonation tank	SVOC	3	B	Average process rate in 1,000 gal/hr; samples were diluted during analysis
B-side second carbonation tank	Aldehydes	1	D	Only one test run conducted; process rate in 1,000 gal/hr
A-side No. 2 thin juice heater (first evaporator)	Aldehydes	3	C	Process rates in 1,000 gal/hr; high stack gas moisture content and temperature caused several problems that may have affected results
B-side second carbonation heater (first evaporator)	Aldehydes	3	C	Only one set of flow data for three test runs; process rates in 1,000 gal/hr; high stack gas moisture content and temperature caused several problems that may have affected results
	SVOC	4	C	Process rates in 1,000 gal/hr; high stack gas moisture content and temperature caused several problems that may have affected results

[a]Data for a specific pollutant are rated C if three or more of the six test runs detected the pollutant. If a specific pollutant was detected in less than three test runs, the data for that pollutant are not rated.

4.2.8 Reference 8

This report documents a compliance test conducted at the Monitor Bay Sugar Company in Bay City, Michigan, on October 14, 1992. Natural gas-fired pulp dryer No. 1, followed by multiclones and a wet scrubber operating with a pressure drop of about 4 in. w.c., was tested for filterable PM and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 and 3 (with an Orsat gas analyzer), respectively. Process data, including hourly wet beet pulp feed rates to the dryer, are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix H.

4.2.9 Reference 9

This report documents a compliance test conducted at the Western Sugar Company in Billings, Montana, on December 8-9, 1988. The east natural gas-fired pulp dryer, followed by a wet scrubber, was tested for filterable PM, condensible inorganic PM, and CO_2 emissions. Particulate matter emissions were quantified using EPA Method 5 (including front- and back-half analyses) and CO_2 emissions were measured using EPA Method 3 (with an Orsat gas analyzer). Process data, including an average wet beet pulp feed rate to the dryer, are included in the report.

The data from this report are assigned a B rating. The test methodology appears to be sound and sufficient process data are provided. However, the scrubber pressure drop is not provided in the report, and only an average process rate is provided. Pertinent test data, process data, and emission factor calculations are provided in Appendix I.

4.2.10 Reference 10

This report documents a compliance test conducted at the Western Sugar Company in Billings, Montana, on January 23-25, 1990. The west natural gas-fired pulp dryer, followed by a wet scrubber, was tested for filterable PM, condensible inorganic PM, and CO_2 emissions. Particulate matter emissions were quantified using EPA Method 5 (including front- and back-half analyses) and

CO_2 emissions were measured using EPA Method 3 (with an Orsat gas analyzer). Process data, including run-by-run wet beet pulp feed rates to the dryer, are included in the report.

The data from this report are assigned a B rating. The test methodology appears to be sound and sufficient process data are provided. However, the scrubber pressure drop is not provided in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix J.

4.2.11 Reference 11

This report documents a compliance test conducted at the Western Sugar Company in Billings, Montana, on January 23-25, 1991. A natural gas-fired pulp dryer, followed by a wet scrubber, was tested for filterable PM and condensible inorganic PM emissions. Particulate matter emissions were quantified using EPA Method 5 (including front- and back-half analyses). An average wet beet pulp feed rate to the dryer is included in the report. The pellet cooler was also tested, but process data for the pellet cooler are not provided in the report.

The data for emissions from the pulp dryer are assigned a C rating. The test methodology appears to be sound and process data are provided. However, only an average process rate based on historical data is provided, and the scrubber pressure drop in not provided in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix K.

4.2.12 Reference 12

This report documents a compliance test conducted at the Western Sugar Company in Scottsbluff, Nebraska, on December 12-13, 1989. A pulverized coal-fired pulp dryer, followed by a cyclone and wet scrubber (operating with a pressure drop of about 2 in. w.c.) on each of two stacks, was tested for filterable PM, condensible inorganic PM, and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 (including front- and back-half analyses) and 3, respectively. Process data, including run-by-run wet beet pulp feed rates to the dryer, are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix L.

4.2.13 Reference 13

This report documents a compliance test conducted at Holly Sugar Corporation in Sidney, Montana, on October 19-23, 1993. Two No. 6 fuel oil-fired pulp dryers (north and south dryers) were tested for filterable PM, condensible inorganic PM, PM-10, SO_2, and CO_2 emissions. Emissions from the dryers were ducted to four stacks (two for each dryer), each equipped with a dry scrubber with skimmer fans and cyclones. Filterable PM, condensible PM, PM-10, SO_2, and CO_2 emissions were quantified using EPA Methods 5, 202, 201A, 6, and 3 (with an Orsat gas analyzer), respectively. Process data, including wet beet pulp feed rates to the dryer (during each test run), are included in the report. Plant personnel indicated that half of the beet pulp processed is fed to each dryer, and the process data are based on this estimate.

Several problems and deficiencies were encountered in this report. First, only one valid PM-10 test run (Run 1) was conducted on the north dryer (east stack), and two valid PM-10 test runs were conducted on the north dryer (west stack). To estimate PM-10 emissions from the north dryer, the PM-10 emission rate from each of the three single stack test runs was doubled. Second, Run 1 on both south dryer stacks was superisokinetic, and the data from this run are not used. Third, Run 3 on the south dryer (east stack) was subisokinetic. Therefore, to estimate emissions from the south dryer for Run 3, the south dryer (west stack) emission rates (for each pollutant) were doubled. Fourth, only one valid PM-10 test run (Run 2) was conducted on the south dryer (east stack), and two valid PM-10 test runs were conducted on the south dryer (west stack). To estimate PM-10 emissions from the south dryer, the PM-10 emission rate from each of the three single stack test runs was doubled.

The filterable PM, condensible PM, SO_2, and CO_2 data for the north dryer test are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. The PM-10 data for the north and south dryers are assigned a B rating because each test run on each dryer included PM-10 measurements from only one of two stacks, and the emission rates were doubled to represent both stacks. The filterable PM, condensible PM, SO_2, and CO_2 data for the south dryer test are assigned a B rating because only two valid test

runs (Runs 2 and 4) were conducted on the east stack, and the emission rates measured during Run 3 on the west stack were doubled to represent both stacks. Pertinent test data, process data, and emission factor calculations are provided in Appendix M.

4.2.14 Reference 14

This report documents a compliance test conducted at Holly Sugar Corporation in Santa Maria, California, on June 4-14, 1991. Three fuel oil-fired pulp dryers, each followed by two cyclones (and an air recirculation system), were tested for filterable PM, condensible inorganic PM, condensible organic PM, CO_2, SO_2, carbon monoxide (CO), nitrogen oxide (NO_x), total organic compounds (TOC), and methane emissions. One of two stacks on each dryer was tested, and emissions from each stack were multiplied by two to estimate the total emissions from each dryer. Also, a beet pulp cooler was tested for PM emissions, but all three test runs are invalid because the isokinetic ratios were all far below 90 percent. Particulate matter emissions were quantified using EPA Method 5 (including front- and back-half analyses). Continuous monitoring of CO_2, SO_2, CO, and NO_x emissions was conducted according to CARB Method 100, which appears to be similar to EPA-approved continuous monitoring methods for the same pollutants. Sulfur dioxide emissions were not detected during any test run. Total organic compound and methane emissions were quantified by drawing gas samples into tedlar bags and analyzing the samples with a flame ionization detector gas chromatograph (similar to EPA Methods 18 and 25A). The report presents concentrations of C1 through C6 hydrocarbons, and TOC concentrations were calculated on an "as carbon" basis by multiplying the individual C1 through C6 concentrations by the corresponding number of carbons (C1 concentration multiplied by 1, C2 concentration multiplied by 2, etc.) and summing the adjusted concentrations. The reported C1 concentrations were assumed to be entirely methane, and were used to determine methane emissions. Production rates are provided for each dryer, but data needed to convert the production rates to dryer feed rates are only provided for dryer No. 1. Because the reported production rates are the same for the three dryers, the average feed rate calculated for dryer No. 1 is assumed to equal the feed rate for dryers 2 and 3.

The data for dryer No. 1 are assigned a B rating because only one of two stacks from the dryer was tested. Otherwise, the test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. The data for dryers 2 and 3 are assigned a C rating because the dryer feed rates are estimated using the average feed rate for dryer No. 1 and

only one of two stacks from each dryer was tested. Pertinent test data, process data, and emission factor calculations are provided in Appendix N.

4.2.15 Reference 15

This report documents a compliance test conducted at the Great Lakes Sugar Cooperative in Fremont, Ohio, on December 2, 1992. A fuel oil-fired pulp dryer, followed by a cyclone, was tested for filterable PM, CO_2, and SO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 and 3 (with a Fyrite gas analyzer), respectively. Sulfur dioxide emissions were measured using a modified EPA Method 8 test, which was a Method 8 analysis of the impingers from the Method 5 sampling train. Three test runs were conducted, but the first run was not valid because the isokinetic variation was not within the prescribed limits. Process data, including run-by-run wet beet pulp feed rates to the dryer, are included in the report.

The filterable PM and SO_2 data from this report are assigned a B rating because only two valid test runs were conducted. The test methodology appears to be sound, extensive process data are provided, and adequate detail is included in the report. The CO_2 data from this report are assigned a C rating because of the relative inaccuracy of Fyrite analyzers. Pertinent test data, process data, and emission factor calculations are provided in Appendix O.

4.2.16 Reference 16

This report documents a compliance test conducted at the American Crystal Sugar Company in East Grand Forks, Minnesota, on February 24, 1994. Three coal-fired pulp dryers (dryers A, B, and C), each controlled by multiclones, were tested for filterable PM, condensible organic PM, CO_2, and NO_x emissions. In addition, a cascade impactor was used to determine the particle size distribution during a single test run for pulp dryer B. Particulate matter, CO_2, and NO_x emissions were quantified using EPA Methods 5 (including front- and back-half analyses), 3 (with an Orsat gas analyzer), and 7, respectively. Three test runs were conducted for each pollutant and dryer, but only one valid NO_x test run was conducted on dryers B and C. The NO_x data for dryers B and C are not used for emission factor development. Process data, including hourly wet beet pulp feed rates to the dryer, are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, extensive process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix P.

4.2.17 Reference 17

This report documents a compliance test conducted at the American Crystal Sugar Company in Moorhead, Minnesota, on January 21, 1992. The south coal-fired pulp dryer was tested for filterable PM and CO_2 emissions both before and after the control system, which consisted of multiclones and a stack filter system. In addition, condensible organic PM emissions were measured following the control system. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 (including front- and back-half analyses) and 3 (with an Orsat gas analyzer), respectively. Three simultaneous inlet and outlet test runs were conducted under each of four different exhaust gas recycle rates. Because the exhaust gas recycle rates had little effect on the magnitude of PM and CO_2 emissions, the twelve test runs are averaged together and considered a single test. Process data, including hourly wet beet pulp feed rates to the dryer, are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, extensive process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix Q.

4.2.18 Reference 19

This report documents a compliance test conducted at the American Crystal Sugar Company in Crookston, Minnesota, on March 11, 1993. A venturi scrubber-controlled sugar cooler was tested for filterable PM, condensible inorganic PM, condensible organic PM, and CO_2 emissions at the scrubber outlet. The scrubber operated with a pressure drop between 5 and 7 in. w.c. during testing. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 (including front- and back-half analyses) and 3 (with an Orsat gas analyzer), respectively. However, CO_2 was not detected during any test run. Three test runs were conducted, and process data, including run-by-run sugar cooler throughput rates, are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix R.

4.2.19 Reference 20

This report documents a compliance test conducted at the American Crystal Sugar Company in East Grand Forks, Minnesota, on November 11, 1993. Three coal-fired pulp dryers (dryers A, B, and C), each controlled by multiclones, were tested for filterable PM, condensible organic PM, CO_2, SO_2, CO, NO_x, and TOC emissions. Also, two stacks venting pellet cooler emissions and one stack venting emissions from a pellet loadout operation were tested for PM emissions, but process data are not provided for these tests. Particulate matter, CO_2, NO_x, and CO emissions were quantified using EPA Methods 5 (including front- and back-half analyses), 3 (with an Orsat gas analyzer), 7, and 10, respectively. Sulfur dioxide samples were collected in the back half of the Method 5 sampling train and were analyzed in accordance with the large impinger version of EPA Method 6. Total organic compound emissions were quantified by drawing gas samples into tedlar bags and analyzing the samples with a flame ionization detector calibrated against propane (similar to EPA Method 25A). The TOC data are reported on an "as carbon" basis and were converted to an "as methane" basis using the ratio of the molecular weights of methane and carbon. Process data, including hourly wet beet pulp feed rates to the dryer, are only provided for dryer A.

The data for dryer A are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. The data for the other sources tested are not rated because the necessary process data are not provided. Pertinent test data, process data, and emission factor calculations are provided in Appendix S.

4.2.20 Reference 21

This report documents a compliance test conducted at the American Crystal Sugar Company in Moorehead, Minnesota, on November 14, 1990. A sugar cooler and a sugar granulator, each controlled by a mechanical centrifugal separator with water sprays (rotoclone), were tested for filterable PM, condensible organic PM, and CO_2 emissions at the rotoclone outlets. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 (including front- and back-half

analyses) and 3 (with an Orsat gas analyzer), respectively. Because very small amounts (0.03 percent volume) of CO_2 were detected during all test runs, CO_2 emissions are assumed to be negligible. Three test runs were conducted, and process data, including run-by-run sugar cooler throughput rates (equivalent to sugar granulator output rates), are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix T.

4.2.21 Reference 22

This report documents a compliance test conducted at the American Crystal Sugar Company in Crookston, Minnesota, on February 22, 1993. The No.1 and No.2 pulp dryers, each controlled by multiclones and a stack filter system, were tested for filterable PM, condensible organic PM, and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 (including front- and back-half analyses) and 3 (with an Orsat gas analyzer), respectively. Five valid test runs were conducted on dryer No. 1, and nine valid runs were conducted on dryer No. 2. Process data, including run-by-run wet pulp feed rates to the dryers, are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix U.

4.2.22 Reference 23

This report documents a compliance test conducted at the Michigan Sugar Company in Caro, Michigan, on December 14, 1989. A natural gas-fired pulp dryer, followed by multiclones, was tested for filterable PM and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 17 and 3 (with an Orsat gas analyzer), respectively. Five test runs were conducted, but Runs 1 and 3 were not valid and were not used to determine the emissions from the dryer. Process data are included in the report, and run-by-run dryer feed rates were calculated using the process data.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix V.

4.2.23 Reference 24

This report documents a compliance test conducted at the Michigan Sugar Company in Carrollton, Michigan, on November 14 and 16, 1989. A natural gas-fired pulp dryer, followed by multiclones, was tested for filterable PM and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 17 and 3 (with an Orsat gas analyzer), respectively. Three test runs were conducted while the dryer operated at two different aspiration rates, but one run from each test was not valid because the isokinetic variation was not within the prescribed limits. The aspiration rate did not appear to affect PM or CO_2 emissions; therefore, data from the four valid test runs are averaged. Process data are included in the report, and run-by-run dryer feed rates were calculated using the process data.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix W.

4.2.24 Reference 25

This report documents a compliance test conducted at the Michigan Sugar Company in Croswell, Michigan, on November 19, 1990. A fuel oil-fired pulp dryer, followed by multiclones, was tested for filterable PM and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 and 3 (with an Orsat gas analyzer), respectively. Three test runs were conducted, process data are included in the report, and run-by-run dryer feed rates were calculated using the process data.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix X.

4.2.25 Review of FIRE, XATEF, and SPECIATE Data Base Emission Factors

Emission factors for NO_x, sulfur oxides (SO_x) and VOC from dryers were found in the FIRE data base. However, the type of dryer is not specified, and the basis for the emission factors, raw beets, is incorrect because raw beets are not fed to a dryer at any point during processing operations. Therefore, these data are not included in the AP-42 section. Emission factors for sugarbeet processing from the SPECIATE data base are based solely on engineering judgment and are not included in the AP-42 section. Relevant data were not found in XATEF.

4.3 DEVELOPMENT OF CANDIDATE EMISSION FACTORS

Emission factors for rotary drum pulp dryers, first and second carbonation tanks, first evaporators, sugar coolers, and sugar granulators were developed using data from the references described in Section 4.2 of this document. Table 4-2 summarizes the test data from References 1 through 25, and Table 4-3 presents the emission factors developed using these data. The emission factor ratings assigned to the factors for the revised AP-42 section are based on the guidelines presented in Section 3.3 of this report. The main criteria used in rating the factors are as follows:

1. Factors based on C- or D- rated data are assigned a rating of E; and

2. Factors based on B-rated data or a combination of A- and B-rated data generally cannot be assigned a rating higher than C, and if the data are from a small number of facilities that are unlikely to represent a random sample of the industry, the factor generally is assigned a D-rating.

Emission factors were developed by grouping the data from similar combinations of source, pollutant, and control device, discarding the inferior data sets, and averaging the emission factors derived from each data set. In some cases, data were available from multiple tests on the same source. In such cases, the emission factors from the tests on that source were averaged first, and the resulting factor was then averaged with the factors from other similar sources. The following paragraphs describe how the data presented in Table 4-2 were used to develop the emission factors presented in Table 4-3. The emission factor units for the pulp dryers are mass of pollutant per mass of pulp dryer feed, and the units for the tanks and evaporators are mass of pollutant per volume of juice throughput.

TABLE 4-2. SUMMARY OF EMISSION DATA FOR SUGARBEET PROCESSING[a]

Source	Control device	Pollutant	No. of test runs	Data rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. No.
Oil-fired pulp dryer	Cyclone	Filterable PM	3	B	0.61-0.69 (1.2-1.4)	0.64 (1.3)	1
Oil-fired pulp dryer	Cyclone	Condensible inorganic PM	3	B	0.0092-0.017 (0.018-0.035)	0.014 (0.027)	1
Oil-fired pulp dryer	Cyclone	Condensible organic PM	3	B	0.015-0.018 (0.029-0.036)	0.016 (0.032)	1
Oil-fired pulp dryer	Cyclone	CO_2	3	B	150-190 (300-370)	170 (330)	1
Oil-fired pulp dryer	Cyclone	Filterable PM	3	B	0.33-1.4 (0.66-2.8)	0.72 (1.4)	2
Oil-fired pulp dryer	Cyclone	Condensible inorganic PM	3	B	0.027-0.050 (0.055-0.10)	0.040 (0.079)	2
Oil-fired pulp dryer	Cyclone	Condensible organic PM	3	B	0.020-0.063 (0.040-0.093)	0.043 (0.086)	2
Oil-fired pulp dryer	Cyclone	CO_2	3	B	190-360 (370-730)	270 (550)	2
Sugar dryer and cooler	Wet scrubber	Filterable PM	3	B	0.015-0.019 (0.029-0.039)	0.018 (0.035)	3
Sugar dryer and cooler	Wet scrubber	CO_2	3	B	ND	Negligible	3
Coal-fired pulp dryer	Multiple cyclones	Filterable PM	3	A	0.48-0.66 (0.97-1.3)	0.59 (1.2)	4
Coal-fired pulp dryer	Multiple cyclones	SO_2	3	A	0.66-0.69 (1.3-1.4)	0.68 (1.4)	4
Coal-fired pulp dryer	Multiple cyclones	CO_2	3	A	220-250 (430-500)	230 (460)	4
Coal-fired pulp dryer	Wet scrubber	Filterable PM	3	A	0.18-0.23 (0.36-0.46)	0.21 (0.42)	5
Coal-fired pulp dryer	Wet scrubber	Condensible PM	3	A	0.18-0.33 (0.37-0.66)	0.23 (0.47)	5
Coal-fired pulp dryer	Wet scrubber	Filterable PM	4	B	0.12-0.23 (0.23-0.47)	0.17 (0.34)	5
Coal-fired pulp dryer	Wet scrubber	Condensible PM	4	B	0.11-0.25 (0.22-0.50)	0.17 (0.33)	5
Coal-fired pulp dryer	Wet scrubber	Formaldehyde	6	C	ND	0.0042 (0.0083)	5
Coal-fired pulp dryer	Wet scrubber	Acetaldehyde	6	C	ND	0.0065 (0.013)	5
Coal-fired pulp dryer	Wet scrubber	Acrolein	6	C	ND	0.0030 (0.0060)	5
Coal-fired pulp dryer	Wet scrubber	Crotonaldehyde	6	C	ND	0.0012 (0.0024)	5
Coal-fired pulp dryer	Wet scrubber	Benzoic acid	6	C	ND	0.0014 (0.0028)	5
Coal-fired pulp dryer	Wet scrubber	Benzaldehyde	6	C	ND	0.00070 (0.0014)	5
Coal-fired pulp dryer	Wet scrubber	Bis(2-ethylhexyl)phthalate	6	C	ND	0.00075 (0.0015)	5
Coal-fired pulp dryer	Wet scrubber	Phenol	3	C	ND	0.00016 (0.00032)	5
Coal-fired pulp dryer	Wet scrubber	2-nitrophenol	5	C	ND	9.0×10^{-5} (0.00018)	5
Coal-fired pulp dryer	Wet scrubber	4-nitrophenol	4	C	ND	7.0×10^{-5} (0.00014)	5
Coal-fired pulp dryer	Wet scrubber	4-methylphenol	5	C	ND	6.5×10^{-5} (0.00013)	5
Coal-fired pulp dryer	Wet scrubber	Naphthalene	6	C	ND	5.5×10^{-5} (0.00011)	5
Coal-fired pulp dryer	Wet scrubber	Di-n-butylphthalate	4	C	ND	2.6×10^{-5} (5.2×10^{-5})	5

TABLE 4-2. (continued)

Source	Control device	Pollutant	No. of test runs	Data rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. No.
Coal-fired pulp dryer	Wet scrubber	Benzyl alcohol	5	C	ND	3.6×10^{-5} (7.1×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	2,4-dinitrophenol	2	NR	ND	2.6×10^{-5} (5.1×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	2-methylphenol	5	C	ND	1.7×10^{-5} (3.4×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	Nitrobenzene	4	C	ND	9.5×10^{-6} (1.9×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	2,4-dimethylphenol	4	C	ND	1.3×10^{-5} (2.5×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	2-methylnaphthalene	5	C	ND	8.5×10^{-6} (1.7×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	4,6-Dinitro-2-methylphenol	1	NR	ND	7.5×10^{-6} (1.5×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	Dibenzofuran	5	C	ND	5.5×10^{-6} (1.1×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	Phenanthrene	5	C	ND	6.0×10^{-6} (1.2×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	Diethylphthalate	3	C	ND	4.9×10^{-6} (9.8×10^{-6})	5
Coal-fired pulp dryer	Wet scrubber	Acenaphthylene	4	C	ND	8.5×10^{-7} (1.7×10^{-6})	5
Coal-fired pulp dryer	Wet scrubber	Butylbenzylphthalate	1	NR	ND	5.5×10^{-6} (1.1×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	Fluoranthene	1	NR	ND	3.0×10^{-6} (6.0×10^{-6})	5
Coal-fired pulp dryer	Wet scrubber	Anthracene	1	NR	ND	2.5×10^{-6} (5.0×10^{-6})	5
Coal-fired pulp dryer	Wet scrubber	Formaldehyde	3	C	ND	0.0030 (0.0059)	5
Coal-fired pulp dryer	Wet scrubber	Acetaldehyde	3	C	ND	0.0080 (0.016)	5
Coal-fired pulp dryer	Wet scrubber	Acrolein	3	C	ND	0.0046 (0.0092)	5
Coal-fired pulp dryer	Wet scrubber	Crotonaldehyde	3	C	ND	0.00080 (0.0016)	5
First carbonation tank[b]	None	Benzaldehyde	3	B	9.5×10^{-5}-1.2×10^{-4}	1.1×10^{-4}	5
First carbonation tank[b]	None	Bis(2-ethylhexyl)phthalate	3	B	9.6×10^{-6}-1.8×10^{-5}	1.2×10^{-5}	5
First carbonation tank[b]	None	Benzoic acid	3	B	6.2×10^{-6}-1.2×10^{-5}	8.4×10^{-6}	5
First carbonation tank[b]	None	Benzyl alcohol	3	B	4.7×10^{-6}-5.4×10^{-6}	5.0×10^{-6}	5
First carbonation tank[b]	None	2,4-dinitrophenol	3	B	NP-1.1×10^{-5}	NP	5
First carbonation tank[b]	None	Naphthalene	3	B	1.5×10^{-6}-2.4×10^{-6}	2.0×10^{-6}	5
First carbonation tank[b]	None	Phenanthrene	3	B	1.3×10^{-6}-1.4×10^{-6}	1.4×10^{-6}	5
First carbonation tank[b]	None	Phenol	3	B	1.1×10^{-6}-1.4×10^{-6}	1.3×10^{-6}	5
First carbonation tank[b]	None	4-methylphenol	3	B	5.2×10^{-7}-8.7×10^{-7}	6.6×10^{-7}	5
First carbonation tank[b]	None	2-methylnaphthalene	3	B	2.8×10^{-7}-6.4×10^{-7}	5.1×10^{-7}	5
First carbonation tank[b]	None	Acenaphthene	3	B	NP-1.5×10^{-6}	NP	5

TABLE 4-2. (continued)

Source	Control device	Pollutant	No. of test runs	Data rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. No.
Second carbonation tank[b]	None	Formaldehyde	1	D	ND	1.6×10^{-5}	5
Second carbonation tank[b]	None	Acetaldehyde	1	D	ND	0.0043	5
Second carbonation tank[b]	None	Acrolein	1	D	ND	2.4×10^{-4}	5
Second carbonation tank[b]	None	Crotonaldehyde	1	D	ND	3.0×10^{-5}	5
First evaporator[c]	None	Formaldehyde	3	C	2.5×10^{-7}-2.8×10^{-6}	1.3×10^{-6}	5
First evaporator[c]	None	Acetaldehyde	3	C	6.2×10^{-5}-1.4×10^{-4}	1.1×10^{-4}	5
First evaporator[c]	None	Acrolein	3	C	6.5×10^{-8}-2.6×10^{-7}	1.5×10^{-7}	5
First evaporator[c]	None	Crotonaldehyde	3	C	9.8×10^{-8}-3.0×10^{-7}	1.9×10^{-7}	5
First evaporator[c]	None	Formaldehyde	3	C	6.9×10^{-8}-1.5×10^{-7}	1.0×10^{-7}	5
First evaporator[c]	None	Acetaldehyde	3	C	1.5×10^{-5}-3.3×10^{-5}	2.4×10^{-5}	5
First evaporator[c]	None	Acrolein	3	C	5.6×10^{-7}-7.9×10^{-7}	6.8×10^{-7}	5
First evaporator[c]	None	Crotonaldehyde	3	C	6.9×10^{-8}-1.2×10^{-7}	9.5×10^{-8}	5
First evaporator[c]	None	Benzaldehyde	4	C	9.3×10^{-7}-3.5×10^{-6}	2.2×10^{-6}	5
First evaporator[c]	None	Bis(2-ethylhexyl)phthalate	4	C	8.0×10^{-8}-8.2×10^{-7}	3.7×10^{-7}	5
First evaporator[c]	None	Benzyl alcohol	4	C	6.4×10^{-8}-2.5×10^{-7}	1.8×10^{-7}	5
First evaporator[c]	None	Naphthalene	4	C	NP-5.2×10^{-8}	2.5×10^{-8}	5
First evaporator[c]	None	4-methylphenol	4	C	NP-9.5×10^{-8}	NP	5
First evaporator[c]	None	Phenanthrene	4	C	6.5×10^{-9}-3.0×10^{-8}	1.6×10^{-8}	5
First evaporator[c]	None	Isophorone	4	C	NP-5.7×10^{-8}	NP	5
First evaporator[c]	None	Benzoic acid	4	C	NP-5.0×10^{-8}	NP	5
First evaporator[c]	None	Phenol	4	C	NP-3.3×10^{-8}	1.2×10^{-8}	5
First evaporator[c]	None	Diethylphthalate	4	C	NP-4.6×10^{-8}	NP	5
First evaporator[c]	None	Pyridine	4	C	1.4×10^{-8}-4.6×10^{-8}	3.4×10^{-8}	5
First evaporator[c]	None	Dibenzofuran	4	C	NP-1.7×10^{-9}	NP	5
First evaporator[c]	None	Di-n-butylphthalate	4	C	NP-3.1×10^{-9}	1.1×10^{-9}	5
Natural gas-fired pulp dryer	Multiple cyclones and wet scrubber	Filterable PM	3	A	0.13-0.16 (0.27-0.32)	0.15 (0.30)	6
Natural gas-fired pulp dryer	Multiple cyclones and wet scrubber	CO_2	3	A	61-73 (120-150)	68 (140)	6

TABLE 4-2. (continued)

Source	Control device	Pollutant	No. of test runs	Data rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. No.
Natural gas-fired pulp dryer	Multiple cyclones and wet scrubber	Filterable PM	3	A	0.078-0.091 (0.16-0.18)	0.082 (0.16)	7
Natural gas-fired pulp dryer	Multiple cyclones and wet scrubber	CO_2	3	A	33-41 (67-82)	37 (73)	7
Natural gas-fired pulp dryer	Multiple cyclones and wet scrubber	Filterable PM	3	A	0.070-0.090 (0.14-0.18)	0.078 (0.16)	8
Natural gas-fired pulp dryer	Multiple cyclones and wet scrubber	CO_2	3	A	39-56 (78-110)	45 (90)	8
Natural gas-fired pulp dryer	Wet scrubber	Filterable PM	3	B	0.030-0.047 (0.060-0.093)	0.038 (0.075)	9
Natural gas-fired pulp dryer	Wet scrubber	Condensible inorganic PM	3	B	0.0074-0.0081 (0.015-0.016)	0.0077 (0.015)	9
Natural gas-fired pulp dryer	Wet scrubber	CO_2	3	B	28-30 (57-61)	29 (58)	9
Natural gas-fired pulp dryer	Wet scrubber	Filterable PM	3	B	0.039-0.067 (0.078-0.13)	0.055 (0.11)	10
Natural gas-fired pulp dryer	Wet scrubber	Condensible inorganic PM	3	B	0.0054-0.019 (0.011-0.038)	0.014 (0.027)	10
Natural gas-fired pulp dryer	Wet scrubber	CO_2	3	B	68-95 (140-190)	78 (160)	10
Natural gas-fired pulp dryer	Wet scrubber	Filterable PM	3	C	0.19-0.25 (0.37-0.49)	0.22 (0.43)	11
Natural gas-fired pulp dryer	Wet scrubber	Condensible inorganic PM	3	C	0.10-0.13 (0.20-0.27)	0.12 (0.23)	11
Coal-fired pulp dryer	Cyclone and wet scrubber	Filterable PM	3	A	0.30-0.40 (0.61-0.81)	0.36 (0.72)	12
Coal-fired pulp dryer	Cyclone and wet scrubber	Condensible inorganic PM	3	A	0.022-0.029 (0.043-0.057)	0.025 (0.050)	12
Coal-fired pulp dryer	Cyclone and wet scrubber	CO_2	3	A	120-140 (250-270)	130 (260)	12
Oil-fired pulp dryer	Dry scrubber and cyclone	Filterable PM	3	A	0.32-0.45 (0.63-0.91)	0.38 (0.77)	13
Oil-fired pulp dryer	Dry scrubber and cyclone	Condensible inorganic PM	3	A	0.093-0.21 (0.19-0.42)	0.15 (0.29)	13
Oil-fired pulp dryer	Dry scrubber and cyclone	Filterable PM-10	3	B	0.20-0.27 (0.40-0.54)	0.23 (0.47)	13
Oil-fired pulp dryer	Dry scrubber and cyclone	CO_2	3	A	180-220 (360-440)	190 (390)	13
Oil-fired pulp dryer	Dry scrubber and cyclone	SO_2	3	A	0.23-0.47 (0.47-0.95)	0.31 (0.63)	13
Oil-fired pulp dryer	Dry scrubber and cyclone	Filterable PM	3	B	0.69-0.89 (1.4-1.8)	0.76 (1.5)	13

TABLE 4-2. (continued)

Source	Control device	Pollutant	No. of test runs	Data rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. No.
Oil-fired pulp dryer	Dry scrubber and cyclone	Condensible inorganic PM	3	B	0.19-0.40 (0.38-0.80)	0.27 (0.55)	13
Oil-fired pulp dryer	Dry scrubber and cyclone	Filterable PM-10	3	B	0.48-0.74 (0.97-1.5)	0.59 (1.2)	13
Oil-fired pulp dryer	Dry scrubber and cyclone	CO_2	3	B	260-310 (530-620)	290 (570)	13
Oil-fired pulp dryer	Dry scrubber and cyclone	SO_2	3	B	0.57-0.62 (1.1-1.2)	0.60 (1.2)	13
Oil-fired pulp dryer	Dual cyclones	Filterable PM	3	B	0.58-1.1 (1.2-2.2)	0.79 (1.6)	14
Oil-fired pulp dryer	Dual cyclones	Condensible inorganic PM	3	B	0.059-0.24 (0.12-0.47)	0.13 (0.26)	14
Oil-fired pulp dryer	Dual cyclones	Condensible organic PM	3	B	0-0.16 (0-0.32)	0.054 (0.11)	14
Oil-fired pulp dryer	Dual cyclones	CO_2	3	B	170-180 (340-360)	180 (350)	14
Oil-fired pulp dryer	Dual cyclones	SO_2	3	B	NP	NP	14
Oil-fired pulp dryer	Dual cyclones	CO	3	B	0.30-0.83 (0.61-1.7)	0.51 (1.01)	14
Oil-fired pulp dryer	Dual cyclones	NO_x	3	B	0.28-0.33 (0.56-0.67)	0.30 (0.60)	14
Oil-fired pulp dryer	Dual cyclones	TOC as methane	3	B	0.049-0.065 (0.098-0.13)	0.055 (0.11)	14
Oil-fired pulp dryer	Dual cyclones	Methane	3	B	0.0070-0.024 (0.014-0.048)	0.014 (0.028)	14
Oil-fired pulp dryer	Dual cyclones	Filterable PM	3	C	0.31-0.46 (0.63-0.91)	0.39 (0.78)	14
Oil-fired pulp dryer	Dual cyclones	Condensible inorganic PM	3	C	0.052-0.16 (0.10-0.33)	0.11 (0.23)	14
Oil-fired pulp dryer	Dual cyclones	Condensible organic PM	3	C	0.0019-0.0036 (0.0038-0.0072)	0.0029 (0.0057)	14
Oil-fired pulp dryer	Dual cyclones	CO_2	3	C	83-170 (170-340)	130 (260)	14
Oil-fired pulp dryer	Dual cyclones	SO_2	3	C	NP	NP	14
Oil-fired pulp dryer	Dual cyclones	CO	3	C	0.44-0.47 (0.88-0.94)	0.46 (0.92)	14
Oil-fired pulp dryer	Dual cyclones	NO_x	3	C	0.17-0.19 (0.35-0.39)	0.18 (0.37)	14
Oil-fired pulp dryer	Dual cyclones	TOC as methane	3	C	0.086-0.092 (0.17-0.18)	0.089 (0.18)	14
Oil-fired pulp dryer	Dual cyclones	Methane	3	C	0.0085-0.038 (0.017-0.077)	0.020 (0.040)	14
Oil-fired pulp dryer	Dual cyclones	Filterable PM	3	C	0.56-0.76 (1.1-1.5)	0.64 (1.3)	14
Oil-fired pulp dryer	Dual cyclones	Condensible inorganic PM	3	C	0.021-0.030 (0.042-0.059)	0.026 (0.052)	14
Oil-fired pulp dryer	Dual cyclones	Condensible organic PM	3	C	0.0022-0.0046 (0.0043-0.0093)	0.0034 (0.0068)	14
Oil-fired pulp dryer	Dual cyclones	CO_2	3	C	120-170 (240-340)	140 (280)	14
Oil-fired pulp dryer	Dual cyclones	SO_2	3	C	NP	NP	14
Oil-fired pulp dryer	Dual cyclones	CO	3	C	0.43-0.46 (0.86-0.92)	0.45 (0.89)	14

TABLE 4-2. (continued)

Source	Control device	Pollutant	No. of test runs	Data rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. No.
Oil-fired pulp dryer	Dual cyclones	NO_x	3	C	0.19-0.20 (0.38-0.41)	0.20 (0.39)	14
Oil-fired pulp dryer	Dual cyclones	TOC as methane	3	C	0.084-0.10 (0.17-0.21)	0.091 (0.18)	14
Oil-fired pulp dryer	Dual cyclones	Methane	3	C	0.013-0.020 (0.026-0.041)	0.017 (0.034)	14
Oil-fired pulp dryer	Multiple cyclones	Filterable PM	2	B	0.24-0.30 (0.49-0.61)	0.27 (0.55)	15
Oil-fired pulp dryer	Multiple cyclones	CO_2	2	C	200-230 (400-460)	220 (430)	15
Oil-fired pulp dryer	Multiple cyclones	SO_2	2	B	0.64-0.65 (1.3-1.3)	0.65 (1.3)	15
Coal-fired pulp dryer[d]	Multiple cyclones	Filterable PM	3	A	0.21-0.25 (0.41-0.49)	0.22 (0.44)	16
Coal-fired pulp dryer[d]	Multiple cyclones	Condensible organic PM	3	A	0.027-0.030 (0.054-0.060)	0.028 (0.056)	16
Coal-fired pulp dryer[d]	Multiple cyclones	CO_2	3	A	160-180 (320-360)	170 (340)	16
Coal-fired pulp dryer[d]	Multiple cyclones	NO_x	3	A	0.25-0.33 (0.50-0.66)	0.28 (0.57)	16
Coal-fired pulp dryer	Multiple cyclones	Filterable PM	3	A	0.33-0.48 (0.65-0.96)	0.38 (0.76)	16
Coal-fired pulp dryer	Multiple cyclones	Condensible organic PM	3	A	0.016-0.027 (0.032-0.053)	0.021 (0.041)	16
Coal-fired pulp dryer	Multiple cyclones	CO_2	3	A	210-280 (410-560)	230 (460)	16
Coal-fired pulp dryer	Multiple cyclones	Filterable PM	3	A	0.26-0.33 (0.53-0.67)	0.28 (0.57)	16
Coal-fired pulp dryer	Multiple cyclones	Condensible organic PM	3	A	0.019-0.021 (0.037-0.041)	0.019 (0.039)	16
Coal-fired pulp dryer	Multiple cyclones	CO_2	3	A	180-210 (350-420)	200 (390)	16
Coal-fired pulp dryer	None	Filterable PM	12	A	1.9-2.6 (3.9-5.1)	2.2 (4.4)	17
Coal-fired pulp dryer	None	CO_2	12	A	170-240 (350-490)	150 (310)	17
Coal-fired pulp dryer	Multiple cyclones and stack filter system	Filterable PM	12	A	0.25-0.35 (0.50-0.70)	0.31 (0.61)	17
Coal-fired pulp dryer	Multiple cyclones and stack filter system	Condensible organic PM	12	A	0.037-0.086 (0.073-0.17)	0.052 (0.10)	17
Coal-fired pulp dryer	Multiple cyclones and stack filter system	CO_2	12	A	130-180 (250-350)	150 (300)	17
Sugar cooler	Venturi scrubber	Filterable PM	3	A	0.028-0.040 (0.056-0.080)	0.032 (0.065)	19
Sugar cooler	Venturi scrubber	Condensible organic PM	3	A	0.0013-0.0026 (0.0026-0.0051)	0.0021 (0.0042)	19
Sugar cooler	Venturi scrubber	Condensible inorganic PM	3	A	0.0012-0.0035 (0.0024-0.0070)	0.0024 (0.0047)	19
Coal-fired pulp dryer[e]	Multiple cyclones	Filterable PM	3	A	0.23-0.33 (0.45-0.66)	0.28 (0.57)	20

TABLE 4-2. (continued)

Source	Control device	Pollutant	No. of test runs	Data rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. No.
Coal-fired pulp dryer[c]	Multiple cyclones	Condensible organic PM	3	A	0.027-0.031 (0.053-0.062)	0.029 (0.058)	20
Coal-fired pulp dryer[c]	Multiple cyclones	CO_2	3	A	180-210 (350-420)	200 (390)	20
Coal-fired pulp dryer[c]	Multiple cyclones	SO_2	3	A	0.085-0.10 (0.17-0.21)	0.092 (0.18)	20
Coal-fired pulp dryer[c]	Multiple cyclones	NO_x	3	A	0.34-0.39 (0.67-0.78)	0.37 (0.74)	20
Coal-fired pulp dryer[c]	Multiple cyclones	TOC as methane	3	A	0.54-0.65 (1.1-1.3)	0.59 (1.2)	20
Coal-fired pulp dryer[c]	Multiple cyclones	CO	3	A	1.0-1.2 (2.1-2.4)	1.1 (2.3)	20
Sugar cooler	Rotoclone	Filterable PM	3	A	0.061-0.074 (0.12-0.15)	0.066 (0.13)	21
Sugar cooler	Rotoclone	Condensible organic PM	3	A	0.0019-0.0025 (0.0037-0.0051)	0.0022 (0.0043)	21
Sugar granulator	Rotoclone	Filterable PM	3	A	0.017-0.046 (0.034-0.092)	0.032 (0.064)	21
Sugar granulator	Rotoclone	Condensible organic PM	3	A	0.0015-0.0021 (0.0030-0.0041)	0.0018 (0.0037)	21
Coal-fired pulp dryer	Multiple cyclones and stack filter system	Filterable PM	5	A	0.21-0.29 (0.42-0.58)	0.26 (0.52)	22
Coal-fired pulp dryer	Multiple cyclones and stack filter system	Condensible organic PM	5	A	0.066-0.096 (0.13-0.19)	0.086 (0.17)	22
Coal-fired pulp dryer	Multiple cyclones and stack filter system	CO_2	5	A	230-260 (470-520)	240 (490)	22
Coal-fired pulp dryer	Multiple cyclones and stack filter system	Filterable PM	9	A	0.17-0.24 (0.34-0.48)	0.21 (0.42)	22
Coal-fired pulp dryer	Multiple cyclones and stack filter system	Condensible organic PM	9	A	0.040-0.059 (0.081-0.12)	0.047 (0.095)	22
Coal-fired pulp dryer	Multiple cyclones and stack filter system	CO_2	9	A	120-160 (240-320)	140 (280)	22
Natural gas-fired pulp dryer	Multiple cyclones	Filterable PM	3	A	0.29-0.44 (0.58-0.87)	0.38 (0.77)	23
Natural gas-fired pulp dryer	Multiple cyclones	CO_2	3	A	65-100 (130-210)	80 (160)	23
Natural gas-fired pulp dryer	Multiple cyclones	Filterable PM	4	A	0.18-0.43 (0.36-0.85)	0.30 (0.60)	24
Natural gas-fired pulp dryer	Multiple cyclones	CO_2	4	A	87-180 (170-360)	120 (230)	24
Oil-fired pulp dryer	Multiple cyclones	Filterable PM	3	A	0.30-0.34 (0.61-0.67)	0.32 (0.65)	25

TABLE 4-2. (continued)

Source	Control device	Pollutant	No. of test runs	Data rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. No.
Oil-fired pulp dryer	Multiple cyclones	CO_2	3	A	180-210 (350-410)	190 (380)	25

[a]Emission factor units are kg (lb) of pollutant per Mg (ton) of pressed pulp feed to the dryer, unless noted. ND = no data available. NP = pollutant not detected. NR = not rated.
[b]Emission factor units are lb per 1,000 gallons of raw juice throughput.
[c]Emission factor units are lb per 1,000 gallons of thin juice throughput.
[d]Dryer is the same unit for which data are reported in Reference 20.
[e]Dryer is the same as one of the units for which data are reported in Reference 16.

TABLE 4-3. SUMMARY OF EMISSION FACTORS FOR SUGARBEET PROCESSING[a]

Source	Control device	Pollutant	No. of tests	Emission factor rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. Nos.
Coal-fired pulp dryer	None	Filterable PM	1	D	NA	2.2 (4.4)	17
Coal-fired pulp dryer	Multiple cyclones	Filterable PM	8	B	0.21-0.59 (0.42-1.2)	0.33 (0.66)	4,16,17,20,22
Coal-fired pulp dryer	Wet scrubber[b]	Filterable PM	3	D	0.17-0.36 (0.34-0.72)	0.25 (0.49)	5,12
Natural gas-fired pulp dryer	Multiple cyclones	Filterable PM	2	D	0.30-0.38 (0.60-0.77)	0.34 (0.69)	23,24
Natural gas-fired pulp dryer	Wet scrubber[b]	Filterable PM	5	D	0.038-0.15 (0.075-0.30)	0.081 (0.16)	6-10
Oil-fired pulp dryer	Cyclone	Filterable PM	3	C	0.64-0.79 (1.3-1.6)	0.72 (1.4)	1,2,14
Oil-fired pulp dryer	Dry scrubber and cyclone	Filterable PM	2	D	0.38-0.76 (0.77-1.5)	0.57 (1.1)	13
Oil-fired pulp dryer	Multiple cyclones	Filterable PM	2	D	0.27-0.32 (0.55-0.65)	0.30 (0.60)	15,25
Sugar cooler	Rotoclone	Filterable PM	1	D	NA	0.066 (0.13)	21
Sugar cooler	Venturi scrubber	Filterable PM	1	D	NA	0.032 (0.065)	19
Sugar granulator	Rotoclone	Filterable PM	1	D	NA	0.032 (0.064)	21
Sugar dryer and cooler	Wet scrubber	Filterable PM	1	NR	NA	0.018 (0.035)	3
Oil-fired pulp dryer	Dry scrubber and cyclone	Filterable PM-10	2	D	0.23-0.59 (0.47-1.2)	0.41 (0.83)	13
Coal-fired pulp dryer	Wet scrubber[b]	Condensible inorganic PM	1	D	NA	0.025 (0.050)	12
Natural gas-fired pulp dryer	Wet scrubber	Condensible inorganic PM	2	D	0.0077-0.014 (0.015-0.027)	0.011 (0.021)	9,10
Oil-fired pulp dryer	Cyclone	Condensible inorganic PM	3	C	0.014-0.27 (0.027-0.55)	0.12 (0.24)	1,2,13, 14
Sugar cooler	Venturi scrubber	Condensible inorganic PM	1	D	NA	0.0024 (0.0047)	19
Coal-fired pulp dryer	Multiple cyclones	Condensible organic PM	7	C	0.019-0.086 (0.039-0.17)	0.042 (0.084)	16,17, 20,22
Oil-fired pulp dryer	Cyclone	Condensible organic PM	3	C	0.016-0.054 (0.032-0.11)	0.038 (0.076)	1,2,14
Sugar cooler	Rotoclone	Condensible organic PM	1	D	NA	0.0022 (0.0043)	21
Sugar cooler	Venturi scrubber	Condensible organic PM	1	D	NA	0.0021 (0.0042)	19
Sugar granulator	Rotoclone	Condensible organic PM	1	D	NA	0.0018 (0.0037)	21
Coal-fired pulp dryer	Wet scrubber	Condensible PM	2	D	0.17-0.23 (0.33-0.47)	0.20 (0.40)	5
Coal-fired pulp dryer	[c]	TOC as methane	1	D	NA	0.59 (1.2)	20
Oil-fired pulp dryer	[c]	TOC as methane	1	D	NA	0.055 (0.11)	14
Oil-fired pulp dryer	[c]	Methane	1	D	NA	0.014 (0.028)	14
Coal-fired pulp dryer	[c]	CO	1	D	NA	1.1 (2.3)	20
Oil-fired pulp dryer	[c]	CO	1	D	NA	0.51 (1.0)	14

TABLE 4-3. (continued)

Source	Control device	Pollutant	No. of tests	Emission factor rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. Nos.
Coal-fired pulp dryer	[c]	CO_2	10	B	130-240 (260-490)	180 (370)	4,12,16,17,20, 22
Natural gas-fired pulp dryer	[c]	CO_2	7	C	29-120 (58-230)	65 (130)	6-10,23,24
Oil-fired pulp dryer	[c]	CO_2	6	C	170-290 (330-570)	210 (430)	1,2,13, 14,25
Sugar dryer and cooler	[c]	CO_2	1	NR	NA	Negligible	3
Coal-fired pulp dryer	[c]	NO_x	2	D	0.28-0.37 (0.57-0.74)	0.33 (0.66)	16,20
Oil-fired pulp dryer	[c]	NO_x	1	D	NA	0.30 (0.60)	14
Coal-fired pulp dryer	[c]	SO_2	2	D	0.092-0.68 (0.18-1.4)	0.40 (0.79)	4,20
Oil-fired pulp dryer	[c]	SO_2	3	D	0.31-0.65 (0.63-1.3)	0.52 (1.0)	13,15
Coal-fired pulp dryer	Wet scrubber	Acetaldehyde	2	E	0.0065-0.0080 (0.013-0.016)	0.0073 (0.015)	5
Coal-fired pulp dryer	Wet scrubber	Acrolein	2	E	0.0030-0.0046 (0.0060-0.0092)	0.0038 (0.0076)	5
Coal-fired pulp dryer	Wet scrubber	Crotonaldehyde	2	E	0.00080-0.0012 (0.0016-0.0024)	0.0010 (0.0020)	5
Coal-fired pulp dryer	Wet scrubber	Formaldehyde	2	E	0.0030-0.0042 (0.0059-0.0083)	0.0036 (0.0071)	5
Second carbonation tank[d]	None	Acetaldehyde	1	E	NA	0.0043	5
Second carbonation tank[d]	None	Acrolein	1	E	NA	2.4×10^{-4}	5
Second carbonation tank[d]	None	Crotonaldehyde	1	E	NA	3.0×10^{-5}	5
Second carbonation tank[d]	None	Formaldehyde	1	E	NA	1.6×10^{-5}	5
First evaporator[e]	None	Acetaldehyde	2	E	2.4×10^{-5}-1.1×10^{-4}	6.7×10^{-5}	5
First evaporator[e]	None	Acrolein	2	E	1.5×10^{-7}-6.8×10^{-7}	4.2×10^{-7}	5
First evaporator[e]	None	Crotonaldehyde	2	E	9.5×10^{-8}-1.9×10^{-7}	1.4×10^{-7}	5
First evaporator[e]	None	Formaldehyde	2	E	1.0×10^{-7}-1.3×10^{-6}	7.0×10^{-7}	5
Coal-fired pulp dryer	Wet scrubber	2-methylnaphthalene	1	E	NA	8.5×10^{-6} (1.7×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	2-nitrophenol	1	E	NA	9.0×10^{-5} (0.00018)	5
Coal-fired pulp dryer	Wet scrubber	2-methylphenol	1	E	NA	1.7×10^{-5} (3.4×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	2,4-dimethylphenol	1	E	NA	1.3×10^{-5} (2.5×10^{-5})	5
Coal-fired pulp dryer	Wet scrubber	4-methylphenol	1	E	NA	6.5×10^{-5} (0.00013)	5

TABLE 4-3. (continued)

Source	Control device	Pollutant	No. of tests	Emission factor rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. Nos.
Coal-fired pulp dryer	Wet scrubber	4-nitrophenol	1	E	NA	$7.0x10^{-5}$ (0.00014)	5
Coal-fired pulp dryer	Wet scrubber	Acenaphthylene	1	E	NA	$8.5x10^{-7}$ ($1.7x10^{-6}$)	5
Coal-fired pulp dryer	Wet scrubber	Benzaldehyde	1	E	NA	0.00070 (0.0014)	5
Coal-fired pulp dryer	Wet scrubber	Benzoic acid	1	E	NA	0.0014 (0.0028)	5
Coal-fired pulp dryer	Wet scrubber	Benzyl alcohol	1	E	NA	$3.6x10^{-5}$ ($7.1x10^{-5}$)	5
Coal-fired pulp dryer	Wet scrubber	Bis(2-ethylhexyl)phthalate	1	E	NA	0.00075 (0.0015)	5
Coal-fired pulp dryer	Wet scrubber	Di-n-butylphthalate	1	E	NA	$2.6x10^{-5}$ ($5.2x10^{-5}$)	5
Coal-fired pulp dryer	Wet scrubber	Dibenzofuran	1	E	NA	$5.5x10^{-6}$ ($1.1x10^{-5}$)	5
Coal-fired pulp dryer	Wet scrubber	Diethylphthalate	1	E	NA	$4.9x10^{-6}$ ($9.8x10^{-6}$)	5
Coal-fired pulp dryer	Wet scrubber	Naphthalene	1	E	NA	$5.5x10^{-5}$ (0.00011)	5
Coal-fired pulp dryer	Wet scrubber	Nitrobenzene	1	E	NA	$9.5x10^{-6}$ ($1.9x10^{-5}$)	5
Coal-fired pulp dryer	Wet scrubber	Phenanthrene	1	E	NA	$6.0x10^{-6}$ ($1.2x10^{-5}$)	5
Coal-fired pulp dryer	Wet scrubber	Phenol	1	E	NA	0.00016 (0.00032)	5
First carbonation tank[d]	None	2-methylnaphthalene	1	D	NA	$5.1x10^{-7}$	5
First carbonation tank[d]	None	2,4-dinitrophenol	1	D	NA	NP	5
First carbonation tank[d]	None	4-methylphenol	1	D	NA	$6.6x10^{-7}$	5
First carbonation tank[d]	None	Acenaphthene	1	D	NA	NP	5
First carbonation tank[d]	None	Benzaldehyde	1	D	NA	$1.1x10^{-4}$	5
First carbonation tank[d]	None	Benzoic acid	1	D	NA	$8.4x10^{-6}$	5
First carbonation tank[d]	None	Benzyl alcohol	1	D	NA	$5.0x10^{-6}$	5
First carbonation tank[d]	None	Bis(2-ethylhexyl)phthalate	1	D	NA	$1.2x10^{-5}$	5
First carbonation tank[d]	None	Naphthalene	1	D	NA	$2.0x10^{-6}$	5
First carbonation tank[d]	None	Phenanthrene	1	D	NA	$1.4x10^{-6}$	5
First carbonation tank[d]	None	Phenol	1	D	NA	$1.3x10^{-6}$	5
First evaporator[e]	None	4-methylphenol	1	E	NA	NP	5
First evaporator[e]	None	Benzaldehyde	1	E	NA	$2.2x10^{-6}$	5
First evaporator[e]	None	Benzoic acid	1	E	NA	NP	5
First evaporator[e]	None	Benzyl alcohol	1	E	NA	$1.8x10^{-7}$	5
First evaporator[e]	None	Bis(2-ethylhexyl)phthalate	1	E	NA	$3.7x10^{-7}$	5

TABLE 4-3. (continued)

Source	Control device	Pollutant	No. of tests	Emission factor rating	Emission factor range, kg/Mg (lb/ton)	Average emission factor, kg/Mg (lb/ton)	Ref. Nos.
First evaporator[c]	None	Di-n-butylphthalate	1	E	NA	$1.1x10^{-9}$	5
First evaporator[c]	None	Dibenzofuran	1	E	NA	NP	5
First evaporator[c]	None	Diethylphthalate	1	E	NA	NP	5
First evaporator[c]	None	Isophorone	1	E	NA	NP	5
First evaporator[c]	None	Naphthalene	1	E	NA	$2.5x10^{-8}$	5
First evaporator[c]	None	Phenanthrene	1	E	NA	$1.6x10^{-8}$	5
First evaporator[c]	None	Phenol	1	E	NA	$1.2x10^{-8}$	5
First evaporator[c]	None	Pyridine	1	E	NA	$3.4x10^{-8}$	5

[a]Emission factor units are kg (lb) of pollutant per Mg (ton) of pressed pulp feed to the dryer, unless noted. NA = not applicable. NP = pollutant not detected. NR = not rated.
[b]Emission factor includes data for dryers controlled by a cyclone or multiple cyclones, followed by a wet scrubber.
[c]Because the control devices typically used to control beet pulp dryer emissions are not designed to control gaseous emissions, this emission factor is assumed to be applicable to dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices.
[d]Emission factor units are lb per 1,000 gallons of raw juice throughput.
[e]Emission factor units are lb per 1,000 gallons of thin juice throughput.

4.3.1 Filterable PM

An emission factor for uncontrolled filterable PM emissions from a coal-fired pulp dryer was developed using A-rated data from Reference 17. The emission factor is 2.2 kg/Mg (4.4 lb/ton). This emission factor is assigned a D rating because it was developed using data from a single test.

An emission factor for filterable PM emissions from a coal-fired pulp dryer controlled with multiple cyclones was developed using A-rated data from eight tests conducted on seven different dryers. The dryers are located at four facilities. The data range from 0.21 kg/Mg (0.42 lb/ton) to 0.59 kg/Mg (1.2 lb/ton) and average 0.33 kg/Mg (0.66 lb/ton). This candidate emission factor is assigned a B rating because it was developed using A-rated data from 4 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for filterable PM emissions from a coal-fired pulp dryer controlled with a wet scrubber was developed using A- and B-rated data from three tests conducted on two different dryers. The data range from 0.17 kg/Mg (0.34 lb/ton) to 0.36 kg/Mg (0.72 lb/ton) and average 0.25 kg/Mg (0.49 lb/ton). This candidate emission factor is assigned a D rating because it was developed using data from only 2 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for filterable PM emissions from a natural gas-fired pulp dryer controlled with multiple cyclones was developed using A-rated data from two tests conducted at two facilities. The data range from 0.30 kg/Mg (0.60 lb/ton) to 0.38 kg/Mg (0.77 lb/ton) and average 0.34 kg/Mg (0.69 lb/ton). This candidate emission factor is assigned a D rating because it was developed using data from only 2 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for filterable PM emissions from a natural gas-fired pulp dryer controlled with a wet scrubber was developed using A- and B-rated data from five tests conducted on five different dryers. The dryers are located at two facilities. The data range from 0.038 kg/Mg (0.075 lb/ton) to 0.15 kg/Mg (0.30 lb/ton) and average 0.081 kg/Mg (0.16 lb/ton). This candidate emission factor is assigned a D rating because it was developed using data from only 2 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for filterable PM emissions from a fuel oil-fired pulp dryer controlled with a cyclone was developed using B-rated data from three tests conducted at three facilities. The data range from 0.64 kg/Mg (1.3 lb/ton) to 0.79 kg/Mg (1.6 lb/ton) and average 0.72 kg/Mg (1.4 lb/ton). This candidate emission factor is assigned a C rating because it was developed using data from 3 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for filterable PM emissions from a fuel oil-fired pulp dryer controlled with a dry scrubber followed by a cyclone was developed using A- and B-rated data from tests conducted on two dryers located at the same facility. The data range from 0.38 kg/Mg (0.77 lb/ton) to 0.76 kg/Mg (1.5 lb/ton) and average 0.57 kg/Mg (1.1 lb/ton). This candidate emission factor is assigned a D rating because it was developed using data from only 1 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for filterable PM emissions from a fuel oil-fired pulp dryer controlled with multiple cyclones was developed using A- and B-rated data from two tests conducted at different facilities. The data range from 0.27 kg/Mg (0.55 lb/ton) to 0.32 kg/Mg (0.65 lb/ton) and average 0.30 kg/Mg (0.60 lb/ton). This candidate emission factor is assigned a D rating because it was developed using data from only 2 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for filterable PM emissions from a sugar cooler controlled with a mechanical centrigual separator with water sprays was developed using A-rated data from a single test. The emission factor is 0.066 kg/Mg (0.13 lb/ton). This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for filterable PM emissions from a sugar cooler controlled with a venturi scrubber was developed using A-rated data from a single test. The emission factor is 0.032 kg/Mg (0.065 lb/ton). This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for filterable PM emissions from a sugar granulator controlled with a mechanical centrigual separator with water sprays was developed using A-rated data from a single

test. The emission factor is 0.032 kg/Mg (0.064 lb/ton). This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for filterable PM emissions from a sugar granulator and cooler controlled with a wet scrubber was developed using B-rated data from a single test. The data are not used for emission factor development because the emission source is a combined source and data are available for the individual sources.

4.3.2 Filterable PM-10

An emission factor for filterable PM-10 emissions from a fuel oil-fired pulp dryer controlled with a dry scrubber followed by a cyclone was developed using B-rated data from tests conducted on two dryers located at the same facility. The data range from 0.23 kg/Mg (0.47 lb/ton) to 0.59 kg/Mg (1.2 lb/ton) and average 0.41 kg/Mg (0.83 lb/ton). This candidate emission factor is assigned a D rating because it was developed using data from only 1 of the 36 sugarbeet processing plants currently operating in the United States.

4.3.3 Condensible PM

An emission factor for condensible inorganic PM emissions from a coal-fired pulp dryer controlled with a wet scrubber was developed using A-rated data from a single test. The emission factor is 0.025 kg/Mg (0.050 lb/ton). This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for condensible inorganic PM emissions from a natural gas-fired pulp dryer controlled with a wet scrubber was developed using B-rated data from tests conducted on two dryers located at the same facility. The data range from 0.0077 kg/Mg (0.015 lb/ton) to 0.014 kg/Mg (0.027 lb/ton) and average 0.011 kg/Mg (0.021 lb/ton). This candidate emission factor is assigned a D rating because it was developed using data from only 1 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for condensible inorganic PM emissions from a fuel oil-fired pulp dryer controlled with a cyclone was developed using B-rated data from five tests conducted at four facilities.

Two of the dryers were equipped with a dry scrubber and a cyclone, but the condensible inorganic PM emissions from these two dryers were greater than the emissions from the cyclone-controlled dryers. Therefore, the dry scrubber was assumed to have no effect on condensible inorganic PM emissions, and the data were combined. The data range from 0.014 kg/Mg (0.027 lb/ton) to 0.27 kg/Mg (0.55 lb/ton) and average 0.12 kg/Mg (0.24 lb/ton). This candidate emission factor is assigned a C rating because it was developed using data from 4 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for condensible inorganic PM emissions from a sugar cooler controlled with a venturi scrubber was developed using A-rated data from a single test. The emission factor is 0.0024 kg/Mg (0.0047 lb/ton). This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for condensible organic PM emissions from a coal-fired pulp dryer controlled with multiple cyclones was developed using A-rated data from seven tests conducted on seven different dryers. The dryers are located at three facilities. The data range from 0.019 kg/Mg (0.039 lb/ton) to 0.086 kg/Mg (0.17 lb/ton) and average 0.042 kg/Mg (0.084 lb/ton). This candidate emission factor is assigned a C rating because it was developed using data from 3 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for condensible organic PM emissions from a fuel oil-fired pulp dryer controlled with a cyclone was developed using B-rated data from three tests conducted at three facilities. The data range from 0.016 kg/Mg (0.032 lb/ton) to 0.054 kg/Mg (0.11 lb/ton) and average 0.038 kg/Mg (0.076 lb/ton). This candidate emission factor is assigned a C rating because it was developed using data from 3 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for condensible organic PM emissions from a sugar cooler controlled with a mechanical centrigual separator with water sprays was developed using A-rated data from a single test. The emission factor is 0.0022 kg/Mg (0.0043 lb/ton). This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for condensible organic PM emissions from a sugar cooler controlled with a venturi scrubber was developed using A-rated data from a single test. The emission factor is 0.0021 kg/Mg (0.0042 lb/ton). This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for condensible organic PM emissions from a sugar granulator controlled with a mechanical centrigual separator with water sprays was developed using A-rated data from a single test. The emission factor is 0.0018 kg/Mg (0.0037 lb/ton). This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for total condensible PM emissions from a coal-fired pulp dryer controlled with a wet scrubber was developed using A- and B-rated data from two tests conducted on different dryers located at the same facility. The data range from 0.17 kg/Mg (0.33 lb/ton) to 0.23 kg/Mg (0.47 lb/ton) and average 0.20 kg/Mg (0.40 lb/ton). This candidate emission factor is assigned a D rating because it was developed using data from only 2 of the 36 sugarbeet processing plants currently operating in the United States.

4.3.4 Total Organic Compounds

An emission factor for TOC emissions from a coal-fired pulp dryer was developed using A-rated data from a single test. The emission factor is 0.59 kg/Mg (1.2 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control TOC emissions, this emission factor is assumed to be applicable to coal-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for TOC emissions from a fuel oil-fired pulp dryer was developed using B-rated data from a single test. The emission factor is 0.055 kg/Mg (0.11 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control TOC emissions, this emission factor is assumed to be applicable to fuel oil-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control

devices. This emission factor is assigned a D rating because it was developed using data from only a single test.

4.3.5 Methane

An emission factor for methane emissions from a fuel oil-fired pulp dryer was developed using B-rated data from a single test. The emission factor is 0.014 kg/Mg (0.028 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control methane emissions, this emission factor is assumed to be applicable to fuel oil-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This emission factor is assigned a D rating because it was developed using data from only a single test.

4.3.6 Carbon Monoxide

An emission factor for CO emissions from a coal-fired pulp dryer was developed using A-rated data from a single test. The emission factor is 1.1 kg/Mg (2.3 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control CO emissions, this emission factor is assumed to be applicable to coal-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This emission factor is assigned a D rating because it was developed using data from only a single test.

An emission factor for CO emissions from a fuel oil-fired pulp dryer was developed using B-rated data from a single test. The emission factor is 0.51 kg/Mg (1.0 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control CO emissions, this emission factor is assumed to be applicable to fuel oil-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This emission factor is assigned a D rating because it was developed using data from a single test.

4.3.7 Carbon Dioxide

An emission factor for CO_2 emissions from a coal-fired pulp dryer was developed using A-rated data from ten tests conducted on nine different dryers. The dryers are located at five

facilities. The data range from 130 kg/Mg (260 lb/ton) to 240 kg/Mg (490 lb/ton) and average 180 kg/Mg (370 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control CO_2 emissions, this emission factor is assumed to be applicable to coal-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This candidate emission factor is assigned a B rating because it was developed using A-rated data from 5 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for CO_2 emissions from a natural gas-fired pulp dryer was developed using A- and B-rated data from seven tests conducted on seven different dryers. The dryers are located at four facilities. The data range from 29 kg/Mg (58 lb/ton) to 120 kg/Mg (230 lb/ton) and average 65 kg/Mg (130 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control CO_2 emissions, this emission factor is assumed to be applicable to natural gas-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This candidate emission factor is assigned a C rating because it was developed using A- and B-rated data from 4 of the 36 sugarbeet processing plants currently operating in the United States.

An emission factor for CO_2 emissions from a fuel oil-fired pulp dryer was developed using A- and B-rated data from six tests conducted on six different dryers. The dryers are located at four facilities. The data range from 170 kg/Mg (330 lb/ton) to 290 kg/Mg (570 lb/ton) and average 210 kg/Mg (430 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control CO_2 emissions, this emission factor is assumed to be applicable to fuel oil-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This candidate emission factor is assigned a C rating because it was developed using A- and B-rated data from 4 of the 36 sugarbeet processing plants currently operating in the United States.

Carbon dioxide emissions from a sugar granulator and cooler were measured during one test and were negligible during all of the test runs.

4.3.8 Nitrogen Oxides

An emission factor for NO_x emissions from a coal-fired pulp dryer was developed using A-rated data from two tests conducted on the same dryer. The data range from 0.28 kg/Mg (0.57 lb/ton) to 0.37 kg/Mg (0.74 lb/ton) and average 0.33 kg/Mg (0.66 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control NO_x emissions, this emission factor is assumed to be applicable to coal-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This emission factor is assigned a D rating because it was developed using data from only a single facility.

An emission factor for NO_x emissions from a fuel oil-fired pulp dryer was developed using B-rated data from a single test. The emission factor is 0.30 kg/Mg (0.60 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control NO_x emissions, this emission factor is assumed to be applicable to fuel oil-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This emission factor is assigned a D rating because it was developed using data from only a single test.

4.3.9 Sulfur Dioxide

An emission factor for SO_2 emissions from a coal-fired pulp dryer was developed using A-rated data from two tests conducted at different facilities. The data range from 0.092 kg/Mg (0.18 lb/ton) to 0.68 kg/Mg (1.4 lb/ton) and average 0.40 kg/Mg (0.79 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control SO_2 emissions, this emission factor is assumed to be applicable to coal-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This emission factor is assigned a D rating because it was developed using data from only 2 of the 36 sugarbeet processing plants currently operating in the United States..

An emission factor for SO_2 emissions from a fuel oil-fired pulp dryer was developed using A- and B-rated data from three tests conducted on three different dryers. The dryers are located at two facilities. One other test included SO_2 measurements, but SO_2 emissions were not detected; the data from this additional test are not used for emission factor development because the other three tests

document levels of SO_2 that are well above the detection limit of the test method. The data range from 0.31 kg/Mg (0.63 lb/ton) to 0.65 kg/Mg (1.3 lb/ton) and average 0.52 kg/Mg (1.0 lb/ton). Because the control devices typically used to control beet pulp dryer emissions are not designed to control SO_2 emissions, this emission factor is assumed to be applicable to fuel oil-fired dryers controlled by a cyclone, multiple cyclones, a wet scrubber, a venturi scrubber, or any combination of these control devices. This emission factor is assigned a D rating because it was developed using data from only 2 of the 36 sugarbeet processing plants currently operating in the United States.

4.3.10 Acetaldehyde, Acrolein, Crotonaldehyde, Formaldehyde

Emission factors for acetaldehyde, acrolein, crotonaldehyde, and formaldehyde emissions from a coal-fired pulp dryer controlled with a wet scrubber were developed using C-rated data from two tests conducted on two dryers located at the same facility. These emission factors are assigned an E rating because they are based on C-rated data.

Emission factors for acetaldehyde, acrolein, crotonaldehyde, and formaldehyde emissions from a second carbonation tank were developed using C-rated data from a single test. These emission factors are assigned an E rating because they are based on C-rated data. The units for these emission factors are pounds of pollutant per 1,000 gallons of raw juice throughput.

Emission factors for acetaldehyde, acrolein, crotonaldehyde, and formaldehyde emissions from a first evaporator were developed using C-rated data from two tests. These emission factors are assigned an E rating because they are based on C-rated data. The units for these emission factors are pounds of pollutant per 1,000 gallons of thin juice throughput.

4.3.11 Semivolatile Organic Compounds

Emission factors for speciated SVOC emissions from a coal-fired pulp dryer controlled with a wet scrubber were developed using C-rated data from a single test. These emission factors are assigned an E rating because they are based on C-rated data.

Emission factors for speciated SVOC emissions from a first carbonation tank were developed using B-rated data from a single test. These emission factors are assigned a D rating because they are based on data from only a single test.

Emission factors for speciated SVOC emissions from a first evaporator were developed using C-rated data from a single test. These emission factors are assigned an E rating because they are based on C-rated data.

4.4 SUMMARY OF DEVELOPMENT OF AP-42 SECTION

4.4.1 Section Narrative

A process description was written using the most recent available references, and a process flow diagram was developed from the process description. In addition, emissions from sugarbeet processing operations and types of emission control systems currently in use are discussed.

4.4.2 Emission Factors

The emission factors discussed in section 4.3 of this report are presented in the proposed AP-42 Section 9.10.1.2, Sugarbeet Processing.

REFERENCES FOR SECTION 4

1. *Results of a Source Emission Compliance Test at Southern Minnesota Beet Sugar Cooperative, Renville, Minnesota*, MMT Environmental, Inc., St. Paul, MN, January 21, 1988.

2. *Results of an Emission Compliance Test on the North Dryer #2 at Southern Minnesota Beet Sugar Cooperative, Renville, Minnesota*, MMT Environmental, Inc., St. Paul, MN, December 14, 1988.

3. *Results of the November 18, 1986, Particulate Emission Compliance Test on the Combined Discharge Stack of the Sugar Dryer and Sugar Cooler at the Southern Minnesota Sugar Cooperative Plant in Renville, Minnesota*, Interpoll, Inc., Circle Pines, MN, December 8, 1986.

4. *Results of a Source Emission Compliance Test at Minn-Dak Farmers Cooperative, Wahpeton, North Dakota*, MMT Environmental, Inc., St. Paul, MN, November 1, 1983.

5. *Particulate, Aldehyde, and Semi-volatile Organic Compound (SVOC) Testing Report for the Pulp Dryer Stacks, 1st and 2nd Carbonation Tank Vents, and the Evaporator Heater Vents*, The Amalgamated Sugar Company, Nampa, Idaho, May 14, 1993.

6. *Particulate Emission Testing Performed for Monitor Bay Sugar Company, Bay City, Michigan, on the Pulp Dryer 3 Exhaust*, Network Environmental, Inc., Grand Rapids, MI, October 12, 1992.

7. *Particulate Emission Testing Performed for Monitor Bay Sugar Company, Bay City, Michigan, on the Pulp Dryer 2 Exhaust*, Network Environmental, Inc., Grand Rapids, MI, October 13, 1992.

8. *Particulate Emission Testing Performed for Monitor Bay Sugar Company, Bay City, Michigan, on the Pulp Dryer 1 Exhaust*, Network Environmental, Inc., Grand Rapids, MI, October 14, 1992.

9. *Emissions Survey Conducted at Western Sugar Company's Billings, Montana Production Facility*, American Environmental Testing Company, Inc., December 1988.

10. *EPA Method 5 Particulate Emissions Tests Conducted on Western Sugar's Boiler and Pulp Dryer Stacks Located in Billings, Montana*, American Environmental Testing Company, Inc., January 1990.

11. *Western Sugar--Final Report. Emissions Testing and Analysis at Billings, Montana, Refinery*, Radian Corporation, Denver, CO, March 26, 1991.

12. *Report on Compliance Testing Performed at Western Sugar Company Pulp Dryer, Scottsbluff, NE*, Clean Air Engineering, Palatine, IL, January 12, 1990.

13. *Emission Measurement Test Report of C.E. Boilers, Union Boilers, and Pulp Dryers--Permit Compliance for SO_2, Particulate, and PM-10 with Back-Half Emissions--Holly Sugar Corporation, Montana Division*, The Emission Measurement Group, Inc., Englewood, CO, November 16, 1993.

14. *Emission Performance Testing of Four Boilers, Three Dryers, and One Cooler--Holly Sugar Corporation, Santa Maria, California*, Western Environmental Services, Redondo Beach, CA, June 1991.

15. *Report to Great Lakes Sugar Company on Stack Particulate Samples Collected on the Pulp Drier at Fremont, Ohio*, Affiliated Environmental Services, Inc., Sandusky, OH, December 8, 1992.

16. *Results of the February 22-24, 1994, Air Emission Compliance Testing of Process Sources at the American Crystal Sugar East Grand Forks Plant*, Interpoll Laboratories, Inc., Circle Pines, MN, March 21, 1994.

17. *Results of the January 28-31, 1992, Particulate Emission Tests, South Pulp Dryer--American Crystal Sugar Company, Moorehead, Minnesota*, Bay West, Inc., St. Paul, MN, March 26, 1992.

18. *Results of the December 1 & 2, 1992, State Air Emission Compliance Testing on the Pulp Dryers at the American Crystal Sugar Drayton Plant*, Interpoll Laboratories, Inc., Circle Pines, MN, January 7, 1993.

19. *Results of a Source Emission Compliance Test on the Sugar Cooler Stack at American Crystal Sugar Company, Crookston, Minnesota, March 11, 1993*, Twin City Testing Corporation, St. Paul, MN, April 16, 1993.

20. *Results of the November 9-11, 1993, Air Emission Testing of Process Sources at the American Crystal Sugar East Grand Forks Plant*, Interpoll Laboratories, Inc., Circle Pines, MN, December 3, 1993.

21. *Results of the November 14 and 15, 1990, State Particulate Emission Compliance Test on the Sugar Cooler and Sugar Granulator at the ACS Moorehead Plant*, Interpoll Laboratories, Inc., Circle Pines, MN, December 11, 1990.

22. *Unit Nos. 1 and 2 Pulp Dryer Stacks Emission Testing Results for the February 22-26, 1993, Testing of Particulate Conducted at the American Crystal Sugar Company, Crookston, Minnesota*, Bay West, Inc., St. Paul, MN, April 15, 1993.

23. *Particulate Emission Study for Michigan Sugar Company, Caro, Michigan*, Swanson Environmental, Inc., Farmington Hills, MI, December 14, 1989.

24. *Particulate Emission Study for Michigan Sugar Company, Carrollton, Michigan*, Swanson Environmental, Inc., Farmington Hills, MI, November 1989.

25. *Particulate Emission Study--Michigan Sugar Company, Croswell, Michigan*, Swanson Environmental, Inc., Farmington Hills, MI, November 19, 1990.

5. PROPOSED AP-42 SECTION

The proposed AP-42, Section 9.10.1.2, Sugarbeet Processing, is presented on the following pages as it would appear in the document.

9.10.1.2 SUGARBEET PROCESSING

9.10.1.2.1 General[1-2]

Sugarbeet processing is the production of sugar (sucrose) from sugarbeets. Byproducts of sugarbeet processing include pulp and molasses. Most of the molasses produced is processed further to remove the remaining sucrose. The pulp and most of the remaining molasses are mixed together, dried, and sold as livestock feed. The four-digit standard industrial classification (SIC) code for sugarbeet processing is 2063. The six-digit source classification code (SCC) for sugarbeet processing is 3-02-016; there are two eight-digit SCC's: 3-02-016-01 (dryers) and 3-02-016-99 (other not classified).

9.10.1.2.2 Process Description[1-4]

Figures 9.10.1.2-1 and -2 are flow diagrams for a typical sugarbeet processing plant. Figure 9.10.1.2-1 shows preprocessing and livestock feed production operations, and Figure 9.10.1.2-2 shows the beet sugar production operations. Mechanically harvested sugarbeets are shipped to processing plants, where they are typically received by high-speed conveying and screening systems. The screening systems remove loose dirt from the beets and pinch the beet tops and leaves to facilitate separation from the beet roots. The conveyors transport the beets to storage areas and then to the final cleaning and trash removal operations that precede the processing operations. The beets are usually conveyed to the final cleaning phase using flumes, which use water to both move and clean the beets. Although most plants use flumes, some plants use dry conveyors in the final cleaning stage. The disadvantage of flume conveying is that some sugar leaches into the flume water from damaged surfaces of the beets. The flumes carry the beets to the beet feeder, which regulates the flow of beets through the system and prevents stoppages in the system. From the feeder, the flumes carry the beets through several cleaning devices, which may include rock catchers, sand separators, magnetic metal separators, water spray nozzles, and trash catchers. After cleaning, the beets are separated from the water, usually with a beet wheel, and are transported by drag chain, chain and bucket elevator, inclined belt conveyor, or beet pump to the processing operations.

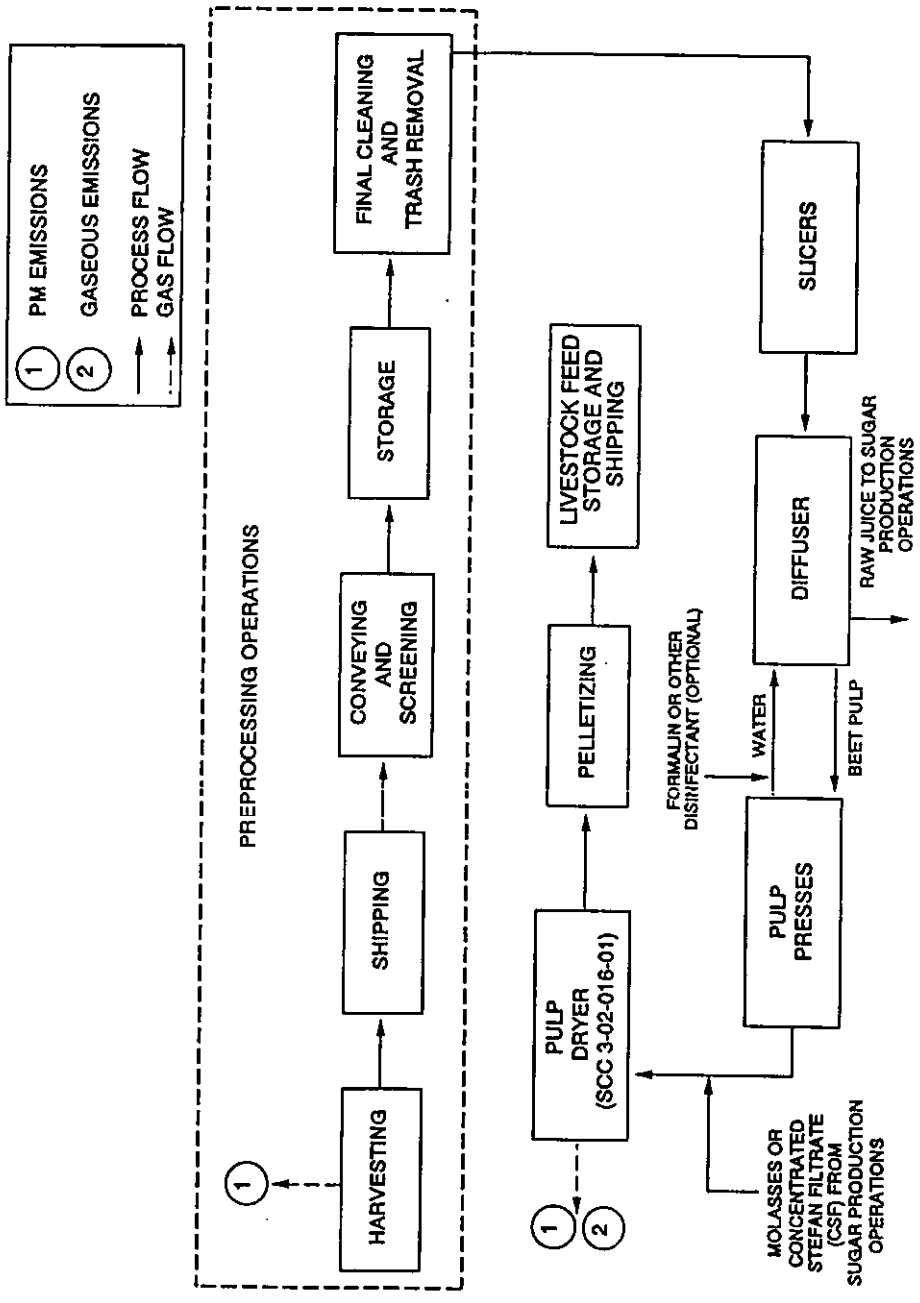


Figure 9.10.1.2-1. Preprocessing and livestock feed production operations at a sugarbeet processing plant. (Source Classification Code in parentheses.)

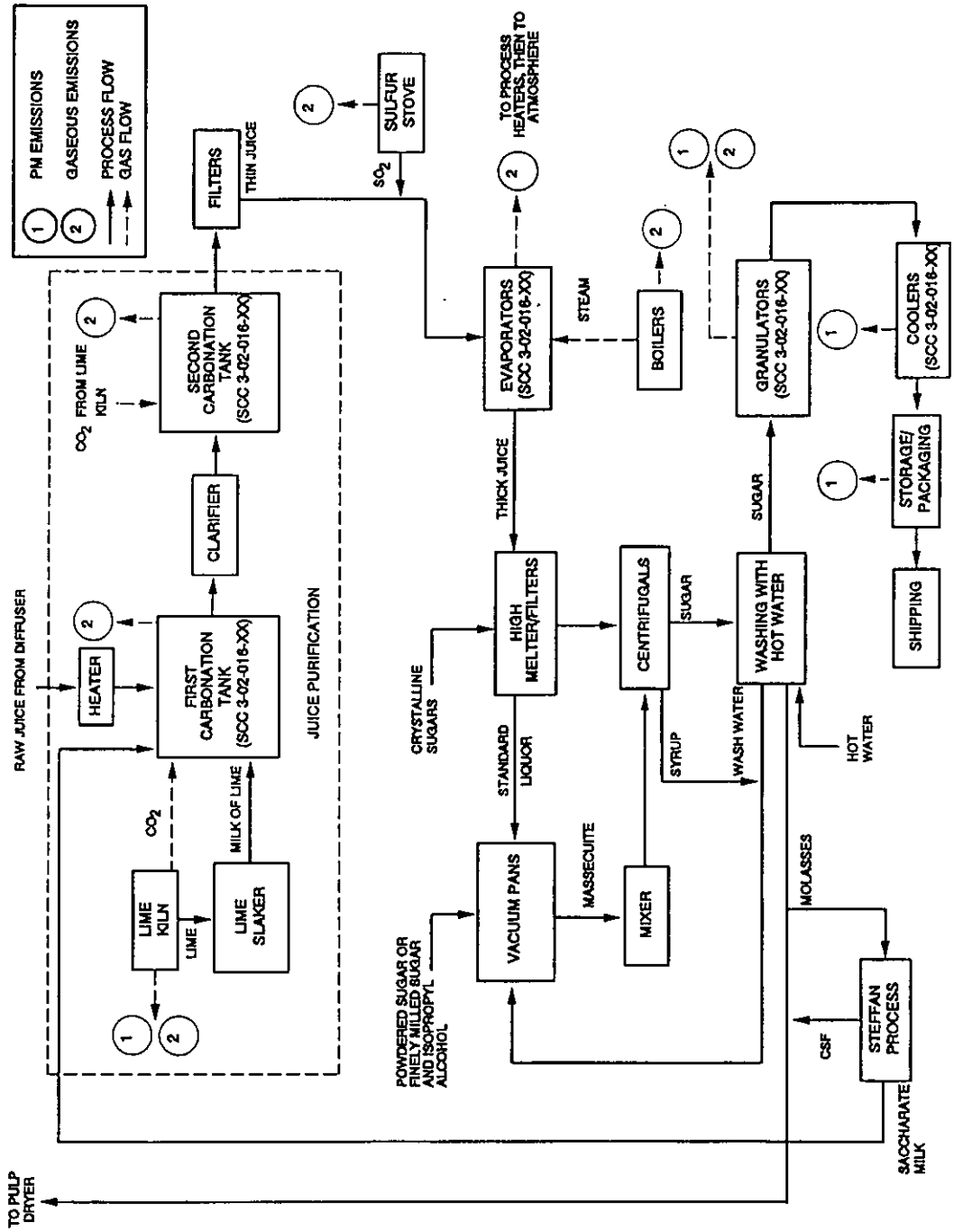


Figure 9.10.1.2-2. Sugar production operations at a sugarbeet processing plant. (Source Classification Code in parentheses.)

Sugarbeet processing operations comprise several steps, including diffusion, juice purification, evaporation, crystallization, dried-pulp manufacture, and sugar recovery from molasses. Descriptions of these operations are presented in the following paragraphs.

Prior to removal of the sucrose from the beet by diffusion, the cleaned and washed beets are sliced into long, thin strips, called cossettes. The cossettes are conveyed to a continuous diffuser, in which hot water is used to extract sucrose from the cossettes. The diffuser is usually slanted upwards and conveys the cossettes up the slope as water is introduced at the top of the diffuser and flows countercurrent to the cossettes. The water temperature in the diffuser is typically maintained between 50° and 80°C (122° and 176°F). This temperature is dependant on several factors, including the denaturization temperature of the cossettes, the thermal behavior of the beet cell wall, potential enzymatic reactions, bacterial activity, and pressability of the beet pulp. Formalin, a 40 percent solution of formaldehyde, is sometimes added to the diffuser water as a disinfectant. Sulfur dioxide and chlorine are also sometimes used as disinfectants. The sugar-enriched water that flows from the outlet of the diffuser is called raw juice and contains between 10 and 15 percent sugar. This raw juice proceeds to the juice purification operations. The processed cossettes, or pulp, leaving the diffuser are conveyed to the dried-pulp manufacture operations.

In the juice purification stage, non-sucrose impurities in the raw juice are removed so that the pure sucrose can be crystallized. First, the juice passes through screens to remove any small cossette particles. Then the mixture is heated to 80° to 85°C (176° to 185°F) and proceeds to the first carbonation tank. In the first carbonation tank, milk of lime [$CA(OH)_2$] is added to the mixture to adsorb or adhere to the impurities in the mixture, and carbon dioxide (CO_2) gas is bubbled through the mixture to precipitate the lime as insoluble calcium carbonate crystals. Lime kilns are used to produce the CO_2 and lime used in carbonation; the lime is converted to milk of lime in a lime slaker. The small, insoluble crystals (produced during carbonation) settle out in a clarifier, after which the juice is again treated with CO_2 (in the second carbonation tank) to remove the remaining lime and impurities. The pH of the juice is lower during this second carbonation, causing large, easily filterable, calcium carbonate crystals to form. After filtration, a small amount of sulfur dioxide (SO_2) is added to the juice to inhibit reactions that lead to darkening of the juice. The SO_2 is produced by burning elemental sulfur in a sulfur stove or is purchased in liquid form. Following the addition of SO_2, the juice (known as thin juice) proceeds to the evaporators.

The evaporation process, which increases the sucrose concentration in the juice by removing water, is typically performed in a series of five evaporators. Steam from large boilers is used to heat the first evaporator, and the steam from the water evaporated in the first evaporator is used to heat the second evaporator. This transfer of heat continues through the five evaporators, and as the temperature decreases (due to heat loss) from evaporator to evaporator, the pressure inside each evaporator is also decreased, allowing the juice to boil at the lower temperatures provided in each subsequent evaporator. Some steam is released from the first three evaporators, and this steam is used as a heat source for various process heaters throughout the plant. After evaporation, the percentage of sucrose in the "thick juice" is 50-65 percent. Crystalline sugars, produced later in the process, are added to the juice and dissolved in the high melter. This mixture is then filtered, yielding a clear liquid known as standard liquor, which proceeds to the crystallization operation.

Sugar is crystallized by low-temperature pan boiling. The standard liquor is boiled in vacuum pans until it becomes supersaturated. To begin crystal formation, the liquor is either "shocked" using a small quantity of powdered sugar or is "seeded" by adding a mixture of finely milled sugar and isopropyl alcohol. The seed crystals are carefully grown through control of the vacuum, temperature, feed-liquor additions, and steam. When the crystals reach the desired size, the mixture of liquor and crystals, known as massecuite or fillmass, is discharged to the mixer. From the mixer, the massecuite is poured into high-speed centrifugals, in which the liquid is centrifuged into the outer shell, and the crystals are left in the inner centrifugal basket. The sugar crystals are then washed with pure hot water and are sent to the granulator, which is a rotary drum dryer, and then to the cooler. Some facilities refer to the granulator as the sugar dryer. The wash water, which contains a small quantity of sucrose, is pumped to the vacuum pans for processing. After cooling, the sugar is screened and then either packaged or stored in large bins for future packaging.

The liquid that was separated from the sugar crystals in the centrifugals is called syrup. This syrup serves as feed liquor for the "second boiling" and is introduced back into the vacuum pans along with standard liquor and recycled wash water. The process is repeated once again, resulting in the production of molasses, which can be further desugarized using the Steffan process. Molasses that is not desugarized can be used in the production of livestock feed.

The Steffan process is used to recover some of the sugar remaining in molasses. The process involves the addition of lime to produce saccharate (sugar and lime compounds) precipitates, which

are broken up by the addition of carbon dioxide gas, thus freeing the sugar and creating a calcium carbonate precipitate. The product of the Steffan process is called saccharate milk and is used as feed for the juice purification operations. Byproducts of the Steffan process include concentrated Steffan filtrate (CSF), which can be added to beet pulp prior to drying or can be used to produce monosodium glutamate. A relatively new process called deep molasses desugarization is used by some plants to remove additional sugar from molasses.

Wet pulp from the diffusion process is another product of sugarbeet processing. The pulp is first pressed, typically in vertical single-screw presses, to reduce the moisture content from about 95 percent to about 80 percent. The water removed by the presses is collected and used as diffusion water. After pressing, CSF or molasses is added to the pulp, which is then dried by hot air in a horizontal rotating drum known as a pulp dryer. The pulp dryer, which can be fired by oil, natural gas, or coal, typically provides entrance temperatures between 482° and 927°C (900° and 1700°F). As the pulp is dried, the gas temperature decreases and the pulp temperature increases. The exit temperature of the flue gas is typically between 88° and 138°C (190° and 280°F). The resulting product is typically pelletized and is sold as livestock feed.

9.10.1.2.3 Emissions And Controls[1,3-4]

Particulate matter (PM), combustion products, and volatile organic compounds (VOC) are the primary pollutants emitted from the sugarbeet processing industry. The pulp dryers, sugar granulators and coolers, sugar conveying and sacking equipment, lime kilns and handling equipment, carbonation tanks, sulfur stoves, evaporators, and boilers, as well as several fugitive sources are potential emission sources. Potential emissions from lime kilns and boilers are addressed in AP-42 Section 11.15 (Lime Manufacturing) and Sections 1.1 through 1.4 (Combustion), respectively, and are not included in this discussion. Potential sources of PM emissions include the pulp dryer, sugar granulators and coolers, sugar conveying and sacking equipment, sulfur stove, and fugitive sources. Fugitive sources include unpaved roads, coal handling, and pulp loading operations. The sulfur stove is a potential source of SO_2 emissions, and the pulp dryers and evaporators are a potential source of nitrogen oxides (NO_x), SO_2, CO_2, carbon monoxide (CO), and VOC. However, only the first three of five evaporators (in a typical five-stage system) release exhaust gases, and the gases are used as a heat source for various process heaters before release to the atmosphere. Emissions from carbonation tanks are primarily VOC and may include CO_2 and other combustion gases.

Particulate matter emissions from pulp dryers are typically controlled by a cyclone or multiclone system, sometimes followed by a secondary device such as a wet scrubber or fabric filter. Particulate matter emissions from granulators are typically controlled with wet scrubbers, and PM emissions from sugar conveying and sacking as well as lime dust handling operations are controlled by hood systems that duct the emissions to fabric filtration systems. Emissions from carbonation tanks and evaporators are not typically controlled.

Table 9.10.1.2-1 and -2 present emission factors for filterable PM, PM-10, and condensible PM emissions from sugarbeet processing operations. Table 9.10.1.2-3 presents emission factors for total organic compounds (TOC), methane, NO_x, SO_2, CO, and CO_2 emissions from sugarbeet processing operations, and Tables 9.10.1.2-4 and -5 present emission factors for organic pollutants emitted from coal-fired dryers, carbonation tanks, and first evaporators.

Draft Table 9.10.1.2-1 (Metric Units).
PARTICULATE MATTER EMISSION FACTORS FOR SUGARBEET PROCESSING OPERATIONS[a]

Source	Filterable PM				Condensible PM					
	PM	EMISSION FACTOR RATING	PM-10	EMISSION FACTOR RATING	Inorganic	EMISSION FACTOR RATING	Organic	EMISSION FACTOR RATING	Total	EMISSION FACTOR RATING
Coal-fired pulp dryer[b] (SCC 3-02-016-XX)	2.2	D	ND		ND		ND		ND	
Coal-fired pulp dryer with multiclone (SCC 3-02-016-XX)	0.33[c]	B	ND		ND		0.042[d]	C	ND	
Coal-fired pulp dryer with wet scrubber (SCC 3-02-016-XX)	0.25[e]	D	ND		0.025[f]	D	0.17[e]	D	0.20[g]	D
Natural gas-fired pulp dryer with multiclone[h] (SCC 3-02-016-XX)	0.34	D	ND		ND		ND		ND	
Natural gas-fired pulp dryer with wet scrubber (SCC 3-02-016-XX)	0.081[j]	D	ND		0.011[k]	D	ND		ND	
Fuel oil-fired pulp dryer with cyclone (SCC 3-02-016-XX)	0.72[m]	C	ND		0.12[n]	C	0.038[m]	C	0.16[n]	C
Fuel oil-fired pulp dryer with dry scrubber and cyclone (SCC 3-02-016-XX)	0.57[p]	D	0.41[p]	D	0.12[n]	C	ND		ND	
Fuel oil-fired pulp dryer with multiclone[q] (SCC 3-02-016-XX)	0.30	D	ND		ND		ND		ND	
Sugar cooler with mechanical centrifugal separator with water sprays[r] (SCC 3-02-016-XX)	0.066	D	ND		ND		0.0022	D	ND	
Sugar cooler with venturi scrubber[s] SCC 3-02-016-XX)	0.032	D	ND		0.0024	D	0.0021	D	0.0045	D
Sugar granulator with mechanical centrifugal separator with water sprays[r] (SCC 3-02-016-XX)	0.032	D	ND		ND		0.0018	D	ND	
Sugar conveying and sacking (SCC 3-02-016-XX)	ND		ND		ND		ND		ND	
Sulfur stove (SCC 3-02-016-XX)	ND		ND		ND		ND		ND	

Draft Table 9.10.1.2-1 (cont.).

[a]Emission factor units are kg/Mg of pressed pulp feed to the dryer, unless noted. Factors represent uncontrolled emissions unless noted. SCC = Source Classification Code. ND = no data.
[b]Reference 17.
[c]References 7,16-17,19,21.
[d]References 16-17,19,21.
[e]References 3,13.
[f]Reference 13.
[g]Reference 3.
[h]References 22-23.
[j]References 8-12.
[k]References 11-12.
[m]References 4-6.
[n]References 4-6,14. Includes condensible organic PM data from dryers controlled by cyclones and dryers controlled by a dry scrubber and cyclone combination.
[p]Reference 14.
[q]References 15,24.
[r]Reference 20. Emission factor units are kg/Mg of sugar throughput.
[s]Reference 18. Emission factor units are kg/Mg of sugar throughput.

Draft Table 9.10.1.2-2 (English Units).
PARTICULATE MATTER EMISSION FACTORS FOR SUGARBEET PROCESSING OPERATIONS[a]

Source	Filterable PM				Condensible PM					
	PM	EMISSION FACTOR RATING	PM-10	EMISSION FACTOR RATING	Inorganic	EMISSION FACTOR RATING	Organic	EMISSION FACTOR RATING	Total	EMISSION FACTOR RATING
Coal-fired pulp dryer[b] (SCC 3-02-016-XX)	4.4	D	ND		ND		ND		ND	
Coal-fired pulp dryer with multiclone (SCC 3-02-016-XX)	0.66	B	ND		ND		0.084[d]	C	ND	
Coal-fired pulp dryer with wet scrubber (SCC 3-02-016-XX)	0.49	D	ND		0.050[f]	D	0.35[e]	D	0.40[g]	D
Natural gas-fired pulp dryer with multiclone[h] (SCC 3-02-016-XX)	0.69	D	ND		ND		ND		ND	
Natural gas-fired pulp dryer with wet scrubber (SCC 3-02-016-XX)	0.16	D	ND		0.021[k]	D	ND		ND	
Fuel oil-fired pulp dryer with cyclone (SCC 3-02-016-XX)	1.4	C	ND		0.24[n]	C	0.076[m]	C	0.32[n]	C
Fuel oil-fired pulp dryer with dry scrubber and cyclone (SCC 3-02-016-XX)	1.1	D	0.83[p]	D	0.24[n]	C	ND		ND	
Fuel oil-fired pulp dryer with multiclone[q] (SCC 3-02-016-XX)	0.60	D	ND		ND		ND		ND	
Sugar cooler with mechanical centrifugal separator with water sprays[r] (SCC 3-02-016-XX)	0.13	D	ND		ND		0.0043	D	ND	
Sugar cooler with venturi scrubber[s] SCC 3-02-016-XX)	0.065	D	ND		0.0047	D	0.0042	D	0.0089	D
Sugar granulator with mechanical centrifugal separator with water sprays[r] (SCC 3-02-016-XX)	0.064	D	ND		ND		0.0037	D	ND	
Sugar conveying and sacking (SCC 3-02-016-XX)	ND		ND		ND		ND		ND	
Sulfur stove (SCC 3-02-016-XX)	ND		ND		ND		ND		ND	

Draft Table 9.10.1.2-2 (cont.).

[a]Emission factor units are lb/ton of pressed pulp feed to the dryer, unless noted. Factors represent uncontrolled emissions unless noted. SCC = Source Classification Code. ND = no data.
[b]Reference 17.
[c]References 7,16-17,19,21.
[d]References 16-17,19,21.
[e]References 3,13.
[f]Reference 13.
[g]Reference 3.
[h]References 22-23.
[j]References 8-12.
[k]References 11-12.
[m]References 4-6.
[n]References 4-6,14. Includes condensible organic PM data from dryers controlled by cyclones and dryers controlled by a dry scrubber and cyclone combination.
[p]Reference 14.
[q]References 15,24.
[r]Reference 20. Emission factor units are lb/ton of sugar throughput.
[s]Reference 18. Emission factor units are lb/ton of sugar throughput.

Draft Table 9.10.1.2-3 (Metric And English Units).
EMISSION FACTORS FOR TOC, METHANE, AND INORGANIC POLLUTANT EMISSIONS FROM SUGARBEET PROCESSING OPERATIONS[a]

EMISSION FACTOR RATING: D

Source	TOC[b]		Methane		NO_x		SO_2		CO		CO_2	
	kg/Mg	lb/ton	kg/Mg	lb/ton	kg/Mg	lb/ton	kg/Mg	lb/ton	kg/Mg	lb/ton	kg/Mg	lb/ton
Coal-fired pulp dryer[c] (SCC 3-02-016-XX)	0.59[d]	1.2[d]	ND	ND	0.33[e]	0.66[e]	0.40[f]	0.79[f]	1.1[d]	2.3[d]	180[g]	370[g]
Natural gas-fired pulp dryer[c] (SCC 3-02-016-XX)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	65[h]	130[h]
Fuel oil-fired pulp dryer[c] (SCC 3-02-016-XX)	0.055[j]	0.11[j]	0.014[j]	0.028[j]	0.30[j]	0.60[j]	0.52[k]	1.0[k]	0.51[j]	1.0[j]	210[m]	430[m]
Evaporator (SCC 3-02-016-XX)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfur stove (SCC 3-02-016-XX)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
First carbonation tank (SCC 3-02-016-XX)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[a]Emission factor units are kg/Mg and lb/ton of pressed pulp feed to the dryer, unless noted. Factors represent uncontrolled emissions unless noted. SCC = Source Classification Code. ND = no data.
[b]Total organic compounds as methane.
[c]Data for pulp dryers equipped with cyclones, multiclones, wet scrubbers, or a combination of these control technologies are averaged together because these control technologies do not effectively control TOC, methane, NO_x, SO_2, CO, or CO_2 emissions.
[d]Reference 19.
[e]References 16,19.
[f]References 7,19.
[g]References 7,13,16-17,19,21. EMISSION FACTOR RATING: B.
[h]References 8-12,22-23. EMISSION FACTOR RATING: C.
[j]Reference 4.
[k]References 14-15.
[m]References 4-6,14,24. EMISSION FACTOR RATING: C.

Draft Table 9.10.1.2-4 (Metric And English Units).
EMISSION FACTORS FOR ORGANIC POLLUTANT
EMISSIONS FROM PULP DRYERS[a]

EMISSION FACTOR RATING: E

Source	Pollutant		Emission factor	
	CASRN	Name	kg/Mg	lb/ton
Coal-fired pulp dryer with wet scrubber (SCC 3-02-016-XX)	75-07-0	Acetaldehyde	0.0073	0.015
	107-02-8	Acrolein	0.0038	0.0076
	123-73-9	Crotonaldehyde	0.0010	0.0020
	50-00-0	Formaldehyde	0.0036	0.0071
	91-57-6	2-methylnaphthalene	8.5×10^{-6}	1.7×10^{-5}
	88-75-5	2-nitrophenol	9.0×10^{-5}	0.00018
		2-methylphenol	1.7×10^{-5}	3.4×10^{-5}
		2,4-dimethylphenol	1.3×10^{-5}	2.5×10^{-5}
		4-methylphenol	6.5×10^{-5}	0.00013
	100-02-7	4-nitrophenol	7.0×10^{-5}	0.00014
	208-96-8	Acenaphthylene	8.5×10^{-7}	1.7×10^{-6}
	100-52-7	Benzaldehyde	0.00070	0.0014
	65-85-0	Benzoic acid	0.0014	0.0028
	100-51-6	Benzyl alcohol	3.6×10^{-5}	7.1×10^{-5}
		Bis(2-ethylhexyl)phthalate	0.00075	0.0015
	84-74-2	Di-n-butylphthalate	2.6×10^{-5}	5.2×10^{-5}
	132-64-9	Dibenzofuran	5.5×10^{-6}	1.1×10^{-5}
	84-66-2	Diethylphthalate	4.9×10^{-6}	9.8×10^{-6}
	91-20-3	Naphthalene	5.5×10^{-5}	0.00011
	98-95-3	Nitrobenzene	9.5×10^{-6}	1.9×10^{-5}
	85-01-8	Phenanthrene	6.0×10^{-6}	1.2×10^{-5}
	108-95-2	Phenol	0.00016	0.00032

[a]Reference 3. Emission factor units are kg/Mg and lb/ton of pressed pulp feed to the dryer.
SCC = Source Classification Code. CASRN = Chemical Abstracts Service Registry Number.

Draft Table 9.10.1.2-5 (English Units)
EMISSION FACTORS FOR ORGANIC POLLUTANT EMISSIONS
FROM CARBONATION TANKS AND EVAPORATORS[a]

Source	Pollutant		Emission factor, lb/1,000 gal	EMISSION FACTOR RATING
	CASRN	Name		
First carbonation tank[b] (SCC 3-02-016-XX)	91-57-6	2-methylnaphthalene	5.1×10^{-7}	D
	51-28-5	2,4-dinitrophenol	ND	D
		4-methylphenol	6.6×10^{-7}	D
	83-32-9	Acenaphthene	ND	D
	100-52-7	Benzaldehyde	1.1×10^{-4}	D
	65-85-0	Benzoic acid	8.4×10^{-6}	D
	100-51-6	Benzyl alcohol	5.0×10^{-6}	D
		Bis(2-ethylhexyl)phthalate	1.2×10^{-5}	D
	91-20-3	Naphthalene	2.0×10^{-6}	D
	85-01-8	Phenanthrene	1.4×10^{-6}	D
	108-95-2	Phenol	1.3×10^{-6}	D
Second carbonation tank[b] (SCC 3-02-016-XX)	75-07-0	Acetaldehyde	0.0043	E
	107-02-8	Acrolein	2.4×10^{-4}	E
	123-73-9	Crotonaldehyde	3.0×10^{-5}	E
	50-00-0	Formaldehyde	1.6×10^{-5}	E
First evaporator[c] (SCC 3-02-016-XX)	75-07-0	Acetaldehyde	6.7×10^{-5}	E
	107-02-8	Acrolein	4.2×10^{-7}	E
	123-73-9	Crotonaldehyde	1.4×10^{-7}	E
	50-00-0	Formaldehyde	7.0×10^{-7}	E
		4-methylphenol	ND	E
	100-52-7	Benzaldehyde	2.2×10^{-6}	E
	65-85-0	Benzoic acid	ND	E
	100-51-6	Benzyl alcohol	1.8×10^{-7}	E
		Bis(2-ethylhexyl)phthalate	3.7×10^{-7}	E
	84-74-2	Di-n-butylphthalate	1.1×10^{-9}	E
	132-64-9	Dibenzofuran	ND	E
	84-66-2	Diethylphthalate	ND	E
		Isophorone	ND	E
	91-20-3	Naphthalene	2.5×10^{-8}	E
	85-01-8	Phenanthrene	1.6×10^{-8}	E
	108-95-2	Phenol	1.2×10^{-8}	E
	110-86-1	Pyridine	3.4×10^{-8}	E

[a]Reference 3. SCC = Source Classification Code. CASRN = Chemical Abstracts Service Registry Number.
[b]Emission factor units are lb per 1,000 gallons of raw juice throughput.
[c]Emission factor units are lb per 1,000 gallons of thin juice throughput.

REFERENCES FOR SECTION 9.10.1.2

1. R.A. McGinnis, *Beet-Sugar Technology, Third Edition*, Beet Sugar Development Foundation, Fort Collins, CO, 1982.

2. *The Beet Sugar Story*, United States Beet Sugar Association, Washington, D.C., 1959.

3. *Particulate, Aldehyde, And Semi-Volatile Organic Compound (SVOC) Testing Report For The Pulp Dryer Stacks, 1st And 2nd Carbonation Tank Vents, And The Evaporator Heater Vents*, The Amalgamated Sugar Company, Nampa, ID, May 14, 1993.

4. *Emission Performance Testing Of Four Boilers, Three Dryers, And One Cooler--Holly Sugar Corporation, Santa Maria, California*, Western Environmental Services, Redondo Beach, CA, June 1991.

5. *Results Of A Source Emission Compliance Test At Southern Minnesota Beet Sugar Cooperative, Renville, Minnesota*, MMT Environmental, Inc., St. Paul, MN, January 21, 1988.

6. *Results Of An Emission Compliance Test On The North Dryer #2 At Southern Minnesota Beet Sugar Cooperative, Renville, Minnesota*, MMT Environmental, Inc., St. Paul, MN, December 14, 1988.

7. *Results Of A Source Emission Compliance Test At Minn-Dak Farmers Cooperative, Wahpeton, North Dakota*, MMT Environmental, Inc., St. Paul, MN, November 1, 1983.

8. *Particulate Emission Testing Performed For Monitor Bay Sugar Company, Bay City, Michigan, On The Pulp Dryer 3 Exhaust*, Network Environmental, Inc., Grand Rapids, MI, October 12, 1992.

9. *Particulate Emission Testing Performed For Monitor Bay Sugar Company, Bay City, Michigan, On The Pulp Dryer 2 Exhaust*, Network Environmental, Inc., Grand Rapids, MI, October 13, 1992.

10. *Particulate Emission Testing Performed For Monitor Bay Sugar Company, Bay City, Michigan, On The Pulp Dryer 1 Exhaust*, Network Environmental, Inc., Grand Rapids, MI, October 14, 1992.

11. *Emissions Survey Conducted At Western Sugar Company's Billings, Montana, Production Facility*, American Environmental Testing Company, Inc., December 1988.

12. *EPA Method 5 Particulate Emissions Tests Conducted On Western Sugar's Boiler And Pulp Dryer Stacks Located In Billings, Montana*, American Environmental Testing Company, Inc., January 1990.

13. *Report On Compliance Testing Performed At Western Sugar Company Pulp Dryer, Scottsbluff, NE*, Clean Air Engineering, Palatine, IL, January 12, 1990.

14. *Emission Measurement Test Report Of C.E. Boilers, Union Boilers, And Pulp Dryers--Permit Compliance For SO_2, Particulate, And PM-10 With Back-Half Emissions--Holly Sugar Corporation, Montana Division*, The Emission Measurement Group, Inc., Englewood, CO, November 16, 1993.

15. *Report To Great Lakes Sugar Company On Stack Particulate Samples Collected On The Pulp Drier At Fremont, Ohio*, Affiliated Environmental Services, Inc., Sandusky, OH, December 8, 1992.

16. *Results Of The February 22-24, 1994, Air Emission Compliance Testing Of Process Sources At The American Crystal Sugar East Grand Forks Plant*, Interpoll Laboratories, Inc., Circle Pines, MN, March 21, 1994.

17. *Results Of The January 28-31, 1992, Particulate Emission Tests, South Pulp Dryer--American Crystal Sugar Company, Moorehead, Minnesota*, Bay West, Inc., St. Paul, MN, March 26, 1992.

18. *Results Of A Source Emission Compliance Test On The Sugar Cooler Stack At American Crystal Sugar Company, Crookston, Minnesota, March 11, 1993*, Twin City Testing Corporation, St. Paul, MN, April 16, 1993.

19. *Results Of The November 9-11, 1993, Air Emission Testing Of Process Sources At The American Crystal Sugar East Grand Forks Plant*, Interpoll Laboratories, Inc., Circle Pines, MN, December 3, 1993.

20. *Results Of The November 14 And 15, 1990, State Particulate Emission Compliance Test On The Sugar Cooler And Sugar Granulator At The ACS Moorehead Plant*, Interpoll Laboratories, Inc., Circle Pines, MN, December 11, 1990.

21. *Unit Nos. 1 And 2 Pulp Dryer Stacks Emission Testing Results For The February 22-26, 1993, Testing Of Particulate Conducted At The American Crystal Sugar Company, Crookston, Minnesota*, Bay West, Inc., St. Paul, MN, April 15, 1993.

22. *Particulate Emission Study For Michigan Sugar Company, Caro, Michigan*, Swanson Environmental, Inc., Farmington Hills, MI, December 14, 1989.

23. *Particulate Emission Study For Michigan Sugar Company, Carrollton, Michigan*, Swanson Environmental, Inc., Farmington Hills, MI, November 1989.

24. *Particulate Emission Study--Michigan Sugar Company, Croswell, Michigan*, Swanson Environmental, Inc., Farmington Hills, MI, November 19, 1990.

APPENDIX A

REPORT EXCERPTS FROM REFERENCE 1

(Southern Minnesota Beet Sugar Cooperative, January 21, 1988)

#29D

MMT Environmental, Inc.
4643 North Chatsworth Street
St. Paul, MN 55112

RESULTS OF A SOURCE EMISSION COMPLIANCE TEST AT SOUTHERN MINNESOTA BEET SUGAR COOPERATIVE RENVILLE, MINNESOTA 56284

January 21, 1988

Submitted to:

Southern Minnesota Beet Sugar
Cooperative
P.O. Box 500
Renville, Minnesota 56248

Attention: Mr. W.D. DeBelly

Prepared by:

Clifford E Mohs

Clifford E. Mohs
Manager, Technical Services

Approved by:

Miles Tomaides, Ph.D., P.E.
Senior Vice President

Report Number 8675
Project Number 8014

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 8014 COMPANY: SOUTHERN MN. BEET SUGAR
TEST NUMBER: 1 SOURCE: CYCLONE "A-2"
RUN NUMBER: 1 TIME: 1/21/88 1128-1231

TEST DATA

GAS METER COEFFICIENT	1.0035 Y	VOLUME OF LIQUID COLLECTED, ML	515.5 Vl
PITOT TUBE COEFFICIENT	0.840 Cp		
		GAS COMPOSITION, % V/V DRY;	
NOZZLE DIMENSIONS;		CARBON DIOXIDE	5.50 CD
DIAMETER, IN	0.375 Dn	OXYGEN	14.20 OX
AREA, SF	0.000767 An	CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	80.30 NI
STACK DIMENSIONS;			
DIAMETER/LENGTH, IN	47.50 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	0.00 Sw	STACK TEMP., DEG F	288 Ts
AREA, SF	12.306 As	METER TEMP., DEG F	68 Tm
		ORIFICE PRESSURE, IN WC	1.450 Po
BAROMETRIC PRESSURE, IN HG	29.30 Pb	SQRT VELOCITY P., IN WC	0.421 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	0.00 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	29.30 Ps	FRONT CATCH (94.8%)	0.4246 Mf
		BACK CATCH (5.2%)	0.0234 Mb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.4480 Mt
VOLUME OF GAS SAMPLED AT METER, DCF	40.427 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	39.872 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.45 Md
		WET BASIS, LB/LB-MOLE	25.12 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	24.265 Vw	AVERAGE GAS VELOCITY, FPS	30.52 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.3783 Bws	ACTUAL, ACFM	22532 Qa
PERCENT BY VOLUME	37.83 Bwp	STANDARD, SCFM	15567 Qs
		DRY STANDARD, DSCFM	9678 Qsd
		ISOKINETIC VARIATION, %	110.24 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0705 Caf	0.0039 Cab	0.0744 Cat
STANDARD, GR/SCF	0.1021 Csf	0.0056 Csb	0.1077 Cst
DRY STANDARD, GR/DSCF	0.1642 Cdf	0.0090 Cdb	0.1733 Cdt
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	13.63 Rcf	0.75 Rcb	14.38 Rct
RATIO OF AREAS METHOD	15.02 Raf	0.83 Rab	15.85 Rat

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG • NON-APPLICABLE DATA

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 8814 COMPANY: SOUTHERN MN. BEET SUGAR
TEST NUMBER: 1 SOURCE: CYCLONE "A-2"
RUN NUMBER: 2 TIME: 1/21/88 1248-1352

TEST DATA

GAS METER COEFFICIENT	1.0035	Y	VOLUME OF LIQUID COLLECTED, ML	460.0	Vl
PITOT TUBE COEFFICIENT	0.840	Cp			
			GAS COMPOSITION, % V/V DRY;		
NOZZLE DIMENSIONS;			CARBON DIOXIDE	4.60	CD
DIAMETER, IN	0.375	Dn	OXYGEN	15.60	OX
AREA, SF	0.000767	An	CARBON MONOXIDE	0.00	CM
			NITROGEN (BY DIFFERENCE)	79.80	NI
STACK DIMENSIONS;					
DIAMETER/LENGTH, IN	47.50	Sl	AVE. TRAVERSE POINT DATA;		
WIDTH, IN	0.00	Sw	STACK TEMP., DEG F	292	Ts
AREA, SF	12.306	As	METER TEMP., DEG F	68	Tm
			ORIFICE PRESSURE, IN WC	1.385	Po
BAROMETRIC PRESSURE, IN HG	29.30	Pb	SQRT VELOCITY P., IN WC	0.422	Pv
STACK PRESSURES;			MASS OF PARTICULATE MATTER		
STATIC, IN WC	0.00	Pg	COLLECTED, G;		
ABSOLUTE, IN HG	29.30	Ps	FRONT CATCH (96.0%)	0.4116	Wf
			BACK CATCH (4.0%)	0.0170	Wb
SAMPLING TIME, MIN	60.00	Ti	TOTAL CATCH	0.4286	Wt
VOLUME OF GAS SAMPLED AT METER, DCF	38.299	Vm			

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	37.767	Vms	GAS MOLECULAR WEIGHT;		
			DRY BASIS, LB/LB-MOLE	29.36	Md
			WET BASIS, LB/LB-MOLE	25.22	Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	21.652	Vw	AVERAGE GAS VELOCITY, FPS	30.60	Vs
GAS MOISTURE CONTENT;			GAS VOLUMETRIC FLOW RATE;		
VOLUME FRACTION	0.3644	Bws	ACTUAL, ACFM	22593	Qa
PERCENT BY VOLUME	36.44	Bwp	STANDARD, SCFM	15535	Qs
			DRY STANDARD, DSCFM	9974	Qsd
			ISOKINETIC VARIATION, %	102.34	I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION:			
ACTUAL, GR/ACF	0.3734 Caf	0.0030 Cab	0.0765 Cat
STANDARD, GR/SCF	0.1368 Csf	0.0044 Csb	0.1112 Cst
DRY STANDARD, GR/DSCF	0.1681 Csf	0.0069 Csb	0.1750 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	14.23 Rcf	0.59 Rcb	14.82 Rct
RATIO OF AREAS METHOD	14.56 Rrf	0.60 Rrb	15.16 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG * NON-APPLICABLE DATA

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 8014 COMPANY: SOUTHERN MN. BEET SUGAR
TEST NUMBER: 1 SOURCE: CYCLONE "A-2"
RUN NUMBER: 3 TIME: 1/21/88 1430-1533

TEST DATA

GAS METER COEFFICIENT	1.0035 Y	VOLUME OF LIQUID COLLECTED, ML	614.1 Vl
PITOT TUBE COEFFICIENT	0.840 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.375 Dn	CARBON DIOXIDE	6.00 CD
AREA, SF	0.000767 An	OXYGEN	13.10 OX
		CARBON MONOXIDE	0.00 CM
STACK DIMENSIONS;		NITROGEN (BY DIFFERENCE)	80.90 NI
DIAMETER/LENGTH, IN	47.50 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	0.00 Sw	STACK TEMP., DEG F	292 Ts
AREA, SF	12.306 As	METER TEMP., DEG F	68 Tm
		ORIFICE PRESSURE, IN WC	1.555 Po
BAROMETRIC PRESSURE, IN HG	29.30 Pb	SQRT VELOCITY P., IN WC	0.446 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	0.00 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	29.30 Ps	FRONT CATCH (95.8%)	0.4170 Wf
		BACK CATCH (4.2%)	0.0184 Wb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.4354 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	41.000 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	40.448 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.46 Md
		WET BASIS, LB/LB-MOLE	24.70 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	28.906 Vw	AVERAGE GAS VELOCITY, FPS	32.65 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.4168 Bws	ACTUAL, ACFM	24108 Qa
PERCENT BY VOLUME	41.68 Bwp	STANDARD, SCFM	16566 Qs
		DRY STANDARD, DSCFM	9662 Qsd
		ISOKINETIC VARIATION, %	112.02 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.2537 Caf	0.0028 Cab	0.0665 Cat
STANDARD, GR/SCF	0.0927 Cwf	0.0041 Cwb	0.0968 Cwt
DRY STANDARD, GR/DSCF	0.1598 Csf	0.0070 Csb	0.1668 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	13.18 Rcf	0.58 Rcb	13.76 Rct
RATIO OF AREAS METHOD	14.75 Rrf	0.65 Rrb	15.40 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG * NON-APPLICABLE DATA

SUMMARY OF PARTICULATE EMISSION TEST LABORATORY DATA

PROJECT NUMBER: 8014 COMPANY: SOUTHERN MN. BEET SUGAR
TEST NUMBER: 1 SOURCE: CYCLONE "A-2"

	MASS OF PARTICULATE MATTER COLLECTED, GRAMS							
	FRONT CATCH				BACK CATCH			TOTAL PARTICULATE
RUN NUMBER	FRONT WASH	CYCLONE CATCH	FILTER CATCH	FRONT TOTAL	IMPINGER CATCH **	IMPINGER WASH	BACK TOTAL	MASS COLLECTED
1	0.1630	0.0000	0.2616	0.4246	0.0112	0.0122	0.0234	0.4480
2	0.1766	0.0000	0.2356	0.4116	0.0087	0.0083	0.0170	0.4286
3	0.1611	0.0000	0.2559	0.4170	0.0122	0.0062	0.0184	0.4354

* NOT APPLICABLE

** CHLOROFORM/ETHYL ETHER EXTRACTION

④ JAN 2 2 1988

SOUTHERN MINNESOTA SUGAR CO-OP

FORM 1 Rev. 6-[illegible]

DIFFUSER REPORT

DAY ENDING 8 A.M. 1-22-88

SIGNATURES

	OPER.	BEET END 4M
SHIFT 1	[illegible]	[illegible]
SHIFT 2	[illegible]	[illegible]
SHIFT 3	Julie Stewart	[illegible]

5%

		A.M. 9	10	11	P.M. 12	1	2	3	4	5	6	7	8	9	10	11	A.M. 12	1	2	3	4	5	6	7
BEETS SLICED TONS	320	320	320	320	320	290	290	290	221	0	270	300	300	300	310	310	325	200	310	300	290	290	275	27[illegible]
COSSETTE SCALE		8 A.M. 21945								4 P.M. 24316								12 Mid. 26431						
SLICERS IN SERVICE		[illegible]	4	3	4	4	4	4	4	↑	4	4	4	4	4	4	4	4	4	4	4	4	4	4
CONDITION OF COSSETTES		[illegible]	gd	gd	gd	gd	gd	gd	gd		gd	gd	gd	gd	gd	gd	gd	gd	gd	gd	gd	gd	gd	gd
TEMPS:																								
SCALDING TEMP. ENT. DIFF.	72	[illegible]	83	79	84	[illegible]	88	89	↑		76	84	85	82	82	83	84	84	84	82	83	80	76	76
RAW JUICE LVG. DIFF.	61	61	56	56	61	68	70	65			65	62	64	60	61	62	63	63	66	64	65	64	62	61
DIFFUSER SUPPLY	67	[illegible]	67	68	67	68	68	67			69	67	67	67	66	67	67	68	68	69	68	68	69	69
RAW JUICE TO CARBS.	81	80	78	-	79	82	86	85			84	84	83	82	82	82	83	84	85	85	85	85	85	[illegible]
Cossette	55	55	[illegible]	50	56	62	64	57			58	57	59	53	55	56	58	58	60	58	58	58	59	57
WATER FLOW TO DIFF. (TON/HR)		[illegible]	305	305 295	295 275	275	275	275	[illegible]	-	275	275	275 285	285 295	295	295 300	300 [illegible]	270	270	270	270	270 260	260 245	24[illegible]
DIFF. SCREENS CLEANED																					X		X	
RAW JUICE FLOW %		[illegible]	62	66	70	70	70	70	✓	✓	66	66	70	70	70	70	70	66	70	70	66	66	66	66
DELAY TO SLICE (BELOW 250 TON/HR)																								

FORMALDEHYDE GALS. SHIFT 1 12:45 P.M. 7[illegible] SHIFT 2 ______ SHIFT 3 8 min 5:00 AM

FOAM OIL GALS. SHIFT 1 [illegible] 7'8½" SHIFT 2 7'8½"-7'6" SHIFT 3 7'6"-7'5"

DIFFUSER TEMP.		A.M. 9	10	11	P.M. 12	1	2	3	4	5	6	7	8	9	10	11	A.M. 12	1	2	3	4	5	6	7
CELL 2	[illegible]	[illegible]	71	↑	70	71	74	74	X	↑	73	69	70	69	69	69	↑	69	72	72	72	73	72	71
CELL 9	71	[illegible]	70		[illegible]	71	71	73	X		71	70	70	70	70	70	X	69	70	71	71	71	70	70
CELL 13	70	[illegible]	69		71	71	71	72	X		67	67	69	67	67	69	X	68	69	70	70	69	69	67
CELL 17	[illegible]	[illegible]	68		70	70	70	70	X		66	67	67	67	67	67	X	67	68	69	69	67	67	68
CELL 22	[illegible]	[illegible]	66		67	67	67	67	X		64	65	65	66	66	66	X	65	66	66	66	66	66	66
CELL 25	67	[illegible]	66	↓	67	67	67	67	X	↓	66	65	66	66	66	66	X	65	66	66	66	66	66	66

REASON FOR DELAY: ______

SHUTTING ↓ 3:30 P.M. LIME KILN ↑ 5:00 P.M.

COMMENTS: Flushed Flume 10:20 A.M. Flushed flume @ 5:15 PM

ICFROZE "B" SLICER - SLICING AGAIN 11:50 -

B-SLICER MOTOR SHUT OFF 3 TIMES [illegible]

SOUTHERN MINNESOTA SUGAR CO-OP

DRYER REPORT

FORM 127 Rev 6-83

JAN 26 1988 [illegible] Test Run

DAY ENDING 1-22-88 8 A.M.

9.1 tons/hour — tons pressed pulp/hour — 85%

	OPERATOR	BEET END 4MAN
SHIFT 1	[signature]	[signature]
SHIFT 2	Dam	[signature]
SHIFT 3	C. F.	[signature]

TIME	A.M. 9	10 (B)	11	12 (B)	P.M. 1	2 (B)	3	4 (B)	5	6 (B)	7	8 (B)	9	10 (B)	11	12 (B)	A.M. 1	2 (B)	3	4 (B)	5	6 (B)	7	8 (B)
FEED RATE % (Tons) NORTH	45	45	45	45	40	40	40	40	40	30	45	45	40	50	45	45	40	40	40	40	40	40	40	45
FEED RATE % SOUTH	45	45	45	45	40	40	40	40	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
FURNACE TEMP. NORTH	1050	1050	1050	1050	1060	1050	1100	1080	1200	1250	1400	1250	1250	1250	1300	1300	1250	1250	1250	1250	1250	1300	1200	1200
FURNACE TEMP. SOUTH	1200	1200	900	1150	1200	1200	1200	1200	1100	1450	1350	1450	1400	1450	1450	1400	1350	1300	1300	1300	1300	1300	1300	1300
EXIT TEMP. NORTH	320	320	320	320	315	310	310	310	315	320	315	315	315	330	320	320	320	310	310	310	310	305	305	310
EXIT TEMP. SOUTH	325	325	325	310	310	310	310	310	325	330	325	330	330	330	330	330	330	330	325	325	325	325	330	330
MOISTURES (%) PRESSED P.	76.2	76.6	75.8	76.0	73.6	75.6	73.4	76.4	78.0	77.8	77.8	78.5	78.2	78.0	78.0	77.4	76.6	76.8	76.4	76.8	76.6	76.2	76.6	76.8
DRIED P.	9.8	9.4	9.2	9.6	8.4	10.2	9.2	10.0	11.5	8.0	8.2	9.6	8.8	8.6	8.4	8.2	8.6	9.0	8.8	9.2	8.8	8.4	8.2	8.6
PELLETS	10.8	11.2	11.0	10.6	10.8	10.4	10.8	10.4	11.5	10.0	10.2	10.4	10.2	10.0	10.2	10.0	10.4	11.2	11.4	11.0	10.8	11.2	11.2	11.4
STORAGE BIN (E) OR (W)																								
PYROMETER NORTH	1200	1200	1200	1200	1200	1150	1250	1200	1300	1350	1450	1350	1350	1350	1400	1400	1300	1300	1300	1300	1300	1300	1300	1300
PYROMETER SOUTH	1400	1350	1000	1350	1350	1350	1350	1350	1250	1600	1500	1600	1550	1600	1600	1600	1600	1600	1600	1600	1600	1550	1550	1600
FIRE VISIBLE EXIT END NORTH	Y	Y	Y	Y	Y	Y	Y	Y																
FIRE VISIBLE EXIT END SOUTH	Y	Y	Y	Y	Y	Y	Y	Y																
CHEMICALS TO WATER TANK		X		X		X		X																

FUEL OIL USED

NORTH METER	8 A.M. ______	4 P.M. ______	12 MID. ______	8 A.M. ______
SOUTH METER	8 A.M. 043052	4 P.M. 045427	12 MID. ______	8 A.M. ______

REASON FOR PULP TO FLOOR: FD Damper 60% Recycle 35% combuston air 90%

*COMMENTS: ______

* NOTE TIMES FOR INSTALLATION OF NEW DIES AND ROLLERS

Filename: BEET1.WQ1
Date: 02-Dec-94
Facility: Southern Minnesota Beet Sugar Cooperative, Renville, Minnesota
Source: Fuel oil-fired drum pulp dryer (assumed south dryer)
Test date: Jan. 21, 1988

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	288	292	292	
	Pressure	in. HG	29.3	29.3	29.3	
	Moisture	%	37.83	36.44	41.68	
	Oxygen	%	14.2	15.6	13.1	
	Volumetric flow, actual	acfm	22532	22593	24108	
	Volumetric flow, standard*	dscfm	9683	9874	9667	
	Isokinetic variation	%	110.2	102.3	112	
	Wet pulp feed rate (Assumed South Dryer)	TPH	45.0	41.0	42.5	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.1642	0.1681	0.159	
	Condensible PM	G/dscf	0.0090	0.0069	0.007	
	CO2	% dv	5.5	4.6	6.0	
	Condensible organic PM	% of CPM	47.9%	51.2%	66.3%	
	Condensible inorganic PM	% of CPM	52.1%	48.8%	33.7%	
	Multiply all conc. by 4 because only one of four stacks was tested.					
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	54.5	56.9	52.7	
	Condensible PM	lb/hr	2.99	2.34	2.32	
	CO2	lb/hr	14600	12451	15901	
	Condensible organic PM	lb/hr	1.43	1.20	1.54	
	Condensible inorganic PM	lb/hr	1.56	1.14	0.782	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	1.21	1.39	1.24	1.28
	Condensible PM	lb/ton	0.0664	0.0570	0.0546	0.0593
	CO2	lb/ton	324	304	374	334
	Condensible organic PM	lb/ton	0.0318	0.0292	0.0362	0.0324
	Condensible inorganic PM	lb/ton	0.0346	0.0278	0.0184	0.0269
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.606	0.694	0.620	0.640
	Condensible PM	kg/Mg	0.0332	0.0285	0.0273	0.0297
	CO2	kg/Mg	162	152	187	167
	Condensible organic PM	kg/Mg	0.0159	0.0146	0.0181	0.0162
	Condensible inorganic PM	kg/Mg	0.0173	0.0139	0.00920	0.0135

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX B

REPORT EXCERPTS FROM REFERENCE 2

(Southern Minnesota Beet Sugar Cooperative, December 14, 1988)

Rec'd 11/9

MMT Environmental Services, Inc.
4643 North Chatsworth Street
St. Paul, MN 55112

RESULTS OF AN EMISSION COMPLIANCE TEST ON THE NORTH DRYER #2 AT SOUTHERN MINNESOTA BEET SUGAR COOPERATIVE RENVILLE, MINNESOTA 56284

December 14, 1988

Submitted to:

Southern Minnesota Beet Sugar Cooperative
P. O. Box 500
Renville, Minnesota 56284

Attention: Mr. W. D. DeBelly

Prepared by:

Clifford E. Mohs
Manager, Technical Services

Approved by:

for Milos Tomaides, Ph.D., P.E.

Report Number 8722
Project Number 8202

TABLE 2.1 SUMMARY OF PARTICULATE EMISSION TEST RESULTS

PROJECT NUMBER: 8202 COMPANY: SOUTHERN MN SUGAR BEET COOP
TEST NUMBER: 1 SOURCE: NORTH CYCLONE DRYER #2

TEST PARAMETER	RUN 1	RUN 2	RUN 3
TEST DATE	12/14/88	12/14/88	12/14/88
TIME OF TEST, HR:			
START	0928	1044	1204
FINISH	1029	1147	1310
EFFLUENT TEMPERATURE, DEGREES F	292	279	259
EFFLUENT MOISTURE CONTENT, % V/V	29.8	30.6	30.5
EFFLUENT COMPOSITION, % V/V DRY;			
CARBON DIOXIDE	5.2	5.2	5.2
OXYGEN	14.9	14.9	14.9
CARBON MONOXIDE	0.0	0.0	0.0
EFFLUENT VOLUMETRIC FLOW RATE;			
ACTUAL CONDITIONS, ACFM	20741	20401	20739
STANDARD CONDITIONS, SCFM	14031	14025	14657
DRY STANDARD CONDITIONS, DSCFM	9847	9733	10183
ISOKINETIC VARIATION, %	96.6	99.4	95.0
EFFLUENT PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.0424	0.0400	0.0462
STANDARD CONDITIONS, GR/SCF	0.0627	0.0582	0.0654
DRY STANDARD CONDITIONS, GR/DSCF	0.0894	0.0839	0.0941
SOURCE PARTICULATE EMISSION RATE;			
CLASSICAL METHOD, LB/HR	7.55	7.01	8.22
RATIO OF AREAS METHOD, LB/HR	7.29	6.96	7.80

9721

0.0391

7.59

7.35

PARTICULATE CONCENTRATION AND EMISSION RATES BASED ON ANALYSIS OF THE SAMPLING TRAIN FRONT AND BACK CATCHES.

STANDARD CONDITIONS: 68 DEGREES FAHRENHEIT, 29.92 INCHES OF MERCURY.

700 5.0520 ... 0.0392

SUMMARY OF PARTICULATE EMISSION TEST LABORATORY DATA

PROJECT NUMBER: 8202 COMPANY: SOUTHERN MN SUGAR BEET COOP
TEST NUMBER: 1 SOURCE: NORTH CYCLONE DRYER #2

	MASS OF PARTICULATE MATTER COLLECTED, GRAMS							
	FRONT CATCH				BACK CATCH			TOTAL PARTICULATE MASS COLLECTED
RUN NUMBER	FRONT WASH	CYCLONE CATCH	FILTER CATCH	FRONT TOTAL	IMPINGER CATCH **	IMPINGER WASH	BACK TOTAL	
1	0.0429	0.0000	0.1237	0.1666	0.0235	0.0139	0.0374	0.2040
2	0.0225	0.0000	0.1326	0.1551	0.0221	0.0175	0.0396	0.1947
3	0.0465	0.0000	0.1400	0.1865	0.0103	0.0214	0.0317	0.2182

* NOT APPLICABLE

** CHLOROFORM/ETHYL ETHER EXTRACTION

DEC 15 1988

SOUTHERN MINNESOTA SUGAR CO.

DRYER REPORT

FORM 12 Rev 6-87

BEET END 4MAN

DAY ENDING 12/14/88 8 A.M.

OPERATOR
SHIFT 1 Terry Mogk
SHIFT 2 [illegible] R. Kennedy
SHIFT 3 [illegible] L. O[illegible]

TIME	A.M. 9	10	11	12	P.M. 1	2	3	4	5	6	7	8	9	10	11	12	A.M. 1	2	3	4	5	6	7	8
FEED RATE % NORTH	35	40	20	20	20	35	40	40	35	35	35	35	35	30	35	35	40	40	40	40	40	40	30	40
FEED RATE % SOUTH	35	20	40	40	40	40	40	40	40	40	40	40	40	35	40	40	40	40	40	40	40	40	40	40
FURNACE TEMP. NORTH	1050	800	800	800	750	950	1050	1050	1050	1000	1000	1000	950	950	1000	950	1000	1000	1000	1000	1000	1000	1000	1000
FURNACE TEMP. SOUTH	1250	1300	1300	1300	1200	1200	1200	1200	1200	1250	1200	1200	1200	1150	1150	1200	1150	1150	1100	1100	1100	1100	1100	1100
EXIT TEMP. NORTH	310	280	270	270	270	300	310	310	310	310	310	310	305	305	305	305	310	310	310	310	310	310	310	310
EXIT TEMP. SOUTH	325	335	335	335	335	330	330	330	330	330	330	330	330	325	325	325	325	325	320	320	320	320	320	320
MOISTURES									X	X	X	X	X	X	X	X	321							
PRESSED P.	74.2	74.2	73.8	73.6	75.0	74.4	74.0	74.2	73.8	69.8	73.6	72.2	72.0	73.6	72.0	72.4	74.2	73.6	73.4	73.6	73.4	73.6	73.6	73.4
DRIED P.	8.4	9.2	9.4	8.8	10.2	8.2	10.0	9.8	9.6	9.0	8.4	8.2	8.4	8.0	8.8	8.4	10.0	9.4	8.6	8.8	8.8	9.0	9.2	9.4
PELLETS	12.2	11.4	11.6	11.2	11.8	10.6	11.6	11.4	11.0	11.2	11.0	10.8	11.8	11.4	12.0	11.8	12.8	12.0	11.8	11.6	12.2	12.0	11.6	12.0
FUEL OIL USED NORTH METER	8 A.M. 220665				4 P.M. 222975								12 MID. 225894										8 A.M. 228835	
FUEL OIL USED SOUTH METER	8 A.M. 861755				4 P.M. 865420								12 MID. 869138										8 A.M. 872635	
STORAGE BIN (E) OR (W)																								
PYROMETER NORTH	1050	800	800	800	750	950	1050	1050	1000	1000	1000	950	950	950	950	950	1000	1000	1000	1000	1000	1000	1000	1000
PYROMETER SOUTH	1300	1350	1350	1350	1250	1250	1250	1250	1250	1300	1250	1250	1250	1200	1200	1250	1200	1200	1150	1150	1150	1150	1150	1150
FIRE VISIBLE EXIT END NORTH	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FIRE VISIBLE EXIT END SOUTH	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CHEMICALS TO WATER TANK										X		X		X		X								

~~REASON FOR PULP TO FLOOR:~~

COMMENTS:

Wild Wild West

Filename: BEET2.WQ1
Date: 02-Dec-94
Facility: Southern Minnesota Beet Sugar Cooperative
Location: Renville, Minnesota
Source: Fuel oil-fired drum pulp dryer (North dryer)
Test date: Dec. 14, 1988

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	292	279	259	
	Pressure	in. HG	28.82	28.8	28.8	
	Moisture	%	29.82	30.6	30.52	
	Oxygen	%	14.9	14.9	14.9	
	Volumetric flow, actual	acfm	20741	20401	20739	
	Volumetric flow, standard*	dscfm	9844	9737	10186	
	Isokinetic variation	%	96.63	99.41	94.95	
	Wet pulp feed rate North Dryer	TPH	37.5	25.3	20	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.073	0.0668	0.159	
	Condensible PM	G/dscf	0.0164	0.0171	0.007	
	CO2	% dv	5.2	5.2	5.2	
	Condensible organic PM	% of CPM	62.8%	55.8%	32.5%	
	Condensible inorganic PM	% of CPM	37.2%	44.2%	67.5%	
	Multiply all conc. by 4 because only one of four stacks was tested.					
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	24.6	22.3	55.5	
	Condensible PM	lb/hr	5.54	5.71	2.44	
	CO2	lb/hr	14033	13880	14519	
	Condensible organic PM	lb/hr	3.48	3.19	0.79	
	Condensible inorganic PM	lb/hr	2.06	2.52	1.65	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.657	0.880	2.78	1.44
	Condensible PM	lb/ton	0.148	0.225	0.122	0.165
	CO2	lb/ton	374	548	726	549
	Condensible organic PM	lb/ton	0.0927	0.126	0.0397	0.0861
	Condensible inorganic PM	lb/ton	0.0549	0.0996	0.0825	0.0790
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.329	0.440	1.39	0.719
	Condensible PM	kg/Mg	0.0738	0.113	0.0611	0.0825
	CO2	kg/Mg	187	274	363	275
	Condensible organic PM	kg/Mg	0.0464	0.0629	0.0199	0.0430
	Condensible inorganic PM	kg/Mg	0.0274	0.0498	0.0413	0.0395

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX C

REPORT EXCERPTS FROM REFERENCE 3

(Southern Minnesota Beet Sugar Cooperative, December 8, 1986)

Interpoll Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014

Telephone (612) 786-6020

RESULTS OF THE NOVEMBER 18, 1986, PARTICULATE EMISSION COMPLIANCE TEST ON THE COMBINED DISCHARGE STACK OF THE SUGAR DRYER AND SUGAR COOLER AT THE SOUTHERN MINNESOTA SUGAR COOPERATIVE PLANT IN RENVILLE, MINNESOTA

Submitted to:

SOUTHERN MINNESOTA SUGAR COOPERATIVE
P. O. Box 500
Renville, Minnesota 56284

Attention: Dean DeBelly

Approved by:

Perry Lonnes, Ph.D.
President

Report Number 6-2305
December 8, 1986

1 INTRODUCTION

On November 18, 1986, Interpoll Inc. personnel conducted a particulate emission compliance test on the combined discharge from the Sugar Dryer and Sugar Cooler scrubbers at the Southern Minnesota Sugar Cooperative (SMSC) Plant located in Renville, Minnesota. On-site testing was performed by J. Buresh and C. Mosser. Coordination between testing activities and plant operation was provided by Dean DeBelly of SMSC. The test was witnessed by Carolina Schutt of the Minnesota Pollution Control Agency (MPCA).

The Sugar Dryer and Cooler are rotary drum indirectly heated units manufactured by Stearns-Roger. Particulate emissions from the dryer and cooler are controlled by identical American Air Filter, Type W, Size 24 wet scrubbers. The scrubbers have a nominal air flow of 13,000 ACFM and a scrubber water flow rate of 6 GPM.

Particulate determinations were performed in accordance with EPA Methods 1-5 and 9, CFR Title 40, Part 60, Appendix A (revised July 1, 1986). A preliminary determination of the gas linear velocity profile was made before the first particulate run to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll sampling train which meets or exceeds specifications in the above-cited reference was used to extract particulate samples by means of a heated glass-lined probe.

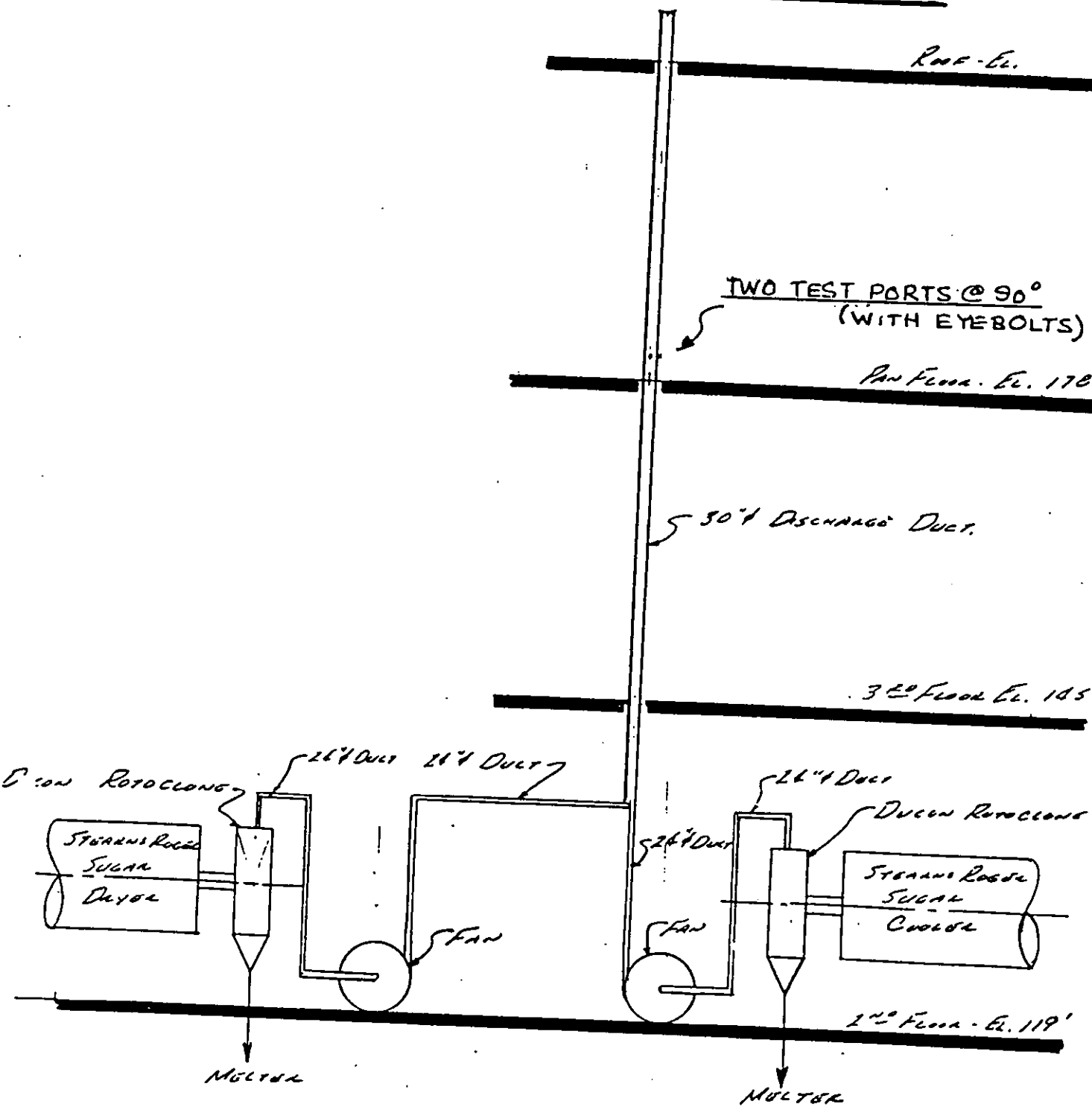
Testing was conducted from two test ports oriented at 90 degrees on the common stack. These test ports are located 30 feet downstream and 20 feet upstream of the nearest flow disturbance. A 12-point traverse was used to extract representative particulate samples. Each traverse point was sampled five minutes to give a total sampling time of 60 minutes per run. Visible emission determinations could not be performed due to a steam plume from an adjacent source.

TABLE 1. Results of the November 18, 1986, Particulate Emission Compliance Test on the Combined Sugar Cooler/Dryer Stack at the Southern Minnesota Sugar Cooperative in Renville, Minnesota.

ITEM		Run 1	Run 2	Run 3	
Date of test		11-18-86	11-18-86	11-18-86	
Time runs were done	(HRS)	800/ 901	926/1027	1038/1139	
Process rate	(KLB/HR)	87.9	87.9	87.9	
Volumetric flow					
actual	(ACFM)	18779	19029	18666	
standard	(DSCFM)	15935	15952	15830	15,906
Gas temperature	(DEG-F)	108	108	107	
Moisture content	(%V/V)	5.72	6.86	5.87	
Gas composition	(%V/V,dry)				
carbon dioxide		0.03	0.03	0.03	
oxygen		20.90	20.90	20.90	
carbon monoxide		0.00	0.00	0.00	
nitrogen		79.07	79.07	79.07	
Isokinetic variation	(%)	101.3	101.1	100.6	
Particulate concentration					
actual	(GR/ACF)	0.01054	0.00792	0.01039	
standard	(GR/DSCF)	0.01243	0.00945	0.01226	
Part. emission rate	(LB/HR)	1.70	1.29	1.66	1.55

* Dry catch only

SO. MINNESOTA SUGAR COOP.



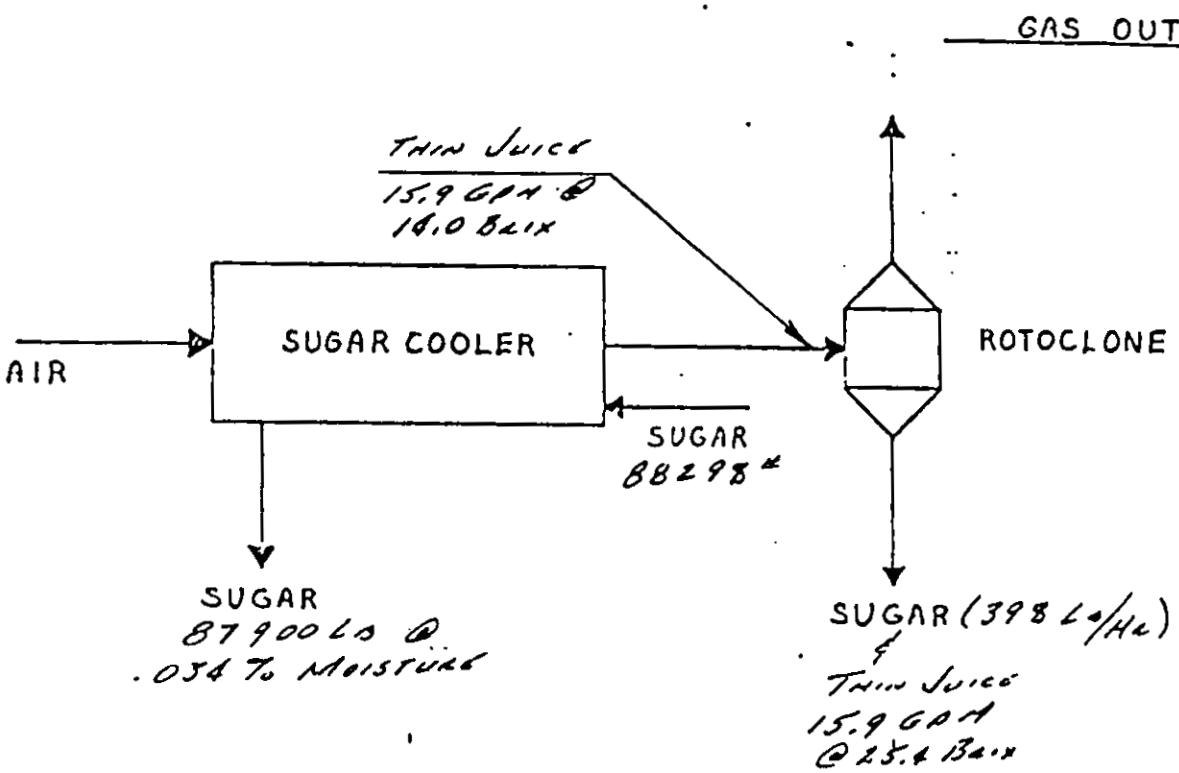
FIRST FLOOR

1ST FLOOR - EL. 100'

SUGAR COOLER & DRYER STACK ELEV.

MLD.

10/30/80



SUGAR COOLER

SUGAR IS COOLED FROM 130°F TO 100°F.

SUGAR INCREASE IN THIN JUICE

= (FLOW)(SP. GR. OUT − SP. GR IN)

= (15.9)(500)(1.107 − 1.057)

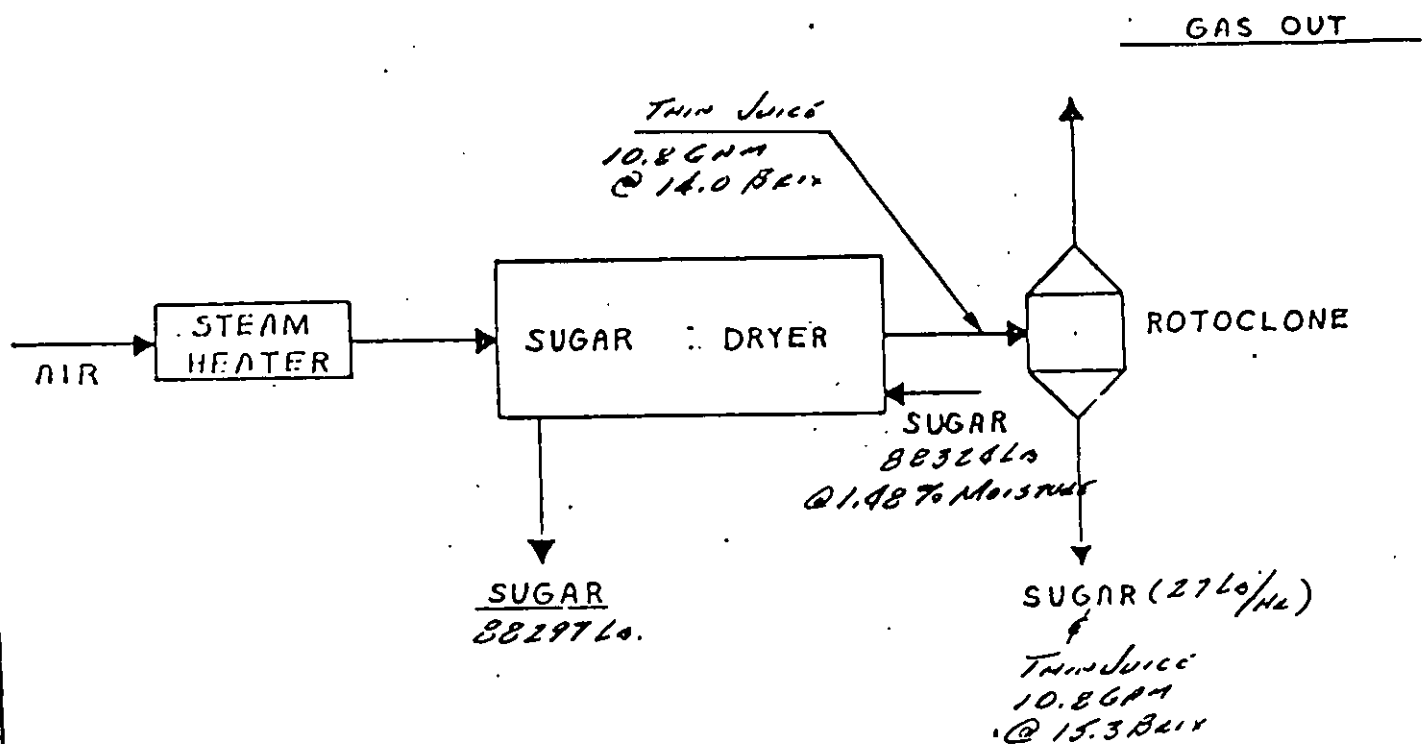
= 398 LB/HR

WPD 11/19/86

H·K·FERGUSON

SUGAR COOLER

2738



SUGAR DRYER

SUGAR IS DRIED AND COOLED FROM 140°F TO 130°F.

Sugar Increase In Thin Juice

= (Flow)(Sp.Gr.$_{out}$ − Sp.Gr.$_{in}$)

= (10.8)(500)(1.062 − 1.057)

= 27 LBS/HR

N.A.P. 11/19/86

H·K·FERGUSON

SUGAR DRYER

T.P. [illegible]

2738

Filename: BEET3.WQ1
Date: 02-Dec-94
Facility: Southern Minnesota Beet Sugar Cooperative
Location: Renville, Minnesota
Source: Sugar dryer & cooler w/wet scrubbers--combined stack after identical controls
Test date: Nov. 18, 1986

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	108	108	107	
	Pressure	in. HG	29.0	29.0	29.0	
	Moisture	%	5.72	6.86	5.87	
	Oxygen	%	20.9	20.9	20.9	
	Volumetric flow, actual	acfm	18779	19029	18666	
	Volumetric flow, standard*	dscfm	15935	15952	15831	
	Isokinetic variation	%	101.3	101.1	100.6	
Sugar produced--cooler output	Process rate	TPH	43.95	43.95	43.95	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.01243	0.00945	0.01226	
	CO2	% dv	0.03	0.03	0.03	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	1.70	1.29	1.66	
	CO2	lb/hr	32.8	32.8	32.5	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.0386	0.0294	0.0379	0.0353
	CO2	lb/ton	0.745	0.746	0.741	~~0.744~~
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0193	0.0147	0.0189	0.0176
	CO2	kg/Mg	0.373	0.373	0.370	~~0.372~~

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX D

REPORT EXCERPTS FROM REFERENCE 4

(Minn-Dak Farmers Cooperative, November 1, 1983)

Rec'd 10/25/84

MMT Environmental, Inc.
4643 N. Chatsworth Street
St. Paul, MN 55112

RESULTS OF A SOURCE EMISSION COMPLIANCE TEST AT MINN-DAK FARMERS COOPERATIVE WAHPETON, NORTH DAKOTA OCTOBER, 1983

Submitted to:

Minn-Dak Farmers Cooperative
Post Office Box 10
Wahpeton, ND 58075

Attention: Mr. John E. Groneman

Prepared by:

for Alan L. Trowbridge
Manager of Technical Services

Approved by:

Milos Tomaides, Ph.D., P.E.
President

Report Number 3531
Project Number 3915

November 1, 1983

RESULTS OF A SOURCE
EMISSION COMPLIANCE TEST AT
MINN-DAK FARMERS COOPERATIVE
WAHPETON, NORTH DAKOTA
OCTOBER, 1983

Report Number 3531
Project Number 3915

1 INTRODUCTION

On October 18, 1983, MMT Environmental, Inc. performed a series of source emission tests at Minn-Dak Farmers Cooperative, Wahpeton, North Dakota. The tests were performed at the request of Mr. John Groneman of Minn-Dak Farmers Cooperative.

The cooperative processes sugar beets. Pressed beet pulp (80% moisture) is dried to less than 10% moisture in a rotary drum dryer. The heat source for the dryer is a spreader stoker, lignite coal fired furnace which can also burn waste gas from an anaerobic waste water treatment plant. The combustion gases come into direct contact with the beet pulp and then pass through an array of 28 cyclones. Prior to entering the discharge stack, a portion of the exhaust gas can be recycled to the furnace and another portion can be removed as a heat source for the flume water heater. A schematic of the process is presented in Figure 1.1.

Three replicate EPA Method 5 particulate and EPA Method 6 sulfur dioxide emission tests were performed simultaneously on the pulp dryer stack and on the flume water heater stack. The results generated by the test program are presented in this report.

The MMT sampling team consisted of Messrs. Alan Trowbridge, Robert Laska and Timothy Puffer. Mr. John Hauges represented Minn-Dak Farmers Cooperative. Messrs. Chuck McDonald and Joe Selnekovic of the North Dakota State Department of Health witnessed the on-site testing.

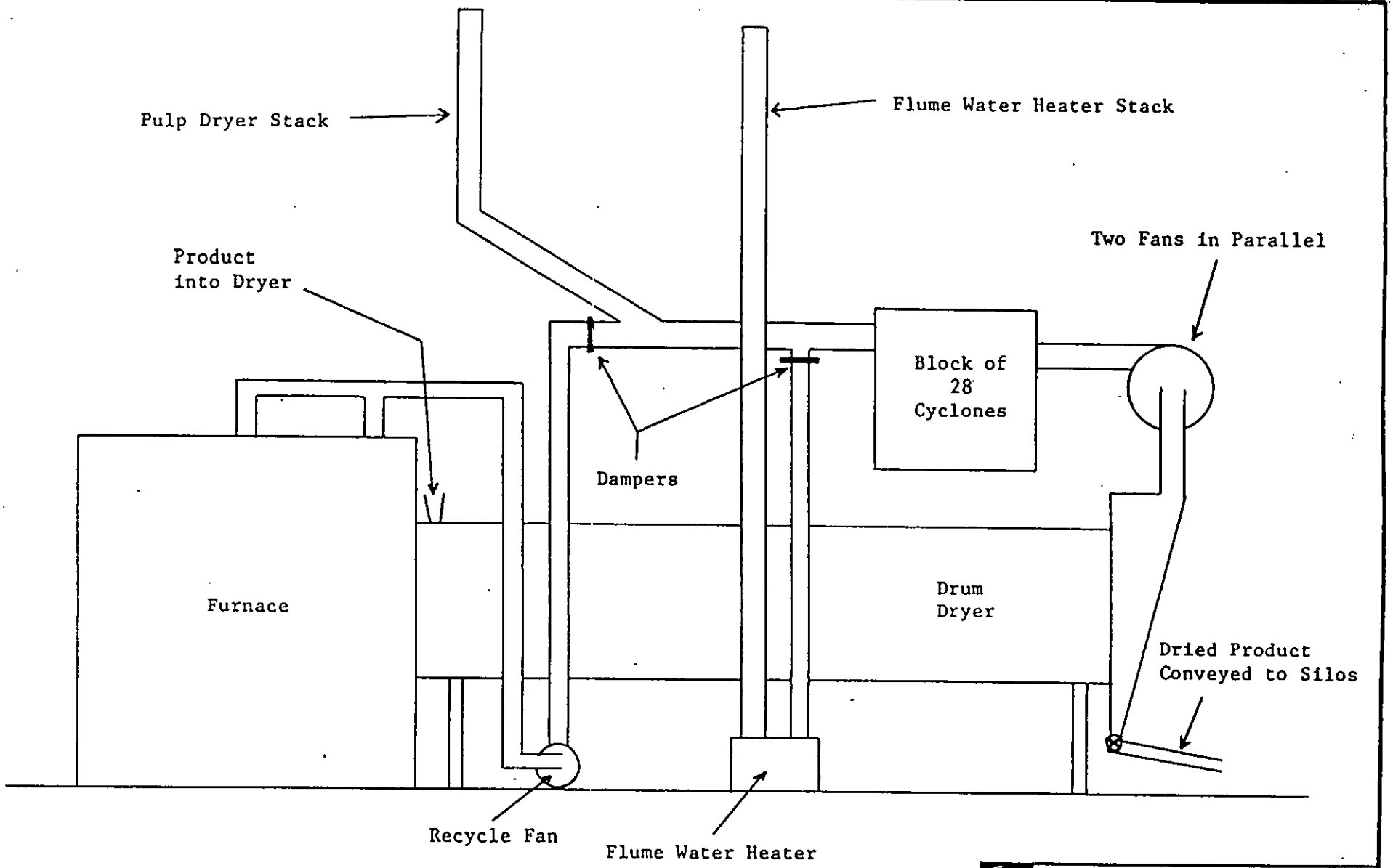


Figure 1.1 Process Schematic

TABLE 2.2 SUMMARY OF PARTICULATE EMISSION TEST RESULTS

PROJECT NUMBER: 3915 COMPANY: MINN-DAK FARMERS COOPERATIVE
TEST NUMBER: 1 SOURCE: PULP DRYER

TEST PARAMETER	RUN 1	RUN 2	RUN 3
TEST DATE	10/18/83	10/18/83	10/18/83
TIME OF TEST, HR:			
START	1019	1311	1606
FINISH	1157	1441	1741
EFFLUENT TEMPERATURE, DEGREES F	257	241	247
EFFLUENT MOISTURE CONTENT, % V/V	35.1	33.1	34.7
EFFLUENT COMPOSITION, % V/V DRY:			
CARBON DIOXIDE	5.1	5.6	5.3
OXYGEN	15.1	14.6	14.9
EFFLUENT VOLUMETRIC FLOW RATE:			
ACTUAL CONDITIONS, ACFM	148865	140178	140673
STANDARD CONDITIONS, SCFM	106967	103078	102478
DRY STANDARD CONDITIONS, DSCFM	69443	68937	66883
ISOKINETIC VARIATION, %	92.0	93.6	95.0
EFFLUENT PARTICULATE CONCENTRATION:			
ACTUAL CONDITIONS, GR/ACF	0.0625	0.0566	0.0513
STANDARD CONDITIONS, GR/SCF	0.0869	0.0770	0.0704
DRY STANDARD CONDITIONS, GR/DSCF	0.1339	0.1151	0.1078
SOURCE PARTICULATE EMISSION RATE:			
CLASSICAL METHOD, LB/HR	79.76	68.05	61.86
RATIO OF AREAS METHOD, LB/HR	73.31	63.69	58.72

PARTICULATE CONCENTRATION AND EMISSION RATES BASED ON ANALYSIS OF THE SAMPLING TRAIN FRONT CATCH ONLY.

STANDARD CONDITIONS: 68 DEGREES FAHRENHEIT, 29.92 INCHES OF MERCURY.

TABLE 2.3 SUMMARY OF SULFUR DIOXIDE EMISSION TEST RESULTS

PROJECT NUMBER: 3915 COMPANY: MINN-DAK FARMERS COOPERATIVE
TEST NUMBER: 1 SOURCE: PULP DRYER

PARAMETER	RUN 1	RUN 2	RUN 3
SULFUR DIOXIDE CONCENTRATION;			
LB/DSCF	0.00002292	0.00002171	0.0000224
mg/DSCM	367	348	35
PPM	138	131	13
SULFUR DIOXIDE MASS EMISSION RATE;			
CLASSICAL METHOD, LB/HR	95.51	89.78	89.9
RATIO OF AREAS METHOD, LB/HR	87.78	84.01	85.4

TABLE 2.4 SUMMARY OF PARTICULATE EMISSION TEST RESULTS

PROJECT NUMBER: 3915 COMPANY: MINN-DAK FARMERS COOPERATIVE
TEST NUMBER: 2 SOURCE: FLUME WATER HEATER

TEST PARAMETER	RUN 1	RUN 2	RUN 3
TEST DATE	10/18/83	10/18/83	10/18/83
TIME OF TEST, HR:			
START	1018	1311	1605
FINISH	1154	1442	1741
EFFLUENT TEMPERATURE, DEGREES F	118	121	124
EFFLUENT MOISTURE CONTENT, % V/V	11.9	13.9	16.1
EFFLUENT COMPOSITION, % V/V DRY:			
CARBON DIOXIDE	5.1	5.6	5.3
OXYGEN	15.1	14.6	14.9
EFFLUENT VOLUMETRIC FLOW RATE:			
ACTUAL CONDITIONS, ACFM	22809	23424	22050
STANDARD CONDITIONS, SCFM	20363	20809	19484
DRY STANDARD CONDITIONS, DSCFM	17948	17925	16343
ISOKINETIC VARIATION, %	105.1	100.7	105.7
EFFLUENT PARTICULATE CONCENTRATION:			
ACTUAL CONDITIONS, GR/ACF	0.0480	0.1020	0.0297
STANDARD CONDITIONS, GR/SCF	0.0538	0.1148	0.0336
DRY STANDARD CONDITIONS, GR/DSCF	0.0610	0.1333	0.0401
SOURCE PARTICULATE EMISSION RATE:			
CLASSICAL METHOD, LB/HR	9.39	20.49	5.62
RATIO OF AREAS METHOD, LB/HR	9.87	20.62	5.94

PARTICULATE CONCENTRATION AND EMISSION RATES BASED ON ANALYSIS OF THE SAMPLING TRAIN FRONT CATCH ONLY.

STANDARD CONDITIONS: 68 DEGREES FAHRENHEIT, 29.92 INCHES OF MERCURY.

TABLE 2.5 SUMMARY OF SULFUR DIOXIDE EMISSION TEST RESULTS

PROJECT NUMBER: 3915 COMPANY: MINN-DAK FARMERS COOPERATIVE
TEST NUMBER: 2 SOURCE: FLUME WATER HEATER

PARAMETER	RUN 1	RUN 2	RUN
SULFUR DIOXIDE CONCENTRATION:			
LB/DSCF	0.00000155	0.00000149	0.0000
mg/DSCM	25	24	
PPM	9	9	
SULFUR DIOXIDE MASS EMISSION RATE:			
CLASSICAL METHOD, LB/HR	1.67	1.60	
RATIO OF AREAS METHOD, LB/HR	1.75	1.61	

Table 2.6 PROCESS DATA*

Test Number	Average Dryer Temperature, °F		Average Product Moisture Content, %		Average Dryer Through-Put, LB/HR	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
1	1722	259	81.6	3.6	140000	26722
2	1675	258	82.4	3.6	133714	24413
3	1718	253	81.9	9.7	139625	27987
Average	1705	257	82.0	5.6	137780	26374

Note: Average coal feed rate: 14414 lb/hr (124.0 MBTU/HR)
Average gas feed rate: 3000 cf/hr (1.5 MBTU/HR)
Average furnace heat input rate: 125.5 MBTU/HR
Average process weight rate (beet pulp and coal): 76.1 tons/hr

* Data furnished by Mr. Hohn Hauges of Minn-Dak Farmers Cooperative

Filename: BEET4.WQ1
Date: 02-Dec-94
Facility: MINN-DAK Farmers Cooperative
Location: Wahpeton, North Dakota
Source: Coal- and supplemental waste gas- (1% of fuel) fired rotary drum beet pulp dryer Controlled by a bank of 28 cyclones, then exhaust goes to two separate stacks.
Test date: Oct. 18, 1983

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	257	241	247	
STACK 1	Pressure	in. HG	29.2	29.2	29.2	
	Moisture	%	35.1	33.1	34.7	
	Oxygen	%	15.1	14.6	14.9	
	Volumetric flow, actual	acfm	148865	140178	140673	
	Volumetric flow, standard*	dscfm	69443	68936	66883	
	Isokinetic variation	%	92	93.6	95	
Process rate: Beet pulp feed to dryer		TPH	70.00	66.86	69.81	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.1339	0.1151	0.1078	
	SO2	lb/dscf	2.292E-05	2.171E-05	2.242E-05	
	CO2	% dv	5.1	5.6	5.30	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	79.70	68.01	61.80	
	SO2	lb/hr	95.5	89.8	90.0	
	CO2	lb/hr	24272	26457	24294	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	1.14	1.02	0.89	1.01
	SO2	lb/ton	1.36	1.34	1.29	1.33
	CO2	lb/ton	347	396	348	363
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.569	0.509	0.443	0.507
	SO2	kg/Mg	0.682	0.672	0.644	0.666
	CO2	kg/Mg	173	198	174	182

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

TOTAL EMISSION FACTORS FOR BOTH STACKS

	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	1.27	1.32	0.966	1.19
	SO2	lb/ton	1.39	1.37	1.31	1.36
	CO2	lb/ton	436	499	433	456
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.636	0.662	0.483	0.594
	SO2	kg/Mg	0.694	0.684	0.656	0.678
	CO2	kg/Mg	218	249	217	228

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg F	118	121	124	
STACK 2	Pressure	in. HG				
	Moisture	%	11.9	13.9	16.1	
	Oxygen	%	15.1	14.6	14.9	
	Volumetric flow, actual	acfm	22809	23424	22050	
	Volumetric flow, standard*	dscfm	17948	17925	16343	
	Isokinetic variation	%	105.1	100.7	105.7	
Process rate: Beet pulp feed to dryer		TPH	70.00	66.86	69.81	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.061	0.1333	0.0401	
	SO2	lb/dscf	1.55E-06	1.49E-06	1.66E-06	
	CO2	% dv	5.1	5.6	5.30	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	9.38	20.48	5.62	
	SO2	lb/hr	1.67	1.60	1.63	
	CO2	lb/hr	6273	6879	5936	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.134	0.306	0.0805	0.174
	SO2	lb/ton	0.0238	0.0240	0.0233	0.0237
	CO2	lb/ton	89.6	103	85.0	92.5
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0670	0.153	0.0402	0.0868
	SO2	kg/Mg	0.0119	0.0120	0.0117	0.0119
	CO2	kg/Mg	44.8	51.4	42.5	46.3

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX E

REPORT EXCERPTS FROM REFERENCE 5

(The Amalgamated Sugar Company, May 14, 1993)

PARTICULATE, ALDEHYDE, AND SEMI-VOLATILE ORGANIC COMPOUND (SVOC) TESTING REPORT FOR THE PULP DRYER STACKS, 1st AND 2nd CARBONATION TANK VENTS, AND THE EVAPORATOR HEATER VENTS

THE AMALGAMATED SUGAR COMPANY

Nampa, Idaho

May 14, 1993

Prepared by:

DEAN C. DeLOREY, Corporate Environmental Engineer

DENNIS STEGENGA, P.E., Nampa Plant Engineer

THE AMALGAMATED SUGAR COMPANY

P.O. BOX 87 • NAMPA, IDAHO 83653 • PHONE (208) 466-3541

September 7, 1994

Mr. Tom Lapp
MRI, Suite 350
401 Harrison Oaks Blvd.
Cary, NC 27513

RE: Particulate, Aldehyde, and Semi-Volatile Organic Compound (SVOC) Emission Testing Results

Dear Mr. Lapp:

In response to your request, attached is a summary of the report entitled "Particulate, Aldehyde, and Semi-Volatile Organic Compound (SVOC) Testing Report for the Pulp Dryer Stacks, 1st and 2nd Carbonation Tank Vents, and the Evaporator Heater Vents". The stack tests were approved by the Idaho Division of Environmental Quality. The stack tests were conducted during the 1992 beet processing campaign at The Amalgamated Sugar Company facility in Nampa, Idaho.

The stack testing results indicate that particulate emission concentrations varied from each pulp dryer. According to the stack testing results, the two scrubbers on the south pulp dryer had the lowest emissions, the two scrubbers on the center pulp dryer had the second lowest emissions, and the north pulp dryer had the highest emissions. One of the primary factors effecting particulate emissions is the design of the impingement type scrubbers. During the testing, the following were the differences in the design of the pulp dryer scrubbers:

1) South Pulp Dryer Scrubbers - Water spray system; highest impingement velocities of gases entering the scrubber; level controls on the scrubber water tub; pressure drop ~ 4 in. H_2O.

2) Center Pulp Dryer Scrubbers - No water sprays; lower impingement velocities than south pulp dryer scrubbers; level controls on the scrubber water tub; pressure drop ~ 4 in. H_2O.

3) North Pulp Dryer Scrubber - Water sprays; lower impingement velocities than south pulp dryer scrubbers; no automatic level controls; pressure drop ~ 2 in. H_2O.

Since completing these tests in 1992, the North Pulp Dryer Scrubber has been rebuilt and provides performance comparable to the South Pulp Dryer Scrubbers.

If you have any questions, feel free to contact either Edward G. Bulgin, Corporate Chief Engineer, or me at 208-466-3541.

Sincerely,

Dean C. DeLorey

Dean C. DeLorey
Corporate Environmental Engineer

Attachment

DCD:ce

cc: George Hobbs
John Lemke
Ed Bulgin

DD02SEP7

SECTION 1.0
INTRODUCTION

Particulate, aldehyde, and semi-volatile organic compound (SVOC) sampling was conducted on a variety of stack and vents at the Nampa facility to satisfy the requirements of the August 12, 1993, Consent Order between the Idaho Department of Health and Welfare and The Amalgamated Sugar Company (TASCO). As part of the Consent Order, on September 11, 1992, the Department and TASCO agreed to a stack sampling protocol.

The stack tests were completed during the 1992 beet processing campaign (i.e. October 1992 through January 1993). Emission sources which were tested included a selected number of the pulp dryer stacks, carbonation tank vents, and heater vents on 1st evaporator vapors. A summary of the emissions testing is shown in Table 1.0.

The objectives of the testing were to: 1) determine the aldehyde and SVOC emissions from the pulp drying process, carbonation process and evaporation process; 2) using the testing data, provided in this report and 1991 campaign testing data, estimate aldehyde and SVOC emissions from all vents associated with the pulp drying process, carbonation process, and evaporation process and; 3) determine the compliance status of the particulate emissions from the pulp dryer stacks.

The stack sampling methods employed were: EPA Method 1 - Sampling Point Determination; EPA Method 2 - Stack Gas Flow and Velocity; EPA Method 3 - Stack Gas Composition and Molecular Weight; EPA Method 4 - Stack Gas Moisture; Alignment Approach - Cyclonic Flows; EPA Method 5 - Particulates; SW846 Method 0010 - SVOC's; and Modified EPA Method TO5 (midget and standard impingers) - Aldehydes.

TASCO's stack testing crew consisted of Dean C. DeLorey, Glenn Jones, Matt Bunn, Ray Reno, Dennis Stegenga, and Homer Martinez. Jeff Kunstling of Entropy Environmentalist oversaw the initial particulate, aldehyde, and SVOC tests conducted on the north pulp dryer. Ron Hill of the Idaho Department of Health and Welfare was present during the 2nd SVOC test run conducted on the B-side evaporator heater vent.

All aldehyde and SVOC samples were extracted and analyzed by Triangle Laboratories.

SECTION 2.0
SUMMARY OF RESULTS

This section includes as summary of the particulate, aldehyde, and SVOC testing at the Nampa facility. The following information is provided: 1) stack emissions and exhaust data; 2) estimated aldehyde and SVOC emissions from all vents associated with the pulp drying process, carbonation process, and evaporation process; and 3) sampling and analytical problems encountered during the testing. All supporting information is included in Appendix A through Appendix F.

Particulate emissions are expressed as grains per dry standard cubic foot (gr/dscf) and pounds per hour (lbs/h). Aldehyde and SVOC emissions are expressed as micrograms per cubic meter (ug/m^3) and pounds per hour. In addition to the emission rates, emission factors are also provided. These factors were calculated by dividing the hourly emission rates (lbs/hour) by the hourly production rates.

2.1 Pulp Dryer Stacks

Particulate, aldehyde and SVOC stack testing results for the pulp dryer stacks are included in Tables 2.1.1 through 2.1.9. A summary of the particulate, aldehyde and SVOC hourly emission rates for all pulp dryer stacks is included in Tables 2.1.10 and 2.1.11. Results of the SVOC and aldehyde testing blanks (i.e. field blank, proof blanks, and resin blanks) are provided in Section A.1 of Appendix A.

Due to the design of the pulp dryer emissions control equipment, cyclonic flows exist within each pulp dryer stack. Cyclonic flow angles (yaw angles) for each test conducted on the pulp dryer stacks were greater than 20°. Particulate and SVOC testing methods (EPA Method 5 and SW846 Method 0010) were modified according to the alignment approach to account for the cyclonic flow (see Appendix F).

All particulate, aldehyde, and SVOC testing was conducted while the dryers were fired on pulverized coal, except for one test run. The second particulate test run (part 2) on the center dryer east stack was conducted while the dryer was fired by natural gas.

As shown, particulate emissions from each pulp dryer stack are below the 0.1 grains per dry standard cubic foot (gr/dscf) permit limit. However, particulate emissions from the north pulp dryer stack were initially above 0.1 gr/dscf. On December 16, 1993, the north pulp dryer scrubber was repaired. As shown, except for the testing conducted December 28, 1992, particulate emissions were in compliance with the permit limit. The December 28, 1993, particulate testing results were not representative of normal operation, due to a fire which occurred in the pulp dryer building. Water flow to the scrubber was below normal because filters which screen scrubbing water were not cleaned as scheduled. Personnel responsible for cleaning the screens were extinguishing the fire.

The last 2 particulate test runs (Run No.'s Part 4 and Part 5) for the south pulp dryer east stack were conducted to determine the relationship between particulate emissions and the pressure drop across the scrubber.

The Department requested aldehyde and SVOC testing on the dryer stack with the highest amount of condensible particulates as determined by the back half catch of EPA Method 5 and Method 202. The Department required this testing to occur during late campaign. The north pulp dryer had the highest amount of condensible particulate. Therefore, the north pulp dryer was sampled for aldehydes and SVOC during the middle part of January.

In addition, the north pulp dryer stack was tested for aldehydes and SVOC's during the early part of campaign (i.e. October). Aldehyde testing was also conducted on the center pulp dryer west stack.

Particulate, aldehyde, and SVOC maximum hourly emission rates for all the pulp dryer stacks are given in Table 2.1.10 and 2.1.11. These emission rates were calculated using average emission factors and the maximum hourly production rates.

2.2 Carbonation Tank Vents

SVOC and aldehyde stack testing results for the B Side 1st carbonation tank and 2nd carbonation tank vents are given in Tables 2.2.1 through 2.2.3. A summary of the SVOC and aldehyde emissions for all carbonation tank vents are given in Tables 2.2.4 and 2.2.5. SVOC and aldehyde blank information is given in Section A.5 and A.6 of Appendix A.

2.3 Heater Vents on 1st Evaporator Vapors

The heater vents on 1st evaporator vapors were sampled by installing a temporary 4 inch diameter stack onto the heater vent pipes. Table 2.3.1 includes the aldehyde testing results for the A-side #2 thin juice evaporator heater vent. Aldehyde and SVOC testing results for the B-side 2nd carbonation evaporator heater vent are provided in Tables 2.3.2 through 2.3.5. SVOC and aldehyde testing blank information is provided in Sections A.7 and A.8 of Appendix A. A summary of the aldehyde and SVOC emissions from the evaporator heater vents are included in Table 2.3.6 and 2.3.7.

2.4 Sampling and Analytical Problems

This section discusses the sampling and analytical problems which occurred during the stack testing. Some of the problems required modification of the stack sampling equipment. Other problems required modification of the sampling procedures. TASCO notified the Department by phone and in writing anytime the pre-agreed upon Stack Sampling Protocol had to be modified. Appendix F provides a detailed discussion of the testing problems and how they were resolved.

2.4.1 Pulp Dryers

Initial particulate test runs, conducted on the north pulp dryer stack were aborted due to incompatible equipment within the sampling train. The sockets on the cyclone bypasses cracked due to the expansion of the ball joints on the stainless steel probes. It was discovered that the stainless steel probes purchased from NuTech were not compatible with Ace Glass cyclone bypasses. To correct the problem, the ball joints on the NuTech probes were removed and

replaced with Ace Glass ball joints.

The particulate sample collection methods had to be slightly modified for some of the pulp dryer test runs. Acetone rinsing and brushing did not adequately remove particulates from the probe and nozzle. In order to remove all particulates, the probe and probe nozzle were additionally rinsed with hot deionized water followed by brushing. The acetone and DI rinses were kept separate for analysis in the laboratory.

Prior to analysis by the GC/MS system, Triangle Laboratories indicated that the SVOC samples collected from the north pulp dryer stack, had to be diluted due to precipitation occurring during the extraction. Final extract volumes were brought to a final volume of 5 ml. This resulted in a 1 to 5 dilution of the final sample.

The 6th SVOC test run on the north pulp dryer had to be stopped prior to collecting 60 dscf. Due to extremely cold weather conditions and moderate winds, the sampling train froze during the sampling in the last port. Prior to stopping the test, 51 dscf had been collected. The Department and TASCO agreed that this sample volume was adequate.

During the SVOC test runs, teflon tape was wrapped around the edges of the ball joints of the condenser and XAD II traps to prevent leakage into the sampling train. Again, XAD II traps and condensers which were purchased from NuTech were not compatible with Ace Glass glassware. Teflon tape was selected because of its inertness. Teflon tape was also applied to the XAD resin and condensers during the B side 1st carbonation and heater vent testing.

2.4.2 Carbonation Tank Vent

During the SVOC testing of the 1st carbonation tank vent, the temperature of the gases exiting the XAD II resin trap occasionally exceeded 20°C. Salt and dry ice was added to the impinger ice bath to maintain the gases below 20°C. The analytical results did not appear to be affected by this occurrence.

SVOC sample extracts from the B-Side 1st carbonation tank vent were also diluted. Firstly, the samples were diluted by a factor of 2 because the samples would not concentrate below 2 mls. Secondly, the samples were diluted by a factor of 2 due to high levels of target and non-target analyses. Finally, the sample for Run SVOC 2 was additionally diluted to bring benzaldehyde concentrations within the calibration range.

2.4.3 Evaporator Heater Vents

Evaporator heater vent sampling was very difficult due to the combination of the extremely high exhaust temperatures (greater than 200°F), high moisture content of the exhaust gas (greater than 98% H_2O), and presence of ammonia in the exhaust gas. In addition, heaters with vapors from the 2nd evaporator could not be sampled due to extremely low flows. For a complete discussion of the problems associated with heater vent sampling and solutions, see Sections F.6, F.8, F.10, F.12 and F.13 of Appendix F.

The high temperatures and moisture contents of the heater vent exhaust caused the

following problems:

- Midget impingers could not be used for aldehyde sampling (Modified Method TO5). Condensed moisture would quickly overflow the midget impingers.

- During the 1st aldehyde test run on the A side heater vent, isoctane from the first 2 impingers volatized and condensed into the third impinger.

- Sampling times and volumes for the aldehyde and SVOC testing had to be drastically reduced due to the excessive amounts of moisture which condensed within the impingers.

- During the first 2 SVOC test runs on the B side heater vent, the temperatures of the gases exiting the XAD II resin regularly exceeded 20°C (68°F).

To correct the above problems, the following modifications to the testing equipment and methods were employed:

- An EPA Method 5 sampling train with standard impingers (approx. 600 mil capacity) was employed for the evaporator heater vent aldehyde sampling (see Section 4.0).

- During the aldehyde testing, a water cooled condenser was inserted prior to the 1st impinger. In addition, the probe heater and box heaters were shut off. Also, the sampling times were drastically reduced.

- To prevent degradation of the XAD II resin due to the high volume of condensed water, the sample volume was reduced to 1 dscf for the SVOC testing. This sample volume was employed for test runs no.'s 3 and 4. Approximately 2500 mls of condensed water was collected in the knockout impingers during each of these test runs.

- An additional condenser was inserted into the SVOC sampling train to ensure gases exiting the resin trap were below 68°F. In addition, the sampling flow rate was significantly reduced.

During the initial sampling, ammonia from the evaporator heater vents eroded the copper tubing within the console and caused the dry gas meter to operate erratically. To correct the problem, a 1% sulfuric solution was added to the last impinger.

TABLE 2.1.1 NORTH PULP DRYER STACK PARTICULATE EMISSION TESTING RESULTS

NAMPA IDAHO FACILITY - 1992 CAMPAIGN

DATE	SCRUBBER	RUN NO.	DRYER INPUT RATE (T/HR)	STACK GAS PARAMETERS						PARTICULATE EMISSIONS					SCRUBBER OPERATION	
										FRONT HALF			BACK HALF			
				TEMP. (DEG. F)	H20 (%)	VELOCITY (FPM)	CYCLE ANGLE (DEG.)	ACTUAL FLOW (ACFM)	DRY STD. FLOW (DSCFM)	GR/DSCF	LB/HR	LBS/TON	GR/DSCF	LB/HR	DELTA P (IN H20)	H2O FLOW (GPM)
10/14/92	N	5	17.5	187	41.6	668	58	33325	14548	0.2599	32.4	1.85	0.079	9.8	0.8	184
10/15/92	N	7	19.6	185	41.7	758	55	37835	16663.2	0.2243	32	1.63	0.12	16.9	0.9	198
10/21/92	N	8	20.8	171	40.8	744	47	37101	16810	0.1609	23.2	1.12	0.11	15.4	1.2	213
10/23/92	N	9	23.7	175	41.5	732	55	36520	16520	0.1512	21.4	0.9	0.13	18.3	1.4	240
11/6/92	N	10	20.4	180	35.9	585	58	29173	14279	0.1965	24	1.18	0.1586	19.4	0.9	235
11/30/92	N	11	15.7	210	37.6	612	54	30513	13967	0.2706	32.4	2.06	0.1031	12.3	0.4	94
12/3/92	N	13	17.3	214	36.8	472	56	23543	10685	0.3419	31.3	1.82	0.1169	10.7	NA	172
AVG			19.3	189	39.4	653	55	32573	14782	0.2293	28.1	1.51	0.1168	14.7	0.9	191
12/22/92	N	14	17.2	156	28.9	593	41	16936	16648	0.0747	10.7	0.62	0.0681	9.7	1.7	247
12/28/92	N	15	21.9	187	41	957	42	47743	20819	0.2362	42.1	1.92	0.1179	21	1	115
1/4/93	N	16	19.8	160	32.4	654	46	32607	17261	0.0882	13	0.66	0.1115	16.5	1.6	196
1/5/93	N	17	18.6	160	30.9	639	46	31880	17266	0.0805	11.2	0.60	0.0764	11.3	1.7	246
AVG [a]			18.5	159	30.7	629	44	27141	17058	0.0811	11.6	0.63	0.0853	12.5	1.7	230

[a] AVERAGE ONLY INCLUDES DATA FOR 12/22/92,1/4/93 AND 1/5/93. PARTICULATE RESULTS FOR 12/28/92 ARE NOT REPRESENTATIVE. ON 12/28/92, A FIRE OCCURRED IN THE PULP DRYER BUILDING. PERSONNEL RESPONSIBLE FOR CLEANING SCREENS WHICH FILTER SCRUBBING WATER, WERE INVOLVED IN PUTTING THE FIRE OUT. THEREFORE, WATER FLOW WAS BELOW NORMAL.

TABLE 2.1.2 SUMMARY OF NORTH PULP DRYER ALDEHYDE EMISSION TESTING RESULTS (FALL92) - RUN NOS. ALD 3-5

SOURCE	DATE	TEST RUN NO.	FORMALDEHYDE			ACETALDEHYDE			ACROLEIN			CROTONALDEHYDE		
			(lbs/hr)	(ug/m3)	(lbs/ton)	(lbs/hr)	(ug/m3)	(lbs/ton)	(lbs/hr)	(ug/m3)	(lbs/ton)	(lbs/hr)	(ug/m3)	(lbs/ton)
N	10/26/92	ALD3	7.69E-03	59.3	3.22E-04	5.02E-02	386.5	2.10E-03	8.17E-02	629.4	3.42E-03	6.03E-02	464.9	2.52E-03
N	10/26/92	ALD4	3.29E-02	256.4	1.38E-03	9.19E-02	715.6	3.85E-03	1.25E-01	972.1	5.23 ~~5.01~~E-03	7.91E-02	616.0	3.31E-03
N	10/26/92	ALD5	3.27E-02	254.6	1.37E-03	8.38E-02	653.3	3.51E-03	1.08E-01	841.5	4.52E-03	8.00E-02	624.0	3.35E-03
		AVG	2.44E-02	190.1	1.02E-03	7.53E-02	585.1	3.15E-03	1.05E-01	814.3	~~3.75~~E-03 4.39	7.32E-02	568.3	3.06E-03

TABLE 2.1.3 SUMMARY OF THE NORTH PULP DRYER STACK ALDEHYDE EMISSION TESTING RESULTS (WINTER 1993) - RUN NOS. ALD 6-8

SOURCE	DATE	TEST RUN NO.	FORMALDEHYDE			ACETALDEHYDE			ACROLEIN			CROTONALDEHYDE		
			(lbs/hr)	(ug/m3)	(lbs/ton)	(lbs/hr)	(ug/m3)	(lbs/ton)	(lbs/hr)	(ug/m3)	(lbs/ton)	(lbs/hr)	(ug/m3)	(lbs/ton)
N	1/11/93	ALD6	2.69E-02	463.0	1.63E-03	7.51E-02	1293.6	4.55E-03	6.76E-02	1163.0	4.09E-03	1.75E-02	301.4	1.06E-03
N	1/11/93	ALD7	4.79E-01	8248.1	2.99E-02	5.24E-01	9026.7	3.28E-02	1.32E-01	2276.2	8.26E-03	2.87E-02	494.3	1.79E-03
N	1/11/93	ALD8	2.40E-01	4134.0	1.50E-02	4.63E-01	7977.4	2.90E-02	1.71E-01	2947.5	1.07E-02	3.49E-02	601.3	2.18E-03
		AVG	2.49E-01	4281.7	1.55E-02	3.54E-01	6099.2	2.21E-02	1.24E-01	2128.9	7.69E-03	2.71E-02	465.6	1.68E-03

TABLE 2.1.4 SUMMARY OF THE NORTH PULP DRYER STACK SVOC EMISSION TESTING RESULTS (FALL 92) - RUN NO'S. SVOC1,SVOC4,SVOC5

RUN NO'S.	SVOC1			SVOC4			SVOC5		AVERAGE	
COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	(ug/m3)	(lbs/hr)
BENZOIC ACID	736.56	4.293E-02	BENZOIC ACID	1173.08	7.470E-02	BENZOIC ACID	1148.48	7.531E-02	1019.37	6.43E-02
BENZALDEHYDE	397.30	2.316E-02	BENZALDEHYDE	394.67	2.513E-02	BENZALDEHYDE	372.25	2.441E-02	388.07	2.42E-02
BIS(2-ETHYLHEXYL)PHTHALATE)	219.42	1.279E-02	BIS(2-ETHYLHEXYL)PHTHALATE)	88.22	5.617E-03	BIS(2-ETHYLHEXYL)PHTHALATE)	281.72	1.847E-02	196.45	1.23E-02
PHENOL	342.00	1.993E-02	PHENOL	188.92	1.203E-02				176.97	1.07E-02
2-NITROPHENOL	22.54	1.314E-03	2-NITROPHENOL	91.82	5.847E-03	2-NITROPHENOL	212.84	1.396E-02	109.07	7.04E-03
4-NITROPHENOL	17.47	1.018E-03				4-NITROPHENOL	205.60	1.348E-02	74.36	4.83E-03
4-METHYLPHENOL	143.16	8.344E-03	4-METHYLPHENOL	41.72	2.656E-03				61.63	3.67E-03
NAPHTHALENE	47.23	2.753E-03	NAPHTHALENE	37.28	2.374E-03	NAPHTHALENE	64.12	4.205E-03	49.54	3.11E-03
DI-N-BUTYLPHTHALATE	26.07	1.519E-03	DI-N-BUTYLPHTHALATE	75.17	4.787E-03	DI-N-BUTYLPHTHALATE	5.07	3.324E-04	35.44	2.21E-03
BENZYL ALCOHOL	49.51	2.886E-03	BENZYL ALCOHOL	25.11	1.599E-03	BENZYL ALCOHOL	23.67	1.552E-03	32.76	2.01E-03
			2,4-DINITROPHENOL	18.46	1.175E-03	2,4-DINITROPHENOL	37.64	2.468E-03	18.70	1.21E-03
2-METHYLPHENOL	43.86	2.556E-03	2-METHYLPHENOL	7.86	5.004E-04				17.24	1.02E-03
NITROBENZENE	14.29	8.330E-04	NITROBENZENE	12.62	8.036E-04	NITROBENZENE	16.10	1.056E-03	14.34	8.97E-04
2,4-DIMETHYLPHENOL	13.88	8.087E-04	2,4-DIMETHYLPHENOL	12.52	7.975E-04	2,4-DIMETHYLPHENOL	11.70	7.675E-04	12.70	7.91E-04
2-METHYLNAPHTHALENE	11.02	6.421E-04				2-METHYLNAPHTHALENE	8.17	5.356E-04	6.40	3.93E-04
						4,6-DINITRO-2-METHYLPHENOL	16.78	1.101E-03	5.59	3.67E-04
DIBENZOFURAN	7.07	4.120E-04	DIBENZOFURAN	4.45	2.834E-04	DIBENZOFURAN	3.86	2.533E-04	5.13	3.16E-04
PHENANTHRENE	6.15	3.585E-04	PHENANTHRENE	4.61	2.937E-04	PHENANTHRENE	4.05	2.655E-04	4.94	3.06E-04
DIETHYLPHTHALATE	3.50	2.041E-04	DIETHYLPHTHALATE	4.49	2.861E-04	DIETHYLPHTHALATE	3.18	2.085E-04	3.72	2.33E-04
ACENAPHTHYLENE	2.13	1.243E-04	ACENAPHTHYLENE	1.92	1.225E-04				1.35	8.23E-05
									0.00	
TENTATIVELY IDENTIFIED COMPOUNDS										
SUBSTITUTED HC	9059.3	3.144E-01	SUBSTITUTED HC	1095.3	3.749E-02	SUBSTITUTED AROMATIC HC	354.69	1.168E-02		
SUBSTITUTED HC	945.66	3.282E-02	UNKNOWN	614.18	2.102E-02	SUBSTITUTED AROMATIC HC	299.05	9.851E-03		
ACID ESTER	580.8	2.016E-02	METHYLFURAN CARBOXALDEHYDE	389.52	1.333E-02	METHYLFURAN CARBOXALDEHYDE	143.75	4.735E-03		
UNKNOWN	571.9	1.985E-02	AROMATIC HC	270.95	9.274E-03	ACID ESTER	111.98	3.689E-03		
SUBSTITUTED CYCLIC HC	535.17	1.858E-02	SUBSTITUTED AROMATIC HC	241.53	8.267E-03	SUBSTITUTED AROMATIC HC	107.66	3.546E-03		
ALKYL ACID	480.92	1.669E-02								
ALKYL NITRILE	432.87	1.502E-02								

TABLE 2.1.5 SUMMARY OF THE NORTH PULP DRYER STACK SVOC EMISSION TESTING RESULTS (WINTER 1993) - RUN NO'S. SVOC6-SVOC8

RUN NO'S.	SVOC6			SVOC7			SVOC8		AVERAGE	
COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	(ug/m3)	(lbs/hr)
BENZOIC ACID	855.83	4.31E-02	BENZOIC ACID	683.90	4.73E-02	BENZOIC ACID	721.15	5.05E-02	753.63	4.70E-02
BIS(2-ETHYLHEXYL)PHTHALATE	1056.42	5.32E-02	BIS(2-ETHYLHEXYL)PHTHALATE	751.54	5.20E-02	BIS(2-ETHYLHEXYL)PHTHALATE	248.64	1.74E-02	685.53	4.09E-02
BENZALDEHYDE	440.78	2.22E-02	BENZALDEHYDE	422.50	2.92E-02	BENZALDEHYDE	431.52	3.02E-02	431.60	2.72E-02
PHENOL	190.24	9.58E-03							63.41	3.19E-03
4-METHYLPHENOL	44.69	2.25E-03	4-METHYLPHENOL	18.85	1.30E-03	4-METHYLPHENOL	25.95	1.82E-03	29.83	1.79E-03
NAPHTHALENE	23.81	1.20E-03	NAPHTHALENE	20.97	1.45E-03	NAPHTHALENE	18.60	1.30E-03	21.13	1.32E-03
			4-NITROPHENOL	29.41	2.03E-03	4-NITROPHENOL	23.04	1.61E-03	17.48	1.22E-03
2-NITROPHENOL	25.90	1.30E-03	2-NITROPHENOL	24.44	1.69E-03				16.78	9.98E-04
BENZYL ALCOHOL	27.42	1.38E-03				BENZYL ALCOHOL	19.97	1.40E-03	15.80	9.27E-04
2-METHYLPHENOL	9.86	4.96E-04	2-METHYLPHENOL	4.29	2.97E-04	2-METHYLPHENOL	6.19	4.34E-04	6.78	4.09E-04
2-METHYLNAPHTHALENE	5.75	2.89E-04	2-METHYLNAPHTHALENE	4.07	2.82E-04	2-METHYLNAPHTHALENE	3.74	2.62E-04	4.52	2.78E-04
NITROBENZENE	16.43	8.27E-04							5.48	2.76E-04
2,4-DIMETHYLPHENOL	15.95	8.03E-04							5.32	2.68E-04
PHENANTHRENE	7.87	3.96E-04				PHENANTHRENE	2.04	1.43E-04	3.30	1.80E-04
DI-N-BUTYLPHTHALATE	10.33	5.20E-04							3.44	1.73E-04
BUTYLBENZYLPHTHALATE	10.29	5.18E-04							3.43	1.73E-04
DIBENZOFURAN	5.09	2.56E-04	DIBENZOFURAN	2.20	1.52E-04				2.43	1.36E-04
FLUORANTHRENE	5.73	2.88E-04							1.91	9.61E-05
ACENAPHTHYLENE	2.45	1.23E-04	ACENAPHTHYLENE	1.85	1.28E-04				1.43	8.37E-05
ANTHRACENE	4.76	2.40E-04							1.59	7.98E-05
TENTATIVELY IDENTIFIED COMPOUNDS										
2-FURANCARBOXALDEHYDE	1441.32	7.26E-02	2-FURANCARBOXALDEHYDE	1335.25	9.24E-02	2-FURANCARBOXALDEHYDE	1060.98	7.43E-02		
UNKNOWN	632.38	3.18E-02	UNKNOWN	581.53	4.02E-02	UNKNOWN	263.96	1.85E-02		
2-FURANCARBOXALDEHYDE	246.38	1.24E-02	2-FURANCARBOXALDEHYDE	213.43	1.48E-02	PYRAZINE	231.48	1.62E-02		
PYRAZINE	191.63	9.65E-03	UNKNOWN	203.12	1.41E-02	2-FURANCARBOXALDEHYDE	186.63	1.31E-02		
SUBSTITUTED HYDROCARBON	181.36	9.13E-03	PYRAZINE	146.93	1.02E-02	UNKNOWN	153.63	1.08E-02		
PYRAZINE	140.98	7.10E-03	PYRAZINE	122.18	8.45E-03	PYRAZINE	134.56	9.43E-03		
SUBSTITUTED HYDROCARBON	132.09	6.65E-03	SUBSTITUTED HYDROCARBON	112.39	7.78E-03	SUBSTITUTED HYDROCARBON	118.57	8.31E-03		
SUBSTITUTED HYDROCARBON	112.24	5.65E-03	SUBSTITUTED HYDROCARBON	109.87	7.60E-03	SUBSTITUTED HYDROCARBON	109.81	7.69E-03		
SUBSTITUTED HYDROCARBON	107.45	5.41E-03	SUBSTITUTED HYDROCARBON	105.69	7.31E-03	DIMETHYL SULFONE	108.78	7.62E-03		
UNKNOWN	103.34	5.20E-03	UNKNOWN	79.91	5.53E-03	SUBSTITUTED HYDROCARBON	99.5	6.97E-03		

TABLE 2.1.6 CENTER PULP DRYER EAST STACK PARTICULATE EMISSION TESTING RESULTS

NAMPA IDAHO FACILITY - 1992 CAMPAIGN

DATE	SCRUBBER	RUN NO.	DRYER INPUT RATE (T/HR)	STACK GAS PARAMETERS						PARTICULATE EMISSIONS					SCRUBBER OPERATIO	
				TEMP. (DEG. F)	H20 (%)	VELOCITY (FPM)	CYCLE ANGLE (DEG.)	ACTUAL FLOW (ACFM)	DRY STD. FLOW (DSCFM)	FRONT HALF			BACK HALF		DELTA P (IN H20)	H2O FLOW (GPM)
										GR/DSCF	LB/HR	LBS/TON	GR/DSCF	LB/HR		
10/28/92	CE	1	50.2	173	47.4	1011	49	38894	15674	0.0939	12.6	0.25	0.19	24.9	3.5	119.5
10/29/92	CE a	2	47.4	171	44.3	1081	53	41616	17613	0.0668	10.1	0.21	0.05	6.9	3.9	167
10/30/92	CE	3	55.2	170	44.6	1146	52	44102	18534	0.0601	9.5	0.17	0.06	9.9	3.6	170
11/2/92	CE	4	49.7	175	46.7	1050	54	40393	16480	0.0873	12.3	0.25	0.0614	8.7	3.1	166
AVG			50.6	172.25	45.75	1072	52	41251.3	17075	0.077025	11.1	0.22	0.090	12.6	3.5	156

a DRYER FIRED BY NATURAL GAS

TABLE 2.1.7 CENTER PULP DRYER WEST STACK PARTICULATE EMISSION TESTING RESULTS

NAMPA IDAHO FACILITY - 1992 CAMPAIGN

				STACK GAS PARAMETERS						PARTICULATE EMISSIONS					SCRUBBER OPERATION	
										FRONT HALF			BACK HALF			
DATE	SCRUBBER	RUN NO.	DRYER INPUT RATE (T/HR)	TEMP. (DEG. F)	H20 (%)	VELOCITY (FPM)	CYCLE ANGLE (DEG.)	ACTUAL FLOW (ACFM)	DRY STD. FLOW (DSCFM)	GR/DSCF	LB/HR	LBS/TON	GR/DSCF	LB/HR	DELTA P (IN H20)	H2O FLOW (GPM)
11/3/92	CW	1	55.3	173	42.6	994	48	37491	16691	0.0805	11.6	0.21	0.0652	9.4	3.7	165
11/4/92	CW	2	55.8	171	42.2	1015	47	39063	17538	0.0706	10.6	0.19	0.0695	10.4	4	164
11/5/92	CW	3	55.7	169	43.2	971	49	37381	16515	0.0684	9.7	0.17	0.0773	10.9	4.4	156
AVG			55.6	171	42.7	993	48	37978	16915	0.0732	10.6	0.19	0.0707	10.2	4.0	162

TABLE 2.1.8 SUMMARY OF THE CENTER PULP DRYER WEST STACK ALDEHYDE TESTING RESULTS(WINTER 1993) - RUN N0'S. ALD 1-3

SOURCE	DATE	TEST RUN NO.	FORMALDEHYDE			ACETALDEHYDE			ACROLEIN			CROTONALDEHYDE		
			(lbs/hr)	(ug/m3)	(lbs/ton)	(lbs/hr)	(ug/m3)	(lbs/ton)	(lbs/hr)	(ug/m3)	(lbs/ton)	(lbs/hr)	(ug/m3)	(lbs/ton)
CW	1/25/93	ALD1	1.08E-01	1815.0	2.61E-03	4.25E-01	7124.1	1.03E-02	4.25E-01	7135.6	1.03E-02	7.11E-02	1192.5	1.72E-03
CW	1/25/93	ALD2	1.57E-01	2638.9	3.80E-03	5.42E-01	9091.8	1.31E-02	4.99E-01	8367.3	1.20E-02	7.65E-02	1284.3	1.85E-03
CW	1/25/93	ALD3	4.83E-01	8107.2	1.12E-02	1.09E+00	18355.4	2.53E-02	2.28E-01	3827.4	5.27E-03	5.20E-02	872.4	1.20E-03
		AVG	2.50E-01	4187.0	5.86E-03	6.87E-01	11523.8	1.62E-02	3.84E-01	6443.4	9.20E-03	6.65E-02	1116.4	1.59E-03

TABLE 2.1.9 SOUTH PULP DRYER EAST STACK PARTICULATE EMISSION TESTING RESULTS

NAMPA IDAHO FACILITY - 1992 CAMPAIGN

				STACK GAS PARAMETERS						PARTICULATE EMISSIONS					SCRUBBER OPERATION	
										FRONT HALF			BACK HALF			
DATE	SCRUBBE	RUN NO.	DRYER INPUT RATE (T/HR)	TEMP. (DEG. F)	H20 (%)	VELOCITY (FPM)	CYCLE ANGLE (DEG.)	ACTUAL FLOW (ACFM)	DRY STD. FLOW (DSCFM)	GR/DSCF	LB/HR	LBS/TON	GR/DSCF	LB/HR	DELTA P (IN H20)	H2O FLOW (GPM)
11/23/92	SE	1	47.1	165	39.2	891	24	34287	16192	0.0619	8.6	0.18	0.0387	5.4	3.1	137
11/24/92	SE	2	47.1	165	37.5	816	29	31421	15319	0.0497	6.5	0.14	0.0402	5.3	4.9	145
11/25/92	SE	3	47.2	165	37.9	724	40	27870	13630	0.0467	5.5	0.12	0.0763	8.9	5.2	131
12/29/92	SE	4	38.9	156	36.8	609	41	23435	11484	0.0922	9.1	0.23	0.0992	9.8	4.6	136
12/30/92	SE	5	39.8	160	37.1	478	59	18387	8995	0.1082	8.3	0.21	0.078	6	2.7	104
AVG [a]			47.1	165	38.2	810	31	31193	15047	0.0528	6.9	0.15	0.0517	6.5	4.4	138

[a] AVERAGE CALCULATED FOR RUN NO.'S 1 THROUGH 3 ONLY. RUNS 4 AND 5 WERE CONDUCTED TO DETERMINE THE IMPACT OF EMISSIONS VS. PRESSURE DROP

TABLE 2.2.1 SUMMARY OF THE 1ST CARBONATION TANK VENT SVOC EMISSION TESTING RESULTS - RUN NO'S. SVOC1-SVOC3

RUN NO'S.	SVOC1			SVOC2			SVOC3		AVERAGE	
COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	(ug/m3)	(lbs/hr)
BENZALDEHYDE	1341.88	7.312E-03	BENZALDEHYDE	1635.15	9.044E-03	BENZALDEHYDE	1400.87	8.073E-03	1459.30	8.14E-03
BIS(2-ETHYLHEXYL)PHTHALATE	252.09	1.374E-03	BIS(2-ETHYLHEXYL)PHTHALATE	133.42	7.380E-04	BIS(2-ETHYLHEXYL)PHTHALATE	127.69	7.359E-04	171.07	9.49E-04
BENZOIC ACID	171.13	9.324E-04	BENZOIC ACID	85.43	4.725E-04	BENZOIC ACID	91.79	5.290E-04	116.12	6.45E-04
BENZYL ALCOHOL	66.52	3.624E-04	BENZYL ALCOHOL	66.18	3.661E-04	BENZYL ALCOHOL	71.99	4.149E-04	68.23	3.81E-04
						2,4-DINITROPHENOL	141.55	8.155E-04	47.18	2.72E-04
NAPHTHALENE	21.62	1.178E-04	NAPHTHALENE	33.28	1.841E-04	NAPHTHALENE	27.48	1.583E-04	27.46	1.53E-04
PHENANTHRENE	17.91	9.760E-05	PHENANTHRENE	19.62	1.085E-04	PHENANTHRENE	18.78	1.082E-04	18.77	1.05E-04
PHENOL	20.27	1.105E-04	PHENOL	19.48	1.078E-04	PHENOL	14.28	8.228E-05	18.01	1.00E-04
4-METHYLPHENOL	12.22	6.660E-05	4-METHYLPHENOL	8.14	4.504E-05	4-METHYLPHENOL	6.94	3.999E-05	9.10	5.05E-05
2-METHYLNAPHTHALENE	3.98	2.168E-05	2-METHYLNAPHTHALENE	8.90	4.922E-05	2-METHYLNAPHTHALENE	8.18	4.713E-05	7.02	3.93E-05
						ACENAPHTHENE	19.29	1.112E-04	6.43	3.71E-05
TENTATIVELY IDENTIFIED COMPOUNDS										
SATURATED HYDROCARBON	1632.20	8.894E-03	SATURATED HYDROCARBON	1735.40	9.599E-03	SATURATED HYDROCARBON	1737.68	1.001E-02		
DIMETHYL PYRAZINE	1227.86	6.690E-03	SATURATED HYDROCARBON	1337.91	7.400E-03	DIMETHYL PYRAZINE	862.19	4.969E-03		
SATURATED HYDROCARBON	956.85	5.214E-03	DIMETHYL PYRAZINE	1058.17	5.853E-03	ACID ESTER	726.05	4.184E-03		
TRIMETHYL PYRAZINE	783.94	4.272E-03	SUBSTITUED CYCLIC HC	902.88	4.994E-03	UNKNOWN HYDROCARBON	636.45	3.668E-03		
SATURATED HYDROCARBON	777.12	4.234E-03	TRIMETHYL PYRAZINE	644.30	3.564E-03	SATURATED HYDROCARBON	579.13	3.338E-03		
SUBSTITUED HYDROCARBON	653.67	3.562E-03	SATURATED HYDROCARBON	612.21	3.386E-03	SATURATED HYDROCARBON	477.74	2.753E-03		
UNKNOWN HYDROCARBON	586.00	3.193E-03	UNKNOWN HYDROCARBON	588.58	3.256E-03	TRIMETHYL PYRAZINE	476.12	2.744E-03		
SATURATED HYDROCARBON	553.46	3.016E-03	SATURATED HYDROCARBON	532.48	2.945E-03	SATURATED HYDROCARBON	405.03	2.334E-03		
BRANCHED HYDROCARBON	526.56	2.869E-03	SATURATED HYDROCARBON	417.80	2.311E-03	SATURATED HYDROCARBON	394.2	2.272E-03		
ALCOHOL	371.16	2.022E-03	SATURATED HYDROCARBON	279.26	1.545E-03	SATURATED HYDROCARBON	362.78	2.091E-03		

TABLE 2.2.2 B-SIDE 2ND CARBONATION TANK VENT ALDEHYDE TESTING RESULTS - RUN NO. ALD1

STACK SAMPLING DATA

DATE:	11/13/92	SAMPLE FLOW(ml/min):	180	ACTUAL STACK FLOW(ACFM) :	1167
TEST & RUN NO.:	NA1392 ALD1	SAMPLE TIME(min):	60	MOISTURE (% H2O):	77.3
SOURCE THRPT (GAL/HR):	71700	STACK TEMP(DEG F):	194	DRY STD STACK FLOW(DSCFM):	200
		LAB TEMP(DEG F):	62.5	LAB PRESSURE (in hg)	27.8
		SAMPLE VOLUME(ACM):	0.0135		
		SAMPLE VOLUME(ACF):	0.4774		

COMPOUND	MDL (ug/ml)	MASS BLANK (ug)	MASS IMP 1 & 2 (ug)	MASS IMP 3 (ug)	MASS TOTAL (ug)	CONCENTRATION (ug/m3)	CONCENTRATION (lb/acf)	EMISSION RATE (lbs/hr)	EMISSION FACTOR (lbs/gal)
FORMALDEHYDE	0.0079	1.62	5.15	1.54	3.45	271.81	1.592E-08	1.115E-03	1.555E-08
ACETALDEHYDE	0.0131	2.77	945.57	11.34	951.37	74955.48	4.390E-06	3.074E-01	4.287E-06
ACROLEIN	0.0046	2.13	52.99	3.42	52.15	4108.74	2.406E-07	1.685E-02	2.350E-07
CROTONALDEHYDE	0.0295	0.83	7.38	0.83	6.55	516.05	3.022E-08	2.116E-03	2.951E-08

TABLE 2.2.3 CARBONATION TANK VENT EXHAUST DATA

NAMPA IDAHO FACILITY - 1992 CAMPAIGN

DATE	CARB TANK VENT	RUN NO.	STACK GAS PARAMETERS				
			TEMP (DEG. F)	H20 (%)	VEL (FPM)	ACTUAL FLOW (ACFM)	DRY FLOW (DSCFM)
11/13/92	B SIDE 2ND	ALD 1	194	77.3	563	1167	200
11/17/92	B SIDE 1ST	SVOC 1	188	66.9	3305	5841	1456
11/18/92	B SIDE 1ST	SVOC 2	188	67.6	3430	5061	1478
11/19/92	B SIDE 1ST	SVOC 3	186	67.0	3517	6215	1540

TABLE 2.3.1 SUMMARY OF THE A-SIDE #2 THIN JUICE HEATER VENT ALDEHYDE EMISSION TESTING RESULTS - RUN NO'S. ALD1 - ALD3

SOURCE	DATE	TEST RUN NO.	FORMALDEHYDE			ACETALDEHYDE			ACROLEIN			CROTONALDEHYDE		
			(lbs/hr)	(ug/m3)	(lbs/gal)	(lbs/hr)	(ug/m3)	(lbs/gal)	(lbs/hr)	(ug/m3)	(lbs/gal)	(lbs/hr)	(ug/m3)	(lbs/gal)
A HTR	1/13/93	ALD1	2.11E-04	26866	2.83E-09	1.06E-02	1352228	1.42E-07	1.93E-05	2455	2.58E-10	2.21E-05	2812	2.96E-10
A HTR	1/13/93	ALD2	5.79E-05	7369	7.88E-10	8.64E-03	1099809	1.18E-07	8.94E-06	1137	1.22E-10	1.29E-05	1638	1.75E-10
A HTR	1/13/93	ALD3	1.87E-05	2374	2.53E-10	4.55E-03	579289	6.17E-08	4.76E-06	605	6.45E-11	7.22E-06	918	9.78E-11
		AVG	9.59E-05	12203	1.29E-09	7.94E-03	1010442	1.07E-07	1.10E-05	1399	1.48E-10	1.41E-05	1789	1.90E-10

TABLE 2.3.2 SUMMARY OF THE B - SIDE 2ND CARBONATION HEATER VENT ALDEHYDE EMISSION TESTING RESULTS - RUN NO'S. ALD1-ALD3

SOURCE	DATE	TEST RUN NO.	FORMALDEHYDE			ACETALDEHYDE			ACROLEIN			CROTONALDEHYDE		
			(lbs/hr)	(ug/m3)	(lbs/gal)	(lbs/hr)	(ug/m3)	(lbs/gal)	(lbs/hr)	(ug/m3)	(lbs/gal)	(lbs/hr)	(ug/m3)	(lbs/gal)
BHTR	1/21/93	ALD1	1.07E-05	4745	1.45E-10	2.43E-03	1081023	3.31E-08	5.80E-05	25835	7.91E-10	7.17E-06	3193	9.77E-11
BHTR	1/21/93	ALD2	7.12E-06	3170	9.65E-11	1.68E-03	749815	2.28E-08	4.98E-05	22168	6.75E-10	5.10E-06	2273	6.92E-11
BHTR	1/21/93	ALD3	5.07E-06	2260	6.94E-11	1.08E-03	481552	1.48E-08	4.10E-05	18245	5.61E-10	8.72E-06	3885	1.19E-10
		AVG	7.61E-06	3391	1.04E-10	1.73E-03	770797	2.36E-08	4.96E-05	22083	6.75E-10	7.00E-06	3117	9.54E-11

Prod. Rates - Backcalculated 12/5/94 (MRE)

Run 1 $\frac{(73793 + 73414 + 73325 + 73388)}{4} = 73480 \approx 73500$

Run 2 $\frac{(73782 + 73684 + 73777 + 73699)}{4} \approx 73700$

Run 3 $\frac{(73056 + 73305 + 73481 + 73375)}{4} \approx 73300$

TABLE 2.3.3 SUMMARY OF THE B SIDE 2ND CARBONATION HEATER VENT SVOC EMISSION TESTING RESULTS (XAD & RINSES) - RUN NO'S. SVOC1 - 4

RUN NO'S.	SVOC1			SVOC2			SVOC3			SVOC4		AVERAGE	
COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	(ug/m3)	(lbs/hr)
BENZALDEHYDE	80517.0	2.65E-04	BENZALDEHYDE	49269.9	1.66E-04	BENZALDEHYDE	49757.4	8.98E-05	BENZALDEHYDE	74728.8	1.61E-04	63568.2	1.65E-04
BIS(2-ETHYLHEXYL)PHTHALATE	1801.9	5.93E-06	BIS(2-ETHYLHEXYL)PHTHALATE	6805.1	2.26E-05	BIS(2-ETHYLHEXYL)PHTHALATE	44883.2	8.30E-05	BIS(2-ETHYLHEXYL)PHTHALATE	8245.8	1.77E-05	15434.0	2.74E-05
BENZYL ALCOHOL	2510.8	8.27E-06	BENZYL ALCOHOL	1269.8	4.26E-06				BENZYL ALCOHOL	2728.8	5.87E-06	1827.8	4.60E-06
NAPHTHALENE	749.3	2.47E-06	NAPHTHALENE	354.7	1.16E-06				NAPHTHALENE	1844.3	3.97E-06	737.1	1.91E-06
4-METHYLPHENOL	2214.8	7.29E-06										553.7	1.82E-06
PHENANTHRENE	320.9	1.06E-06	PHENANTHRENE	285.3	9.61E-07	PHENANTHRENE	357.3	5.01E-07	PHENANTHRENE	1073.5	2.31E-06	509.3	1.21E-06
			ISOPHORONE	1304.1	4.39E-06							326.0	1.10E-06
			BENZOIC ACID	1133.43	3.82E-06							283.4	9.55E-07
			PHENOL	352.2	1.19E-06	PHENOL	1825.0	2.56E-06				544.3	9.37E-07
									DIETHYLPHTHLATE	1640.4	3.53E-06	410.1	8.83E-07
			PYRIDINE	526.1	1.76E-06				PYRIDINE	784.2	1.69E-06	328.1	8.67E-07
						DIBENZOFURAN	95.3	1.34E-07				23.8	3.34E-08
TENTATIVELY IDENTIFIED COMPOUNDS													
TRIMETHYL PYRAZINE	294248.3	9.69E-04	UNKNOWN AROMATIC HC	30996.2	1.04E-04	ALKYL PYRAZINE	14550.7	2.04E-05	TRIMETHYL PYRAZINE (SAT)	63838.1	1.81E-04		
UNKNOWN AROMATIC HC	147676.5	4.86E-04	DIMETHYL PYRAZINE	16161.9	5.44E-05	UNKNOWN AROMATIC HC	11041.8	1.55E-05	DIMETHYL PYRAZINE (SAT)	65828.9	1.42E-04		
DIMETHYL PYRAZINE	27789.3	9.15E-05	DIMETHYL PYRAZINE	15288.5	5.15E-05	UNKNOWN AROMATIC HC (SAT)	11041.8	1.55E-05	UNKNOWN AROMATIC HC	34784.6	7.49E-05		
METHYL PYRAZINE	11853.5	3.90E-05	UNKNOWN AROMATIC HC	10027.0	3.38E-05	UNKNOWN AROMATIC HC	8080.2	1.13E-05	ALKYL PYRAZINE	20607.7	4.43E-05		
UNKNOWN AROMATIC HC	10894.4	3.59E-05	UNKNOWN AROMATIC HC	6763.8	2.28E-05	ALKYL PYRAZINE	7585.1	1.06E-05	METHYL PYRAZINE	4800.0	1.03E-05		
ALKYL PYRAZINE	3864.3	1.21E-05	TETRAMETHYL PYRAZINE	4003.8	1.35E-05	TRIMETHYL PYRAZINE (SAT)	5311.7	7.45E-06	UNKNOWN AROMATIC HC	4178.7	8.99E-06		
ALKYL PYRAZINE	2705.2	8.91E-06	ALKYL PYRAZINE	3640.5	1.23E-05	DIMETHYL PYRAZINE (SAT)	4261.5	8.01E-06	UNKNOWN CYCLIC HC	3085.7	6.64E-06		
ALKYL PYRAZINE	2410.0	7.94E-06	UNKNOWN AROMATIC HC	2131.2	7.18E-06	SUBSTITUTED PYRAZINE (SAT.)	2993.8	4.20E-06	DIMETHYL SULFOXIDE	2805.2	6.04E-06		
UNKNOWN AROMATIC HC	1696.9	5.59E-06	UNKNOWN AROMATIC HC	1725.9	5.81E-06	ALKYL PYRAZINE	1223.3	1.72E-06	UNKNOWN AROMATIC HC	2244.2	4.83E-06		
UNKNOWN AROMATIC HC	1573.9	5.18E-06	ALKYL PYRAZINE	1397.5	4.71E-06	UNKNOWN AROMATIC HC	611.7	8.58E-07	ALKYL PYRAZINE	2181.8	4.69E-06		

TABLE 2.3.4 SUMMARY OF THE B-SIDE 2ND CARBONATION HEATER VENT SVOC EMISSION TESTING RESULTS (KNOCKOUT IMPINGER WATER) - RUN NO'S. SVOC1-SVOC4

RUN NO'S.	SVOC1			SVOC2			SVOC3			SVOC4		AVERAGE	
COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	COMPOUND	CONC. (ug/m3)	EMISSION RATE (lbs/hr)	(ug/m3)	(lbs/hr)
BENZYL ALCOHOL	2741.5	9.03E-06	BENZYL ALCOHOL	4336.5	1.46E-05	BENZYL ALCOHOL	3484.4	4.90E-06	BENZYL ALCOHOL	3957.2	8.52E-06	3632.4	9.26E-06
BENZALDEHYDE	240.0	7.90E-07	BENZALDEHYDE	5059.3	1.70E-05	BENZALDEHYDE	1202.0	1.69E-06	BENZALDEHYDE	1267.3	2.73E-06	1942.2	5.56E-06
PYRIDINE	699.4	2.30E-06	PYRIDINE	528.1	1.78E-06	PYRIDINE	783.2	1.10E-06	PYRIDINE	764.2	1.69E-06	698.7	1.72E-06
BIS(2-ETHYLHEXYL)PHTHALATE	72.8	2.39E-07	BIS(2-ETHYLHEXYL)PHTHALATE	80.8	2.72E-07	BIS(2-ETHYLHEXYL)PHTHALATE	95.0	1.33E-07	BIS(2-ETHYLHEXYL)PHTHALATE	1321.6	2.84E-06	392.4	8.72E-07
DI-N-BUTYLPHTHALATE	34.9	1.15E-07				DI-N-BUTYLPHTHALATE	71.8	1.01E-07				26.7	5.39E-08
												0.0	0.00E+00
												0.0	0.00E+00
TENTATIVELY IDENTIFIED COMPOUNDS													
SUBSTITUTED PYRIMIDINE (SAT)	132724.4	4.37E-04	SUBSTITUTED PYRIMIDINE (SAT)	127587.5	4.30E-04	SUBSTITUTED PYRIMIDINE (SAT)	245269.8	3.44E-04	SUBSTITUTED PYRIMIDINE (SAT)	308074.4	6.83E-04		
SUBSTITUTED PYRAZINE (SAT.)	43626.7	1.44E-04	SUBSTITUTED PYRAZINE (SAT.)	61161.0	2.06E-04	SUBSTITUTED PYRAZINE (SAT.)	157031.9	2.20E-04	SUBSTITUTED PYRAZINE (SAT)	184634.7	3.54E-04		
SUBSTITUTED PYRAZINE (SAT.)	43184.0	1.42E-04	SUBSTITUTED PYRAZINE	60525.1	2.04E-04	SUBSTITUTED PYRAZINE (SAT.)	66926.9	9.39E-05	UNKNOWN AROMATIC	109340.9	2.35E-04		
UNKNOWN	35142.3	1.16E-04	SUBSTITUTED PYRAZINE (SAT.)	28417.9	9.57E-05	UNKNOWN AROMATIC	40754.9	5.72E-05	SUBSTITUTED PYRAZINE (SAT)	84442.1	2.03E-04		
UNKNOWN	34576.7	1.14E-04	SUBSTITUTED HYDROCARBON	12507.5	4.21E-05	SUBSTITUTED AROMATIC	35121.3	4.93E-05	SUBSTITUTED AROMATIC	35314.5	7.60E-05		
SUBSTITUTED PYRAZINE (SAT.)	16526.0	5.44E-05	SUBSTITUTED HYDROCARBON	10921.4	3.68E-05	SUBSTITUTED HYDROCARBON	26429.5	3.71E-05	UNKNOWN AROMATIC	34130.1	7.34E-05		
UNKNOWN	13943.8	4.59E-05	UNKNOWN AROMATIC	7169.1	2.41E-05	SUBSTITUTED PYRAZINE	25208.2	3.54E-05	SUBSTITUTED PYRAZINE	19636.5	4.23E-05		
SUBSTITUTED HYDROCARBON	10820.6	3.56E-05	SUBSTITUTED BENZALDEHYDE	6931.5	2.33E-05	SUBSTITUTED HYDROCARBON	24240.5	3.40E-05	UNKNOWN AROMATIC	19636.5	4.23E-05		
SUBSTITUTED HYDROCARBON	10181.2	3.35E-05	SUBST. CYCLIC HYDROCARBON	5897.4	1.99E-05	UNKNOWN AROMATIC	19884.6	2.79E-05	UNKNOWN AROMATIC	19044.3	4.10E-05		
SUBSTITUTED PYRAZINE	5582.4	1.84E-05	SUBSTITUTED PYRAZINE	5247.6	1.77E-05	SUBST. CYCLIC HC	19830.2	2.78E-05	SUBSTITUTED HYDROCARBON	17810.5	3.79E-05		

TABLE 2.3.5 EXHAUST DATA FOR THE EVAPORATOR HEATER VENTS

NAMPA IDAHO FACILITY - 1992 CAMPAIGN

DATE	HEATER VENT	RUN NO.	STACK GAS PARAMETERS				
			TEMP (DEG. F)	H20 (%)	VEL (FPM)	ACTUAL FLOW (ACFM)	DRY FLOW (DSCFM)
1/14/93	A SIDE #2 THIN JUICE	ALD 1-3	207	98.6	2426	212	2.1
1/18/93	B SIDE 2ND CARB	SVOC 1	206	98.5	957	83.5	0.9
11/19/92	B SIDE 2ND CARB	SVOC 2	207	98.4	891	77.8	0.9
1/21/93	B SIDE 1ST 2ND CARB	ALD 1-3	211	98.9	830	72.5	0.6
1/22/93	B SIDE 2ND CARB	SVOC 3	207	99.1	678	59.2	0.4
1/27/93	B SIDE 2ND CARB	SVOC 4	207	99.0	903	78.8	0.6

SECTION 3.0
PROCESS DESCRIPTION AND OPERATION

A general flow diagram of the beet sugar production process is shown in Figure 3.0. The process can be divided into 2 operations; the beet end and the sugar end. The "beet end" involves the production of thick sugar juice and includes all process equipment from the beet flumes (where beets enter the factory) through the evaporators. The Nampa facility operates 2 parallel beet end production lines, referred to as the A and B sides. The "sugar end" (A side only) involves the production of granulated sugar and molasses, and includes all process equipment after the evaporators. The tank farm (B side only) stores thick juice for processing after all the sugar beets are processed.

Stack testing was conducted on the pulp drying, carbonation and evaporation processes. The following sections briefly discuss these processes and the operation of the process equipment during the testing.

3.1 Pulp Drying

The purpose of the pulp drying process is to dry pressed pulp. Dried pulp is a highly desirable livestock feed.

The Nampa facility operates 3 pulp dryers: the north pulp dryer; the center pulp dryer; and the south pulp dryer. Each pulp dryer consists of a rotating drum and a furnace. The dryers are direct fired by pulverized coal. The dryers can also be fired by natural gas. Temperature sensors are located in the furnace, throat and the discharge end of the dryer.

Pressed pulp and varying amounts of sugar juice additives are screw conveyed into each dryer. Sugar juice additives include molasses and concentrated separator byproduct (CSB). The amount of the molasses and CSB added to the pressed pulp is dependent on customer needs. Once dried, the dried pulp is either conveyed to the pellet mills or sold in bulk.

The total amount of material added to each dryer was calculated using the total amount of dried pulp produced per hour; percent throughput to each dryer; pressed pulp moisture; dried pulp moisture; molasses characteristics; CSB characteristics; coal heating value; and coal throughput. Example calculations are provided in Appendix C.

Emissions from the north pulp dryer are controlled by a cyclone and impingement type wet scrubber in series. Both the south and center dryer emissions are controlled by a parallel pair of cyclones and impingement type scrubbers in series. When the dryer stacks were tested, the pressure drop across the scrubber and scrubbing liquid flow rate was recorded.

A summary of the process data for each dryer is shown in Table 3.1.1. The table provides the average operations for all testing. Because the north pulp dryer scrubber was modified during the testing, 2 sets of process data are provided. Appendix C includes all process data information.

3.2 Carbonation

The 1st and 2nd carbonation tanks are used to precipitate non-sugar substances from raw juice. Prior to entering the carbonation tanks, milk of lime ($Ca(OH)_2$) is added to the raw juice. The limed raw juice is transferred into the 1st carbonation tank where CO_2 is added. The milk of lime combines with the CO_2 to form a precipitate of calcium carbonate ($CaCO_3$) and non-sugars. To ensure that all milk of lime has reacted, the juice is transferred from the 1st carbonation tank to the second (2nd) carbonation tank where CO_2 is also added.

The following operating data for the B side 1st and 2nd carbonation tanks are averages for all test runs:

Raw Juice Flow	(GPM)	1,274
	(GPH)	76,955
Juice Temperature	(°F)	191
Juice pH		9.7
Juice CaO	(%)	1.0
Milk of Lime	(%CaO)	18
$Ca(OH)_2$ Feed Rate	(GPM)	0
Kiln Gas CO_2	(%)	29.1
O_2	(%)	2.9
CO_2	(%)	0.4

3.3 Evaporator

Sugar juices are heated at various stages of the juice purification process using heaters. Thermoenergy in the form of steam is supplied to the heaters from the evaporators.

Evaporators are used to drive off water from the beet juices. At Nampa, both the A and B sides operate 5 effect evaporator systems. Each evaporator consists of a calandria and dome. Steam from the factory boilers supply heat to 1st evaporator. Water vapor driven off from the juices in the 1st evaporator supplies the heat for the 2nd effect. This scheme is continued for each successive effect.

The pressure and temperature vary from one evaporator effect to the next. The highest pressures and temperatures occur in the 1st evaporator. The pressure and temperature decrease through each subsequent effect. The 5th effect operates under a vacuum.

Non-condensible gases (air, carbon dioxide, ammonia, and oxygen) and water vapor from the 1st three evaporators are exhausted to the heaters. Non-condensible gases must be vented to allow for efficient heating within the evaporators. Non-condensible gases and water vapor are vented through heaters to the atmosphere through pipes with 1/8" to 3/8" orifices.

The average operating data for the A side 1st evaporator and the B side 1st evaporator data is as follows:

		A SIDE	B SIDE
Thin Juice Flow	(GPM)	1,233	1,212
Thin Juice Flow	(GPH)	74,000	72,703
Evaporator Temp	(°F)	245	253
Evaporator Pressure			
◆ Chest	(PSI)	27.7	27.1
◆ Dome	(PSI)	13.8	14.2
Steam Feed Rate	(lb/hr)	5,152	7,979

3.4 Biocide Additions

Biocides are added at various points of the beet end operations to control bacterial growth. Biocides are typically added at the cossette mixer, diffusion tower, and press water from the pulp presses.

The biocides used during the 1992 campaign were formaldehyde, ammonium bisulfite, and Busan 1007. Brocide 900 was not used during 1992 campaign.

The formaldehyde biocide consists of 37% formaldehyde and 21% methanol. The usage of formaldehyde during the 1992 campaign was significantly reduced compared to previous campaigns. During the testing, only one addition occurred. On October 14, 1993, 10,500 lbs of formaldehyde was added to the A and B side mixers, towers and press water. Formaldehyde was not used for the remainder of the testing.

Both ammonium bisulfite solution and Busan 1007 were continuously added throughout the 1992 campaign. Since these biocides were continuously added at a constant rate, hourly records were not maintained during the testing. Ammonium bisulfite solution (67% NH_4HSO_3) was added to the A and B side cossette mixers and diffusion towers. The amount of ammonium bisulfite added to each side was 20.5 gallons per hour (238 lbs/hour). Busan 1007 is a FDA approved biocide consisting of 14.7% cyanodithiomido-carbonate and 23.3% potassium-N-methyldithiocarbamate. Busan 1007 was added to the diffusion towers via press water at a concentration of 20 ppm. The average amount of Busan added to each side was 2.0 gallons per hour (20.4 lbs/hour).

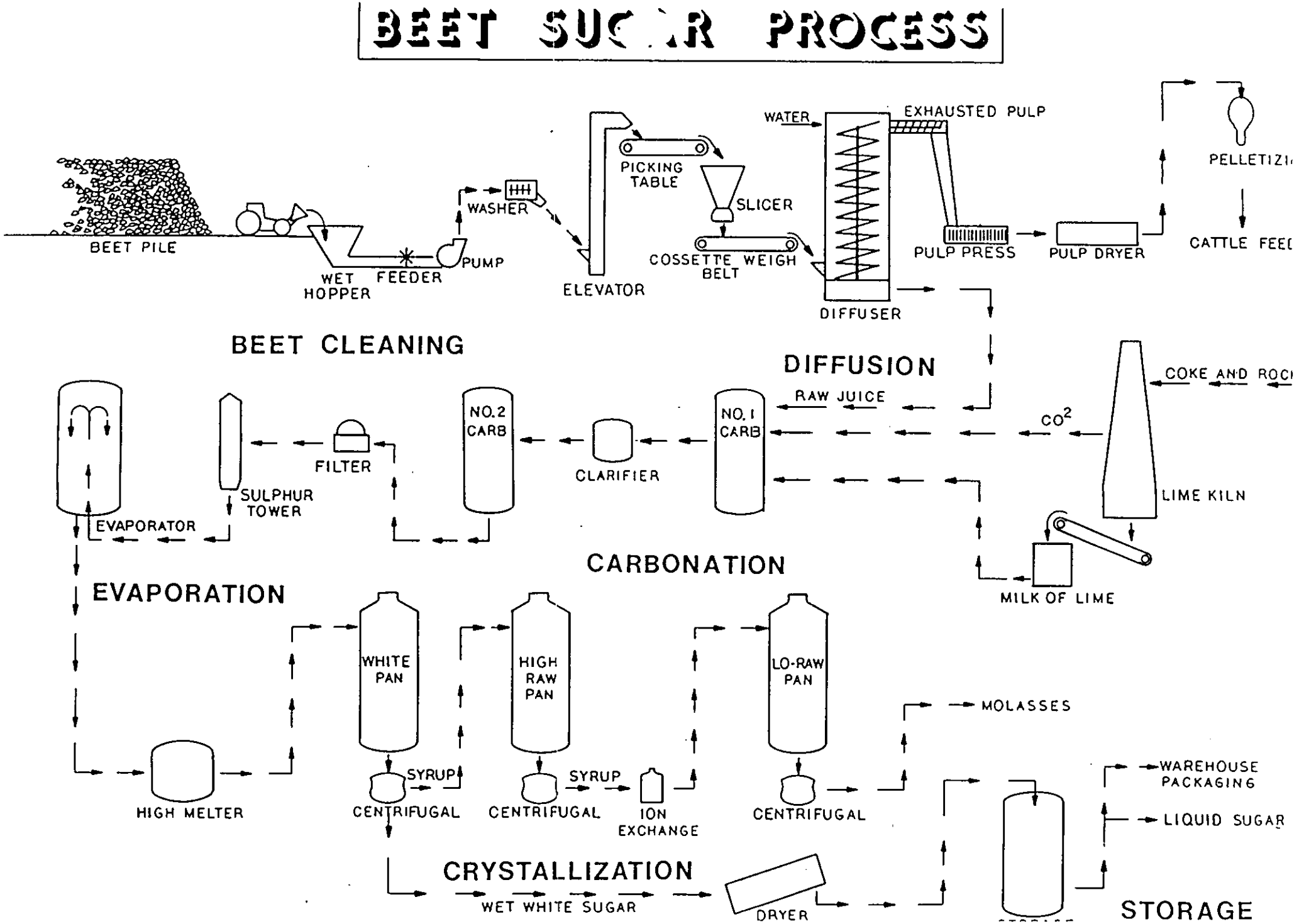

BEET SUGAR PROCESS
BEET PILE
WET HOPPER
FEEDER
PUMP
WASHER
ELEVATOR
PICKING TABLE
SLICER
COSSETTE WEIGH BELT
WATER
EXHAUSTED PULP
DIFFUSER
PULP PRESS
PULP DRYER
PELLETIZI
CATTLE FEE
BEET CLEANING
DIFFUSION
RAW JUICE
NO. 1 CARB
NO. 2 CARB
CLARIFIER
FILTER
SULPHUR TOWER
EVAPORATOR
CO2
COKE AND ROC
LIME KILN
MILK OF LIME
CARBONATION
EVAPORATION
WHITE PAN
HIGH RAW PAN
LO-RAW PAN
HIGH MELTER
SYRUP
SYRUP
CENTRIFUGAL
CENTRIFUGAL
ION EXCHANGE
CENTRIFUGAL
MOLASSES
WAREHOUSE PACKAGING
LIQUID SUGAR
CRYSTALLIZATION
WET WHITE SUGAR
DRYER
STORAGE

FIGURE 3.0

TABLE 3.1.1 SUMMARY OF THE PROCESS DATA FOR THE PULP DRYERS
NAMPA IDAHO FACILITY - 1992 CAMPAIGN

DRYER	TOTAL THROUGHPUT RATE (T/H) a	COAL b (T/H)	DRYER TEMPERATURES		SCRUBBER OPERATION	
			THROAT (DEG. F)	DISCHARGE (DEG. F)	PRES. DROP (IN H2O)	WATER FLOW (GPM)
NORTH c	20.1	1.6	1,616	288	1.0	199
NORTH d	18.3	1.5	1,640	282	2.0	243
CENTER	51.4	4.6	1,769	297	4.0	162
SOUTH	44.0	5.3	1,367	253	4.4	138

a TOTAL THROUGHPUT RATE TO EACH DRYER WAS BACK CALCULATED BASED ON: THE TOTAL AMOUNT OF DRIED PULP PRODUCED PER HOUR; PULP MOISTURES; GRAVIMETRIC ANALYSIS OF MOLASSES, CSB, DRYER HEAT INPUT AND COAL HEATING VALUE.

b THE AVERAGE ASH AND SULFUR CONTENTS OF THE COAL WERE 5.7% AND 0.72%, RESPECTIVELY.

c PROCESS DATA PRIOR TO THE 12-16-92 MODIFICATION TO THE INTERNAL SKIRT OF THE SCRUBBER.

d PROCESS DATA AFTER THE 12-16-92 MODIFICATION TO THE INTERNAL SKIRT TO THE SCRUBBER.

Filename: BEET5.WQ1
Date: 02-Dec-94
Facility: The Amalgamated Sugar Company
Location: Nampa, Idaho
Source: North pulp dryer stack w/wet scrubber operating @ 1" w.c. pressure drop
Test date: Oct. 14-Dec. 3, 1992

VOID DATA - SCRUBBER NOT OPERATING CORR

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported							
			Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8
1	Stack temperature	Deg F	187	185	171	175	180	210	214	
	Moisture	%	41.6	41.7	40.8	41.5	35.9	37.6	36.8	
	Oxygen	%								
	Volumetric flow, actual	acfm	33325	37835	37101	36520	29173	30513	23543	
	Volumetric flow, standard*	dscfm	14548	16663	16810	16520	14279	13967	10685	
	Isokinetic variation	%								
Process rate: dryer feed		TPH	17.50	19.60	20.80	23.7	20.40	15.70	17.30	
	Pollutant concentrations:									
	Filterable PM	G/dscf	0.2599	0.2243	0.1609	0.1512	0.1965	0.2706	0.3419	
	Condensible PM	G/dscf	0.079	0.12	0.11	0.13	0.1586	0.1031	0.1169	
	CO2	% dv								
	Pollutant mass flux rates:									
	Filterable PM	lb/hr	32.4	32.0	23.2	21.4	24.0	32.4	31.3	
	Condensible PM	lb/hr	9.80	16.90	15.40	18.30	19.40	12.30	10.70	
	CO2	lb/hr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Emission factors (ENGLISH UNITS):									AVERAGE
	Filterable PM	lb/ton	1.85	1.63	1.11	0.90	1.18	2.06	1.81	1.5
	Condensible PM	lb/ton	0.560	0.862	0.740	0.772	0.951	0.783	0.618	0.75
	CO2	lb/ton	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
	Emission factors (METRIC UNITS):									AVERAGE
	Filterable PM	kg/Mg	0.926	0.817	0.557	0.452	0.589	1.032	0.905	0.75
	Condensible PM	kg/Mg	0.280	0.431	0.370	0.386	0.475	0.392	0.309	0.37
	CO2	kg/Mg	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00

North Pulp Dryer
PM
Data (1992)
Not representative of typical control systems. Data Not used

Filename: BEET5A.WQ1
Date: 02-Dec-94
Facility: The Amalgamated Sugar Company
Location: Nampa, Idaho
Source: CENTRAL PULP DRYER
Coal-fired rotary drum beet pulp dryer controlled with cyclones and wet impingement type scrubbers in series (two parallel stacks each w/controls)
Note: Run 2--east stack: dryer fired by natural gas
Test date: Oct. 28-Nov. 2, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2**	Run 3	Run 4
1 EAST STACK	Stack temperature	Deg F	173	171	170	175
	Moisture	%	47.4	44.3	44.6	46.7
	Oxygen	%	nd	nd	nd	nd
	Volumetric flow, actual	acfm	38894	41616	44102	40393
	Volumetric flow, standard*	dscfm	15674	17613	18534	16480
	Isokinetic variation	%	nd	nd	nd	nd
Process rate: Beet pulp feed to dryer		TPH	50.20	47.40	55.20	49.7
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0939	0.0668	0.0601	0.0873
	Condensible PM	G/dscf	0.185	0.0457	0.0623	0.0614
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	12.6	10.1	9.55	12.3
	Condensible PM	lb/hr	24.9	6.90	9.90	8.67
	Emission factors (ENGLISH UNITS):					
	Filterable PM	lb/ton	0.251	0.213	0.173	0.248
	Condensible PM	lb/ton	0.495	0.146	0.179	0.175
	Emission factors (METRIC UNITS):					
	Filterable PM	kg/Mg	0.126	0.106	0.0865	0.124
	Condensible PM	kg/Mg	0.248	0.0728	0.0896	0.0873

TOTAL EMISSION FACTORS FOR BOTH STACKS (EAST RUNS 1,3,4 + WEST RUNS 1,2,3)

	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.460	0.363	0.422	0.415
	Condensible PM	lb/ton	0.664	0.367	0.371	0.467
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.230	0.182	0.211	0.207
	Condensible PM	kg/Mg	0.332	0.183	0.185	0.234

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2 WEST STACK	Stack temperature	Deg F	173	171	169	
	Moisture	%	42.6	42.2	43.2	
	Oxygen	%	nd	nd	nd	
	Volumetric flow, actual	acfm	37491	39063	37381	
	Volumetric flow, standard*	dscfm	16691	17538	16515	
	Isokinetic variation	%	nd	nd	nd	
Process rate: Beet pulp feed to dryer		TPH	55.30	55.80	55.70	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0805	0.0706	0.0684	
	Condensible PM	G/dscf	0.0652	0.0695	0.0773	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	11.5	10.6	9.7	
	Condensible PM	lb/hr	9.3	10.4	10.9	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.208	0.190	0.174	0.191
	Condensible PM	lb/ton	0.169	0.187	0.196	0.184
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.104	0.0951	0.0869	0.0954
	Condensible PM	kg/Mg	0.0843	0.0936	0.0982	0.0921

Filename: BEET5C.WQ1
Date: 07-Dec-94
Facility: The Amalgamated Sugar Company
Location: Nampa, Idaho
Source: SOUTH PULP DRYER--east stack
Coal-fired rotary drum beet pulp dryer controlled with cyclones and wet impingement type scrubbers in series (two parallel stacks each w/controls)
Note: Only one of the two stacks was tested; emission rates are doubled to account for both stacks.
Test date: Oct. 28-Nov. 2, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported				
			Run 1	Run 2	Run 3	Run 4	
1	Stack temperature	Deg F	165	165	165	156	
EAST STACK	Moisture	%	39.2	37.5	37.9	36.8	
	Oxygen	%	nd	nd	nd	nd	
	Volumetric flow, actual	acfm	34287	31421	27870	23435	
	Volumetric flow, standard*	dscfm	16192	15319	13630	11484	
	Isokinetic variation	%	nd	nd	nd	nd	
Process rate: Beet pulp feed to dryer		TPH	47.10	47.10	47.20	38.9	
	Pollutant concentrations:						
	Filterable PM	G/dscf	0.0619	0.0497	0.0467	0.0922	
	Condensible PM	G/dscf	0.0387	0.0402	0.0763	0.0992	
	Pollutant mass flux rates:						
	Filterable PM	lb/hr	8.59	6.53	5.46	9.08	
	Condensible PM	lb/hr	5.37	5.28	8.91	9.76	
	Multiply mass flux rate by number of emission points:				2		
	Emission factors (ENGLISH UNITS):						AVERAGE
	Filterable PM	lb/ton	0.365	0.277	0.231	0.467	0.335
	Condensible PM	lb/ton	0.228	0.224	0.378	0.502	0.333
	Emission factors (METRIC UNITS):					AVERAGE	
	Filterable PM	kg/Mg	0.182	0.139	0.1156	0.233	0.167
	Condensible PM	kg/Mg	0.114	0.1121	0.1889	0.2510	0.166

RUN 5 DATA ARE NOT PRESENTED BECAUSE THE PRESSURE DROP ACROSS THE SCRUBBER WAS 2.7" H2O.
RUNS 1-4 PRESSURE DROP >3" H2O.

Aldehyde and SVOC data for Amalgamated Sugar–North Pulp Dryer

Test date	No. of runs detected*	Pollutant	Concentration (ug/m ^ 3)	Emission Rate (lb/hr)	Emission factor (lb/ton)		
		ALDEHYDES				AVG. OF 2 TESTS	
10/26/92	3	Formaldehyde	190.1	0.0244	0.00102	0.0083	
	3	Acetaldehyde	585.1	0.0753	0.00315	0.013	
	3	Acrolein	814.3	0.105	0.00439	0.0060	
	3	Crotonaldehyde	568.3	0.0732	0.00306	0.0024	
01/11/93	3	Formaldehyde	4281.7	0.249	0.0155		
	3	Acetaldehyde	6099.2	0.354	0.0221		
	3	Acrolein	2128.9	0.124	0.00769		
	3	Crotonaldehyde	465.6	0.0271	0.00168		
		SVOC				AVG. OF 2 TESTS	TOTAL # OF RUNS DETECTE
10/92	3	Benzoic acid	1019.37	6.43E-02	0.00269	0.0028	6
	3	Benzaldehyde	388.07	2.42E-02	0.00101	0.0014	6
	3	Bis(2-ethylhexyl)phthalate	196.45	1.23E-02	0.000515	0.0015	6
	2	Phenol	176.97	1.07E-02	0.000448	0.00032	3
	3	2-Nitrophenol	109.07	7.04E-03	0.000295	0.00018	5
	2	4-Nitrophenol	74.36	4.83E-03	0.000202	0.00014	4
	2	4-Methylphenol	61.63	3.67E-03	0.000154	0.00013	5
	3	Naphthalene	49.54	3.11E-03	0.000130	0.00011	6
	3	Di-n-butylphthalate	35.44	2.21E-03	9.25E-05	5.16E-05	4
	3	Benzyl alcohol	32.76	2.01E-03	8.41E-05	7.08E-05	5
	2	2,4-Dinitrophenol	18.7	1.21E-03	5.06E-05	5.06E-05	2
	2	2-Methylphenol	17.24	1.02E-03	4.27E-05	3.40E-05	5
	3	Nitrobenzene	14.34	8.97E-04	3.75E-05	1.88E-05	4
	3	2,4-Dimethylphenol	12.7	7.91E-04	3.31E-05	2.49E-05	4
	2	2-Methylnaphthalene	6.4	3.93E-04	1.64E-05	1.69E-05	5
	1	4,6-Dinitro-2-methylphenol	5.59	3.67E-04	1.54E-05	1.54E-05	1
	3	Dibenzofuran	5.13	3.16E-04	1.32E-05	1.08E-05	5
	3	Phenanthrene	4.94	3.06E-04	1.28E-05	1.20E-05	5
	3	Diethylphthalate	3.72	2.33E-04	9.75E-06	9.75E-06	3
	2	Acenaphthylene	1.35	8.23E-05	3.44E-06	1.72E-06	4
1/93	3	Benzoic acid	753.63	0.047	0.00292		
	3	Bis(2-ethylhexyl)phthalate	685.53	0.0409	0.00254		
	3	Benzaldehyde	431.6	0.0272	0.00169		
	1	Phenol	63.41	0.00319	0.000198		
	3	4-Methylphenol	29.83	0.00179	0.000111		
	3	Naphthalene	21.13	0.00132	8.20E-05		
	2	4-Nitrophenol	17.48	0.00122	7.58E-05		
	2	2-Nitrophenol	16.78	0.000998	6.20E-05		
	2	Benzyl alcohol	15.8	0.000927	5.76E-05		
	3	2-Methylphenol	6.78	0.000409	2.54E-05		
	3	2-Methylnaphthalene	4.52	0.000278	1.73E-05		
	1	Nitrobenzene	5.48	0.000276	1.71E-05		
	1	2,4-Dimethylphenol	5.32	0.000268	1.66E-05		
	2	Phenanthrene	3.3	0.00018	1.12E-05		
	1	Di-n-butylphthalate	3.44	0.000173	1.07E-05		
	1	Butylbenzylphthalate	3.43	0.000173	1.07E-05	1.07E-05	1
	2	Dibenzofuran	2.43	0.000136	8.45E-06		
	1	Fluoranthene	1.91	9.61E-05	5.97E-06	5.97E-06	1
	2	Acenaphthylene	1.43	8.37E-05	5.20E-06		
	1	Anthracene	1.59	7.98E-05	4.96E-06	4.96E-06	1

Aldehyde data for Amalgamated Sugar--Central Pulp Dryer

Test date	No. of runs detected*	Pollutant	Concentration (ug/m^3)	Emission Rate (lb/hr)	Emission factor (lb/ton)
		ALDEHYDES			
01/25/93	3	Formaldehyde	4187	0.25	0.00586
	3	Acetaldehyde	11523.8	0.687	0.0162
	3	Acrolein	6443.4	0.384	0.0092
	3	Crotonaldehyde	1116.4	0.0665	0.00159

SVOC data for Amalgamated Sugar--B-side 1st carbonation tank vent

Test date	Run #	Pollutant	Concentration (ug/m^3)	Flow rate (dscfm)	Emission Rate (lb/hr)	Emission factor (lb/1000 gal)
SVOC		Process throughput rate (1000 gal/hr) =		76.955		
11/17/92	1	Benzaldehyde	1341.88	1456	7.32E-03	9.51E-05
to	2	Benzaldehyde	1635.15	1478	9.05E-03	1.18E-04
11/19/92	3	Benzaldehyde	1400.87	1540	8.08E-03	1.05E-04
	AVERAGE					1.06E-04
	1	Bis(2-ethylhexyl)phthalate	252.09	1456	1.37E-03	1.79E-05
	2	Bis(2-ethylhexyl)phthalate	133.42	1478	7.39E-04	9.60E-06
	3	Bis(2-ethylhexyl)phthalate	127.69	1540	7.37E-04	9.57E-06
	AVERAGE					1.23E-05
	1	Benzoic acid	171.13	1456	9.33E-04	1.21E-05
	2	Benzoic acid	85.43	1478	4.73E-04	6.15E-06
	3	Benzoic acid	91.79	1540	5.29E-04	6.88E-06
	AVERAGE					8.38E-06
	1	Benzyl alcohol	66.52	1456	3.63E-04	4.71E-06
	2	Benzyl alcohol	66.18	1478	3.66E-04	4.76E-06
	3	Benzyl alcohol	71.99	1540	4.15E-04	5.40E-06
	AVERAGE					4.96E-06
	1	2,4-Dinitrophenol	ND	1456	0.00E+00	ND
	2	2,4-Dinitrophenol	ND	1478	0.00E+00	ND
	3	2,4-Dinitrophenol	141.55	1540	8.16E-04	1.06E-05
	AVERAGE					ND
	1	Naphthalene	21.62	1456	1.18E-04	1.53E-06
	2	Naphthalene	33.28	1478	1.84E-04	2.39E-06
	3	Naphthalene	27.48	1540	1.59E-04	2.06E-06
	AVERAGE					2.00E-06
	1	Phenanthrene	17.91	1456	9.77E-05	1.27E-06
	2	Phenanthrene	19.62	1478	1.09E-04	1.41E-06
	3	Phenanthrene	18.78	1540	1.08E-04	1.41E-06
	AVERAGE					1.36E-06
	1	Phenol	20.27	1456	1.11E-04	1.44E-06
	2	Phenol	19.48	1478	1.08E-04	1.40E-06
	3	Phenol	14.28	1540	8.24E-05	1.07E-06
	AVERAGE					1.30E-06
	1	4-Methylphenol	12.22	1456	6.66E-05	8.66E-07
	2	4-Methylphenol	8.14	1478	4.51E-05	5.86E-07
	3	4-Methylphenol	6.94	1540	4.00E-05	5.20E-07
	AVERAGE					6.57E-07
	1	2-Methylnaphthalene	3.98	1456	2.17E-05	2.82E-07
	2	2-Methylnaphthalene	8.9	1478	4.93E-05	6.40E-07
	3	2-Methylnaphthalene	8.18	1540	4.72E-05	6.13E-07
	AVERAGE					5.12E-07
	1	Acenaphthene	ND	1456	0.00E+00	ND
	2	Acenaphthene	ND	1478	0.00E+00	ND
	3	Acenaphthene	19.29	1540	1.11E-04	1.45E-06
	AVERAGE					ND

Aldehyde data for Amalgamated Sugar--B-side 2nd carbonation tank vent

Test date	No. of test runs	Pollutant	Concentration (lb/acf)	Flow rate (acfm)	Emission Rate (lb/hr)	Emission factor (lb/1000 gal)
ALDEHYDES		Process throughput rate (1000 gal/hr) =		71.7		
11/13/92	1	Formaldehyde	1.592E-08	1167	0.00111	1.55E-05
	1	Acetaldehyde	4.39E-06	1167	0.307	0.00429
	1	Acrolein	2.406E-07	1167	0.0168	0.000235
	1	Crotonaldehyde	3.022E-08	1167	0.00212	2.95E-05

Aldehyde data for Amalgamated Sugar--A-side No.2 thin juice heater vent

Test date	Test run #	Pollutant	Concentration (ug/m ^3)	Flow rate (dscfm)	Emission Rate (lb/hr)	Emission factor (lb/1000 gal)
ALDEHYDES	Process throughput rate (1000 gal/hr) =		Run 1--74.6	Run 2--73.4	Run 3--73.8	
01/13/93	1	Formaldehyde	26866	2.1	2.11E-04	2.83E-06
	2	Formaldehyde	7369	2.1	5.80E-05	7.90E-07
	3	Formaldehyde	2374	2.1	1.87E-05	2.53E-07
	AVERAGE					1.29E-06
	1	Acetaldehyde	1352228	2.1	1.06E-02	1.43E-04
	2	Acetaldehyde	1099809	2.1	8.65E-03	1.18E-04
	3	Acetaldehyde	579289	2.1	4.56E-03	6.17E-05
	AVERAGE					1.07E-04
	1	Acrolein	2455	2.1	1.93E-05	2.59E-07
	2	Acrolein	1137	2.1	8.94E-06	1.22E-07
	3	Acrolein	605	2.1	4.76E-06	6.45E-08
	AVERAGE					1.48E-07
	1	Crotonaldehyde	2812	2.1	2.21E-05	2.96E-07
	2	Crotonaldehyde	1638	2.1	1.29E-05	1.76E-07
	3	Crotonaldehyde	918	2.1	7.22E-06	9.78E-08
	AVERAGE					1.90E-07

Aldehyde data for Amalgamated Sugar–B-side 2nd carbonation heater vent

Test date	Test run #	Pollutant	Concentration (ug/m^3)	Flow rate (dscfm)	Emission Rate (lb/hr)	Emission factor (lb/1000 gal)
ALDEHYDES Process throughput rate (1000 gal/hr) =			Run 1–73.5	Run 2–73.7	Run 3–73.3	
01/21/93	1	Formaldehyde	4745	0.6	1.07E-05	1.45E-07
	2	Formaldehyde	3170	0.6	7.12E-06	9.67E-08
	3	Formaldehyde	2260	0.6	5.08E-06	6.93E-08
	AVERAGE					1.04E-07
	1	Acetaldehyde	1081023	0.6	2.43E-03	3.31E-05
	2	Acetaldehyde	749815	0.6	1.69E-03	2.29E-05
	3	Acetaldehyde	481552	0.6	1.08E-03	1.48E-05
	AVERAGE					2.36E-05
	1	Acrolein	25835	0.6	5.81E-05	7.90E-07
	2	Acrolein	22168	0.6	4.98E-05	6.76E-07
	3	Acrolein	18245	0.6	4.10E-05	5.59E-07
	AVERAGE					6.75E-07
	1	Crotonaldehyde	3193	0.6	7.18E-06	9.76E-08
	2	Crotonaldehyde	2273	0.6	5.11E-06	6.93E-08
	3	Crotonaldehyde	3885	0.6	8.73E-06	1.19E-07
	AVERAGE					9.54E-08

SVOC data for Amalgamated Sugar--B-side 2nd carbonation heater vent

Test date	Run #	Pollutant	Concentration (ug/m^3)	Flow rate (dscfm)	Emission Rate (lb/hr)	Emission factor (lb/1000 gal)
SVOC		Process throughput rate (1000 gal/hr) =		76.955		
01/18/93	1	Benzaldehyde	80757	0.879	2.66E-04	3.45E-06
to	2	Benzaldehyde	54329.2	0.901	1.83E-04	2.38E-06
01/27/93	3	Benzaldehyde	50959.4	0.375	7.15E-05	9.29E-07
	4	Benzaldehyde	75995.9	0.574	1.63E-04	2.12E-06
	AVERAGE					2.22E-06
	1	Bis(2-ethylhexyl)phthalate	1874.5	0.879	6.17E-06	8.02E-08
	2	Bis(2-ethylhexyl)phthalate	6885.7	0.901	2.32E-05	3.02E-07
	3	Bis(2-ethylhexyl)phthalate	44978.2	0.375	6.31E-05	8.20E-07
	4	Bis(2-ethylhexyl)phthalate	9567.4	0.574	2.06E-05	2.67E-07
	AVERAGE					3.67E-07
	1	Benzyl alcohol	5252.1	0.879	1.73E-05	2.25E-07
	2	Benzyl alcohol	5606.4	0.901	1.89E-05	2.46E-07
	3	Benzyl alcohol	3494.4	0.375	4.90E-06	6.37E-08
	4	Benzyl alcohol	6327	0.574	1.36E-05	1.77E-07
	AVERAGE					1.78E-07
	1	Naphthalene	749.3	0.879	2.47E-06	3.21E-08
	2	Naphthalene	354.7	0.901	1.20E-06	1.56E-08
	3	Naphthalene	ND	0.375	ND	ND
	4	Naphthalene	1844.3	0.574	3.96E-06	5.15E-08
	AVERAGE					2.48E-08
	1	4-Methylphenol	2214.8	0.879	7.29E-06	9.47E-08
	2	4-Methylphenol	ND	0.901	ND	ND
	3	4-Methylphenol	ND	0.375	ND	ND
	4	4-Methylphenol	ND	0.574	ND	ND
	AVERAGE					ND
	1	Phenanthrene	320.9	0.879	1.06E-06	1.37E-08
	2	Phenanthrene	285.3	0.901	9.63E-07	1.25E-08
	3	Phenanthrene	357.3	0.375	5.01E-07	6.52E-09
	4	Phenanthrene	1073.5	0.574	2.31E-06	3.00E-08
	AVERAGE					1.57E-08
	1	Isophorone	ND	0.879	ND	ND
	2	Isophorone	1304.1	0.901	4.40E-06	5.72E-08
	3	Isophorone	ND	0.375	ND	ND
	4	Isophorone	ND	0.574	ND	ND
	AVERAGE					ND
	1	Benzoic acid	ND	0.879	ND	ND
	2	Benzoic acid	1133.43	0.901	3.82E-06	4.97E-08
	3	Benzoic acid	ND	0.375	ND	ND
	4	Benzoic acid	ND	0.574	ND	ND
	AVERAGE					ND
	1	Phenol	ND	0.879	ND	ND
	2	Phenol	352.2	0.901	1.19E-06	1.54E-08
	3	Phenol	1825	0.375	2.56E-06	3.33E-08
	4	Phenol	ND	0.574	ND	ND
	AVERAGE					1.22E-08
	1	Diethylphthalate	ND	0.879	ND	ND
	2	Diethylphthalate	ND	0.901	ND	ND
	3	Diethylphthalate	ND	0.375	ND	ND
	4	Diethylphthalate	1640.4	0.574	3.52E-06	4.58E-08
	AVERAGE					ND
	1	Pyridine	699.4	0.879	2.30E-06	2.99E-08
	2	Pyridine	1056.2	0.901	3.56E-06	4.63E-08
	3	Pyridine	783.2	0.375	1.10E-06	1.43E-08
	4	Pyridine	1568.4	0.574	3.37E-06	4.38E-08
	AVERAGE					3.36E-08
	1	Dibenzofuran	ND	0.879	ND	ND
	2	Dibenzofuran	ND	0.901	ND	ND
	3	Dibenzofuran	95.3	0.375	1.34E-07	1.74E-09
	4	Dibenzofuran	ND	0.574	ND	ND
	AVERAGE					ND
	1	Di-n-butylphthalate	34.9	0.879	1.15E-07	1.49E-09
	2	Di-n-butylphthalate	ND	0.901	ND	ND
	3	Di-n-butylphthalate	167.1	0.375	2.35E-07	3.05E-09
	4	Di-n-butylphthalate	ND	0.574	ND	ND
	AVERAGE					1.14E-09

APPENDIX F

REPORT EXCERPTS FROM REFERENCE 6

(Monitor Bay Sugar Company, October 12, 1992)

Report of...

Particulate Emission Testing

performed for...

Monitor Sugar Company
Bay City, Michigan

on the

Pulp Dryer 3 Exhaust

October 12, 1992

022.06

Network Environmental, Inc.
Grand Rapids, MI

Network Environmental, Inc.

SUMMARY OF PARTICULATE EMISSIONS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/12/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #3 NORTH

SAMPLING STAFF: BYRD/CARGILL

SAMPLE NUMBER	1	2	3
STANDARD ANALYSIS			
E1. TOTAL WEIGHT COLLECTED, grams	0.096	0.095	0.103
E2. LBS. PARTICULATE/1000 LBS. GAS, ACTUAL(1)	0.051	0.050	0.049
E3. LBS. PARTICULATE/1000 LBS. GAS, DRY(2)	0.051	0.050	0.049
E6. GRAINS/DSCF(4)	0.037	0.034	0.034
E7. LBS./HOUR	10.64	10.21	11.00

1. 'ACTUAL' MEANS AT THE CONDITIONS FOUND AT THE SAMPLING LOCATION.
2. 'DRY' INCLUDES ONLY THE NATURAL MOISTURE THAT WOULD BE EMITTED FROM THE PROCESS. MOISTURE ADDED OR SUBTRACTED BY THE COLLECTOR IS NOT INCLUDED.
3. 'WET' INCLUDES THE MOISTURE AS MEASURED AT THE SAMPLING LOCATION.
4. 'DSCF' IS UNDER TOTALLY DRY CONDITIONS, ALL MOISTURE REMOVED.

Network Environmental, Inc.

SUMMARY OF EXHAUST GAS PARAMETERS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/12/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #3 NORTH

SAMPLING STAFF: BYRD/CARGILL

	SAMPLE NUMBER	1	2	3
G1.	STACK RADIUS, inches	33.0	33.0	33.0
G2.	AREA OF STACK, sq. ft.	23.76	23.76	23.76
G3.	BAROMETRIC PRESSURE, in. HG.	28.75	28.75	28.75
G4.	STATIC PRESSURE IN STACK, in. H2O	0.51-	0.51-	0.51-
G5.	STACK GAS TEMPERATURE, deg. F	168	165	164
G6.	AVG. SQRT VELOCITY PRESSURE OF POINTS SAMPLED	0.675	0.657	0.721
G7.	PERCENT MOISTURE AT TEST LOCATION	37.29	33.04	33.90
G8.	PERCENT MOISTURE BEFORE COLLECTOR	37.29	33.04	33.90
G9.	DRY GAS COMPOSITION: % OXYGEN	16.00	16.40	16.20
	% CARBON DIOXIDE	2.93	2.73	2.13
	% CARBON MONOXIDE	0.00	0.00	0.00
	% NITROGEN	81.07	80.87	81.67
G10.	PERCENT EXCESS AIR AT TEST LOCATION			
	DENSITY AND MOLECULAR WEIGHT OF STACK GAS:			
G11.	DRY, @ STP, lbs./cu.ft.	0.0753	0.0752	0.0749
G12.	WET, @ STP, lbs./cu.ft.	0.0645	0.0657	0.0653
G13.	WET, @ STACK CONDITIONS, lbs./cu.ft.	0.0522	0.0535	0.0533
G14.	MOLECULAR WEIGHT, DRY, @ STP, lbs./mole	29.12	29.10	29.00
G15.	AVERAGE GAS VELOCITY, feet/min.	2783	2678	2946
	STACK GAS FLOW RATE:			
G16.	STACK CONDITIONS, ACFM	66,117	63,616	69,994
G17.	STANDARD CONDITIONS, SCFM	53,512	51,804	57,097
G18.	STANDARD CONDITIONS, DRY SCFM	33,556	34,688	37,739

*STANDARD TEMPERATURE AND PRESSURE (STP) = 29.92 inches HG, 70 deg. F

Network Environmental, Inc.

SUMMARY OF PARTICULATE TRAIN PARAMETERS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/12/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #3 NORTH

SAMPLING STAFF: BYRD/CARGILL

	SAMPLE NUMBER	1	2	3
P1.	NUMBER OF POINTS SAMPLED	12	12	12
P2.	DURATION OF SAMPLE, minutes	60.00	60.00	60.00
P3.	NOZZLE DIAMETER, inches	0.309	0.309	0.309
P4.	NOZZLE AREA, sq. ft.	0.00052	0.00052	0.00052
P5.	PITOT CALIBRATION FACTOR	0.860	0.860	0.860
P6.	METER CALIBRATION FACTOR	0.982	0.982	0.982
P7.	AVERAGE FILTER TEMPERATURE, deg. F	0	0	0
P8.	AVERAGE METER TEMPERATURE, deg. F	69.5	70.9	71.5
P9.	AVERAGE METER PRESSURE, inches of water	1.570	1.835	2.193
P10.	METER VOLUME, ACTUAL READING, cu.ft.	42.13	45.09	49.35
P11.	METER VOLUME, @ STP, cu.ft.	39.93	42.65	46.67
P12.	LIQUID VOLUME OF WATER CONDENSED, mls.	501.0	444.0	505.0
P13.	VAPOR VOLUME OF WATER CONDENSED, @ STP, cu.ft.	23.75	21.05	23.94
P14.	TOTAL GAS SAMPLED, @ STP, cu.ft.	63.68	63.70	70.60
P15.	WEIGHT OF GAS SAMPLED, DRY, lbs.	3.01	3.21	3.50
P16.	WEIGHT OF GAS SAMPLED, WET, lbs.	4.11	4.19	4.61
P17.	PERCENT ISOKINETICS	90.3	93.3	93.8

CONCENTRATION CONVERSION FACTORS:

P18.	50 % EXCESS AIR, AFTER COLLECTOR			
P19.	50 % EXCESS AIR, BEFORE COLLECTOR			
P20.	MOISTURE CONDITIONS BEFORE COLLECTOR	1.00	1.00	1.00

STANDARD TEMPERATURE AND PRESSURE (STP) = 29.92 inches Hg, 70 deg. F

Network Environmental, Inc.

SUMMARY OF PARTICULATE EMISSIONS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/12/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #3 SOUTH

SAMPLING STAFF: ENGELHARDT/SMITH

SAMPLE NUMBER	1	2	3
STANDARD ANALYSIS			
E1. TOTAL WEIGHT COLLECTED, grams	0.102	0.117	0.111
E2. LBS. PARTICULATE/1000 LBS. GAS, ACTUAL(1)	0.053	0.052	0.051
E3. LBS. PARTICULATE/1000 LBS. GAS, DRY(2)	0.053	0.052	0.051
E6. GRAINS/DSCF(4)	0.036	0.036	0.035
E7. LBS./HOUR	9.99	10.46	9.72

1. 'ACTUAL' MEANS AT THE CONDITIONS FOUND AT THE SAMPLING LOCATION.
2. 'DRY' INCLUDES ONLY THE NATURAL MOISTURE THAT WOULD BE EMITTED FROM THE PROCESS. MOISTURE ADDED OR SUBTRACTED BY THE COLLECTOR IS NOT INCLUDED.
3. 'WET' INCLUDES THE MOISTURE AS MEASURED AT THE SAMPLING LOCATION.
4. 'DSCF' IS UNDER TOTALLY DRY CONDITIONS, ALL MOISTURE REMOVED.

Network Environmental, Inc.

SUMMARY OF EXHAUST GAS PARAMETERS

COMPANY NAME: MONITOR SUGAR COMPANY — TEST DATE: 10/12/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #3 SOUTH

SAMPLING STAFF: ENGELHARDT/SMITH

	SAMPLE NUMBER	1	2	3
G1.	STACK RADIUS, inches	33.0	33.0	33.0
G2.	AREA OF STACK, sq. ft.	23.76	23.76	23.76
G3.	BAROMETRIC PRESSURE, in. HG.	28.75	28.75	28.75
G4.	STATIC PRESSURE IN STACK, in. H2O	0.28-	0.28-	0.28-
G5.	STACK GAS TEMPERATURE, deg. F	176	174	174
G6.	AVG. SQRT VELOCITY PRESSURE OF POINTS SAMPLED	0.637	0.672	0.649
G7.	PERCENT MOISTURE AT TEST LOCATION	33.19	33.72	34.79
G8.	PERCENT MOISTURE BEFORE COLLECTOR	33.19	33.72	34.79
G9.	DRY GAS COMPOSITION: % OXYGEN	16.80	17.60	17.33
	% CARBON DIOXIDE	1.80	1.27	1.20
	% CARBON MONOXIDE	0.00	0.00	0.00
	% NITROGEN	81.40	81.13	81.47
G10.	PERCENT EXCESS AIR AT TEST LOCATION			
	DENSITY AND MOLECULAR WEIGHT OF STACK GAS:			
G11.	DRY, @ STP, lbs./cu.ft.	0.0749	0.0747	0.0747
G12.	WET, @ STP, lbs./cu.ft.	0.0655	0.0652	0.0649
G13.	WET, @ STACK CONDITIONS, lbs./cu.ft.	0.0524	0.0524	0.0521
G14.	MOLECULAR WEIGHT, DRY, @ STP, lbs./mole	28.97	28.92	28.89
G15.	AVERAGE GAS VELOCITY, feet/min.	2530	2670	2588
	STACK GAS FLOW RATE:			
G16.	STACK CONDITIONS, ACFM	60,105	63,439	61,475
G17.	STANDARD CONDITIONS, SCFM	48,120	50,943	49,359
G18.	STANDARD CONDITIONS, DRY SCFM	32,147	33,763	32,189

*STANDARD TEMPERATURE AND PRESSURE (STP) = 29.92 inches HG, 70 deg. F

Network Environmental, Inc.

SUMMARY OF PARTICULATE TRAIN PARAMETERS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/12/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #3 SOUTH

SAMPLING STAFF: ENGELHARDT/SMITH

	SAMPLE NUMBER	1	2	3
P1.	NUMBER OF POINTS SAMPLED	12	12	12
P2.	DURATION OF SAMPLE, minutes	60.00	60.00	60.00
P3.	NOZZLE DIAMETER, inches	0.322	0.322	0.322
P4.	NOZZLE AREA, sq. ft.	0.00057	0.00057	0.00057
P5.	PITOT CALIBRATION FACTOR	0.830	0.830	0.830
P6.	METER CALIBRATION FACTOR	0.998	0.998	0.998
P7.	AVERAGE FILTER TEMPERATURE, deg. F	0	0	0
P8.	AVERAGE METER TEMPERATURE, deg. F	69.8	71.0	72.5
P9.	AVERAGE METER PRESSURE, inches of water	1.903	2.583	2.408
P10.	METER VOLUME, ACTUAL READING, cu.ft.	44.95	51.94	50.44
P11.	METER VOLUME, @ STP, cu.ft.	43.31	50.03	48.43
P12.	LIQUID VOLUME OF WATER CONDENSED, mls.	454.0	537.0	545.0
P13.	VAPOR VOLUME OF WATER CONDENSED, @ STP, cu.ft.	21.52	25.45	25.83
P14.	TOTAL GAS SAMPLED, @ STP, cu.ft.	64.83	75.48	74.26
P15.	WEIGHT OF GAS SAMPLED, DRY, lbs.	3.24	3.74	3.62
P16.	WEIGHT OF GAS SAMPLED, WET, lbs.	4.24	4.92	4.82
P17.	PERCENT ISOKINETICS	94.3	103.7	105.3

CONCENTRATION CONVERSION FACTORS:

P18.	50 % EXCESS AIR, AFTER COLLECTOR			
P19.	50 % EXCESS AIR, BEFORE COLLECTOR			
P20.	MOISTURE CONDITIONS BEFORE COLLECTOR	1.00	1.00	1.00

STANDARD TEMPERATURE AND PRESSURE (STP) = 29.92 inches HG, 70 deg. F

DISCUSSION OF RESULTS

The resulting combined exhaust particulate emission concentrations for the three samples were 0.052 Lbs/1000 Lbs for sample one, 0.051 Lbs/1000 Lbs for sample two, and 0.050 Lbs/1000 Lbs for sample three. The average exhaust particulate concentration was 0.051 Lbs/1000 Lbs.

The combined particulate mass emission rates were 20.63 Lbs/Hr for sample one, 20.67 Lbs/Hr for sample two, and 20.72 Lbs/Hr for sample three. The average mass emission rate was 20.68 Lbs/Hr.

SOURCE DESCRIPTION

The source tested was the number three beet pulp dryer. The rotary dryer is fired by natural gas and dries the pulp with direct contact. The pulp is fed into the dryer at the beginning of the rotary section. The pulp is passed through the rotary dryer where most of the moisture is removed. The particulate laden exhaust is then passed through a multiclone collector and then a scrubber for particulate removal before it is exhausted to the atmosphere through the twin exhaust stacks. Each exhaust stack is equipped with a scrubber.

Process operating information for the day of the sampling can be found in Appendix C.

SAMPLING AND ANALYTICAL PROTOCOL

The sampling locations were on the twin 66 inch I.D. exhaust stacks at a distance that meets the eight duct diameter downstream two duct diameter upstream requirement of U.S. EPA Reference Method 1.

Particulate

The particulate sampling and analysis were performed in accordance with MDNR Reference Method 5B, and the methods referenced therein. Three (3) samples, each sixty (60) minutes in duration, were collected simultaneously from the north and south exhausts. All the quality control and quality assurance requirements specified in the methods were incorporated in the sampling and analysis. No alterations were incorporated in the testing or analysis. Figure 1 shows a schematic of the particulate sampling train.

3 JACKS TEST #1 11:05 A.M - 12:10 P.M.
TEST #2 12:35 P.M - 1:40 P.M.
TEST #3 2:00 PM - 3:30

MONITOR SUGAR COMPANY

Operating Log
Pulp Driers Station

2913290

Day Ending: 10-12-92
Campaing Day: 19

Time	Inlet Temp.			Outlet Temp.			Moist. Plain			Moist. Pellets	Collectors Press. Drop				Belt Scale Wet Pulp Ton/Hr.	Feed Conv. R.P.M.			Loading Scrolls		
	#1	#2	#3	#1	#2	#3	#1	#2	#3		#1	#2	#3	#4		#1	#2	#3	#1	#2	#3
7	780	950	820	168	145	125	12.1	10.1	10.1	9.9	4	4	4	4	68	235	220	100	60	41	50
8	740	920	820	168	145	125	10.6	12.6	12.4	10.2	4	4	4	4	70	235	220	100	58	41	52
9	740	740	810	168	145	125	15.0	12.6	11.2	10.1	4	4	4	4	67	210	195	100	58	40	52
10	720	940	830	168	145	125	14.1	13.5	14.3	10.3	4	4	4	4	78	235	210	100	58	41	52
11	700	940	830	168	145	125	10.6	12.6	11.8	10.3	4	4	4	4	79	235	210	100	60	41	50
12	660	930	820	168	145	125	11.0	12.8	11.0	10.1	4	4	4	4	67	235	210	100	60	41	50
1	680	920	840	168	145	125	11.0	10.6	10.8	10.1	4	4	4	4	63	235	210	100	60	41	50
2	620	920	880	168	145	125	9.2	12.6	11.8	9.9	4	4	4	4	69	235	210	100	58	41	58
3	600	900	800	170	145	125	9.6	11.3	11.3	10.6	4	4	2.5	3.25	63	235	210	100	56	40	56
4	680	900	820	170	145	125	11.1	12.8	13.1	10.0	4	4	3.5	3.75	65	235	210	100	58	42	50
5	700	900	840	170	145	125	10.2	12.8	11.6	10.2	4	4	2.5	3.25	79	235	210	100	58	42	52
6	700	880	840	170	145	125	9.3	13.7	12.8	9.8	4	4	3.5	3.75	79	235	210	100	60	42	52
7	700	900	840	170	145	125	10.2	11.1	9.6	10.3	4	4	3.5	3.25	64	235	210	100	58	40	52
8	700	900	740	170	145	125	8.7	9.8	7.2	10.6	4	4	2.5	3.25	50	235	210	100	58	42	54
9	700	900	760	170	145	125	9.6	10.0	10.2	9.8	4	4	2.5	3.25	51	235	210	100	58	42	48
10	680	920	820	170	145	125	7.0	9.6	9.8	10.5	4	4	2.5	3.25	65	235	210	80	58	42	52
11	720	920	860	170	145	125	8.5	11.0	10.5	9.2	4	4	3.5	3.75	64	235	210	98	58	42	50
12	620	920	880	165	145	125	11.1	9.6	8.9	8.9	4	4	3.5	3.75	60	235	210	98	56	40	52
1	/	900	880	/	145	125	/	8.2	9.5	9.2	/	4	3.5	3.75	51	/	210	98	/	40	52
2	620	930	860	165	145	125	8.0	11.0	9.5	9.5	4	4	3.5	3.75	40	240	170	80	50	40	58
3	600	980	920	165	145	125	10.5	11.6	10.2	9.5	4	4	3.5	3.75	62	240	210	98	48	40	58
4	/	940	840	165	145	125	8.0	11.1	10.3	9.2	4	4	3.5	3.75	72	240	180	98	48	40	54
5	/	1000	800	/	145	125	/	10.5	12.1	9.5	/	4	3.5	3.75	46	/	200	80	/	42	56
6	260	1000	880	165	145	125	13.0	12.8	13.0	9.9	4	4	3.5	3.75	49	240	200	98	60	42	50

FAC-042
(11-88)

Filename: BEET6.WQ1
Date: 07-Dec-94
Facility: Monitor Sugar Company
Location: Bay City, Michigan
Source: Pulp dryer 3
Natural gas-fired rotary drum beet pulp dryer controlled with a multiclone and wet scrubber in series (two parallel stacks following controls)
Test date: Oct. 12, 1992

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	168	165	164	
NORTH STACK	Pressure	in. HG	28.75	28.75	28.75	
	Moisture	%	37.29	33.04	33.9	
	Oxygen	%	16	16.4	16.2	
	Volumetric flow, actual	acfm	66117	63616	69994	
	Volumetric flow, standard*	dscfm	33623	34710	37760	
	Isokinetic variation	%	90.3	93.3	93.8	
Circle: Production or feed rate Capacity:		TPH	77.15	64.54	67.00	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.037	0.034	0.034	
	CO2	% vol	2.93	2.73	2.13	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	10.66	10.12	11.00	
	CO2	lb/hr	6750	6493	5511	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.138	0.157	0.164	0.153
	CO2	lb/ton	87.5	101	82.3	90.1
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0691	0.0784	0.0821	0.0765
	CO2	kg/Mg	43.7	50.3	41.1	45.1

*DSCFM BASED ON A STANDARD TEMPERATURE OF 70 DEGREES FAHRENHEIT

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg F	176	174	174	
SOUTH STACK	Pressure	in. HG	28.75	28.75	28.75	
	Moisture	%	33.19	33.72	34.79	
	Oxygen	%	16.8	17.6	17.33	
	Volumetric flow, actual	acfm	60105	63439	61475	
	Volumetric flow, standard*	dscfm	32155	33775	32201	
	Isokinetic variation	%	94.3	103.7	105.3	
Circle: Production or feed rate Capacity:		TPH	77.15	64.54	67.00	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.036	0.036	0.035	
	CO2	% vol	1.8	1.27	1.2	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	9.92	10.42	9.66	
	CO2	lb/hr	3966	2939	2648	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.129	0.161	0.144	0.145
	CO2	lb/ton	51.4	46	39.5	45.5
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0643	0.0807	0.0721	0.0724
	CO2	kg/Mg	25.7	22.8	19.8	22.7

*DSCFM BASED ON A STANDARD TEMPERATURE OF 70 DEGREES FAHRENHEIT

TOTAL EMISSION FACTORS FOR BOTH STACKS	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.267	0.318	0.308	0.298
	CO2	lb/ton	139	146	122	136
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.133	0.159	0.154	0.149
	CO2	kg/Mg	69.4	73.1	60.9	67.8

APPENDIX G

REPORT EXCERPTS FROM REFERENCE 7

(Monitor Bay Sugar Company, October 13, 1992)

Report of...

Particulate Emission Testing

performed for...

Monitor Sugar Company
Bay City, Michigan

on the

Pulp Dryer 2 Exhaust

October 13, 1992

022.06

Network Environmental, Inc.
Grand Rapids, MI

Network Environmental, Inc.

SUMMARY OF PARTICULATE EMISSIONS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/13/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #2

SAMPLING STAFF: CARGILL/SMITH

SAMPLE NUMBER	1	2	3
STANDARD ANALYSIS			
E1. TOTAL WEIGHT COLLECTED, grams	0.125	0.125	0.126
E2. LBS. PARTICULATE/1000 LBS. GAS, ACTUAL(1)	0.061	0.063	0.060
E3. LBS. PARTICULATE/1000 LBS. GAS, DRY(2)	0.061	0.063	0.060
E6. GRAINS/DSCF(4)	0.044	0.047	0.045
E7. LBS./HOUR	12.68	13.34	13.24

1. 'ACTUAL' MEANS AT THE CONDITIONS FOUND AT THE SAMPLING LOCATION.
2. 'DRY' INCLUDES ONLY THE NATURAL MOISTURE THAT WOULD BE EMITTED FROM THE PROCESS. MOISTURE ADDED OR SUBTRACTED BY THE COLLECTOR IS NOT INCLUDED.
3. 'WET' INCLUDES THE MOISTURE AS MEASURED AT THE SAMPLING LOCATION.
4. 'DSCF' IS UNDER TOTALLY DRY CONDITIONS, ALL MOISTURE REMOVED.

Network Environmental, Inc.

SUMMARY OF EXHAUST GAS PARAMETERS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/13/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #2

SAMPLING STAFF: CARGILL/SMITH

	SAMPLE NUMBER	1	2	3
G1.	STACK RADIUS, inches	33.0	33.0	33.0
G2.	AREA OF STACK, sq. ft.	23.76	23.76	23.76
G3.	BAROMETRIC PRESSURE, in. HG.	28.80	28.80	28.80
G4.	STATIC PRESSURE IN STACK, in. H2O	0.98-	0.98-	0.98-
G5.	STACK GAS TEMPERATURE, deg. F	171	180	182
G6.	AVG. SQRT VELOCITY PRESSURE OF POINTS SAMPLED	0.685	0.698	0.726
G7.	PERCENT MOISTURE AT TEST LOCATION	38.54	39.55	39.63
G8.	PERCENT MOISTURE BEFORE COLLECTOR	38.54	39.55	39.63
G9.	DRY GAS COMPOSITION: % OXYGEN,	16.40	16.60	16.00
	% CARBON DIOXIDE	2.20	2.47	2.93
	% CARBON MONOXIDE	0.00	0.00	0.00
	% NITROGEN	81.40	80.93	81.07
G10.	PERCENT EXCESS AIR AT TEST LOCATION			
	DENSITY AND MOLECULAR WEIGHT OF STACK GAS:			
G11.	DRY, @ STP, lbs./cu.ft.	0.0750	0.0751	0.0753
G12.	WET, @ STP, lbs./cu.ft.	0.0640	0.0638	0.0639
G13.	WET, @ STACK CONDITIONS, lbs./cu.ft.	0.0516	0.0507	0.0506
G14.	MOLECULAR WEIGHT, DRY, @ STP, lbs./mole	29.02	29.07	29.12
G15.	AVERAGE GAS VELOCITY, feet/min.	2842	2922	3040
	STACK GAS FLOW RATE:			
G16.	STACK CONDITIONS, ACFM	67,529	69,415	72,232
G17.	STANDARD CONDITIONS, SCFM	54,467	55,208	57,255
G18.	STANDARD CONDITIONS, DRY SCFM	33,475	33,376	34,565

STANDARD TEMPERATURE AND PRESSURE (STP) = 29.92 inches HG, 70 deg. F

Network Environmental, Inc.

SUMMARY OF PARTICULATE TRAIN PARAMETERS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/13/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #2

SAMPLING STAFF: CARGILL/SMITH

	SAMPLE NUMBER	1	2	3
P1.	NUMBER OF POINTS SAMPLED	12	12	12
P2.	DURATION OF SAMPLE, minutes	60.00	60.00	60.00
P3.	NOZZLE DIAMETER, inches	0.313	0.313	0.313
P4.	NOZZLE AREA, sq. ft.	0.00053	0.00053	0.00053
P5.	PITOT CALIBRATION FACTOR	0.860	0.860	0.860
P6.	METER CALIBRATION FACTOR	0.998	0.998	0.998
P7.	AVERAGE FILTER TEMPERATURE, deg. F	0	0	0
P8.	AVERAGE METER TEMPERATURE, deg. F	69.7	70.6	71.1
P9.	AVERAGE METER PRESSURE, inches of water	1.963	1.871	2.001
P10.	METER VOLUME, ACTUAL READING, cu.ft.	45.09	42.78	44.98
P11.	METER VOLUME, @ STP, cu.ft.	43.54	41.23	43.32
P12.	LIQUID VOLUME OF WATER CONDENSED, mls.	576.0	569.0	600.0
P13.	VAPOR VOLUME OF WATER CONDENSED, @ STP, cu.ft.	27.30	26.97	28.44
P14.	TOTAL GAS SAMPLED, @ STP, cu.ft.	70.84	68.20	71.76
P15.	WEIGHT OF GAS SAMPLED, DRY, lbs.	3.27	3.10	3.26
P16.	WEIGHT OF GAS SAMPLED, WET, lbs.	4.53	4.35	4.58
P17.	PERCENT ISOKINETICS	96.7	91.8	93.2
	CONCENTRATION CONVERSION FACTORS:			
P18.	50 % EXCESS AIR, AFTER COLLECTOR			
P19.	50 % EXCESS AIR, BEFORE COLLECTOR			
P20.	MOISTURE CONDITIONS BEFORE COLLECTOR	1.00	1.00	1.00

STANDARD TEMPERATURE AND PRESSURE (STP) = 29.92 inches HG, 70 deg. F

DISCUSSION OF RESULTS

The particulate emission concentrations for the three samples were 0.061 Lbs/1000 Lbs for sample one, 0.063 Lbs/1000 Lbs for sample two, and 0.060 Lbs/1000 Lbs for sample three. The average exhaust particulate concentration was 0.0614 Lbs/1000 Lbs.

The particulate mass emission rates were 12.68 Lbs/Hr for sample one, 13.34 Lbs/Hr for sample two, and 13.24 Lbs/Hr for sample three. The average mass emission rate was 13.09 Lbs/Hr.

SOURCE DESCRIPTION

The source tested was the number two beet pulp dryer. The rotary dryer is fired by natural gas and dries the pulp with direct contact. The pulp is fed into the dryer at the beginning of the rotary section. The pulp is passed through the rotary dryer where most of the moisture is removed. The particulate laden exhaust is then passed through a multiclone collector and then a scrubber for particulate removal before it is exhausted to the atmosphere.

Process operating information for the day of the sampling can be found in Appendix A.

SAMPLING AND ANALYTICAL PROTOCOL

The sampling location was on the 66 inch I.D. exhaust stack at a distance that meets the eight duct diameter downstream two duct diameter upstream requirement of U.S. EPA Reference Method 1.

Particulate

The particulate sampling and analysis were performed in accordance with MDNR Reference Method 5B, and the methods referenced therein. Three (3) samples, each sixty (60) minutes in duration, were collected from the exhaust stack. All the quality control and quality assurance requirements specified in the methods were incorporated in the sampling and analysis. No alterations were incorporated in the testing or analysis. Figure 1 shows a schematic of the particulate sampling train.

11:25 - 12:35
12:51 - 13:55
14:07 - 15:09

MONITOR SUGAR COMPANY

Operating Log
Pulp Driers Station

Day Ending: 10-13-92
Campaing Day: 20

Time	Inlet Temp.			Outlet Temp.			Moist. Plain			Moist. Pellets	Collectors Press. Drop				Belt Scale Wet Pulp Ton/Hr.	Feed Conv. R.P.M.			Loading Scrolls %		
	#1	#2	#3	#1	#2	#3	#1	#2	#3		#1	#2	#3	#4		#1	#2	#3	#1	#2	#3
7	720	860	820	170	145	125	9.5	9.7	10.1	10.3	4	4	4	4	80	240	195	95	60	41	58
8	780	920	820	170	145	125	9.5	11.0	8.6	10.1	4	4	4	4	63	240	190	95	60	42	58
9	460	1040	820	170	145	125	15.0	10.8	10.8	10.1	4	4	4	4	76	240	195	98	58	41	58
10	—	620	820	—	145	125	12.6	11.8	7.8	9.9	4	4	4	4	46	240	[illegible]	90	58	[illegible]	[illegible]
11	880	1000	880	170	145	125	11.8	13.3	8.6	10.3	4	4	4	4	55	240	200	100	60	41	51
12	820	920	860	170	145	125	11.5	13.4	10.1	10.5	4	4	4	4	85	240	[illegible]	[illegible]	60	41	51
1	800	940	880	170	[illegible]	125	13.2	11.3	10.6	9.9	4	4	[illegible]	4	85	[illegible]	[illegible]	80	[illegible]	41	52
2	760	980	900	170	[illegible]	125	12.0	13.2	[illegible]	10.0	4	4	4	4	87	[illegible]	[illegible]	[illegible]	[illegible]	41	[illegible]
3	580	920	900	170	145	125	10.5	10.6	11.0	10.8	4	4	3	3.75	70	240	200	100	60	40	56
4	680	900	800	170	145	125	10.8	11.0	9.6	9.5	4	4	3	3.75	61	240	[illegible]	96	60	40	56
5	780	800	800	170	145	125	10.2	11.8	10.0	9.2	4	4	3	3.75	69	240	200	92	60	40	58
6	700	880	820	170	145	125	9.8	12.4	10.2	9.2	4	4	3	3.75	67	[illegible]	190	[illegible]	[illegible]	[illegible]	50
7	720	940	840	170	145	125	8.5	10.8	11.8	9.5	4	4	3	3.75	71	240	200	[illegible]	60	42	50
8	700	920	820	170	145	125	7.6	10.3	8.2	9.7	4	4	3	3.75	72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	54
9	720	900	840	170	145	125	11.0	11.4	10.8	9.2	4	4	3	3.75	67	[illegible]	180	90	58	42	54
10	800	940	900	170	145	125	8.9	11.0	11.3	9.9	4	4	3	3.75	57	240	200	[illegible]	57	42	54
11	780	920	860	170	145	125	10.0	9.8	9.6	10.1	4	4	3.5	3.75	71	240	200	98	60	42	50
12	720	940	820	170	145	125	10.6	12.2	9.8	9.9	4	4	3.5	[illegible]	65	[illegible]	200	95	[illegible]	42	50
1	780	900	860	170	145	125	11.8	11.6	11.3	10.2	4	4	3.5	3.75	81	240	200	[illegible]	[illegible]	42	50
2	800	920	880	170	145	[illegible]	11.3	9.8	10.6	10.1	4	4	3.5	3.75	76	240	200	95	[illegible]	[illegible]	54
3	720	920	880	170	145	125	10.3	10.1	9.9	9.5	4	4	3.5	3.75	79	240	200	93	58	42	54
4	720	960	860	170	[illegible]	[illegible]	10.2	9.8	11.0	9.5	4	4	3.5	[illegible]	83	240	200	[illegible]	[illegible]	[illegible]	54
5	820	960	860	170	145	125	9.5	10.1	8.6	9.7	4	4	3.5	3.75	69	240	200	98	58	42	54
6	800	960	860	170	145	125	10.0	11.1	9.8	10.3	4	4	3.5	3.75	67	240	200	95	60	42	56

FAC-042
(11-88)

Filename: BEET7.WQ1
Date: 07-Dec-94
Facility: Monitor Sugar Company
Location: Bay City, Michigan
Source: Pulp dryer 2
Natural gas-fired rotary drum beet pulp dryer controlled with a multiclone and wet scrubber in series
Test date: Oct. 13, 1992

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	171	180	182	
	Pressure	in. HG	28.80	28.80	28.80	
	Moisture	%	38.54	39.55	39.63	
	Oxygen	%	16.4	16.6	16	
	Volumetric flow, actual	acfm	67529	69415	72232	
	Volumetric flow, standard*	dscfm	33555	33448	34652	
	Isokinetic variation	%	96.7	91.8	93.2	
Circle: Production or feed rate Capacity:		TPH	70.00	85.00	85.39	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.044	0.047	0.045	
	CO2	% vol	2.2	2.47	2.93	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	12.68	13.36	13.25	
	CO2	lb/hr	5058	5661	6957	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.181	0.157	0.155	0.165
	CO2	lb/ton	72.3	67	81.5	73.4
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0906	0.0786	0.0776	0.0823
	CO2	kg/Mg	36.1	33.3	40.7	36.7

*DSCFM BASED ON A STANDARD TEMPERATURE OF 70 DEGREES FAHRENHEIT

APPENDIX H

REPORT EXCERPTS FROM REFERENCE 8

(Monitor Bay Sugar Company, October 14, 1992)

Report of...

Particulate Emission Testing

performed for...

Monitor Sugar Company
Bay City, Michigan

on the

Pulp Dryer 1 Exhaust

October 14, 1992

022.06

Network Environmental, Inc.
Grand Rapids, MI

Network Environmental, Inc.

SUMMARY OF PARTICULATE EMISSIONS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/14/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #1

SAMPLING STAFF: CARGILL/SMITH

SAMPLE NUMBER	1	2	3
STANDARD ANALYSIS			
E1. TOTAL WEIGHT COLLECTED, grams	0.135	0.129	0.124
E2. LBS. PARTICULATE/1000 LBS. GAS, ACTUAL(1)	0.064	0.063	0.058
E3. LBS. PARTICULATE/1000 LBS. GAS, DRY(2)	0.064	0.063	0.058
E6. GRAINS/DSCF(4)	0.046	0.044	0.043
E7. LBS./HOUR	13.98	13.97	12.59

1. 'ACTUAL' MEANS AT THE CONDITIONS FOUND AT THE SAMPLING LOCATION.
2. 'DRY' INCLUDES ONLY THE NATURAL MOISTURE THAT WOULD BE EMITTED FROM THE PROCESS. MOISTURE ADDED OR SUBTRACTED BY THE COLLECTOR IS NOT INCLUDED.
3. 'WET' INCLUDES THE MOISTURE AS MEASURED AT THE SAMPLING LOCATION.
4. 'DSCF' IS UNDER TOTALLY DRY CONDITIONS, ALL MOISTURE REMOVED.

Network Environmental, Inc.

SUMMARY OF EXHAUST GAS PARAMETERS

COMPANY NAME: MONITOR SUGAR COMPANY — TEST DATE: 10/14/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #1

SAMPLING STAFF: CARGILL/SMITH

	SAMPLE NUMBER	1	2	3
G1.	STACK RADIUS, inches	33.0	33.0	33.0
G2.	AREA OF STACK, sq. ft.	23.76	23.76	23.76
G3.	BAROMETRIC PRESSURE, in. HG.	28.86	28.86	28.86
G4.	STATIC PRESSURE IN STACK, in. H2O	1.05-	1.05-	1.05-
G5.	STACK GAS TEMPERATURE, deg. F	178	177	178
G6.	AVG. SQRT VELOCITY PRESSURE OF POINTS SAMPLED	0.711	0.718	0.715
G7.	PERCENT MOISTURE AT TEST LOCATION	37.08	34.48	39.92
G8.	PERCENT MOISTURE BEFORE COLLECTOR	37.08	34.48	39.92
G9.	DRY GAS COMPOSITION: % OXYGEN	15.33	16.07	15.93
	% CARBON DIOXIDE	3.60	2.93	3.00
	% CARBON MONOXIDE	0.00	0.00	0.00
	% NITROGEN	81.07	81.00	81.07
G10.	PERCENT EXCESS AIR AT TEST LOCATION			
	DENSITY AND MOLECULAR WEIGHT OF STACK GAS:			
G11.	DRY, @ STP, lbs./cu.ft.	0.0755	0.0753	0.0753
G12.	WET, @ STP, lbs./cu.ft.	0.0647	0.0653	0.0638
G13.	WET, @ STACK CONDITIONS, lbs./cu.ft.	0.0517	0.0523	0.0510
G14.	MOLECULAR WEIGHT, DRY, @ STP, lbs./mole	29.20	29.12	29.13
G15.	AVERAGE GAS VELOCITY, feet/min.	2947	2962	2985
	STACK GAS FLOW RATE:			
G16.	STACK CONDITIONS, ACFM	70,027	70,367	70,925
G17.	STANDARD CONDITIONS, SCFM	55,969	56,285	56,680
G18.	STANDARD CONDITIONS, DRY SCFM	35,214	36,876	34,051

STANDARD TEMPERATURE AND PRESSURE (STP) = 29.92 Inches HG, 70 deg. F

Network Environmental, Inc.

SUMMARY OF PARTICULATE TRAIN PARAMETERS

COMPANY NAME: MONITOR SUGAR COMPANY TEST DATE: 10/14/92

COMPANY LOCATION: BAY CITY, MICHIGAN

SOURCE NAME: PULP DRYER #1

SAMPLING STAFF: CARGILL/SMITH

	SAMPLE NUMBER	1	2	3
P1.	NUMBER OF POINTS SAMPLED	12	12	12
P2.	DURATION OF SAMPLE, minutes	60.00	60.00	60.00
P3.	NOZZLE DIAMETER, inches	0.313	0.313	0.313
P4.	NOZZLE AREA, sq. ft.	0.00053	0.00053	0.00053
P5.	PITOT CALIBRATION FACTOR	0.860	0.860	0.860
P6.	METER CALIBRATION FACTOR	0.998	0.998	0.998
P7.	AVERAGE FILTER TEMPERATURE, deg. F	0	0	0
P8.	AVERAGE METER TEMPERATURE, deg. F	84.7	81.9	90.2
P9.	AVERAGE METER PRESSURE, inches of water	2.083	2.097	2.079
P10.	METER VOLUME, ACTUAL READING, cu.ft.	47.59	47.50	47.53
P11.	METER VOLUME, @ STP, cu.ft.	44.79	44.94	44.29
P12.	LIQUID VOLUME OF WATER CONDENSED, mls.	557.0	499.0	621.0
P13.	VAPOR VOLUME OF WATER CONDENSED, @ STP, cu.ft.	26.40	23.65	29.44
P14.	TOTAL GAS SAMPLED, @ STP, cu.ft.	71.20	68.59	73.73
P15.	WEIGHT OF GAS SAMPLED, DRY, lbs.	3.38	3.38	3.33
P16.	WEIGHT OF GAS SAMPLED, WET, lbs.	4.61	4.48	4.70
P17.	PERCENT ISOKINETICS	94.6	90.6	96.7

CONCENTRATION CONVERSION FACTORS:

P18.	50 % EXCESS AIR, AFTER COLLECTOR			
P19.	50 % EXCESS AIR, BEFORE COLLECTOR			
P20.	MOISTURE CONDITIONS BEFORE COLLECTOR	1.00	1.00	1.00

STANDARD TEMPERATURE AND PRESSURE (STP) = 29.92 inches HG, 70 deg. F

DISCUSSION OF RESULTS

The particulate emission concentrations for the three samples were 0.064 Lbs/1000 Lbs for sample one, 0.063 Lbs/1000 Lbs for sample two, and 0.058 Lbs/1000 Lbs for sample three. The average exhaust particulate concentration was 0.0619 Lbs/1000 Lbs.

The particulate mass emission rates were 13.98 Lbs/Hr for sample one, 13.97 Lbs/Hr for sample two, and 12.59 Lbs/Hr for sample three. The average mass emission rate was 13.51 Lbs/Hr.

SOURCE DESCRIPTION

The source tested was the number one beet pulp dryer. The rotary dryer is fired by natural gas and dries the pulp with direct contact. The pulp is fed into the dryer at the beginning of the rotary section. The pulp is passed through the rotary dryer where most of the moisture is removed. The particulate laden exhaust is then passed through a multiclone collector and then a scrubber for particulate removal before it is exhausted to the atmosphere.

Process operating information for the day of the sampling can be found in Appendix A.

SAMPLING AND ANALYTICAL PROTOCOL

The sampling location was on the 66 inch I.D. exhaust stack at a distance that meets the eight duct diameter downstream two duct diameter upstream requirement of U.S. EPA Reference Method 1.

Particulate

The particulate sampling and analysis were performed in accordance with MDNR Reference Method 5B, and the methods referenced therein. Three (3) samples, each sixty (60) minutes in duration, were collected from the exhaust stack. All the quality control and quality assurance requirements specified in the methods were incorporated in the sampling and analysis. No alterations were incorporated in the testing or analysis. Figure 1 shows a schematic of the particulate sampling train.

Run
1 8:45-9:46
2 9:57-10:59
3 11:13-12:16

MONITOR SUGAR COMPANY

Operating Log
Pulp Driers Station

Day Ending: 10-14-92
Campaing Day: 21

Time	Inlet Temp.			Outlet Temp.			Moist. Plain			Moist. Pellets	Collectors Press. Drop				Belt Scale Wet Pulp Ton/Hr.	Feed Conv. R.P.M.			Loading Scrolls %		
	#1	#2	#3	#1	#2	#3	#1	#2	#3		#1	#2	#3	#4		#1	#2	#3	#1	#2	#3
7	850	900	830	170	146	126	13.2	10.1	10.6	10.6	4	4	4	4	69	240	180	100	61	41	52
8	870	1040	850	170	145	125	10.3	9.5	9.7	10.4	4	4	4	4	87	240	210	100	60	41	52
9	870	1000	830	170	145	125	14.0	11.6	10.1	10.4	4	4	4	4	74	240	210	100	60	41	50
10	860	1060	860	170	145	125	12.8	12.4	13.1	10.1	4	4	4	4	95	240	205	100	60	41	55
11	870	1040	880	170	145	125	12.4	11.0	12.6	9.9	4	4	4	4	90	240	195	100	60	41	45
12	860	1020	880	170	145	125	13.1	11.8	13.5	10.1	4	4	4	4	90	240	195	100	60	41	50
1	680	1000	860	170	145	125	10.1	10.1	11.8	10.3	4	4	4	4	85	240	195	100	58	41	50
2	830	1020	900	170	145	125	15.5	11.0	11.8	10.1	4	4	4	4	62	240	195	60	60	41	55
3	600	900	880	170	145	125	7.2	10.0	11.4	10.5	4	4	3	4	57	240	200	100	60	40	50
4	720	920	880	170	145	125	11.6	12.1	13.1	9.5	4	4	3	4	71	240	200	100	60	40	50
5	740	980	880	170	145	125	13.7	11.0	11.0	8.9	4	4	3	4	64	240	220	100	62	44	52
6	780	940	880	175	145	125	9.3	9.3	11.0	9.7	4	4	3	4	79	240	220	100	60	44	50
7	820	1000	840	175	145	125	10.0	10.2	9.5	9.5	4	4	3	4	75	240	220	100	60	44	50
8	760	940	820	175	145	125	8.5	11.4	11.0	9.2	4	4	3	4	78	240	220	100	60	44	50
9	740	980	800	175	145	125	8.7	9.3	10.8	9.2	4	4	3	4	82	240	220	100	60	44	50
10	760	940	840	175	145	125	8.7	9.5	11.0	9.9	4	4	3	4	71	240	220	100	60	44	50
11	600	940	820	165	145	125	8.7	9.1	11.0	10.1	4	4	4	4	75	240	220	100	60	44	50
12	560	820	900	165	145	125	10.2	11.1	12.1	10.3	4	4	4	4	62	240	220	100	60	44	52
1	700	820	840	165	145	125	10.0	10.3	11.0	9.9	4	4	4	4	52	240	220	100	60	44	52
2	800	940	820	165	145	125	8.9	10.8	10.3	9.8	4	4	4	4	77	240	200	100	60	42	50
3	780	920	800	165	145	125	9.2	10.8	9.8	10.0	4	4	4	4	76	240	200	100	60	42	52
4	780	920	840	165	145	125	10.1	11.0	9.6	10.1	4	4	4	4	88	240	200	100	60	42	52
5	740	900	820	165	145	125	9.9	11.3	10.2	9.6	4	4	4	4	85	240	200	100	60	42	52
6	760	920	840	165	145	125	10.4	8.2	10.2	9.9	4	4	4	4	75	240	200	100	60	42	52

FAC-042
(11-8[illegible]

Filename: BEET8.WQ1
Date: 07-Dec-94
Facility: Monitor Sugar Company
Location: Bay City, Michigan
Source: Pulp dryer 1
Natural gas-fired rotary drum beet pulp dryer controlled with a multiclone and wet scrubber in series
Test date: Oct. 14, 1992

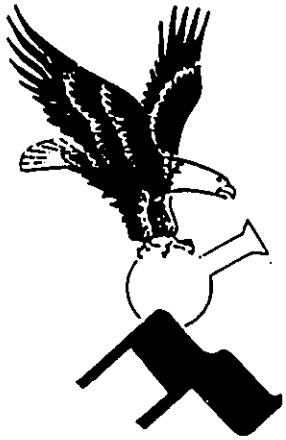
Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	178	177	178	
	Pressure	in. HG	28.86	28.86	28.86	
	Moisture	%	37.08	34.48	39.92	
	Oxygen	%	15.33	16.07	15.93	
	Volumetric flow, actual	acfm	70027	70367	70925	
	Volumetric flow, standard*	dscfm	35306	37001	34144	
	Isokinetic variation	%	94.6	90.6	96.7	
Circle: Production or feed rate Capacity:		TPH	77.20	93.98	90.00	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.046	0.044	0.043	
	CO2	% vol	3.60	2.93	3.00	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	13.92	13.95	12.58	
	CO2	lb/hr	8709	7428	7019	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.180	0.148	0.140	0.156
	CO2	lb/ton	113	79.0	78.0	89.9
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0902	0.0742	0.0699	0.0781
	CO2	kg/Mg	56.4	39.5	39.0	45.0

*DSCFM BASED ON A STANDARD TEMPERATURE OF 70 DEGREES FAHRENHEIT

APPENDIX I

REPORT EXCERPTS FROM REFERENCE 9

(Western Sugar Company, December 1988)



1988-89

"EMISSIONS SURVEY CONDUCTED AT

WESTERN SUGAR COMPANY'S BILLINGS, MONTANA

PRODUCTION FACILITY"

American Environmental Testing Company Inc.

801-266-7111

TABLE I-B

(Data Summary - Pulp Dryer)

I.	North Dryer Method 5 Particulate Emissions	Test 1	Test 2	Test 2	Ave.
	a) Sample Volume collected (DSCF)	61.698	47.350	47.713	52.2
	b) Particulate matter collected (mg)	131.1	135.0	145.1	137.1
	c) Emission rate (lbs/hr)	5.59	7.35	7.74	6.8
	1. lbs/dscf x 10^{-6}	4.685	6.286	6.704	5.8
	2. grains/dscf	0.0328	0.0440	0.0469	0.0
II.	South Dryer Method 5 Particulate Emissions				
	a) Sample Volume collected (dscf)	48.783	46.022	45.157	46.6
	b) Particulate matter collected (mg)	80.0	139.5	80.2	99.9
	c) Emission rate (lbs/hr)	4.47	7.27	4.25	5.3
	1. lbs/dscf x 10^{-6}	3.615	6.683	3.915	4.7
	2. grains/dscf	0.0253	0.0468	0.0274	0.0
III.	Total Emissions				
	a) lbs/hr.	10.06	14.63	11.99	12.2
	b) % of allowable	9.17	13.34	10.93	11.1

Table IV a)

FIELD AND LABORATORY DATA.

Plant or Job Description: Western Sugar - Billings, Montana

East Dryer - North and South Stacks Bank

RUN NO. Compl. #5

DATE 12-8-88

SYMBOL	DESCRIPTION	UNITS	N#1 1	S#1 2	N -
V_m	volume dry gas sampled @ meter conditions	ft^3	61.145	47.330	45.
P_b	barometric pressure	"Hg abs	26.52	26.33	26.
ΔH	average pressure drop across the orifice meter	in H_2O	1.788	2.04	1.
T_m	average gas meter temperature	°F	57.4	42.9	40.
Y_i	meter coefficient		1.116	1.116	1.
V_w	total H_2O collected, impingers & silica gel	ml	539.8	398.1	385.
CO_2		%	3.6	2.3	3.
O_2		%	11.4	10.8	11.
N_2 + CO		%	85.0	86.9	85.
R_n	nozzle dia.	in.	0.492	0.492	0.4
T_s	stack temperature	°F	168.5	162.7	167.1
$\sqrt{\Delta P}$	velocity head of stack gas	in H_2O	0.2253	0.2284	0.2
C_p	pitot tube coefficient		0.8955	0.8955	0.8
P_s	static pressure	in H_2O	+0.02	+0.02	+0.0
A_s	area stack	$ft.^2$	38.028	38.028	38.0
T_t	net time of test	min.	96.0	72.0	72.0
Mg_p	Total particulates	mg	131.1	80.0	135.0

Table IV b)

FIELD AND LABORATORY DATA.

Plant or Job Description: Western Sugar Company - Billings, Montana
East Bank of Pulp Dryers

RUN NO. Part. Compliance

DATE 12-9-88

SYMBOL	DESCRIPTION	UNITS	#2 S 1	#3 N 2	#3 S 3
V_m	volume dry gas sampled @ meter conditions	ft^3	45.681	47.496	44.6
P_b	barometric pressure	"Hg abs	26.33	26.28	26.2
ΔH	average pressure drop across the orifice meter	in H_2O	1.755	1.931	1.7
T_m	average gas meter temperature	°F	54.5	55.0	50.8
Y_i	meter coefficient		1.116	1.116	1.1
V_w	total H_2O collected, impingers & silica gel	ml	428.0	422.8	413.6
CO_2		%	2.6	3.4	2.6
O_2		%	10.7	11.0	10.8
N_2+ CO		%	86.7	85.6	86.6
R_n	nozzle dia.	in.	0.492	0.492	0.49
T_s	stack temperature	°F	170.2	173.1	170.8
$\sqrt{\Delta P}$	velocity head of stack gas	in H_2O	0.2091	0.2203	0.20
C_p	pitot tube coefficient		0.8955	0.8955	0.89
P_s	static pressure	in H_2O	26.332 +0.02	26.282 +0.02	26.22 +0.02
A_s	area stack	$ft.^2$	38.028	38.028	38.02
T_t	net time of test	min.	72.0	72.0	72.0
Mg_p	Total particulates	mg	139.5	145.1	80.2

DATA SUMMARY.

Table V a)

Plant or Job Description: Western Sugar - Billings, Montana

East Dryer Bank - North and South Stack

Date 12-8-88

SYMBOL	DESCRIPTION	UNITS	N #1 1	S #1 2	N #2 3
$V_{m\ std}$	volume dry gas sampled @ standard conditions*	dscf	61.698	48.783	47.350
$V_{w\ gas}$	volume water vapor collected @ standard conditions*	scf	25.408	18.739	18.150
B_{wp}	proportion by volume of water vapor in gas steam dimensionless		0.2917	0.2775	0.2771
M_d	dry molecular weight	lb/lb mole	29.032	28.80	28.980
M_s	wet molecular weight	lb/lb. mile	25.814	25.803	25.937
V_s	stack gas velocity	ft/sec	16.526	16.739	15.965
Q_s	volumetric flow rate dry basis, standard conditions*	ft^3/hr	1.1933403 X 10^6	1.2344225 X 10^6	1.169438 X 10^6
Iso	isokinetic variation	%	93.45	95.21	97.6
C_s	conc. particulate matter in stack gas, dry basis	lb/scf	4.6844495 X 10^{-6}	3.615334 X 10^{-6}	6.285513 X 10^{-6}
Em_4	emission rate	lb/hr gr/dscf	5.59 0.0328	4.47 0.0253	7.35 0.0440
			Comb. 10.06 #/hr.		Comb. 14.62 #

* 70° F & 29.92 "Hg

DATA SUMMARY.

Table V b)

Plant or Job Description: Western Sugar Company - Billings, Montana

East Dryer Bank

Date 12-9-88

SYMBOL	DESCRIPTION	UNITS	S #2 1	N #3 2	S #3 3
$V_{m\ std}$	volume dry gas sampled @ standard conditions*	dscf	46.022	47.713	45.157
$V_{w\ gas}$	volume water vapor collected @ standard conditions*	scf	20.146	19.901	19.468
B_{wp}	proportion by volume of water vapor in gas steam dimensionless		0.3045	0.2943	0.3013
M_d	dry molecular weight	lb/lb mole	28.844	28.984	28.848
M_s	wet molecular weight	lb/lb. mile	25.542	25.751	25.580
V_s	stack gas velocity	ft/sec	15.496	16.312	15.457
Q_s	volumetric flow rate dry basis, standard conditions*	ft^3/hr	1.08792859 X 10^6	1.1544942 X 10^6	1.08459 X 10^6
Iso	isokinetic variation	%	101.93	99.63	100.31
C_s	conc. particulate matter in stack gas, dry basis	lb/scf	6.682449 X 10^{-6}	6.704364551 X 10^{-6}	3.91540(X 10
Em_4	emission rate	lb/hr	7.27	7.74	4.25
		gr/dscf	0.0468	0.0469	0.0274

* 70° F & 29.92 in Hg

American Environmental Testing Co.
565 South Birch Drive
Spanish Fork, Utah 84660
(801) 266-7111

JOB Western Sugar Co., Billing Mon
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

East Dryer Production Rates.

#1

12/8-88

Tons/Hr. @ = 135 Tons.

24/Hr = 3240 Tons.

#2

12/9-88

Tons/Hr. @ = 135 Tons.

24/Hr. = 3240 Tons.

Received from Joe Moore on 12/11-88.

T.B.

Filename: BEET9.WQ1
Date: 07-Dec-94
Facility: Western Sugar Company
Location: Billings, Montana
Source: East Pulp Dryer
Natural gas-fired rotary drum beet pulp dryer controlled with a wet scrubber
Test date: Dec. 8-9, 1988

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	168.5	167.1	173.1	
NORTH STACK	Pressure	in. HG	26.52	26.3	26.28	
	Moisture	%	29.17	27.71	29.43	
	Oxygen	%	10.8	11.3	11	
	Volumetric flow, actual	acfm	ND	ND	ND	
	Volumetric flow, standard*	dscfm	19889	19491	19242	
	Isokinetic variation	%	93.45	97.6	99.63	
Circle: Production or feed rate Capacity: Feed to dryers		TPH	135.00	135.00	135.00	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0285	0.0401	0.0430	
	Condensible inorganic PM	G/dscf	0.00425	0.00391	0.00388	
	CO2	% vol	2.3	3.3	3.4	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	4.87	6.70	7.10	
	Condensible inorganic PM	lb/hr	0.725	0.653	0.640	
	CO2	lb/hr	3134	4407	4483	
	Total PM	lb/hr	5.59	7.35	7.74	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.0360	0.0496	0.0526	0.0461
	Condensible inorganic PM	lb/ton	0.00537	0.00484	0.00474	0.00498
	CO2	lb/ton	23.2	32.6	33.2	29.7
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0180	0.0248	0.0263	0.0230
	Condensible inorganic PM	kg/Mg	0.00269	0.00242	0.00237	0.00249
	CO2	kg/Mg	11.6	16.3	16.6	14.8

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg F	162.7	170.2	170.8	
SOUTH STACK	Pressure	in. HG	26.33	26.33	26.22	
	Moisture	%	27.75	30.45	30.13	
	Oxygen	%	11.4	10.7	10.8	
	Volumetric flow, actual	acfm	ND	ND	ND	
	Volumetric flow, standard*	dscfm	20574	18132	18077	
	Isokinetic variation	%	95.21	101.93	100.31	
Circle: Production or feed rate Capacity:		TPH	135.00	135.00	135.00	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0180	0.0377	0.0175	
	Condensible inorganic PM	G/dscf	0.00727	0.00906	0.00991	
	CO2	% vol	3.6	2.6	2.6	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	3.18	5.87	2.71	
	Condensible inorganic PM	lb/hr	1.28	1.41	1.54	
	CO2	lb/hr	5075	3230	3220	
	Total PM	lb/hr	4.46	7.27	4.25	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.0235	0.0435	0.0201	0.0290
	Condensible inorganic PM	lb/ton	0.00950	0.0104	0.0114	0.0104
	CO2	lb/ton	37.6	23.9	23.9	28.5
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0118	0.0217	0.0100	0.0145
	Condensible inorganic PM	kg/Mg	0.00475	0.00521	0.00569	0.00522
	CO2	kg/Mg	18.8	12.0	11.9	14.2

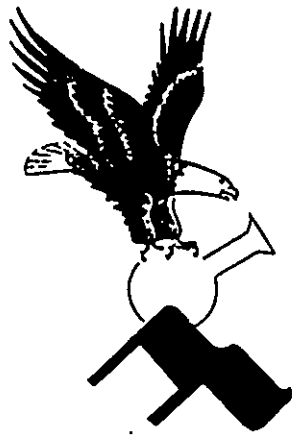
Condensible inorganic

TOTAL EMISSION FACTORS FOR BOTH STACKS	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.0596	0.0931	0.0726	0.0751
	Condensible inorganic PM	lb/ton	0.0149	0.0153	0.0161	0.0154
	CO2	lb/ton	60.8	56.6	57.1	58.1
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0298	0.0465	0.0363	0.0375
	Condensible inorganic PM	kg/Mg	0.00744	0.00763	0.00805	0.00771
	CO2	kg/Mg	30.4	28.3	28.5	29.1

APPENDIX J

REPORT EXCERPTS FROM REFERENCE 10

(Western Sugar Company, January 1990)



1989-90

"EPA METHOD 5 PARTICULATE EMISSIONS TESTS CONDUCTED ON WESTERN SUGAR'S BOILER AND PULP DRYER STACKS LOCATED IN BILLINGS, MONTANA"

American Environmental Testing Company Inc.

801-266-7111

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED
565 So. Birch Drive 801-266-7111
Spanish Fork, Utah 84660

FIELD AND LABORATORY DATA
TABLE IVa

Plant or Job Description : Western Sugar Company - Located in Billings, Montana
Wet Scrubber On Pulp Dryer
Type : Compliance EPA #5
Date : 1/23-24/90

Symbol	Description	Units	1 South	2 North	3 South
Vm	Volume dry gas sampled @ meter conditions	Ft3	66.554	64.264	65.52
Pb	Barometric Pres	"Hg abs	26.38	26.42	26.79
ΔH	Average Pres drop across the orifice meter	"H2O	3.8189	3.57	3.7701
Tm	Average gas meter temp	°R	536.71	535.38	531.58
		°F	76.71	75.38	71.58
Yi	Meter Coefficient		1.07	1.07	1.07
Vw	Total H2O collected, impingers & silica gel	ml	268	249	229.1
CO2		%	2.6	2.4	2.73
O2		%	10.8	10.93	11.2
N2 + CO		%	86.6	86.67	86.07
Rn	Nozzle Dia.	in.	0.5037	0.5037	0.503
Ts	Stack Temp	°R	582.58	584.54	589.42
		°F	122.58	124.54	129.42
Sqr rt ΔP	Velocity head of stack gas	"H2O	0.242	0.2413	0.2509
Cp	Pitot Tube Coefficient		0.8484	0.8484	0.8484
Ps	Static Pres	"H2O	0.03	0.03	0.03
Pabs	Absolute Pres	"Hg	26.38	26.42	26.79
As	Area stack	Ft2	33.183	33.183	33.183
Tt	Net time of test	min.	72	72	72
Mgp	Total Particulate	mg	33.7	49.2	50.2

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED
565 So. Birch Drive 801-266-7111
Spanish Fork, Utah 84660

FIELD AND LABORATORY DATA
TABLE IVb

Plant or Job Description : Western Sugar Company - Located In Billings, Montana
Wet Scrubber On Pulp Dryer
Type : Compliance EPA #5
Date : 1/23-24/90

Symbol	Description	Units	4 North	5 South	6 North
Vm	Volume dry gas sampled @ meter conditions	Ft3	67.27	62.806	61.523
Pb	Barometric Pres	"Hg abs	26.79	26.79	26.78
ΔH	Average Pres drop across the orifice meter	"H20	3.9678	3.4535	3.3218
Tm	Average gas meter temp	°R	534.42	536.9	533.33
		°F	74.42	76.9	73.33
Yi	Meter Coefficient		1.07	1.07	1.07
Vw	Total H20 collected, impingers & silica gel	ml	271.2	302.2	295.1
CO2		%	1.96	2.2	2.37
O2		%	12.13	12.1	11.87
N2 + CO		%	85.91	85.7	85.76
Rn	Nozzle Dia.	in.	0.503	0.503	0.503
Ts	Stack Temp	°R	597.29	595.5	605.71
		°F	137.29	135.5	145.71
Sqr rt ΔP	Velocity head of stack gas	"H20	0.2531	0.2354	0.2335
Cp	Pitot Tube Coefficient		0.8484	0.8484	0.8484
Ps	Static Pres	"H20	0.03	0.03	0.03
Pabs	Absolute Pres	"Hg	26.79	26.79	26.78
As	Area stack	Ft2	33.183	33.183	33.183
Tt	Net time of test	min.	72	72	72
Mgp	Total Particulate	mg	53.9	85.2	63.6

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED
565 So. Birch Drive 801-266-7111
Spanish Fork, Utah 84660

DATA SUMMARY
TABLE Va

Plant : Western Sugar Company - Located In Billings, Montana
Wet Scrubber On Plup Dryer
Type : Compliance EPA #5
Date : 1/23-24/90

SYMBOL	DESCRIPTION	UNITS	1 South	2 North	3 South
Vm std	Volume dry gas	dscfm	0.8747	0.8453	0.8742
	sampled @ standard	dscf	62.9784	60.861	62.9451
	Conditions				
Vw gas	Volume water	scf	12.6148	11.7204	10.7837
	vapor collected @				
	standard conditions				
Bws	Proportion by		0.1669	0.1615	0.1463
	volume of water				
	vapor in gas stream				
	ddimensionless				
Md	Dry molecular	lb/lb mole	28.848	28.8212	28.8848
	weight				
Ms	Wet molecular	lb/lb mole	27.0377	27.0738	27.2928
	weight				
Vs	Stack gas	ft/sec	15.8635	15.818	16.3412
	velocity				
Qs	Volumetric flow	ft3/hr	1.2617	1.2639	1.3369
	rate dry basis		X 10 6	X 10 6	X 10 6
	standard conditions				
Iso	Isokinetic	%	99.3405	95.7276	94.4232
	variation				
Cs	Conc. particulat	lb/scf	5.351	8.084	7.9752
	matter in stack		X 10 -4	X 10 -4	X 10 -4
	gas, dry basis				
Emr	Emission rate	lbs/dscf	1.1797	1.7822	1.7582
			X 10 -6	X 10 -6	X 10 -6
		gr/dscf	0.0083	0.0125	0.0123
		lbs/hr	1.4884	2.2525	2.3505

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED
565 So. Birch Drive 801-266-7111
Spanish Fork, Utah 84660

DATA SUMMARY
TABLE Vb

Plant : Western Sugar Company - Located In Billings, Montana
Wet Scrubber On Plup Dryer
Type : Compliance EPA #5
Date : 1/23-24/90

SYMBOL	DESCRIPTION	UNITS	4 North	5 South	6 North
Vm std	Volume dry gas	dscfm	0.8981	0.8373	0.8196
	sampled @ standard	dscf	64.661	60.2859	59.0114
	Conditions				
Vw gas	Volume water	scf	12.7654	14.2246	13.8904
	vapor collected @				
	standard conditions				
Bws	Proportion by		0.1649	0.1909	0.1905
	volume of water				
	vapor in gas stream				
	ddimensionless				
Md	Dry molecular	lb/lb mole	28.7988	28.836	28.854
	weight				
Ms	Wet molecular	lb/lb mole	27.0184	26.7673	26.7859
	weight				
Vs	Stack gas	ft/sec	16.6776	15.5576	15.5646
	velocity				
Qs	Volumetric flow	ft3/hr	1.317	1.1939	1.1744
	rate dry basis		X 10 6	X 10 6	X 10 6
	standard conditions				
Iso	Isokinetic	%	98.0207	100.4534	100.5011
	variation				
Cs	Conc. particulate	lb/scf	8.3358	1.4133	1.0778
	matter in stack		X 10 -4	X 10 -3	X 10 -3
	gas, dry basis				
Emr	Emission rate	lbs/dscf	1.8377	3.1157	2.376
			X 10 -6	X 10 -6	X 10 -6
		gr/dscf	0.0129	0.0218	0.0166
		lbs/hr	2.4203	3.7197	2.7903

DRYER STACK TESTS 1-23-90 (TEST #1)

PROCESS FEED RATE TO DRYER DURING TEST

= 42 TONS/HR.

PROCESS FEED RATE TO [redacted] WEST DRUM DURING TEST

= 21 TONS/HR

DRYER STACK TESTS 1-24-90

TEST #2

PROCESS FEED RATE TO DRYER DURING TEST
= 32.2 TONS/HR
PROCESS FEED RATE TO WEST DRUM DURING TEST
= 16.1 TONS/HR

TEST # 3

PROCESS FEED RATE TO DRYER DURING TEST
= 37.6 TONS/HR
PROCESS FEED RATE TO WEST DRUM DURING TEST
= 18.8 TONS/HR

Filename: BEET10.WQ1
Date: 02-Feb-95
Facility: Western Sugar Company
Location: Billings, Montana
Source: West Pulp Dryer
Natural gas-fired rotary drum beet pulp dryer controlled with a wet scrubber
Test date: Jan. 23-25, 1990

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	124.54	137.29	145.71	
NORTH	Pressure	in. HG	26.42	26.79	26.78	
STACK	Moisture	%	16.15	16.49	19.05	
	Oxygen	%	10.93	12.13	11.87	
	Volumetric flow, actual	acfm	ND	ND	ND	
	Volumetric flow, standard*	dscfm	21065	21950	19573	
	Isokinetic variation	%	95.7	98.02	100.5	
Circle: Production or feed rate Feed to dryer		TPH	42.00	32.20	37.60	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0117	0.00972	0.0134	
	Condensible inorganic PM	G/dscf	0.000838	0.00318	0.00321	
	CO2	% vol	2.4	1.96	2.37	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	2.11	1.83	2.25	
	Condensible inorganic PM	lb/hr	0.151	0.599	0.539	
	CO2	lb/hr	3464	2948	3178	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.050	0.057	0.060	0.056
	Condensible inorganic PM	lb/ton	0.0036	0.019	0.014	0.012
	CO2	lb/ton	55	61	56	57
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.025	0.028	0.030	0.028
	Condensible inorganic PM	kg/Mg	0.0018	0.0093	0.0072	0.0061
	CO2	kg/Mg	28	31	28	29

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg F	122.58	129.42	135.5	
SOUTH	Pressure	in. HG	26.38	26.79	26.79	
STACK	Moisture	%	16.69	14.63	19.09	
	Oxygen	%	10.8	11.2	12.1	
	Volumetric flow, actual	acfm	ND	ND	ND	
	Volumetric flow, standard*	dscfm	21028	22282	19898	
	Isokinetic variation	%	99.34	94.42	100.45	
Circle: Production or feed rate Feed to dryer		TPH	42.00	32.20	37.60	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.00660	0.00985	0.0166	
	Condensible inorganic PM	G/dscf	0.00170	0.00245	0.00522	
	CO2	% vol	2.6	2.73	2.2	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	1.19	1.88	2.83	
	Condensible inorganic PM	lb/hr	0.306	0.468	0.890	
	CO2	lb/hr	3746	4168	2999	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.028	0.058	0.075	0.054
	Condensible inorganic PM	lb/ton	0.0073	0.015	0.024	0.015
	CO2	lb/ton	89	129	80	99
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.014	0.029	0.038	0.027
	Condensible inorganic PM	kg/Mg	0.0036	0.0073	0.012	0.0076
	CO2	kg/Mg	45	65	40	50

TOTAL	Emission factors (ENGLISH UNITS):					AVERAGE
EMISSION	Filterable PM	lb/ton	0.078	0.12	0.13	0.11
FACTORS	Condensible inorganic PM	lb/ton	0.011	0.033	0.038	0.027
FOR BOTH	CO2	lb/ton	144	190	136	157
STACKS	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.039	0.058	0.067	0.055
	Condensible inorganic PM	kg/Mg	0.0054	0.017	0.019	0.014
	CO2	kg/Mg	72	95	68	78

APPENDIX K

REPORT EXCERPTS FROM REFERENCE 11

(Western Sugar Company, March 1991)

Western Sugar

Final Report

Emissions Testing and Analysis at Billings, Montana Refinery

March 26, 1991

RADIAN
CORPORATION

RADIAN CORPORATION

Table 3-5.

Results of Emissions Testing at Western Sugar's
Billings, Montana Facility

Pulp Dryer—North Stack

Test No.	RM5-4-2N	RM5-4-3N	RM5-4-4N	
Date	01-25-91	01-25-91	01-25-91	
Test Time	1047-1237	1630-1759	1909-2053	Average
Effluent Conditions				
Gas Velocity (fps)	16.18	15.10	15.43	15.57
Flow Rate (acfm)	36,941	34,473	35,219	35544
Flow Rate (dscfm)	17,391	17,032	16,884	17102
Gas Temperature (F)	185	163	166	171
Moisture (%)	35.1	35.0	36.6	35.6
Isokinetics (%)	102.54	104.58	108.90	105.34
Sample Volume (dscf)	35.06	35.02	36.15	35.41
Analysis (mg)				
Filter	139.1	95.2	115.5	116.6
Probe Wash	24.9	14.3	25.5	21.6
Condensables	77.3	60.0	63.4	66.9
Concentration (gr/dscf)				
Filter	0.06123	0.04195	0.04931	0.05083
Probe Wash	0.01096	0.00630	0.01089	0.00938
Condensables	0.03403	0.02644	0.02706	0.02918
Emission Rate (lb/hr)				
Filter	9.13	6.12	7.14	7.46
Probe Wash	1.63	0.92	1.58	1.38
Condensables	5.07	3.86	3.92	4.28

RADIAN CORPORATION

Table 3-6.

Results of Emissions Testing at Western Sugar's
Billings, Montana Facility

Pulp Dryer—South Stack

Test No.	RM5-4-2S	RM5-4-3S	RM5-4-4S	
Date	01-25-91	01-25-91	01-25-91	
Test Time	1047-1237	1630-1759	1909-2053	Average
Effluent Conditions				
Gas Velocity (fps)	14.36	14.21	14.51	14.36
Flow Rate (acfm)	32,769	32,445	33,118	32777
Flow Rate (dscfm)	16,800	16,374	16,467	16547
Gas Temperature (F)	177	165	164	169
Moisture (%)	31.0	33.4	34.5	33.0
Isokinetics (%)	106.80	103.52	108.57	106.30
Sample Volume (dscf)	35.28	33.32	35.15	34.58
Analysis (mg)				
Filter	85.4	72.9	75.9	78.1
Probe Wash	8.4	12.9	25.7	15.7
Condensables	29.9	62.1	82.9	58.3
Concentration (gr/dscf)				
Filter	0.03736	0.03376	0.03332	0.03481
Probe Wash	0.00367	0.00597	0.01128	0.00698
Condensables	0.01308	0.02876	0.03640	0.02608
Emission Rate (lb/hr)				
Filter	5.38	4.74	4.70	4.94
Probe Wash	0.53	0.84	1.59	0.99
Condensables	1.88	4.04	5.14	3.69

RADIAN CORPORATION

Table 3-7.

Results of Emissions Testing at Western Sugar's
Billings, Montana Facility

Pellet Cooler

Test No.	RM5-5-1	RM5-5-2	RM5-5-3	
Date	01-26-91	01-26-91	01-26-91	
Test Time	1113-1230	1434-1551	1647-1806	Average
Effluent Conditions				
Gas Velocity (fps)	51.80	50.34	49.68	50.61
Flow Rate (acfm)	21,968	21,349	21,071	21,463
Flow Rate (dscfm)	17,476	16,764	16,533	16,924
Gas Temperature (F)	114	121	118	118
Moisture (%)	2.3	2.3	3.0	2.6
Isokinetics (%)	96.65	100.84	102.56	100.02
Sample Volume (dscf)	58.64	58.68	58.87	58.73
Analysis (mg)				
Filter	14.6	18.3	20.0	17.6
Probe Wash	10.9	6.0	4.8	7.2
Condensables	7.9	8.4	3.3	6.5
				31.3
Concentration (gr/dscf)				
Filter	3.84E-03	4.81E-03	5.24E-03	4.63E-03
Probe Wash	2.87E-03	1.58E-03	1.26E-03	1.90E-03
Condensables	2.08E-03	2.21E-03	8.65E-04	1.72E-03
				.00835 gr/dscf
Emission (lb/hr)				
Filter	0.58	0.69	0.74	0.67
Probe Wash	0.43	0.23	0.18	0.28
Condensables	0.31	0.32	0.12	0.25
				1.20
Emission (gr/sec)				
Filter	0.73	0.87	0.94	0.84
Probe Wash	0.54	0.29	0.22	0.35
Condensables	0.39	0.40	0.15	0.32
				1.51

4.0 PROCESS DESCRIPTION

The following section presents a brief description of the beet processing procedures, a discussion of the stack schematics, and a description of the air pollution control equipment.

4.1 Beet Process Description

The following is a description of the processes used by Western Sugar at their Billings, Montana site:

Process 1 -- Power Boiler/Wet Scrubber Unit: Low-sulfur coal is fired in three separate power boilers (stoker feeders). After the useful heat has been removed from the combustion gases, the flue gases are combined and passed through two parallel (north and south) wet venturi scrubbers for particulate removal (see Figure 4-1). Maximum coal firing rate: 18 tons of coal per hour (total in the three boilers; firing rate is read once per shift).

Process 2 -- Pulp Dryer: Processed wet beet pulp is sent to a natural gas fired dryer and pelletized for stock feed. Oil is used as an emergency backup fuel for the pulp dryer. The wet pressed pulp is fed at an average rate of 34 tons per hour; however, the pulp is not routinely weighed, nor is the pellet production weighed (except for loads leaving the facility). Therefore, the only direct measure of the production rate is the natural gas feed rate. Maximum natural gas feed rate is 1600 cubic feet per minute.

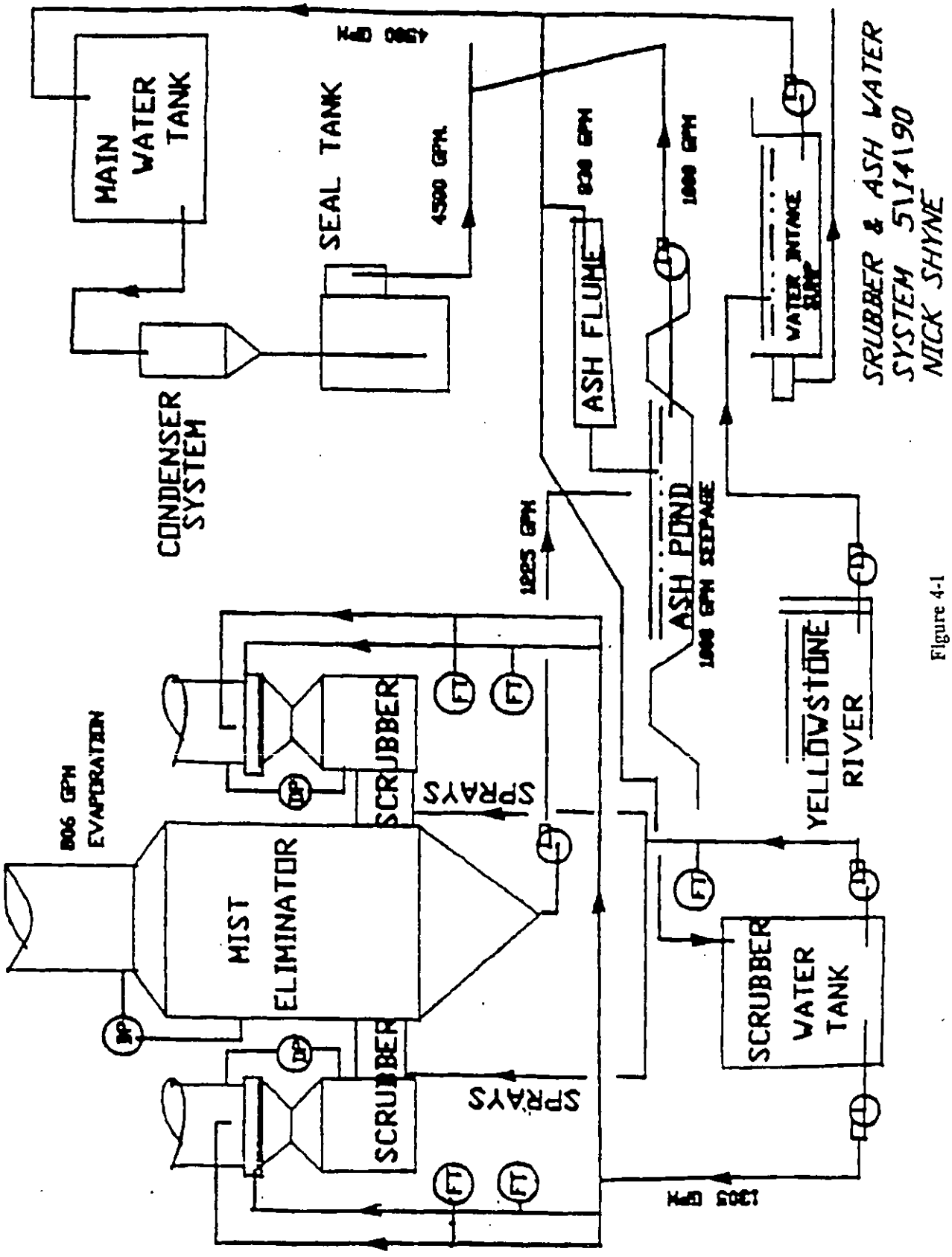

SRUBBER & ASH WATER
SYSTEM 5/14/90
NICK SHYNE
MAIN WATER TANK
SEAL TANK
4300 GPM
CONDENSER SYSTEM
ASH FLUME
ASH POND
1225 GPM
1000 GPM SEEPAGE
YELLOWSTONE RIVER
SCRUBBER WATER TANK
SCRUBBER
SPRAYS
MIST ELIMINATOR
806 GPM EVAPORATION
FT
DP

Figure 4-1

Filename: BEET11.WQ1
Date: 08-Dec-94
Facility: Western Sugar Company
Location: Billings, Montana
Source: Pulp Dryer
Natural gas-fired rotary drum beet pulp dryer controlled with a wet scrubber
Test date: Jan. 23-25, 1991

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	185	163	166	
NORTH STACK	Pressure	in. HG	ND	ND	ND	
	Moisture	%	35.1	35	36.6	
	Oxygen	%	ND	ND	ND	
	Volumetric flow, actual	acfm	36941	34473	35219	
	Volumetric flow, standard*	dscfm	17391	17032	16884	
	Isokinetic variation	%	102.54	104.58	108.9	
Circle: Production or feed rate Feed to dryer ~~and wet drum~~		TPH	34.00	34.00	34.00	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0722	0.04825	0.0602	
	Condensible inorganic PM	G/dscf	0.034030	0.02644	0.02706	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	10.76	7.04	8.71	
	Condensible inorganic PM	lb/hr	5.073	3.860	3.916	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.317	0.207	0.256	0.260
	Condensible inorganic PM	lb/ton	0.149	0.114	0.115	0.126
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.158	0.104	0.128	0.130
	Condensible inorganic PM	kg/Mg	0.0746	0.0568	0.0576	0.0630

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg F	177	165	164	
SOUTH STACK	Pressure	in. HG	ND	ND	ND	
	Moisture	%	31	33.4	34.5	
	Oxygen	%	ND	ND	ND	
	Volumetric flow, actual	acfm	32769	32445	33118	
	Volumetric flow, standard*	dscfm	16800	16374	16467	
	Isokinetic variation	%	106.8	103.52	108.57	
Circle: Production or feed rate Capacity:		TPH	34.00	34.00	34.00	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.04103	0.03973	0.0446	
	Condensible inorganic PM	G/dscf	0.01308	0.02876	0.03640	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	5.91	5.58	6.30	
	Condensible inorganic PM	lb/hr	1.88	4.04	5.14	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.174	0.164	0.185	0.174
	Condensible inorganic PM	lb/ton	0.0554	0.119	0.151	0.108
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0869	0.0820	0.0926	0.0872
	Condensible inorganic PM	kg/Mg	0.0277	0.0594	0.0756	0.0542

TOTAL EMISSION FACTORS FOR BOTH STACKS	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.490	0.371	0.441	0.434
	Condensible inorganic PM	lb/ton	0.205	0.232	0.266	0.234
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.245	0.186	0.221	0.217
	Condensible inorganic PM	kg/Mg	0.102	0.116	0.133	0.117

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
3	Stack temperature	Deg F	114	121	118	
PELLET	Pressure	in. HG	ND	ND	ND	
COOLER	Moisture	%	2.3	2.3	3	
	Oxygen	%	ND	ND	ND	
	Volumetric flow, actual	acfm	21968	21349	21071	
	Volumetric flow, standard*	dscfm	17476	16764	16533	
	Isokinetic variation	%	96.65	100.84	102.56	
Circle: Production or feed rate Wet pulp feed to dryer		TPH	34.00	34.00	34.00	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.00671	0.00639	0.00650	
	Condensible inorganic PM	G/dscf	0.00208	0.00221	0.000865	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	1.01	0.918	0.921	
	Condensible inorganic PM	lb/hr	0.312	0.318	0.123	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.0296	0.0270	0.0271	0.0279
	Condensible inorganic PM	lb/ton	0.00916	0.00934	0.00361	0.00737
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0148	0.0135	0.0135	0.0139
	Condensible inorganic PM	kg/Mg	0.00458	0.00467	0.00180	0.00368

Emission factors based on feed rate to DRYER...may not be useful.

APPENDIX L

REPORT EXCERPTS FROM REFERENCE 12

(Western Sugar Company, January 12, 1990)

207 Woodwork Ln. • Palatine, IL 60067 • 708/991-3300

Clean Air Engineering

January 12, 1990

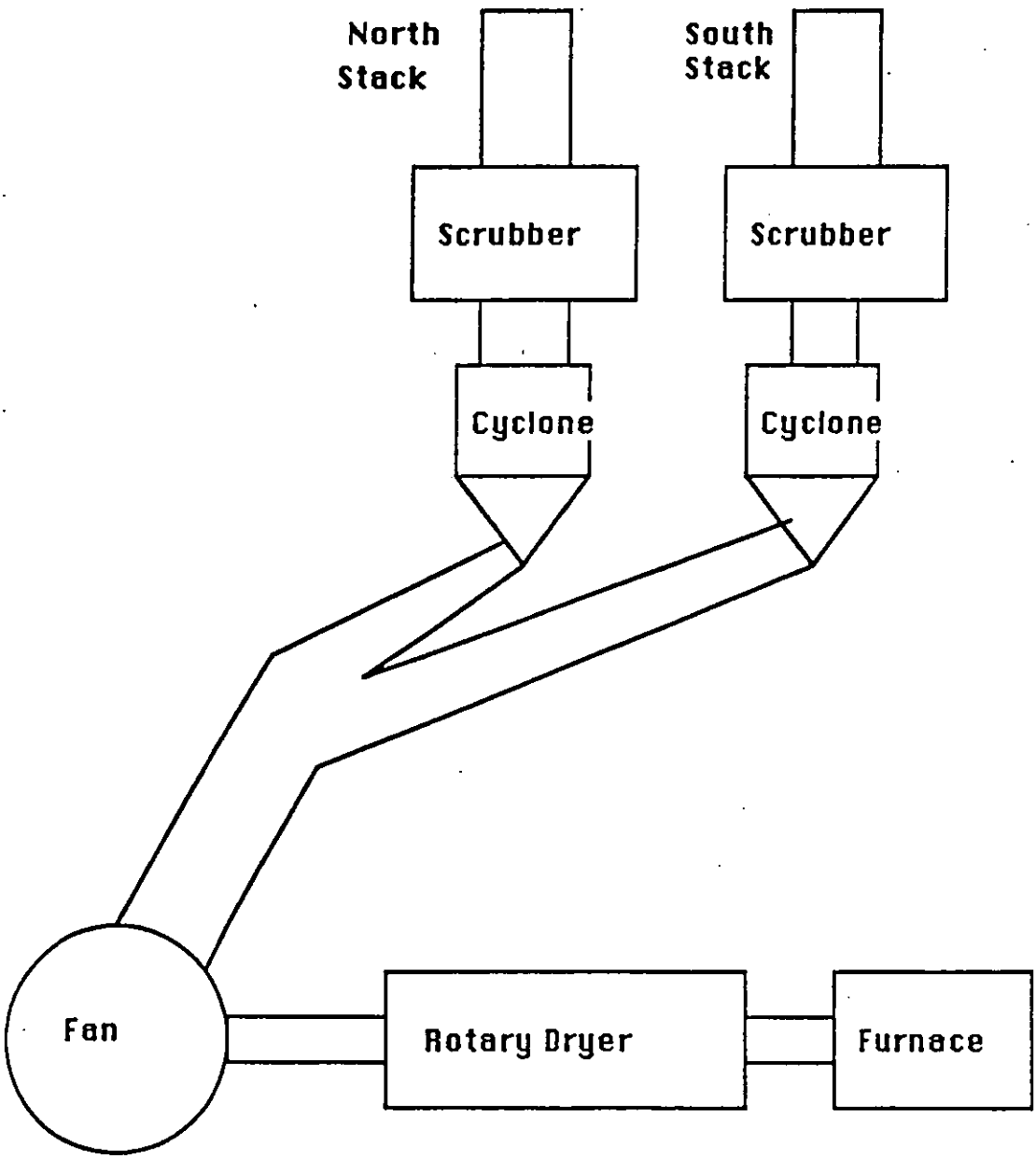
Note that this pulp dryer has been modified since this testing, but this data may still be useful for emissions from a micronized-coal fired dryer.

REPORT ON COMPLIANCE TESTING

Performed at:
WESTERN SUGAR COMPANY
PULP DRYER
SCOTTSBLUFF, NE
CAE Project No: 5119

FIGURE 1

A schematic of the process is shown.



WESTERN SUGAR COMPANY
CAE Project No: 5119

TABLE 1 - Particulate Results

EPA Method 5
Pulp Dryer North and South Stacks Combined
December 13, 1989

RUN NO. *	2	3	4
Start Time (approx.)	10:17 am	2:12 pm	5:08 pm
Stop Time (approx.)	11:46 am	3:38 pm	8:21 pm
Process Data			
Coal (tons/hr)	3.20	3.39	3.48
Molasses (tons/hr)	0.57	0.57	0.83
% MARC	19.5	19.6	17.4
Pressed Pulp (tons/hr)	32.01	29.92	34.38
Process Wt. (tons/hr)	35.21	33.31	37.86
Gas Conditions			
Temperature (^{o}F)	158	159	161
Moisture (volume %)	31.5	31.6	31.6
O_2 (dry volume %)	16.1	16.0	15.8
CO_2 (dry volume %)	3.9	4.1	4.2
Volumetric Flow Rate			
acfm	57,977	57,612	59,560
dscfm	29,512	29,257	30,180
Particulate Results			
gr/dscf	0.0749	0.0896	0.1070
lb/hr	19.0	22.5	27.7
lb/ton	0.540	0.676	0.732

* See discussion

WESTERN SUGAR COMPANY
CAE Project No: 5119

TABLE 2 - Particulate Results

EPA Method 5
Pulp Dryer South Stack
December 13, 1989

RUN NO.	2	3	4
Start Time (approx.)	10:17 am	2:12 pm	5:08 pm
Stop Time (approx.)	11:46 am	3:38 pm	8:21 pm
Process Data			
Pressure Differential			
Demister (in. H_20)	0.2	0.2	0.2
Cyclone (in. H_20)	2.2	1.9	2.6
Scrubber (in. H_20)	2.2	2.6	2.2
Gas Conditions			
Temperature (^oF)	161	162	162
Moisture (volume %)	32.9	32.8	32.7
O_2 (dry volume %)	16.2	16.1	15.7
CO_2 (dry volume %)	3.9	3.9	4.2
Volumetric Flow Rate			
acfm	31,668	31,181	33,617
dscfm	15,750	15,497	16,747
Particulate Results			
gr/dscf	0.1033	0.0941	0.1081
lb/hr	14.0	12.5	15.5

* See discussion

TABLE 3 - Particulate Results

EPA Method 5
Pulp Dryer North Stack
December 13, 1989

RUN NO.	2	3	4
Start Time (approx.)	10:17 am	2:12 pm	5:08 pm
Stop Time (approx.)	11:46 am	3:38 pm	8:21 pm
Process Data			
Pressure Differential			
Demister (in. H_2O)	.1	.2	.2
Cyclone (in. H_2O)	2.7	2.7	2.5
Scrubber (in. H_2O)	1.8	1.8	2.0
Gas Conditions			
Temperature (^oF)	155	156	159
Moisture (volume %)	30.1	30.3	30.4
O_2 (dry volume %)	16.0	15.8	15.8
CO_2 (dry volume %)	3.9	4.2	4.2
Volumetric Flow Rate			
acfm	26,309	26,431	25,943
dscfm	13,762	13,760	13,433
Particulate Results	~~0.0459~~		
gr/dscf	~~0.0425~~	0.0845 ✓	0.1056 ✓
lb/hr	~~5.0~~ 5.42 ↑	10.0	12.2

Grains / dry @ 68 stack conditions reported here BLS 3/13/95

• See discussion

WESTERN SUGAR COMPANY
CAE Project No: 5119

PULP PROCESS DATA
NORTH AND SOUTH STACKS COMBINED

RUN NO.	2	3	4
DATE	12/13/89	12/13/89	12/13/89
START TIME	10:17 AM	2:12 PM	5:08 PM
STOP TIME	11:46 AM	3:38 PM	8:21 PM
DATA			
% SUGAR	19.5	19.6	17.4
% MARC	0.0579	0.0581	0.0534
SLICE RATE (tons/hr)	170	170	170
% DRY PULP MOISTURE	11.2	9.2	13.7
% PRESSED PULP MOISTURE	72.7	73.9	73.8
COAL FEED RATE (tons/hr)	3.20	3.39	3.48
CALCULATIONS			
PRESSED PULP (tons/hr)	32.01	29.92	34.38
PROCESS WEIGHT (tons/hr)	35.21	33.31	37.86

Filename: BEET12.WQ1
Date: 08-Dec-94
Facility: Western Sugar Company
Location: Scottsbluff, Nebraska
Source: Pulp Dryer
Pulverized coal-fired rotary drum beet pulp dryer controlled with two sets of cyclones and wet scrubbers in parallel (two stacks) (about 2" pressure drop)
Test date: Dec. 12-13, 1989

Test ID	Parameter	Units	Values reported Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	155	156	159	
NORTH	Pressure	in. HG	26.1	26.1	26.1	
STACK	Moisture	%	30.10	30.32	30.36	
	Oxygen	%	16	15.8	15.8	
	Volumetric flow, actual	acfm	26309	26431	25943	
	Volumetric flow, standard*	dscfm	13773	13771	13443	
	Isokinetic variation	%	98.1	99.9	102.5	
Circle: Production or feed rate		TPH	32.01	29.92	34.38	
Feed to dryer and west drum						
	Pollutant concentrations:	mistake in report run 1 G/dscf calc. as G/dcf				
	Filterable PM	G/dscf	0.0459	0.08450	0.1056	
	Condensible inorganic PM	G/dscf	0.00494	0.00654	0.00554	
	CO2	% vol	3.9	4.2	4.2	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	5.42	9.97	12.2	
	Condensible inorganic PM	lb/hr	0.583	0.772	0.638	
	CO2	lb/hr	3680	3963	3869	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.169	0.333	0.354	0.286
	Condensible inorganic PM	lb/ton	0.0182	0.0258	0.0186	0.0209
	CO2	lb/ton	115	132	113	120
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0846	0.167	0.177	0.143
	Condensible inorganic PM	kg/Mg	0.00910	0.0129	0.00928	0.01043
	CO2	kg/Mg	57.5	66.2	56.3	60.0

Test ID	Parameter	Units	Values reported Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg F	161	162	162	
SOUTH	Pressure	in. HG	26.1	26.1	26.1	
STACK	Moisture	%	32.89	32.83	32.67	
	Oxygen	%	16.2	16.1	15.7	
	Volumetric flow, actual	acfm	31668	31181	33617	
	Volumetric flow, standard*	dscfm	15763	15509	16761	
	Isokinetic variation	%	101.7	103.1	101.5	
Circle: Production or feed rate		TPH	32.01	29.92	34.38	
Feed to dryer and west drum						
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.1033	0.09412	0.1081	
	Condensible inorganic PM	G/dscf	0.00918	0.00529	0.00585	
	CO2	% vol	3.9	3.9	4.2	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	14.0	12.5	15.5	
	Condensible inorganic PM	lb/hr	1.24	0.704	0.840	
	CO2	lb/hr	4212	4144	4823	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.436	0.418	0.452	0.435
	Condensible inorganic PM	lb/ton	0.0387	0.0235	0.0244	0.0289
	CO2	lb/ton	132	139	140	137
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.218	0.209	0.226	0.218
	Condensible inorganic PM	kg/Mg	0.0194	0.0118	0.0122	0.0144
	CO2	kg/Mg	65.8	69.3	70.1	68.4

TOTAL	Emission factors (ENGLISH UNITS):					AVERAGE
EMISSION	Filterable PM	lb/ton	0.605	0.752	0.806	0.721
FACTORS	Condensible inorganic PM	lb/ton	0.0570	0.0493	0.0430	0.0498
FOR BOTH	CO2	lb/ton	247	271	253	257
STACKS	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.303	0.376	0.403	0.360
	Condensible inorganic PM	kg/Mg	0.0285	0.0247	0.0215	0.0249
	CO2	kg/Mg	123	135	126	128

APPENDIX M

REPORT EXCERPTS FROM REFERENCE 13

(Holly Sugar Corporation, November 16, 1993)

EMISSION MEASUREMENT TEST REPORT

of

C.E. Boilers, Union Boilers & Pulp Dryers
Permit Compliance

for

SO_2, Particulate and PM10 with back-half Emission(s)

C.E. Boilers, Union Boilers, Pulp Dryers
Sidney, Montana Plant, Sidney, MT
Test Date: October 19-23, 1993

Prepared for:

Holly Sugar Corporation
Montana Division

East Holly Street
Sidney, MT 59270
Mr. Tom B. Jacobsen, Environmental Engineer
Phone: 307 532-7141, Ext.: N/A

Submitted to:

Montana State Department of Health and Environmental Sciences
Air Quality Bureau

Room A116
Cogswell Bldg.
Helena, MT 59620
Mr. Brian Hohn, Environmental Specialist
Phone: 406 444-3454

Prepared by:

THE EMISSION MEASUREMENT GROUP, INC.

P.O. Box 4953, ENGLEWOOD, CO 80155-4953
Nationwide Watts: 800-222-4187
Office Phone: 303 693-6725

Report Date: November 16, 1993

The Emission Measurement Group, Inc.

Table 3-6 (Pulp - NE)
TEST RESULTS, by Run

Pulp Dryer - Northeast Sidney, MT

CORPORATE DATA	
Company Name:	Holly Sugar Corporation
Division Name:	Montana Division
Plant/Fac. Name:	Sidney, MT
Dept. Name:	Environmental
Contact Name:	Mr. Tom Jacobsen
Contact's Title:	Environmental Engineer
Process Ident./Type:	Sugar Beet Processing
Fuel Type:	#6 Fuel Oil
Fd(dscf gas/10^6 BTU):	9220
Stack/Duct Identifier:	Pulp Dryer - Northeast
Equiv.Flue Dia.(ft.):	5.250
Hrs of Oper./Year:	4320

TEST CONDITIONS				
Test Date, (mm/dd/yy):	10/23/93	10/23/93	10/23/93	
Test Operator, (LN,FI):	Lynn, M.	Lynn, M.	Lynn, M.	
Tech. Helper #1:	Floyd, J.	Floyd, J.	Floyd, J.	
Run ID Number, (VDRR):	**8101**	**8102**	**8103**	**AVERAGE**
Time- Start, (24hr.):	10:24	16:32	20:02	
- End, (24hr.):	12:38	18:27	22:29	
Time of Test, (t, min.):	100.0	100.0	100.0	100.0
Max. Rtd. Cap.,(TPH,Feed):	48.8	48.8	48.8	48.8
Feed Load, (TPH):	25.0	25.0	25.0	25.0
Test Cond., Feed, (%MRC):	51.25	51.25	51.25	51.25
PARTICULATE RESULTS, (RM5)				
gr./dscf:	0.0609	0.0596	0.0868	0.0691
gr./acf:	0.0273	0.0268	0.0367	0.0303
lbs./hr.:	9.03	7.62	10.72	9.12
lbs./10^6 BTU:	0.439	0.296	0.554	0.430
lbs./Ton of Feed:	0.361	0.305	0.429	0.365
Tons/Year:	19.50	16.46	23.16	19.71

The Emission Measurement Group, Inc.

Table 3-6 (Pulp - NE Continued)
TEST RESULTS, by Run

TEST CONDITIONS				
Test Date, (mm/dd/yy):	10/23/93	10/23/93	10/23/93	
Run ID Number, (VDRR):	**8101**	**8102**	**8103**	AVERAGE
PM-10 RESULTS, (including backhalf)				
gr./dscf:	0.0651	N/A	N/A	0.0651
gr./acf:	0.0292	N/A	N/A	0.0292
lbs./hr.:	9.65	N/A	N/A	9.65
lbs./10^6 BTU:	0.470	N/A	N/A	0.470
lbs./Ton of Feed:	0.386	N/A	N/A	0.386
Tons/Year:	20.84	N/A	N/A	20.84
PARTICULATE TOTAL RESULTS (including backhalf)				
gr./dscf:	0.0876	0.0680	0.1204	0.0920
gr./acf:	0.0393	0.0305	0.0510	0.0403
lbs./hr.:	12.99	8.69	14.88	12.19
lbs./10^6 BTU:	0.632	0.338	0.769	0.580
lbs./Ton of Feed:	0.52	0.35	0.60	0.49
Tons/Year:	28.07	18.77	32.13	26.32
SO2 RESULTS, (RM6C)				
ppm, (dry, v/v):	34.09	70.96	39.93	48.32
ppm, (wet, v/v):	20.96	43.38	22.95	29.10
lbs./hr.:	5.871	10.535	5.729	7.378
lbs./10^6 BTU:	0.2857	0.4094	0.2963	0.3305
lbs./Ton of Feed:	0.23	0.42	0.23	0.30
Tons/Year:	12.68	22.76	12.37	15.94
PARAMETRIC FLUE GAS RESULTS				
Pres.Vel.Del.P(in.w.g.):	0.1764	0.1318	0.1364	0.1482
Moisture, (%v/v):	38.50	38.86	42.53	39.97
CO2, Inst., (% dry,v/v):	4.08	4.88	4.26	4.41
O2, Inst., (%, dry,v/v):	17.09	15.36	16.59	16.34
Temperature,Stack, (F):	212.8	208.4	207.2	209.5
Velocity,Flue Gas,(Furl/Ftnt):	29.67	25.57	26.21	27.15
Volume Flow, (DSCFM):	17297	14912	14411	15540
Volume Flow, (ACFM):	38539	33209	34041	35263

The Emission Measurement Group, Inc.

Table 3-6 (Pulp - NW)
TEST RESULTS, by Run

Pulp Dryer - Northwest Sidney, MT

CORPORATE DATA	
Company Name:	Holly Sugar Corporation
Division Name:	Montana Division
Plant/Fac. Name:	Sidney, MT
Dept. Name:	Environmental
Contact Name:	Mr. Tom Jacobsen
Contact's Title:	Environmental Engineer
Process Ident./Type:	Sugar Beet Processing
Fuel Type:	#6 Fuel Oil
Fd(dscf gas/10^6 BTU):	9220
Stack/Duct Identifier:	Pulp Dryer - Northwest
Equiv.Flue Dia,(ft.):	5.250
Hrs of Oper./Year:	4320

TEST CONDITIONS				
Test Date, (mm/dd/yy):	10/23/93	10/23/93	10/23/93	
Test Operator, (LN,FI):	Lynn, M.	Lynn, M.	Lynn, M.	
Tech. Helper #1:	Floyd, J.	Floyd, J.	Floyd, J.	
Run ID Number, (VDRR):	**7101**	**7102**	**7103**	AVERAGE
Time- Start, (24hr.):	10:26	15:18	19:18	
- End, (24hr.):	12:40	17:20	21:57	
Time of Test, (t, min.):	100.0	100.0	100.0	100.0
Max. Rtd. Cap.,(TPH,Feed):	48.8	48.8	48.8	48.8
Feed Load, (TPH):	25.0	25.0	25.0	25.0
Test Cond., Feed, (%MRC):	51.25	51.25	51.25	51.25
PARTICULATE RESULTS, (RM5)				
gr./dscf:	0.0524	0.0724	0.0755	0.0668
gr./acf:	0.0250	0.0337	0.0358	0.0315
lbs./hr.:	6.73	11.55	11.89	10.06
lbs./10^6 BTU:	0.276	0.368	0.439	0.361
lbs./Ton of Feed:	0.269	0.462	0.476	0.402
Tons/Year:	14.54	24.95	25.69	21.73

The Emission Measurement Group, Inc.

Table 3-6 (Pulp - NW Continued)
TEST RESULTS, by Run

TEST CONDITIONS				
Test Date, (mm/dd/yy):	10/23/93	10/23/93	10/23/93	
Run ID Number, (VDRR):	**7101**	**7102**	**7103**	**AVERAGE**
PM-10 RESULTS, (including backhalf)				
gr./dscf:	N/A	0.0567	0.0529	0.0548
gr./acf:	N/A	0.0264	0.0251	0.0258
lbs./hr.:	N/A	9.05	8.33	8.69
lbs./10^6 BTU:	N/A	0.289	0.307	0.298
lbs./Ton of Feed:	N/A	0.362	0.333	0.348
Tons/Year:	N/A	19.55	17.99	18.77
PARTICULATE TOTAL RESULTS (including backhalf)				
gr./dscf:	0.1039	0.0946	0.0908	0.0964
gr./acf:	0.0496	0.0441	0.0431	0.0456
lbs./hr.:	13.35	15.10	14.30	14.25
lbs./10^6 BTU:	0.548	0.481	0.527	0.519
lbs./Ton of Feed:	0.53	0.60	0.57	0.57
Tons/Year:	28.83	32.62	30.88	30.78
SO2 RESULTS, (RM6C)				
ppm, (dry, v/v):	39.10	70.56	32.44	47.37
ppm, (wet, v/v):	25.67	45.92	21.74	31.11
lbs./hr.:	5.833	13.083	5.933	8.283
lbs./10^6 BTU:	0.2396	0.4171	0.2189	0.2919
lbs./Ton of Feed:	0.23	0.52	0.24	0.33
Tons/Year:	12.60	28.26	12.82	17.89
PARAMETRIC FLUE GAS RESULTS				
Pres.Vel.Del.P(in.w.g.):	0.1188	0.1893	0.1767	0.1616
Moisture, (%v/v):	34.35	34.92	32.98	34.08
CO2, Inst., (% dry,v/v):	4.15	4.60	3.93	4.23
O2, Inst., (%, dry,v/v):	15.68	15.49	16.16	15.78
Temperature,Stack, (F):	216.1	225.9	234.1	225.4
Velocity,Flue Gas,(fps):	24.20	30.78	29.80	28.26
Volume Flow, (DSCFM):	14984	18623	18370	17326
Volume Flow, (ACFM):	31428	39979	38709	36705

The Emission Measurement Group, Inc.

Table 3-6 (Pulp - SE)
TEST RESULTS, by Run

Pulp Dryer - Southeast Sidney, MT

CORPORATE DATA	
Company Name:	Holly Sugar Corporation
Division Name:	Montana Division
Plant/Fac. Name:	Sidney, MT
Dept. Name:	Environmental
Contact Name:	Mr. Tom Jacobsen
Contact's Title:	Environmental Engineer
Process Ident./Type:	Sugar Beet Processing
Fuel Type:	#6 Fuel Oil
Fd(dscf gas/10^6 BTU):	9220
Stack/Duct Identifier:	Pulp Dryer - Southeast
Equiv.Flue Dia,(ft.):	5.250
Hrs of Oper./Year:	4320

TEST CONDITIONS					
Test Date, (mm/dd/yy):	10/21/93	10/22/93	10/22/93	10/22/93	
Test Operator, (LN,FI):	Lynn, M.	Lynn, M.	Lynn, M.	Lynn, M.	
Tech. Helper #1:	Floyd, J.	Floyd, J.	Floyd, J.	Floyd, J.	
Run ID Number, (VDRR):	**6101**	**6102**	**6103**	**6104**	**AVERAGE**
Time- Start, (24hr.):	20:56	9:34	15:27	19:24	
- End, (24hr.):	21:16	13:36	17:46	21:50	
Time of Test, (t, min.):	20.0	113.5	120.0	120.0	93.4
Max. Rtd. Cap.,(TPH,Feed):	48.8	48.8	48.8	48.8	48.8
Feed Load, (TPH):	24.0	25.0	25.0	25.0	24.8
Test Cond., Feed, (%MRC):	49.20	51.25	51.25	51.25	50.74

PARTICULATE RESULTS, (RM5)					
gr./dscf:	0.1306	0.1281	0.0705	0.1047	0.1085
gr./acf:	0.0555	0.0582	0.0374	0.0440	0.0488
lbs./hr.:	15.99	24.34	12.61	14.33	16.82
lbs./10^6 BTU:	0.535	0.518	0.278	0.393	0.431
lbs./Ton of Feed:	0.666	0.974	0.504	0.573	0.679
Tons/Year:	34.54	52.58	27.24	30.96	36.33

The Emission Measurement Group, Inc.

Table 3-6 (Pulp - SE Continued)
TEST RESULTS, by Run

TEST CONDITIONS					
Test Date, (mm/dd/yy):	10/21/93	10/22/93	10/22/93	10/22/93	
Run ID Number, (VDRR):	**6101**	**6102**	**6103**	**6104**	AVERAGE
PM-10 RESULTS, (including backhalf)					
gr./dscf:	0.0943	0.1494	N/A	N/A	0.1218
gr./acf:	0.0401	0.0679	N/A	N/A	0.0540
lbs./hr.:	11.54	28.40	N/A	N/A	19.97
lbs./10^6 BTU:	0.386	0.605	N/A	N/A	0.495
lbs./Ton of Feed:	0.481	1.136	N/A	N/A	0.808
Tons/Year:	24.92	61.33	N/A	N/A	43.13
PARTICULATE TOTAL RESULTS (including backhalf)					
gr./dscf:	0.1582	0.2133	0.1089	0.1372	0.1544
gr./acf:	0.0673	0.0970	0.0577	0.0577	0.0699
lbs./hr.:	19.36	40.55	19.48	18.79	24.54
lbs./10^6 BTU:	0.647	0.863	0.429	0.515	0.614
lbs./Ton of Feed:	0.81	1.62	0.78	0.75	0.99
Tons/Year:	41.82	87.58	42.07	40.59	53.01
SO2 RESULTS, (RM6C)					
ppm, (dry, v/v):	71.31	72.19	88.02	82.43	78.49
ppm, (wet, v/v):	42.00	45.29	63.96	47.45	49.67
lbs./hr.:	10.138	15.940	18.292	13.115	14.371
lbs./10^6 BTU:	0.3389	0.3395	0.4030	0.3595	0.3602
lbs./Ton of Feed:	0.42	0.64	0.73	0.52	0.58
Tons/Year:	21.90	34.43	39.51	28.33	31.04
PARAMETRIC FLUE GAS RESULTS					
Pres.Vel.Del.P(in.w.g.):	0.1312	0.2825	0.1940	0.1694	0.1943
Moisture, (%v/v):	41.10	37.27	27.34	42.44	37.04
CO2, Inst., (% dry,v/v):	5.32	5.20	5.57	6.18	5.57
O2, Inst., (%, dry,v/v):	14.17	14.10	13.92	13.57	13.94
Temperature,Stack, (F):	222.5	219.4	213.4	211.8	216.8
Velocity,Flue Gas,(fps):	25.86	37.54	30.32	29.26	30.74
Volume Flow, (DSCFM):	14279	22177	20872	15980	18327
Volume Flow, (ACFM):	33584	48757	39378	38003	39930

The Emission Measurement Group, Inc.

Table 3-6 (Pulp-SW)
TEST RESULTS, by Run

Pulp Dryer - Southwest Sidney, MT

CORPORATE DATA	
Company Name:	Holly Sugar Corporation
Division Name:	Montana Division
Plant/Fac. Name:	Sidney, MT
Dept. Name:	Environmental
Contact Name:	Mr. Tom Jacobsen
Contact's Title:	Environmental Engineer
Process Ident./Type:	Sugar Beet Processing
Fuel Type:	#6 Fuel Oil
Fd(dscf gas/10^6 BTU):	9220
Stack/Duct Identifier:	Pulp Dryer - Southwest
Equiv.Flue Dia,(ft.):	5.250
Hrs of Oper./Year:	4320

TEST CONDITIONS					
Test Date, (mm/dd/yy):	10/21/93	10/22/93	10/22/93	10/22/93	
Test Operator, (LN,FI):	Lynn, M.	Lynn, M.	Lynn, M.	Lynn, M.	
Tech. Helper #1:	Floyd, J.	Floyd, J.	Floyd, J.	Floyd, J.	
Run ID Number, (VDRR):	**5101**	**5102**	**5103**	**5104**	**AVERAGE**
Time- Start, (24hr.):	21:08	9:43	15:24	19:27	
- End, (24hr.):	21:33	13:35	17:43	21:59	
Time of Test, (t, min.):	25.0	110.5	120.0	120.0	93.9
Max. Rtd. Cap.,(TPH,Feed):	48.8	48.8	48.8	48.8	48.8
Feed Load, (TPH):	24.0	25.0	25.0	25.0	24.8
Test Cond., Feed, (%MRC):	49.20	51.25	51.25	51.25	50.74

PARTICULATE RESULTS, (RM5)					
gr./dscf:	0.0431	0.0666	0.1409	0.1179	0.0921
gr./acf:	0.0183	0.0283	0.0609	0.0552	0.0407
lbs./hr.:	4.66	9.96	22.30	20.40	14.33
lbs./10^6 BTU:	0.175	0.269	0.594	0.451	0.372
lbs./Ton of Feed:	0.194	0.398	0.892	0.816	0.575
Tons/Year:	10.06	21.51	48.17	44.07	30.95

The Emission Measurement Group, Inc.

Table 3-6 (Pulp-SW Continued)
TEST RESULTS, by Run

TEST CONDITIONS					
Test Date, (mm/dd/yy):	10/21/93	10/22/93	10/22/93	10/22/93	
Run ID Number, (VDRR):	**5101**	**5102**	**5103**	**5104**	**AVERAGE**
PM-10 RESULTS, (including backhalf)					
gr./dscf:	N/A	N/A	0.1154	0.1030	0.1092
gr./acf:	N/A	N/A	0.0499	0.0482	0.0491
lbs./hr.:	N/A	N/A	18.27	17.83	18.05
lbs./10^6 BTU:	N/A	N/A	0.486	0.394	0.440
lbs./Ton of Feed:	N/A	N/A	0.731	0.713	0.722
Tons/Year:	N/A	N/A	39.45	38.51	38.98
PARTICULATE TOTAL RESULTS (including backhalf)					
gr./dscf:	0.1276	0.0916	0.1709	0.1585	0.1372
gr./acf:	0.0540	0.0390	0.0739	0.0742	0.0603
lbs./hr.:	13.77	13.71	27.05	27.43	20.49
lbs./10^6 BTU:	0.518	0.370	0.720	0.606	0.554
lbs./Ton of Feed:	0.57	0.55	1.08	1.10	0.83
Tons/Year:	29.74	29.60	58.43	59.25	44.26
SO2 RESULTS, (RM6C)					
ppm, (dry, v/v):	72.50	86.83	84.48	75.17	79.74
ppm, (wet, v/v):	44.16	52.20	51.94	49.84	49.54
lbs./hr.:	9.089	15.089	15.532	15.110	13.705
lbs./10^6 BTU:	0.3419	0.4069	0.4137	0.3338	0.3741
lbs./Ton of Feed:	0.38	0.60	0.62	0.60	0.55
Tons/Year:	19.63	32.59	33.55	32.64	29.60
PARAMETRIC FLUE GAS RESULTS					
Pres.Vel.Del.P(in.w.g.):	0.1000	0.1928	0.2091	0.2197	0.1804
Moisture, (%v/v):	39.08	39.88	38.51	33.70	37.80
CO2, Inst., (% dry,v/v):	5.45	5.24	5.25	6.27	5.55
O2, Inst., (%, dry,v/v):	14.12	14.08	14.37	13.70	14.07
Temperature,Stack, (°F):	248.7	235.9	238.4	235.4	239.6
Velocity,Flue Gas,(fps):	22.89	31.57	32.88	33.22	30.14
Volume Flow, (DSCFM):	12591	17453	18466	20189	17175
Volume Flow, (ACFM):	29735	40999	42701	43148	39146

The Emission Measurement Group, Inc.

Table 3-7 (Pulp - NE)
SAMPLING and ANALYTICAL DATA, by Run

Pulp Dryer - Northeast Sidney, MT

CORPORATE DATA	
Company Name:	Holly Sugar Corporation
Division Name:	Montana Division
Plant/Fac. Name:	Sidney, MT
Dept. Name:	Environmental
Contact Name:	Mr. Tom Jacobsen
Contact's Title:	Environmental Engineer
Process Ident./Type:	Sugar Beet Processing
Fuel Type:	#6 Fuel Oil
Fd(dscf gas/10^6 BTU):	9220
Stack/Duct Identifier:	Pulp Dryer - Northeast
Equiv.Flue Dia,(ft.):	5.250
Hrs of Oper./Year:	4320

TEST CONDITIONS			
Test Operator (LN,FI):	Lynn, M.	Lynn, M.	Lynn, M.
Tech. Helper #1:	Floyd, J.	Floyd, J.	Floyd, J.
Test Date, (mm/dd/yy):	10/23/93	10/23/93	10/23/93
Run ID Number, (VDRR):	**8101**	**8102**	**8103**
Time- Start, (24hr.):	10:24	16:32	20:02
- End, (24hr.):	12:38	18:27	22:29
Time of Test, (t, min.):	100.0	100.0	100.0
PROCESS LOAD DATA			
Max. Rtd. Cap., (TPH, Feed):	48.8	48.8	48.8
Feed Load, (TPH):	25.0	25.0	25.0
Test Cond., Feed, (%MRC):	51.25	51.25	51.25
SAMPLE VOLUME DATA			
Reference Diluent (CO2) %:	12.0	12.0	12.0
Reference Diluent (O2) %:	15.0	15.0	15.0
Console ID #:	CC-2	CC-2	CC-2
Gas Meter ID Number:	6848398	6848398	6848398
Gas Mtr. Cal Factor, (Yo):	0.99650	0.99650	0.99650
Volume,Gas Samp.@ Std.Cond,(dscf):	46.551	38.077	37.750
Corrected for Excess Leak,(acf):	50.476	41.847	40.498
At Meter Conditions, (acf):	50.476	41.847	40.498
Temperature, @ Gas Meter, ('F):	72.10	78.80	66.60
Delta H Pres.@ Meter, (in.w.g.):	1.09	0.80	0.86
Pressure Barometeric.,Abs.,(in.Hg.):	27.825	27.820	27.850
Leak Ck.Result,Post,Excessive,(acf):	0.000	0.000	0.000
Leak Rate Result, (cfm):	0.000	0.000	0.000
At Vacuum, (in. Hg.):	24.00	25.00	25.00
High During Run, (in. Hg.):	15.00	5.80	3.00

The Emission Measurement Group, Inc.

Table 3-7 (Pulp - NE Continued)
SAMPLING and ANALYTICAL DATA, by Run

TEST CONDITIONS			
Test Date, (mm/dd/yy):	10/23/93	10/23/93	10/23/93
Run ID Number, (VDRR):	**8101**	**8102**	**8103**
STACK MOISTURE DATA			
Press.H2O Vap.@ Saturation,(in.Hg.):	0.2411	0.2586	0.2374
Of Gas @ Silica Gel, (in. Hg.):	19.025	23.620	25.850
Temperature @ Silica Gel Imp., (F):	39.30	41.10	38.90
Vacuum @ Silica Gel/Pump,(in.Hg.):	8.800	4.200	2.000
Volume H2O @ Silica Gel,(gm):	13.75	9.83	7.97
Condensed H2O @ Impingers,(ml.):	605.0	504.0	585.0
Total Vol. H2O Collected,(ml.):	618.75	513.83	592.97
FLUE GAS MOL. WT. & FLOWRATE DATA			
Area of Flue, (sq. ft.):	21.65	21.65	21.65
Pres., Duct, Static, (in. w.g.):	0.00	0.00	0.00
Pitobe ID #:	PM-60	PM-60	PM-60
Pitot ID #:	PM-60	PM-60	PM-60
Pitot Side ID #:	A	A	A
Pitot Coef., (Cp):	0.840	0.840	0.840
Density of Flue Gas, (lb/cf):	0.0647	0.0647	0.0635
Molecular Weight, wet:	24.984	24.980	24.533
PARTICULATE SAMPLING DATA			
Isokinetic Sampling Rate, Final,(%):	104.32	98.97	101.53
" Point-by-Point, (Avg., %):	104.40	96.90	94.30
" Point-by-Point, (High, %):	140.30	112.80	106.40
" Point-by-Point, (Low, %):	91.20	50.80	69.60
Filter A ID #:	7492	7490	7497
B ID #:	N/A	N/A	N/A
Nozzle ID #:	PM10-11	PM10-11	PM10-11
Nozzle Diameter, (in.):	0.32000	0.32000	0.32000
Orifice Factor, Del. Ha, (in. w.g.):	1.904	1.904	1.904
Sampling Rate Factor, (K3):	4.29	4.18	4.06

The Emission Measurement Group, Inc.

Table 3-7 (Pulp - NW)
SAMPLING and ANALYTICAL DATA, by Run

Pulp Dryer - Northwest Sidney, MT

CORPORATE DATA	
Company Name:	Holly Sugar Corporation
Division Name:	Montana Division
Plant/Fac. Name:	Sidney, MT
Dept. Name:	Environmental
Contact Name:	Mr. Tom Jacobsen
Contact's Title:	Environmental Engineer
Process Ident./Type:	Sugar Beet Processing
Fuel Type:	#6 Fuel Oil
Fd(dscf gas/10^6 BTU):	9220
Stack/Duct Identifier:	Pulp Dryer - Northwest
Equiv.Flue Dia.(ft.):	5.250
Hrs of Oper./Year:	4320

TEST CONDITIONS			
Test Operator (LN,FI):	Lynn, M.	Lynn, M.	Lynn, M.
Tech. Helper #1:	Floyd, J.	Floyd, J.	Floyd, J.
Test Date, (mm/dd/yy):	10/23/93	10/23/93	10/23/93
Run ID Number, (VDRR):	**7101**	**7102**	**7103**
Time- Start, (24hr.):	10:26	15:18	19:18
- End, (24hr.):	12:40	17:20	21:57
Time of Test, (t, min.):	100.0	100.0	100.0
PROCESS LOAD DATA			
Max. Rtd. Cap., (TPH, Feed):	48.8	48.8	48.8
Feed Load, (TPH):	25.0	25.0	25.0
Test Cond., Feed, (%MRC):	51.25	51.25	51.25
SAMPLE VOLUME DATA			
Reference Diluent (CO2) %:	12.0	12.0	12.0
Reference Diluent (O2) %:	15.0	15.0	15.0
Console ID #:	JC-1	JC-1	JC-1
Gas Meter ID Number:	382459	382459	382459
Gas Mtr. Cal Factor, (Yo):	0.99650	0.99650	0.99650
Volume,Gas Samp.@ Std.Cond,(dscf):	34.178	47.555	46.146
Corrected for Excess Leak,(acf):	37.149	53.029	49.506
At Meter Conditions, (acf):	37.149	53.029	49.506
Temperature, @ Gas Meter, (F):	72.20	86.20	66.00
Delta H Pres.@ Meter, (in.w.g.):	0.25	0.46	0.43
Pressure Barometeric.,Abs.,(in.Hg.):	27.825	27.820	27.850
Leak Ck.Result,Post,Excessive,(acf):	0.000	0.000	0.000
Leak Rate Result, (cfm):	0.000	0.000	0.000
At Vacuum, (in. Hg.):	23.50	23.50	23.50
High During Run, (in. Hg.):	17.00	5.20	4.00

The Emission Measurement Group, Inc.

Table 3-7 (Pulp - NW Continued)
SAMPLING and ANALYTICAL DATA, by Run

TEST CONDITIONS			
Test Date, (mm/dd/yy):	10/23/93	10/23/93	10/23/93
Run ID Number, (VDRR):	**7101**	**7102**	**7103**
STACK MOISTURE DATA			
Press.H2O Vap.@ Saturation,(in.Hg.):	0.3586	0.3252	0.2392
Of Gas @ Silica Gel, (in. Hg.):	18.425	25.320	25.350
Temperature @ Silica Gel Imp., (°F):	49.70	47.10	39.10
Vacuum @ Silica Gel/Pump,(in.Hg.):	9.400	2.500	2.500
Volume H2O @ Silica Gel,(gm):	15.65	14.65	10.01
Condensed H2O @ Impingers,(ml.):	364.0	527.0	472.0
Total Vol. H2O Collected,(ml.):	379.65	541.65	482.01
FLUE GAS MOL. WT. & FLOWRATE DATA			
Area of Flue, (sq. ft.):	21.65	21.65	21.65
Pres., Duct, Static, (in. w.g.):	0.20	0.20	0.20
Pitobe ID #:	60-1	60-2	60-2
Pitot ID #:	60-1	60-2-PM10	60-2-PM10
Pitot Side ID #:	A	A	A
Pitot Coef., (Cp):	0.840	0.840	0.840
Density of Flue Gas, (lb/cf):	0.0659	0.0658	0.0662
Molecular Weight, wet:	25.425	25.403	25.569
PARTICULATE SAMPLING DATA			
Isokinetic Sampling Rate, Final,(%):	88.41	98.97	97.37
" Point-by-Point, (Avg., %):	88.70	98.90	99.20
" Point-by-Point, (High, %):	118.00	111.60	114.60
" Point-by-Point, (Low, %):	81.50	94.10	88.50
Filter A ID #:	7493	7489	7496
B ID #:	N/A	N/A	N/A
Nozzle ID #:	10-2	PM10-11	PM10-11
Nozzle Diameter, (in.):	0.32000	0.32000	0.32000
Orifice Factor, Del. Ha, (in. w.g.):	0.940	0.940	0.940
Sampling Rate Factor, (K3):	2.16	2.29	2.21

The Emission Measurement Group, Inc.

Table 3-7 (Pulp - SE)
SAMPLING and ANALYTICAL DATA, by Run

Pulp Dryer - Southeast Sidney, MT

CORPORATE DATA	
Company Name:	Holly Sugar Corporation
Division Name:	Montana Division
Plant/Fac. Name:	Sidney, MT
Dept. Name:	Environmental
Contact Name:	Mr. Tom Jacobsen
Contact's Title:	Environmental Engineer
Process Ident./Type:	Sugar Beet Processing
Fuel Type:	#6 Fuel Oil
Fd(dscf gas/10^6 BTU):	9220
Stack/Duct Identifier:	Pulp Dryer - Southeast
Equiv.Flue Dia,(ft.):	5.250
Hrs of Oper./Year:	4320

TEST CONDITIONS				
Test Operator (LN,FI):	Lynn, M.	Lynn, M.	Lynn, M.	Lynn, M.
Tech. Helper #1:	Floyd, J.	Floyd, J.	Floyd, J.	Floyd, J.
Test Date, (mm/dd/yy):	10/21/93	10/22/93	10/22/93	10/22/93
Run ID Number, (VDRR):	**6101**	**6102**	**6103**	**6104**
Time- Start, (24hr.):	20:56	9:34	15:27	19:24
- End, (24hr.):	21:16	13:36	17:46	21:50
Time of Test, (t, min.):	20.0	113.5	120.0	120.0
PROCESS LOAD DATA				
Max. Rtd. Cap., (TPH, Feed):	48.8	48.8	48.8	48.8
Feed Load, (TPH):	24.0	25.0	25.0	25.0
Test Cond., Feed, (%MRC):	49.20	51.25	51.25	51.25
SAMPLE VOLUME DATA				
Reference Diluent (CO2) %:	12.0	12.0	12.0	12.0
Reference Diluent (O2) %:	15.0	15.0	15.0	15.0
Console ID #:	CC-2	CC-2	CC-2	CC-2
Gas Meter ID Number:	6848398	6848398	6848398	6848398
Gas Mtr. Cal Factor, (Yo):	0.99650	0.99650	0.99650	0.99650
Volume,Gas Samp.@ Std.Cond,(dscf):	8.719	51.819	27.042	46.895
Corrected for Excess Leak,(acf):	9.165	54.983	29.744	50.673
At Meter Conditions, (acf):	9.165	54.983	29.744	50.673
Temperature, @ Gas Meter, (F):	57.60	62.70	79.70	69.80
Delta H Pres.@ Meter, (in.w.g.):	1.10	1.33	0.92	0.97
Pressure Barometeric.,Abs.,(in.Hg.):	27.920	27.915	27.835	27.810
Leak Ck.Result,Post,Excessive,(acf):	0.000	0.000	0.000	0.000
Leak Rate Result, (cfm):	0.000	0.000	0.000	0.000
At Vacuum, (in. Hg.):	14.00	14.00	14.00	23.50
High During Run, (in. Hg.):	5.00	17.80	2.80	5.80

The Emission Measurement Group, Inc.

Table 3-7 (Pulp - SE)
SAMPLING and ANALYTICAL DATA, by Run

STACK MOISTURE DATA				
Press.H2O Vap.@ Saturation,(in.Hg.):	0.2656	0.2430	0.2729	0.2656
Of Gas @ Silica Gel, (in. Hg.):	24.020	21.215	26.135	24.110
Temperature @ Silica Gel Imp., (°F):	41.80	39.50	42.50	41.80
Vacuum @ Silica Gel/Pump,(in.Hg.):	3.900	6.700	1.700	3.700
Volume H2O @ Silica Gel,(gm):	2.18	13.52	6.66	11.98
Condensed H2O @ Impingers,(ml.):	127.0	640.0	209.3	722.0
Total Vol. H2O Collected,(ml.):	129.18	653.52	215.96	733.98
FLUE GAS MOL. WT. & FLOWRATE DATA				
Area of Flue, (sq. ft.):	21.65	21.65	21.65	21.65
Pres., Duct, Static, (in. w.g.):	0.00	0.00	0.00	0.00
Pitobe ID #:	PM10-60	PM10-60	60-1	60-1
Pitot ID #:	PM10-60	PM10-60	60-1	60-1
Pitot Side ID #:	A	A	A	A
Pitot Coef., (Cp):	0.840	0.840	0.840	0.840
Density of Flue Gas, (lb/cf):	0.0641	0.0652	0.0682	0.0638
Molecular Weight, wet:	24.739	25.162	26.332	24.651
PARTICULATE SAMPLING DATA				
Isokinetic Sampling Rate, Final,(%):	133.75	90.19	47.30	107.13
" Point-by-Point, (Avg., %):	80.40	100.00	103.30	94.20
" Point-by-Point, (High, %):	111.20	111.40	114.60	119.00
" Point-by-Point, (Low, %):	99.90	20.20	88.10	87.80
Filter A ID #:	7480	7481	7485	7488
B ID #:	N/A	7484	N/A	N/A
Nozzle ID #:	PM10-10	PM10-10	10.2	10.2
Nozzle Diameter, (in.):	0.30100	0.30100	0.30100	0.30100
Orifice Factor, Del. Ha, (in. w.g.):	1.904	1.904	1.904	1.904
Sampling Rate Factor, (K3):	5.02	3.28	3.30	3.09

The Emission Measurement Group, Inc.

Table 3-7 (Pulp - SW)
SAMPLING and ANALYTICAL DATA, by Run

Pulp Dryer - Southwest Sidney, MT

CORPORATE DATA	
Company Name:	Holly Sugar Corporation
Division Name:	Montana Division
Plant/Fac. Name:	Sidney, MT
Dept. Name:	Environmental
Contact Name:	Mr. Tom Jacobsen
Contact's Title:	Environmental Engineer
Process Ident./Type:	Sugar Beet Processing
Fuel Type:	#6 Fuel Oil
Fd(dscf gas/10^6 BTU):	9220
Stack/Duct Identifier:	Pulp Dryer - Southwest
Equiv.Flue Dia.(ft.):	5.250
Hrs of Oper./Year:	4320

TEST CONDITIONS				
Test Operator (LN,FI):	Lynn, M.	Lynn, M.	Lynn, M.	Lynn, M.
Tech. Helper #1:	Floyd, J.	Floyd, J.	Floyd, J.	Floyd, J.
Test Date, (mm/dd/yy):	10/21/93	10/21/93	10/21/93	10/21/93
Run ID Number, (VDRR):	**5101**	**5102**	**5103**	**5104**
Time- Start, (24hr.):	21:08	9:43	15:24	19:27
- End, (24hr.):	21:33	13:35	17:43	21:59
Time of Test, (t, min.):	25.0	110.5	120.0	120.0
PROCESS LOAD DATA				
Max. Rtd. Cap., (TPH, Feed):	48.8	48.8	48.8	48.8
Feed Load, (TPH):	24.0	25.0	25.0	25.0
Test Cond., Feed, (%MRC):	49.20	51.25	51.25	51.25
SAMPLE VOLUME DATA				
Reference Diluent (CO2) %:	12.0	12.0	12.0	12.0
Reference Diluent (O2) %:	15.0	15.0	15.0	15.0
Console ID #:	JC-1	JC-1	JC-1	JC-1
Gas Meter ID Number:	352648	352648	352648	352648
Gas Mtr. Cal Factor, (Yo):	0.99650	0.99650	0.99650	0.99650
Volume,Gas Samp.@ Std.Cond,(dscf):	8.704	45.704	47.334	54.085
Corrected for Excess Leak,(acf):	9.021	48.808	53.503	58.278
At Meter Conditions, (acf):	9.021	48.808	53.503	58.278
Temperature, @ Gas Meter, (°F):	49.00	64.90	93.80	67.50
Delta H Pres.@ Meter, (in.w.g.):	0.18	0.35	0.36	0.39
Pressure Barometeric.,Abs.,(in.Hg.):	27.915	27.925	27.835	27.810
Leak Ck.Result,Post,Excessive,(acf):	0.000	0.000	0.000	0.000
Leak Rate Result, (cfm):	0.000	0.000	0.000	0.000
At Vacuum, (in. Hg.):	5.00	14.00	23.00	23.50
High During Run, (in. Hg.):	1.50	4.80	4.80	8.00

The Emission Measurement Group, Inc.

Table 3-7 (Pulp - SW Continued)
SAMPLING and ANALYTICAL DATA, by Run

TEST CONDITIONS				
Test Date, (mm/dd/yy):	10/21/93	10/21/93	10/21/93	10/21/93
Run ID Number, (VDRR):	**5101**	**5102**	**5103**	**5104**
STACK MOISTURE DATA				
Press.H2O Vap.@ Saturation,(in.Hg.):	0.2143	0.2365	0.3015	0.2576
Of Gas @ Silica Gel, (in. Hg.):	26.585	25.525	25.835	23.810
Temperature @ Silica Gel Imp., (°F):	36.30	38.80	45.10	41.00
Vacuum @ Silica Gel/Pump,(in.Hg.):	1.330	2.400	2.000	4.000
Volume H2O @ Silica Gel,(gm):	1.56	9.69	13.41	13.53
Condensed H2O @ Impingers,(ml.):	117.0	634.0	616.0	570.0
Total Vol. H2O Collected,(ml.):	118.56	643.69	629.41	583.53
FLUE GAS MOL. WT. & FLOWRATE DATA				
Area of Flue, (sq. ft.):	21.65	21.65	21.65	21.65
Pres., Duct, Static, (in. w.g.):	0.00	0.00	0.00	0.00
Pitobe ID #:	60-1	60-1	60-1	60-1
Pitot ID #:	60-1	60-1	60-1	60-1
Pitot Side ID #:	A	A	A	A
Pitot Coef., (Cp):	0.840	0.840	0.840	0.840
Density of Flue Gas, (lb/cf):	0.0647	0.0644	0.0648	0.0665
Molecular Weight, wet:	24.980	24.868	25.032	25.672
PARTICULATE SAMPLING DATA				
Isokinetic Sampling Rate, Final,(%):	139.59	103.82	93.58	97.80
" Point-by-Point, (Avg., %):	172.95	91.60	94.50	104.30
" Point-by-Point, (High, %):	240.00	181.80	127.20	118.60
" Point-by-Point, (Low, %):	105.90	42.50	34.10	94.70
Filter A ID #:	7479	7482	7486	7487
B ID #:	N/A	N/A	N/A	N/A
Nozzle ID #:	9.2	10.2	10.2	10.2
Nozzle Diameter, (in.):	0.28040	0.30100	0.30100	0.30100
Orifice Factor, Del. Ha, (in. w.g.):	0.940	0.940	0.940	0.940
Sampling Rate Factor, (K3):	1.75	1.52	1.50	1.62

HOLLY SUGAR CORPORATION
SIDNEY, MT FACTORY
OPERATING CONDITIONS 11/10/93

SUMMARY

PULP DRYERS

PULP DRYER No. 1 (South)	TONS WET PULP PER HOUR INPUT	*gallons per hou Fuel Oil Consu
10-21-93 RUNS 5101 thru 6101	24	275*
10-22-93 RUNS 5102 thru 6104	25	275*
PULP DRYER No. 2 (North)		
10-23-93 RUNS 7101 thru 8103	25	275*

* Data were collected of fuel oil consumed during testing by monitoring elevation changes in the fuel oil storage tank, temperature of the tank, and fuel oil deliveries. All testing was performed with only one unit (2 union boilers + 2 pulp dryers) on fuel oil in an attempt to get accurate informatio But calculated fuel oil consumption was highly variable though the process ran steady. Our best estimate of fuel oil consumed is based on recent data on Dryer No. 2 (North) over a number of days of operation with no other units on fuel oil. They had been averging approx. 275 gph at ≈225 TPH slice rate. The same method of tank measurement was employed, bu over periods of days rather than hours. Testing was performed at 220 to 224 TPH slice.

Filename: BEET13.WQ1
Date: 23-Jan-95
Facility: Holly Sugar Corporation
Location: Sidney, Montana
Source: #6 fuel oil-fired pulp dryer with dry scrubber w/skimmer fan and cyclone
Test date: October 19-23, 1993

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	212.8	208.4	207.2	
Northeast	Pressure	in. HG	27.825	27.82	27.85	
pulp	Moisture	%	38.5	38.86	42.53	
dryer	Oxygen	%	17.09	15.36	16.59	
	Volumetric flow, actual	acfm	38539	33209	34041	
	Volumetric flow, standard*	dscfm	17298	14913	14411	0
	Isokinetic variation	%	104.32	98.97	101.53	
Wet Pulp Feed Rate To Dryer		TPH	25	25	25	
	Pollutant concentrations:					
	Total PM	G/dscf	0.0876	0.068	0.1204	
	Total PM-10	G/dscf	0.0651	no data	no data	
	Filterable PM	G/dscf	0.0609	0.0596	0.0868	
	Condensible inorganic PM	G/dscf	0.0267	0.0084	0.0336	
	CO2	% dv	4.08	4.88	4.26	
	SO2	ppmdv	34.09	70.96	39.93	
	Pollutant mass flux rates:					
	Total PM	lb/hr	13.0	8.69	14.9	
	Total PM-10	lb/hr	9.65	no data	no data	
	Filterable PM	lb/hr	9.03	7.62	10.72	
	Condensible inorganic PM	lb/hr	3.96	1.07	4.15	
	CO2	lb/hr	4837	4988	4207	
	SO2	lb/hr	5.88	10.56	5.74	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Total PM	lb/ton	0.520	0.348	0.595	0.487
	Total PM-10	lb/ton	0.386	no data	no data	
	Filterable PM	lb/ton	0.361	0.305	0.429	0.365
	Condensible inorganic PM	lb/ton	0.158	0.043	0.166	0.122
	Filterable PM-10	lb/ton	0.228	no data	no data	
	CO2	lb/ton	193	200	168	187
	SO2	lb/ton	0.235	0.422	0.230	0.296
	Emission factors (METRIC UNITS):					AVERAGE
	Total PM	kg/Mg	0.260	0.174	0.297	0.244
	Total PM-10	kg/Mg	0.193	no data	no data	
	Filterable PM	kg/Mg	0.181	0.152	0.214	0.182
	Condensible inorganic PM	kg/Mg	0.0792	0.0215	0.0830	0.0612
	Filterable PM-10	kg/Mg	0.114	no data	no data	
	CO2	kg/Mg	96.7	99.8	84.1	93.5
	SO2	kg/Mg	0.118	0.211	0.115	0.148

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

TOTAL EMISSION FACTORS--NORTHEAST AND NORTHWEST STACKS

	Emission factors (ENGLISH UNITS):					AVERAGE
	Total PM	lb/ton	1.1	0.95	1.2	1.1
	*Total PM-10	lb/ton	0.77	0.72	0.67	0.72
	Filterable PM	lb/ton	0.63	0.77	0.91	0.77
	Condensible inorganic PM	lb/ton	0.42	0.19	0.26	0.29
	Filterable PM-10	lb/ton	0.46	0.54	0.40	0.47
	CO2	lb/ton	363	435	366	388
	SO2	lb/ton	0.47	0.95	0.47	0.63
	Emission factors (METRIC UNITS):					AVERAGE
	Total PM	kg/Mg	0.53	0.48	0.58	0.53
	*Total PM-10	kg/Mg	0.39	0.36	0.33	0.36
	Filterable PM	kg/Mg	0.32	0.38	0.45	0.38
	Condensible inorganic PM	kg/Mg	0.21	0.093	0.13	0.15
	Filterable PM-10	kg/Mg	0.23	0.27	0.20	0.23
	CO2	kg/Mg	182	218	183	194
	SO2	kg/Mg	0.23	0.47	0.23	0.31

*TOTAL PM-10 DOES NOT INCLUDE CONDENSIBLE ORGANIC PM

Filename: BEET13A.WQ1
Date: 08-Dec-94
Facility: Holly Sugar Corporation
Location: Sidney, Montana
Source: #6 fuel oil-fired pulp dryer with dry scrubber w/skimmer fan and cyclone
Test date: October 19-23, 1993

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	216.1	225.9	234.1	
Northwest	Pressure	in. HG	27.825	27.82	27.85	
pulp	Moisture	%	34.35	34.92	32.98	
dryer	Oxygen	%	15.68	15.49	16.16	
	Volumetric flow, actual	acfm	31428	39979	38709	
	Volumetric flow, standard*	dscfm	14985	18623	18369	0
	Isokinetic variation	%	88.41	98.97	97.37	
Wet Pulp Feed Rate To Dryer		TPH	25	25	25	
	Pollutant concentrations:					
	Total PM	G/dscf	0.1039	0.0946	0.0908	
	Total PM-10	G/dscf	ND	0.0567	0.0529	
	Filterable PM	G/dscf	0.0524	0.0724	0.0755	
	Condensible inorganic PM	G/dscf	0.0515	0.0222	0.0153	
	Filterable PM-10	G/dscf	ND	0.0345	0.0376	
	CO2	% dv	4.15	4.6	3.93	
	SO2	ppmdv	39.1	70.56	32.44	
	Pollutant mass flux rates:					
	Total PM	lb/hr	13.3	15.10	14.3	
	Total PM-10	lb/hr	ND	9.05	8.33	
	Filterable PM	lb/hr	6.73	11.56	11.89	
	Condensible inorganic PM	lb/hr	6.61	3.54	2.41	
	Filterable PM-10	lb/hr	ND	5.51	5.92	
	CO2	lb/hr	4262	5871	4948	
	SO2	lb/hr	5.84	13.11	5.94	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Total PM	lb/ton	0.534	0.604	0.572	0.570
	Total PM-10	lb/ton	ND	0.362	0.333	0.348
	Filterable PM	lb/ton	0.269	0.462	0.476	0.402
	Condensible inorganic PM	lb/ton	0.265	0.142	0.096	0.168
	Filterable PM-10	lb/ton	ND	0.220	0.237	0.229
	CO2	lb/ton	170	235	198	201
	SO2	lb/ton	0.234	0.524	0.238	0.332
	Emission factors (METRIC UNITS):					AVERAGE
	Total PM	kg/Mg	0.267	0.302	0.286	0.285
	Total PM-10	kg/Mg	ND	0.181	0.167	0.174
	Filterable PM	kg/Mg	0.135	0.231	0.238	0.201
	Condensible inorganic PM	kg/Mg	0.1323	0.0709	0.0482	0.0838
	Filterable PM-10	kg/Mg	ND	0.110	0.118	0.114
	CO2	kg/Mg	85.2	117.4	99.0	100.5
	SO2	kg/Mg	0.117	0.262	0.119	0.166

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET13B.WQ1
Date: 01-Feb-95
Facility: Holly Sugar Corporation
Location: Sidney, Montana
Source: #6 fuel oil-fired pulp dryer with dry scrubber w/skimmer fan and cyclone
Test date: October 19-23, 1993

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	222.5	219.4	213.4	211.8
Southeast	Pressure	in. HG	27.92	27.915	27.835	27.81
pulp	Moisture	%	41.1	37.27	27.34	42.44
dryer	Oxygen	%	14.17	14.1	13.92	13.57
	Volumetric flow, actual	acfm	33584	48757	39378	38003
	Volumetric flow, standard*	dscfm	14280	22177	20871	15980
	Isokinetic variation	%	133.75	90.19	47.3	107.13
Wet Pulp Feed Rate To Dryer		TPH	24	25	25	25
	Pollutant concentrations:					
	Total PM	G/dscf	0.1582	0.2133	0.1089	0.1372
	Total PM-10	G/dscf	0.0943	0.1494	ND	ND
	Filterable PM	G/dscf	0.1306	0.1281	0.0705	0.1047
	Condensible inorganic PM	G/dscf	0.0276	0.0852	0.0384	0.0325
	Filterable PM-10	G/dscf	0.0667	0.0642	ND	ND
	CO2	% dv	5.32	5.2	5.57	6.18
	SO2	ppmdv	71.31	72.19	88.02	82.43
	Pollutant mass flux rates:					
	Total PM	lb/hr	19.4	40.55	19.5	18.8
	Total PM-10	lb/hr	11.54	28.40	ND	ND
	Filterable PM	lb/hr	15.99	24.35	12.61	14.34
	Condensible inorganic PM	lb/hr	3.38	16.20	6.87	4.45
	Filterable PM-10	lb/hr	8.16	12.20	ND	ND
	CO2	lb/hr	5207	7903	7967	6768
	SO2	lb/hr	10.16	15.97	18.33	13.14
	Emission factors (ENGLISH UNITS):					AVERAGE
	Total PM	lb/ton	void	1.62	void	0.752	1.19
	Total PM-10	lb/ton	void	1.136	void	ND	
	Filterable PM	lb/ton	void	0.974	void	0.574	0.774
	Condensible inorganic PM	lb/ton	void	0.648	void	0.178	0.413
	Filterable PM-10	lb/ton	void	0.488	void	ND	
	CO2	lb/ton	void	316	void	271	293
	SO2	lb/ton	void	0.639	void	0.526	0.582
	Emission factors (METRIC UNITS):					AVERAGE
	Total PM	kg/Mg	void	0.811	void	0.376	0.593
	Total PM-10	kg/Mg	void	0.568	void	ND	
	Filterable PM	kg/Mg	void	0.487	void	0.287	0.387
	Condensible inorganic PM	kg/Mg	void	0.324	void	0.0890	0.206
	Filterable PM-10	kg/Mg	void	0.244	void	ND	
	CO2	kg/Mg	void	158	void	135	147
	SO2	kg/Mg	void	0.319	void	0.263	0.291

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT
Run 1 and 3 PM measurements are void because of isokinetics.

TOTAL EMISSION FACTORS FOR SOUTHEAST AND SOUTHWEST STACKS

	Emission factors (ENGLISH UNITS):						AVERAGE
	Total PM	lb/ton	void	2.2	2.2	1.8	2.1
	*Total PM-10	lb/ton	void	2.3	1.5	1.4	1.7
	Filterable PM	lb/ton	void	1.4	1.8	1.4	1.5
	Condensible inorganic PM	lb/ton	void	0.80	0.38	0.46	0.55
	Filterable PM-10	lb/ton	void	1.5	1.1	0.97	1.2
	CO2	lb/ton	void	567	532	618	572
	SO2	lb/ton	void	1.2	1.2	1.1	1.2
	Emission factors (METRIC UNITS):						AVERAGE
	Total PM	kg/Mg	void	1.1	1.1	0.92	1.0
	*Total PM-10	kg/Mg	void	1.1	0.73	0.71	0.86
	Filterable PM	kg/Mg	void	0.69	0.89	0.69	0.76
	Condensible inorganic PM	kg/Mg	void	0.40	0.19	0.23	0.27
	Filterable PM-10	kg/Mg	void	0.74	0.54	0.48	0.59
	CO2	kg/Mg	void	283	266	309	286
	SO2	kg/Mg	void	0.62	0.62	0.57	0.60

*TOTAL PM-10 DOES NOT INCLUDE CONDENSIBLE ORGANIC PM IN THIS TEST

Filename: BEET13C.WQ1
Date: 01-Feb-95
Facility: Holly Sugar Corporation
Location: Sidney, Montana
Source: #6 fuel oil-fired pulp dryer with dry scrubber w/skimmer fan and cyclone
Test date: October 19-23, 1993

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported				
			Run 1	Run 2	Run 3	Run 4	
1	Stack temperature	Deg F	248.7	235.9	238.4	235.4	
Southwest	Pressure	in. HG	27.915	27.925	27.835	27.81	
pulp	Moisture	%	39.08	39.88	38.51	33.7	
dryer	Oxygen	%	14.12	14.08	14.37	13.7	
	Volumetric flow, actual	acfm	29735	40999	42701	43148	
	Volumetric flow, standard*	dscfm	12591	17455	18467	20189	
	Isokinetic variation	%	139.59	103.82	93.58	97.8	
Wet Pulp Feed Rate To Dryer		TPH	24	25	25	25	
	Pollutant concentrations:						
	Total PM	G/dscf	0.1276	0.0916	0.1709	0.1585	
	Total PM-10	G/dscf	ND	ND	0.1154	0.103	
	Filterable PM	G/dscf	0.0431	0.0666	0.1409	0.1179	
	Condensible inorganic PM	G/dscf	0.0845	0.0250	0.0300	0.0406	
	Filterable PM-10	G/dscf	ND	ND	0.0854	0.0624	
	CO2	% dv	5.45	5.24	5.25	6.27	
	SO2	ppmdv	72.5	86.83	84.48	75.17	
	Pollutant mass flux rates:						
	Total PM	lb/hr	void	13.70	27.1	27.4	
	Total PM-10	lb/hr	void	ND	18.3	17.8	
	Filterable PM	lb/hr	void	9.96	22.3	20.4	
	Condensible inorganic PM	lb/hr	void	3.74	4.75	7.03	
	Filterable PM-10	lb/hr	void	ND	13.5	10.8	
	CO2	lb/hr	void	6268	6645	8675	
	SO2	lb/hr	void	15.1	15.6	15.1	
	Emission factors (ENGLISH UNITS):						AVERAGE
	Total PM	lb/ton	void	0.548	1.082	1.097	0.909
	Total PM-10	lb/ton	void	ND	0.731	0.713	0.722
	Filterable PM	lb/ton	void	0.399	0.892	0.816	0.702
	Condensible inorganic PM	lb/ton	void	0.150	0.190	0.281	0.207
	Filterable PM-10	lb/ton	void	ND	0.541	0.432	0.486
	CO2	lb/ton	void	251	266	347	288
	SO2	lb/ton	void	0.605	0.623	0.606	0.611
	Emission factors (METRIC UNITS):						AVERAGE
	Total PM	kg/Mg	void	0.274	0.541	0.549	0.455
	Total PM-10	kg/Mg	void	ND	0.365	0.356	0.361
	Filterable PM	kg/Mg	void	0.199	0.446	0.408	0.351
	Condensible inorganic PM	kg/Mg	void	0.0748	0.0950	0.141	0.103
	Filterable PM-10	kg/Mg	void	ND	0.270	0.216	0.243
	CO2	kg/Mg	void	125	133	174	144
	SO2	kg/Mg	void	0.302	0.311	0.303	0.305

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Run 1 PM measurements are void because of isokinetics.

APPENDIX N

REPORT EXCERPTS FROM REFERENCE 14

(Holly Sugar Corporation, June 1991)

EMISSION PERFORMANCE TESTING OF FOUR BOILERS, THREE DRYRERS AND ONE COOLER

Book 1 of 2

SITE: HOLLY SUGAR CORPORATION
Santa Maria, California

DATE: JUNE 1991

Prepared For:

HOLLY SUGAR CORPORATION
2820 W. Betteravia Road
Santa Maria, California 93455

Contact: Ralph Medema
(805) 925-8633

Prepared By:

THOMAS ROONEY
(213) 540-4676

WESTERN ENVIRONMENTAL SERVICES
1010 South Pacific Coast Highway
Redondo Beach, California 90277

TABLE 2.14 CONTINUOUS MONITORING DATA

SITE: HOLLY SUGAR
UNIT: DRYER #1
DATE: JUNE 13, 1991

TIME	FUNCTION	NOx ppm	O(2) %	CO ppm	CO(2) %	SO(2) ppm	NOx (1) ppm	CO (1) ppm
825	System Check	Vacuum Check						
828	Zero	0	0.04	1	0.36	0		
	Mid	94.7	5.20	233	4.36	19		
	High	222	15	495	10	51.1		
1021	Test #1							
1119	Average 58 min	88	14.00	360	4.90	0	227.36	930
1124	Zero	1	0.03	1	0.39	0.6		
	Mid	93.4	5.21	226.8	4.59	19.3		
	High	220	14.62	496	10.32	50.9		
1348	Test #2							
1428	Average 40 min	70	15.77	126	4.50	0	241.66	436
1433	Zero	-1	0.06	-1	0.41	0.5		
	Mid	93	5.12	228	4.66	20.1		
	High	219.2	14	496.3	10	51.2		
1521	Test #3							
1627	Average 66 min	75	15.30	160	4.80	0	238.07	509
1642	Zero	-2	0.04	-2	0.40	0.1		
	Mid	93.6	5.09	231.4	5.14	18.9		
	High	219	14.32	501	10.10	50.2		
1718	System	Vacuum Check						

Span Gases	
NOx, ppm	220.7,94.3
CO, ppm	230.7,500
O(2), %	14.51,5.11
CO(2), %	10.34,4.40
SO(2), ppm	19.54,51.7

* NOx (1) and CO (1) - values corrected to 3% oxygen.

TABLE 2.14a HYDROCARBON TEST DATA

DRYER #1
June 13, 1991 ?

SITE: Dryer #3
DATE: June 11, 1991 DATE ANALYZED: June 13, 1991

Standards	RT	Area	ppm
C1	0.8	31963	21.5
C2	1.277	51659	21.4
C3	2.32	79668	21.4
C4	5.08	106031	21.6
C5	11.93	122802	20.9
C6	15.8	6789	21.0

Test #1	Area	Concentration	Test #2	Area	Concentration
C1	26978	18.15	C1	11877	7.99
C2	28395	11.76	C2	29504	12.22
C3	9399	2.52	C3	3613	0.97
C4	0	0.00	C4	0	0.00
C5	0	0.00	C5	0	0.00
C6	0	0.00	C6	0	0.00

Test #3	Area	Concentration	Average	Concentration
C1	7949	5.35	C1	10.49
C2	25294	10.48	C2	11.49
C3	12838	3.45	C3	2.31
C4	0	0.00	C4	0.00
C5	0	0.00	C5	0.00
C6	0	0.00	C6	0.00

TABLE 2.15 PARTICULATE SAMPLING

SITE: Holly Sugar Dryer #1
DATE: June 13, 1991

STACK PARAMETERS	TEST 1	TEST 2	TEST 3	AVERAGE
Barometric Pressure "Hg	29.95	29.95	29.95	29.95
Static Pressure "H20	-0.70	-0.70	-0.70	-0.70
CO2 %	4.90	4.50	4.80	4.73
O2 %	14.00	15.77	15.30	15.02
N2 %	81.1	79.73	79.9	80.24
CO ppm	360	126	160	215.33
Stack Diameter "	39.5	39.5	39.5	39.50
Stack Temperature F	242	219	218	226.33
Stack Pressure "Hg	29.90	29.90	29.90	29.90
TEST CONDITIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Sample Volume Ft3	40.899	40.595	38.904	40.13
Meter F	72	81	74	75.67
Nozzle Dia "	0.245	0.245	0.245	0.25
Time Min	60	60	60	60.00
Points	24	24	24	24.00
Pitot Tube Factor cp	0.84	0.84	0.84	0.84
Orfice Press "H2O	1.74	1.69	1.57	1.67
Condensate mls	483	388	368	413.00
Velocity Pressure "H2O	1.015	0.938	0.88	0.94
Meter Calibration	1.02	1.02	1.02	1.02
TEST CALCULATIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Water Vapor SDCF	22.411	18.003	17.075	19.16
Gas Sampled SDCF	40.992	40.006	38.830	39.94
Moisture %	35.35	31.04	30.54	32.31
Molecular Weight Dry	29.34	29.35	29.38	29.36
Molecular Weight Wet	25.33	25.83	25.90	25.69
Gas Velocity Ft/Sec	69.65	65.22	63.03	65.97
Flow Rate ACFM	35562	33299	32182	33681
Flow Rate DSCFM	17019	17574	17131	17242
Isokinetics %	102.8	97.2	96.8	98.92

TABLE 2.15a PARTICULATE ANALYSIS

SITE: Holly Sugar Dryer #1
DATE: June 13, 1991

ANALYTICAL DATA	TEST 1	TEST 2	TEST 3	AVERAGE
FRONT HALF				
Probe mg	343.3	541.8	258.0	381.03
Filter mg	72.4	47.2	54.7	58.10
Blanks mg	0.5	0.5	0.5	0.50
Subtotal mg	415.2	588.5	312.2	438.63
BACK HALF				
Impingere Inorg mg	137.9	56.8	32.1	75.60
Impingers Org mg	94.1	1.3	0.0	31.80
Blank mg	0.5	0.5	0.5	0.50
Subtotal mg	231.5	57.6	31.6	106.90
Total Weight Gain mg	646.7	646.1	343.8	545.53

EMISSION DATA	TEST 1	TEST 2	TEST 3	AVERAGE
FRONT HALF				
Grs/SDCF	0.1563	0.2270	0.1241	0.1691
Lbs/Hr	22.782	34.167	18.203	25.051
BACK HALF				
Grs/SDCF	0.0871	0.0222	0.0126	0.0406
Lbs/Hr	12.702	3.344	1.842	5.963

TOTAL EMISSIONS	TEST 1	TEST 2	TEST 3	AVERAGE
Grs/SDCF	0.2434	0.2492	0.1366	0.2097
Lbs/Hrs	35.484	37.511	20.046	31.014

TABLE 2.16 O2 TRAVERSE

SITE: Holly Sugar
UNIT: Dryer #1
DATE: June 13, 1991

LOCATION POINT	TIME	NOx ppm	O(2) %	CO ppm	CO(2) %	SO(2) ppm
SE PORT						
1	1522	70.0	15.25	160	4.50	0
2	1527	70.0	15.00	180	5.10	0
3	1532	70.0	15.75	150	4.65	0
4	1538	72.5	15.25	150	4.80	0
5	1545	73.0	15.75	120	4.50	0
6	1553	72.5	15.50	140	4.70	0
SW PORT						
1	1556	72.5	14.75	150	5.30	0
2	1601	75.0	15.25	150	4.50	0
3	1606	70.0	14.80	200	5.10	0
4	1611	72.5	15.00	180	5.00	0
5	1617	71.0	15.25	160	4.95	0
6	1625	69.5	15.50	150	4.65	0
AVERAGE		71.5	15.3	157.5	4.8	0.0

Span Gases	
NOx, ppm	197.6,896
CO, ppm	230.7,946
O(2), %	14.51,7.44
CO(2), %	10.34,8.40
SO(2), ppm	51.7,99

TABLE 2.17 CONTINUOUS MONITORING DATA

SITE: HOLLY SUGAR
UNIT: DRYER #2
DATE: JUNE 12, 1991

TIME	FUNCTION	NOx ppm	O(2) %	CO ppm	CO(2) %	SO(2) ppm	NOx (1) ppm	CO (1) ppm
820	System Check	Vacuum Check						
825	Zero	0	0.06	1	0.40	-0.1		
	Mid	94.4	5.14	229	5.21	19.2		
	High	198	14	948	10	50.9		
1019	Test #1							
1120	Average 61 min	50	16.03	200	4.20	0	182.53	730
1122	Zero	1	0.05	-1	0.38	0.1		
	Mid	93.8	5.06	223.7	4.68	20.3		
	High	194	14.16	947	10.32	51.4		
1214	Test #2							
1312	Average 58 min	46	16.81	205	2.31	0	197.42	889
1315	Zero	1	0.06	-2	0.39	0.1		
	Mid	96	5.07	225	4.54	19.5		
	High	219.9	14	510.3	11	52.7		
1604	Test #3							
1650	Average 46 min	51	15.79	200	4.63	0	175.77	696
1655	Zero	2	0.06	-1	0.40	0.1		
	Mid	94.4	5.14	223.7	4.41	19.2		
	High	219	14.36	500	9.65	51.2		
1716	System	Vacuum Check						

Span Gases	
NOx, ppm	220.7,94.3,197.6
CO, ppm	230.7,500,946
O(2), %	14.51,5.11
CO(2), %	10.34,4.40
SO(2), ppm	51.7,19.54

* NOx (1) and CO (1) – values corrected to 3% oxygen.

TABLE 2.17a HYDROCARBON TEST DATA

SITE: Dryer #2
DATE: June 12, 1991 DATE ANALYZED: June 13, 1991

Standards	RT	Area	ppm
C1	0.695	8573	21.5
C2	1.11	33018	21.4
C3	2.04	57788	21.4
C4	4.45	68045	21.6
C5	10.47	80451	20.9
C6	14.97	6578	21.0

Test #1	Area	Concentration	Test #2	Area	Concentration
C1	12107	30.36	C1	3878	9.73
C2	6096	3.95	C2	12913	8.37
C3	16566	6.13	C3	21096	7.81
C4	8802	2.79	C4	15591	4.95
C5	0	0.00	C5	0	0.00
C6	0	0.00	C6	0	0.00

Test #3	Area	Concentration	Average	Concentration
C1	2581	6.47	C1	15.52
C2	9476	6.14	C2	6.15
C3	27316	10.12	C3	8.02
C4	14288	4.54	C4	4.09
C5	0	0.00	C5	0.00
C6	0	0.00	C6	0.00

TABLE 2.18 PARTICULATE SAMPLING

SITE: Holly Sugar Dryer #2
DATE: June 12, 1991

STACK PARAMETERS	TEST 1	TEST 2	TEST 3	AVERAGE
Barometric Pressure "Hg	29.95	29.95	29.95	29.95
Static Pressure "H20	-0.65	-0.65	-0.65	-0.65
CO2 %	4.20	2.31	4.63	3.71
O2 %	16.03	16.81	15.79	16.21
N2 %	79.77	80.88	79.58	80.08
CO ppm	200	205	200	201.67
Stack Diameter "	39.5	39.5	39.5	39.50
Stack Temperature F	245	246	245	245.33
Stack Pressure "Hg	29.90	29.90	29.90	29.90
TEST CONDITIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Sample Volume Ft3	36.765	36.051	36.476	36.43
Meter F	71	73	74	72.67
Nozzle Dia "	0.245	0.245	0.245	0.25
Time Min	60	60	60	60.00
Points	24	24	24	24.00
Pitot Tube Factor cp	0.84	0.84	0.84	0.84
Orfice Press "H2O	1.42	1.36	1.44	1.41
Condensate mls	312	288	289	296.33
Velocity Pressure "H2O	0.773	0.806	0.825	0.80
Meter Calibration	1.02	1.02	1.02	1.02
TEST CALCULATIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Water Vapor SDCF	14.864	13.720	13.768	14.12
Gas Sampled SDCF	36.889	36.032	36.395	36.44
Moisture %	28.72	27.58	27.45	27.91
Molecular Weight Dry	29.31	29.04	29.37	29.24
Molecular Weight Wet	26.06	26.00	26.25	26.10
Gas Velocity Ft/Sec	60.05	61.44	61.81	61.10
Flow Rate ACFM	30661	31371	31562	31198
Flow Rate DSCFM	16110	16724	16880	16571
Isokinetics %	97.8	92.0	92.0	93.93

TABLE 2.18a PARTICULATE ANALYSIS

SITE: Holly Sugar Dryer #2
DATE: June 12, 1991

ANALYTICAL DATA	TEST 1	TEST 2	TEST 3	AVERAGE
FRONT HALF				
Probe mg	162.6	193.1	153.8	169.83
Filter mg	55.3	43.4	9.9	36.20
Blanks mg	0.5	0.5	0.5	0.50
Subtotal mg	217.4	236.0	163.2	205.53
BACK HALF				
Impingers Inorg mg	91.2	65.1	27.4	61.23
Impingers Org mg	2.0	1.0	1.6	1.53
Blank mg	0.5	0.5	0.5	0.50
Subtotal mg	92.7	65.6	28.5	62.27
Total Weight Gain mg	310.1	301.6	191.7	267.80

EMISSION DATA	TEST 1	TEST 2	TEST 3	AVERAGE
FRONT HALF				
Grs/SDCF	0.0909	0.1011	0.0692	0.0871
Lbs/Hr	12.548	14.476	10.003	12.342
BACK HALF				
Grs/SDCF	0.0388	0.0281	0.0121	0.0263
Lbs/Hr	5.350	4.024	1.747	3.707

TOTAL EMISSIONS	TEST 1	TEST 2	TEST 3	AVERAGE
Grs/SDCF	0.1297	0.1292	0.0813	0.1134
Lbs/Hrs	17.898	18.500	11.750	16.050

TABLE 2.19 O2 TRAVERSE

SITE: Holly Sugar
UNIT: Dryer #2
DATE: June 12, 1991

LOCATION POINT	TIME	NOx ppm	O(2) %	CO ppm	CO(2) %	SO(2) ppm
SW PORT						
1	1020	60.0	15.00	190	4.35	0
2	1023	50.5	14.00	290	4.50	0
3	1025	50.7	14.20	270	4.80	0
4	1027	50.7	14.20	270	4.65	0
5	1030	60.0	14.10	280	4.95	0
6	1033	50.5	14.50	260	4.80	0
SE PORT						
1	1036	45.0	15.00	250	4.00	0
2	1045	50.0	15.00	140	4.00	0
3	1054	34.0	15.25	200	3.80	0
4	1103	50.0	15.10	120	3.80	0
5	1110	47.0	15.50	200	3.00	0
6	1119	35.0	15.75	250	3.20	0
AVERAGE		48.6	14.8	226.7	4.2	0.0

Span Gases	
NOx, ppm	197.6,896
CO, ppm	230.7,946
O(2), %	14.51,7.44
CO(2), %	10.34,8.40
SO(2), ppm	51.7,99

TABLE 2.20 CONTINUOUS MONITORING DATA

SITE: HOLLY SUGAR
UNIT: DRYER #3
DATE: JUNE 11, 1991

TIME	FUNCTION	NOx ppm	O(2) %	CO ppm	CO(2) %	SO(2) ppm	NOx (1) ppm	CO (1) ppm
750	System Check	Vacuum Check						
755	Zero	0.00	0.06	0	0.52	0.4		
	Mid	96.20	5.11	227	4.68	20.6		
	High	197	14.37	940	11	51.4		
1052	Test #1							
1158	Average 66 min	61	13.90	230	4.10	0	155.62	586
1202	Zero	-3	0.09	-2	0.42	0		
	Mid	95.8	5.07	224.6	4.88	52.4		
	High	197	14.21	947	10.80	98.5		
1308	Test #2							
1404	Average 56 min	61	13.90	230	4.10	0	155.62	586
1406	Zero	-3	0.04	0	0.42	-0.4		
	Mid	96	5.11	229	4.92	51.2		
	High	199.9	14	947.1	11	93.7		
1544	Test #3							
1655	Average 71 min	69	13.97	250	6.10	0	177.50	643
1657	Zero	-2	0.09	-1	0.45	-0.2		
	Mid	92.3	5.05	227.6	5.5	51.4		
	High	197	14.17	947	10.15	96		
1725	System	Vacuum Check						

Span Gases	
NOx, ppm	94.3,197.6
CO, ppm	230.7,946
O(2), %	14.51,5.11
CO(2), %	10.34,4.40
SO(2), ppm	51.7,99

* NOx (1) and CO (1) – values corrected to 3% oxygen.

TABLE 2.20a HYDROCARBON TEST DATA

SITE: Dryer #3
DATE: June 11, 1991 DATE ANALYZED: June 13, 1991

Standards	RT	Area	ppm
C1	0.695	8573	21.5
C2	1.11	33018	21.4
C3	2.04	57788	21.4
C4	4.45	68045	21.6
C5	10.47	80451	20.9
C6	14.97	6578	21.0

Test #1	Area	Concentration	Test #2	Area	Concentration
C1	4618	11.58	C1	7599	19.06
C2	21866	14.17	C2	22772	14.76
C3	13135	4.86	C3	11236	4.16
C4	28332	8.99	C4	13400	4.25
C5	0	0.00	C5	0	0.00
C6	0	0.00	C6	0	0.00

Test #3	Area	Concentration	Average	Concentration
C1	6474	16.24	C1	15.62
C2	22739	14.74	C2	14.56
C3	16886	6.25	C3	5.09
C4	15257	4.84	C4	6.03
C5	0	0.00	C5	0.00
C6	0	0.00	C6	0.00

TABLE 2.21 PARTICULATE SAMPLING

SITE: Holly Sugar Dryer #3
DATE: June 11, 1991

STACK PARAMETERS	TEST 1	TEST 2	TEST 3	AVERAGE
Barometric Pressure "Hg	28.90	28.90	28.90	28.90
Static Pressure "H20	-0.07	-0.07	-0.07	-0.07
CO2 %	4.10	4.10	6.10	4.77
O2 %	13.90	13.90	13.97	13.92
N2 %	82	82	79.93	81.31
CO ppm	230	230	250	236.67
Stack Diameter "	39.5	39.5	39.5	39.50
Stack Temperature F	225	216	212	217.67
Stack Pressure "Hg	28.89	28.89	28.89	28.89
TEST CONDITIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Sample Volume Ft3	26.700	32.951	33.485	31.05
Meter F	85	91	83	86.33
Nozzle Dia "	0.2	0.245	0.245	0.23
Time Min	60	60	60	60.00
Points	24	24	24	24.00
Pitot Tube Factor cp	0.84	0.84	0.84	0.84
Orfice Press "H2O	0.66	1.08	1.17	0.97
Condensate mls	193	223	316	244.00
Velocity Pressure "H2O	0.595	0.607	0.644	0.55
Meter Calibration	1.02	1.02	1.02	1.02
TEST CALCULATIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Water Vapor SDCF	8.955	10.347	14.662	11.32
Gas Sampled SDCF	25.142	30.722	31.688	29.18
Moisture %	26.26	25.19	31.63	27.70
Molecular Weight Dry	29.21	29.21	29.53	29.32
Molecular Weight Wet	26.27	26.39	25.89	26.18
Gas Velocity Ft/Sec	52.62	48.15	50.20	50.32
Flow Rate ACFM	26869	24583	25634	25695
Flow Rate DSCFM	14525	13661	13096	13761
Isokinetics %	110.9	96.0	103.3	103.40

TABLE 2.21a PARTICULATE ANALYSIS

SITE: Holly Sugar Dryer #3
DATE: June 11, 1991

ANALYTICAL DATA	TEST 1	TEST 2	TEST 3	AVERAGE
FRONT HALF				
Probe mg	292.9	286.0	258.9	279.27
Filter mg	22.5	41.4	68.0	43.97
Blanks mg	0.5	0.5	0.5	0.50
Subtotal mg	314.9	326.9	326.4	322.73
BACK HALF				
Impingers Inorg mg	12.0	11.8	17.7	13.83
Impingers Org mg	2.0	1.9	1.3	1.73
Blank mg	0.5	0.5	0.5	0.50
Subtotal mg	13.5	13.2	18.5	15.07
Total Weight Gain mg	328.4	340.1	344.9	337.80
EMISSION DATA	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
FRONT HALF				
Grs/SDCF	0.1933	0.1642	0.1589	0.1721
Lbs/Hr	24.043	19.211	17.828	20.360
BACK HALF				
Grs/SDCF	0.0083	0.0066	0.0090	0.0080
Lbs/Hr	1.031	0.776	1.010	0.939
TOTAL EMISSIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Grs/SDCF	0.2015	0.1708	0.1679	0.1801
Lbs/Hrs	25.073	19.986	18.838	21.299

TABLE 2.22 O2 TRAVERSE

SITE: Holly Sugar
UNIT: Dryer #3
DATE: June 11, 1991

LOCATION POINT	TIME	NOx ppm	O(2) %	CO ppm	CO(2) %	SO(2) ppm
SW PORT						
1	1053	94.0	14.30	190	4.65	0
2	1059	89.0	14.30	180	4.45	0
3	1105	84.0	14.30	185	4.35	0
4	1111	70.0	14.30	170	3.70	0
5	1117	64.0	14.90	120	3.30	0
6	1123	64.0	14.95	120	3.20	0
NE PORT						
1	1127	62.5	15.20	120	3.00	0
2	1132	62.5	15.25	98	3.00	0
3	1137	62.5	15.50	95	2.90	0
4	1142	63.0	15.75	90	2.80	0
5	1149	63.0	15.90	70	2.80	0
6	1157	63.0	16.00	60	2.70	0
AVERAGE		70.1	15.1	124.8	3.4	0.0

Span Gases	
NOx, ppm	197.6,896
CO, ppm	230.7,946
O(2), %	14.51,7.44
CO(2), %	10.34,8.40
SO(2), ppm	51.7,99

TABLE 2.23 PARTICULATE SAMPLING

SITE: Holly Suger Cooler Stack
DATE: June 10, 1991

STACK PARAMETERS	TEST 1	TEST 2	TEST 3	AVERAGE
Barometric Pressure "Hg	29.80	29.80	29.80	29.80
Static Pressure "H20	-0.50	-0.50	-0.50	-0.50
CO2 %	0.00	0.00	0.00	0.00
O2 %	20.90	20.90	20.90	20.90
N2 %	79.1	79.1	79.1	79.10
CO ppm	0	0	0	0.00
Stack Diameter "	61.5	61.5	61.5	61.50
Stack Temperature F	70	70	70	70.00
Stack Pressure "Hg	29.76	29.76	29.76	29.76
TEST CONDITIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Sample Volume Ft3	36.88	35.279	35.149	35.77
Meter F	78	81	74	77.67
Nozzle Dia "	0.5	0.5	0.5	0.50
Time Min	60	60	60	60.00
Points	24	24	24	24.00
Pitot Tube Factor cp	0.84	0.84	0.84	0.84
Orfice Press "H2O	1.34	1.21	1.22	1.26
Condensate mls	20	19	18	19.00
Velocity Pressure "H2O	0.533	0.478	0.49	0.50
Meter Calibration	1.02	1.02	1.02	1.02
TEST CALCULATIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Water Vapor SDCF	0.928	0.882	0.835	0.88
Gas Sampled SDCF	36.313	34.533	34.857	35.23
Moisture %	2.49	2.49	2.34	2.44
Molecular Weight Dry	28.84	28.84	28.84	28.84
Molecular Weight Wet	28.57	28.57	28.58	28.57
Gas Velocity Ft/Sec	41.39	39.20	39.68	40.09
Flow Rate ACFM	51234	48519	49110	49621
Flow Rate DSCFM	48758	46175	46809	47248
Isokinetics %	18.5	18.6	18.5	18.53

TABLE 2.23a PARTICULATE ANALYSIS

SITE: Holly Suger Cooler Stack
DATE: June 10, 1991

ANALYTICAL DATA	TEST 1	TEST 2	TEST 3	AVERAGE
FRONT HALF				
Probe mg	261.3	72.6	65.9	133.27
Filter mg	3.1	8.2	7.7	6.33
Blanks mg	0.5	0.5	0.5	0.50
Subtotal mg	263.9	80.3	73.1	139.10
BACK HALF				
Impingers Inorg mg	2.6	1.5	1.2	1.77
Impingers Org mg	0.0	0.0	0.5	0.17
Blank mg	0.5	0.5	0.5	0.50
Subtotal mg	2.1	1.0	1.2	1.43
Total Weight Gain mg	266.0	81.3	74.3	140.53
EMISSION DATA	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
FRONT HALF				
Grs/SDCF	0.1121	0.0359	0.0324	0.0601
Lbs/Hr	46.830	14.190	12.973	24.665
BACK HALF				
Grs/SDCF	0.0009	0.0004	0.0005	0.0006
Lbs/Hr	0.373	0.177	0.213	0.254
TOTAL EMISSIONS	**TEST 1**	**TEST 2**	**TEST 3**	**AVERAGE**
Grs/SDCF	0.1130	0.0363	0.0329	0.0607
Lbs/Hrs	47.203	14.367	13.186	24.919

BETTERAVIA BYPRODUCTS
24 HOUR SHIFT REPORT

DAY #49- Mon. DATE JUN 1 0 1991

[illegible] 200	BULK TOTAL	SMALL WHSE	LARGE WHSE	PELLET WHSE	PRESSED PULP DUMPED	BY-PASS DRY SCALE	PRESS WATER OVERFLOW	PULSAIRE
STOP 8 AM	63005070	38528	374209	091122	01095.7	19272.3	00776.0	05121.3
MIDNIGHT	62987415	23625	374209	091122	01095.7	19272.3	00776.0	05113.4
4 PM	62971494	07868	374208	091122	01095.7	19272.4	00776.0	05105.2
8 AM	62958540	04387	374208	091122	01094.8	19271.7	00776.0	05098.0
TOTAL	469.325	TONS PRODUCED						

65.3

4.025

MOLASSES ON PULP	MOLASSES INVENTORY PLANT TANK READINGS		
141.4985	15 FT 9½ IN	77.0	TONS
082.3905	15 FT 1½ IN	80.0	TONS
031.3917	15 FT 2 IN	80.0	TONS
979.7599	13 FT 2 IN	69.0	TONS
161.7386	TOTAL USED		

[illegible]	#1 DRIER	#2 DRIER	#3 DRIER
STOP 8 AM	185699.8	162609.5	0789667
MIDNIGHT	185630.2	162609.5	0789030
4 PM	185560.8	162609.6	0788494
8AM	185522.9	162555.6	078??9.7

NATURAL GAS METERS LARGE	NATURAL GAS METERS SMALL	PG&E MAIN	SUGAR PLANT MAIN	SUGAR PLANT WELLS	BLOCK 5	BLOCK 6
093953	898570	1835	8402	3689	1689	0000
093953	898567	1796	8401	3689	1689	0000
093953	898565	1796	8401	3689	1689	00.00
093953	898560	1776	8400	3688	1689	0000

MOLASSES INVENTORY STORAGE TANK READINGS		
6 FT ½ IN	385	TONS
6 FT 7 IN	415	TONS
6 FT ¾ IN	382	TONS
6 FT 6 3/16 IN	411	TONS

[illegible]

[illegible]

OIL TEMPERATURE	148.66°	
PRESSED PULP MOISTURE	75.3375	%
DRY BULK MOISTURE	10.758	%

ALUMINUM SULFATE @ $0.077/LB 8,812.5 LBS

SALES		
BULK	274.14	TONS
LIME	113.70	TONS

[illegible] RR CAR OR TRUCK #	TONS
940-13	25.10
920-059	28.51
920-055	28.19

[illegible] TOTAL USED - 4.5615 TONS		
12-8	3,211	LBS
4-12	3182	LBS
8-4	2,230	LBS

TIME	COMMENTS
	7 buckets [illegible]
	950 [illegible] " 4.025 TONS
12:10	1 Load of Alum in 2' 4"
1:25	Alum Truck out 7' 7"
3:20	Chlorine back on Auto

D00027

BETTERAVIA BYPRODUCTS
24 HOUR SHIFT REPORT

DAY #51-Wed. DATE: JUN 1 2 1991

SCALE FACTOR: 20.0

	BULK TOTAL	[illegible] SMALL WHSE	LARGE WHSE	PELLET WHSE	PRESSED PULP DUMPED	BY-PASS DRY SCALE	PRESS WATER OVERFLOW	PULSAIRE
STOP 8 AM	63103188	08220	374231	091122	01095.7	19272.7	00776.0	05167.8
MIDNIGHT	63088020	93833	374222	091122	01095.7	19272.5	00776.0	05160.6
4 PM	63071397	78868	374222	091122	01095.7	19272.5	00776.0	05152.6
8 AM	63054850	75695	374219	091122	01095.7	19272.5	00776.0	05144.8
TOTAL	489.13	TONS PRODUCED						

MOLASSES ON PULP	MOLASSES INVENTORY PLANT TANK READINGS		
491.8910	14 FT 10¼ IN	63.0	TONS
433.7485	13 FT 1 IN	58.0	TONS
374.4197	14 FT IN	62.5	TONS
316.0898	14 FT 11½ IN	65.0	TONS
175.8012	TOTAL USED		

438
5.75

[illegible]	#1 DRIER	#2 DRIER	#3 DRIER
STOP 8 AM	186084.0	162729.3	079064.3
MIDNIGHT	186019.1	162729.3	079064.3
4 PM	185954.7	162716.0	079064.3
8 AM	185896.2	162664.7	079064.3

[illegible]

NATURAL GAS METERS LARGE	SMALL
094507	898591
094180	898589
093953	898583
093953	898580

PG&E MAIN	SUGAR PLANT MAIN	SUGAR PLANT WELLS	BLOCK 5	BLOCK 6
1958	8405	3691	1689	0000
1930	8405	3690	1689	0000
1918	8404	3690	1689	0000
1897	8403	3690	1689	0000

MOLASSES INVENTORY STORAGE TANK READINGS		
5 FT 2 IN	322	TONS
5 FT 5¾ IN	340	TONS
5 FT 0 IN	310	TONS
5 FT 2½ IN	325	TONS

MOLASSES SHIPPED

RR CAR OR TRUCK #	TONS
920-058	28.22
920-059	28.16

TIME	COMMENTS
9:30	CHlorine System OFF,
	Need New Parts
9:30	SC1-62-System ON
10:10	Increase exchanger 4°
3:15	DECREASED EXCHANGER TO 140°
	#1 Drier on oil #2 on gas
2:35	10 950 buckets thru Tail
	Screw 5.75 TONS

24 HOUR AVERAGES

OIL TEMPERATURE	148.66°	
PRESSED PULP MOISTURE	73.7	%
DRY BULK MOISTURE	10.721	%

ALUMINUM SULFATE @ $0.077/LB 10,312.5 LBS

LIME APPLIED TO PULP

TOTAL USED - 4,747 TONS		
12-8	3,230	LBS
4-12	3118	LBS
8-4	3,146	LBS

SALES

BULK	335.16	TONS
LIME	47.30	TONS

D00033

BETTERAVIA BYPRODUCTS
24 HOUR SHIFT REPORT

DAY # 52-THURS. DATE: JUN 13 1991

DAY OPERATOR Robert. SWING OPERATOR Steve GRAVEYARD OPERATOR

	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
#1 MOISTURE	10.6	10.8	11.0	9.4	9.0	9.2	9.4	9.6	10.4	10.5														
#1 RECYCLE	6	6	6	6	6	6	6	6	6	6	6													
#1 MAIN FAN	4¼	4¼	4¼	4¼	4¼	3¾	3¾	3¾	3¾	4¾	4¾													
#1 TAIL TEMP	245	246	249	247	229	225	223	225	225	225														
#1 THROAT TEMP	1243	1276	1232	1236	1090	1018	1039	1044	1092	1023														
#1 SCALE GATE SETTING	26.7	26.7	26.7	26.7	25.3	25.3	25.3	25.0	25.0	25.0	25.2													
#2 MOISTURE	11.8	11.6	11.2	9.6	9.4	9.4	9.6	9.0	10.4	10.2														
#2 RECYCLE	5	5	5	5	5	5	5¼	5¼	5	5	5													
#2 MAIN FAN	5	5¼	5¼	5¼	5¼	5¼	5¼	5¼	5¼	5¼	5¼													
#2 TAIL TEMP	234	240	246	233	232	238	230	227	246	247														
#2 THROAT TEMP	1198	1111	1200	991	1049	1175	1061	793	1311	1374														
#2 SCALE GATE SETTING	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN													
#3 MOISTURE																								
#3 RECYCLE																								
#3 MAIN FAN																								
#3 TAIL TEMP																								
#3 THROAT TEMP																								
#3 SCALE GATE SETTING																								
FACTORY SLICE RATE	255 TPH								Hole TPH 255															
MOLASSES RATE (TPH)	7.68	7.80	7.70	7.60	7.50	7.72	7.70	6.96	7.32	7.62														
PRESS PULP MOISTURE	75.0	73.7	72.3	72.5	72.3	72.2	71.8	72.0	72.0	74.2														
DRY PULP MOISTURE	11.0	11.4	11.0	9.4	9.0	7.4	9.3	9.6	10.5	10.4														
STOP DOG SETTINGS	4-5	2-6 2-5	4-3	3-5	3-1	4-4	4-3	4-3	4-5	4-5														
TRANSFER WATER TEMP	67°	68°	67°	67°	68°	66°	68°	66°	67°	67°														
SHIFT AVERAGES		10.0125 DRY PULP			72.725 PRESS PULP			2 SPEK	DRY PULP		PRESS PULP		SPEK	DRY PULP		PRESS PULP		SPEK					

JUNE 11, 1991

BETTERAVIA BYPRODUCTS
24 HOUR SHIFT REPORT

SCALE FACTOR:	20.0	BULK PRODUCTION			PRESSED PULP DUMPED	BY-PASS DRY SCALE	PRESS WATER OVERFLO
	BULK TOTAL	SMALL WHSE	LARGE WHSE	PELLET WHSE			
STOP 8 AM	63054850	75695	374219	091122	01095.7	19272.5	00776.
MIDNIGHT	63037517	59464	374213	091122	01095.7	19272.5	00776.
4 PM	63020617	42745	374212	091122	01095.7	19272.5	00776.
8 AM	63005070	38525	374209	091122	01095.7	19272.5	00776.0
TOTAL:	507.575	TONS PRODUCED					

TONS 497.8 − 9.775

	OIL CONSUMPTION			NATURAL GAS METERS		PG&E	SUGAR
	#1 DRIER	#2 DRIER	#3 DRIER	LARGE	SMALL	MAIN	MAIN
STOP 8 AM	185896.2	162664.7	079064.3	093953	898580	1897	8403
MIDNIGHT	185830.2	162609.5	079058.6	093953	898575	1875	8403
4 PM	185763.0	162609.5	079010.8	093953	898572	1856	8402
8AM	185699.8	162609.5	078965.7	093953	898570	1835	8402

Wed
Tues
Tues

Barrels
42.0 gal/1 Barrel

INFORMATION REQUIRED BY SUGAR FACTORY

24 HOUR AVERAGES

OIL TEMPERATURE	150°	
PRESSED PULP MOISTURE	73.733	%
DRY BULK MOISTURE	10.408	%

ALUMINUM SULFATE
@ $0.077/LB 10,875 LBS

SALES		
BULK	150.31	TONS
LIME	114.89	TONS

MOLASSES SHIPPED

RR CAR OR TRUCK #
940-14
920-056
940-15
#920-57

LIME APPLIED TO PULP

TOTAL USED = 4.920.5 TONS

12–8	3130	LBS
4–12	3322	LBS
8–4	3,189	LBS

Filename: BEET14.WQ1
Date: 16-Dec-94
Facility: Holly Sugar Corporation
Location: Santa Maria, California
Source: Fuel oil-fired pulp dryer with two cyclones in series and an air recycling (recirculation) system
Test date: June 1991

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	242	219	218	
Dryer #1	Pressure	In. HG	29.9	29.9	29.9	
	Moisture	%	35.35	31.04	30.54	
	Oxygen	%	14	15.77	15.3	
	Volumetric flow, actual	acfm	35562	33299	32182	
	Volumetric flow, standard*	dscfm	17281	17844	17396	0
	Isokinetic variation	%	102.8	97.2	96.8	
Wet Pulp Feed Rate To Dryer		TPH	32.6	32.2	32.1	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.1563	0.227	0.1241	
	Condensible inorganic PM	G/dscf	0.0518	0.0217	0.0126	
	Condensible organic PM	G/dscf	0.0353	0.0004967	0	
	CO2	% dv	4.9	4.5	4.8	
	SO2	ppmdv	0	0	0	
	CO	ppmdv	360	126	160	
	NOx	ppmdv	88	70	75	
	THC	ppmdv	49.23	35.34	36.66	
	Methane	ppmdv	18.15	7.99	5.35	
	Pollutant mass flux rates:					
	NUMBER OF EMISSION POINTS		2	2	2	
	Filterable PM	lb/hr	46.3	69.44	37.0	
	Condensible inorganic PM	lb/hr	15.34	6.64	3.76	
	Condensible organic PM	lb/hr	10.47	0.15	0.00	
	CO2	lb/hr	11606	11006	11445	
	SO2	lb/hr	0.00	0.00	0.00	
	CO	lb/hr	54.27	19.61	24.28	
	NOx	lb/hr	21.79	17.90	18.69	
	THC as methane	lb/hr	4.25	3.15	3.19	
	Methane	lb/hr	1.57	0.71	0.47	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	1.42	2.2	1.15	1.58
	Condensible inorganic PM	lb/ton	0.47	0.21	0.117	0.26
	Condensible organic PM	lb/ton	0.32	0.0047	0	0.109
	CO2	lb/ton	356	342	357	351
	SO2	lb/ton	ND	ND	ND	ND
	CO	lb/ton	1.66	0.61	0.76	1.01
	NOx	lb/ton	0.67	0.56	0.58	0.60
	THC as methane	lb/ton	0.13	0.098	0.099	0.11
	Methane	lb/ton	0.048	0.022	0.014	0.028
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.71	1.08	0.58	0.79
	Condensible inorganic PM	kg/Mg	0.24	0.103	0.059	0.132
	Condensible organic PM	kg/Mg	0.16	0.0024	0	0.054
	CO2	kg/Mg	178	171	178	176
	SO2	kg/Mg	ND	ND	ND	ND
	CO	kg/Mg	0.83	0.30	0.38	0.51
	NOx	kg/Mg	0.33	0.28	0.29	0.30
	THC as methane	kg/Mg	0.065	0.049	0.050	0.055
	Methane	kg/Mg	0.024	0.011	0.007	0.014

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT
**FLOW RATES DISAGREE WITH RATES SHOWN IN REPORT.
***THC CONCENTRATIONS DISAGREE WITH CONC. SHOWN IN REPORT

Filename: BEET14A.WQ1
Date: 26-Jan-95
Facility: Holly Sugar Corporation
Location: Santa Maria, California
Source: Fuel oil-fired pulp dryer with two cyclones in series and an air recycling (recirculation) system
Test date: June 1991

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	245	246	245	
Dryer #2	Pressure	in. HG	29.9	29.9	29.9	
	Moisture	%	28.72	27.58	27.45	
	Oxygen	%	16.03	16.81	15.79	
	Volumetric flow, actual	acfm	30661	31371	31562	
	Volumetric flow, standard*	dscfm	16357	16980	17138	0
	Isokinetic variation	%	97.8	92	92	
Wet Pulp Feed Rate To Dryer		TPH	32.3	32.3	32.3	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0909	0.1011	0.0692	
	Condensible inorganic PM	G/dscf	0.0380	0.0277	0.0114	
	Condensible organic PM	G/dscf	0.000833	0.0004251	0.0006676	
	CO2	% dv	4.2	2.31	4.63	
	SO2	ppmdv	0	0	0	
	CO	ppmdv	200	205	200	
	NOx	ppmdv	50	46	51	
	THC	ppmdv	67.81	69.7	67.27	
	Methane	ppmdv	30.36	9.73	6.47	
	Pollutant mass flux rates:					
	NUMBER OF EMISSION POINTS		2	2	2	
	Filterable PM	lb/hr	25.5	29.43	20.3	
	Condensible inorganic PM	lb/hr	10.65	8.06	3.36	
	Condensible organic PM	lb/hr	0.23	0.12	0.20	
	CO2	lb/hr	9416	5376	10876	
	SO2	lb/hr	0.00	0.00	0.00	
	CO	lb/hr	28.54	30.37	29.90	
	NOx	lb/hr	11.72	11.19	12.52	
	THC as methane	lb/hr	5.54	5.91	5.76	
	Methane	lb/hr	2.48	0.83	0.55	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.79	0.91	0.63	0.78
	Condensible inorganic PM	lb/ton	0.33	0.25	0.10	0.23
	Condensible organic PM	lb/ton	0.0072	0.0038	0.0061	0.0057
	CO2	lb/ton	292	166	337	265
	SO2	lb/ton	ND	ND	ND	ND
	CO	lb/ton	0.88	0.94	0.93	0.92
	NOx	lb/ton	0.36	0.35	0.39	0.37
	THC as methane	lb/ton	0.17	0.18	0.18	0.18
	Methane	lb/ton	0.077	0.026	0.017	0.040
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.39	0.46	0.31	0.39
	Condensible inorganic PM	kg/Mg	0.16	0.12	0.052	0.11
	Condensible organic PM	kg/Mg	0.0036	0.0019	0.0030	0.0029
	CO2	kg/Mg	146	83	168	132
	SO2	kg/Mg	ND	ND	ND	ND
	CO	kg/Mg	0.44	0.47	0.46	0.46
	NOx	kg/Mg	0.18	0.17	0.19	0.18
	THC as methane	kg/Mg	0.086	0.092	0.089	0.089
	Methane	kg/Mg	0.038	0.013	0.009	0.020

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT
**FLOW RATES DISAGREE WITH RATES SHOWN IN REPORT.
***THC CONCENTRATIONS DISAGREE WITH CONC. SHOWN IN REPORT

Filename: BEET14B.WQ1
Date: 26-Jan-95
Facility: Holly Sugar Corporation
Location: Santa Maria, California
Source: Fuel oil-fired pulp dryer with two cyclones in series and an air recycling (recirculation) system
Test date: June 11, 1991

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	225	216	212	
Dryer #3	Pressure	in. HG	28.89	28.89	28.89	
	Moisture	%	26.26	25.19	31.63	
	Oxygen	%	13.9	13.9	13.97	
	Volumetric flow, actual	acfm	26869	24583	25634	
	Volumetric flow, standard*	dscfm	14746	13870	13296	0
	Isokinetic variation	%	110.9	96	103.3	
Wet Pulp Feed Rate To Dryer		TPH	32.3	32.3	32.3	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.1933	0.1642	0.1589	
	Condensible inorganic PM	G/dscf	0.00711	0.00568	0.00838	
	Condensible organic PM	G/dscf	0.00119	0.0009153	0.0006158	
	CO2	% dv	4.1	4.1	6.1	
	SO2	ppmdv	0	0	0	
	CO	ppmdv	230	230	250	
	NOx	ppmdv	61	61	69	
	THC	ppmdv	90.46	78.06	83.83	
	Methane	ppmdv	11.58	19.06	16.24	
	Pollutant mass flux rates:					
	NUMBER OF EMISSION POINTS		2	2	2	
	Filterable PM	lb/hr	48.9	39.04	36.2	
	Condensible inorganic PM	lb/hr	1.80	1.35	1.91	
	Condensible organic PM	lb/hr	0.300	0.218	0.140	
	CO2	lb/hr	8287	7794	11117	
	SO2	lb/hr	0.00	0.00	0.00	
	CO	lb/hr	29.6	27.8	29.0	
	NOx	lb/hr	12.9	12.1	13.1	
	THC as methane	lb/hr	6.66	5.41	5.57	
	Methane	lb/hr	0.853	1.32	1.08	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	1.5	1.2	1.1	1.3
	Condensible inorganic PM	lb/ton	0.056	0.042	0.059	0.052
	Condensible organic PM	lb/ton	0.0093	0.0067	0.0043	0.0068
	CO2	lb/ton	257	241	344	281
	SO2	lb/ton	ND	ND	ND	ND
	CO	lb/ton	0.92	0.86	0.90	0.89
	NOx	lb/ton	0.40	0.38	0.41	0.39
	THC as methane	lb/ton	0.21	0.17	0.17	0.18
	Methane	lb/ton	0.026	0.041	0.033	0.034
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.76	0.60	0.56	0.64
	Condensible inorganic PM	kg/Mg	0.028	0.021	0.030	0.026
	Condensible organic PM	kg/Mg	0.0046	0.0034	0.0022	0.0034
	CO2	kg/Mg	128	121	172	140
	SO2	kg/Mg	ND	ND	ND	ND
	CO	kg/Mg	0.46	0.43	0.45	0.45
	NOx	kg/Mg	0.20	0.19	0.20	0.20
	THC as methane	kg/Mg	0.10	0.084	0.086	0.091
	Methane	kg/Mg	0.013	0.020	0.017	0.017

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT
**FLOW RATES DISAGREE WITH RATES SHOWN IN REPORT.
***THC CONCENTRATIONS DISAGREE WITH CONC. SHOWN IN REPORT

Filename: BEET14c.WQ1
Date: 26-Jan-95
Facility: Holly Sugar Corporation
Location: Santa Maria, California
Source: Cooler--test void due to isokinetics
Test date: June 10, 1991

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	70	70	70	
Cooler	Pressure	in. HG	29.76	29.76	29.76	
	Moisture	%	2.49	2.49	2.34	
	Oxygen	%	20.9	20.9	20.9	
	Volumetric flow, actual	acfm	51234	48519	49110	
	Volumetric flow, standard*	dscfm	49504	46880	47524	0
	Isokinetic variation	%	18.5	18.6	18.5	
Dried pulp produced (to cooler)		TPH	10.0	10.0	10.0	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.1121	0.0359	0.0324	
	Condensible inorganic PM	G/dscf	0.00090	0.00040	0.00035	
	Condensible organic PM	G/dscf	0	0	0.0001471	
	CO2	% dv	0	0	0	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	47.6	14.4	13.2	
	Condensible inorganic PM	lb/hr	0.382	0.161	0.144	
	Condensible organic PM	lb/hr	ND	ND	0.0599	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	4.8	1.4	1.3	2.5
	Condensible inorganic PM	lb/ton	0.038	0.016	0.014	0.023
	Condensible organic PM	lb/ton	ND	ND	0.0060	ND
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	2.4	0.72	0.66	1.3
	Condensible inorganic PM	kg/Mg	0.019	0.0080	0.0072	0.011
	Condensible organic PM	kg/Mg	ND	ND	0.0030	ND

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT
**FLOW RATES DISAGREE WITH RATES SHOWN IN REPORT.

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03-03 Date/Time 12/14/94

Project Title Sugar Beet Processing AP-42

Signature Brian Bunger Verified by _____ (signature/date)

Phone Contact ☐ Meeting Notes ☐ Work Sheet ☒

Page ___ of ___

HOLLY SUGAR, SANTA MARIA, CA

TEST DATES: JUNE 11-13, 1991

DRYER #1	TIME	DATE	SLICE RATE (TPH)	PRESSED PULP MOISTURE (%)	DRIED PULP MOISTURE (%)
RUN 1	10:21-11:19	6/13	255	72.4	10.2
RUN 2	13:48-14:28	6/13	255	71.8	9.3
RUN 3	15:21-16:27	6/13	255	72.0	10.0

$$\%\ \text{SOLIDS} = \frac{\text{DRY PULP PRODUCED} - \text{DRY PULP MOISTURE} \times \text{DRY PULP PRODUCED}}{\text{BEET SLICE RATE}}$$

DRY PULP PRODUCTION RATE = 10.0125 TPH

RUN 1: $\%\ \text{SOLIDS} = \frac{10.0125 - 0.102 \times 10.0125}{255} = 3.53\ \%$

RUN 2: $\%\ \text{SOLIDS} = \frac{10.0125 - 0.093 \times 10.0125}{255} = 3.56\ \%$

RUN 3: $\%\ \text{SOLIDS} = \frac{10.0125 - 0.10 \times 10.0125}{255} = 3.53\ \%$

$$\text{WET PULP FEED TO DRYER (TPH)} = \frac{\text{BEET SLICE RATE} \times \%\ \text{SOLIDS}}{1 - \left(\frac{\text{WET PULP MOISTURE}}{100}\right)}$$

RUN 1: $\text{PROCESS RATE} = \frac{255 \times 0.0353}{1 - \left(\frac{72.4}{100}\right)} = 32.6\ \text{TPH}$

RUN 2: $\text{PROCESS RATE} = \frac{255 \times 0.0356}{1 - (71.8/100)} = 32.2\ \text{TPH}$

RUN 3: $\text{PROCESS RATE} = \frac{255 \times 0.0353}{1 - (72/100)} = 32.1\ \text{TPH}$

FOR DRYERS 2 AND 3, WET PULP FEED (TPH) = AVG. OF DRYER 1 = 32.3 TPH ⇒ ASSUMED

APPENDIX O

REPORT EXCERPTS FROM REFERENCE 15

(Great Lakes Sugar Company, December 8, 1992)

affiliated Environmental services, inc.

Great Lakes Sugar Co.
Attn: Mr. Joe Flynn
3rd Floor Plaza North
P.O. Box 1348
Saginaw, MI 48605

REPORT TO GREAT LAKES SUGAR CO.

ON

STACK PARTICULATE SAMPLES
COLLECTED ON THE PULP DRIER AT
FREMONT, OH

SUBMITTED BY

AFFILIATED ENVIRONMENTAL SERVICES, INC.
3606 VENICE RD.
SANDUSKY, OH 44870

DATE OF TESTING: 12-2-92

DATE OF REPORT: 12-8-92

Joe Gillingham
FIELD TEST SUPERVISOR

Don Dauch
MANAGER, AIR SAMPLING DIVISION

AFFILIATED ENVIRONMENTAL SERVICES, INC.
3606 VENICE RD.
SANDUSKY, OHIO 44870

PLANT NAME: Great Lakes Sugar Pulp Dryer

DATE OF TEST: 12-2-92

STACK SAMPLING PARAMETERS

TEST RUN NUMBER 1

MINUTES OF TEST	60
VOLUME OF GAS COLLECTED cubic feet	44.646
METER CALIBRATION FACTOR Y	.93
BAROMETRIC PRESSURE	30.12
PRESSURE DIFFERENTIAL ACROSS ORIFICE DELTA H	1.48
METER TEMPERATURE (+460)	559
STACK STATIC PRESSURE (HG)	.0029
STACK TEMPERATURE (+460)	727
AVERAGE SQUARE ROOT OF VELOCITY HEAD	.855
VOLUME OF IMPINGER WATER COLLECTED ml	455
WEIGHT OF SILICA COLLECTED gms	10
AREA OF SAMPLING NOZZLE square feet	.0003436
PITOT TUBE COEFFICIENT	.84
AREA OF STACK square feet	28.27
CARBON DIOXIDE (DRY FRACTION)	5.5
CARBON MONOXIDE (DRY FRACTION)	0
OXYGEN (DRY FRACTION)	15.5
NITROGEN (DRY FRACTION)	79

STACK PARTICULATE DATA

GAS VOLUME STANDARD CONDITIONS DSCF	39.607
VOLUME OF WATER VAPOR cubic feet	21.902
PERCENT MOISTURE IN STACK GAS	35.6
DRY GAS MOLECULAR WEIGHT	29.5
STACK GAS MOLECULAR WEIGHT	25.406
VELOCITY OF STACK GAS feet per second	59.836
FLOW RATE OF STACK GAS DSCFH	2867553
FLOW RATE OF STACK GAS DSCFM	47793
ISOKINICITY %	113.7
WEIGHT GAIN OF IMPINGERS mg	0
WEIGHT GAIN OF FILTER mg	71.1
WEIGHT GAIN OF PROBE WASH mg	58.8
PARTICULATES COLLECTED POUNDS/HOUR	20.71
PARTICULATES COLLECTED GRAINS/DSCF	.0504
PARTICULATES COLLECTED POUNDS/DSCF	7.2234E-06

AFFILIATED ENVIRONMENTAL SERVICES, INC.
3606 VENICE RD.
SANDUSKY, OHIO 44870

PLANT NAME: Great Lakes Sugar

DATE OF TEST: 12-2-92

STACK SAMPLING PARAMETERS

TEST RUN NUMBER 2

MINUTES OF TEST	60
VOLUME OF GAS COLLECTED cubic feet	43.251
METER CALIBRATION FACTOR Y	.93
BAROMETRIC PRESSURE	30.12
PRESSURE DIFFERENTIAL ACROSS ORIFICE DELTA H	1.41
METER TEMPERATURE (+460)	563
STACK STATIC PRESSURE (HG)	.0029
STACK TEMPERATURE (+460)	733
AVERAGE SQUARE ROOT OF VELOCITY HEAD	.864
VOLUME OF IMPINGER WATER COLLECTED ml	430
WEIGHT OF SILICA COLLECTED gms	10
AREA OF SAMPLING NOZZLE square feet	.0003409
PITOT TUBE COEFFICIENT	.84
AREA OF STACK square feet	28.27
CARBON DIOXIDE (DRY FRACTION)	5.5
CARBON MONOXIDE (DRY FRACTION)	0
OXYGEN (DRY FRACTION)	15.5
NITROGEN (DRY FRACTION)	79

STACK PARTICULATE DATA

GAS VOLUME STANDARD CONDITIONS DSCF	38.09
VOLUME OF WATER VAPOR cubic feet	20.724
PERCENT MOISTURE IN STACK GAS	35.2
DRY GAS MOLECULAR WEIGHT	29.5
STACK GAS MOLECULAR WEIGHT	25.452
VELOCITY OF STACK GAS feet per second	60.66
FLOW RATE OF STACK GAS DSCFH	2901155
FLOW RATE OF STACK GAS DSCFM	48353
ISOKINICITY %	109
WEIGHT GAIN OF IMPINGERS mg	0
WEIGHT GAIN OF FILTER mg	98.1
WEIGHT GAIN OF PROBE WASH mg	65.6
PARTICULATES COLLECTED POUNDS/HOUR	27.47
PARTICULATES COLLECTED GRAINS/DSCF	.0661
PARTICULATES COLLECTED POUNDS/DSCF	9.4678E-06

AFFILIATED ENVIRONMENTAL SERVICES, INC.
3606 VENICE RD.
SANDUSKY, OHIO 44870

PLANT NAME: Great Lakes Sugar

DATE OF TEST: 12-2-92

STACK SAMPLING PARAMETERS

TEST RUN NUMBER 3

MINUTES OF TEST	60
VOLUME OF GAS COLLECTED cubic feet	39.961
METER CALIBRATION FACTOR Y	.93
BAROMETRIC PRESSURE	30.12
PRESSURE DIFFERENTIAL ACROSS ORIFICE DELTA H	1.12
METER TEMPERATURE (+460)	565
STACK STATIC PRESSURE (HG)	.0029
STACK TEMPERATURE (+460)	741
AVERAGE SQUARE ROOT OF VELOCITY HEAD	.856
VOLUME OF IMPINGER WATER COLLECTED ml	412
WEIGHT OF SILICA COLLECTED gms	13
AREA OF SAMPLING NOZZLE square feet	.0003409
PITOT TUBE COEFFICIENT	.84
AREA OF STACK square feet	28.27
CARBON DIOXIDE (DRY FRACTION)	6.5
CARBON MONOXIDE (DRY FRACTION)	0
OXYGEN (DRY FRACTION)	13.5
NITROGEN (DRY FRACTION)	80

STACK PARTICULATE DATA

GAS VOLUME STANDARD CONDITIONS DSCF	35.044
VOLUME OF WATER VAPOR cubic feet	20.018
PERCENT MOISTURE IN STACK GAS	36.4
DRY GAS MOLECULAR WEIGHT	29.58
STACK GAS MOLECULAR WEIGHT	25.365
VELOCITY OF STACK GAS feet per second	60.529
FLOW RATE OF STACK GAS DSCFH	2810605
FLOW RATE OF STACK GAS DSCFM	46843
ISOKINICITY %	103.4
WEIGHT GAIN OF IMPINGERS mg	0
WEIGHT GAIN OF FILTER mg	72.5
WEIGHT GAIN OF PROBE WASH mg	51.9
PARTICULATES COLLECTED POUNDS/HOUR	21.97
PARTICULATES COLLECTED GRAINS/DSCF	.0546
PARTICULATES COLLECTED POUNDS/DSCF	7.8179E-06

Post-it™ brand fax transmittal memo 7671 | # of pages ▸

To	Don Dauch	From	Joe Flynn
Co.		Co.	
Dept.		Phone #	
Fax #		Fax #	

Don Dauch

A.E.S.

Ref: Fremont stack test

Don:

pulp DRIER STANDARD formulars:

wet pulp to DRIER (tons/hr) =
(process weight rate)

$$\text{tons beet sliced (tons/hr)} \times \text{\% solids in beets} \div \left(1 - \frac{\text{wet pulp moisture (\%)}}{100}\right)$$

process weight DATA

tons beets sliced	171 tons/hr
wet pulp moisture	77.2% moisture
% solids	6%

$$\text{process weight RATE} = \frac{171 \text{ tons/hr} \times 0.06}{1 - \left(\frac{77.2}{100}\right)} =$$

45 tons/hr

19

Allowable discharge tons/hr =

Ohio EPA formula

$55(45)^{.11} - 40 = 43.602$ lbs/hr

$55(PWR)^{.11} - 40$

If you have any questions give me a call (513) 777-7300

Joe

12 PAGE LAB REPORT GREAT LAKES SUGAR CO. PLANT: FREMONT CAMPAIGN 1991-92 PAGE: 1

		DIFFUSER #1 SHIFTS			DIFFUSER #2 SHIFTS			BEETS SLICED			SUGAR IN COSSETES				STEAM ON BEETS					
DATE	DAYS	1ST	2ND	3RD	1ST	2ND	3RD	TOTAL DAY	TONS SLICED TODATE	AVE.	% SUGAR DAY	% SUGAR TODATE	TONS SUGAR DAY	TONS SUGAR TODATE	TEMP C BTS	TEMP C COSS	% STEAM DAY	% STEAM TD	PRODUCT DAY	PRODUCT TD
11/29	57.62	701	727	652	633	701	689	4103	222714	3865	15.52	16.94	636.79	37733.57	5	21	2.73	2.13	112.0	4742.1
11/30	58.62	678	659	718	527	618	686	3886	226600	3866	14.84	16.91	576.68	38310.25	6	24	3.07	2.15	119.3	4861.4
12/01	59.62	688	661	656	662	619	574	3860	230460	3865	14.90	16.87	575.14	38885.39	7	25	3.07	2.16	118.5	4979.9
12/02	60.62	636	678	687	483	632	580	3696	234156	3863	15.35	16.85	567.34	39452.73	7	24	2.90	2.17	107.2	5087.1
12/03	61.62	662	679	570	637	657	423	3628	237784	3859	14.69	16.82	532.95	39985.68	5	24	3.24	2.19	117.5	5204.6
12/04	62.62	670	686	668	576	668	662	3930	241714	3860	15.95	16.80	626.84	40612.52	2	20	3.07	2.20	120.7	5325.3
12/05	63.62	680	638	615	613	576	618	3740	245454	3858	15.46	16.78	578.20	41190.72	3	15	2.05	2.20	76.7	5402.0
WK 9								26843		3835	15.25		4093.94							
TD									245454	3858		16.78		41190.72				2.20		5402.0
12/06	64.62	690	602	663	499	437	688	3579	249033	3854	15.68	16.77	561.19	41751.91	3	20	2.90	2.21	103.8	5505.8
12/07	65.62	694	653	615	566	616	563	3707	252740	3852	16.03	16.75	594.23	42346.14	6	22	2.73	2.22	101.2	5607.0
12/08	66.62	670	645	641	641	653	629	3879	256619	3852	15.86	16.74	615.21	42961.35	8	25	2.90	2.23	112.5	5719.5
12/09	67.62	649	632	698	344	241	189	2753	259356	3835	16.00	16.73	440.48	43399.15	7	24	2.90	2.24	79.8	5799.3
12/10	68.62	616	499	640	488	555	434	3232	262588	3827	16.39	16.73	529.72	43928.87	7	25	3.07	2.25	99.2	5898.5
12/11	69.62	644	639	652	577	536	407	3455	266043	3821	16.62	16.73	574.22	44503.09	7	26	3.24	2.26	111.9	6010.4
12/12	70.62	568	655	653	468	515	602	3461	269504	3816	16.69	16.73	577.64	45080.73	7	26	3.24	2.27	112.1	6122.5
WK 10								24066		3438	16.18		3892.69							
TD									269504	3816		16.73		45080.73				2.27		6122.5
12/13	71.62	612	661	683	449	316	662	3383	272887	3810	16.98	16.73	574.43	45655.16	7	28	3.58	2.29	121.1	6243.6
12/14	72.62	671	634	665	666	608	625	3869	276756	3811	16.87	16.73	652.70	46307.86	7	24	2.90	2.30	112.2	6355.8
12/15	73.62	675	469	648	651	290	621	3354	280110	3805	17.22	16.74	577.56	46885.42	5	22	2.90	2.30	97.3	6453.1
12/16	74.62	700	581	307	320	314	332	2554	282647	3788	16.66	16.74	425.50	47308.07	5	22	2.90	2.31	74.1	6527.2
12/17	75.62	667	586	643	506	513	332	3247	285894	3781	16.83	16.74	546.47	47854.54	4	25	3.58	2.32	116.2	6643.4
12/18	76.62	657	585	590	366	580	585	3363	289257	3775	17.09	16.74	574.74	48429.28	1	24	3.92	2.34	131.8	6775.2
12/19	77.62	598	632	643	560	622	661	3716	292973	3774	16.35	16.74	607.57	49036.85	1	24	3.92	2.36	145.7	6920.9
WK 11								23486		3355	16.86		3958.97							
TD									292973	3774		16.74		49036.85				2.36		6920.9
12/20	78.62	655	655	653	566	588	609	3726	296699	3774	16.11	16.73	600.26	49637.11	2	25	3.92	2.38	146.1	7067.0
12/21	79.62	603	655	655	486	660	647	3706	300405	3773	16.42	16.73	608.53	50245.64	3	25	3.75	2.40	139.0	7206.0
12/22	80.62	673	669	651	663	655	645	3956	304361	3775	16.38	16.72	647.99	50893.63	5	24	3.24	2.41	128.2	7334.2
12/23	81.62	470	607	632	513	584	641	3447	307808	3771	16.45	16.72	567.03	51460.66	4	26	3.75	2.42	129.3	7463.5
12/24	82.62	637	653	656	647	442	662	3697	311505	3770	16.38	16.71	605.57	52066.23	4	25	3.58	2.44	132.4	7595.9
12/25	83.62	633	305	649	636	218	661	3102	314607	3762	16.45	16.71	510.28	52576.51	4	26	3.75	2.45	116.3	7712.2
12/26	84.62	547	584	643	583	581	637	3575	318182	3760	16.25	16.71	580.94	53157.45	6	25	3.24	2.46	115.8	7828.0
WK 12								25209		3601	16.35		4120.60							
TD									318182	3760		16.71		53157.45				2.46		7828.0

		PULP PRODUCED					PRESSED PULP			DRY PULP			PELLET PULP			% SUGAR IN PRESSED PULP			
		TONS		% ON BEETS			% MOISTURE			% MOISTURE			% MOISTURE			% SUGAR		TONS	
DATE	DAY	DAY	TODATE	DAY	TD	AVE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TD	DAY	TD
11/29	58	234	13189	5.70	5.92	227	73.05	4271.37	73.64	12.19	660.00	11.38	10.49	611.72	10.55	.36	.35	14.77	786.
11/30	59	216	13405	5.56	5.92	227	73.47	4344.84	73.64	11.30	671.30	11.38	10.95	622.67	10.55	.38	.35	14.77	801.
12/01	60	215	13620	5.57	5.91	227	73.55	4418.39	73.64	12.34	683.64	11.39	11.06	633.73	10.56	.31	.35	11.97	813.6
12/02	61	210	13830	5.68	5.91	227	74.83	4493.22	73.66	11.06	694.70	11.39	10.31	644.04	10.56	.39	.35	14.41	828.07
12/03	62	201	14031	5.54	5.90	226	72.47	4565.69	73.64	9.78	704.48	11.36	10.34	654.38	10.55	.35	.35	12.70	840.77
12/04	63	229	14260	5.83	5.90	226	73.08	4638.77	73.63	10.67	715.15	11.35	10.70	665.08	10.56	.29	.35	11.40	852.17
12/05	64	214	14474	5.72	5.90	226	74.57	4713.34	73.65	11.14	726.29	11.35	10.85	675.93	10.56	.37	.35	13.84	866.01
WK 9		1519		5.66			73.57			11.21			10.67			.35		93.86	
TD			14474		5.90				73.65			11.35			10.56		.35		866.01
12/06	65	206	14680	5.76	5.89	226	71.77	4785.11	73.62	12.79	739.08	11.37	11.14	687.07	10.57	.38	.35	13.60	879.61
12/07	66	217	14897	5.85	5.89	226	74.15	4859.26	73.63	10.90	749.98	11.36	10.88	697.95	10.58	.47	.35	17.42	897.03
12/08	67	225	15122	5.80	5.89	226	76.77	4936.03	73.67	11.60	761.58	11.37	9.87	707.82	10.56	.44	.36	17.07	914.10
12/09	68	161	15283	5.85	5.89	225	73.78	5009.81	73.67	10.93	772.51	11.36	10.85	718.67	10.57	.45	.36	12.39	926.49
12/10	69	192	15475	5.94	5.89	224	73.60	5083.41	73.67	9.78	782.29	11.34	10.24	728.91	10.56	.41	.36	13.25	939.74
12/11	70	207	15682	5.99	5.89	224	75.58	5158.99	73.70	10.98	793.27	11.33	10.57	739.48	10.56	.45	.36	15.55	955.29
12/12	71	208	15890	6.01	5.90	224	73.55	5232.54	73.70	12.16	805.43	11.34	10.73	750.21	10.57	.45	.36	15.57	970.86
WK 10		1416		5.88			74.17			11.31			10.61			.44		104.85	
TD			15890		5.90				73.70			11.34			10.57		.36		970.86
12/13	72	206	16096	6.09	5.90	224	73.68	5306.22	73.70	11.53	816.96	11.35	10.25	760.46	10.56	.40	.36	13.53	984.39
12/14	73	234	16330	6.05	5.90	224	73.72	5379.94	73.70	10.73	827.69	11.34	10.27	770.73	10.56	.38	.36	14.70	999.09
12/15	74	206	16536	6.14	5.90	223	74.98	5454.92	73.72	10.66	838.35	11.33	9.53	780.26	10.54	.41	.36	13.75	1012.84
12/16	75	153	16689	5.99	5.90	223	77.28	5532.20	73.76	11.75	850.10	11.33	10.05	790.31	10.54	.40	.36	10.22	1023.06
12/17	76	196	16885	6.04	5.91	222	72.30	5604.50	73.74	11.25	861.35	11.33	10.74	801.05	10.54	.31	.36	10.07	1033.13
12/18	77	205	17090	6.10	5.91	222	73.80	5678.30	73.74	12.70	874.05	11.35	10.83	811.88	10.54	.35	.36	11.77	1044.90
12/19	78	220	17310	5.92	5.91	222	74.35	5752.65	73.75	12.21	886.26	11.36	10.99	822.87	10.55	.41	.36	15.24	1060.14
WK 11		1420		6.05			74.30			11.55			10.38			.38		89.28	
TD			17310		5.91				73.75			11.36			10.55		.36		1060.14
12/20	79	219	17529	5.88	5.91	222	74.38	5827.03	73.76	13.35	899.61	11.39	11.34	834.21	10.56	.29	.36	10.81	1070.95
12/21	80	220	17749	5.94	5.91	222	74.42	5901.45	73.77	12.90	912.51	11.41	10.95	845.16	10.56	.38	.36	14.08	1085.03
12/22	81	235	17984	5.94	5.91	222	76.32	5977.77	73.80	11.46	923.97	11.41	11.09	856.25	10.57	.46	.36	18.20	1103.23
12/23	82	205	18189	5.95	5.91	222	73.72	6051.49	73.80	11.12	935.09	11.40	10.24	866.49	10.57	.36	.36	12.41	1115.64
12/24	83	219	18408	5.92	5.91	222	74.05	6125.54	73.80	10.20	945.29	11.39	10.70	877.19	10.57	.32	.36	11.83	1127.47
12/25	84	185	18593	5.96	5.91	221	73.73	6199.27	73.80	10.43	955.72	11.38	10.90	888.09	10.57	.29	.36	9.00	1136.47
12/26	85	211	18804	5.90	5.91	221	71.82	6271.09	73.78	12.64	968.36	11.39	10.08	898.17	10.57	.40	.36	14.30	1150.77
WK 12		1494		5.93			74.06			11.73			10.76			.36		90.63	
TD			18804		5.91				73.78			11.39			10.57		.36		1150.77

Filename: BEET15.WQ1
Date: 26-Jan-95
Facility: Great Lakes Sugar Cooperative
Location: Fremont, Ohio
Source: Fuel oil-fired rotary drum beet pulp dryer with cyclones
Test date: December 2, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	267	273	281	
	Pressure	in. HG	30.12	30.12	30.12	
	Moisture	%	35.6	35.2	36.4	
	Oxygen	%	15.5	15.5	15.5	
	Volumetric flow, actual	acfm	101493.82	102891.49	102669.29	
	Volumetric flow, standard*	dscfm	47788	48348	46839	
	Isokinetic variation	%	113.7	109	103.4	
Wet pulp feed to dryer		TPH	45.00	45.00	45.00	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0504	0.0661	0.0546	
	CO2	% dv	5.5	5.5	6.50	
	SO2	lb/dscf	1.934E-05	2.002E-05	2.065E-05	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	20.6	27.4	21.9	
	CO2	lb/hr	18013	18224	20865	
	SO2	lb/hr	55.5	58.1	58.0	
	Emission factors (ENGLISH UNITS):		run 1 void			AVERAGE
	Filterable PM	lb/ton		0.61	0.49	0.55
	CO2	lb/ton		405	464	434
	SO2	lb/ton		1.3	1.3	1.3
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg		0.30	0.24	0.27
	CO2	kg/Mg		202	232	217
	SO2	kg/Mg		0.65	0.64	0.65

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX P

REPORT EXCERPTS FROM REFERENCE 16

(American Crystal Sugar Company, March 21, 1994)

Interpoll Laboratories, Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014-1819

TEL: (612) 786-6020
FAX: (612) 786-7854

RESULTS OF THE FEBRUARY 22 - 24, 1994 AIR EMISSION COMPLIANCE TESTING OF PROCESS SOURCES AT THE AMERICAN CRYSTAL SUGAR EAST GRAND FORKS PLANT

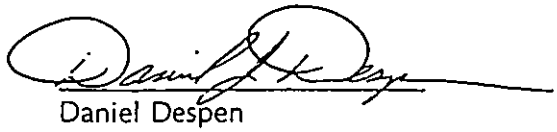
Submitted to:

AMERICAN CRYSTAL SUGAR COMPANY
Business Highway 220
P.O. Box 357
East Grand Forks, Minnesota 56721

Attention:

Bruce Keifenheim

Approved by:



Daniel Despen
Manager
Stationary Source Testing Department

Report Number 4-2326
March 21, 1994
SP/slp

Table 1a. Summary of the Results of the February 24, 1994 Particulate Emission Compliance Test on the A Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	02-24-94	02-24-94	02-24-94
Time runs were done (HRS)	930/1134	1200/1405	1425/1625
* Process rate			
Volumetric flow			
actual (ACFM)	44409	43415	43154
standard (DSCFM)	23522	23490	23462
Gas temperature (DEG-F)	208	204	203
Moisture content (%V/V)	31.36	30.37	30.12
Gas composition (%V/V,dry)			
carbon dioxide	4.40	4.30	4.30
oxygen	15.90	16.00	16.00
nitrogen	79.70	79.70	79.70
Isokinetic variation (%)	99.3	98.2	99.2
Particulate concentration			
actual (GR/ACF)	.0292	.0251	.0269
standard (GR/DSCF)	.0552	.0465	.0495
Part. emission rate (LB/HR)	11.13	9.35	9.96

Note: Dry + Organic Wet Catch

* For process information - see Appendix E.

Table 1b. Summary of the Results of the February 24, 1994 Particulate Emission Compliance Test on the A Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	02-24-94	02-24-94	02-24-94
Time runs were done (HRS)	930/1134	1200/1405	1425/1625
* Process rate			
Volumetric flow			
actual (ACFM)	44409	43415	43154
standard (DSCFM)	23522	23490	23462
Gas temperature (DEG-F)	208	204	203
Moisture content (%V/V)	31.36	30.37	30.12
Gas composition (%V/V,dry)			
carbon dioxide	4.40	4.30	4.30
oxygen	15.90	16.00	16.00
nitrogen	79.70	79.70	79.70
Isokinetic variation (%)	99.3	98.2	99.2
Particulate concentration			
actual (GR/ACF)	.0264	.0220	.0238
standard (GR/DSCF)	.0498	.0407	.0438
Part. emission rate (LB/HR)	10.04	8.19	8.81

Note: Dry Catch Only

* For process information - see Appendix E.

Table 2a. Summary of the Results of the February 23, 1994 Particulate Emission Compliance Test on the B Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		02-23-94	02-23-94	02-23-94
Time runs were done	(HRS)	1021/1225	1300/1503	1543/1744
* Process rate				
Volumetric flow				
actual	(ACFM)	68268	68024	68536
standard	(DSCFM)	36779	36865	37205
Gas temperature	(DEG-F)	239	237	236
Moisture content	(%V/V)	27.37	27.13	27.14
Gas composition	(%V/V,dry)			
carbon dioxide		3.90	3.90	3.90
oxygen		16.50	16.50	16.50
nitrogen		79.60	79.60	79.60
Isokinetic variation	(%)	91.3	96.3	98.6
Particulate concentration				
actual	(GR/ACF)	.0306	.0289	.0279
standard	(GR/DSCF)	.0569	.0533	.0515
Part. emission rate	(LB/HR)	17.93	16.84	16.41

Note: Dry + Organic Wet Catch

* For process information - see Appendix E.

Table 2b. Summary of the Results of the February 23, 1994 Particulate Emission Compliance Test on the B Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	02-23-94	02-23-94	02-23-94
Time runs were done (HRS)	1021/1225	1300/1503	1543/1744
*Process rate			
Volumetric flow			
actual (ACFM)	68268	68024	68536
standard (DSCFM)	36779	36865	37205
Gas temperature (DEG-F)	239	237	236
Moisture content (%V/V)	27.37	27.13	27.14
Gas composition (%V/V,dry)			
carbon dioxide	3.90	3.90	3.90
oxygen	16.50	16.50	16.50
nitrogen	79.60	79.60	79.60
Isokinetic variation (%)	91.3	96.3	98.6
Particulate concentration			
actual (GR/ACF)	.0290	.0273	.0266
standard (GR/DSCF)	.0539	.0504	.0491
Part. emission rate (LB/HR)	16.99	15.93	15.64

Note: Dry Catch Only

* For process information, see Appendix F

Table 3a. Summary of the Results of the February 22, 1994 Particulate Emission Compliance Test on the C Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		02-22-94	02-22-94	02-22-94
Time runs were done	(HRS)	1418/1622	1705/1911	1940/2146
*Process rate				
Volumetric flow				
actual	(ACFM)	46487	47360	47936
standard	(DSCFM)	24316	24619	25136
Gas temperature	(DEG-F)	212	213	215
Moisture content	(%V/V)	33.27	33.65	32.89
Gas composition	(%V/V,dry)			
carbon dioxide		4.80	5.20	4.80
oxygen		15.50	15.00	15.40
nitrogen		79.70	79.80	79.80
Isokinetic variation	(%)	102.2	100.9	99.7
Particulate concentration				
actual	(GR/ACF)	.0322	.0367	.0276
standard	(GR/DSCF)	.0616	.0706	.0526
Part. emission rate	(LB/HR)	12.84	14.91	11.34

Note: Dry + Organic Wet Catch

* For process information - see Appendix E.

Table 3b. Summary of the Results of the February 22, 1994 Particulate Emission Compliance Test on the C Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	02-22-94	02-22-94	02-22-94
Time runs were done (HRS)	1418/1622	1705/1911	1940/2146
*Process rate			
Volumetric flow			
actual (ACFM)	46487	47360	47936
standard (DSCFM)	24316	24619	25136
Gas temperature (DEG-F)	212	213	215
Moisture content (%V/V)	33.27	33.65	32.89
Gas composition (%V/V,dry)			
carbon dioxide	4.80	5.20	4.80
oxygen	15.50	15.00	15.40
nitrogen	79.70	79.80	79.80
Isokinetic variation (%)	102.2	100.9	99.7
Particulate concentration			
actual (GR/ACF)	.0301	.0348	.0255
standard (GR/DSCF)	.0575	.0669	.0487
Part. emission rate (LB/HR)	11.99	14.13	10.49

Note: Dry Catch Only

* For process information - see Appendix E.

Test No. 1
C Pulp Dryer Stack

Results of Volumetric Flow Rate Determination-------Method 2

Date of Determination.....	02-22-94
Time of Determination.....(HRS)	1250
Barometric pressure.....(IN.HG)	29.94
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	48
Duct area.....(SQ.FT)	12.57
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.95
Avg. gas temp.....(DEG-F)	210
Moisture content.....(% V/V)	33.27
Avg. linear velocity.....(FT/SEC)	61.4
Gas density.....(LB/ACF)	.05230
Molecular weight.....(LB/LBMOLE)	29.39
Mass flow of gas.....(LB/HR)	145175
Volumetric flow rate.....	
actual.....(ACFM)	46262
dry standard.....(DSCFM)	24288

Test No. 1
C Pulp Dryer Stack

Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	02-22-94	02-22-94	02-22-94
Time run start/end.....(HRS)	1418/1622	1705/1911	1940/2146
Static pressure.....(IN.WC)	-0.95	-0.95	-0.95
Cross sectional area (SQ.FT)	12.57	12.57	12.57
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	452.0	461.0	454.0
desiccant.....(GRAMS)	11.0	10.0	5.0
total.....(GRAMS)	463.0	471.0	459.0
Total particulate material..			
.....collected(grams)	0.1748	0.2005	0.1507
Gas meter coefficient.....	0.9976	0.9976	0.9976
Barometric pressure..(IN.HG)	29.94	29.94	29.94
Avg. orif.pres.drop..(IN.WC)	0.47	0.47	0.48
Avg. gas meter temp..(DEF-F)	85.0	85.0	84.6
Volume through gas meter....			
at meter conditions...(CF)	45.24	45.25	45.60
standard conditions.(DSCF)	43.79	43.80	44.17
Total sampling time....(MIN)	120.00	120.00	120.00
Nozzle diameter.....(IN)	.184	.184	.184
Avg.stack gas temp ..(DEG-F)	212	213	215
Volumetric flow rate.....			
actual.....(ACFM)	46487	47360	47936
dry standard.....(DSCFM)	24316	24619	25136
Isokinetic variation.....(%)	102.2	100.9	99.7
Particulate concentration...			
actual.....(GR/ACF)	0.03221	0.03671	0.02760
dry standard.....(GR/DSCF)	0.06160	0.07064	0.05265
Particle mass rate...(LB/HR)	12.839	14.907	11.343

Test No. 2
B Pulp Dryer Stack

Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	02-23-94	02-23-94	02-23-94
Time run start/end.....(HRS)	1021/1225	1300/1503	1543/1744
Static pressure.....(IN.WC)	-0.79	-0.79	-0.79
Cross sectional area (SQ.FT)	18.99	18.99	18.99
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	305.0	322.0	331.0
desiccant.....(GRAMS)	8.0	5.0	7.0
total.....(GRAMS)	313.0	327.0	338.0
Total particulate material..			
.....collected(grams)	0.1444	0.1430	0.1427
Gas meter coefficient.....	0.9976	0.9976	0.9976
Barometric pressure..(IN.HG)	29.43	29.43	29.43
Avg. orif.pres.drop..(IN.WC)	0.43	0.43	0.46
Avg. gas meter temp..(DEF-F)	85.3	85.3	84.3
Volume through gas meter....			
at meter conditions...(CF)	41.20	43.55	44.91
standard conditions.(DSCF)	39.17	41.41	42.78
Total sampling time....(MIN)	120.00	120.00	120.00
Nozzle diameter.....(IN)	.184	.184	.184
Avg.stack gas temp ..(DEG-F)	239	237	236
Volumetric flow rate.....			
actual.....(ACFM)	68268	68024	68536
dry standard.....(DSCFM)	36779	36865	37205
Isokinetic variation.....(%)	91.3	96.3	98.6
Particulate concentration...			
actual.....(GR/ACF)	0.03063	0.02887	0.02793
dry standard.....(GR/DSCF)	0.05688	0.05329	0.05147
Particle mass rate...(LB/HR)	17.931	16.839	16.413

Interpoll Labs Report No. 4-2326
American Crystal Sugar
East Grand Forks, MN

Test No. 4
A Pulp Dryer Stack

Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	02-24-94	02-24-94	02-24-94
Time run start/end.....(HRS)	930/1134	1200/1405	1425/1625
Static pressure.....(IN.WC)	-0.78	-0.78	-0.78
Cross sectional area (SQ.FT)	12.05	12.05	12.05
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	403.0	380.0	380.0
desiccant.....(GRAMS)	13.0	12.0	11.0
total.....(GRAMS)	416.0	392.0	391.0
Total particulate material..			
.....collected(grams)	0.1536	0.1276	0.1372
Gas meter coefficient.....	1.0027	1.0027	1.0027
Barometric pressure..(IN.HG)	29.28	29.28	29.28
Avg. orif.pres.drop..(IN.WC)	0.41	0.41	0.42
Avg. gas meter temp..(DEF-F)	69.7	73.8	74.4
Volume through gas meter....			
at meter conditions...(CF)	43.86	43.64	44.08
standard conditions.(DSCF)	42.93	42.38	42.76
Total sampling time....(MIN)	120.00	120.00	120.00
Nozzle diameter.....(IN)	.184	.184	.184
Avg.stack gas temp ..(DEG-F)	208	204	203
Volumetric flow rate.....			
actual.....(ACFM)	44409	43415	43154
dry standard.....(DSCFM)	23522	23490	23462
Isokinetic variation.....(%)	99.3	98.2	99.2
Particulate concentration...			
actual.....(GR/ACF)	0.02923	0.02512	0.02690
dry standard.....(GR/DSCF)	0.05521	0.04645	0.04950
Particle mass rate...(LB/HR)	11.132	9.353	9.956

Interpoll Labs Report No. 3-1638
American Crystal Suger
East Grand Forks, Minnesota

Test No. 3

Results of the Particle Size Distribution Determination

Sample Identification: B Pulp Dyrer Stack - February 23, 1994
Cascade Impactor Sampling

Assigned Density: 1.00 g/cc

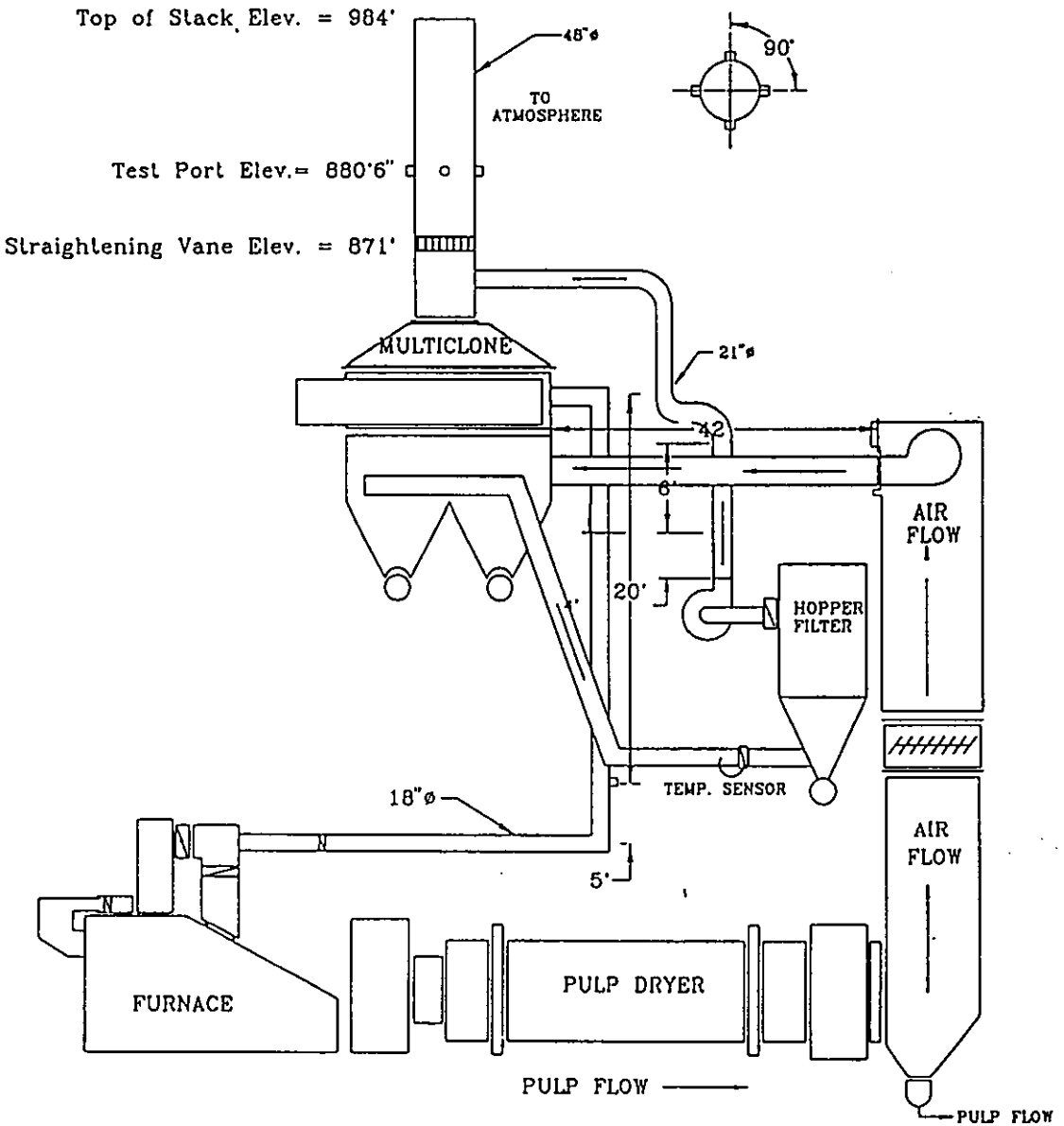
	Run 1	
Stage	um	% ≥
Preimpactor	10.0	10.9
1	6.1	18.0
2	4.0	23.0
3	2.5	29.8
4	1.5	33.2
5	0.98	36.0
6	0.61	39.5
7	0.35	45.6

um — Aerodynamic equivalent diameter in microns
% ≥ — Relative cumulative frequency - percent by mass of aerosol with diameters greater than stated size

Test No. 3
B Pulp Dryer Stack
(CASCACE IMPACTOR)

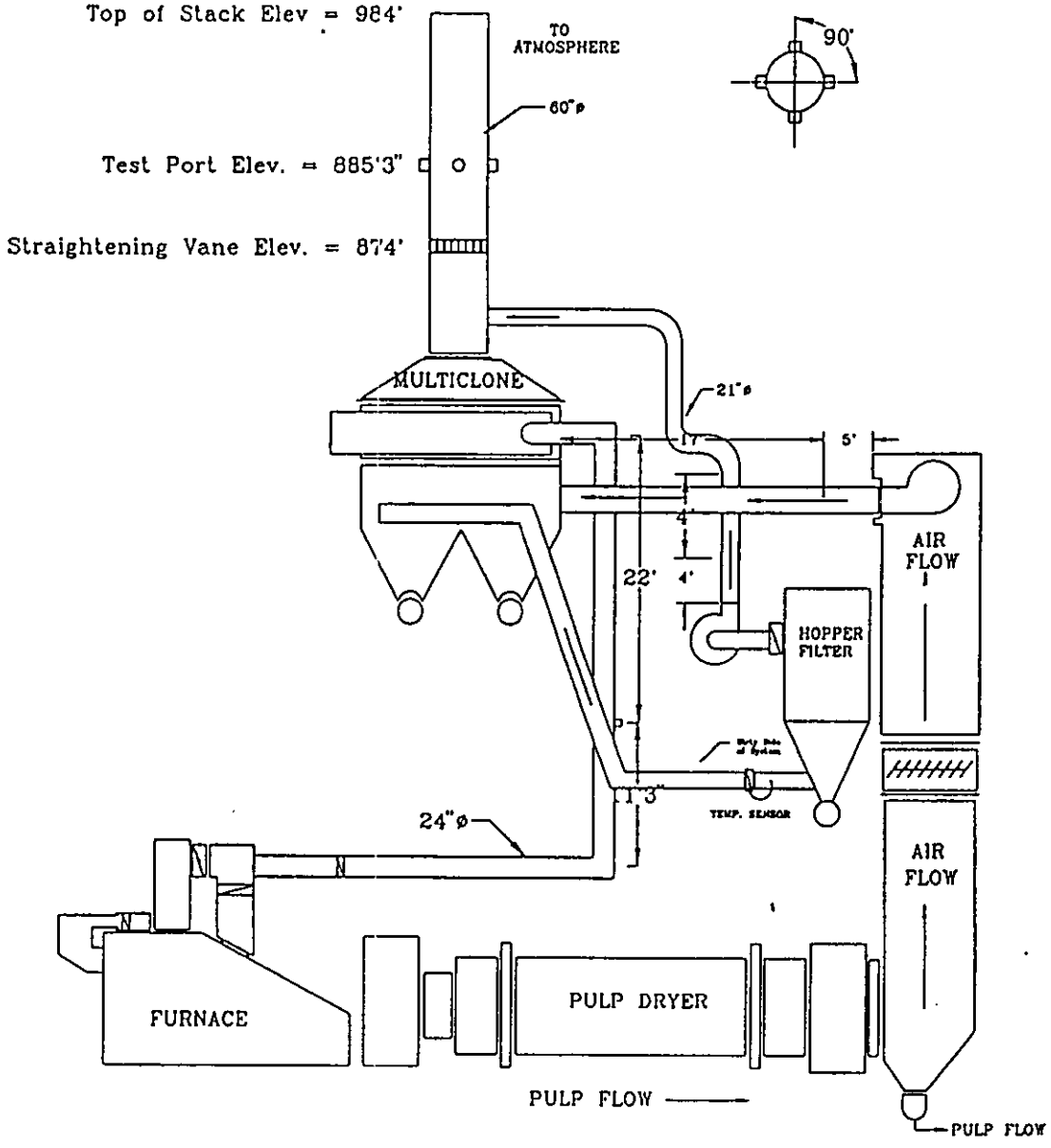
Results of Particulate Loading Determinations-------Method 5

	Run 1
Date of run	02-23-94
Time run start/end.....(HRS)	1833/1940
Static pressure.....(IN.WC)	-0.79
Cross sectional area (SQ.FT)	18.99
Pitot tube coefficient.....	.840
Water in sample gas	
condenser.....(ML)	0.0
impingers.....(GRAMS)	201.0
desiccant.....(GRAMS)	5.0
total.....(GRAMS)	206.0
Total particulate material..	
.....collected(grams)	0.0697
Gas meter coefficient.....	0.9976
Barometric pressure..(IN.HG)	29.43
Avg. orif.pres.drop..(IN.WC)	0.71
Avg. gas meter temp..(DEF-F)	82.0
Volume through gas meter....	
at meter conditions...(CF)	28.05
standard conditions.(DSCF)	26.85
Total sampling time....(MIN)	60.00
Nozzle diameter.....(IN)	.206
Avg.stack gas temp ..(DEG-F)	236
Volumetric flow rate.....	
actual.....(ACFM)	68604
dry standard.....(DSCFM)	37510
Isokinetic variation.....(%)	97.9
Particulate concentration...	
actual.....(GR/ACF)	0.02189
dry standard.....(GR/DSCF)	0.04004
Particle mass rate...(LB/HR)	12.87

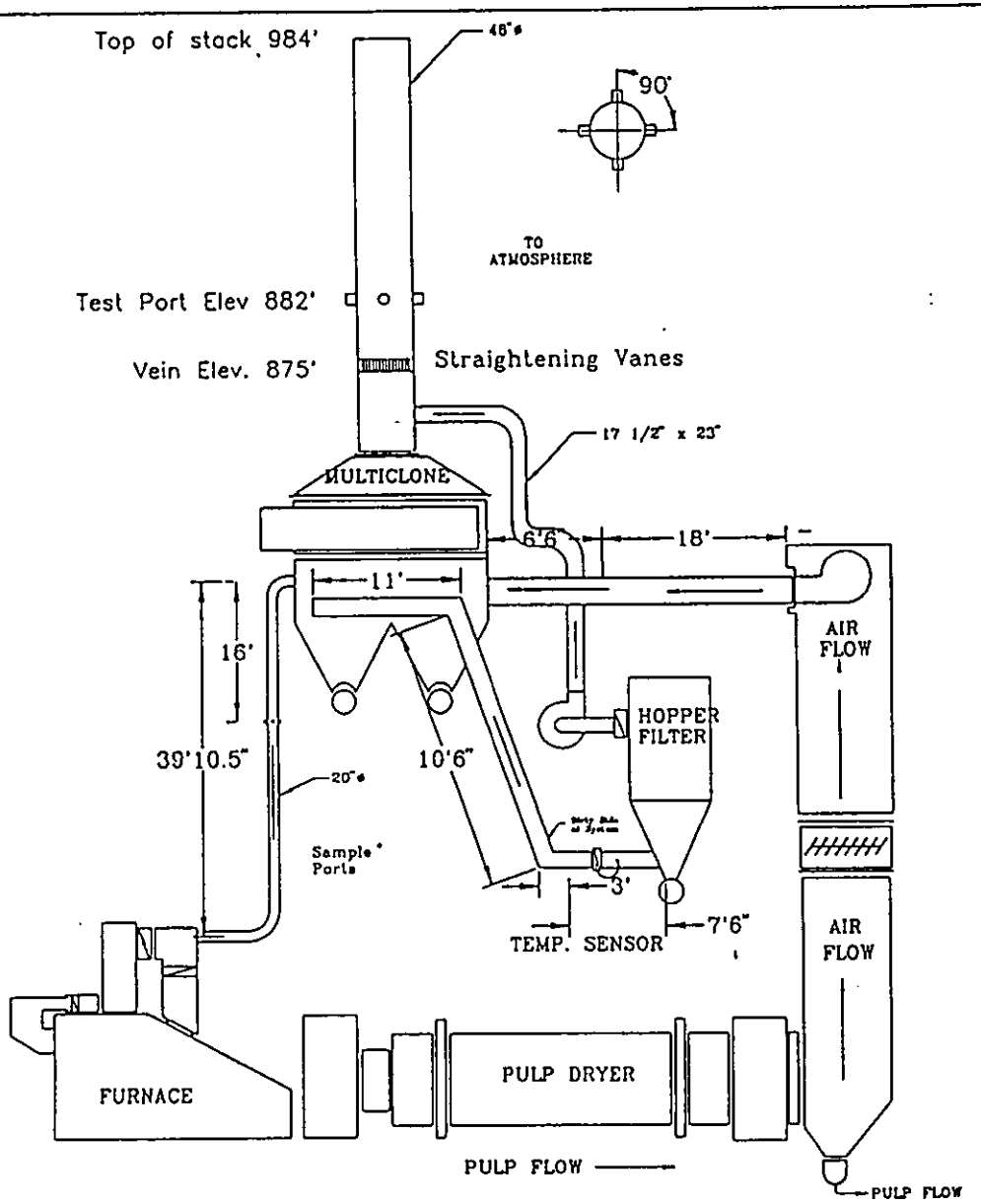


BASE Elev. 834'0"

'A' Pulp Drier Pollution Control Equipment Flow Diagram.



"B" Pulp Drier Pollution Control Equipment Flow Diagram.



Base Elev. = 834'

'C' Pulp Drier Pollution Control Equipment Flow Diagram.

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job AC5 / EGF
Team Leader DVH
Date Submitted 2-25-94
Test No. 1
Date of Analysis 3-6-94

Source C dryer
Test Site stack
Date of Test 2-22-94
No. of Runs Completed 3
Technician R. ELDEM

0	Test 1 Run 0 Field Blank Log Number 2326-05I Comments	Dish No. 12 Dish Tare Wt. 48.1490 g Dish+Sample Wt. 48.1494 g Sample Wt. 0.0004 g
1	Test 1 Run 1 Log Number -06I Comments	Dish No. 19 Dish Tare Wt. 48.9561 g Dish+Sample Wt. 48.9681 g Sample Wt. 0.0120 g
2	Test 1 Run 2 Log Number -07I Comments	Dish No. 20 Dish Tare Wt. 48.8128 g Dish+Sample Wt. 48.8237 g Sample Wt. 0.0109 g
3	Test 1 Run 3 Log Number -08I Comments	Dish No. 21 Dish Tare Wt. 47.5271 g Dish+Sample Wt. 47.5388 g Sample Wt. 0.0117 g
4	Test Run Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test Run Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0004g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0116	0.0105	0.0113	0-12	

LSC-0

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS-EGF
Team Leader DVH
Date Submitted 2-25-94
Test No. 1
Date of Analysis 3-3-94
Transport Leakage ☐ (None) ☒ _____ ml

Source C Dryer
Test Site Stack
Date of Test 1
No. of Runs Completed 3
Technician R.EIDEM
Solvent acetone

0	Test 1 Run 0 (Field Blank) Log Number 2326-05P Vol. of Solvent 100 ml *Solvent Residue 3.0 ug/ml	Dish No. 502 Dish Tare Wt. 46.9039 g Dish+Sample Wt. 46.9038 g Sample Wt. 0.0003 g
1	Test 1 Run 1 Vol. of Solvent 225 ml Log Number -06P Comments	Dish No. 504 Dish Tare Wt. 50.0215 g Dish+Sample Wt. 50.0644 g Sample Wt. 0.0429 g
2	Test 1 Run 2 Vol. of Solvent 190 ml Log Number -07P Comments	Dish No. 522 Dish Tare Wt. 47.0022 g Dish+Sample Wt. 47.0816 g Sample Wt. 0.0794 g
3	Test 1 Run 3 Vol. of Solvent 150 ml Log Number -08P Comments	Dish No. 609 Dish Tare Wt. 45.5609 g Dish+Sample Wt. 45.5828 g Sample Wt. 0.0219 g
4	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

*Solvent Residue 3.0 ug/ml = [(Sample Wt. 0.0003 g)(10⁶)]/Vol. of Sol. 100 ml
EPA-MS Acetone Residue Blank Spec. ≤ 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0423	0.0788	0.0214 D-13		

LSC-011

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job AGS/EGF
Team Leader DVH
Date Submitted 2-25-94
Test No. 1
Date of Analysis 3-3-94

Source C Dryer
Test Site Stack
Date of Test 2-22-94
No. of Runs Completed 3
Technician C. Helgeson

	Test 1 Run 0 Field Blank Log Number 2326-05F Comments	Filter No. 6263 Filter Type 4"GF Filter Tare Wt. .8703 g Filter+Sample Wt. .8703 g Sample Wt. g	
1	Test 1 Run 1 Log Number -06F Comments	Filter No. 6139 Filter Type 4"GF Filter Tare Wt. .8880 g Filter+Sample Wt. 1.0089 g Sample Wt. 0.1209 g	
2	Test 1 Run 2 Log Number -07F Comments	Filter No. 6141 Filter Type 4"GF Filter Tare Wt. .8786 g Filter+Sample Wt. .9898 g Sample Wt. 0.1112 g	
3	Test 1 Run 3 Log Number -08F Comments	Filter No. 6258 Filter Type 4"GF Filter Tare Wt. .8791 g Filter+Sample Wt. .9971 g Sample Wt. 0.1180 g	
4	Test Run Log Number Comments	Filter No. Filter Type Filter Tare Wt. g Filter+Sample Wt. g Sample Wt. g	
5	Test Run Log Number Comments	Filter No. Filter Type Filter Tare Wt. g Filter+Sample Wt. g Sample Wt. g	

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1209	0.1112	0.1180		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1748	0.2005	0.1507		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS / E6F
Team Leader DUH
Date Submitted 2-25-94
Test No. 2
Date of Analysis 3-6-94

Source R dryer
Test Site Stack
Date of Test 2-23-94
No. of Runs Completed 3
Technician R. ELDEN

0	Test 2 Run 0 Field Blank Log Number 2326-12I Comments	Dish No. 2 Dish Tare Wt. 46.2267 g Dish+Sample Wt. 46.2271 g Sample Wt. 0.0004 g
1	Test 2 Run 1 Log Number -13I Comments	Dish No. 3 Dish Tare Wt. 52.1230 g Dish+Sample Wt. 52.1310 g Sample Wt. 0.0080 g
2	Test 2 Run 2 Log Number -14I Comments	Dish No. 11 Dish Tare Wt. 47.7595 g Dish+Sample Wt. 47.7676 g Sample Wt. 0.0081 g
3	Test 2 Run 3 Log Number -15I Comments	Dish No. 17 Dish Tare Wt. 48.3931 g Dish+Sample Wt. 48.4002 g Sample Wt. 0.0071 g
4	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0004 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0076	0.0077	0.0067	D-18	

LSC-03

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS - EGF
Team Leader DUTT
Date Submitted 2-25-94
Test No. 2
Date of Analysis 3-3-94
Transport Leakage ☐ None ☒ _____ ml

Source B Dryer
Test Site Stack
Date of Test 2-23-94
No. of Runs Completed 3
Technician R. EIDEM
Solvent acetone

0	Test 2 Run 0 Field Blank Log Number 2326 - 12P Vol. of Solvent 100 ml *Solvent Residue 3.00 ug/ml	Dish No. 40 Dish Tare Wt. 47.6433 g Dish+Sample Wt. 47.6436 g Sample Wt. 0.0003 g
1	Test 2 Run 1 Vol. of Solvent 150 ml Log Number -13P Comments	Dish No. 47 Dish Tare Wt. 48.4658 g Dish+Sample Wt. 48.4968 g Sample Wt. 0.0310 g
2	Test 2 Run 2 Vol. of Solvent 160 ml Log Number -14P Comments	Dish No. 64 Dish Tare Wt. 43.1473 g Dish+Sample Wt. 43.1756 g Sample Wt. 0.0283 g
3	Test 2 Run 3 Vol. of Solvent 125 ml Log Number -15P Comments	Dish No. 69 Dish Tare Wt. 47.9924 g Dish+Sample Wt. 48.0209 g Sample Wt. 0.0285 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

*Solvent Residue 3.0 ug/ml = [(Sample Wt. 0.0003 g)(10^6)]/Vol. of Sol. 100 ml
EPA-M5 Acetone Residue Blank Spec. < 7.3 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0305	0.0278	0.0281		

LSC-01

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS/EGF
Team Leader DVH
Date Submitted 2-25-94
Test No. 2
Date of Analysis 3-3-94

Source B Dryer
Test Site Stack
Date of Test 2-23-94
No. of Runs Completed 3
Technician B. Shanks

0	Test 2 Run 0 Field Blank Log Number 2326-12F Comments	Filter No. 6262 Filter Type 41 6F Filter Tare Wt. .8607 g Filter+Sample Wt. .8608 g Sample Wt. 0.0001 g
1	Test 2 Run 1 Log Number -13F Comments	Filter No. 6257 Filter Type 41 6F Filter Tare Wt. .8697 g Filter+Sample Wt. .9760 g Sample Wt. 0.1063 g
2	Test 2 Run 2 Log Number -14F Comments	Filter No. 6261 Filter Type 41 6F Filter Tare Wt. .8723 g Filter+Sample Wt. .9798 g Sample Wt. 0.1075 g
3	Test 2 Run 3 Log Number -15F Comments	Filter No. 6142 Filter Type 41 6F Filter Tare Wt. .8724 g Filter+Sample Wt. .9803 g Sample Wt. 0.1079 g
4	Test ____ Run ____ Log Number ____ Comments	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1063	0.1075	0.1079		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1444	0.1430	0.1427		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS/EGF
Team Leader DUH
Date Submitted
Test No. 4
Date of Analysis 3-9-94

Source A Dryer
Test Site Stack
Date of Test 2-24-94
No. of Runs Completed 3
Technician C. Helgeson

0	Test ___ Run 0 Field Blank Log Number Comments	Dish No. Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g
1	Test 4 Run 1 Log Number 2326-16I Comments	Dish No. 328 Dish Tare Wt. 41.9654 g Dish+Sample Wt. 41.9809 g Sample Wt. 0.0155 g
2	Test 4 Run 2 Log Number -17I Comments	Dish No. 340 Dish Tare Wt. 47.9136 g Dish+Sample Wt. 47.9299 g Sample Wt. 0.0163 g
3	Test 4 Run 3 Log Number -18I Comments	Dish No. 341 Dish Tare Wt. 47.6589 g Dish+Sample Wt. 47.6751 g Sample Wt. 0.0162 g
4	Test ___ Run ___ Log Number Comments	Dish No. Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g
5	Test ___ Run ___ Log Number Comments	Dish No. Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g

Blank Solvent Wt. 1.0004 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0151	0.0159	0.0158		

D-21

LSC-0

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS-EGF
Team Leader Ovit
Date Submitted 2-25-94
Test No. 4
Date of Analysis 3-3-94
Transport Leakage ☐ None ☑ _____ ml

Source A Dryer
Test Site Stack
Data of Test 2-24-94
No. of Runs Completed 3
Technician REIDEM
Solvent acetone

0	Test ____ Run 0 Field Blank Log Number _____ Vol. of Solvent ____ ml *Solvent Residue 3.0 ug/ml	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
1	Test 4 Run 1 Vol. of Solvent 125 ml Log Number 2326-16P Comments _____	Dish No. 16 Dish Tare Wt. 49.1384 g Dish+Sample Wt. 49.1860 g Sample Wt. 0.0476 g
2	Test 4 Run 2 Vol. of Solvent 190 ml Log Number -17P Comments _____	Dish No. 175 Dish Tare Wt. 53.0301 g Dish+Sample Wt. 53.0600 g Sample Wt. 0.0299 g
3	Test 4 Run 3 Vol. of Solvent 150 ml Log Number -18P Comments _____	Dish No. 509 Dish Tare Wt. 47.6214 g Dish+Sample Wt. 47.6500 g Sample Wt. 0.0286 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

*Solvent Residue ___ ug/ml = [(Sample Wt. ____ g)(10⁶)]/Vol. of Sol. ____ ml
EPA-MS Acetone Residue Blank Spec. (7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0469	0.0293	0.0281 D-22		

LSC-01

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS EGF
Team Leader DUH
Date Submitted 2-25-94
Test No. 4
Date of Analysis 3-3-94

Source A Dryer
Test Site stack
Date of Test 2-24-94
No. of Runs Completed 3
Technician D.D

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
1	Test 4 Run 1 Log Number 2326-16F Comments ____	Filter No. 6271 Filter Type 4"GF Filter Tare Wt. .8667 g Filter+Sample Wt. .9583 g Sample Wt. 0.0916 g
2	Test 4 Run 2 Log Number -17F Comments ____	Filter No. 6272 Filter Type 4"GF Filter Tare Wt. .8611 g Filter+Sample Wt. .9435 g Sample Wt. .0824 g
3	Test 4 Run 3 Log Number -18F Comments ____	Filter No. 6273 Filter Type 4"GF Filter Tare Wt. .8641 g Filter+Sample Wt. .9574 g Sample Wt. .0933 g
4	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0916	0.0824	0.0933		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1536	0.1276	0.1372		

LSC-02PR

Campaign Day: 169

Date: Feb 24, 1994

PULP DRIER STACK TESTING

"A" Drier Test # Run 1

☐ Engineering
☒ Compliance

Hr.	Slice Rate Hr. TPH	Air Heat F.D. Air Hr. °C	Air Heat F.D. Air 1/2 Hr. °C	Heat Profile: Recycle Air Hr. °C	Recycle Air 1/2 Hr. °C	Inlet Hr. °C	Inlet 1/2 Hr. °C	Drum Exit Hr. °C	Drum Exit 1/2 Hr. °C	Air/Fuel Ratio Hr. %	Air/Fuel Ratio 1/2 Hr. %	Pressed Pulp Feed Hr. TPH	Pressed Pulp Feed 1/2 Hr. TPH	Damper Position: FD Hr. % Open	Damper Position: [illegible] Hr. % Open	Damper Position: ID Hr. % Open	Coal Rate Hr. TPH	Coal Rate 1/2 Hr. TPH	Grate Speed Hr.	Grate Speed 1/2 Hr.	% Moisture: Pressed Pulp Hr. %	Pressed Pulp 1/2 Hr. %	Dried Pulp Hr. %	Dried Pulp 1/2 Hr. %	Pressure Drop: Multiclone Hr. "H₂O	Multiclone 1/2 Hr. "H₂O	Multiclone Inlet Hr. "H₂O	Multiclone Inlet 1/2 Hr. "H₂O	Pressure: [illegible] Hr. "H₂O	Pressure: [illegible] Hr. "H₂O
9:00 / 9:30	295	82	84	103	—	574	575	103	102	—	—	18	19	36.8	82.1	60	—	—	37.2	32.8	69.8	68.8	6.6	5.7	6.49	6.48	6.70	6.68	-.21	-.19
10:00 / 10:30	321	84	✓	—	—	612	632	101	102	—	—	21.4	21.1	55.1	77.1	60	—	—	45.3	31.0	68.8	68.8	6.4	8.2	6.42	6.39	6.69	6.49	-.22	-.31
11:00 / 11:30	322			-	-	582	590	102	101	—	—	19.9	[illegible]	28.1	82.2	60	—	—	27.5	[illegible]	69.2	68.4	7.5	5.2	6.45	6.57	6.49	6.69	-.18	-.47
12:00 / 12:30	310	95	82	-	-	621	609	99	99	—	-	21.5	19.9	34.0	78.9	65	—	—	34.2	31.6	68.6	69.0	6.6	9.0	6.46	6.43	6.49	6.49	-.19	-.48
1:00 / 1:30	307	82	82	-	-	604	590	100	100	—	-	[illegible]	21.4	27.9	83.3	60	—	-	[illegible]	30.2	68.3	69.6	8.0	7.2	6.47	6.51	6.70	6.70	-.18	-.5
2:00 / 2:30	330	82	82	-	-	640	640	99	99	—	-	21.9	21.7	33.9	80.7	60	—	—	[illegible]	[illegible]	70.8	70.0	7.8	7.3	6.41	6.35	6.68	6.68	-.14	-.50
3:00 / 3:30	[illegible]	80	80	-	-	612	591	99	99	—	-	20.4	20.5	34.0	[illegible]	66	—	—	32.7	[illegible]	69.2	70.3	8.4	8.7	6.45	6.52	6.48	6.49	-.11	-.51
4:00	[illegible]	81		—	-	601				—	-	23.4		28.0	73.3	60	—	—	31.7				7.7		6.54		6.49		-.14	-.31
				-	-					—	-					60	—	-												
				-	-					—	-					65	—	-												

Hr.		Manometer Readings: [illegible] Hr. "H₂O	Manometer Readings: FD Test Hr. "H₂O	CO	Hopper [illegible] D.P. "H₂O	O_2 %	[illegible]
9:00	Hr	6.30	.50	2402	4.15	—	3.72
	1/2	6.30	.30	2509	4.49	12.2	3.46
10:00	Hr	6.4	.35	2517	4.57	11.3	3.20
	1/2	—		2486	4.41	—	—
11:00	Hr	6.46	.25	2006	4.34	11.0	3.12
	1/2	—	.25	1946	4.43	—	—
12:00	Hr	6.5	.25	2138	4.52	10.	3.24
	1/2	—	.25	[illegible]	[illegible]	—	-
1:00	Hr	6.5	.26	2515	4.18	[illegible]	3.14
	1/2	—	.26	2040	4.27	-	-
2:00	Hr	6.6	.25	2593	4.45	10.9	3.10
	1/2	—	.25	2801	4.47	—	-
3:00	Hr	6.5	.25	2174	4.54	10.0	2.92
	1/2	—	.25	2593	4.12	—	-
4:00	Hr	6.5	.25	2560	4.29	11.0	2.10
	1/2	—				—	-
	Hr						
	1/2	—				—	-
	Hr						
	1/2	—				-	-

Air Registers:

Run #1: Closed 1,2,5,7,8; 25%; 50% C; 75%; 100% 3,4,5

Run #2: Closed; 25%; 50%; 75%; 100%

	Run 1	Run 2
Start:	9:30 AM	Noon
End:	11:30 AM	

Customer Name	[illegible]	[illegible]
[illegible]	75	[illegible]
[illegible]	25	[illegible]

NOTES: Run 1

Coal [illegible] height = 2.75"

Dry pulp

NOTES: Run 2

GENERAL NOTES:

DOC [illegible]

Sheet 1 of 1

Campaign Day: 168

Date: Feb 23, 1994

PULP DRIER STACK TESTING

B Drier Test # 2 Runs 1, 2 + 3.

☐ Engineering
☒ Compliance

Hr.	Stack Rate Hr. TPH	Pre Heat F.D. Air Hr. °C	Pre Heat F.D. Air 1/2 Hr. °C	Heat Profile: Recycle Air Hr. °C	Recycle Air 1/2 Hr. °C	Throat Hr. °C	Throat 1/2 Hr. °C	Drum Exit Hr. °C	Drum Exit 1/2 Hr. °C	Air/Fuel Ratio Hr. %	Air/Fuel Ratio 1/2 Hr. %	Pressed Pulp Feed Hr. TPH	Pressed Pulp Feed 1/2 Hr. TPH	Damper Position: FD Hr. % Open	Recycle Hr. % Open	ID Hr. % Open	Coal Rate Hr. TPH	Coal Rate 1/2 Hr. TPH	Grate Speed Hr.	Grate Speed 1/2 Hr.	% Moisture: Pressed Pulp Hr. %	Pressed Pulp 1/2 Hr. %	Dried Pulp Hr. %	Dried Pulp 1/2 Hr. %	Pressure Drop (Old Sensors): Multiclone Hr. "H₂O	Multiclone 1/2 Hr. "H₂O	Multiclone Inlet Hr. "H₂O	Multiclone Inlet 1/2 Hr. "H₂O	Pressure Readings: Furnace Hr. "H₂O	Drum Exit Hr. "H₂O
9:00 / 9:30	301	74°		–	–	605		112		–	–	22.7		384	80	55.0	–	–	30.2				8.5	6.7	4.00		4.50		-.23	-.74
10:00 / 10:30	307	77	76	–	–	630	588	114	111	–	–	23.5	23.74	25.4	84.1	55	–	–	(1) 24.0	31.1	70	69.5	6.5	7.6	3.94	3.99	4.40	4.51	-.26	-.75
11:00 / 11:30	301	78	77	–	–	628	586	112	111	–	–	22.9	23.7	24.8	76.3	55	–	–	23.6	24.2	69.3	69.7	6.1	7.6	3.95	3.96	4.46	4.48	-.30	-.76
12:00 / 12:30	303	79	79	–	–	599	595	112	109	–	–	23.50	24.10	25.7	84.0	55	–	–	23.4	29.3	70.3	69.3	8.3	6.6	3.97	4.01	4.48	4.53	-.29	-.78
1:00 / 1:30	284	79	79	–	–	597	594	112	111	–	–	23.80	23.44	24.3	87.1	55	–	–	(2) 23.5	25.7	69.2	69.8	8.4	7.0	3.97	3.96	4.51	4.56	-.31	-.79
2:00 / 2:30	301	79	79	–	–	596	601	111	110	–	–	24.41	23.39	27.1	81.1	55	–	–	22.4	25.7	70.3	70.1	7.0	7.1	3.98	3.95	4.44	4.42	-.31	-.81
3:00 / 3:30	241	79	79	–	–	585	614	111	109	–	–	24.0	24.4	24.5	85.8	55	–	–	22.8	(3) 25.9	70.1	70.2	7.7	7.6	3.94	3.94	4.51	4.45	-.31	-.82
4:00 / 4:30	259	79	79	–	–	599	584	109	110	–	–	24.02	24.00	37.4	77.3	55	–	–	27.2	23.4	70.2	71.5			3.95	3.94	4.45	4.37	-.32	-.82
5:00 / 5:30	304	79	79	–	–	580	602	109	111	–	–	23.5	24.2	34.9	82.4	55	–	–	28.5	18.9	68.9	–			3.97	3.95	4.52	4.42	-.27	-.77
6:00 / 6:30	305	79	79	–	–	622	623	109		–	–	24.8	24.5	33.7	85.2	55	–	–	27.2		72.6	69.6			3.93	3.91	4.44	4.44	-.22	-.78

Hr.		Manometer Readings: Suction Head ΔP Hr. "H₂O	FD Duct Hr. "H₂O	Recycle Airflow (Control) 6	Hopper Filter D.P. "H₂O	O₂ %	Methane Recycle Static
9:00	Hr	·	.75		5.17		2.0
9:30	1/2						
10:00	Hr	4.0	.50	5844	5.14	11.8	2.2
10:30	1/2	4.0	.50	5838	4.81	–	–
11:00	Hr	4.0	.50	5827	4.93	11.8	2.2
11:30	1/2	4.0	.50	5693	5.14	–	–
12:00	Hr	4.0	.45	5755	4.78	12.2	2.2
12:30	1/2	4.0	.50	5727	4.98	–	–
1:00	Hr	4.0	.50	5934	5.15	12.2	2.4
1:30	1/2	4.0	.50	5989	4.97	–	–
2:00	Hr	4.0	.50	6006	5.12	12.2	2.4
2:30	1/2	4.0	.75	5962	5.00	–	–
3:00	Hr	4.0	.75	6104	5.20	12.0	2.8
3:30	1/2	4.0	.50	6053	4.52	–	–
4:00	Hr	4.0	.50	5939	5.05	12.0	2.4
4:30	1/2	4.0	.50	6020	4.81	–	–
5:00	Hr	4.0	.50	6045	5.09	12.0	2.4
5:30	1/2	4.0	.50	6034	4.57	–	–
6:00	Hr	4.0	.60	6110	4.96	12.2	2.4
6:30	1/2	4.0	.50	6104	4.75	–	–

Air Registers:

Run #1: Closed 1,2,6–9; 25%; 50%; 75%; 100% 3,4,5

Run #2: Closed; 25%; 50%; 75%; 100%

Run 1 Start: 10:22 End: 12:30

Run #2 Start: 13:00 End: 15:05

Run #3 15:45

Controller Names	Ratio	Bias
Recycle Airflow	5800	
Grate Speed		-1.0
Ratio		.75

NOTES: Run 1

3.5" Grate Height

NOTES: Run 2

GENERAL NOTES:

CAO/ C7111001

8.8

Campaign Day: 167

Date: Feb. 22, 1994

PULP DRIER STACK TESTING

C Drier · Test # 1   Sheet # 1 of 2

☐ Engineering
☒ Compliance

Hr.	Stea Rate Hr. TPH	Pre Heat F.D. Air Hr. °C	Pre Heat F.D. Air 1/2 Hr. °C	Heat Profile – Recycle Air Hr. °C	Recycle Air 1/2 Hr. °C	Throat Hr. °C	Throat 1/2 Hr. °C	Drum Exit Hr. °C	Drum Exit 1/2 Hr. °C	Air/Fuel Ratio Hr. %	Air/Fuel Ratio 1/2 Hr. %	Pressed Pulp Feed Hr. TPH	Pressed Pulp Feed 1/2 Hr. TPH	Damper Position FD Hr. % Open	Damper Position Recycle Hr. % Open	Damper Position ID Hr. % Open	Coal Rate Hr. TPH	Coal Rate 1/2 Hr. TPH	Grate Speed Hr.	Grate Speed 1/2 Hr.
9:00/9:30	302	67	66	103	105	720	711	105	104	—	—	24.83	24.23	35.6	51.9	85	—	—	26.8	28.3
10:00/10:30	309	64	65	105	105	690	680	104	105	—	—	22.46	23.86	33.1	56.0	85	—	—	24.0	25.2
11:00/11:30	301	65	65	105	104	650	697	103	105	—	—	22.24	20.47	44.7	53.0	85	—	—	31.5	30.0
12:00/12:30	300	65	65	104	104	677	715	104	106	—	—	21.02	20.89	44.9	52.4	85	—	—	24.7	23.4
1:00/1:30	306	64	64	105	105	686	678	102	105	—	—	21.08	20.12	38.2	54.7	85	—	—	32.20	33.0
2:00/2:30	300	63	63	104	102	681	707	102	105	—	—	21.67	19.71	45.1	55.5	85	—	—	24.2	23.1
3:00/3:30	320	64	63	102	102	680	649	105	105	—	—	23.46	20.61	37.7	57.3	85	—	—	23.1	21.1
4:00/4:30	302	65	64	102	102	666	675	104	103	—	—	30.03	19.09	36.9	57.3	65	—	—	23.5	28.4
5:00/5:30										—	—					85	—	—		
										—						85	—	—		

Hr.	% Moisture Pressed Pulp Hr. %	Pressed Pulp 1/2 Hr. %	Dried Pulp Hr. %	Dried Pulp 1/2 Hr. %	Pressure Drop (Cell Sensors) Multiclone Hr. "H₂O	Multiclone 1/2 Hr. "H₂O	Multiclone Inlet Hr. "H₂O	Multiclone Inlet 1/2 Hr. "H₂O	Pressure Readings Furnace Hr. "H₂O	Pressure Readings Drum Exit Hr. "H₂O
9:00/9:30	74.9	71.9	8.9	9.8	5.88	5.89	6.23	6.28	-.22	-.49
10:00/10:30	71.8	71.3	8.4	7.3	5.94	5.99	6.24	6.27	-.24	-.41
11:00/11:30	72.3	70.7	8.0	7.6	6.02	5.90	6.33	6.27	-.17	-.51
12:00/12:30	70.7	71.0	8.3	7.7	5.93	5.98	6.30	6.17	-.19	-.61
1:00/1:30	70.7	70.0	7.3	6.6	6.01	6.06	6.29	6.29	-.23	-.50
2:00/2:30	71.0	71.0	8.6	8.4	6.03	5.99	6.23	6.20	-.23	-.55
3:00/3:30	71.0	65.8	7.9	7.5	6.08	6.04	6.27	6.22	-.21	-.54
4:00/4:30	69.3	71.6	71.6	9.4	6.09	6.03	6.38	6.21	-.22	-.49
5:00/5:30										

Hr.	Manometer Readings Multiclone Inlet ΔP "H₂O	FD Duct "H₂O	6 Recycle Airflow (Control)	Hopper Filter D.P. "H₂O	O₂ %	Recycle
9:00 Hr	→	.60	4453	4.7	—	—
9:30 1/2	6.1	.75	4443	4.80	—	—
10:00 Hr	6.1	.45	4467	4.80	—	—
10:30 1/2	6.0	.50	4465	4.90		—
11:00 Hr	6.0	1.25	4431	4.84	—	—
11:30 1/2	5.9	1.00	4425	4.70	—	—
12:00 Hr	6.0	1.00	4462	4.10	—	—
12:30 1/2	6.0	.75	4470	4.7	—	—
1:00 Hr	6.0	.50	4480	4.7	—	—
1:30 1/2	6.0	.45	4486	4.8	—	—
2:00 Hr	6.0	.75	4495	4.8	—	—
2:30 1/2	6.0	.50	4410	4.6	—	1.2
3:00 Hr	6.6	.45	4507	4.8	—	1.4
3:30 1/2	6.0	.35	4507	4.8	—	1.4
4:00 Hr	6.0	.50	4480	4.8	—	1.4
4:30 1/2	6.0	.66			—	1.2
5:00 Hr					—	
5:30 1/2					—	
Hr					—	
1/2					—	—

Air Registers:

Run #1: Closed 1,2; 6-9 / 25% / 50% / 75% / 100% 3,4,5 — Start: 14:18 End: 16:22

Run #2: Closed / 25% / 50% / 75% / 100% — Start: End:

Controller Name	Ratio	Bias
Grate	.70	-1.0

NOTES: Run 1

Coal Height = 2.75"; Exit Temp Set Pt: 101

Overall, run was very stable in as much as the furnace + exit temp, plus a steady product moisture. Coal burn-off was better than usual. The furnace lancing and sifting was performed near end of run (15:47).

NOTES: Run 2

Furnace O₂ position started through last hour and a half of test.

GENERAL NOTES:

C&D/ C7111001

Campaign Day: 167

Date: 2/22/94

PULP DRIER STACK TESTING

C Drier   Test # 1   Sheet 2 of 2

☐ Engineering
☒ Compliance

Hr.	Stoo Rate Hr. TPH	Pre Heat F.D. Air Hr. °C	Pre Heat F.D. Air 1/2 Hr. °C	Heat Profile: Recycle Air Hr. °C	Recycle Air 1/2 Hr. °C	Throat Hr. °C	Throat 1/2 Hr. °C	Drum Exit Hr. °C	Drum Exit 1/2 Hr. °C	Air/Fuel Ratio Hr. %	Air/Fuel Ratio 1/2 Hr. %	Pressed Pulp Feed Hr. TPH	Pressed Pulp Feed 1/2 Hr. TPH	Damper Position FD Hr. % Open	Damper Position Recycle Hr. % Open	Damper Position ID Hr. % Open	Coal Rate Hr. TPH	Coal Rate 1/2 Hr. TPH	Grate Speed Hr.	Grate Speed 1/2 Hr.	% Moisture Pressed Pulp Hr. %	Pressed Pulp 1/2 Hr. %	Dried Pulp Hr. %	Dried Pulp 1/2 Hr. %	Pressure Drop (Field Sensors) Multiclone Hr. "H₂O	Multiclone 1/2 Hr. "H₂O	Multiclone Inlet Hr. "H₂O	Multiclone Inlet 1/2 Hr. "H₂O	Pressure Readings Furnace Hr. "H₂O	Pressure Readings Drum Exit Hr. "H₂O
5:00 / 5:30	324	60	63	101	102	622	738	101	108	–	–	19.65	23.16	59.4	51.2	85	–	–	42.4	20.7	70.5	70.1	9.0	9.4	6.09	5.87	6.31	6.12	-.14	-.53
6:00 / 6:30	340	72	70	102	102	694	630	108	104	–	–	20.70	21.13	29.1	67.8	85	–	–	17.6	23.3	(65.4)	70.0	6.8	6.9	5.84	6.09	6.09	6.29	-.12	-.60
7:00 / 7:30	325	65	65	102	102	658	679	102	103	–	–	20.01	21.39	44.5	53.7	85	–	–	29.4	30.7	69.9	71.2	7.2		6.02	6.37	6.31	6.32	-.14	-.51
8:00 / 8:30	309	65	64	102	102	663	661	106	105	–	–	20.36	20.23	37.9	56.0	85	–	–	22.5	24.3	71.2	72.0	7.8	7.7	6.15	6.02	6.43	6.48	-.20	-.53
9:00 / 9:30		64	64	102	102	662	664	105	104	–	–	19.37	21.99	37.7	56.0	85	–	–	24.4	27.2	70.1	(68.25)	9.1	9.0	6.11	6.04	6.24	6.35	-.20	-.51
10:00 / 10:30										–	–					85	–	–												
										–	–					85	–	–												
										–	–					85	–	–												
										–	–					85	–	–												
										–	–					85	–	–												

	Manometer Readings Multiclone Inlet ΔP Hr. "H₂O	Manometer Readings FD Duct Hr. "H₂O	Recycle Airflow (Control)	Hopper Filter D.P. "H₂O	O₂ %	Recycle
Hr	6.00	.75	4518	4.7		1.2
1/2	6.10	.50	4469	4.8		1.2
Hr	6.00	0.0	4577	4.8		1.2
1/2	6.00	.40	4529	4.7		1.04
Hr	6.00	.50	4328	4.8		1.4
1/2	6.00	.75	4334	4.7		1.4
Hr	6.10	.50	4357	4.7		1.4
1/2	6.00	.40	9317	4.8		1.2
Hr	6.10	.50	4274	4.7		1.2
1/2	6.0	.50	4335	4.6		
Hr						
1/2						
Hr						
1/2						
Hr						
1/2						
Hr						
1/2						
Hr						
1/2						

Air Registers:

Run #1: Closed / 25% / 50% / 75% / 100%

Run #2: Closed / 25% / 50% / 75% / 100%

Start: 17:05 End: 19:11

Start: 19:45 End: 21:45

Controller Name:	Rollo	Bas

NOTES: Run 1

NOTES: Run 2

GENERAL NOTES:

CAD/ E7111001

Test No. 4
A Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	02-24-94	02-24-94	02-24-94	02-24-94
Time of run.....(HRS)	930	945	1000	1015
Flask number.....	61	62	63	64
Volume of flask.....(ML)	2100	2079	2067	2087
Data: time of sampling				
flask temperature..(DEG-F)	60.00	60.00	60.00	60.00
bar. press.....(IN.HG)	29.28	29.28	29.28	29.28
flask vacuum.....(IN.HG)	26.55	26.60	26.60	26.55
flask abs. press...(IN.HG)	2.73	2.68	2.68	2.73
Data: Time of Flask Opening				
flask temperature..(DEG-F)	70.00	70.00	70.00	70.00
lab. bar. press....(IN.HG)	29.10	29.10	29.10	29.10
flask static press.(IN.HG)	-0.25	-0.10	-0.70	0.90
flask abs. press...(IN.HG)	28.85	29.00	28.40	30.00
Volume gas sampled....(DSML)	1800	1796	1745	1868
Moisture content.....(%V/V)	30.55	30.55	30.55	30.55
Nitrate in gas sample...(JG)	284.0	273.0	318.0	350.0
NO2 in gas sample.....(JG)	210.7	202.6	235.9	259.7
<u>NOx Concentration</u>				
(GR/DSCF).....	0.0512	0.0493	0.0591	0.0608
(MG/DSCM).....	117	113	135	139
(PPM-DRY).....	61	59	71	73
(PPM-WET).....	43	41	49	50
NOX Emission rate....(LB/HR)	10.30	9.93	11.91	12.24

Test No. 4
A Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	02-24-94	02-24-94	02-24-94	02-24-94
Time of run.....(HRS)	1030	1045	1100	1115
Flask number.....	65	66	19	20
Volume of flask.....(ML)	2068	2096	2069	2060
Data: time of sampling				
flask temperature..(DEG-F)	60.00	60.00	60.00	60.00
bar. press.....(IN.HG)	29.28	29.28	29.28	29.28
flask vacuum.....(IN.HG)	26.65	26.65	26.65	26.60
flask abs. press...(IN.HG)	2.63	2.63	2.63	2.68
Data: Time of Flask Opening				
flask temperature..(DEG-F)	70.00	70.00	70.00	70.00
lab. bar. press....(IN.HG)	29.10	29.10	29.10	29.10
flask static press.(IN.HG)	-0.30	-0.90	0.70	-1.00
flask abs. press...(IN.HG)	28.80	28.20	29.80	28.10
Volume gas sampled....(DSML)	1776	1759	1845	1718
Moisture content.....(%V/V)	30.55	30.55	30.55	30.55
Nitrate in gas sample...(JG)	324.0	274.0	251.0	261.0
NO2 in gas sample.....(JG)	240.4	203.3	186.2	193.7
<u>NOx Concentration</u>				
(GR/DSCF).....	0.0592	0.0505	0.0441	0.0493
(MG/DSCM).....	135	116	101	113
(PPM-DRY).....	71	60	53	59[1]
(PPM-WET).....	49	42	37	41
NOX Emission rate....(LB/HR)	11.91	10.17	8.89	9.92

Test No. 4
A Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	02-24-94	02-24-94	02-24-94	02-24-94
Time of run.....(HRS)	1200	1215	1230	1245
Flask number.....	21	22	23	24
Volume of flask.....(ML)	2068	2031	2056	2031
Data: time of sampling				
flask temperature..(DEG-F)	60.00	60.00	60.00	60.00
bar. press.....(IN.HG)	29.28	29.28	29.28	29.28
flask vacuum.....(IN.HG)	26.70	26.70	26.70	26.70
flask abs. press...(IN.HG)	2.58	2.58	2.58	2.58
Data: Time of Flask Opening				
flask temperature..(DEG-F)	70.00	70.00	70.00	70.00
lab. bar. press....(IN.HG)	29.10	29.10	29.10	29.10
flask static press.(IN.HG)	-1.90	-0.30	-1.25	1.70
flask abs. press...(IN.HG)	27.20	28.80	27.85	30.80
Volume gas sampled....(DSML)	1671	1747	1705	1881
Moisture content.....(%V/V)	30.55	30.55	30.55	30.55
Nitrate in gas sample...(JG)	368.0	335.0	342.0	349.0
NO2 in gas sample.....(JG)	273.0	248.6	253.8	259.0
<u>NOx Concentration</u>				
(GR/DSCF).....	0.0714	0.0622	0.0650	0.0602
(MG/DSCM).....	163	142	149	138
(PPM-DRY).....	85	74	78	72
(PPM-WET).....	59	52	54	50
NOX Emission rate....(LB/HR)	14.39	12.52	13.10	12.12

Test No. 2
B Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	02-23-94	02-23-94	02-23-94	02-23-94
Time of run.....(HRS)	1645	1700	1715	1730
Flask number.....	43	44	46	45
Volume of flask.....(ML)	2088	2090	2090	2086
Data: time of sampling				
flask temperature..(DEG-F)	60.00	60.00	60.00	60.00
bar. press.....(IN.HG)	29.43	29.43	29.43	29.43
flask vacuum.....(IN.HG)	26.80	26.80	26.85	26.90
flask abs. press...(IN.HG)	2.63	2.63	2.58	2.53
Data: Time of Flask Opening				
flask temperature..(DEG-F)	70.00	70.00	70.00	70.00
lab. bar. press....(IN.HG)	29.11	29.11	29.11	29.11
flask static press.(IN.HG)	-5.65	0.70	-6.00	-5.00
flask abs. press...(IN.HG)	23.46	29.81	23.11	24.11
Volume gas sampled....(DSML)	1427	1864	1407	1477
Moisture content.....(%V/V)	27.68	27.68	27.68	27.68
Nitrate in gas sample...(JG)				
NO2 in gas sample.....(JG)				
<u>NOx Concentration</u>				
(GR/DSCF).....				
(MG/DSCM).....				
(PPM-DRY).....				
(PPM-WET).....				
NOX Emission rate....(LB/HR)				

Test No. 2
B Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	02-23-94	02-23-94	02-23-94	02-23-94
Time of run.....(HRS)	1745	1835	1850	1910
Flask number.....	47	48	67	68
Volume of flask.....(ML)	2074	2102	2073	2101
Data: time of sampling				
flask temperature..(DEG-F)	60.00	60.00	60.00	60.00
bar. press.....(IN.HG)	29.43	29.43	29.43	29.43
flask vacuum.....(IN.HG)	26.95	26.85	26.95	27.00
flask abs. press...(IN.HG)	2.48	2.58	2.48	2.43
Data: Time of Flask Opening				
flask temperature..(DEG-F)	70.00	70.00	70.00	70.00
lab. bar. press....(IN.HG)	29.11	29.11	29.11	29.11
flask static press.(IN.HG)	0.50	-3.35	0.60	0.50
flask abs. press...(IN.HG)	29.61	25.76	29.71	29.61
Volume gas sampled....(DSML)	1847	1599	1853	1875
Moisture content.....(%V/V)	27.68	27.68	27.68	27.68
Nitrate in gas sample...(JG)			259.0	243.0
NO2 in gas sample.....(JG)			192.2	180.3
<u>NOx Concentration</u>				
(GR/DSCF).....			0.0453	0.0420
(MG/DSCM).....			104	96
(PPM-DRY).....			54	50
(PPM-WET).....			39	36
NOX Emission rate....(LB/HR)			14.53	13.47

Test No. 2
B Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	02-23-94	02-23-94	02-23-94	02-23-94
Time of run.....(HRS)	1945	2013	2029	2040
Flask number.....	69	70	71	72
Volume of flask.....(ML)	2069	2071	2038	2092
Data: time of sampling				
flask temperature..(DEG-F)	60.00	60.00	60.00	60.00
bar. press.....(IN.HG)	29.43	29.43	29.43	29.43
flask vacuum.....(IN.HG)	26.85	26.80	26.80	26.80
flask abs. press...(IN.HG)	2.58	2.63	2.63	2.63
Data: Time of Flask Opening				
flask temperature..(DEG-F)	70.00	70.00	70.00	70.00
lab. bar. press....(IN.HG)	29.11	29.11	29.11	29.11
flask static press.(IN.HG)	0.10	-0.10	-6.50	-4.30
flask abs. press...(IN.HG)	29.21	29.01	22.61	24.81
Volume gas sampled....(DSML)	1808	1793	1335	1522
Moisture content.....(%V/V)	27.68	27.68	27.68	27.68
Nitrate in gas sample...(JG)	276.0	307.0	253.0	270.0
NO2 in gas sample.....(JG)	204.8	227.8	187.7	200.3
<u>NOx Concentration</u>				
(GR/DSCF).....	0.0495	0.0555	0.0614	0.0575
(MG/DSCM).....	113	127	141	132
(PPM-DRY).....	59	66	74	69
(PPM-WET).....	43	48	53	50
NOX Emission rate....(LB/HR)	15.87	17.80	19.70	18.44

Test No. 5
C Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	02-24-94	02-24-94	02-24-94	02-24-94
Time of run.....(HRS)	832	847	914	929
Flask number.....	13	14	15	16
Volume of flask.....(ML)	2060	2048	2045	2067
Data: time of sampling				
flask temperature..(DEG-F)	50.00	50.00	50.00	50.00
bar. press.....(IN.HG)	29.24	29.24	29.24	29.24
flask vacuum.....(IN.HG)	26.70	26.90	26.80	26.85
flask abs. press...(IN.HG)	2.54	2.34	2.44	2.39
Data: Time of Flask Opening				
flask temperature..(DEG-F)	70.00	70.00	70.00	70.00
lab. bar. press....(IN.HG)	29.10	29.10	29.10	29.10
flask static press.(IN.HG)	1.10	6.35	5.75	-0.40
flask abs. press...(IN.HG)	30.20	35.45	34.85	28.70
Volume gas sampled....(DSML)	1867	2223	2173	1782
Moisture content.....(%V/V)	28.69	28.69	28.69	28.69
Nitrate in gas sample...(JG)	525.0	454.0	436.0	438.0
NO2 in gas sample.....(JG)	389.5	336.9	323.5	325.0
<u>NOx Concentration</u>				
(GR/DSCF).....	0.0912	0.0662	0.0651	0.0797
(MG/DSCM).....	209	152	149	182
(PPM-DRY).....	109	79	78	95
(PPM-WET).....	78	56	56	68
NOX Emission rate....(LB/HR)	19.62	14.25	14.00	17.15

Test No. 5
C Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	02-24-94	02-24-94	02-24-94	02-24-94
Time of run.....(HRS)	945	958	1014	1030
Flask number.....	17	18	43	44
Volume of flask.....(ML)	2054	2045	2088	2090
Data: time of sampling				
flask temperature..(DEG-F)	45.00	40.00	40.00	40.00
bar. press.....(IN.HG)	29.24	29.24	29.24	29.24
flask vacuum.....(IN.HG)	26.90	26.60	27.10	27.10
flask abs. press...(IN.HG)	2.34	2.64	2.14	2.14
Data: Time of Flask Opening				
flask temperature..(DEG-F)	70.00	70.00	70.00	70.00
lab. bar. press....(IN.HG)	29.10	29.10	29.10	29.10
flask static press.(IN.HG)	1.60	-5.00	-5.65	0.70
flask abs. press...(IN.HG)	30.70	24.10	23.45	29.80
Volume gas sampled....(DSML)	1907	1432	1454	1892
Moisture content.....(%V/V)	28.69	28.69	28.69	28.69
Nitrate in gas sample...(JG)	333.0	327.0		
NO2 in gas sample.....(JG)	247.1	242.6		
<u>NOx Concentration</u>				
(GR/DSCF).....	0.0566	0.0740		
(MG/DSCM).....	130	169		
(PPM-DRY).....	68	89		
(PPM-WET).....	48	63		
NOX Emission rate....(LB/HR)	12.18	15.93		

Test No. 5
C Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	02-24-94	02-24-94	02-24-94	02-24-94
Time of run.....(HRS)	1048	1108	1120	1135
Flask number.....	45	46	47	48
Volume of flask.....:(ML)	2086	2090	2074	2102
Data: time of sampling				
flask temperature..(DEG-F)	40.00	40.00	35.00	36.00
bar. press.....(IN.HG)	29.24	29.24	29.24	29.24
flask vacuum.....(IN.HG)	27.10	26.90	27.40	27.80
flask abs. press...(IN.HG)	2.14	2.34	1.84	1.44
Data: Time of Flask Opening				
flask temperature..(DEG-F)	70.00	70.00	70.00	70.00
lab. bar. press....(IN.HG)	29.10	29.10	29.10	29.10
flask static press.(IN.HG)	5.00	6.00	0.50	-3.35
flask abs. press...(IN.HG)	34.10	35.10	29.60	25.75
Volume gas sampled....(DSML)	2184	2242	1884	1674
Moisture content.....(%V/V)	28.69	28.69	28.69	28.69
Nitrate in gas sample...(JG)				
NO2 in gas sample.....(JG)				
<u>NOx Concentration</u>				
(GR/DSCF).....				
(MG/DSCM).....				
(PPM-DRY).....				
(PPM-WET).....				
NOX Emission rate....(LB/HR)				

Filename: BEET16.WQ1
Date: 16-Dec-94
Facility: American Crystal Sugar
Location: East Grand Forks, Minnesota
Source: Pulp dryer with multiple cyclones
Test date: 02/24/94

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	208	204	203	
"A" pulp dryer (coal-fired)	Pressure	in. HG	29.28	29.28	29.28	
	Moisture	%	31.36	30.37	30.12	
	Oxygen	%	15.9	16	16	
	Volumetric flow, actual	acfm	44409	43415	43154	
	Volumetric flow, standard*	dscfm	23578	23524	23502	0
	Isokinetic variation	%	99.3	98.2	99.2	
Wet Pulp Feed Rate To Dryer		TPH	20.35	19.55	21.4	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0498	0.0407	0.0438	
	Condensible organic?? PM	G/dscf	0.0054	0.0058	0.0057	
	CO2	% dv	4.4	4.3	4.3	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	10.1	8.21	8.82	
	Condensible organic?? PM	lb/hr	1.09	1.17	1.15	
	CO2	lb/hr	7110	6932	6926	
	NOx--4 samples per run	lb/hr	11.1	10.2	13	
	NOx test feed rates	TPH	20.2	20.5	19.7	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.49	0.42	0.41	0.44
	Condensible organic?? PM	lb/ton	0.054	0.060	0.054	0.056
	CO2	lb/ton	349	355	324	343
	NOx	lb/ton	0.55	0.50	0.66	0.57
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.25	0.21	0.21	0.22
	Condensible organic?? PM	kg/Mg	0.027	0.030	0.027	0.028
	CO2	kg/Mg	175	177	162	171
	NOx	kg/Mg	0.27	0.25	0.33	0.28

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET16A.WQ1
Date: 16-Dec-94
Facility: American Crystal Sugar
Location: East Grand Forks, Minnesota
Source: Pulp dryer with multiple cyclones
Test date: 02/23/94

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	239.4	237	236	
"B"	Pressure	in. HG	29.43	29.43	29.43	
pulp	Moisture	%	27.37	27.13	27.14	
dryer	Oxygen	%	16.5	16.5	16.5	
(coal-fired)	Volumetric flow, actual	acfm	68268	68024	68536	
	Volumetric flow, standard*	dscfm	36819	36935	37262	0
	Isokinetic variation	%	91.3	96.3	98.6	
Wet Pulp Feed Rate To Dryer		TPH	17.72	24.01	23.98	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0539	0.0504	0.0491	
	Condensible organic?? PM	G/dscf	0.00300	0.00290	0.00240	
	CO2	% dv	3.9	3.9	3.9	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	17.0	16.0	15.7	
	Condensible organic?? PM	lb/hr	0.947	0.918	0.767	
	CO2	lb/hr	9841	9872	9959	
	NOx DATA ARE VOID--ONLY ONE VALID TEST RUN WAS COMPLETED					
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.96	0.66	0.65	0.76
	Condensible organic?? PM	lb/ton	0.053	0.038	0.032	0.041
	CO2	lb/ton	555	411	415	461
	NOx	lb/ton				VOID
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.48	0.33	0.33	0.38
	Condensible organic?? PM	kg/Mg	0.027	0.019	0.016	0.021
	CO2	kg/Mg	278	206	208	230
	NOx	kg/Mg				VOID

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET16B.WQ1
Date: 16-Dec-94
Facility: American Crystal Sugar
Location: East Grand Forks, Minnesota
Source: Pulp dryer with multiple cyclones
Test date: 02/23/94

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	212	213	215	
"C" pulp dryer (coal-fired)	Pressure	in. HG	29.94	29.94	29.94	
	Moisture	%	33.27	33.65	32.89	
	Oxygen	%	15.5	15	15.4	
	Volumetric flow, actual	acfm	46487	47360	47936	
	Volumetric flow, standard*	dscfm	24390	24670	25181	0
	Isokinetic variation	%	102.2	100.9	99.7	
Wet Pulp Feed Rate To Dryer		TPH	22.86	21.12	20.46	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0575	0.0669	0.0487	
	Condensible organic?? PM	G/dscf	0.00410	0.00370	0.00390	
	CO2	% dv	4.8	5.2	4.8	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	12.0	14.1	10.5	
	Condensible organic?? PM	lb/hr	0.857	0.782	0.842	
	CO2	lb/hr	8023	8792	8283	
	NOx DATA ARE VOID--ONLY ONE VALID TEST RUN WAS COMPLETED					
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.53	0.67	0.51	0.57
	Condensible organic?? PM	lb/ton	0.038	0.037	0.041	0.039
	CO2	lb/ton	351	416	405	391
	NOx	lb/ton				VOID
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.26	0.33	0.26	0.28
	Condensible organic?? PM	kg/Mg	0.019	0.019	0.021	0.019
	CO2	kg/Mg	176	208	202	195
	NOx	kg/Mg				VOID

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX Q

REPORT EXCERPTS FROM REFERENCE 17

(American Crystal Sugar Company, March 26, 1992)

RESULTS OF THE
JANUARY 28 - 31, 1992
PARTICULATE EMISSION TESTS
SOUTH PULP DRYER

AMERICAN CRYSTAL SUGAR COMPANY
MOORHEAD, MINNESOTA

Submitted to:

David Walden
American Crystal Sugar Co.

Prepared by

Bay West, Inc.

Roger Martin, CHMM
Department Manager
Air and Waste Management

March 26, 1992

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

BayWest

TEST NO. 1
SOURCE/SITE: SOUTH DRYER STACK

RESULTS OF PARTICULATE LOADING DETERMINATIONS - METHOD 5

	RUN 1	RUN 2	RUN 3
DATE OF RUN	21-Jan-92	21-Jan-92	21-Jan-92
RUN START TIME	1315	1600	1815
RUN END TIME	1519	1745	2013
STACK STATIC PRESSURE (in. H2O)	-0.84	-0.84	-0.84
CROSS SECTIONAL AREA (sq. ft.)	19.308	19.308	19.308
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	0.00	0.00	0.00
IMPINGER (ml.)	696.00	676.00	740.00
DESSICCANT (grams)	300.00	302.00	174.00
TOTAL (grams)	996.00	978.00	914.00
SAMPLE GAS MOISTURE CONTENT (%)	32.39	33.09	32.16
TOTAL PARTICULATE COLLECTED (g)	0.4594	0.4335	0.4454
DRY GAS METER COEFFICIENT	1.001	1.001	1.001
BAROMETRIC PRESSURE (in. Hg)	28.85	28.85	28.85
AVG. ORIFICE PRESSURE DROP (in. H2O)	3.65	3.32	3.16
AVG. GAS METER TEMP. (degrees F)	113.3	118.7	117.6
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	109.20	104.93	102.16
STANDARD CONDITIONS (dscf)	97.93	93.16	90.82
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.312	0.312	0.312
AVG. STACK GAS TEMP. (degrees F)	233.3	232.8	228.8
AVG. STACK GAS VELOCITY (ft/sec)	58.99	59.33	58.89
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	68336	68733	68225
DRY STANDARD (dscfm)	33856	33725	34139
ISOKINETIC VARIATION (%)	109.64	104.70	100.84
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.0359	0.0352	0.0379
DRY STANDARD (gr/dscf)	0.0724	0.0718	0.0757
PARTICLE MASS RATE (lb/hr)	20.985	20.736	22.121

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 2
SOURCE/SITE: SOUTH DRYER STACK

RESULTS OF PARTICULATE LOADING DETERMINATIONS - METHOD 5

	RUN 1	RUN 2	RUN 3
DATE OF RUN	22-Jan-92	22-Jan-92	22-Jan-92
RUN START TIME	1020	1250	1515
RUN END TIME	1212	1430	1652
STACK STATIC PRESSURE (in. H2O)	-0.43	-0.43	-0.43
CROSS SECTIONAL AREA (sq. ft.)	19.308	19.308	19.308
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	0.00	0.00	0.00
IMPINGER (ml.)	984.00	1074.00	1018.00
DESSICCANT (grams)	341.00	86.00	189.00
TOTAL (grams)	1325.00	1160.00	1207.00
SAMPLE GAS MOISTURE CONTENT (%)	42.65	42.44	44.09
TOTAL PARTICULATE COLLECTED (g)	0.5441	0.4578	0.5965
DRY GAS METER COEFFICIENT	1.001	1.001	1.001
BAROMETRIC PRESSURE (in. Hg)	28.70	28.70	28.70
AVG. ORIFICE PRESSURE DROP (in. H2O)	2.75	2.14	2.04
AVG. GAS METER TEMP. (degrees F)	122.4	123.5	128.6
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	95.77	84.86	83.29
STANDARD CONDITIONS (dscf)	83.91	74.11	72.09
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.312	0.312	0.312
AVG. STACK GAS TEMP. (degrees F)	227.8	218.4	219.8
AVG. STACK GAS VELOCITY (ft/sec)	54.50	54.01	54.35
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	63134	62566	62962
DRY STANDARD (dscfm)	26632	26857	26199
ISOKINETIC VARIATION (%)	109.19	104.60	104.29
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.0422	0.0409	0.0531
DRY STANDARD (gr/dscf)	0.1001	0.0953	0.1277
PARTICLE MASS RATE (lb/hr)	22.816	21.920	28.644

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 3
SOURCE/SITE: SOUTH DRYER STACK

RESULTS OF PARTICULATE LOADING DETERMINATIONS - METHOD 5

	RUN 1	RUN 2	RUN 3
DATE OF RUN	23-Jan-92	23-Jan-92	23-Jan-92
RUN START TIME	1005	1220	1445
RUN END TIME	1145	1355	1630
STACK STATIC PRESSURE (in. H2O)	-0.45	-0.45	-0.45
CROSS SECTIONAL AREA (sq. ft.)	19.308	19.308	19.308
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	0.00	0.00	0.00
IMPINGER (ml.)	1135.00	1135.00	1036.00
DESSICCANT (grams)	89.00	89.00	23.00
TOTAL (grams)	1224.00	1224.00	1059.00
SAMPLE GAS MOISTURE CONTENT (%)	46.02	46.74	43.70
TOTAL PARTICULATE COLLECTED (g)	0.4289	0.4762	~~0.4544~~ 0.5052
DRY GAS METER COEFFICIENT	1.001	1.001	1.001
BAROMETRIC PRESSURE (in. Hg)	28.68	28.68	28.68
AVG. ORIFICE PRESSURE DROP (in. H2O)	1.74	1.64	1.58
AVG. GAS METER TEMP. (degrees F)	107.5	107.8	109.7
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	75.44	73.35	72.00
STANDARD CONDITIONS (dscf)	67.63	65.70	64.26
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.312	0.312	0.312
AVG. STACK GAS TEMP. (degrees F)	217.1	213.1	203.3
AVG. STACK GAS VELOCITY (ft/sec)	49.30	49.33	48.71
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	57117	57148	56430
DRY STANDARD (dscfm)	23021	22860	24213
ISOKINETIC VARIATION (%)	109.02	108.94	100.60
PARTICULATE CONCENTRATION	0.0877	0.1002	0.1083
ACTUAL (gr/acf)	~~0.0995~~	~~0.0448~~	~~0.0468~~
DRY STANDARD (gr/dscf)	0.0979	0.1119	~~0.1091~~ 0.1213
PARTICLE MASS RATE (lb/hr)	19.291	21.893	~~22.621~~ 25.174

These are wrong! BLS 3/95

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 4
SOURCE/SITE: SOUTH DRYER STACK

RESULTS OF PARTICULATE LOADING DETERMINATIONS - METHOD 5

	RUN 1	RUN 2	RUN 3
DATE OF RUN	24-Jan-92	24-Jan-92	24-Jan-92
RUN START TIME	1015	1245	1505
RUN END TIME	1210	1420	1655
STACK STATIC PRESSURE (in. H2O)	-0.55	-0.55	-0.55
CROSS SECTIONAL AREA (sq. ft.)	19.308	19.308	19.308
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	0.00	0.00	0.00
IMPINGER (ml.)	1109.00	1190.00	1242.00
DESSICCANT (grams)	122.00	24.00	15.00
TOTAL (grams)	1231.00	1214.00	1257.00
SAMPLE GAS MOISTURE CONTENT (%)	43.35	44.73	45.34
TOTAL PARTICULATE COLLECTED (g)	0.6358	0.5193	0.4688
DRY GAS METER COEFFICIENT	1.001	1.001	1.001
BAROMETRIC PRESSURE (in. Hg)	28.83	28.83	28.83
AVG. ORIFICE PRESSURE DROP (in. H2O)	2.17	1.90	1.98
AVG. GAS METER TEMP. (degrees F)	107.8	115.3	126.5
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	84.02	79.47	81.83
STANDARD CONDITIONS (dscf)	75.75	70.66	71.38
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.312	0.312	0.312
AVG. STACK GAS TEMP. (degrees F)	209.5	201.5	190.8
AVG. STACK GAS VELOCITY (ft/sec)	50.80	50.17	50.24
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	58851	58123	58206
DRY STANDARD (dscfm)	25297	24675	24840
ISOKINETIC VARIATION (%)	108.32	108.55	108.92
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.0557	0.0482	0.0433
DRY STANDARD (gr/dscf)	0.1295	0.1134	0.1014
PARTICLE MASS RATE (lb/hr)	28.053	23.961	21.555

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 2
SOURCE/SITE: SOUTH DRYER MULTI-CLONE INLET

RESULTS OF PARTICULATE LOADING DETERMINATIONS - METHOD 5

	RUN 1	RUN 2	RUN 3
DATE OF RUN	22-Jan-92	22-Jan-92	22-Jan-92
RUN START TIME	1020	1250	1515
RUN END TIME	1200	1430	1655
STACK STATIC PRESSURE (in. H2O)	2.80	2.80	2.80
CROSS SECTIONAL AREA (sq. ft.)	53.472	53.472	53.472
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	381.00	398.00	407.00
IMPINGER (ml.)	0.00	0.00	0.00
DESSICCANT (grams)	206.00	179.00	120.00
TOTAL (grams)	587.00	577.00	527.00
SAMPLE GAS MOISTURE CONTENT (%)	39.35	42.06	40.72
TOTAL PARTICULATE COLLECTED (g)	1.1431	1.0204	1.0523
DRY GAS METER COEFFICIENT	1.000	1.000	1.000
BAROMETRIC PRESSURE (in. Hg)	28.70	28.70	28.70
AVG. ORIFICE PRESSURE DROP (in. H2O)	0.85	0.66	0.62
AVG. GAS METER TEMP. (degrees F)	124.8	125.0	128.2
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	49.12	43.19	41.92
STANDARD CONDITIONS (dscf)	42.62	37.44	36.14
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.313	0.313	0.313
AVG. STACK GAS TEMP. (degrees F)	243.0	242.8	242.8
AVG. STACK GAS VELOCITY (ft/sec)	27.56	27.31	27.09
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	88431	87614	86927
DRY STANDARD (dscfm)	38918	36846	37402
ISOKINETIC VARIATION (%)	105.87	105.98	100.77
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.1822	0.1769	0.1934
DRY STANDARD (gr/dscf)	0.4139	0.4206	0.4494
PARTICLE MASS RATE (lb/hr)	137.931	132.691	143.911

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 1
SOURCE/SITE: SOUTH DRYER MULTI-CLONE INLET

RESULTS OF PARTICULATE LOADING DETERMINATIONS - METHOD 5

	RUN 1	RUN 2	RUN 3
DATE OF RUN	21-Jan-92	21-Jan-92	21-Jan-92
RUN START TIME	1315	1600	1825
RUN END TIME	1500	1742	2002
STACK STATIC PRESSURE (in. H2O)	2.80	2.80	2.80
CROSS SECTIONAL AREA (sq. ft.)	53.472	53.472	53.472
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	374.00	342.00	0.00
IMPINGER (ml.)	0.00	0.00	0.00
DESSICCANT (grams)	34.00	46.00	34.00
TOTAL (grams)	408.00	388.00	34.00
SAMPLE GAS MOISTURE CONTENT (%)	31.09	31.76	31.18
TOTAL PARTICULATE COLLECTED (g)	0.9751	1.0606	0.8696
DRY GAS METER COEFFICIENT	1.000	1.000	1.000
BAROMETRIC PRESSURE (in. Hg)	28.85	28.85	28.85
AVG. ORIFICE PRESSURE DROP (in. H2O)	0.84	0.73	0.72
AVG. GAS METER TEMP. (degrees F)	127.0	124.5	126.6
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	49.03	45.02	45.22
STANDARD CONDITIONS (dscf)	42.60	39.27	39.30
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.313	0.313	0.313
AVG. STACK GAS TEMP. (degrees F)	248.8	247.2	244.4
AVG. STACK GAS VELOCITY (ft/sec)	25.39	25.10	25.26
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	81456	80531	81030
DRY STANDARD (dscfm)	40605	39847	40596
ISOKINETIC VARIATION (%)	109.42	102.80	100.98
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.1761	0.2062	0.2388
DRY STANDARD (gr/dscf)	0.3533	0.4167	0.3414
PARTICLE MASS RATE (lb/hr)	122.817	142.180	118.679

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 3
SOURCE/SITE: SOUTH DRYER MULTI-CLONE INLET

RESULTS OF PARTICULATE LOADING DETERMINATIONS - METHOD 5

	RUN 1	RUN 2	RUN 3
DATE OF RUN	23-Jan-92	23-Jan-92	23-Jan-92
RUN START TIME	945	1220	1450
RUN END TIME	1130	1400	1640
STACK STATIC PRESSURE (in. H2O)	2.60	2.60	2.60
CROSS SECTIONAL AREA (sq. ft.)	53.472	53.472	53.472
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	416.00	423.00	424.00
IMPINGER (ml.)	0.00	0.00	0.00
DESSICCANT (grams)	125.00	140.00	98.00
TOTAL (grams)	541.00	563.00	522.00
SAMPLE GAS MOISTURE CONTENT (%)	42.88	44.87	43.13
TOTAL PARTICULATE COLLECTED (g)	1.0501	1.0421	1.1957
DRY GAS METER COEFFICIENT	1.000	1.000	1.000
BAROMETRIC PRESSURE (in. Hg)	28.68	28.68	28.68
AVG. ORIFICE PRESSURE DROP (in. H2O)	0.53	0.50	0.49
AVG. GAS METER TEMP. (degrees F)	105.6	106.8	108.7
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	37.90	36.45	36.40
STANDARD CONDITIONS (dscf)	33.94	32.58	32.42
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.313	0.313	0.313
AVG. STACK GAS TEMP. (degrees F)	243.6	243.3	244.0
AVG. STACK GAS VELOCITY (ft/sec)	25.16	25.05	25.26
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	80713	80381	81039
DRY STANDARD (dscfm)	33386	32101	33356
ISOKINETIC VARIATION (%)	106.05	105.85	101.38
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.1975	0.1972	0.2343
DRY STANDARD (gr/dscf)	0.4774	0.4937	0.5692
PARTICLE MASS RATE (lb/hr)	136.465	135.681	162.548

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 4
SOURCE/SITE: SOUTH DRYER MULTI-CLONE INLET

RESULTS OF PARTICULATE LOADING DETERMINATIONS - METHOD 5

	RUN 1	RUN 2	RUN 3
DATE OF RUN	24-Jan-92	24-Jan-92	24-Jan-92
RUN START TIME	1015	1245	1505
RUN END TIME	1200	1426	1645
STACK STATIC PRESSURE (in. H2O)	2.75	2.75	2.75
CROSS SECTIONAL AREA (sq. ft.)	53.472	53.472	53.472
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	413.00	571.00	563.00
IMPINGER (ml.)	0.00	0.00	0.00
DESSICCANT (grams)	223.00	22.00	30.00
TOTAL (grams)	636.00	593.00	593.00
SAMPLE GAS MOISTURE CONTENT (%)	42.35	43.45	43.48
TOTAL PARTICULATE COLLECTED (g)	1.2384	1.2746	1.1254
DRY GAS METER COEFFICIENT	1.000	1.000	1.000
BAROMETRIC PRESSURE (in. Hg)	28.83	28.83	28.83
AVG. ORIFICE PRESSURE DROP (in. H2O)	0.74	0.59	0.60
AVG. GAS METER TEMP. (degrees F)	116.9	118.7	124.1
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	46.17	41.30	41.64
STANDARD CONDITIONS (dscf)	40.78	36.35	36.31
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.313	0.313	0.313
AVG. STACK GAS TEMP. (degrees F)	246.6	244.2	247.5
AVG. STACK GAS VELOCITY (ft/sec)	28.26	27.69	28.26
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	90671	88849	90663
DRY STANDARD (dscfm)	37901	36556	37106
ISOKINETIC VARIATION (%)	104.99	103.72	102.06
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.1959	0.2227	0.1958
DRY STANDARD (gr/dscf)	0.4687	0.5411	0.4783
PARTICLE MASS RATE (lb/hr)	152.087	169.361	151.958

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 1
SOURCE/SITE: SOUTH DRYER STACK

RESULTS OF ORSAT & MOISTURE ANALYSES - METHODS 3 & 4 (%V/V)

	RUN 1	RUN 2	RUN 3
DATE OF TEST	21-Jan-92	21-Jan-92	21-Jan-92
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	4.12	4.08	4.11
OXYGEN	16.00	15.50	15.25
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	79.88	80.42	80.64
WET BASIS (ORSAT), %			
CARBON DIOXIDE	2.79	2.73	2.79
OXYGEN	10.82	10.37	10.35
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	54.01	53.81	54.71
WATER VAPOR	32.39	33.09	32.16
DRY MOLECULAR WEIGHT	29.30	29.27	29.27
WET MOLECULAR WEIGHT	25.64	25.54	25.64

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 2
SOURCE/SITE: SOUTH DRYER STACK

RESULTS OF ORSAT & MOISTURE ANALYSES - METHODS 3 & 4 (%V/V)

	RUN 1	RUN 2	RUN 3
DATE OF TEST	22-Jan-92	22-Jan-92	22-Jan-92
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	5.50	6.00	5.20
OXYGEN	14.75	14.25	15.10
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	79.75	79.75	79.70
WET BASIS (ORSAT), %			
CARBON DIOXIDE	3.15	3.45	2.91
OXYGEN	8.46	8.20	8.44
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	45.73	45.91	44.55
WATER VAPOR	42.65	42.44	44.10
DRY MOLECULAR WEIGHT	29.47	29.53	29.44
WET MOLECULAR WEIGHT	24.58	24.64	24.39

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 3
SOURCE/SITE: SOUTH DRYER STACK

RESULTS OF ORSAT & MOISTURE ANALYSES - METHODS 3 & 4 (%V/V)

	RUN 1	RUN 2	RUN 3
DATE OF TEST	23-Jan-92	23-Jan-92	23-Jan-92
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	5.02	5.79	4.85
OXYGEN	15.10	14.58	15.50
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	79.88	79.63	79.65
WET BASIS (ORSAT), %			
CARBON DIOXIDE	2.71	3.08	2.73
OXYGEN	8.15	7.76	8.72
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	43.12	42.41	44.83
WATER VAPOR	46.02	46.75	43.71
DRY MOLECULAR WEIGHT	29.41	29.51	29.40
WET MOLECULAR WEIGHT	24.16	24.13	24.41

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 4
SOURCE/SITE: SOUTH DRYER STACK

RESULTS OF ORSAT & MOISTURE ANALYSES - METHODS 3 & 4 (%V/V)

	RUN 1	RUN 2	RUN 3
DATE OF TEST	24-Jan-92	24-Jan-92	24-Jan-92
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	6.12	6.58	6.58
OXYGEN	14.00	13.65	13.88
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	79.88	79.77	79.54
WET BASIS (ORSAT), %			
CARBON DIOXIDE	3.47	3.64	3.60
OXYGEN	7.93	7.55	7.59
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	45.24	44.10	43.48
WATER VAPOR	43.37	44.71	45.34
DRY MOLECULAR WEIGHT	29.54	29.60	29.61
WET MOLECULAR WEIGHT	24.54	24.41	24.35

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 1
SOURCE/SITE: SOUTH DRYER MULTI-CLONE INLET

RESULTS OF ORSAT & MOISTURE ANALYSES - METHODS 3 & 4 (%V/V)

	RUN 1	RUN 2	RUN 3
DATE OF TEST	21-Jan-92	21-Jan-92	21-Jan-92
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	4.12	4.08	4.11
OXYGEN	16.00	15.50	15.25
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	79.88	80.42	80.64
WET BASIS (ORSAT), %			
CARBON DIOXIDE	2.84	2.79	2.83
OXYGEN	11.03	10.58	10.50
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	55.05	54.90	55.50
WATER VAPOR	31.09	31.74	31.18
DRY MOLECULAR WEIGHT	29.30	29.27	29.27
WET MOLECULAR WEIGHT	25.79	25.69	25.75

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 2
SOURCE/SITE: SOUTH DRYER MULTI-CLONE INLET

RESULTS OF ORSAT & MOISTURE ANALYSES - METHODS 3 & 4 (%V/V)

	RUN 1	RUN 2	RUN 3
DATE OF TEST	22-Jan-92	22-Jan-92	22-Jan-92
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	5.50	6.00	5.20
OXYGEN	14.75	14.25	15.10
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	79.75	79.75	79.70
WET BASIS (ORSAT), %			
CARBON DIOXIDE	3.34	3.48	3.08
OXYGEN	8.94	8.26	8.95
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	48.36	46.21	47.25
WATER VAPOR	39.36	42.06	40.72
DRY MOLECULAR WEIGHT	29.47	29.53	29.44
WET MOLECULAR WEIGHT	24.96	24.68	24.78

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 3
SOURCE/SITE: SOUTH DRYER MULTI-CLONE INLET

RESULTS OF ORSAT & MOISTURE ANALYSES - METHODS 3 & 4 (%V/V)

	RUN 1	RUN 2	RUN 3
DATE OF TEST	23-Jan-92	23-Jan-92	23-Jan-92
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	5.02	5.79	4.85
OXYGEN	15.10	14.58	15.50
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	79.88	79.63	79.65
WET BASIS (ORSAT), %			
CARBON DIOXIDE	2.87	3.19	2.76
OXYGEN	8.62	8.04	8.82
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	45.62	43.90	45.30
WATER VAPOR	42.89	44.88	43.13
DRY MOLECULAR WEIGHT	29.41	29.51	29.40
WET MOLECULAR WEIGHT	24.51	24.34	24.48

AMERICAN CRYSTAL SUGAR
MOORHEAD, MINNESOTA

TEST NO. 4
SOURCE/SITE: SOUTH DRYER MULTI-CLONE INLET

RESULTS OF ORSAT & MOISTURE ANALYSES - METHODS 3 & 4 (%V/V)

	RUN 1	RUN 2	RUN 3
DATE OF TEST	24-Jan-92	24-Jan-92	24-Jan-92
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	6.12	6.58	6.12
OXYGEN	14.00	13.65	13.88
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	79.88	79.77	80.00
WET BASIS (ORSAT), %			
CARBON DIOXIDE	3.53	3.72	3.46
OXYGEN	8.07	7.72	7.85
CARBON MONOXIDE	0.00	0.00	0.00
NITROGEN	46.05	45.10	45.22
WATER VAPOR	42.35	43.46	43.47
DRY MOLECULAR WEIGHT	29.54	29.60	29.53
WET MOLECULAR WEIGHT	24.65	24.56	24.52

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 1
RUN NO.'S 1,2,3
DATE: 2.13.92
ANALYST: R. Hessler

SUMMARY OF PARTICULATE ANALYSES

Lab No.	Run No.	Total Corrected Wt. (g)
18908, '942, '973	1	0.4594
18910, '943, '974	2	0.4335
18912, '944, '975	3	0.4454

BLANK VALUE ANALYSES

ACETONE

Lab No.	Final Wt.(g).		Tare Wt.(g)		Gain (g)(residue)
18954	21.2536	-	21.2525	=	0.0011

Residue(g)		Volume(l)		g/l
0.0011	/	0.135	=	0.0081

CONDENSIBLE ORGANICS

Lab No.	Final Wt.(g)		Tare Wt.(g)		Gain (g)(residue)
18941	140.7325	-	140.7303	=	0.0022

Residue(g)		Volume(l)		g/l
0.0022	/	0.200	=	0.011

NOTE: (l)=Liter
(g)=Gram
(g/l)=gram per liter

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St. Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Steck
SITE:
LOCATION:

TEST NO: 1
RUN NO: 1
DATE: 2-13-92
ANALYST: R. Hessel

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18973	0.9356	−	0.6204	=	0.3152

TOTAL 0.3152

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18942	21.4289	−	21.3372	=	0.0917

BLANK 0.092 (l) * 0.0081 (g/l) = −0.0007 (g)

CORRECTED TOTAL 0.0910

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18908	141.7641	−	141.7008	=	0.0633

BLANK 0.915 (l) * 0.011 (g/l) = −0.0101

CORRECTED TOTAL 0.0532

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
1	0.3152	+	0.0910	+	0.0532	=	0.4594

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 1
RUN NO: 2
DATE: 2.13.92
ANALYST: R Hessler

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
16974	0.9284	−	0.6217	=	0.3067

TOTAL 0.3067

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
16943	21.4370	−	21.3611	=	0.0759

BLANK 0.095 (l) * 0.0008 (g/l) = −0.0008 (g)

CORRECTED TOTAL 0.0751

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
16910	137.3848	−	137.3233	=	0.0615

BLANK 0.890 (l) * 0.011 (g/l) = −0.0098

CORRECTED TOTAL 0.0517

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
2	0.3067	+	0.0751	+	0.0617	=	0.4335

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St. Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: stack
SITE:
LOCATION:

TEST NO: 1
RUN NO: 3
DATE: 2.13.92
ANALYST: R. Hessler

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18975	0.9156	−	0.6261	=	0.2895

TOTAL 0.2895

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18944	21.3925	−	21.3138	=	0.0787

BLANK 0.066 (l) * 0.0081 (g/l) = −0.0005 (g)

CORRECTED TOTAL 0.0782

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18912	135.2443	−	135.1561	=	0.0882

BLANK 0.955 (l) * 0.011 (g/l) = −0.005

CORRECTED TOTAL 0.0777

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
3	0.2895	+	0.0782	+	0.0777	=	0.4454

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: stack
SITE:
LOCATION:

TEST NO: 2
RUN NO.'S 1, 2, 3
DATE: 2.13.92
ANALYST: R. Hesskel

SUMMARY OF PARTICULATE ANALYSES

Lab No.	Run No.	Total Corrected Wt. (g)
18914, '945, '976	1	0.5441
18917, '946, '977	2	0.4578
18920, '947, '978	3	0.5965

BLANK VALUE ANALYSES

ACETONE

Lab No.	Final Wt.(g).	Tare Wt.(g)	Gain (g)(residue)
18954	21.2536 -	21.2525 =	0.0011

Residue(g)	Volume(l)	g/l
0.0011 /	0.135 =	0.0081

CONDENSIBLE ORGANICS

Lab No.	Final Wt.(g)	Tare Wt.(g)	Gain (g)(residue)
18941	140.7325 -	140.7303 =	0.0022

Residue(g)	Volume(l)	g/l
0.0022 /	0.200 =	0.011

NOTE: (l)=Liter
(g)=Gram
(g/l)=gram per liter

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 2
RUN NO: 1
DATE: 2.13.92
ANALYST: R. Hessler

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18976	1.0054	−	0.6219	=	0.3835

TOTAL 0.3835

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18945	21.3288	−	21.2513	=	0.0775

BLANK 0.087 (l) * 0.008/ (g/l) = −0.0007 (g)

CORRECTED TOTAL 0.0768

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18914	136.8943	−	136.7975	=	0.0968

BLANK 1.180 (l) * 0.011 (g/l) = −0.030

CORRECTED TOTAL 0.0838

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
1	0.3835	+	0.0768	+	0.0838	=	0.5441

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St. Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 2
RUN NO: 2
DATE: 2/13/97
ANALYST: R. Hessler

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18977	0.9627	−	0.6341	=	0.3286

TOTAL 0.3286

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18946	21.4229	−	21.3557	=	0.0672

BLANK 0.064 (l) * 0.0081 (g/l) = −0.0005 (g)

CORRECTED TOTAL 0.0667

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18917	138.2972	−	138.2205	=	0.0767

BLANK 1.295 (l) * 0.011 (g/l) = −0.0142

CORRECTED TOTAL 0.0625

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
2	0.3286	+	0.0667	+	0.0625	=	0.4578

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: stack
SITE:
LOCATION:

TEST NO: 2
RUN NO: 3
DATE: 2.13.92
ANALYST: R. Hessler

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18978	0.9565	−	0.6244	=	0.3321

TOTAL 0.3321

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18947	21.4479	−	21.3038	=	0.1441

BLANK 0.090 (l) * 0.0008 (g/l) = −0.0007 (g)

CORRECTED TOTAL 0.1434

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18920	137.8898	−	137.7530	=	0.1368

BLANK 1.440 (l) * 0.011 (g/l) = −0.0158

CORRECTED TOTAL 0.1210

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
3	0.3321	+	0.1434	+	0.1210	=	0.5965

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1667

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: stack
SITE:
LOCATION:

TEST NO: 3
RUN NO.'S 1, 2, 3
DATE: 2.13.92
ANALYST: R. Hessler

SUMMARY OF PARTICULATE ANALYSES

Lab No.	Run No.	Total Corrected Wt. (g)
18923, '945, '979	1	0.4289
18926, '949, '980	2	0.4762
18929, '950, '981	3	0.4544

BLANK VALUE ANALYSES

ACETONE

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g) (residue)
18954	21.2536	-	21.2525	=	0.0011

Residue (g)		Volume (l)		g/l
0.0011	/	0.135	=	0.0081

CONDENSIBLE ORGANICS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g) (residue)
18941	140.7325	-	140.7303	=	0.0022

Residue (g)		Volume (l)		g/l
0.0022	/	0.200	=	0.011

NOTE: (l)=Liter
(g)=Gram
(g/l)=gram per liter

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St. Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 3
RUN NO: 1
DATE: 2/13/92
ANALYST: R. Hesslop

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18979	0.8987	−	0.6095	=	0.2892

TOTAL 0.2892

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18948	21.4469	−	21.3712	=	0.0757

BLANK 0.060 (l) * 0.0081 (g/l) = −0.0005 (g)

CORRECTED TOTAL 0.0752

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18923	137.5262	−	137.4492	=	0.0770

BLANK 1.140 (l) * 0.011 (g/l) = −0.0125

CORRECTED TOTAL 0.0645

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
1	0.2892	+	0.0752	+	0.0645	=	0.4289

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: stack
SITE:
LOCATION:

TEST NO: 3
RUN NO: 2
DATE: 11.13.92
ANALYST: R. Hessler

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18980	0.9048	−	0.6144	=	0.2904

TOTAL 0.2904

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18949	21.5347	−	21.3994	=	0.1353

BLANK 0.077 (l) * 0.0051 (g/l) = −0.0006 (g)

CORRECTED TOTAL 0.1347

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18926	135.4499	−	135.3837	=	0.0662

BLANK 1.370 (l) * 0.011 (g/l) = −0.015

CORRECTED TOTAL 0.0511

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
2	0.2904	+	0.1347	+	0.0511	=	0.4762

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 3
RUN NO: 3
DATE: 2.13.92
ANALYST: M. Hessler

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18981	0.7079	−	0.6148	=	0.0931

TOTAL 0.2931

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18950	21.5119	−	21.3617	=	0.1502

BLANK 0.075 (l) * 0.0081 (g/l) = −0.0006 (g)

CORRECTED TOTAL 0.1496

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18929	136.6045	−	136.5283	=	~~0.0256~~ 0.0762

BLANK 1.245 (l) * 0.011 (g/l) = −0.0137

CORRECTED TOTAL ~~0.0117~~ 0.0625

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
3	0.2931	+	0.1496	+	~~0.0117~~ 0.0625	=	~~0.4544~~ 0.5052

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St. Paul, Minnesota
55103-1857

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 4
RUN NO.'S 1, 2, 3
DATE: 2/13/92
ANALYST: R. Hessler

SUMMARY OF PARTICULATE ANALYSES

Lab No.	Run No.	Total Corrected Wt. (g)
18932, 1951, 1952	1	0.6358
18935, 1952, 1983	2	0.5193
18938, 1953, 1984	3	0.4658

BLANK VALUE ANALYSES

ACETONE

Lab No.	Final Wt.(g).		Tare Wt.(g)		Gain (g)(residue)
18954	21.2536	-	21.2525	=	0.0011

Residue(g)		Volume(l)		g/l
0.0011	/	0.135	=	0.0081

CONDENSIBLE ORGANICS

Lab No.	Final Wt.(g)		Tare Wt.(g)		Gain (g)(residue)
18941	140.7325	-	140.7303	=	0.0022

Residue(g)		Volume(l)		g/l
0.0022	/	0.200	=	0.011

NOTE: (l)=Liter
(g)=Gram
(g/l)=gram per liter

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 4
RUN NO: 1
DATE: 2.13.92
ANALYST: R. Hessler

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18982	0.9505	−	0.6222	=	0.3283

TOTAL 0.3283

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18951	21.6776	−	21.4506	=	0.2270

BLANK 0.076 (l) * 0.0081 (g/l) = −0.0006 (g)

CORRECTED TOTAL 0.2264

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18932	139.6786	−	139.5835	=	0.0951

BLANK 1.275 (l) * 0.011 (g/l) = −0.0140

CORRECTED TOTAL 0.0811

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
1	0.3283	+	0.2264	+	0.0811	=	0.6358

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St. Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 4
RUN NO: 2
DATE: 2.13.92
ANALYST: R. Hesskr

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18983	0.9165	−	0.6289	=	0.2876

TOTAL 0.2876

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18952	21.4627	−	21.3043	=	0.1584

BLANK 0.076 (l) * 0.0081 (g/l) = −0.0006 (g)

CORRECTED TOTAL 0.1578

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18935	139.1562	−	139.0667	=	0.0895

BLANK 1.415 (l) * 0.011 (g/l) = −0.0156

CORRECTED TOTAL 0.0739

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
2	0.2876	+	0.1578	+	0.0739	=	0.5193

Bay West Analytical Laboratory

Bay West Inc.
Five Empire Drive
St Paul, Minnesota
55103-1867

612-291-0456
FAX 291-0099

LAB NO: 2034
SOURCE: Stack
SITE:
LOCATION:

TEST NO: 4
RUN NO: 3
DATE: 2/13/92
ANALYST: K. Hessler

FILTERS

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18984	0.9261	−	0.6357	=	0.2904

TOTAL 0.2904

Probe & Front Half Wash

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18953	21.3424	−	21.2453	=	0.0971

BLANK 0.062 (l) * 0.0081 (g/l) = −0.0005 (g)

CORRECTED TOTAL 0.0966

IMPINGER CATCH

Lab No.	Final Wt. (g)		Tare Wt. (g)		Gain (g)
18938	139.9249	−	139.8271	=	0.0978

BLANK 1.455 (l) * 0.011 (g/l) = −0.0160

CORRECTED TOTAL 0.0818

SUMMARY OF CORRECTED TOTALS (g)

RUN NO.	FILTER		PROBE WASH		IMP. CATCH		TOTAL
3	0.2904	+	0.0966	+	0.0818	=	0.4688

"MISS[illegible]N TE[illegible] LOG [illegible]HEET 62.[illegible] rpm on pu[illegible] [illegible]

COAL FEED [illegible] T/HOUR [illegible] Sixth Dryer, 15% Recycle, ≈ 14% Aspiration

[illegible]ATE: 1/[illegible]/'77

PULP DRYER:

		0730	0800	0930	1000	1030	1100	1130	1200	1230	1300	1330	1400	1430	1500	1530	1600
SLICE (TPH)		207	2[illegible]	201	204	195	203	205	206	200	201	214	201	204	208	198	198
PULP FLOWS (TPH)	PRESSED	64.1	63.9	63.9	68.8	65.8	60.4	57.8	50.7	54.3	56.7	50.3	48.8	46.2	55.4	62.1	62.5
	DRYER FEED	33.9	38.8	38.3	37.1	37.2	35.5	35.5	38.5	32.3	36.1	35.[illegible]	30.1	30.5	40.2	39.6	36.1
FEEDER RPM		61.9	62.3	62.3	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2
PULP MOISTURES (%)	PRESSED																
	DRIED																
GRATE SPEED		34.3	[illegible]	60.1	57.5	53.7	49.8	56.3	55.7	47.2	46.2	58.5	55.0	48.1	52.1	53.2	55.8
THROAT TEMP. (°C)		718		809	856	869	812	813	820	819	775	804	823	799	772	814	818
EXIT TEMP. (°C)		133		127	129	130	130	128	129	131	129	128	129	131	129	130	129
P DRUM		0.35		0.50	0.51	0.47	0.49	0.47	0.46	0.44	0.47	0.48	0.47	0.45	0.50	0.51	0.52
I.D. FAN RPM		578.3		584.3	585.4	585.1	584.6	587.2	583.8	587.2	587.2	587.2	588.2	587.5	588.5	590.8	590.8
.C. ΔP		2.48		2.47	2.41	2.48	2.35	2.39	2.30	2.35	2.36	2.37	2.36	2.37	2.33	2.22	2.31
BAGHOUSE ΔP		2.05		2.17	2.14	2.20	2.19	2.23	2.23	2.23	2.27	2.28	2.27	2.30	2.31	2.30	2.33
ASP. AIRFLOW		8.1		7.9	7.8	8.1	8.1	7.8	7.7	7.7	8.0	7.7	7.9	7.8	7.8	7.7	7.4
RECYCLE AIRFLOW (CFM)		15%[illegible]		n/	n/	n/	n/	n/	n/	n/	n/	n/	n/	n/	n/	n/	

Moorhead Factory

Pulp Dryer Data Sheets

Date 1/24/92

Name ______

	[1] Time of [2] Day	[3] 1500	[4]	[5] 1530	[6] 1600	[7] 1630	[8] 1700	[9]
1	Slice Rate, Tph	204			204	213	212	
2	Total Pulp Flow, Tph	58.3			50.3	47.4	53.8	
3								
4	NORTH Unit							
5	Grate Speed, %	34.9			49.3			
6	ID Damper, %	94.0			94.0			
7	ID Fan, rpm	711.0			699.7			
8	Pulp Feed Gate, % Open	[illegible] rpm			[illegible] rpm			
9	Draft Control, %	-3.3			29.0			
10	FD Air Flow, MPPH	—			10.41			
11	BH Temp. In, °C	115			109			
12	Out, °C	108			107			
13	BH ΔP	6.22			6.33			
14	Multiclone, ΔP	3.80			3.86			
15	Dryer Throat, °C	531			503			
16	Dryer Exit, °C	134			123			
17	Furnace Pressure	-0.73			-0.14			
18	Exit Pressure	-1.84			-1.13			
19	Dryer ΔP	0.60			0.73			
20	Aspiration Flow, ccfm	5.7			5.3			
21	Drum, amps.	16.5			16.5			
22	I.D. Fan, amps.	149			149			
23								
24	W h [illegible]	= 2 3/4"	29.0/29.0					
25	measured	~ 7 5/8"	8" in 5 sec.					
26	SOUTH Unit							
27	Grate Speed, %	51.7		51.6	54.6	46.0	56.6	
28	ID Damper, %	97.0		97.0	97.0	97.0	97.0	
29	ID Fan, rpm	589.0		590.1	591.9	592.9	590.6	
30	Pulp Feed Gate, % Open	62.3		62.3 rpm	62.3 rpm	do	do	
31	Draft Control, %	38.5		35.1	39.5	30.9	41.4	
32	FD Air Flow, MPPH	17.32		13.31	19.24	0.00	20.07	
33	BH Temp. In, °C	115		115	115	117	115	
34	Out, °C	113		113	113	114	114	
35	BH ΔP	2.29		2.28	2.26	2.33	2.35	
36	Multiclone, ΔP	2.33		2.21	2.27	2.29	2.28	
37	Dryer Throat, °C	776		822	837	812	780	
38	Dryer Exit, °C	129		130	131	130	127	
39	Furnace Pressure	-0.23		-0.20	-0.18	-0.26	-0.19	
40	Exit Pressure	-1.09		-1.05	-1.07	-1.13	-1.06	
41	Dryer ΔP	0.46		0.48	0.51	0.49	0.47	
42	Aspiration Flow, ccfm	7.9		7.6	7.7	7.6	7.4	
43	Drum, amps	18.0		18.0	17.5	17.5	17.6	
44	ID Fan, amps	164		165	165	166	166	
45								
46		50.4/47.9			51.1/48.1			
47		8" in 99 sec			8" in 100 sec.			
48	Unit [illegible]							
49								
50								

EMISSION TEST LOG SHEET

Coal Feed ___ Tons/Hour

DATE: 1/ / 2

PULP DRYER:

TIME		1630	1700														
SLICE (TPH)		205	213														
PULP FLOWS (TPH)	PRESSED	56.3	53.7														
	DRYER FEED	34.2	34.9														
FEEDER RPM		67.2	67.2														
PULP MOISTURES (%)	PRESSED																
	DRIED																
GRATE SPEED		49.3	54.8														
THROAT TEMP. (°C)		813	781														
EXIT TEMP. (°C)		130	127														
P. DRUM		0.49	0.47														
[illegible]		[illegible]	[illegible]														
M.C. ΔP		2.25	2.30														
BAGHOUSE ΔP		2.32	2.33														
ASP. AIRFLOW		7.5	7.8														
RECYCLE AIRFLOW (CFM)		n/	n/c														

1/21/92 cont'd

Time		Draft Control ✓
1915	SO Side ΔP	14.2%
1917		12.3%
1919		11.0%
1921		13.4%
1925	No Side ΔP	20.1%
1928		24.3%
1930		23.6%

Check on pulp feed

5300 TPd slice 5% Mars 60% South

221 Tph slice 11.04 Tph dry solids = 52.58 Tph ws
@ 79% H_2O
∴ Fee
60% = 31.55 Tph

50 = 26 0.52 Tph/rpm
31.55 = 62 rpm

COAL FEED ______ T/HOUR No Recycle, 14% Aspiration, 34 Tph Pulp

'ISS' ' TE' LOG ' IEET Pre...d ATE: 1/ _ 1.

PULP DRYER: South

TIME		1400	1430	1500	1530	1600	1630	1700	1730	1800	1830	1900	1930	2000	2030		
SLICE (TPH)		196	200	207	197	195	207	1	197	195	196	186	181	185	175		
PULP FLOWS (TPH)	PRESSED	57.5	55.2	53.6	56.2	54.2	58.3		61.7	58.0	60.7	51.4	51.3	57.6	53.4		
	DRYER FEED	51 RPM on [illegible]	29.1	24.9	27.1	27.5	28.4		30.0	27.8	30.4	[illegible]	27.4	27.4	26.4		
FEEDER RPM		51	51	51	50.0 Y [illegible]	50 Y	50 Y		50 Y	do	do	do	do	do	do		
PULP MOISTURES (%)	PRESSED																
	DRIED																
GRATE SPEED		43.3	33.9	45.3	45.3	40.4	39.6		38.8	40.0	39.5	45.0	42.6	40.0	41.9		
THROAT TEMP. (°C)		778	723	713	745	740	711		759	725	723	727	735	746	737		
EXIT TEMP. (°C)		130	131	127	129	130	129		129	128	128	127	128	128	128		
P DRUM		0.40	0.38	0.42	0.43	0.37	0.38		0.42	0.36	0.41	0.39	0.41	0.41	0.41		
I.D. FAN RPM		589.8	589.8	589.8	590.8	590.6	590.6		593.4	593.4	593.4	592.9	592.8	593.4	592.7		
I.C. ΔP		2.11	2.12	2.12	2.08	--	--		---	2.15	2.15	2.15	2.13	2.1	2.11		
BAGHOUSE ΔP		2.16	2.40	2.49	2.52	2.63	2.73		2.91	3.00	3.08	3.13	3.22	3.30	3.38		
ASP. AIRFLOW		8.4	8.3	8.4	8.2	8.1	8.2		8.5	8.3	8.1	8.1	8.1	8.1	7.9		
RECYCLE AIRFLOW (CFM)																	

8:00 – 7.6 8:30 – 6.2

9:00 – 6.5 9:30 – 8.2

10 – 6.4 10:30 – 6.9

11:00 – 6.5 11:30 – 6.8

12:00 – 7.8 12:30 – 7.1

[illegible] 9.1

1:30 – 9.2 2:30 – 6.4

3:00 – 7.4

3:30 – 8.9 4:00 – 6.6

[illegible]

1/23/92

Product Pulp

Moisture

South Dryer

MHD

Coal Fee[illegible] HOUR [illegible] MISSION TEST LOG SHEET DATE 1/22/92

PULP DRYER: South

TIME		0830	0900	0930	1000	1030	1100	1130	1200	1230	1300	1330	1400	1430	1500	1530	1600
SLICE (TPH)		191	1[illegible]0	202	192	189	169	196	206	204	195	197	208	183	210	233	203
PULP FLOWS (TPH)	PRESSED	49.6	49.3	52.7	53.1	50.5	60.2	56.3	53.7	50.2	48.8	48.9	48.8	50.2	58.3	45.7	54.5
	DRYER FEED	34.3	32.4	35.5	33.6	35.9	37.1	32.5	33.1	32.3	33.3	36.2	32.11	34.6	35.8	37.3	31.9
FEEDER RPM		62.0	62.4	62.2	62.2	62.4	62.1	62.2	62.3	62.2	62.5	62.4	62.2	62.4	62.4	62.3	62.2
PULP MOISTURES (%)	PRESSED																
	DRIED																
GRATE SPEED		58.3	49.4	55.9	53.0	52.3	52.7	57.1	52.7	56.7	56.3	54.4	48.9	57.0	52.2	52.3	55.0
THROAT TEMP. (°C)		778	829	816	828	831	801	798	831	830	827	831	[illegible]	834	831	811	824
EXIT TEMP. (°C)		126	128	126	127	128	127	126	128	127	127	128	129	128	127	127	127
P DRUM		0.48	0.49	0.49	0.49	0.44	0.45	0.45	0.45	0.46	0.51	0.49	0.47	0.49	0.49	0.49	0.49
I.D. FAN RPM		593.4	594.2	592.4	593.4	593.4	594.5	593.4	594.5	592.9	594.5	593.7	594.5	596.3	596.0	597.9	597.1
C. ΔP		2.25	2.22	2.20	2.16	2.20	2.15	2.11	2.17	2.15	2.17	2.14	2.12	2.21	2.21	2.22	2.14
BAGHOUSE ΔP		4.74	4.88	5.70		2.31	2.42	2.51	2.63	2.68	2.80	2.85	[illegible]	2.99	3.12	3.19	3.23
ISP. AIRFLOW		7.0	6.9	8.1		8.0	8.0	8.0	8.2	8.0	8.2	7.9	[illegible]	7.9	7.9	9.0	7.7
RECYCLE AIRFLOW (CFM)		n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Moorhead Factory

Pulp Dryer Data Sheets

Date 11/22/92

Name

Time of Day	1500	~~1500~~	1530	1600	1630	1700	1730
Slice Rate, Tph	219		195	199	194	202	205
Total Pulp Flow, Tph	54.3		49.4	45.5	52.7	53.9	50.6
NORTH Unit							
Grate Speed, %	43.0			24.7		42.7	57.0
ID Damper, %	94.1			94.0		94.0	94.0
ID Fan, rpm	647.7			700.0		698.9	698.9
Pulp Feed Gate, % Open	25.4 @ 41.4 / 57.4 rpm			~~23.2~~ @ 40, 34.5 rpm		32.4 @ 31.0 rpm	30 @ 47 rpm
Draft Control, %	43.1			4.8		31.6	48.9 ~~40.0~~
FD Air Flow, MPPH	5.11			—		2.07	7.60
BH Temp. In, °C	114			120		107	108
Out, °C	112			115		107	104
BH ΔP	3.12			6.12 ~~3.53~~		6.24	6.27
Multiclone, ΔP	2.13			3.53		3.80	3.73
Dryer Throat, °C	832			544		561	578
Dryer Exit, °C	127			133		114	125
Furnace Pressure	-0.50			-0.92		-0.57	-0.38
Exit Pressure	-1.06			-2.00		-1.74	-1.59
Dryer ΔP	0.46			0.59		0.79	0.74
Aspiration Flow, acfm	7.8	EOT 1430		6.1		5.9	5.7
Drum, amps	20.0	SOT 1515		16.5		17.5	17.0
I.D. Fan, amps	166			149		149	149
							47.1/45.7
							8" in 45 sec.
SOUTH Unit							
Grate Speed, %	50.8		52.3	52.5	56.6	56.6	50.8
ID Damper, %	97.0		97.0	97.0	97.0	97.0	97.0
ID Fan, rpm	596.3		597.9	597.9	593.4	596.3	595.5
Pulp Feed Gate, % Open	62.4 rpm		~~[illegible]~~ 62.7	50 @ 62.2 rpm	same	same	same
Draft Control, %	37.0		37.6	36.5	41.1	39.6	35.9
FD Air Flow, MPPH	11.65		12.73	13.50	21.3	18.4	10.20
BH Temp. In, °C	114		114	114	113	114	115
Out, °C	112		112	112	112	112	112
BH ΔP	3.12		3.19	3.23	3.29	3.35	3.42
Multiclone, ΔP	2.16		2.17	2.11	2.14	2.14	2.16
Dryer Throat, °C	830		809	834	865	872	886
Dryer Exit, °C	128		127	127	125	129	128
Furnace Pressure	-0.49		-0.48	-0.45	-0.43	-0.42	-0.43
Exit Pressure	-1.08		-1.12	-1.09	-1.01	-1.05	-1.05
Dryer ΔP	0.43		0.46 ~~0.43~~	0.46	0.47	0.47	0.45
Aspiration Flow, acfm	7.9		7.8 ~~[illegible]~~	7.7	7.7	7.7	7.5
Drum, amps	18.0		20.0	19.0	20.0	20.5	20.5
ID Fan, amps	167		167	166	166	166	164
			~~[illegible]~~/51.2/50.7		62.7/58.3	~~[illegible]~~	50.4/52.1
			8" in 111 sec.		8" in 85 sec.		4" in 95 sec.

COAL FEED _____ T/HOUR

'ISS' ' TE' 'OG 'EET

ATE: 1/2 /

PULP DRYER:

TIME		1630	1700	1730														
SLICE (TPH)		219	203	203														
PULP FLOWS (TPH)	PRESSED	47.8	52.3	56.0														
	DRYER FEED	31.8	32.0	39.5														
FEEDER RPM		62.2	62.2	62.2														
PULP MOISTURES (%)	PRESSED																	
	DRIED																	
GRATE SPEED		57.5	55.3	50.8														
THROAT TEMP. (°C)		863	864	885														
EXIT TEMP. (°C)		127	128	129														
ΔP DRUM		0.44	0.47	0.49														
I.D. FAN RPM		593.4	596.0	595.5														
I.C. ΔP		2.15	2.15	2.12														
BAGHOUSE ΔP		3.30	3.36	3.39														
SP. AIRFLOW		7.9	7.8	7.6														
RECYCLE AIRFLOW (CFM)		n/	n/	n/														

Moorhead Factory

Pulp Dryer Data Sheets

Date 1/23/92

Name

	[1]Time of [2]Day	[3]1430	[4]1700	5	6	7	8	9
1	Slice Rate, Tph	193	206					
2	Total Pulp Flow, Tph	62.8	54.2					
3								
4	NORTH Unit							
5	Grate Speed, %	45.1	32.3					
6	ID Damper, %	94.5	94.0					
7	ID Fan, rpm	698.9	698.6					
8	Pulp Feed Gate, % open	47.5 % 55 rpm	26.6 % 38.5 rpm					
9	Drate Control, %	14.1	5.5					
10	FD Air Flow, MPPH	-1.40	-1.40					
11	BH Temp. In, °C	108	108					
12	Out, °C	103	102					
13	BH ΔP	6.40	6.44					
14	Multiclone, ΔP	3.87	3.66					
15	Dryer Throat, °C	610	623					
16	Dryer Exit, °C	125	132					
17	Furnace Pressure	-0.46	-0.74					
18	Exit Pressure	-1.66	-1.76					
19	Dryer ΔP	0.70	0.61					
20	Aspiration Flow, acfm	5.1	5.3					
21	Drum, amps	14.5	14.5					
22	ID Fan, amps	149	149					
23								
24								
25								
26	SOUTH Unit							
27	Grate Speed, %	50.2	52.0					
28	ID ~~Damper~~ Speed, %	97.0	97.0					
29	ID Fan, rpm	580.2	581.2					
30	Pulp Feed Gate, % open	43.3 rpm	62.2 rpm					
31	Drate Control, %	36.2	38.7					
32	FD Air Flow, MPPH	13.47	15.21					
33	BH Temp. In, °C	114	114					
34	Out, °C	111	111					
35	BH ΔP	4.14	4.28					
36	Multiclone, ΔP	2.44	2.46					
37	Dryer Throat, °C	787	770					
38	Dryer Exit, °C	129	127					
39	Furnace Pressure	-0.16	-0.16					
40	Exit Pressure	-0.89	-1.01					
41	Dryer ΔP	0.40	0.47					
42	Aspiration Flow, acfm	7.4	7.7					
43	Drum, amps	17.5	18.0					
44	ID Fan, amps	163	164					
45								
46								
47								
48								
49								

Coal FEED ______ T/HOUR ______ 10% Ke[illegible] EMISSION TEST LOG SHEET DATE: 1/23/93

PULP DRYER:

TIME		0938	1000	1030	1100	1130	1200	1230	1300	1330	1400	1430	1500	1530	1600	1630	1700
SLICE (TPH)		202	202	186	196	192	202	194	201	204	202	202	194	207	197	199	187
PULP FLOWS (TPH)	PRESSED	53.5	47.7	48.2	44.7	50.5	58.9	46.6	51.7	54.4	56.2	63.3	53.4	56.2	? 35.1	58.5	66.3
	DRYER FEED	31.9	35.7	31.5	35.8	31.8	39.1	30.3	31.2	34.8	41.2	38.0	34.9	32.0	25.8	34.2	37.4
FEEDER RPM		50 to yld 62.3 rpm	62.3 rpm	62.1	62.3	62.3	62.2	62.3	62.3	62.3	62.2	62.2	62.3	62.3	62.2	62.2	62.2
PULP MOISTURES (%)	PRESSED																
	DRIED																
GRATE SPEED		54.1	50.1	50.9	52.0	53.4	55.0	50.5	58.3	54.6	47.1	53.3	51.3	47.1	49.5	52.0	53.2
THROAT TEMP. (°C)		763	757	763	768	787	755	785	775	801	781	743	791	783	758	780	772
EXIT TEMP. (°C)		127	127	127	127	127	126	127	125	127	128	125	128	129	128	128	126
ΔP DRUM		0.46	0.50	0.43	0.50	0.41	0.45	0.41	0.44	0.40	0.45	0.47	0.48	0.48	0.55	0.50	0.49
I.D. FAN RPM		583.5	582.8	584.6	583.8	583.5	579.9	582.8	584.3	584.3	583.8	580.9	584.8	585.1	586.1	581.2	580.9
M.C. ΔP		2.49	2.45	2.45	2.49	2.49	2.53	2.56	2.54	2.52	2.42	2.43	2.53	2.49	2.52	2.43	2.51
BAGHOUSE ΔP		3.08	3.1[illegible]	3.27	3.29	3.43	3.50	3.54	3.63	3.65	3.74	3.85	3.96	4.08	4.13	4.15	4.28
ASP. AIRFLOW		7.6	7.[illegible]	7.8	7.7	7.5	7.9	7.5	7.8	7.6	7.6	7.5	7.7	7.5	7.4	7.5	7.6
RECYCLE AIRFLOW (CFM)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

All condensible PM is condensible organic PM only!!

Filename: BEET17.WQ1
Date: 19-Dec-94
Facility: American Crystal Sugar
Location: Moorhead, Minnesota
Source: South pulp dryer--coal-fired rotary drum with multiclone and stack filter system
Test date: January 21, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	233.3	232.8	228.8	
South pulp dryer	Pressure	in. HG	28.8	28.8	28.8	
	Moisture	%	32.39	33.09	32.16	
	Oxygen	%	16	15.5	15.25	
	Volumetric flow, actual	acfm	68336	68733	68225	
	Volumetric flow, standard*	dscfm	33857	33726	34139	
	Isokinetic variation	%	109.64	104.7	100.84	
Wet Pulp Feed Rate To Dryer		TPH	27.0	28.6	27.7	
	Pollutant concentrations:					
	Total PM	G/dscf	0.0724	0.0718	0.0757	
	Filterable PM	G/dscf	0.0640	0.0632	0.0625	
	Condensible PM	G/dscf	0.00838	0.00856	0.0132	
	CO2	% dv	4.12	4.08	4.11	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	18.6	18.28	18.29	
	Condensible PM	lb/hr	2.43	2.48	3.86	
	CO2	lb/hr	9560	9430	9616	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.69	0.64	0.66	0.66
	Condensible PM	lb/ton	0.090	0.086	0.14	0.11
	CO2	lb/ton	354	329	348	344
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.34	0.32	0.33	0.33
	Condensible PM	kg/Mg	0.045	0.043	0.070	0.053
	CO2	kg/Mg	177	165	174	172

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Total emission factors for 12 test runs

	controlled	uncontrolled
Filterable PM	0.31 kg/Mg (0.61 lb/ton)	2.2 kg/Mg (4.4 lb/ton)
Condensible organic PM	0.052 kg/Mg (0.10 lb/ton)	No Data
CO_2	151 kg/Mg (302 lb/ton)	155 kg/Mg (310 lb/ton)

Filename: BEET17A.WQ1
Date: 19-Dec-94
Facility: American Crystal Sugar
Location: Moorhead, Minnesota
Source: South pulp dryer--coal-fired rotary drum with multiclone and stack filter system
Test date: January 22, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg F	227.8	218.4	219.8	
South pulp dryer	Pressure	in. HG	28.7	28.7	28.7	
	Moisture	%	42.65	42.44	44.09	
	Oxygen	%	14.75	14.25	15.1	
	Volumetric flow, actual	acfm	63134	62566	62962	
	Volumetric flow, standard*	dscfm	26633	26857	26198	
	Isokinetic variation	%	109.19	104.6	104.29	
Wet Pulp Feed Rate To Dryer		TPH	34.7	34.1	33.7	
	Pollutant concentrations:					
	Total PM	G/dscf	0.1001	0.0953	0.1277	
	Filterable PM	G/dscf	0.0847	0.0823	0.102	
	Condensible PM	G/dscf	0.0154	0.0130	0.0259	
	CO2	% dv	5.5	6	5.2	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	19.3	18.94	22.86	
	Condensible PM	lb/hr	3.52	3.00	5.82	
	CO2	lb/hr	10039	11044	9336	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.56	0.56	0.68	0.60
	Condensible PM	lb/ton	0.10	0.088	0.17	0.12
	CO2	lb/ton	290	324	277	297
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.28	0.28	0.34	0.30
	Condensible PM	kg/Mg	0.051	0.044	0.086	0.060
	CO2	kg/Mg	145	162	139	148

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET17B.WQ1
Date: 26-Jan-95
Facility: American Crystal Sugar
Location: Moorhead, Minnesota
Source: South pulp dryer--coal-fired rotary drum with multiclone and stack filter system
Test date: January 23, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
3	Stack temperature	Deg F	217.1	213.1	203.3	
South pulp dryer	Pressure	in. HG	28.6	28.6	28.6	
	Moisture	%	46.02	46.74	43.7	
	Oxygen	%	15.1	14.58	15.5	
	Volumetric flow, actual	acfm	57117	57148	56430	
	Volumetric flow, standard*	dscfm	23021	22860	24213	
	Isokinetic variation	%	109.02	108.94	100.6	
Wet Pulp Feed Rate To Dryer		TPH	33.0	32.1	31.7	
	Pollutant concentrations:					
	Total PM	G/dscf	0.0979	0.1119	0.1213	
	Filterable PM	G/dscf	0.0832	0.0999	0.106	
	Condensible PM	G/dscf	0.0147	0.0120	0.0150	
	CO2	% dv	5.02	5.79	4.85	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	16.4	19.6	22.1	
	Condensible PM	lb/hr	2.91	2.35	3.11	
	CO2	lb/hr	7920	9071	8048	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.50	0.61	0.70	0.60
	Condensible PM	lb/ton	0.088	0.073	0.098	0.086
	CO2	lb/ton	240	283	254	259
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.25	0.30	0.35	0.30
	Condensible PM	kg/Mg	0.044	0.037	0.0491	0.043
	CO2	kg/Mg	120	141	127	129

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT
Run three PM does not match PM in report. Mistake in reporting condensibles in report.

Filename: BEET17C.WQ1
Date: 19-Dec-94
Facility: American Crystal Sugar
Location: Moorhead, Minnesota
Source: South pulp dryer--coal-fired rotary drum with multiclone and stack filter system
Test date: January 24, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
4	Stack temperature	Deg F	209.5	201.5	190.8	
South pulp dryer	Pressure	in. HG	28.8	28.8	28.8	
	Moisture	%	43.35	44.73	45.34	
	Oxygen	%	14	13.65	13.88	
	Volumetric flow, actual	acfm	58851	58123	58206	
	Volumetric flow, standard*	dscfm	25297	24675	24840	
	Isokinetic variation	%	108.32	108.55	108.92	
Wet Pulp Feed Rate To Dryer		TPH	36.7	33.8	36.6	
	Pollutant concentrations:					
	Total PM	G/dscf	0.1295	0.1134	0.1014	
	Filterable PM	G/dscf	0.1130	0.0973	0.0837	
	Condensible PM	G/dscf	0.0165	0.0161	0.0177	
	CO2	% dv	6.12	6.58	6.58	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	24.5	20.57	17.82	
	Condensible PM	lb/hr	3.58	3.41	3.77	
	CO2	lb/hr	10610	11127	11202	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.67	0.61	0.49	0.59
	Condensible PM	lb/ton	0.10	0.10	0.10	0.10
	CO2	lb/ton	289	330	306	308
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.33	0.30	0.24	0.29
	Condensible PM	kg/Mg	0.049	0.051	0.051	0.050
	CO2	kg/Mg	145	165	153	154

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET17D.WQ1
Date: 19-Dec-94
Facility: American Crystal Sugar
Location: Moorhead, Minnesota
Source: South pulp dryer--coal-fired rotary drum multiclone inlet
Test date: January 21, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	248.8	247.2	244.4	
South pulp dryer multiclone inlet	Pressure	in. HG	29.06	29.06	29.06	
	Moisture	%	31.09	31.76	31.18	
	Oxygen	%	16	15.5	15.25	
	Volumetric flow, actual	acfm	81456	80531	81030	
	Volumetric flow, standard*	dscfm	40609	39847	40596	
	Isokinetic variation	%	109.42	102.8	100.98	
Wet Pulp Feed Rate To Dryer		TPH	27	28.6	27.7	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.3533	0.4167	0.3414	
	CO2	% dv	4.12	4.08	4.11	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	123	142	119	
	CO2	lb/hr	11466	11142	11435	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	4.6	5.0	4.3	4.6
	CO2	lb/ton	425	390	413	409
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	2.3	2.5	2.1	2.3
	CO2	kg/Mg	212	195	206	205

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET17E.WQ1
Date: 19-Dec-94
Facility: American Crystal Sugar
Location: Moorhead, Minnesota
Source: South pulp dryer--coal-fired rotary drum multiclone inlet
Test date: January 22, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg F	243	242.8	242.8	
South pulp dryer multiclone inlet	Pressure	in. HG	28.91	28.91	28.91	
	Moisture	%	39.35	42.06	40.72	
	Oxygen	%				
	Volumetric flow, actual	acfm	88431	87614	86927	
	Volumetric flow, standard*	dscfm	38918	36846	37403	
	Isokinetic variation	%	105.87	105.98	100.77	
Wet Pulp Feed Rate To Dryer		TPH	34.7	34.1	33.7	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.4139	0.4206	0.4494	
	CO2	% dv	5.5	6	5.2	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	138	133	144	
	CO2	lb/hr	14670	15151	13329	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	4.0	3.9	4.3	4.0
	CO2	lb/ton	423	444	396	421
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	2.0	1.9	2.1	2.0
	CO2	kg/Mg	211	222	198	210

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET17F.WQ1
Date: 19-Dec-94
Facility: American Crystal Sugar
Location: Moorhead, Minnesota
Source: South pulp dryer--coal-fired rotary drum multiclone inlet
Test date: January 23, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
3	Stack temperature	Deg F	243.6	243.3	244	
South pulp dryer multiclone inlet	Pressure	in. HG	28.87	28.87	28.87	
	Moisture	%	42.88	44.87	43.13	
	Oxygen	%	15.1	14.58	15.5	
	Volumetric flow, actual	acfm	80713	80381	81039	
	Volumetric flow, standard*	dscfm	33386	32104	33356	
	Isokinetic variation	%	106.05	105.85	101.38	
Wet Pulp Feed Rate To Dryer		TPH	33	32.1	31.7	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.4774	0.4937	0.5692	
	CO2	% dv	5.02	5.79	4.85	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	137	136	163	
	CO2	lb/hr	11486	12739	11087	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	4.1	4.2	5.1	4.5
	CO2	lb/ton	348	397	350	365
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	2.1	2.1	2.6	2.3
	CO2	kg/Mg	174	198	175	182

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET17G.WQ1
Date: 19-Dec-94
Facility: American Crystal Sugar
Location: Moorhead, Minnesota
Source: South pulp dryer--coal-fired rotary drum multiclone inlet
Test date: January 24, 1992

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
4	Stack temperature	Deg F	246.6	244.2	247.5	
South pulp dryer multiclone inlet	Pressure	in. HG	29.03	29.03	29.03	
	Moisture	%	42.35	43.45	43.48	
	Oxygen	%	14	13.65	13.88	
	Volumetric flow, actual	acfm	90671	88849	90663	
	Volumetric flow, standard*	dscfm	37901	36556	37106	
	Isokinetic variation	%	106.05	105.85	101.38	
Wet Pulp Feed Rate To Dryer		TPH	36.7	33.8	36.6	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.4687	0.5411	0.4783	
	CO2	% dv	6.12	6.58	6.12	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	152	170	152	
	CO2	lb/hr	15897	16485	15563	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	4.1	5.0	4.2	4.4
	CO2	lb/ton	433	488	425	449
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	2.1	2.5	2.1	2.2
	CO2	kg/Mg	217	244	213	224

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. _____ Date/Time _____ Phone Contact ☐
Project Title _____ Meeting Notes ☐
_____ Work Sheet ☐
Signature _____ Verified by _____ (signature/date) Page ___ of ___

PROCESS RATES FOR AMERICAN CRYSTAL SUGAR 1/92 TESTS

TEST #	RUN #	DATE	WET PULP FEED RATE
1	1	1/21 13:15-15:19	$\frac{(29.1+24.9)}{2} = 27.0$ TPH
	2	1/21 16:00-17:45	$\frac{(27.5+28.4+30)}{3} = 28.6$ TPH
	3	1/21 18:15-20:13	$\frac{(30.4+25.4+27.4+27.4)}{4} = 27.7$ TPH
2	1	1/22 10:20-12:12	$\frac{(35.9+37.1+32.5+33.1)}{4} = 34.7$ TPH
	2	1/22 12:50-14:30	$\frac{(33.3+36.2+32.4+34.6)}{4} = 34.1$ TPH
	3	1/22 15:15-16:52	$\frac{(37.3+31.9+31.8)}{3} = 33.7$ TPH
3	1	1/23 10:05-11:45	$\frac{(31.5+35.8+31.8)}{3} = 33.0$ TPH
	2	1/23 12:20-13:55	$\frac{(30.3+31.2+34.8)}{3} = 32.1$ TPH
	3	1/23 14:45-16:30	$\frac{(34.9+32.0+25.8+34.2)}{4} = 31.7$ TPH
4	1	1/24 10:15-12:10	$\frac{(37.2+35.5+35.5+38.5)}{4} = 36.7$ TPH
	2	1/24 12:45-14:20	$\frac{(36.1+35.1+30.1)}{3} = 33.8$ TPH
	3	1/24 15:05-16:55	$\frac{(39.6+36.1+34.2)}{3} = 36.6$ TPH

MRI

APPENDIX R

REPORT EXCERPTS FROM REFERENCE 19

(American Crystal Sugar Company, March 11, 1993)

Report Number: 4232-93-2259-5

Report Issued: April 16, 1993

AIR EMISSION TEST REPORT

RESULTS OF A
SOURCE EMISSION COMPLIANCE TEST ON
THE SUGAR COOLER STACK AT
AMERICAN CRYSTAL SUGAR COMPANY
CROOKSTON, MINNESOTA
MARCH 11, 1993

Submitted to:

AMERICAN CRYSTAL SUGAR COMPANY
Highway 75, P.O. Box 600
Crookston, MN 56716

Submitted by:

TWIN CITY TESTING CORPORATION
Air Quality Services Department
737 Pelham Blvd.
St. Paul, Minnesota 55114

Prepared by:

Alan L. Trowbridge
Manager, Source and Ambient Testing
Air Quality Services

Approved by:

Ahto Niemioja, P.E.
Director
Air Quality Services

FIGURE 1. PROCESS SCHEMATIC WITH SAMPLING PORT LOCATION

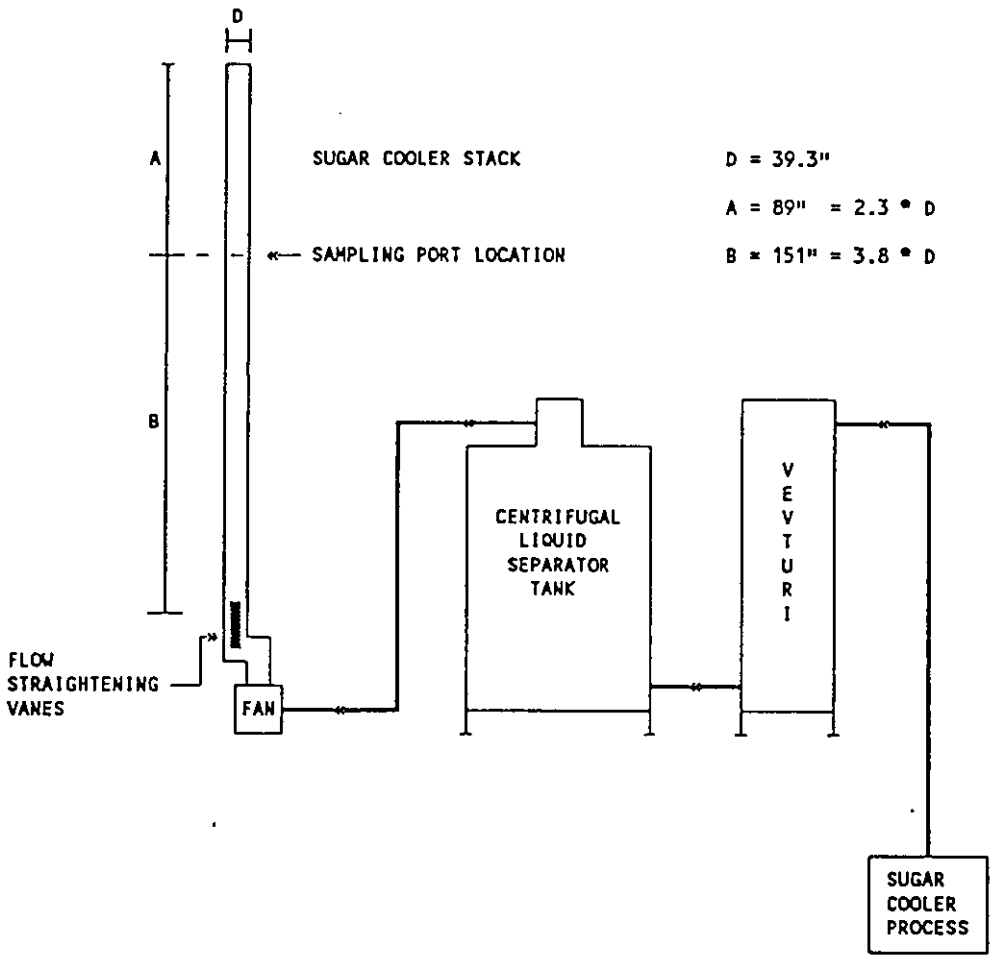


Table 1
Summary of particulate emission test results
American Crystal Sugar Company, Crookston, Minnesota
Sugar Cooler Scrubber Stack
March 11, 1993

Parameter	Run #1	Run #2	Run #3	Average
Time of Test;				
Start	0945	1137	1313	---
Finish	1050	1242	1420	---
Effluent Temperature, °F	117	113	111	114
Effluent Moisture Content, % v/v	9.0	8.3	7.5	8.3
Effluent Composition, % v/v dry;				
Carbon Dioxide	0.0	0.0	0.0	0.0
Oxygen	20.6	20.5	20.5	20.5
Effluent Volumetric Flow Rate;				
Actual Conditions, acfm	28,154	28,854	30,359	29,122
Standard Conditions, scfm	25,773	26,728	28,224	26,908
Dry Standard Conditions, dscfm	23,453	24,523	26,102	24,693
Isokinetic Variation, %	99.2	98.6	95.3	97.7
Effluent Particulate Concentration;				
Actual Conditions, gr/acf	0.0161	0.0105	0.0098	0.0121
Standard Conditions, gr/scf	0.0176	0.0113	0.0106	0.0132
Dry Standard Conditions, gr/dscf	0.0193	0.0123	0.0114	0.0143
Source Particulate Emission Rate;				
Classical Method, lb/hr	3.89	2.59	2.56	3.01
Ratio of Areas Method, lb/hr	3.85	2.56	2.44	2.95
Process Weight Rate, ton/hr	43.30	41.05	37.30	40.55

Standard Conditions: 68°F, 29.92 in. Hg. Particulate concentration and emission rates are based on analysis of the sampling train front and back catches.

SUMMARY OF PARTICULATE EMISSION TEST LABORATORY DATA

PROJECT NUMBER: 4232-93-2259
TEST NUMBER: 5

COMPANY: American Crystal Sugar
SOURCE: Sugar Cooler

	MASS OF PARTICULATE MATTER COLLECTED, GRAMS							
	FRONT CATCH				BACK CATCH			TOTAL PARTICULATE MASS COLLECTED
RUN NUMBER	FRONT WASH	CYCLONE CATCH	FILTER CATCH	FRONT TOTAL	IMPINGER CATCH **	IMPINGER WASH	BACK TOTAL	
1	0.0429	0.0000	0.0054	0.0483	0.0031	0.0029	0.0060	0.0543
2	0.0291	0.0000	0.0040	0.0331	0.0015	0.0014	0.0029	0.0360
3	0.0263	0.0000	0.0020	0.0283	0.0025	0.0035	0.0060	0.0343

* NOT APPLICABLE

** CHLOROFORM/ETHYL ETHER EXTRACTION

twin city testing corporation

A-4

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 93-2259 COMPANY: American Crystal Sugar
TEST NUMBER: 5 SOURCE: Sugar Cooler
RUN NUMBER: 1 TIME: 3/11/93 0945-1050

TEST DATA

GAS METER COEFFICIENT	0.9908	Y	VOLUME OF LIQUID COLLECTED, ML	91.0	Vl
PITOT TUBE COEFFICIENT	0.840	Cp			
NOZZLE DIMENSIONS;			GAS COMPOSITION, % V/V DRY;		
DIAMETER, IN	0.219	Dn	CARBON DIOXIDE	0.00	CD
AREA, SF	0.000262	An	OXYGEN	20.60	OX
			CARBON MONOXIDE	0.00	CM
STACK DIMENSIONS;			NITROGEN (BY DIFFERENCE)	79.40	NI
DIAMETER/LENGTH, IN	39.30	Sl	AVE. TRAVERSE POINT DATA;		
WIDTH, IN	0.00	Sw	STACK TEMP., DEG F	117	Ts
AREA, SF	8.424	As	METER TEMP., DEG F	92	Tm
			ORIFICE PRESSURE, IN WC	2.092	Po
BAROMETRIC PRESSURE, IN HG	29.92	Pb	SQRT VELOCITY P., IN WC	0.932	Pv
STACK PRESSURES;			MASS OF PARTICULATE MATTER		
STATIC, IN WC	0.00	Pg	COLLECTED, G;		
ABSOLUTE, IN HG	29.92	Ps	FRONT CATCH (89.0%)	0.0483	Wf
			BACK CATCH (11.0%)	0.0060	Wb
SAMPLING TIME, MIN	60.00	Ti	TOTAL CATCH	0.0543	Wt
VOLUME OF GAS SAMPLED AT METER, DCF	45.495	Vm			

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	43.306	Vms	GAS MOLECULAR WEIGHT;		
			DRY BASIS, LB/LB-MOLE	28.82	Md
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	4.283	Vw	WET BASIS, LB/LB-MOLE	27.85	Ms
			AVERAGE GAS VELOCITY, FPS	55.70	Vs
GAS MOISTURE CONTENT;			GAS VOLUMETRIC FLOW RATE;		
VOLUME FRACTION	0.0900	Bws	ACTUAL, ACFM	28154	Qa
PERCENT BY VOLUME	9.00	Bwp	STANDARD, SCFM	25773	Qs
			DRY STANDARD, DSCFM	23453	Qsd
			ISOKINETIC VARIATION, %	99.16	I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0143 Caf	0.0018 Cab	0.0161 Cat
STANDARD, GR/SCF	0.0157 Cwf	0.0019 Cwb	0.0176 Cwt
DRY STANDARD, GR/DSCF	0.0172 Csf	0.0021 Csb	0.0193 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	3.46 Rcf	0.43 Rcb	3.89 Rct
RATIO OF AREAS METHOD	3.43 Rrf	0.43 Rrb	3.85 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG * NON-APPLICABLE DATA

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 93-2259 COMPANY: American Crystal Sugar
TEST NUMBER: 5 SOURCE: Sugar Cooler
RUN NUMBER: 2 TIME: 3/11/93 1137-1242

TEST DATA

GAS METER COEFFICIENT	0.9908	Y	VOLUME OF LIQUID COLLECTED, ML	86.0	Vl
PITOT TUBE COEFFICIENT	0.840	Cp			
NOZZLE DIMENSIONS;			GAS COMPOSITION, % V/V DRY;		
DIAMETER, IN	0.219	Dn	CARBON DIOXIDE	0.00	CD
AREA, SF	0.000262	An	OXYGEN	20.50	OX
			CARBON MONOXIDE	0.00	CM
STACK DIMENSIONS;			NITROGEN (BY DIFFERENCE)	79.50	NI
DIAMETER/LENGTH, IN	39.30	Sl	AVE. TRAVERSE POINT DATA;		
WIDTH, IN	0.00	Sw	STACK TEMP., DEG F	113	Ts
AREA, SF	8.424	As	METER TEMP., DEG F	94	Tm
			ORIFICE PRESSURE, IN WC	2.254	Po
BAROMETRIC PRESSURE, IN HG	30.08	Pb	SQRT VELOCITY P., IN WC	0.963	Pv
STACK PRESSURES;			MASS OF PARTICULATE MATTER		
STATIC, IN WC	0.00	Pg	COLLECTED, G;		
ABSOLUTE, IN HG	30.08	Ps	FRONT CATCH (91.9%)	0.0331	Wf
			BACK CATCH (8.1%)	0.0029	Wb
SAMPLING TIME, MIN	60.00	Ti	TOTAL CATCH	0.0360	Wt
VOLUME OF GAS SAMPLED AT METER, DCF	47.114	Vm			

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	45.003	Vms	GAS MOLECULAR WEIGHT;		
			DRY BASIS, LB/LB-MOLE	28.82	Md
			WET BASIS, LB/LB-MOLE	27.93	Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	4.048	Vw	AVERAGE GAS VELOCITY, FPS	57.09	Vs
GAS MOISTURE CONTENT;			GAS VOLUMETRIC FLOW RATE;		
VOLUME FRACTION	0.0825	Bws	ACTUAL, ACFM	28854	Qa
PERCENT BY VOLUME	8.25	Bwp	STANDARD, SCFM	26728	Qs
			DRY STANDARD, DSCFM	24523	Qsd
			ISOKINETIC VARIATION, %	98.55	I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0096 Caf	0.0008 Cab	0.0105 Cat
STANDARD, GR/SCF	0.0104 Cwf	0.0009 Cwb	0.0113 Cwt
DRY STANDARD, GR/DSCF	0.0113 Csf	0.0010 Csb	0.0123 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	2.39 Rcf	0.21 Rcb	2.59 Rct
RATIO OF AREAS METHOD	2.35 Rrf	0.21 Rrb	2.56 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG • NON-APPLICABLE DATA

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 93-2259 COMPANY: American Crystal Sugar
TEST NUMBER: 5 SOURCE: Sugar Cooler
RUN NUMBER: 3 TIME: 3/11/93 1313-1420

TEST DATA

GAS METER COEFFICIENT	0.9908 Y	VOLUME OF LIQUID COLLECTED, ML	80.0 Vl
PITOT TUBE COEFFICIENT	0.840 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.219 Dn	CARBON DIOXIDE	0.00 CD
AREA, SF	0.000262 An	OXYGEN	20.50 OX
		CARBON MONOXIDE	0.00 CM
STACK DIMENSIONS;		NITROGEN (BY DIFFERENCE)	79.50 NI
DIAMETER/LENGTH, IN	39.30 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	0.00 Sw	STACK TEMP., DEG F	111 Ts
AREA, SF	8.424 As	METER TEMP., DEG F	92 Tm
		ORIFICE PRESSURE, IN WC	2.538 Po
BAROMETRIC PRESSURE, IN HG	30.09 Pb	SQRT VELOCITY P., IN WC	1.016 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	0.00 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	30.09 Ps	FRONT CATCH (82.5%)	0.0283 Wf
		BACK CATCH (17.5%)	0.0060 Wb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.0343 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	48.313 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	46.321 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	28.82 Md
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	3.766 Vw	WET BASIS, LB/LB-MOLE	28.01 Ms
		AVERAGE GAS VELOCITY, FPS	60.06 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.0752 Bws	ACTUAL, ACFM	30359 Qa
PERCENT BY VOLUME	7.52 Bwp	STANDARD, SCFM	28224 Qs
		DRY STANDARD, DSCFM	26102 Qsd
		ISOKINETIC VARIATION, %	95.30 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0081 Caf	0.0017 Cab	0.0098 Cat
STANDARD, GR/SCF	0.0087 Cwf	0.0018 Cwb	0.0106 Cwt
DRY STANDARD, GR/DSCF	0.0094 Csf	0.0020 Csb	0.0114 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	2.11 Rcf	0.45 Rcb	2.56 Rct
RATIO OF AREAS METHOD	2.01 Rrf	0.43 Rrb	2.44 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG • NON-APPLICABLE DATA

Filename: BEET19.WQ1
Date: 19-Dec-94
Facility: American Crystal Sugar
Location: Crookston, Minnesota
Source: Sugar cooler with venturi scrubber (5-7" pressure drop)
Test date: March 11, 1993

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	117	113	111	
Sugar cooler	Pressure	in. HG	29.92	30.08	30.09	
	Moisture	%	9.00	8.25	7.52	
	Oxygen	%	20.6	20.5	20.5	
	Volumetric flow, actual	acfm	28154	28854	30359	
	Volumetric flow, standard*	dscfm	23444	24525	26109	
	Isokinetic variation	%	99.2	98.6	95.3	
Sugar cooler throughput rate		TPH	43.30	41.05	37.30	
	Pollutant concentrations:					
	Total PM	G/dscf	0.0193	0.0123	0.0114	
	Filterable PM	G/dscf	0.0172	0.0113	0.00941	
	Condensible organic PM	G/dscf	0.00110	0.000513	0.00083	
	Condensible inorganic PM	G/dscf	0.00103	0.000478	0.00116	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	3.45	2.38	2.10	
	Condensible organic PM	lb/hr	0.221	0.108	0.186	
	Condensible inorganic PM	lb/hr	0.207	0.101	0.260	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.080	0.058	0.056	0.065
	Condensible organic PM	lb/ton	0.0051	0.0026	0.0050	0.0042
	Condensible inorganic PM	lb/ton	0.0048	0.0024	0.0070	0.0047
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.040	0.029	0.028	0.032
	Condensible organic PM	kg/Mg	0.0026	0.0013	0.0025	0.0021
	Condensible inorganic PM	kg/Mg	0.0024	0.0012	0.0035	0.0024

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX S

REPORT EXCERPTS FROM REFERENCE 20

(American Crystal Sugar Company, December 3, 1993)

Interpoll Laboratories, Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014-1819

TEL: (612) 786-6020
FAX: (612) 786-7854

RESULTS OF THE NOVEMBER 9 - 11, 1993 AIR EMISSION TESTING OF PROCESS SOURCES AT THE AMERICAN CRYSTAL SUGAR EAST GRAND FORKS PLANT

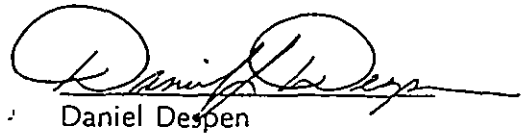
Submitted to:

AMERICAN CRYSTAL SUGAR COMPANY
Business Highway 220
P.O. Box 357
East Grand Forks, Minnesota 56721

Attention:

Bruce Keifenheim

Approved by:



Daniel Despen
Manager
Stationary Source Testing Department

Report Number 3-1636
December 3, 1993
SP/slp

Table 1a. Summary of the Results of the November 11, 1993 Particulate Emission Test on the A - Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-11-93	11-11-93	11-11-93
Time runs were done	(HRS)	930/1037	1100/1208	1230/1334
* Process rate				
Volumetric flow				
actual	(ACFM)	50585	51776	51507
standard	(DSCFM)	22618	24090	24043
Gas temperature	(DEG-F)	214	214	215
Moisture content	(%V/V)	41.60	39.20	38.96
Gas composition	(%V/V,dry)			
carbon dioxide		6.60	3.30	6.30
oxygen		13.60	13.80	13.90
nitrogen		79.80	82.90	79.80
Isokinetic variation	(%)	105.1	101.1	102.0
Particulate concentration				
actual	(GR/ACF)	.0425	.0328	.0347
standard	(GR/DSCF)	.0950	.0706	.0745
Part. emission rate	(LB/HR)	18.43	14.58	15.35

13.77

Note: Dry + Organic Wet Catch

* For Process Rate Information - See Appendix E.

Table 1b. Summary of the Results of the November 11, 1993 Particulate Emission Test on the A - Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-11-93	11-11-93	11-11-93
Time runs were done (HRS)	930/1037	1100/1208	1230/1334
* Process rate			
Volumetric flow			
actual (ACFM)	50585	51776	51507
standard (DSCFM)	22618	24090	24043
Gas temperature (DEG-F)	214	214	215
Moisture content (%V/V)	41.60	39.20	38.96
Gas composition (%V/V,dry)			
carbon dioxide	6.60	3.30	6.30
oxygen	13.60	13.80	13.90
nitrogen	79.80	82.90	79.80
Isokinetic variation (%)	105.1	101.1	102.0
Particulate concentration			
actual (GR/ACF)	.0370	.0295	.0320
standard (GR/DSCF)	.0827	.0634	.0685
Part. emission rate (LB/HR)	16.03	13.09	14.12

* For Process Rate Information, See Appendix E

Note: Dry Catch Only

Table 2a. Summary of the Results of the November 10, 1993 Particulate Emission Test on the B - Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-10-93	11-10-93	11-10-93
Time runs were done	(HRS)	905/1106	1130/1332	1350/1551
* Process rate				
Volumetric flow				
actual	(ACFM)	76428	76312	74513
standard	(DSCFM)	43382	44674	43695
Gas temperature	(DEG-F)	243	234	232
Moisture content	(%V/V)	23.30	21.92	21.97
Gas composition	(%V/V,dry)			
carbon dioxide		3.40	3.00	3.30
oxygen		17.10	17.50	17.20
nitrogen		79.50	79.50	79.50
Isokinetic variation	(%)	103.9	96.0	99.6
Particulate concentration				
actual	(GR/ACF)	.0283	.0365	.0323
standard	(GR/DSCF)	.0498	.0624	.0551
Part. emission rate	(LB/HR)	18.53	23.89	20.63

Note: Dry + Organic Wet Catch

* For Process Rate Information - See Appendix E.

Table 9. Summary of the Results of the November 9 - 11, 1993 Sulfur Dioxide Emission Compliance Tests at the American Crystal Sugar Plant in East Grand Forks, Minnesota.

Date	Time	Concentration (ppm,d)	Emission Rate (LB/HR)
(A - Pulp Dryer Stack)			
11-11-93	0930-1037	21	4.73
11-11-93	1100-1208	16	3.92
11-11-93	1230-1334	16	3.91
Average		18	4.19
(B - Pulp Dryer Stack)			
11-10-93	0905-1106	18	7.76
11-10-93	1130-1332	16	7.32
11-10-93	1350-1551	14	5.99
Average		16	7.02
(C - Pulp Dryer Stack)			
11-09-93	1030-1235	19	4.80
11-09-93	1315-1517	12	3.08
11-09-93	1535-1738	25	5.87
Average		19	4.58

Table 10. Summary of the Results of the November 9 - 11, 1993 Oxides of Nitrogen Emission Compliance Tests at the American Crystal Sugar Plant in East Grand Forks, Minnesota.

Date	Time	Concentration (ppm,d)	Emission Rate (LB/HR)
(A - Pulp Dryer Stack)			
11-11-93	0930-1037	95	15.3
11-11-93	1100-1208	99	17.2
11-11-93	1230-1334	100	17.2
Average		98	16.6
(B - Pulp Dryer Stack)			
11-10-93	0905-1106	69	21.3
11-10-93	1130-1332	67	21.5
11-10-93	1350-1551	66	20.8
Average		67	21.2
(C - Pulp Dryer Stack)			
11-09-93	1030-1235	97	17.2
11-09-93	1315-1517	98	17.8
11-09-93	1535-1738	90	15.1
Average		95	16.7
(No. 1 Boiler Stack)			
11-10-93	0810-0917	284	186
11-10-93	0948-1053	273	179
11-10-93	1115-1220	278	179
Average		278	181
(No. 2 Boiler Stack)			
11-11-93	0830-0947	319	186
11-11-93	1011-1124	335	200
11-11-93	1146-1257	329	192
Average		328	193

Table 11. Summary of the Results of the November 9 - 11, 1993 Total Hydrocarbon Emission Compliance Tests at the American Crystal Sugar Plant in East Grand Forks, Minnesota.

Date	Time	Concentration (ppmC,w)	Emission Rate (LB/HR)
(A - Pulp Dryer Stack)			
11-11-93	0930-1037	310	22.4
11-11-93	1100-1208	264	19.6
11-11-93	1230-1334	246	18.1
Average		273	20.0
(B - Pulp Dryer Stack)			
11-10-93	0905-1106	106	11.2
11-10-93	1130-1332	72	7.70
11-10-93	1350-1551	65	6.80
Average		81	8.57
(C - Pulp Dryer Stack)			
11-09-93	1030-1235	123	8.61
11-09-93	1315-1517	177	12.2
11-09-93	1535-1738	172	12.0
Average		157	10.9

Table 12. Summary of the Results of the November 9 - 11, 1993 Carbon Monoxide Emission Compliance Tests at the American Crystal Sugar Plant in East Grand Forks, Minnesota.

Date	Time	Concentration (ppm,d)	Emission Rate (LB/HR)
(A - Pulp Dryer Stack)			
11-11-93	0930-1037	540	53.3
11-11-93	1100-1208	500	52.5
11-11-93	1230-1334	450	47.2
Average		497	51.0
(B - Pulp Dryer Stack)			
11-10-93	0905-1106	750	142
11-10-93	1130-1332	830	162
11-10-93	1350-1551	590	112
Average		723	139
(C - Pulp Dryer Stack)			
11-09-93	1030-1235	240	26.0
11-09-93	1315-1517	260	28.8
11-09-93	1535-1738	290	29.7
Average		263	28.2
(No. 1 Boiler Stack)			
11-10-93	0810-0917	319	128
11-10-93	0948-1053	336	134
11-10-93	1115-1220	330	130
Average		328	131
(No. 2 Boiler Stack)			
11-11-93	0830-0947	580	206
11-11-93	1011-1124	535	194
11-11-93	1146-1257	375	134
Average		497	178

Test No. 9
A - Pulp Dryer Stack

Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	930/1037	1100/1208	1230/1334
Static pressure.....(IN.WC)	-0.70	-0.70	-0.70
Cross sectional area (SQ.FT)	12.05	12.05	12.05
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	617.0	575.0	574.0
desiccant.....(GRAMS)	17.0	13.0	12.0
total.....(GRAMS)	634.0	588.0	586.0
Total particulate material..			
.....collected(grams)	0.2585	0.1968	0.2089
Gas meter coefficient.....	0.9985	0.9975	0.9975
Barometric pressure..(IN.HG)	29.30	29.30	29.30
Avg. orif.pres.drop..(IN.WC)	1.78	1.74	1.72
Avg. gas meter temp..(DEF-F)	77.2	78.8	78.2
Volume through gas meter....			
at meter conditions...(CF)	43.49	44.74	44.99
standard conditions.(DSCF)	41.97	43.00	43.28
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.255	.255	.255
Avg.stack gas temp ..(DEG-F)	214	214	215
Volumetric flow rate.....			
actual.....(ACFM)	50585	51776	51507
dry standard.....(DSCFM)	22618	24090	24043
Isokinetic variation.....(%)	105.1	101.1	102.0
Particulate concentration...			
actual.....(GR/ACF)	0.04248	0.03285	0.03475
dry standard.....(GR/DSCF)	0.09504	0.07062	0.07447
Particle mass rate...(LB/HR)	18.426	14.583	15.347

Test No. 9
A - Pulp Dryer Stack

Results of Sulfur Dioxide Determinations----------Method 6

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	0930-1037	1100-1208	1230-1334
Barometric pressure..(IN.HG)	29.30	29.30	29.30
Meter temperature....(DEG-F)	77.20	78.80	78.20
Meter correction coefficient	0.9985	0.9975	0.9975
Volume through gas meter....			
at meter conditions...(CF)	43.490	44.740	44.990
standard conditions..(SCF)	41.967	42.997	43.283
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	41.60	39.20	38.96
Oxygen content....(%V/V DRY)	13.60	13.80	13.90
Milliequivalents of SO4 in..			
gas sample.....	2.0700	1.6500	1.6600
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.0244	0.0190	0.0190
(MG/DSCM).....	56	43	43
(PPM-DRY).....	21	16	16
(PPM-WET).....	12	10	10
SO2 Emission rate....(LB/HR)	4.73	3.92	3.91

Test No. 9
A - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	11-11-93	11-11-93	11-11-93	11-11-93
Time of run.....(HRS)	930	945	1000	1015
Flask number.....	13	14	15	16
Volume of flask.....(ML)	2060	2048	2045	2067
Data: time of sampling				
flask temperature..(DEG-F)	40.00	40.00	38.00	37.00
bar. press.....(IN.HG)	29.30	29.30	29.30	29.30
flask vacuum.....(IN.HG)	27.65	27.60	27.65	27.60
flask abs. press...(IN.HG)	1.65	1.70	1.65	1.70
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-0.40	0.20	-0.20	-0.10
flask abs. press...(IN.HG)	28.76	29.36	28.96	29.06
Volume gas sampled....(DSML)	1822	1848	1822	1844
Moisture content.....(%V/V)	41.59	41.59	41.59	41.59
Oxygen content....(%V/V,DRY)	13.60	13.60	13.60	13.60
Nitrate in gas sample...(JG)	443.0	460.0	441.0	445.0
NO2 in gas sample.....(JG)	328.7	341.3	327.2	330.2
<u>NOx Concentration</u>				
(GR/DSCF).....	0.0788	0.0807	0.0785	0.0782
(MG/DSCM).....	180	185	180	179
(PPM-DRY).....	94	97	94	94
(PPM-WET).....	55	56	55	55
NOX Emission rate....(LB/HR)	15.28	15.65	15.22	15.17
NOx emission factor..... .....(LB/MMBTU)*	0.315	0.323	0.314	0.313

* F = 9780 DSCF/MMBTU

Test No. 9
A - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	11-11-93	11-11-93	11-11-93	11-11-93
Time of run.....(HRS)	1105	1130	1145	1155
Flask number.....	17	18	73	74
Volume of flask.....(ML)	2054	2045	2065	2071
Data: time of sampling				
flask temperature..(DEG-F)	37.00	38.00	40.00	39.00
bar. press.....(IN.HG)	29.30	29.30	29.30	29.30
flask vacuum.....(IN.HG)	27.65	27.65	27.60	27.60
flask abs. press...(IN.HG)	1.65	1.65	1.70	1.70
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	0.30	0.10	0.10	-0.60
flask abs. press...(IN.HG)	29.46	29.26	29.26	28.56
Volume gas sampled....(DSML)	1863	1842	1857	1815
Moisture content.....(%V/V)	39.20	39.20	39.20	39.20
Oxygen content....(%V/V,DRY)	13.80	13.80	13.80	13.80
Nitrate in gas sample...(JG)	455.0	458.0	500.0	479.0
NO2 in gas sample.....(JG)	337.6	339.8	371.0	355.4
<u>NOx Concentration</u>				
(GR/DSCF).....	0.0792	0.0806	0.0873	0.0856
(MG/DSCM).....	181	185	200	196
(PPM-DRY).....	95	96	104	102
(PPM-WET).....	58	59	64	62
NOX Emission rate....(LB/HR)	16.35	16.65	18.03	17.67
NOx emission factor..... .....(LB/MMBTU)*	0.326	0.332	0.359	0.352

* F = 9780 DSCF/MMBTU

Test No. 9
A - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	11-11-93	11-11-93	11-11-93	11-11-93
Time of run.....(HRS)	1235	1255	1310	1325
Flask number.....	75	76	77	78
Volume of flask.....(ML)	2066	2093	2104	2077
Data: time of sampling				
flask temperature..(DEG-F)	40.00	40.00	40.00	40.00
bar. press.....(IN.HG)	29.30	29.30	29.30	29.30
flask vacuum.....(IN.HG)	27.60	27.60	27.60	27.60
flask abs. press...(IN.HG)	1.70	1.70	1.70	1.70
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	0.20	1.50	0.40	0.70
flask abs. press...(IN.HG)	29.36	30.66	29.56	29.86
Volume gas sampled....(DSML)	1865	1978	1913	1909
Moisture content.....(%V/V)	38.96	38.96	38.96	38.96
Oxygen content....(%V/V,DRY)	13.90	13.90	13.90	13.90
Nitrate in gas sample...(JG)	487.0	489.0	499.0	499.0
NO2 in gas sample.....(JG)	361.3	362.8	370.2	370.2
NOx Concentration				
(GR/DSCF).....	0.0847	0.0801	0.0846	0.0848
(MG/DSCM).....	194	183	194	194
(PPM-DRY).....	101	96	101	101
(PPM-WET).....	62	59	62	62
NOX Emission rate....(LB/HR)	17.45	16.52	17.43	17.47
NOx emission factor..... .....(LB/MMBTU)*	0.353	0.334	0.353	0.354

* F = 9780 DSCF/MMBTU

Interpoll Labs Report No. 3-1636
American Crystal Sugar
East Grand Forks, Minnesota

Test No. 9
A - Pulp Dryer Stack

Results of CO Determinations ----------Method 10

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	0930/1037	1100/1208	1230/1334
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	41.60	39.20	38.96
O2 Concentration.....(%V/V)	13.60	13.80	13.90
Volumetric flow rate (DSCFM)	22618	24090	24043
CO concentration.....			
(GR/DSCF).....	0.2748	0.2544	0.2290
(MG/DSCM).....	629.10	582.50	524.25
(PPM-WET).....	315.36	304.00	274.68
(PPM-DRY).....	540.00	500.00	450.00
(PPM-DRY @ 7% O2).....	1021.	972.22	887.32
CO emission rate.....(LB/HR)	53.268	52.532	47.187

CO = Carbon monoxide

A trailing '<' symbol indicates that the true value is less than or equal to the reported value

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS
Team Leader SCB
Date Submitted 11-12-93
Test No. 9
Date of Analysis 11-24-93

Source A Pulp Dryer
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Hazleson

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 9 Run 1 Log Number 1636-103 Comments ____	Dish No. 61A Dish Tare Wt. 51.4730 g Dish+Sample Wt. 51.5067 g Sample Wt. 0.0337 g
2	Test 9 Run 2 Log Number -105 Comments ____	Dish No. 62 Dish Tare Wt. 50.8880 g Dish+Sample Wt. 50.9082 g Sample Wt. 0.0202 g
3	Test 9 Run 3 Log Number -107 Comments ____	Dish No. 65 Dish Tare Wt. 44.6566 g Dish+Sample Wt. 44.6734 g Sample Wt. 0.0168 g
4	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

Blank Solvent Wt. 0.0001 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0336	0.0201	0.0167	D-11	

LSC-0

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS
Team Leader SLB
Date Submitted 11-12-93
Test No. 9
Date of Analysis 11-23-93
Transport Leakage [X] None [ ] _____ ml

Source A - Pulp Dryer
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson
Solvent Acetone

0	Test ____ Run 0 Field Blank Log Number _____ Vol. of Solvent ____ ml *Solvent Residue 4.0 ug/ml	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
1	Test 9 Run 1 Vol. of Solvent 100 ml Log Number 1636-100P Comments _____	Dish No. 46 Dish Tare Wt. 45.4233 g Dish+Sample Wt. 45.4402 g Sample Wt. 0.0169 g
2	Test 9 Run 2 Vol. of Solvent 110 ml Log Number -101P Comments _____	Dish No. 47 Dish Tare Wt. 48.4658 g Dish+Sample Wt. 48.4863 g Sample Wt. 0.0205 g
3	Test 9 Run 3 Vol. of Solvent 100 ml Log Number -102P Comments _____	Dish No. 48 Dish Tare Wt. 47.8872 g Dish+Sample Wt. 47.9087 g Sample Wt. 0.0215 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

*Solvent Residue ___ ug/ml = [(Sample Wt. ____ g)(10^6)]/Vol. of Sol. ____ ml
EPA-MS Acetone Residue Blank Spec. ≤ 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0165	0.0201	0.0211	0-12	

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS
Team Leader SCP
Date Submitted 11-12-93
Test No. 9
Date of Analysis 11-24-93

Source A-Pulp Dryer
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson

0	Test ___ Run 0 Field Blank Log Number ___ Comments ___	Filter No. ___ Filter Type ___ Filter Tare Wt. ___ g Filter+Sample Wt. ___ g Sample Wt. ___ g
1	Test 9 Run 1 Log Number 1636-100F Comments ___	Filter No. 6014 Filter Type 4" GF Filter Tare Wt. .8867 g Filter+Sample Wt. 1.0951 g Sample Wt. 0.2084 g
2	Test 9 Run 2 Log Number -101F Comments ___	Filter No. 9999 Filter Type 4" GF Filter Tare Wt. .8785 g Filter+Sample Wt. 1.0351 g Sample Wt. 0.1566 g
3	Test 9 Run 3 Log Number -102F Comments ___	Filter No. 5953 Filter Type 4" GF Filter Tare Wt. .9287 g Filter+Sample Wt. 1.0998 g Sample Wt. 0.1711 g
4	Test ___ Run ___ Log Number ___ Comments ___	Filter No. ___ Filter Type ___ Filter Tare Wt. ___ g Filter+Sample Wt. ___ g Sample Wt. ___ g
5	Test ___ Run ___ Log Number ___ Comments ___	Filter No. ___ Filter Type ___ Filter Tare Wt. ___ g Filter+Sample Wt. ___ g Sample Wt. ___ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.2084	0.1566	0.1711		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.2585	0.1968	0.2089		

LSC-02PR

Campaign Day: 1st

Date: [illegible]

PULP DRIER STACK TESTING

[illegible] Drier Test # [illegible]

☐ Engineering
☒ Compliance

Hr.	Stock Rate	Pre Heat F.D. Air		Heat Profile: Recycle Air		Furnace		Drum Exit		Air/Fuel Ratio		Pressed Pulp Feed		Damper Position: FD	Recycle	ID	Coal Rate		Grate Speed		% Moisture: Pressed Pulp		Dried Pulp		Pressure Drop (Inch Series): Multiclone		Multiclone Inlet		Pressure Readings: Furnace	Dryer Exit	Manometer Readings: Multiclone Inlet	FD Duct	Recycle Airflow (Control)	Hopper Filter D.P.	O_2 %	Moisture
	Hr. TPH	Hr. °C	1/2 Hr. °C	Hr. °C	1/2 Hr. °C	Hr. °C	1/2 Hr. °C	Hr. °C	1/2 Hr. °C	Hr. %	1/2 Hr. %	Hr. TPH	1/2 Hr. TPH	Hr. % Open	Hr. % Open	Hr. % Open	Hr. TPH	1/2 Hr. TPH	Hr.	1/2 Hr.	Hr. %	1/2 Hr. %	Hr. %	1/2 Hr. %	Hr. "H_2O	1/2 Hr. "H_2O	Hr. "H_2O	1/2 Hr. "H_2O	Hr. "H_2O	Hr. "H_2O	Hr. "H_2O	Hr. "H_2O		"H_2O		
8	315	–	–	–	–	787	782	108	108	–	–	22.7	22.7	41.6	39.8	60	–	–	32.3	31.4	7.2		7.7	8.6	5.90	5.78	6.16	6.16	-.07	-.51	6.00	.2			9.2	
9	316	–	–	–	–	777	774	108	108	–	–	20.8	20.1	34.2	39.4	60	–	–	33.9	33.3	7.2	7.5	8.5	7.6	5.94	5.89	6.47	6.45	-.15	-.42	5.00	.2				
10	314	–	–	–	–	803	801	107	107	–	–	22.9	22.1	41.6	41.6	60	–	–	32.0	34.1	7.3	7.5	8.1	8.2	5.80	5.91	6.44	6.44	-.07	-.59	6.00	.2				
11	317	–	–	–	–	796	797	108	108	–	–	21.5	22.1	41.2	39.9	60	–	–	31.6	30.9	7.3	7.2	8.3	8.6	5.84	5.87	6.41	6.44	-.13	-.61	6.00	.2				
12	315	–	–	–	–	802	804	107	108	–	–	23.2	22.5	43.1	46.4	60	–	–	33.6	30.1	7.2	7.2	8.1	8.6	5.78	5.86	6.64	6.64	-.11	-.60	6.0	.2	3502	4.68	9.27	11.78
1	321	–	–	–	–	775	806	107	107	–	–	22.6	21.9	43.0	44.8	60	–	–	31.2	31.8			8.5		5.76	5.67	6.64	6.64	-.15	-.60	6.0	.2	3554	4.31		
2		–	–	–	–					–	–					60	–	–													6.0	.2	3554	4.67		11.21
3		–	–	–						–	–					60	–	–																		
4		–	–	–						–	–					60	–	–																		
5		–	–	–						–	–					60	–	–																		
6		–	–	–	–					–	–					60	–	–																		

Air Registers:

Run #1:
- Closed
- 25%
- 50%
- 75%
- 100%

Run #2:
- Closed
- 25%
- 50%
- 75%
- 100%

Run 1 Start: [illegible] End: [illegible]

Run 2 Start: [illegible] End:

Controller Name:	Ratio	Bias

NOTES: Run 1

NOTES: Run 2

GENERAL NOTES: Run 3

[illegible] : 12:40 - 12:45

[illegible] : 12:45 - 1:00

CAGJ 07111001

Filename: BEET20.WQ1
Date: 31-Jan-95
Facility: American Crystal Sugar
Location: East Grand Forks, Minnesota
Source: Coal-fired pulp dryer 'A' (several other sources were tested, but process data are not provided for these sources)
Test date: November 11, 1993

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	214	214	215	
Pulp dryer A	Pressure	in. HG	29.30	29.30	29.30	
	Moisture	%	41.60	39.20	38.96	
	Oxygen	%	13.6	13.8	13.9	
	Volumetric flow, actual	acfm	50585	51776	51507	
	Volumetric flow	scfm	38806	39720	39455	
	Volumetric flow, standard*	dscfm	22663	24150	24083	
	Isokinetic variation	%	105.1	101.1	102	
Pressed pulp feed to dryer		TPH	23.0	22.0	22.6	
	Pollutant concentrations:					
	Total PM	G/dscf	0.0606	0.069	0.0776	
	Filterable PM	G/dscf	0.0538	0.0624	0.07180	
	Condensible organic PM	G/dscf	0.00680	0.00660	0.00580	
	CO2	% vol	5.2	5.6	5.6	
	SO2	ppmdv	21	16	16	
	NOx	ppmdv	95	99	100	
	THC as carbon	ppmwv	310	264	246	
	CO	ppmdv	540	500	450	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	10.45	12.92	14.82	
	Condensible organic PM	lb/hr	1.321	1.366	1.197	
	CO2	lb/hr	8076	9268	9243	
	SO2	lb/hr	4.75	3.85	3.84	
	NOx	lb/hr	15.4	17.1	17.3	
	THC as carbon	lb/hr	22.5	19.6	18.1	
	THC as methane	lb/hr	30.0	26.1	24.2	
	CO	lb/hr	53.4	52.7	47.3	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.45	0.59	0.66	0.57
	Condensible organic PM	lb/ton	0.057	0.062	0.053	0.058
	CO2	lb/ton	351	422	410	394
	SO2	lb/ton	0.21	0.18	0.17	0.18
	NOx	lb/ton	0.67	0.78	0.77	0.74
	THC as methane	lb/ton	1.3	1.2	1.1	1.2
	CO	lb/ton	2.3	2.4	2.1	2.3
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.23	0.29	0.33	0.28
	Condensible organic PM	kg/Mg	0.029	0.031	0.027	0.029
	CO2	kg/Mg	176	211	205	197
	SO2	kg/Mg	0.10	0.088	0.085	0.092
	NOx	kg/Mg	0.34	0.39	0.38	0.37
	THC as methane	kg/Mg	0.65	0.60	0.54	0.59
	CO	kg/Mg	1.2	1.2	1.0	1.1

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX T

REPORT EXCERPTS FROM REFERENCE 21

(American Crystal Sugar Company, December 11, 1990)

Interpoll Laboratories, Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014-1819

TEL: (612) 786-6020
FAX: (612) 786-7854

RESULTS OF THE NOVEMBER 14 AND 15, 1990 STATE PARTICULATE EMISSION COMPLIANCE TEST ON THE SUGAR COOLER AND SUGAR GRANULATOR AT THE ACS MOORHEAD PLANT

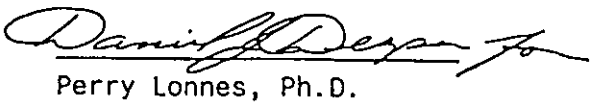
Submitted to:

AMERICAN CRYSTAL SUGAR COMPANY
2500 North Eleventh Street
P.O. Box 1037
Moorhead, Minnesota 56560

Attention:

Dave Waldon

Approved by:



Perry Lonnes, Ph.D.
Director
Field Testing Division

Report Number 0-3202
December 11, 1990
KE/kce

1 INTRODUCTION

On November 14 and 15, 1990, Interpoll Laboratories personnel conducted a particulate emission compliance test on the Sugar Cooler and Sugar Granulator at the American Crystal Sugar (ACS) Plant located in Moorhead, Minnesota. On-site testing was performed by D. Van Hoever and M. Kaehler. Coordination between testing activities and plant operation was provided by Dan Gust of ACS. The tests were not witnessed by a member of the Minnesota Pollution Control Agency.

The granulator and sugar cooler dry and cool the sugar in the later part of the overall process. After the juice is boiled down to the point where the crystal size and concentration in the mother liquor is appropriate; the entire mass is mixed; the crystal separated from the mother liquor and washed with high purity water in centrifugals; then scrolled off and conveyed by elevator to the granulator. The granulator is a horizontal rotary drum dryer. Heated air flows counter current to the sugar crystals passage through the drum and removes the excess moisture. Louvers in the drum cause the sugar to be carried up the side of the rotating drum, much like a cement mixer. This causes the sugar to fall through the heated air stream and increases the speed and efficiency of drying. The dried sugar is then conveyed by elevator to the sugar cooler which is also a horizontal rotary drum. The counter current flow of ambient air through the drum cools the sugar. Finally, the cooled sugar is screened for crystal size control. Particulate emissions from the granulator and cooler are controlled by Rotoclones.

Evaluations were performed in accordance with EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1989). A preliminary determination of the gas linear velocity profile was made before the first particulate determination to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited

Table 1. Summary of the Results of the November 14, 1990 Particulate Emission Compliance Test on the Sugar Cooler at the American Crystal Sugar Company in Moorhead, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-14-90	11-14-90	11-14-90
Time runs were done	(HRS)	938/1040	1102/1204	1226/1329
Process rate	(TPH)	39.7	34.1	36.6
Volumetric flow				
actual	(ACFM)	14075	14382	12971
standard	(DSCFM)	12162	12397	11167
Gas temperature	(DEG-F)	97	97	98
Moisture content	(%V/V)	4.65	4.87	4.79
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	102.0	103.3	98.8
Particulate concentration				
actual	(GR/ACF)	.0412	.0424	.0426
standard	(GR/DSCF)	.0477	.0492	.0496
Part. emission rate	(LB/HR)	4.97	5.23	4.74

Note: Dry + Organic Wet Catch

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job A.C.S / Moorhead
Team Leader MK
Date Submitted 11-16-90
Test No. 1
Date of Analysis 11-19-90

Source Sugar Cooler
Test Site Stack
Date of Test 11-14-90
No. of Runs Completed 3
Technician R. Sikma

0	Test 1 Run 0 Field Blank Log Number 1743-03 Comments	Dish No. 2 Dish Tare Wt. 46.2262 g Dish+Sample Wt. 46.2268 g Sample Wt. 0.0006 g
1	Test 1 Run 1 Log Number -06 Comments	Dish No. 7 Dish Tare Wt. 50.0319 g Dish+Sample Wt. 50.0357 g Sample Wt. 0.0038 g
2	Test 1 Run 2 Log Number -09 Comments	Dish No. 11 Dish Tare Wt. 47.7584 g Dish+Sample Wt. 47.7628 g Sample Wt. 0.0044 g
3	Test 1 Run 3 Log Number -12 Comments	Dish No. 14 Dish Tare Wt. 49.7341 g Dish+Sample Wt. 49.7379 g Sample Wt. 0.0038 g
4	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0006 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0006	0.0032	0.0038	0.0032	D-1	

LSC-

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job A.C.S./Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 1
Date of Analysis 11-16-90
Transport Leakage ☒ None ☐ _____ ml

Source Sugar Cooler
Test Site Stack
Date of Test 11-14-90
No. of Runs Completed 3
Technician R. Cullum
Solvent 60% DI H2O

0	Test 1 Run 0 Field Blank Log Number 1743-01 Vol. of Solvent 100 ml *Solvent Residue 2.0 ug/ml	Dish No. 72 Dish Tare Wt. 64.1083 g Dish+Sample Wt. 64.1085 g Sample Wt. 0.0002 g
1	Test 1 Run 1 Vol. of Solvent 170 ml Log Number -04 Comments	Dish No. 76 Dish Tare Wt. 70.2561 g Dish+Sample Wt. 70.3397 g Sample Wt. 0.0836 g
2	Test 1 Run 2 Vol. of Solvent 170 ml Log Number -07 Comments	Dish No. 77 Dish Tare Wt. 80.0596 g Dish+Sample Wt. 80.1473 g Sample Wt. 0.0877 g
3	Test 1 Run 3 Vol. of Solvent 170 ml Log Number -10 Comments	Dish No. 79 Dish Tare Wt. 85.9295 g Dish+Sample Wt. 86.0004 g Sample Wt. 0.0709 g
4	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

*Solvent Residue 2.0 ug/ml = [(Sample Wt. 0.0002 g)(10^6)]/Vol. of Sol. 100 ml
EPA-MS Acetone Residue Blank Spec. < 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0002	0.0833	0.0874	0.0706	D-2	

LSC-01Y

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job A.C.S./Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 1
Date of Analysis 11-16-90

Source Sugar Cooler
Test Site Stacks
Date of Test 11-14-90
No. of Runs Completed 3
Technician R. Cubin

0	Test 1 Run 0 Field Blank Log Number 1793-02 Comments	Filter No. 2811 Filter Type 4"GF Filter Tare Wt. .9299 g Filter+Sample Wt. .9300 g Sample Wt. 0.0001 g
1	Test 1 Run 1 Log Number -05 Comments	Filter No. 2814 Filter Type 4"GF Filter Tare Wt. .9296 g Filter+Sample Wt. .9508 g Sample Wt. 0.0212 g
2	Test 1 Run 2 Log Number -08 Comments	Filter No. 2832 Filter Type 4"GF Filter Tare Wt. .9442 g Filter+Sample Wt. .9675 g Sample Wt. 0.0233 g
3	Test 1 Run 3 Log Number -11 Comments	Filter No. 2833 Filter Type 4"GF Filter Tare Wt. .9147 g Filter+Sample Wt. .9403 g Sample Wt. 0.0256 g
4	Test ____ Run ____ Log Number ____ Comments	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0000	0.0212	0.0233	0.0256		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1077	0.1145	0.0994		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS / Moorhead — Source Granulator
Team Leader MK — Test Site Stack
Date Submitted 11-16-90 — Date of Test 11-15-90
Test No. — No. of Runs Completed 3
Date of Analysis 11-19-90 — Technician P. Gibson

0	Test ___ Run 0 Field Blank Log Number ___ Comments ___	Dish No. ___ Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g
1	Test 2 Run 1 Log Number 1743-15 Comments ___	Dish No. 16 Dish Tare Wt. 52.8212 g Dish+Sample Wt. 52.8254 g Sample Wt. 0.0042 g
2	Test 2 Run 2 Log Number -18 Comments ___	Dish No. 61 Dish Tare Wt. 44.5893 g Dish+Sample Wt. 44.5948 g Sample Wt. 0.0055 g
3	Test 2 Run 3 Log Number -21 Comments ___	Dish No. 107 Dish Tare Wt. 44.0702 g Dish+Sample Wt. 44.0749 g Sample Wt. 0.0047 g
4	Test ___ Run ___ Log Number ___ Comments ___	Dish No. ___ Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g
5	Test ___ Run ___ Log Number ___ Comments ___	Dish No. ___ Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g

Blank Solvent Wt. 0.0006 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0006	0.0036	0.0046	0.0041	D-4	

LSC-0

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job A.C.S./Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 2
Date of Analysis 11-16-90
Transport Leakage ☒ None ☐ _____ ml

Source Granulator
Test Site Stack
Date of Test 11-15-90
No. of Runs Completed 3
Technician R. Gulsvig
Solvent DI H2O

0	Test ____ Run 0 Field Blank Log Number ____ Vol. of Solvent ____ ml *Solvent Residue 2.0 ug/ml	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 2 Run 1 Vol. of Solvent 160 ml Log Number 1743-13 Comments ____	Dish No. 303 Dish Tare Wt. 49.5732 g Dish+Sample Wt. 49.6228 g Sample Wt. 0.0496 g
2	Test 2 Run 2 Vol. of Solvent 160 ml Log Number -16 Comments ____	Dish No. 304 Dish Tare Wt. 60.5533 g Dish+Sample Wt. 60.5769 g Sample Wt. 0.0236 g
3	Test 2 Run 3 Vol. of Solvent 150 ml Log Number -19 Comments ____	Dish No. 305 Dish Tare Wt. 56.0210 g Dish+Sample Wt. 56.1239 g Sample Wt. 0.1029 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

*Solvent Residue ___ ug/ml = [(Sample Wt. ____ g)(10^6)]/Vol. of Sol. ____ ml
EPA-M5 Acetone Residue Blank Spec. ≤7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0002	0.0493	0.0233	0.1026	D-5	

LSC-0

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job A.C.S. / Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 1
Date of Analysis 11-16-90

Source Granulator
Test Site Stack
Date of Test 11-15-90
No. of Runs Completed 3
Technician R. Cuthrell

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
1	Test 2 Run 1 Log Number 1793 -14 Comments ____	Filter No. 2815 Filter Type 4" GF Filter Tare Wt. .9335 g Filter+Sample Wt. .9435 g Sample Wt. 0.0100 g
2	Test 2 Run 2 Log Number -17 Comments ____	Filter No. 2816 Filter Type 4" GF Filter Tare Wt. .9138 g Filter+Sample Wt. .9341 g Sample Wt. 0.0203 g
3	Test 2 Run 3 Log Number -20 Comments ____	Filter No. 2807 Filter Type 4" GF Filter Tare Wt. .9404 g Filter+Sample Wt. .9637 g Sample Wt. 0.0233 g
4	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0001	0.0100	0.0203	0.0233		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0629	0.0485	0.1300		

LSC-02PR

Filename: BEET21.WQ1
Date: 18-Jan-95
Facility: American Crystal Sugar
Location: Moorehead, Minnesota
Source: Sugar cooler (horiz. rotating drum cooled w/ ambient air) with rotoclone
Test date: November 14, 1990

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	97	97	98	
Sugar cooler with rotoclone	Pressure	in. HG	28.62	28.62	28.62	
	Moisture	%	4.65	4.87	4.79	
	Oxygen	%	20.9	20.9	20.9	
	Volumetric flow, actual	acfm	14075	14382	12971	
	Volumetric flow, standard*	dscfm	12169	12406	11178	
	Isokinetic variation	%	102	103.3	98.8	
Sugar cooler throughput rate		TPH	39.70	34.10	36.60	
	Pollutant concentrations:					
	Total PM	G/dscf	0.0477	0.0492	0.0496	
	Filterable PM	G/dscf	0.0463	0.0476	0.0480	
	Condensible organic PM	G/dscf	0.00142	0.001633	0.00160	
	CO2	% vol	0.03%	0.03%	0.03%	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	4.83	5.06	4.60	
	Condensible organic PM	lb/hr	0.148	0.174	0.153	
	CO2	lb/hr	0.250	0.255	0.230	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.12	0.15	0.13	0.13
	Condensible organic PM	lb/ton	0.0037	0.0051	0.0042	0.0043
	CO2	lb/ton	0.0063	0.0075	0.0063	neglig.
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.061	0.074	0.063	0.066
	Condensible organic PM	kg/Mg	0.0019	0.0025	0.0021	0.0022
	CO2	kg/Mg	0.0032	0.0037	0.0031	neglig.

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET21A.WQ1
Date: 18-Jan-95
Facility: American Crystal Sugar
Location: Moorehead, Minnesota
Source: Sugar granulator (horiz. rotating drum dryer) with rotoclone
Test date: November 15, 1990

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	108	104	105	
Sugar granulator with rotoclone	Pressure	in. HG	28.75	28.75	28.75	
	Moisture	%	7.82	7.14	6.89	
	Oxygen	%	20.9	20.9	20.9	
	Volumetric flow, actual	acfm	12572	12039	11958	
	Volumetric flow, standard*	dscfm	10351	10057	9998	
	Isokinetic variation	%	103.4	99.1	99.7	
Sugar granulator output rate		TPH	39.70	34.10	36.60	
	Pollutant concentrations:					
	Total PM	G/dscf	0.03235	0.01506	0.04037	
	Filterable PM	G/dscf	0.0305	0.0135	0.0391	
	Condensible organic PM	G/dscf	0.00185	0.001522	0.00127	
	CO2	% vol	0.03%	0.03%	0.03%	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	2.71	1.17	3.35	
	Condensible organic PM	lb/hr	0.164	0.131	0.109	
	CO2	lb/hr	0.213	0.207	0.206	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.07	0.03	0.09	0.06
	Condensible organic PM	lb/ton	0.0041	0.0038	0.0030	0.0037
	CO2	lb/ton	0.0054	0.0061	0.0056	neglig.
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.034	0.017	0.046	0.032
	Condensible organic PM	kg/Mg	0.0021	0.0019	0.0015	0.0018
	CO2	kg/Mg	0.0027	0.0030	0.0028	neglig.

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX U

REPORT EXCERPTS FROM REFERENCE 22

(American Crystal Sugar Company, April 15, 1993)

Bay West

Unit Nos. 1 and 2 Pulp Dryer Stacks
EMISSION TESTING RESULTS
for the
Feburary 22-26, 1993 Testing of
Particulate

conducted at the

American Crystal Sugar Company
Crookston, Minnesota

Submitted to:

Mr. Dave Noble
American Crystal Sugar Company
Highway 75 South
Crookston, Minnesota 56716

Submitted by:

BAY WEST, INC.
FIVE EMPIRE DRIVE
ST. PAUL, MINNESOTA 55103
Telephone (612) 291-0456
Fax (612) 291-0099

Timothy Roland Nelson
Project Manager
Air Quality

April 15, 1993
Project No. BW920441

TABLE 1

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 1 PULP DRYER STACK

RESULTS OF ORSAT & MOISTURE ANALYSES - EPA METHODS 3 & 4 (%V/V)

TEST NO.: 1	RUN 1	RUN 2
DATE OF TEST	22-Feb-93	22-Feb-93
DRY BASIS (ORSAT), %		
CARBON DIOXIDE	9.03	9.67
OXYGEN	10.42	9.76
CARBON MONOXIDE	NM	NM
NITROGEN	80.55	80.57
WET BASIS (ORSAT), %		
CARBON DIOXIDE	4.67	4.95
OXYGEN	5.39	5.00
CARBON MONOXIDE	NM	NM
NITROGEN	41.65	41.26
WATER VAPOR	48.29	48.80
DRY MOLECULAR WEIGHT	29.86	29.94
WET MOLECULAR WEIGHT	24.13	24.11

NM = NOT MEASURED

TABLE 2

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 1 PULP DRYER STACK

RESULTS OF PARTICULATE LOADING DETERMINATIONS - EPA METHOD 5

TEST NO.: 1	RUN 1	RUN 2
DATE OF RUN	22-Feb-93	22-Feb-93
RUN START TIME	1200	1420
RUN END TIME	1340	1600
STACK STATIC PRESSURE (in. H2O)	-0.60	-0.60
CROSS SECTIONAL AREA (sq. ft.)	19.634	19.634
PITOT TUBE COEFFICIENT	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES		
CONDENSER (ml.)	0.00	0.00
IMPINGER (ml.)	814.00	793.00
DESSICCANT (grams)	7.00	5.00
TOTAL (grams)	821.00	798.00
SAMPLE GAS MOISTURE CONTENT (%)	48.29	48.80
DRY GAS METER COEFFICIENT	1.039	1.039
BAROMETRIC PRESSURE (in. Hg)	29.30	29.30
AVG. ORIFICE PRESSURE DROP (in. H2O)	0.57	0.52
AVG. GAS METER TEMP. (degrees F)	94	94
VOLUME THROUGH GAS METER		
AT METER CONDITIONS (cf)	42.67	40.62
STANDARD CONDITIONS (dscf)	41.40	39.44
TOTAL SAMPLING TIME (min.)	96	96
NOZZLE DIAMETER (in.)	0.250	0.250
AVG. STACK GAS TEMP. (degrees F)	209	210
AVG. STACK GAS VELOCITY (ft/sec)	49.58	49.63
VOLUMETRIC FLOWRATE		
ACTUAL (acfm)	58413	58464
DRY STANDARD (dscfm)	23301	23076
ISOKINETIC VARIATION. %	106.67	102.61
PARTICULATE COLLECTED		
FILTER CATCH (g)	0.0752	0.1337
PROBE WASH (g)	0.1101	0.0984
IMPINGER CATCH (g)	0.0703	0.0722
TOTAL PARTICULATE COLLECTED (g)	0.2556	0.3043
PARTICULATE CONCENTRATION		
ACTUAL (gr/acf)	0.0380	0.0470
DRY STANDARD (gr/dscf)	0.0953	0.1191
PARTICULATE MASS RATE (lb/hr)	19.028	23.550

TABLE 3

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 1 PULP DRYER STACK

RESULTS OF ORSAT & MOISTURE ANALYSES - EPA METHODS 3 & 4 (%V/V)

TEST NO.: 2	RUN 1	RUN 2	RUN 3
DATE OF TEST	23-Feb-93	23-Feb-93	23-Feb-93
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	6.71	6.12	6.05
OXYGEN	13.15	13.86	13.93
CARBON MONOXIDE	NM	NM	NM
NITROGEN	80.14	80.02	80.02
WET BASIS (ORSAT), %			
CARBON DIOXIDE	4.08	3.76	3.75
OXYGEN	8.00	8.52	8.65
CARBON MONOXIDE	NM	NM	NM
NITROGEN	48.75	49.19	49.66
WATER VAPOR	39.17	38.53	37.93
DRY MOLECULAR WEIGHT	29.60	29.53	29.53
WET MOLECULAR WEIGHT	25.06	25.09	25.15

NM = NOT MEASURED

TABLE 4

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 1 PULP DRYER STACK

RESULTS OF PARTICULATE LOADING DETERMINATIONS - EPA METHOD 5

TEST NO.: 2	RUN 1	RUN 2	RUN 3
DATE OF RUN	23-Feb-93	23-Feb-93	23-Feb-93
RUN START TIME	835	1050	1315
RUN END TIME	1015	1230	1455
STACK STATIC PRESSURE (in. H2O)	-0.65	-0.65	-0.65
CROSS SECTIONAL AREA (sq. ft.)	19.634	19.634	19.634
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	0.00	0.00	0.00
IMPINGER (ml.)	693.00	652.00	645.00
DESSICCANT (grams)	3.00	6.00	6.00
TOTAL (grams)	696.00	658.00	651.00
SAMPLE GAS MOISTURE CONTENT (%)	39.17	38.53	37.93
DRY GAS METER COEFFICIENT	1.039	1.039	1.039
BAROMETRIC PRESSURE (in. Hg)	29.40	29.40	29.40
AVG. ORIFICE PRESSURE DROP (in. H2O)	0.88	0.82	0.85
AVG. GAS METER TEMP. (degrees F)	99	98	100
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	52.73	51.11	51.99
STANDARD CONDITIONS (dscf)	50.91	49.44	50.17
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.250	0.250	0.250
AVG. STACK GAS TEMP. (degrees F)	207	208	209
AVG. STACK GAS VELOCITY (ft/sec)	52.98	52.86	52.93
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	62418	62273	62355
DRY STANDARD (dscfm)	29486	29663	29946
ISOKINETIC VARIATION. %	103.65	100.06	100.57
PARTICULATE COLLECTED			
FILTER CATCH (g)	0.0478	0.0887	0.0685
PROBE WASH (g)	0.1106	0.0961	0.1198
IMPINGER CATCH (g)	0.0604	0.0567	0.0431
TOTAL PARTICULATE COLLECTED (g)	0.2188	0.2415	0.2314
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.0313	0.0359	0.0342
DRY STANDARD (gr/dscf)	0.0663	0.0754	0.0712
PARTICULATE MASS RATE (lb/hr)	16.763	19.166	18.271

TABLE 5

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 2 PULP DRYER STACK

RESULTS OF ORSAT & MOISTURE ANALYSES - EPA METHODS 3 & 4 (%V/V)

TEST NO.: 3	RUN 1	RUN 2	RUN 3
DATE OF TEST	24-Feb-93	24-Feb-93	24-Feb-93
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	5.57	5.02	4.55
OXYGEN	14.45	15.10	15.63
CARBON MONOXIDE	NM	NM	NM
NITROGEN	79.98	79.88	79.82
WET BASIS (ORSAT), %			
CARBON DIOXIDE	3.58	3.29	3.07
OXYGEN	9.30	9.88	10.53
CARBON MONOXIDE	NM	NM	NM
NITROGEN	51.47	52.29	53.77
WATER VAPOR	35.64	34.54	32.64
DRY MOLECULAR WEIGHT	29.47	29.41	29.35
WET MOLECULAR WEIGHT	25.38	25.47	25.65

NM = NOT MEASURED

TABLE 6

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 2 PULP DRYER STACK

RESULTS OF PARTICULATE LOADING DETERMINATIONS - EPA METHOD 5

TEST NO.: 3	RUN 1	RUN 2	RUN 3
DATE OF RUN	24-Feb-93	24-Feb-93	24-Feb-93
RUN START TIME	1010	1230	1440
RUN END TIME	1150	1410	1620
STACK STATIC PRESSURE (in. H2O)	-0.85	-0.85	-0.85
CROSS SECTIONAL AREA (sq. ft.)	12.306	12.306	12.306
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	0.00	0.00	0.00
IMPINGER (ml.)	428.00	683.00	637.00
DESSICCANT (grams)	2.00	9.00	7.00
TOTAL (grams)	430.00	692.00	644.00
SAMPLE GAS MOISTURE CONTENT (%)	35.64	34.54	32.64
DRY GAS METER COEFFICIENT	1.039	1.039	1.039
BAROMETRIC PRESSURE (in. Hg)	29.43	29.43	29.43
AVG. ORIFICE PRESSURE DROP (in. H2O)	0.44	1.26	1.31
AVG. GAS METER TEMP. (degrees F)	88	94	100
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	37.13	63.25	64.78
STANDARD CONDITIONS (dscf)	36.57	61.77	62.61
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.190	0.250	0.250
AVG. STACK GAS TEMP. (degrees F)	195	195	195
AVG. STACK GAS VELOCITY (ft/sec)	61.72	61.59	61.38
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	45571	45475	45322
DRY STANDARD (dscfm)	23190	23547	24147
ISOKINETIC VARIATION. %	102.72	98.70	97.55
PARTICULATE COLLECTED			
FILTER CATCH (g)	0.0502	0.0664	0.0647
PROBE WASH (g)	0.1111	0.1714	0.1599
IMPINGER CATCH (g)	0.0296	0.0635	0.0521
TOTAL PARTICULATE COLLECTED (g)	0.1909	0.3013	0.2767
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.0410	0.0390	0.0363
DRY STANDARD (gr/dscf)	0.0806	0.0753	0.0682
PARTICULATE MASS RATE (lb/hr)	16.013	15.192	14.116

TABLE 7

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 2 PULP DRYER STACK

RESULTS OF ORSAT & MOISTURE ANALYSES - EPA METHODS 3 & 4 (%V/V)

TEST NO.: 4	RUN 1	RUN 2	RUN 3
DATE OF TEST	25-Feb-93	25-Feb-93	25-Feb-93
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	3.18	3.74	3.75
OXYGEN	17.25	16.59	16.56
CARBON MONOXIDE	NM	NM	NM
NITROGEN	79.57	79.67	79.69
WET BASIS (ORSAT), %			
CARBON DIOXIDE	2.36	2.64	2.67
OXYGEN	12.79	11.72	11.79
CARBON MONOXIDE	NM	NM	NM
NITROGEN	58.98	56.29	56.73
WATER VAPOR	25.88	29.35	28.81
DRY MOLECULAR WEIGHT	29.20	29.26	29.26
WET MOLECULAR WEIGHT	26.30	25.96	26.02

NM = NOT MEASURED

TABLE 8

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 2 PULP DRYER STACK

RESULTS OF PARTICULATE LOADING DETERMINATIONS - EPA METHOD 5

TEST NO.: 4	RUN 1	RUN 2	RUN 3
DATE OF RUN	25-Feb-93	25-Feb-93	25-Feb-93
RUN START TIME	910	1135	1350
RUN END TIME	1150	1315	1530
STACK STATIC PRESSURE (in. H2O)	-0.76	-0.76	-0.76
CROSS SECTIONAL AREA (sq. ft.)	12.306	12.306	12.306
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	0.00	0.00	0.00
IMPINGER (ml.)	463.00	575.00	547.00
DESSICCANT (grams)	8.00	14.00	14.00
TOTAL (grams)	471.00	589.00	561.00
SAMPLE GAS MOISTURE CONTENT (%)	25.88	29.35	28.81
DRY GAS METER COEFFICIENT	1.039	1.039	1.039
BAROMETRIC PRESSURE (in. Hg)	29.40	29.40	29.40
AVG. ORIFICE PRESSURE DROP (in. H2O)	1.32	1.49	1.43
AVG. GAS METER TEMP. (degrees F)	89	100	105
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	64.47	69.20	68.16
STANDARD CONDITIONS (dscf)	63.54	66.78	65.29
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.250	0.250	0.250
AVG. STACK GAS TEMP. (degrees F)	193	194	194
AVG. STACK GAS VELOCITY (ft/sec)	58.97	59.42	60.19
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	43538	43872	44437
DRY STANDARD (dscfm)	25591	24558	25036
ISOKINETIC VARIATION. %	93.42	102.32	98.12
PARTICULATE COLLECTED			
FILTER CATCH (g)	0.0390	0.0521	0.0430
PROBE WASH (g)	0.1360	0.1017	0.1241
IMPINGER CATCH (g)	0.0440	0.0420	0.0350
TOTAL PARTICULATE COLLECTED (g)	0.2190	0.1958	0.2021
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.0313	0.0253	0.0269
DRY STANDARD (gr/dscf)	0.0532	0.0452	0.0478
PARTICULATE MASS RATE (lb/hr)	11.667	9.524	10.251

TABLE 9

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 2 PULP DRYER STACK

RESULTS OF ORSAT & MOISTURE ANALYSES - EPA METHODS 3 & 4 (%V/V)

TEST NO.: 5	RUN 1	RUN 2	RUN 3
DATE OF TEST	26-Feb-93	26-Feb-93	26-Feb-93
DRY BASIS (ORSAT), %			
CARBON DIOXIDE	3.92	3.60	3.46
OXYGEN	16.37	16.76	16.93
CARBON MONOXIDE	NM	NM	NM
NITROGEN	79.71	79.64	79.61
WET BASIS (ORSAT), %			
CARBON DIOXIDE	2.80	2.60	2.53
OXYGEN	11.69	12.10	12.37
CARBON MONOXIDE	NM	NM	NM
NITROGEN	56.93	57.51	58.17
WATER VAPOR	28.58	27.78	26.94
DRY MOLECULAR WEIGHT	29.28	29.25	29.23
WET MOLECULAR WEIGHT	26.06	26.12	26.21

NM = NOT MEASURED

TABLE 10

CLIENT: AMERICAN CRYSTAL SUGAR, CROOKSTON
SOURCE/SITE: NO. 2 PULP DRYER STACK

RESULTS OF PARTICULATE LOADING DETERMINATIONS - EPA METHOD 5

TEST NO.: 5	RUN 1	RUN 2	RUN 3
DATE OF RUN	26-Feb-93	26-Feb-93	26-Feb-93
RUN START TIME	805	1020	1230
RUN END TIME	945	1200	1410
STACK STATIC PRESSURE (in. H2O)	-0.82	-0.82	-0.82
CROSS SECTIONAL AREA (sq. ft.)	12.306	12.306	12.306
PITOT TUBE COEFFICIENT	0.840	0.840	0.840
SAMPLE GAS MOISTURE ANALYSES			
CONDENSER (ml.)	0.00	0.00	0.00
IMPINGER (ml.)	581.00	547.00	532.00
DESSICCANT (grams)	7.00	10.00	10.00
TOTAL (grams)	588.00	557.00	542.00
SAMPLE GAS MOISTURE CONTENT (%)	28.58	27.78	26.94
DRY GAS METER COEFFICIENT	1.039	1.039	1.039
BAROMETRIC PRESSURE (in. Hg)	29.52	29.52	29.52
AVG. ORIFICE PRESSURE DROP (in. H2O)	1.57	1.49	1.61
AVG. GAS METER TEMP. (degrees F)	93	100	104
VOLUME THROUGH GAS METER			
AT METER CONDITIONS (cf)	70.42	70.37	71.88
STANDARD CONDITIONS (dscf)	69.20	68.19	69.25
TOTAL SAMPLING TIME (min.)	96	96	96
NOZZLE DIAMETER (in.)	0.250	0.250	0.250
AVG. STACK GAS TEMP. (degrees F)	195	194	196
AVG. STACK GAS VELOCITY (ft/sec)	61.34	59.12	61.21
VOLUMETRIC FLOWRATE			
ACTUAL (acfm)	45293	43647	45191
DRY STANDARD (dscfm)	25677	25072	26167
ISOKINETIC VARIATION. %	101.40	102.33	99.57
PARTICULATE COLLECTED			
FILTER CATCH (g)	0.0480	0.0452	0.0509
PROBE WASH (g)	0.1581	0.1573	0.1656
IMPINGER CATCH (g)	0.0436	0.0412	0.0457
TOTAL PARTICULATE COLLECTED (g)	0.2497	0.2437	0.2622
PARTICULATE CONCENTRATION			
ACTUAL (gr/acf)	0.0316	0.0317	0.0338
DRY STANDARD (gr/dscf)	0.0557	0.0552	0.0584
PARTICULATE MASS RATE (lb/hr)	12.256	11.852	13.106

02/22/93

NUMBER 1 DRYER, NORTH

TIME OF DAY	1030	1130		1200	1230	1300	
SLICE RATE, TPH	198	228		239	238	231	
TOTAL PULP FLOW, TPH	56	57		59	59	64	
GRATE SPEED, %	91.5%	77.70		85.41	76.27	76.69	
DRYER EXIT, °C	108.6	108.8		109.1	108.9	109.01	
ID FAN SPEED, %	85	85.0		85.0	85.0	85.0	
PULP FEED SCROLL, %	27.2	27.6	S	25.8	26.1	26.6	
PULP GATE, % CLOSED	40.0	40.0		40.0	40.0	40.0	
FD DAMPER, % OPEN	27.6	24.5	O	35.9	23.3	28.57	
RECYCLE DAMPERS, % OPEN	47.0	47.0		47.0	47.0	47.0	
RATIO SETUP	manual	manual	T	manual	Manual	Manual	
DRYER THROAT	864	864		848	847	839	
DRYER EXIT, °C	105	105	#1	105	105	106	
FURNACE PRESS, IN H20	0	-0.9		-0.6	-0.9	-0.7	
EXIT PRESS, INC H20	-1.6	-1.5	(a)	-1.6	-1.6	-1.5	
DRYER ΔP, IN H20	0.50	0.40		-0.4	0.4	0.2	
DRUM AMPS	32	33	1200	35	33	35	
ID FAN, AMPS	168	168		170	169	169	
ID FLOW	61	62		61	62	61	
REC. FLOW	13.6	13.8		13.5	13.7	13.7	
M.C. ΔP	5.8	5.8		5.8	5.75	5.8	
BAGHOUSE ΔP	4.18	4.11		4.10	4.07	4.07	
ASP	8.0	8.0		8.0	8.0	7.9	
FD FLOW, ΔP	0.49	0.50		0.50	0.50	0.49	
#1 PULP FEED, TPH	31	31		31	31	31	@1311/1314
#2 PULP FEED, TPH	24	27		29	32	31	83.48/93.33/95.92
C, %	4.5%	4.5		4.1	4.4	4.6	take out 16" in 96 sec
Brix, %	104.4	104.2		104.7	104.7	104.8	Wheel
Wet, °C	99.4	99.6		99.4	99.4	99.6	No 50
							3.75 4

time/wp51

02/22/93

NUMBER 1 DRYER, NORTH

TIME OF DAY	1330	1400		1430	1500		1530
SLICE RATE, TPH	246	229		215	151		245
TOTAL PULP FLOW, TPH	63	59		56	55		57
GRATE SPEED, %	86.25	89.14		78.12	81.66		91.48
DRYER EXIT, °C	108.5	108.4		109.1	108.6		108.7
ID FAN SPEED, %	85.0	85.0	5	85.0	85.0		85.0
PULP FEED SCROLL, %	27.8	27.6	6	27.9	31.2		31.6
PULP GATE, % CLOSED	40.0	40.0	0	40.0	40.0		40.0
FD DAMPER, % OPEN	47.08	37.66		24.92	43.96		44.14
RECYCLE DAMPERS, % OPEN	47.0	47.0	I	47.0	47.0		47.0
RATIO SETUP	—	—		—	—		—
DRYER THROAT							
DRYER EXIT, °C	838	818	#2	827	838		888
FURNACE PRESS, IN H20	106	.105		106	105		105
EXIT PRESS, INC H20	-0.1	-0.6	@	-0.8	-0.3		-0.1
DRYER ΔP, IN H20	-1.5	-1.5		-1.6	-1.5		-1.6
DRUM AMPS	0.1	0	1420	0	0.1		0.2
ID FAN, AMPS	32	32		33.3	34	1508/1510	33.5
ID FLOW	170	170		168	170	82.7/86.69	168
REC. FLOW	60	62		60	60	88.22	59
M.C. ΔP	13.8	13.7		13.6	13.4	8" in	13.3
BAGHOUSE ΔP	5.8	5.85		5.8	5.8	53 sec	5.7
ASP	4.11	4.09		4.13	4.13		4.21
FD FLOW, ΔP	8.0	8.0		7.9	8.0	Wheel	7.8
	0.49	0.48		0.49	0.50	No 50	0.52
#1 PULP FEED, TPH	31	31		31	31	3.75 4.0	31
#2 PULP FEED, TPH	28	33		27	21	3¾-3⅝	25
O_2, % ...	4.2	4.5		4.5	4.2		3.1
BH in, °C ..	105.0	104.9		105.0	105.1		105.2
out, °C ..	99.4	99.6		99.7	100.6		99.7

time/wp51

02/22/93

NUMBER 1 DRYER, NORTH

TIME OF DAY	1600						
SLICE RATE, TPH	210						
TOTAL PULP FLOW, TPH	61						
GRATE SPEED, %	92.31						
DRYER EXIT, °C	108.9						
ID FAN SPEED, %	85.0						
PULP FEED SCROLL, %	33.2						
PULP GATE, % CLOSED	40						
FD DAMPER, % OPEN	34.4						
RECYCLE DAMPERS, % OPEN	47.0						
RATIO SETUP	—						
DRYER THROAT	928						
DRYER EXIT, °C	105						
FURNACE PRESS, IN H20	-0.1						
EXIT PRESS, INC H20	-1.6						
DRYER ΔP, IN H20	0.3						
DRUM AMPS	34						
ID FAN, AMPS	167						
ID FLOW	3						
REC. FLOW	13.2						
M.C. ΔP	5.7						
BAGHOUSE ΔP	4.29						
ASP	7.8						
FD FLOW, ΔP	0.52						
#1 PULP FEED, TPH	31						
#2 PULP FEED, TPH	31						
O_2, %...	2.4						
BH in, °C..	105.1						
out, °C..	99.7						

time/wp51

02/23/93

NUMBER 1 DRYER (North)

TIME OF DAY	0830		0900	0930	1000	1030	
SLICE RATE, TPH	234		232	228	234	235	
TOTAL PULP FLOW, TPH	65		64	64	65	55	
GRATE SPEED, %	82.36		68.28	66.79	65.07	71.38	
DRYER EXIT, °C	107.9		108.4	107.8	107.7	108.2	
ID FAN SPEED, %	76.0		78.0	78.0	78.0	78.0	
PULP FEED SCROLL, %	20.5	S	20.1	20.2	19.8	20.5	S
PULP GATE, % CLOSED	40.0		40.0	40.0	40.0	40.0	
FD DAMPER, % OPEN	33.46	O	14.87	17.08	15.39	18.31	O
RECYCLE DAMPERS, % OPEN	47.0		47.0	47.0	47.0	47.0	
RATIO SETUP	Manual	T	Manual	Manual	Manual	Manual	T
DRYER THROAT	597		605	600	594	596	
DRYER EXIT, °C	105	#1	105	104	104	105	#2
FURNACE PRESS, IN H20	-0.6		-0.9	-1.1	-1.0	-1.0	
EXIT PRESS, INC H20	-1.4	(a)	-1.5	-1.6	-1.6	-1.6	(a)
DRYER ΔP, IN H20	0.9		0.9	0.9	1.0	0.8	
DRUM AMPS	31.5	0835	30.0	30.0	31.5	31.5	1050
ID FAN, AMPS	157		158	158	159	158	
ID FLOW	61		62	60	61	63	
REC. FLOW	13.5		13.5	13.4	13.5	13.5	
M.C. ΔP	4.8		4.8	4.8	4.8	4.8	
BAGHOUSE ΔP	4.19		4.21	4.29	4.28	4.24	
ASP	8.1		8.1	8.0	8.2	8.2	
FD FLOW	0.46		0.45	0.44	0.43	0.45	
#1 PULP FEED, TPH	26		26	26	26	26	
#2 PULP FEED, TPH	27		26	27	29	25	
O_2, %..	6.6		7.2	7.2	6.9	7.2	
BH in, °C..	104.5		104.3	104.4	104.5	104.5	
out, °C..	98.6		98.3	99.1	99.4	99.6	

time/wp51

02/23/93

NUMBER 1 DRYER (North)

TIME OF DAY	1100	1130	1200	1230	1300		1330
SLICE RATE, TPH	225	224	226	223	202		231
TOTAL PULP FLOW, TPH	60	59	58	60	58		60
GRATE SPEED, %	67.78	81.95	76.69	77.47	63.41		74.50
DRYER EXIT, °C	107.7	108.3	108.2	107.8	108.2		107.5
ID FAN SPEED, %	78.0	78.0	78.0	78.0	78.0		78.0
PULP FEED SCROLL, %	20.3	20.3	20.3	20.9	20.2	S	19.8
PULP GATE, % CLOSED	40.0	40.0	40.0	40.0	40.0		40.0
FD DAMPER, % OPEN	21.15	14.22	16.90	27.58	12.86	O	27.62
RECYCLE DAMPERS, % OPEN	47.0	47.0	47.0	47.0	47.0		47.0
RATIO SETUP	—	—	—	—	—	T	—
DRYER THROAT	595	586	576	587	593		586
DRYER EXIT, °C	105	105	105	105	105	#3	105
FURNACE PRESS, IN H20	-0.9	-1.0	-1.0	-0.7	-1.0		-0.8
EXIT PRESS, INC H20	-1.6	-1.5	-1.5	-1.6	-1.4	@	-1.6
DRYER ΔP, IN H20	0.7	0.6	0.6	0.5	0.5		0.4
DRUM AMPS	32	32	32	32	32	1315	31
ID FAN, AMPS	158	158	158	157	158		158
ID FLOW	62	60	60	60	62		60
REC. FLOW	13.6	13.5	13.5	13.3	13.5		13.5
M.C. ΔP	4.8	4.75	4.8	4.75	4.8		4.8
BAGHOUSE ΔP	4.28	4.25	4.24	4.22	4.22		4.24
ASP	8.1	7.9	8.0	8.0	8.0		7.9
FD FLOW, ΔP	0.44	0.44	0.45	0.45	0.43		0.45
#1 PULP FEED, TPH	26	26	26	26	26		26
#2 PULP FEED, TPH	28	31	24	26	24		25
O_2, %	7.0	7.7	7.7	6.9	7.5		7.4
BH in, °C	104.4	104.4	104.4	104.5	104.3		104.4
out, °C	99.4	99.6	99.4	99.4	99.4		99.6

time/wp51

02/23/93

NUMBER 1 DRYER (North)

TIME OF DAY		1410		1445			
SLICE RATE, TPH		218		211			
TOTAL PULP FLOW, TPH		58		58			
GRATE SPEED, %		43.75		76.92			
DRYER EXIT, °C		108.2		107.6			
ID FAN SPEED, %		78.0		78.0			
PULP FEED SCROLL, %		20.0		20.3			
PULP GATE, % CLOSED		40.0		40.0			
FD DAMPER, % OPEN		12.06		29.66			
RECYCLE DAMPERS, % OPEN		47.0		47.0			
RATIO SETUP		—		—			
DRYER THROAT		580		591			
DRYER EXIT, °C		105		104			
FURNACE PRESS, IN H20		-1.1		-0.8			
EXIT PRESS, INC H20		-1.6		-1.5			
DRYER ΔP, IN H20		0.1		0.2			
DRUM AMPS		31		31			
ID FAN, AMPS		159		158			
ID FLOW		61		59			
REC. FLOW		13.7		13.6			
M.C. ΔP		4.8		4.75			
BAGHOUSE ΔP		4.29		4.26			
ASP		7.9	1414 – 1416	7.9			
FD FLOW, ΔP		0.43		0.44			
#1 PULP FEED, TPH	Wheel / 50	26	62.00 / 9214 / 80.0	26			
#2 PULP FEED, TPH	NO / 4.0	25		26			
O_2, %	3.5, 3 5/8, 3 1/2, 3 5/8, 3 3/4, 3 5/8,	7.8	8" in 57 sec	6.9			
BH in, °C		104.5		104.4			
out, °C		99.4		99.4			

02/24/93

NUMBER 2 DRYER (South)

TIME OF DAY	0830	0910	0935	1000		1030	1106
SLICE RATE, TPH	227	271	228	225		225	234
TOTAL PULP FLOW, TPH	68	55	63	62		63	66
GRATE SPEED, %	70.07	79.50	79.16	73.56 ~~77.17~~		71.66	74.40
DRYER EXIT, °C	100.3	100.5	100.1	99.9		99.9	99.8
ID FAN SPEED, %	70.0	70.0	70.0	70.0		70.0	70.0
PULP FEED SCROLL, %	103.3	103.3	103.3	103.3		103.3	103.3
PULP GATE, % CLOSED	68.25	-3.34	-3.34	60.00	S	61.51	61.35
FD DAMPER, % OPEN	16.20	24.79	28.96	27.73		19.95	27.66
RECYCLE DAMPERS, % OPEN	26.0	65.0	49.0	45.0	O	45.0	45.0
RATIO SETUP	Manual	Manual	Manual	Manual		Manual	Manual
DRYER THROAT	704	608	612	651	T	653	649
DRYER EXIT, °C	101	101	100	100		100	100
FURNACE PRESS, IN H2O	-1.3	-1.2	-1.2	-1.2	#1	-1.3	-1.2
EXIT PRESS, INC H2O	-1.0	-1.0	-1.1	-1.0		-1.1	-1.1
DRYER ΔP, IN H2O	1.2	1.2	1.1	1.1	@	1.2	1.2
DRUM AMPS	28	27.5	26.5	27		27.5	27
ID FAN, AMPS	154	154	154	154	1010	154	154
ID FLOW	32	34	33	32		33	32.5
REC. FLOW	5.0	10.6	9.6	8.7		8.6	8.3
M.C. ΔP	4.05	4.05	4.05	4.05		4.05	3.8
BAGHOUSE ΔP	4.78	4.70	4.69	4.69		4.65	4.67
ASP	7.4	6.9	7.25	7.4		6.7	7.3
FD FLOW, ΔP	1.03	1.03	1.03	1.03		1.03	1.03
#1 PULP FEED, TPH	32	28	33	31		31	32
#2 PULP FEED, TPH	26	27	30	27		27	30
O_2, %	9.5	8.8	8.8	8.8		9.0	8.3
BH in, °C	103.0	102.5	102.4	102.6		102.8	102.5
out, °C	93.7	93.9	93.5	93.3		93.3	93.5

time/wp51

02/24/93

NUMBER 2 DRYER (South)

Wheel @ 3.9

TIME OF DAY	1130	1200		1230	South	1300	1330
SLICE RATE, TPH	230	227		236		236	—
TOTAL PULP FLOW, TPH	66	59		60		62	60
GRATE SPEED, %	77.25	68.64		68.17	3⅝	72.55	72.89
DRYER EXIT, °C	99.8	99.9		100.0		99.7	100.0
ID FAN SPEED, %	70.0	70.0		70.0		70.0	70.0
PULP FEED SCROLL, %	103.3	103.0		103.0	3¾	103.0	103.0
PULP GATE, % CLOSED	64.01	60.00	S	60.00		60.0	60.0
FD DAMPER, % OPEN	24.64	16.61		16.12		21.85	17.68
RECYCLE DAMPERS, % OPEN	45.0	45.00	0	45.0	3¼	45.0	45.0
RATIO SETUP	Manual	Manual		Manual		Manual	Manual
DRYER THROAT	688	676	T	589		626	621
DRYER EXIT, °C	100	100		100	3¼	100	101
FURNACE PRESS, IN H20	-1.2	-1.4	# 2	-1.3		-1.3	-1.4
EXIT PRESS, INC H20	-1.1	-1.1		-1.0		-1.0	-1.1
DRYER ΔP, IN H20	1.3	1.3	@	1.2	3½	1.2	1.2
DRUM AMPS	26.5	26.5		26.5		26.5	27
ID FAN, AMPS	154	154	1230	156		154	154
ID FLOW	32.5	32.5		33	3⅜	34	32
REC. FLOW	9.0	9.1		8.5		9.0	9.4
M.C. ΔP	3.9	3.9		3.9		3.9	3.9
BAGHOUSE ΔP	4.66	4.69		4.67	3½	4.65	4.65
ASP	7.2	7.3		7.2		7.35	7.2
FD FLOW, Δp	1.03	1.03		1.03		1.03	1.03
#1 PULP FEED, TPH	32	31		30	3⅝	32	31
#2 PULP FEED, TPH	26	27		28	12"	28	25
O_2, %	8.1	9.3		10.2	3⅝	9.0	9.6
					13"		
BH in, °C	102.8	103.1		102.8	3⅝	103.0	103.3
out, °C	93.5	93.2		93.1	13"	93.6	93.6
	1137 - 1139	Wheel @		Furnace	¾		
	77.36/80.75/	3.9		Static			
	84.76			-0.06 H2O	3¾		
	4" in 70 sec				North		

time/wp51

02/24/93

NUMBER 2 DRYER (south)

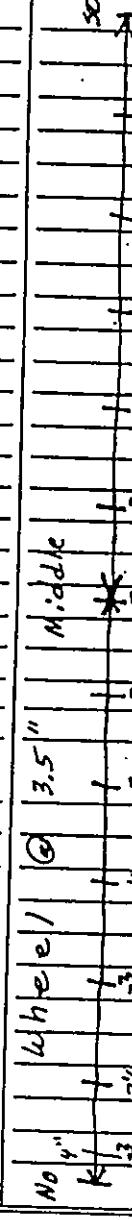
TIME OF DAY	1400	1430		1500	1530	1600	1630
SLICE RATE, TPH	228	229		230	229	220	217
TOTAL PULP FLOW, TPH	59	58		57	56	55	57
GRATE SPEED, %	75.13	78.22		78.28	67.50	67.26	74.86
DRYER EXIT, °C	100.0	99.8		100.0	100.0	99.8	99.8
ID FAN SPEED, %	70.0	70.0		70.0	70.0	70.0	70.0
PULP FEED SCROLL, %	103.3	103.3		103.3	103.3	103.3	103.3
PULP GATE, % CLOSED	60.0	60.0		60.0	60.0	60.0	60.0
FD DAMPER, % OPEN	22.66	28.96		26.35	22.11	12.58	20.42
RECYCLE DAMPERS, % OPEN	45.0	45.0		45.0	45.0	45.0	45.0
RATIO SETUP	Manual	Manual		Manual	Manual	Manual	Manual
DRYER THROAT	582	577	S	573	523	504	559
DRYER EXIT, °C	100	100		100	100	100	101
FURNACE PRESS, IN H20	-1.2	-1.2	O	-1.3	-1.4	-1.4	-1.3
EXIT PRESS, INC H20	-1.1	-1.1		-1.1	-1.1	-1.1	-1.1
DRYER ΔP, IN H20	1.3	1.3	T	1.3	1.2	1.2	1.3
DRUM AMPS	26.5	27		27	27	27	27
ID FAN, AMPS	155	156	#3	154	154	154	154
ID FLOW	33	33		32.5	34	34	33.5
REC. FLOW	9.3	9.4	@	9.6	8.7	9.0	9.6
M.C. ΔP	3.7	3.7		3.9	3.95	3.95	3.95
BAGHOUSE ΔP	4.62	4.62	1440	4.54	4.54	4.62	4.50
ASP	6.9	7.1		7.2	7.0	7.1	7.2
FD FLOW, ΔP	1.03	1.03		1.03	1.03	1.03	1.03
#1 PULP FEED, TPH	30	30		30	30	29	31
#2 PULP FEED, TPH	27	27		27	26	27	27
O_2, %	9.8	9.4		9.5	10.2	10.4	9.4
BH in, °C	103.2	103.2		103.2	103.2	103.2	103.4
out, °C	93.5	93.7		93.4	93.4	93.4	94.0

time/wp51

02/25/93

NUMBER 2 DRYER (#2 South)

TIME OF DAY	0900		0930	1000		1030	1100
SLICE RATE, TPH	233		233	227		160	234
TOTAL PULP FLOW, TPH	61		52	54		55	58
GRATE SPEED, %	67.10		62.42	64.50		67.18	77.83
DRYER EXIT, °C	98.9		98.9	98.8		98.8	98.8
ID FAN SPEED, %	70.0		70.0	70.0		70.0	70.0
PULP FEED SCROLL, %	103.3		103.3	103.3		103.3	103.3
PULP GATE, % CLOSED	65.00	5	60.00	60.00		60.00	60.00
FD DAMPER, % OPEN	17.16		13.23	15.03		17.60	25.96
RECYCLE DAMPERS, % OPEN	45.0	0	45.0	45.0		45.0	45.0
RATIO SETUP	Manual		Manual	Manual		Manual	Manual
DRYER THROAT	473	To	405	356		384	433
DRYER EXIT, °C	99		99	99		99	99
FURNACE PRESS, IN H2O	-1.3	#1	-1.4	-1.4		-1.4	-1.3
EXIT PRESS, INC H2O	-1.0		-0.8	-0.9		-0.9	-1.1
DRYER ΔP, IN H2O	1.1	@	1.3	1.3		1.3	1.3
DRUM AMPS	26.5		26.0	26.5		26.5	27
ID FAN, AMPS	156	0910	156	155		154	154
ID FLOW	34		35	35		35	34
REC. FLOW	10		9.3	9.4		9.5	9.5
M.C. ΔP	4.05		4.05	4.05		4.05	4.05
BAGHOUSE ΔP	4.76		4.72	4.78		4.74	4.67
ASP	7.0		7.2	6.9		7.0	7.0
FD FLOW, ΔP	1.03		1.03	1.03		1.03	1.03
#1 PULP FEED, TPH	35		33	33		34	33
#2 PULP FEED, TPH	22		19	22		23	26
O_2, %	10.9		12.6	12.4		11.7	11.0
BH in, °C	102.8		102.8	102.7		102.8	103.0
out, °C	91.6		91.3	91.6		91.8	92.4
						1040 - 1044	
						68.54/67.69/67.34	
						8" in 99 sec.	



time/wp51

02/25/93

NUMBER 2 DRYER (South)

TIME OF DAY	1130		1200	1230	1300	1315	1330
SLICE RATE, TPH	230		226	230	228	228	220
TOTAL PULP FLOW, TPH	60		64	67	66	64	63
GRATE SPEED, %	69.28		79.73	74.92	64.08	73.41	67.89
DRYER EXIT, °C	98.9		98.7	98.9	99.0	98.8	98.8
ID FAN SPEED, %	70.0		70.0	70.0	70.0	70.0	70.0
PULP FEED SCROLL, %	103.3		103.3	103.3	103.3	103.3	103.3
PULP GATE, % CLOSED	62.03		70.75	69.97	70.65	70.65	69.50
FD DAMPER, % OPEN	21.43	5	32.68	24.74	13.02	21.38	19.09
RECYCLE DAMPERS, % OPEN	45.0		45.0	45,0	45.0.	45.0	45.0
RATIO SETUP	Manual	0	Manual	Manual	Manual	Manual	Manual
DRYER THROAT	467		482	439	427	429	434
DRYER EXIT, °C	99	T	99	99	99	99	99
FURNACE PRESS, IN H20	-1.4		-1.2	-1.4	-1.5	-1.4	-1.4
EXIT PRESS, INC H20	-0.9	#2	-1.2	-1.1	-1.1	-1.2	-1.0
DRYER ΔP, IN H20	1.3		1.1	1.3	1.3	1.2	1.2
DRUM AMPS	27	@	27	27		27.5	26.5
ID FAN, AMPS	154		154	154		155	154
ID FLOW	35	1135	34	33		33.5	33
REC. FLOW	9.4		9.4	9.6		9.4	9.3
M.C. ΔP	4.05		4.05	4.05		4.05	4.05
BAGHOUSE ΔP	4.66		4.61	4.63		4.57	4.63
ASP	7.0		7.0	7.2		7.0	6.9
FD FLOW, ΔP	1.03		1.03	1.03	1.03	1.03	1.03
#1 PULP FEED, TPH	35		35	35	36	36	36
#2 PULP FEED, TPH	26		22	22	22	21	20
O_2, %	10.4		10.7	11.5		11.3	11.4
BH in, °C	103.2		103.1	103.2		103.4	103.5
out, °C	92.6		92.6	92.6		92.9	92.8
				1230-1234			
				68.17/69.99			
				68.45			

time/wp51

grain in ...

02/25/93

NUMBER 2 DRYER (South)							
TIME OF DAY		1400	1430	1500	1530		
SLICE RATE, TPH		228	230	226	225.		
TOTAL PULP FLOW, TPH		61	61	60	58		
GRATE SPEED, %		78.33	61.30	65.05	65.67		
DRYER EXIT, °C		99.1	98.9	98.9	98.8		
ID FAN SPEED, %		70.0	70.0	70.0	70.0		
PULP FEED SCROLL, %		103.3	103.3	103.3	103.3		
PULP GATE, % CLOSED		67.0	69.76	69.76	69.76		
FD DAMPER, % OPEN	5	30.29	14.04	13.78	16.54		
RECYCLE DAMPERS, % OPEN		45.0	45.0	45.0	45.0		
RATIO SETUP	0	Manual	Manual	Manual	Manual		
DRYER THROAT		440	455	445	404		
DRYER EXIT, °C	I	100	99	99	99		
FURNACE PRESS, IN H2O		-1.3	-1.5	-1.5	-1.5		
EXIT PRESS, INC H2O	#3	-1.1	-1.1	-1.0	-1.0		
DRYER ΔP, IN H2O		1.2	1.3	1.3	1.2		
DRUM AMPS	@	27	26	27	26.5		
ID FAN, AMPS		154	154	154	154		
ID FLOW	1350	35	33.5	34.5	36		
REC. FLOW		9.5	9.4	9.3	9.2		
M.C. ΔP		4.05	4.05	4.05	4.05		
BAGHOUSE ΔP		4.57	4.53	4.54	4.57		
ASP		7.1	7.0	6.9	6.8		
FD FLOW, ΔP		1.03	1.03	1.03	1.03		
#1 PULP FEED, TPH		35	35	35	35		
#2 PULP FEED, TPH		24	27	21	21		
O_2, %..		10.7	11.0	11.2	11.7		
BH in, °C..		103.5	103.2	103.3	103.3		
out, °C..		93.2	93.1	93.0	92.6		
		1406					
		46.53/49.46		Furnace			
		5.43		Pressure:			
		1.653		0.14-0.16			

8" in .25 sec. — in H2O ... rate

time/wp51

2/26/93

NUMBER 2 DRYER (South)

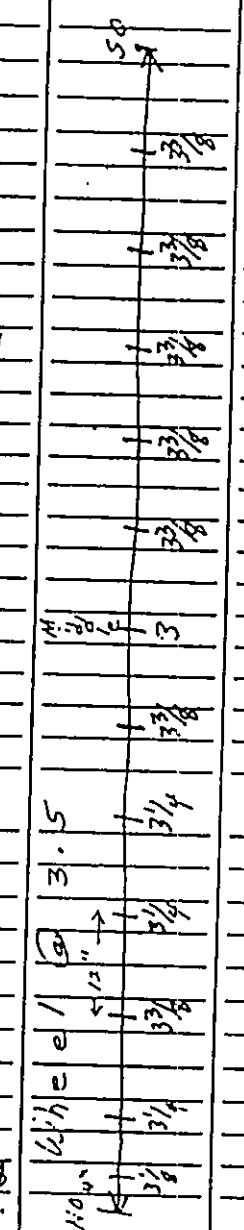
TIME OF DAY		0830	0900	0930	1000		1030
SLICE RATE, TPH		235	141	247	200		205
TOTAL PULP FLOW, TPH		55	58	61	62		56 ~~[illegible]~~
GRATE SPEED, %		64.21	79.92	83.93	66.09		63.51
DRYER EXIT, °C		99.8	99.9	99.8	100.2		99.6
ID FAN SPEED, %		72.0	72.0	72.0	72.0		72.0
PULP FEED SCROLL, %		44.4	103.0	103.3	103.3		103.3
PULP GATE, % CLOSED		-3.34	60.0	60.0	67.65		60.0
FD DAMPER, % OPEN		16.48	29.17	32.42	17.16		13.57
RECYCLE DAMPERS, % OPEN		45.0	45.0	45.0	45.0		45.0
RATIO SETUP	S	Manual	Manual	Manual	Manual	S	Manual
DRYER THROAT		372	431	486	466		391
DRYER EXIT, °C	O	100	100	100	100	C	100
FURNACE PRESS, IN H2O		-1.4	-1.1	-1.1	-1.3		-1.4
EXIT PRESS, INC H2O	T	-0.9	-1.1	-1.2	-1.1	T	-1.1
DRYER ΔP, IN H2O		1.3	1.1	1.2	1.2		1.3
DRUM AMPS	#1	25.5	26.5	26.5	26.0	#2	26.0
ID FAN, AMPS		156	155	155	156		156
ID FLOW	@	37	36	36	36	@	36.5
REC. FLOW		9.3	9.4	9.3	9.4		9.35
M.C. ΔP	0805	4.05	4.05	4.05	4.05	1020	4.05
BAGHOUSE ΔP		4.76	4.78	4.78	4.77		4.80
ASP		6.9	6.7	7.0	6.7		7.1
FD FLOW, ΔP		1.03	1.03	1.03	1.03		1.03
#1 PULP FEED, TPH		34	33	35	34		33
#2 PULP FEED, TPH		24	25	25	23		23
O_2, %		12.0	10.9	10.2	11.1		12.0
BH in, °C		102.8	102.6	102.8	102.8		102.7
out, °C		92.9	93.4	93.4	93.1		93.1
		0927 furnace static above grate -0.16 to -0.19 in-H_2O		0934/0937 64.03/65.15/66.87 8" in 96 sec.			

time/wp51

02/26/93

NUMBER 2 DRYER (South)

TIME OF DAY	1100		1130	1200		1230	1300
SLICE RATE, TPH	210		220	226		183	200
TOTAL PULP FLOW, TPH	55		53	54		58	52
GRATE SPEED, %	71.53		68.67	69.16		75.52	64.65
DRYER EXIT, °C	99.9		99.7	99.8		99.8	99.8
ID FAN SPEED, %	72.0		72.0	72.0		72.0	72.0
PULP FEED SCROLL, %	103.3		103.3	103.3		103.3	103.3
PULP GATE, % CLOSED	60.0		60.0	60.0	S	64.01	60.0
FD DAMPER, % OPEN	22.47		18.96	20.13		22.45	14.84
RECYCLE DAMPERS, % OPEN	45.0		45.0	45.0	O	45.0	45.0
RATIO SETUP	Manual		Manual	Manual		Manual	Manual
DRYER THROAT	404		428	442	T	452	399
DRYER EXIT, °C	100		100	100		100	100
FURNACE PRESS, IN H20	-1.2		-1.3	-1.3	#3	-1.2	-1.4
EXIT PRESS, INC H20	1.1		-1.1	-1.0		-1.0	-1.0
DRYER ΔP, IN H20	1.3		1.2	1.3	@	1.2	1.4
DRUM AMPS	26.5		26.5	26		26.5	26.0
ID FAN, AMPS	157		156	156	1230	157	156
ID FLOW	36.5		37	36.5		36.5	37
REC. FLOW	9.3		9.2	9.3		9.6	9.3
M.C. ΔP	4.05		4.05	4.05		4.05	4.05
BAGHOUSE ΔP	4.80		4.74	4.75		4.79	4.73
ASP	6.9		6.8	6.8		6.8	6.6
FD FLOW, ΔP	1.03		1.03	1.03		1.03	1.03
#1 PULP FEED, TPH	31		30	32		34	31
#2 PULP FEED, TPH	24		24	25		23	23
O_2, %	11.4		11.3	11.1		11.3	12.1
BH in, °C	102.7		102.7	102.8		103.1	103.0
out, °C	93.1		93.4	93.5		93.5	93.4
	1123/1126						1305/1308
	69.27/72.47/73.48						63.25/67.14/65.15
	4" in 92 pw.						9" in 95 pw.



02/26/93

NUMBER 2 DRYER (South)

TIME OF DAY	1330	1400	1430	1500			
SLICE RATE, TPH	200	204	218	215			
TOTAL PULP FLOW, TPH	56	51	57	57			
GRATE SPEED, %	71.19	72.03	92.89	80.72			
DRYER EXIT, °C	99.8	99.9	100.0	99.9			
ID FAN SPEED, %	72.0	72.0	72.0	72.0			
PULP FEED SCROLL, %	103.3	103.3	103.3	103.3			
PULP GATE, % CLOSED	60.0	60.0	60.0	60.0			
FD DAMPER, % OPEN	20.96	19.11	42.76	28.59			
RECYCLE DAMPERS, % OPEN	45.0	45.0	45.0	45.0			
RATIO SETUP	Manual	Manual	Manual	Manual			
DRYER THROAT	385	427	485	478			
DRYER EXIT, °C	100	100	100	100			
FURNACE PRESS, IN H20	-1.3	-1.3	-1.0	-1.2			
EXIT PRESS, INC H20	-1.1	-1.1	-1.3	-1.3			
DRYER ΔP, IN H20	1.3	1.2	1.2	1.2			
DRUM AMPS	26.5	26.5	27	26.5			
ID FAN, AMPS	156	156	155	156			
ID FLOW.	34.5	36.5	33	33.5			
REC. FLOW	9.6	9.5	9.5	9.6			
M.C. ΔP	4.05	4.05	4.05	4.05			
BAGHOUSE ΔP	4.71	4.66	4.60	4.61			
ASP	6.8	6.9	6.8	7.0			
FD FLOW, ΔP	1.03	1.03	1.03	1.03			
#1 PULP FEED, TPH	29	30	33	34			
#2 PULP FEED, TPH	24	24	27	24			
O_2, %	11.9	11.2	10.0	11.0			
BH in, °C	102.8	103.2	103.6	103.6			
out, °C	93.5	93.8	94.2	93.9			
	Furnace Static -0.04"						

about grate

time/wp51

Filename: BEET22.WQ1
Date: 19-Jan-95
Facility: American Crystal Sugar
Location: Crookston, Minnesota
Source: No. 1 pulp dryer (coal-fired) w/multiclones and stack filter system
Test date: February 22, 1993

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported					
			Run 1	Run 2	Run 3	Run 4	Run 5	
1	Stack temperature	Deg F	209	210	207	208	209	
No. 1 pulp dryer	Pressure	in. HG	29.30	29.30	29.40	29.40	29.40	
	Moisture	%	48.29	48.80	39.17	38.53	37.93	
	Oxygen	%	10.42	9.765	13.15	13.86	13.93	
	Volumetric flow, actual	acfm	58413	58464	62418	62273	62355	
	Volumetric flow, standard*	dscfm	23345	23101	29534	29731	30016	
	Isokinetic variation	%	106.67	102.61	103.65	100.06	100.57	
Pulp dryer feed rate NEED TO CHECK W/PLANT!!		TPH	31.0	31.0	26.0	26.0	26.0	
	Pollutant concentrations:							
	Total PM	G/dscf	0.0953	0.1191	0.0663	0.0754	0.0712	
	Filterable PM	G/dscf	0.0656	0.0908	0.0480	0.0577	0.0579	
	Condensible organic PM	G/dscf	0.0297	0.0283	0.0183	0.0177	0.0133	
	CO2	% vol	9.03	9.67	6.71	6.12	6.05	
	Pollutant mass flux rates:							
	Filterable PM	lb/hr	13.1	18.0	12.2	14.7	14.9	
	Condensible organic PM	lb/hr	5.94	5.60	4.63	4.51	3.41	
	CO2	lb/hr	14447	15309	13581	12470	12445	
	Emission factors (ENGLISH UNITS):							AVERAGE
	Filterable PM	lb/ton	0.42	0.58	0.47	0.57	0.57	0.52
	Condensible organic PM	lb/ton	0.19	0.18	0.18	0.17	0.13	0.17
	CO2	lb/ton	466	494	522	480	479	488
	Emission factors (METRIC UNITS):							AVERAGE
	Filterable PM	kg/Mg	0.21	0.29	0.23	0.28	0.29	0.26
	Condensible organic PM	kg/Mg	0.096	0.090	0.089	0.087	0.066	0.086
	CO2	kg/Mg	233	247	261	240	239	244

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET22A.WQ1
Date: 19-Jan-95
Facility: American Crystal Sugar
Location: Crookston, Minnesota
Source: No. 2 pulp dryer (coal-fired) w/multiclones and stack filter system
Test date: February 24-25, 1993

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported									
			Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	
2	Stack temperature	Deg F	195	195	195	193	194	194	195	194	196	
No. 2 pulp dryer	Pressure	in. HG	29.43	29.43	29.43	29.40	29.40	29.40	29.52	29.52	29.52	
	Moisture	%	35.64	34.54	32.64	25.88	29.35	28.81	28.58	27.78	26.94	
	Oxygen	%	14.45	15.1	15.63	17.25	16.59	16.56	16.37	16.76	16.93	
	Volumetric flow, actual	acfm	45571	45475	45322	43538	43872	44437	45293	43647	45191	
	Volumetric flow, standard*	dscfm	23256	23603	24207	25640	24589	25096	25728	25109	26219	
	Isokinetic variation	%	102.72	98.7	97.55	93.42	102.32	98.12	101.4	102.33	99.57	
Pulp dryer feed rate NEED TO CHECK W/PLANT!!		TPH	28.0	27.0	26.8	23.2	22.0	22.0	24.3	24.0	23.5	
	Pollutant concentrations:											
	Total PM	G/dscf	0.0806	0.0753	0.0682	0.0532	0.0452	0.0478	0.0557	0.0552	0.0584	
	Filterable PM	G/dscf	0.0681	0.0594	0.0554	0.0425	0.0355	0.0395	0.0460	0.0459	0.0482	
	Condensible organic PM	G/dscf	0.0125	0.0159	0.0128	0.0107	0.0097	0.008278	0.009726	0.009332	0.0102	
	CO2	% vol	5.57	5.02	4.55	3.18	3.74	3.75	3.92	3.6	3.46	
	Pollutant mass flux rates:											
	Filterable PM	lb/hr	13.6	12.0	11.5	9.3	7.5	8.5	10.1	9.9	10.8	
	Condensible organic PM	lb/hr	2.49	3.21	2.66	2.35	2.04	1.78	2.14	2.01	2.29	
	CO2	lb/hr	8877	8120	7548	5588	6303	6450	6912	6195	6217	
	Emission factors (ENGLISH UNITS):											AVERAGE
	Filterable PM	lb/ton	0.48	0.45	0.43	0.40	0.34	0.39	0.42	0.41	0.46	0.42
	Condensible organic PM	lb/ton	0.089	0.12	0.10	0.10	0.093	0.081	0.088	0.084	0.097	0.095
	CO2	lb/ton	317	301	282	241	286	293	285	258	265	281
	Emission factors (METRIC UNITS):											AVERAGE
	Filterable PM	kg/Mg	0.24	0.22	0.21	0.20	0.17	0.19	0.21	0.21	0.23	0.21
	Condensible organic PM	kg/Mg	0.044	0.059	0.050	0.051	0.046	0.040	0.044	0.042	0.049	0.047
	CO2	kg/Mg	159	150	141	120	143	147	143	129	132	140

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

APPENDIX V

REPORT EXCERPTS FROM REFERENCE 23

(Michigan Sugar Company, December 14, 1989)

PARTICULATE EMISSION STUDY
FOR
MICHIGAN SUGAR COMPANY
CARO, MICHIGAN

DATE OF TESTING:
December 14, 1989

Prepared For:

Michigan Sugar Company
P.O. Box 1348
Saginaw, Michigan 48605

Prepared By:

Swanson Environmental, Inc.
24156 Haggerty Road
Farmington Hills, Michigan 48024

MA-5491

SWANSON ENVIRONMENTAL INC.

EMISSION STUDY
PULP DRIER STACK
MICHIGAN SUGAR COMPANY
CARO, MICHIGAN
JANUARY 11, 1990
MA-5491

EXECUTIVE SUMMARY

Swanson Environmental, Inc., was retained by Michigan Sugar Company to conduct a study of the particulate emissions from the beet pulp drier at the Caro, Michigan facility.

The purpose of the study was to determine if the particulate emissions were in compliance with Michigan Sugar's Operations Permit (Number 566-89) Special Conditions requirements. The results of the study are as follows:

TABLE 1

TEST NO.	TEST DATE	STACK GAS FLOW RATE (DSCFM)	GRAIN PER DSCF	LBS/1000 LBS ACTUAL-GAS	LBS/1000 LBS DRY 50% EA*	LBS/ HOUR
P-1	12-14-89	41580	0.0595	0.089	0.202	21.22
P-2	12-14-89	35799	0.0669	0.089	0.230	20.52
P-4	12-14-89	31426	0.0727	0.092	0.247	19.58
P-5	12-14-89	31940	0.0676	0.085	0.229	18.49
AVERAGE (P2, P4, P5)		33055	0.0691	0.089	0.235	19.53

* EA = Excess Air

The average result of 0.089 pounds of total particulate per 100C pounds of air meets the permit requirements of 0.10 pounds as established by the Michigan Department of Natural Resources (MDNR).

Note:

The average results were calclulated using only the results from tests P-2, P-4 and P-5. The data obtained in test P-1 was deemed invalid and test P-3 was discontinued during sampling (see Section 7.0).

EMISSION STUDY
PULP DRIER STACK
MICHIGAN SUGAR COMPANY
CARO, MICHIGAN
JANUARY 11, 1990
MA-5491

1.0 INTRODUCTION

Swanson Environmental, Inc., was retained by Michigan Sugar Company, of Saginaw, Michigan to conduct a particulate emission study on the beet pulp drier stack at their Caro, Michigan facility.

The purpose of the study was to determine if the particulate emissions were in compliance with Michigan Sugar's Operating Permit (Number 566-89) Special Conditions. The test was conducted in accordance with the procedures outlined in 40 CFR 60, Appendix A, for U.S. EPA Method 17.

The study was conducted on December 14, 1989, by Mr. Dan Larin, Mr. Andrew Secord, Mr. Mark Hook and Mr. Thomas Wilk of Swanson Environmental, Inc. Mr. Mark Suhr of Michigan Sugar assisted in the study. Mr. Fred Harris, the MDNR field representative, was present to monitor the study.

2.0 PROCESS DESCRIPTION

The pulp, after being extracted from the beets and discharged from the diffuser, is pressed to remove excess moisture. The pulp is then dried by feeding the material into large revolving drums through which hot air is blown.

SWANSON ENVIRONMENTAL, INC.
PARTICULATE SAMPLING DATA AND CALCULATIONS

PLANT: MICH. SUGAR SOURCE: PULP DRIER
DATE: 12/14/89

	CLOCK TIME:	60.00	60.00	60.00	60.00
	1.00 NUMBER	P-1	P-2	P-4	P-5
B.	STACK DIAMETER, In	73.01	73.01	73.01	73.01
C.	STACK AREA, Sq.Ft	29.08	29.08	29.08	29.08
D.	No. SAMPLE POINTS	30.00	30.00	30.00	30.00
E.	TOTAL SAMPLE TIME, MIN.	60.00	60.00	60.00	60.00
F.	NOZZLE DIAMETER, In.	0.248	0.248	0.248	0.248
G.	NOZZLE AREA, Sq.Ft.	0.00034	0.00034	0.00034	0.00034
H.	CALIBRATION FACTORS:				
	PITOT TUBE, Cp	0.840	0.840	0.840	0.840
	GAS METER, y	1.005	1.005	1.005	1.005
I.	BAROMETRIC PRESSURE, In.Hg.	29.30	29.30	29.30	29.30
J.	STACK STATIC PRESSURE In.H20	1.30	1.30	1.30	1.30
K.	STACK GAS TEMP.	213.83	269.40	280.17	288.90
L.	AVG. Sq. Rt. VEL. HEAD	0.66	0.68	0.64	0.66
M.	AVG. METER TEMP.	89.37	92.27	88.13	86.53
N.	AVG. METER PRESS., H2O	0.40	0.67	0.39	0.39
O.	METER VOL., ACTUAL Cu. Ft.	27.86	24.13	21.13	20.91
P.	METER VOL., @STP	26.48	22.83	20.13	19.98
Q.	LIQUID VOL., H20 COND., Ml.	249.70	336.80	348.80	355.20
R.	VAPOR VOL., H20 COND., @STP, Cu.Ft.	11.84	15.96	16.53	16.84
S.	TOTAL GAS SAMPLED, @ STP, Cu.Ft.	38.32	38.79	36.66	36.81
T.	%MOISTURE IN EXHAUST GAS				
	1) AT TEST LOCATION	30.89	41.15	45.10	45.74
	2) BEFORE COLLECTOR	0.00	0.00	0.00	0.00
U.	DRY GAS COMP. %O2	13.6	13.7	13.6	13.6
	%CO2	2.4	1.9	1.6	2.0
	%CO	0.0	0.0	0.0	0.0
	%N2	84.0	84.4	84.8	84.4
V.	DENSITY & MOL. Wt. -STACK GAS				
	1)DRY, @ STP,Lbs/Cu.Ft.	0.0748	0.0746	0.0745	0.0746
	2)WET, @ STP,Lbs/Cu.Ft.	0.0661	0.0630	0.0619	0.0618
	3)WET @ STACK,Lbs/Cu.Ft.	0.0509	0.0449	0.0434	0.0428
	4)MOL.Wt., @ STP,Lb/MOLE	28.94	28.86	28.81	28.87

W. WEIGHT OF GAS SAMPLED:				
1)DRY GAS,Lbs	1.98	1.70	1.50	1.49
2)WET GAS,Lbs	2.53	2.45	2.27	2.27
X. TOTAL PARTICULATE COLLECTED (GRAMS)	0.1023	0.0990	0.0949	0.0875
Y. AVERAGE GAS VELOCITY, FPM	2686.50	2940.34	2807.53	2921.04
Z. STACK GAS FLOW RATE				
1)AT STACK, Qa, ACFM	78111	85492	81631	84931
2)AT Std.,Qstd, SCFM	60165	60833	57241	58860
3)Std. DRY,Qdg, SCFM	41580	35799	31426	31940
AA. PERCENT EXCESS AIR	158.58	159.64	154.77	156.65
BB. CONCENTRATION CONVERSION FACTORS:				
1)50% E.A.,AFTER COLLECTOR	1.52	1.45	1.40	1.40
2)50% E.A.,BEFORE COLLECTOR	2.27	2.58	2.68	2.71
3)MOISTURE BEFORE COLLECTOR	1.28	1.44	1.51	1.53
CC. PARTICULATE CONCENTRATION:				
1)Lbs/1000 Lbs., ACTUAL	0.089	0.089	0.092	0.085
2)Lbs/1000 Lbs., DRY	0.114	0.128	0.140	0.129
3)Lbs/1000 Lbs., WET @ 50%E.A	0.135	0.129	0.129	0.119
4)Lbs/1000 Lbs., DRY @ 50%E.A	0.202	0.230	0.247	0.229
5)GRAINS / DSCF	0.0595	0.0669	0.0727	0.0676
6)POUNDS / HOUR	21.22	20.52	19.58	18.49
DD. PERCENT ISOKINETIC	91.70	91.82	92.22	90.05

SHEET No. 3

Caro Factory 78 Day Beginning 7 A.M. 12-14-89

Lime	Day	To Date	Lime Cake	Day	To Date	Molasses	Day	To Date	Dried Pulp	Day	To Date
Rock to Kiln, Tons			% CaO in Cake			Molasses Prod. Tons			Pulp Produced Tons		
Rock % on Beets			% CaO in Sewer			Molasses Prod. % on Beets			Pulp Produced % Beets		
Discard from Kiln, Tons			Sugar in Cake % on Beets			Sugar in Mol. Prod. Tons					
Discard from Slacker, Tons			Sugar in Lime Sewer Tons			Sugar in Mol. Prod. % on Beets					
Lime Bought or Sold, Tons			Sugar in Lime Sewer % on Beets								
CaO Introduced Tons											
CaO Introduced % on Beets											

Hour	Lime Cake 1st % Sugar	Lime Cake 2nd % Sugar	Lime Cake 3rd % Sugar	Lime Cake Composite	Lime Sewer % Sugar	Milk of Lime Bx	Milk of Lime % CaO	Limed Juice CaO per 100 ml	Kiln Gas % CO2	Molasses Brix	Molasses Pol.	Molasses App. Purity	Molasses Sucrose	Molasses Raff.	Molasses True Purity	Molasses SO2	Molasses Inv. Sugar	Pulp Wet Moist. %	Pulp Press Moist. %	Pulp Dry Moist. %	Pulp Dry Sugar %	Pellets Moist. %	Pellets Sugar %	Condensed Water Boiler Feed	Condensed Water Heater	Condensed Water Sugar %	Condensed Water Seal Tank	Condensed Water Sugar %
7			.2			14		225		86.7	50.4	58.3	7.0	B								10.29		O	O	O	VL	
8								260	26.0											13.45				0	0	0	VL	
9	.3					20		240	?									I 4	82.6			10.15		0	0	0	VL	
10								225												8.05			4.0	0	0	0	VL	
11			.3					210										II	—			11.64		0	0	0	VL	
PM 12						21		215												8.90				0	0	0	VL	
1	.1							230														11.49		0	0	0	VL	
2						18		265		83.3	48.0	57.2	7.0	B						9.45				0	0	0	VL	
Avg.																												
3			.9			19		250		83.2	48.4	58.1	6.8	B								—		0	0	0	L	
4								215												15.[illegible]				0	0	[illegible]	VL	
5		.2				20		200										#1	84.9			10.25		0	[illegible]	[illegible]	L	
6								210												16.10				VL	VL	0	L	
7			.1			22		235														11.99	.56	L	VL	0	L	
8								230										#3	71.3	9.40				L	VL	0	L	
9	.1					23		215											71.3			10.15		0	0	0	L	
10								200		83.2	48	58.4	6.5	B						16.45				0	0	0	L	
Avg.																												
11		.1				24		200		80.4	47.2	58.70	6.8									10.84		0	0	0	L	
AM 12								205												16.50				0	0	0	VL	
1	.6					22		230										#2	71.5			11.05		0	0	0	L	
2								210												14.61			.24	0	0	0	L	
3		.1				23		215														11.52		0	VL	0	L	
4								200										#3	70.5	13.27				0	VL	0	L	
5	.7					21		200		79.2	45.4	57.3	9.1									11.03		0	VL	0	L	
6								250												13.56				0	VL	VL	L	
Avg.																												
24 hr Avg.	.36	.13	.34			21.00		2.23	26.0	82.7	47.37	57.30	7.2						72.14	12.81		10.89	4.00					

CARO FACTORY

DIFFUSER DATA

No. Days Slicing 22
DATE 1/4/89 Beginning 7:00 A.M.

TEMPERATURE 1 Cold Jul.	2 Circ. Jul.	3 Mixer	4 C.T.	5 Fresh Water	6 Press Water	7 R.J.	TOWER 8 Amp.	Level	SCREEN Pressure	PH C.T	PH Press Water	PH Fresh Water	DIFFUSION JUICE Brix	Purity	pH	SUGAR Press Water	Cossi.	WEIGHTOMETER Reading	Tons / Hr.	KNIFE CHANGE Time	Slicer #	REMARKS
59	69	61	71	59	81	47	74	58	20	5.7	5.6	6.3	15.1	88.74	6.0	1.66	17.4	233380	130			1:00 - Soft water
60	69	61	71	59	81	46	76	40	20	5.5	5.6	5.8			5.8	1.18		232450	70			
63	68	62	71	58	77	54	100	60	20	5.6	6.0	6.1	15.1	87.41	5.9	1.66	18.0	233484	135			
57	68	58	70	59	80	45	78	58	20	5.6	6.4	6.0			5.9	.83		232780	135	10:28	I	
58	68	59	70	59	80	44	76	52	20	5.5	5.2	6.0	14.1	87.34	6.0	.84	17.8	232840	120			
57	68	58	71	58	80	45	74	52	20	5.4	4.8	5.8			5.9	1.33		230972	135			
59	68	60	70	59	80	47	74	56	20	5.4	5.9	5.6	15.8	87.34	5.8	1.64	17.6	233110	135			
58	68	59	71	59	80	46	76	48	20	5.4	5.8	5.6			5.8	1.92		232845	135			
59	67	59	71	57	76	47	78	48	20	5.6	5.8	6.0	15.2	88.88	5.9	2.13	17.6	233780	135			
58	69	59	71	58	80	48	80	48	20	5.7	5.9	5.6			5.9	1.99		233515	135			
58	69	59	71	59	80	48	80	46	20	5.7	6.0	5.9	15.9	90.56	5.9	1.78	7.4	233450	135			
62	68	62	70	59	66	49	80	46	20	5.6	5.6	5.9			5.9	1.79		233765	135			
60	68	60	70	59	76	50	84	50	20	5.8	5.9	5.8	15.9	89.93	5.9	1.80	18.2	233980	135			
59	67	60	70	60	70	46	90	50	20	5.6	6.0	5.9			5.9	1.20		234058	135			
59	68	60	70	60	80	47	80	50	20	5.6	5.7	5.9	14.6	90.41	5.9	1.79	18.0	234190	135			
58	66	59	71	58	80	45	76	48	20	5.6	5.9	5.8			5.8	1.19		234245	135			
57	66	57	70	59	79	43	76	46	20	5.5	5.9	5.8	14.9	90.86	5.8	1.35	17.8	234460	135			
58	66	59	70	58	77	45	76	48	20	5.8	6.1	5.8			5.9	1.35		234595	135			
59	68	60	70	58	76	49	78	54	20	5.9	6.3	6.0	15.9	89.30	6.0	1.45	17.2	234730	135	3:00	II	
61	70	61	70	58	79	45	76	52	20	5.8	5.5	5.9			6.0	1.50		234865	135			
61	69	62	69	59	79	48	74	56	20	5.7	6.0	6.0	15.9	89.30	6.0	1.56	17.6	235000	135			
59	69	60	70	59	81	43	72	54	20	5.8	6.1	6.0			6.0	1.56		235135	135			
61	68	61	70	58	80	44	72	54	20	5.7	6.2	5.9	15.6	89.10	6.0	1.66	18.0	235270	135			
60	68	60	71	58	78	45	74	54	20	5.8	6.2	6.0			6.0	1.66		235405	135			

SHIFT I: TONS SLICED 995

DELAYS: 7:15 - 8:30 : Dryer Kick-out
11:45 - 11:55 : " " "

SHIFT II: TONS SLICED 1080

DELAYS: Kiln Dryer Down
8:20 " "
1:50 " "

SHIFT III: TONS SLICED 1080 Total: 3155

DELAYS:

101-A (Rev. 9-87)

MONTAGE PRESS 87-1988

12 PAGE LAB REPORT MICHIGAN SUGAR COMPANY PLANT: CARO PAGE: 5

		PULP PRODUCED					PRESSED PULP			DRY PULP			PELLET PULP			% SUGAR IN PRESSED PULP			
		---TONS---		% ON BEETS			-----% MOISTURE-----			-----% MOISTURE-----			-----% MOISTURE-----			-% SUGAR-		---TONS---	
ATE	DAY	DAY	TODATE	DAY	TD	AVE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TD	DAY	TD
1/24	58	179	9995	5.50	5.49	172	73.18	4116.37	74.84	11.15	673.31	12.02	11.15	595.72	10.64	.30	.28	9.77	512.
1/25	59	169	10164	5.51	5.49	172	66.82	4183.19	74.70	10.38	683.69	11.99	10.34	606.06	10.63	.24	.28	7.36	519.
1/26	60	168	10332	5.50	5.49	172	66.55	4249.74	74.56	10.24	693.93	11.96	10.73	616.79	10.63	.27	.28	8.25	528.
1/27	61	126	10458	5.51	5.49	171	67.53	4317.27	74.44	11.99	705.92	11.96	11.44	628.23	10.65	.27	.28	6.17	534.28
1/28	62	133	10591	5.52	5.50	171	69.52	4386.79	74.35	11.20	717.12	11.95	11.14	639.37	10.66	.28	.28	6.75	541.03
1/29	63	155	10746	5.49	5.50	171	66.10	4452.89	74.21	14.71	731.83	12.00	11.41	650.78	10.67	.25	.28	7.06	548.09
1/30	64	145	10891	5.49	5.50	170	67.03	4519.92	74.10	13.14	744.97	12.02	10.61	661.39	10.67	.21	.28	5.54	553.63
K	9	1075		5.50			68.10			11.83			10.97			.26		50.90	
D			10891		5.50				74.10			12.02			10.67		.28		553.63
2/01	65	159	11050	5.49	5.50	170	70.62	4590.54	74.04	10.09	755.06	11.99	11.04	672.43	10.67	.26	.28	7.53	561.16
2/02	66	77	11127	5.48	5.49	169	70.03	4660.57	73.98	8.46	763.52	11.93	10.52	682.95	10.67	.21	.28	2.95	564.11
2/03	67	114	11241	5.52	5.50	168	75.85	4736.42	74.01	8.21	771.73	11.87	10.32	693.27	10.67	.32	.28	6.61	570.72
2/04	68	118	11359	5.50	5.50	167	73.43	4809.85	74.00	9.53	781.26	11.84	10.74	704.01	10.67	.24	.28	5.15	575.87
2/05	69	164	11523	5.50	5.50	167	71.08	4880.93	73.95	12.68	793.94	11.85	11.72	715.73	10.68	.27	.28	8.05	583.92
2/06	70	152	11675	5.51	5.50	167	71.72	4952.65	73.92	9.71	803.65	11.82	10.53	726.26	10.68	.21	.28	5.80	589.72
2/07	71	159	11834	5.51	5.50	167	74.96	5027.61	73.94	9.22	812.87	11.78	10.31	736.57	10.67	.33	.28	9.52	599.24
K	10	943		5.50			72.53			9.70			10.74			.27		45.61	
D			11834		5.50				73.94			11.78			10.67		.28		599.24
2/08	72	175	12009	5.50	5.50	167	77.03	5104.64	73.98	9.59	822.46	11.75	10.72	747.29	10.68	.32	.28	10.18	609.42
2/09	73	166	12175	5.51	5.50	167	73.98	5178.62	73.98	11.28	833.74	11.74	10.07	757.36	10.67	.30	.28	9.03	618.45
2/10	74	182	12357	5.51	5.50	167	75.23	5253.85	74.00	11.05	844.79	11.73	10.23	767.59	10.66	.31	.28	10.25	628.70
2/11	75	174	12531	5.52	5.50	167	74.55	5328.40	74.01	10.80	855.59	11.72	10.68	778.27	10.66	.27	.28	8.52	637.22
2/12	76	68	12599	5.48	5.50	166	75.95	5404.35	74.03	10.26	865.85	11.70	10.33	788.60	10.66	.22	.28	2.73	639.95
2/13	77	166	12765	5.50	5.50	166	73.08	5477.43	74.02	11.75	877.60	11.70	11.17	799.77	10.66	.23	.28	6.95	646.90
2/14	78	174	12939	5.52	5.50	166	77.16	5554.59	74.06	12.81	890.41	11.72	10.89	810.66	10.67	.29	.28	9.15	656.05
(	11	1105		5.51			75.28			11.08			10.58			.28		56.81	
)			12939		5.50				74.06			11.72			10.67		.28		656.05
2/15	79	181	13120	5.50	5.50	166	73.38	5627.97	74.05	12.10	902.51	11.72	10.77	821.43	10.67	.24	.28	7.90	663.95
2/16	80	190	13310	5.51	5.50	166	71.88	5699.85	74.02	12.00	914.51	11.72	10.84	832.27	10.67	.27	.28	9.32	673.27
2/17	81	186	13496	5.49	5.50	167	73.00	5772.85	74.01	11.97	926.48	11.73	10.87	843.14	10.67	.28	.28	9.48	682.75
2/18	82	171	13667	5.49	5.50	167	77.87	5850.72	74.06	10.81	937.29	11.72	10.66	853.80	10.67	.33	.28	10.28	693.03
2/19	83	182	13849	5.49	5.50	167	73.93	5924.65	74.06	12.31	949.60	11.72	10.95	864.75	10.68	.26	.28	8.62	701.65
2/20	84	156	14705	5.51	5.77	175	71.58	5996.23	74.03	11.09	960.69	11.72	10.46	875.21	10.67	.24	.28	6.79	708.44
2/21	85	163	14868	5.49	5.77	175	71.62	6067.85	74.00	10.06	970.75	11.70	11.07	886.28	10.68	.21	.28	6.24	714.68
:	12	1229		5.50			73.32			11.48			10.80			.26		58.63	
)			14868		5.77				74.00			11.70			10.68		.28		714.68

Filename: BEET23.WQ1
Date: 19-Jan-95
Facility: Michigan Sugar Company
Location: Caro, Michigan
Source: Pulp dryer with multiclones (Natural gas-fired)
Test date: December 14, 1989

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 2	Run 4	Run 5	Average
1	Stack temperature	Deg F	269.4	280.17	288.9	
	Pressure	in. HG	29.30	29.30	29.30	
	Moisture	%	41.15	45.1	45.74	
	Oxygen	%	13.7	13.6	13.6	
	Volumetric flow, actual	acfm	85492	81631	84931	
	Volumetric flow, standard*	dscfm	35800	31425	31938	
	Isokinetic variation	%	91.7	91.82	92.22	
	Wet pulp feed rate	TPH	35.7	23.1	21.2	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0669	0.0727	0.0676	
	CO2	% dv	1.9	1.6	2.0	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	20.5	19.6	18.5	
	CO2	lb/hr	4662	3446	4378	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.58	0.85	0.87	0.77
	CO2	lb/ton	131	149	206	162
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.29	0.42	0.44	0.38
	CO2	kg/Mg	65	75	103	81

*DSCFM BASED ON A STANDARD TEMPERATURE OF 70 DEGREES FAHRENHEIT

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03 Date/Time 12/9/94
Project Title SUGAR BEET PROCESSING AP-42
Signature [signature] Verified by _____ (signature/date)

Phone Contact ☐
Meeting Notes ☐
Work Sheet ☒

CARO, MICHIGAN FACILITY

TEST DATE: 12/14/89

TEST NO.	TIME DURATION
P-2	3:13 - 4:23 PM
P-4	7:35 - 9:25 AM
P-5	10:00 - 11:10 PM

TOTAL DRY PULP PRODUCED ON 12/14/89 = 174 TONS = 7.25 TONS/HR. AVERAGE

AVERAGE OVER TEST RUN

TEST NO.	SLICE RATE (TONS/HR)	PRESSED PULP MOISTURE (%)	DRIED PULP MOISTURE (%)
P-2	135	82.6	15.0
P-4	135	71.3	9.4
P-5	135	71.3	16.45

$$\%\ \text{SOLIDS} = \frac{\text{DRY PULP PRODUCED} - \text{DRY PULP MOISTURE} * \text{PULP PRODUCED}}{\text{BEETS SLICED}}$$

P-2: $\%\ \text{SOLIDS} = \frac{7.25 - (0.15 * 7.25)}{135} = \frac{6.16}{135} \times 100 = 4.6\%$

P-4: $\%\ \text{SOLIDS} = \frac{7.25 - (0.094 * 7.25)}{135} = \frac{6.57}{135} \times 100 = 4.9\%$

P-5: $\%\ \text{SOLIDS} = \frac{7.25 - (0.1645 * 7.25)}{135} = \frac{6.06}{135} \times 100 = 4.5\%$

MRI

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03 Date/Time 12/9/94

Project Title ~~Sugar Beet Processing~~ - AP-42

Signature [signature] Verified by _____ (signature/date)

Phone Contact ☐ Meeting Notes ☐ Work Sheet ☒

$$\text{Process Rate (tons/hr)} = \frac{\text{Beets Sliced} * \% \text{ Solids}}{1 - \left(\frac{\text{Wet Pulp Moisture (\%)}}{100}\right)}$$

P-2: Rate = $\frac{135 * 0.046}{1 - \left(\frac{82.6}{100}\right)} = \frac{6.21}{0.174} = 35.7$ tons/hr.

P-4: Rate = $\frac{135 * 0.049}{1 - \left(\frac{71.3}{100}\right)} = \frac{6.62}{0.287} = 23.1$ tons/hr.

P-5: Rate = $\frac{135 * 0.045}{1 - \left(\frac{71.3}{100}\right)} = \frac{6.08}{0.287} = 21.2$ tons/hr.

APPENDIX W

REPORT EXCERPTS FROM REFERENCE 24

(Michigan Sugar Company, November 1989)

PARTICULATE EMISSION STUDY
FOR
MICHIGAN SUGAR COMPANY
CARROLTON, MICHIGAN

DATES OF TESTING:
November 14 and 16, 1989

Prepared For:

Michigan Sugar Company
P.O. Box 1348
Saginaw, Michigan 48605

Prepared By:

Swanson Environmental, Inc.
24156 Haggerty Road
Farmington Hills, Michigan 48024

MA-5490

SWANSON ENVIRONMENTAL INC.

1.0 INTRODUCTION

Swanson Environmental, Inc., was retained by Michigan Sugar Company, of Saginaw, Michigan to conduct two particulate emission tests on the beet pulp drier stack at the Carrolton plant, located in Carrolton, Michigan.

The purpose of the study was to determine whether the particulate emissions from two different aspiration rates were in compliance with Michigan Sugar's Special Conditions Permit Number 300-86A. The tests were in accordance with the procedures outlined for Method 17 of 40 CFR 60, Appendix A.

The study was conducted on November 14 and 16, 1989 by Mr. Mark Hook, Mr. Dan Larin, Mr. Mark Morter, and Mr. Andrew Secord of Swanson Environmental, Inc. Mr. Mark Suhr of Michigan Sugar assisted in the study.

2.0 PROCESS DESCRIPTION

Expanded cossettes, or pulp, discharged from the diffuser is pressed to remove excess moisture. The pulp is then dried by feeding the material into large revolving drums through which hot air is drawn. The drying reduces the pulp moisture to approximately 12% from a high of approximately 80%. The moist air leaves the drum and passes through a multiclone and a side stream is sent through a baghouse. The bag house is aspirated at two different rates and the recirculated air is used to

combust the heating flame. The drier exhaust is discharged to the atmosphere via a 100 foot high, 8 foot diameter stack. Sampling was performed from the elevated walkway located approximately 60 feet above ground level.

3.0 GENERAL

Prior to the start of testing the stack diameter was measured and a total of 12 traverse points were selected. Four 4-inch diameter sampling ports were previously installed on the 96" diameter stack (Figure 1). Preliminary velocity traverses (USEPA Method 2) and wet bulb-dry bulb moisture determinations (USEPA Method 4) were performed at the sampling location. All velocity measurements used a calibrated S-type pitot tube with an attached thermocouple probe.

Following the calculation of gas density and gas velocities, a sampling nozzle size was determined which would allow isokinetic sampling at all measured points.

4.0 PARTICULATE SAMPLING PROCEDURE

The sampling train used to sample the drier stack emissions followed 40 CFR 60, Appendix A, USEPA Method 17. This method is also approved by the Michigan Department of Natural Resources, as Method 5C. The sampling train components were:

1. An appropriately sized stainless steel sample nozzle:
2. One 47 MM A/E glass fiber filter backed up with a ceramic thimble and a holder for each;

SWANSON ENVIRONMENTAL, INC.

TABLE 4

PLANT: MI SUGAR
LOCATION: CARROLLTON
DATE: 11-14-89

PARTICULATE EMISSION RATE

TEST No.	TEST DATE	STACK GAS FLOW RATE (DSCFM)	EMISSION CONC. RATE GRAIN PER DSCF	LBS/1000 LBS DRY-GAS	LBS/1000 LBS DRY 50%E A*	EMISSION RATE LBS HOUR
P-1	11-14-89	33672	0.0643	0.084	0.251	18.56
P-2	11-14-89	37871	0.0462	0.064	0.225	14.98
P-3	11-14-89	38795	0.0703	0.100	0.363	23.39
AVERAGE		36779.46	0.06	0.083	0.280	18.98

* E A = EXCESS AIR

SWANSON ENVIRONMENTAL, INC.
PARTICULATE SAMPLING DATA AND CALCULATIONS

PLANT: MI SUGAR SOURCE: PULP DRIER
DATE: 11-1-89 14

	CLOCK TIME:	60.00	60.00	60.00
1.00	NUMBER	P-1	P-2	P-3
B.	STACK DIAMETER, In	96.00	96.00	96.00
C.	STACK AREA, Sq.Ft	50.27	50.27	50.27
D.	No. SAMPLE POINTS	12.00	12.00	12.00
E.	TOTAL SAMPLE TIME, MIN.	60.00	60.00	60.00
F.	NOZZLE DIAMETER, In.	0.310	0.310	0.310
G.	NOZZLE AREA, Sq.Ft.	0.00052	0.00052	0.00052
H.	CALIBRATION FACTORS:			
	PITOT TUBE, Cp	0.828	0.828	0.828
	GAS METER, y	1.005	1.005	1.005
I.	BAROMETRIC PRESSURE, In.Hg.	29.33	29.34	29.30
J.	STACK STATIC PRESSURE In.H20	0.04	0.04	0.04
K.	STACK GAS TEMP.	178.17	197.92	203.75
L.	AVG. Sq. Rt. VEL. HEAD	0.36	0.38	0.38
M.	AVG. METER TEMP.	64.50	64.75	61.25
N.	AVG. METER PRESS., H2O	0.53	0.57	0.54
O.	METER VOL., ACTUAL Cu. Ft.	23.29	24.17	24.68
P.	METER VOL., @STP	23.22	24.09	24.73
Q.	LIQUID VOL., H20 COND., Ml.	362.70	304.10	278.40
R.	VAPOR VOL., H20 COND., @STP, Cu.Ft.	17.19	14.41	13.20
S.	TOTAL GAS SAMPLED, @ STP, Cu.Ft.	40.41	38.51	37.93
T.	%MOISTURE IN EXHAUST GAS			
	1) AT TEST LOCATION	42.55	37.43	34.79
	2) BEFORE COLLECTOR	0.00	0.00	0.00
U.	DRY GAS COMP. %O2	14.3	15.7	16.3
	%CO2	3.1	2.4	1.8
	%CO	0.1	0.2	0.1
	%N2	81.3	81.0	82.7
V.	DENSITY & MOL. Wt. -STACK GAS			
	1)DRY, @ STP,Lbs/Cu.Ft.	0.0743	0.0744	0.0754
	2)WET, @ STP,Lbs/Cu.Ft.	0.0625	0.0640	0.0654
	3)WET @ STACK,Lbs/Cu.Ft.	0.0509	0.0505	0.0511
	4)MOL.Wt., @ STP,Lb/MOLE	28.75	28.79	29.19
W.	WEIGHT OF GAS SAMPLED:			
	1)DRY GAS,Lbs	1.73	1.79	1.87
	2)WET GAS,Lbs	2.52	2.46	2.48
X.	TOTAL PARTICULATE COLLECTED	0.0968	0.0721	0.1128

	(GRAMS)		
Y. AVERAGE GAS VELOCITY, FPM	1432.16	1524.35	1513.72
Z. STACK GAS FLOW RATE			
1)AT STACK, Qa, ACFM	71988	76622	76088
2)AT Std.,Qstd, SCFM	58607	60528	59497
3)Std. DRY,Qdg, SCFM	33672	37871	38795
AA. PERCENT EXCESS AIR	200.11	276.65	297.10
BB. CONCENTRATION CONVERSION FACTORS:			
1)50% E.A.,AFTER COLLECTOR	1.53	1.79	1.91
2)50% E.A.,BEFORE COLLECTOR	2.97	3.49	3.62
3)MOISTURE BEFORE COLLECTOR	1.46	1.37	1.33
CC. PARTICULATE CONCENTRATION:			
1)Lbs/1000 Lbs., ACTUAL	0.084	0.064	0.100
2)Lbs/1000 Lbs., DRY	0.124	0.089	0.133
3)Lbs/1000 Lbs., WET @ 50%E.A	0.129	0.115	0.191
4)Lbs/1000 Lbs., DRY @ 50%E.A	0.251	0.225	0.363
5)GRAINS / DSCF	0.0643	0.0462	0.0703
6)POUNDS / HOUR	18.56	14.98	23.39
DD. PERCENT ISOKINETIC	110.19	101.67	101.88

SWANSON ENVIRONMENTAL, INC.

TABLE 4

PLANT: MI SUGAR
LOCATION: CARROLLTON
DATE: 11-16-89

PARTICULATE EMISSION RATE

TEST No.	TEST DATE	STACK GAS FLOW RATE (DSCFM)	EMISSION RATE GRAIN PER DSCF	CONC. LBS/1000 LBS GAS	LBS/1000 LBS DRY 50%E A*	EMISSION RATE LBS HOUR
P-1	11-16-89	46482	0.0411	0.069	0.238	16.37
P-2	11-16-89	37617	0.0478	0.067	0.230	15.42
P-3	11-16-89	41090	0.0558	0.085	0.203	19.65
AVERAGE		41729.76	0.05	0.074	0.224	17.15

* E A = EXCESS AIR

SWANSON ENVIRONMENTAL, INC.
PARTICULATE SAMPLING DATA AND CALCULATIONS

PLANT: MI SUGAR SOURCE: PULP DRIER
DATE: 11-16-89

	CLOCK TIME:	60.00	60.00	60.00
	1.00 NUMBER	P-1	P-2	P-3
B.	STACK DIAMETER, In	96.00	96.00	96.00
C.	STACK AREA, Sq.Ft	50.27	50.27	50.27
D.	No. SAMPLE POINTS	12.00	12.00	12.00
E.	TOTAL SAMPLE TIME, MIN.	60.00	60.00	60.00
F.	NOZZLE DIAMETER, In.	0.310	0.310	0.310
G.	NOZZLE AREA, Sq.Ft.	0.00052	0.00052	0.00052
H.	CALIBRATION FACTORS:			
	PITOT TUBE, Cp	0.828	0.828	0.828
	GAS METER, y	1.005	1.005	1.005
I.	BAROMETRIC PRESSURE, In.Hg.	28.85	28.85	28.85
J.	STACK STATIC PRESSURE In.H2O	4.20	4.20	4.20
K.	STACK GAS TEMP.	190.92	191.50	195.17
L.	AVG. Sq. Rt. VEL. HEAD	0.37	0.37	0.37
M.	AVG. METER TEMP.	51.25	55.50	52.50
N.	AVG. METER PRESS., H2O	0.51	0.54	0.52
O.	METER VOL., ACTUAL Cu. Ft.	23.29	24.17	24.68
P.	METER VOL., @STP	23.43	24.11	24.77
Q.	LIQUID VOL., H20 COND., Ml.	107.80	293.30	202.70
R.	VAPOR VOL., H20 COND., @STP, Cu.Ft.	5.11	13.90	9.61
S.	TOTAL GAS SAMPLED, @ STP, Cu.Ft.	28.54	38.02	34.37
T.	%MOISTURE IN EXHAUST GAS			
	1) AT TEST LOCATION	17.91	36.57	27.95
	2) BEFORE COLLECTOR	0.00	0.00	0.00
U.	DRY GAS COMP. %O2	16.7	15.8	14.2
	%CO2	2.0	3.3	3.5
	%CO	0.0	0.0	0.0
	%N2	81.3	81.0	82.7
V.	DENSITY & MOL. Wt. -STACK GAS			
	1)DRY, @ STP,Lbs/Cu.Ft.	0.0749	0.0754	0.0755
	2)WET, @ STP,Lbs/Cu.Ft.	0.0698	0.0648	0.0674
	3)WET @ STACK,Lbs/Cu.Ft.	0.0548	0.0508	0.0526
	4)MOL.Wt., @ STP,Lb/MOLE	28.99	29.17	29.22
W.	WEIGHT OF GAS SAMPLED:			
	1)DRY GAS,Lbs	1.76	1.82	1.87
	2)WET GAS,Lbs	1.99	2.46	2.32
X.	TOTAL PARTICULATE COLLECTED	0.0624	0.0748	0.0896

	(GRAMS)		
Y. AVERAGE GAS VELOCITY, FPM	1434.72	1504.07	1454.58
Z. STACK GAS FLOW RATE			
1)AT STACK, Qa, ACFM	72117	75603	73115
2)AT Std.,Qstd, SCFM	56620	59304	57032
3)Std. DRY,Qdg, SCFM	46482	37617	41090
AA. PERCENT EXCESS AIR	345.36	280.21	184.49
BB. CONCENTRATION CONVERSION FACTORS:			
1)50% E.A.,AFTER COLLECTOR	2.44	1.81	1.63
2)50% E.A.,BEFORE COLLECTOR	3.45	3.43	2.39
3)MOISTURE BEFORE COLLECTOR	1.14	1.36	1.24
CC. PARTICULATE CONCENTRATION:			
1)Lbs/1000 Lbs., ACTUAL	0.069	0.067	0.085
2)Lbs/1000 Lbs., DRY	0.078	0.091	0.106
3)Lbs/1000 Lbs., WET @ 50%E.A	0.169	0.121	0.139
4)Lbs/1000 Lbs., DRY @ 50%E.A	0.238	0.230	0.203
5)GRAINS / DSCF	0.0411	0.0478	0.0558
6)POUNDS / HOUR	16.37	15.42	19.65
DD. PERCENT ISOKINETIC	79.70	101.38	95.31

12 PAGE LAB REPORT MICHIGAN SUGAR COMPANY PLANT: CARROLLTON

8 9 1990

		PULP PRODUCED				PRESSED PULP			DRY PULP			PELLET PULP			% SUGAR IN PRESSED PULP			
		---TONS---	% ON BEETS			-----% MOISTURE-----			-----% MOISTURE-----			-----% MOISTURE-----			-% SUGAR-		---TONS---	
DATE	DAY	DAY	TODATE	DAY	TD	AVE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TD	DAY	TD
10/27	30	180	4962	6.02	6.02	165	76.00	2295.44	76.51	10.85	360.04	12.00	10.95	341.96	11.40	.31	.31	9.28	251.63
10/28	31	190	5152	5.99	6.02	166	75.33	2370.77	76.48	10.20	370.24	11.94	9.73	351.69	11.34	.29	.30	9.20	260.83
10/29	32	187	5339	5.99	6.02	167	76.00	2446.77	76.46	12.32	382.56	11.96	11.08	362.77	11.34	.33	.31	10.30	271.13
10/30	33	176	5515	6.00	6.02	167	76.17	2522.94	76.45	11.54	394.10	11.94	10.94	373.71	11.32	.32	.31	9.39	280.52
10/31	34	182	5697	6.02	6.02	168	75.50	2598.44	76.42	10.74	404.84	11.91	10.75	384.46	11.31	.29	.31	8.76	289.28
11/01	35	189	5886	5.97	6.02	168	75.50	2673.94	76.40	10.35	415.19	11.86	10.04	394.50	11.27	.29	.31	9.18	298.46
11/02	36	186	6072	6.01	6.02	169	77.50	2751.44	76.43	11.65	426.84	11.86	10.86	405.36	11.26	.28	.30	8.66	307.12
WK 5		1290		6.00			76.00			11.09			10.62			.30		64.77	
MO			6072		6.02				76.43			11.86			11.26		.30		307.12
11/03	37	167	6239	6.02	6.02	169	77.25	2828.69	76.45	8.84	435.68	11.78	9.79	415.15	11.22	.28	.30	7.77	314.89
11/04	38	170	6409	5.99	6.01	169	75.50	2904.19	76.43	11.37	447.05	11.76	10.82	425.97	11.21	.30	.30	8.52	323.41
11/05	39	175	6584	6.00	6.01	169	74.50	2978.69	76.38	11.05	458.10	11.75	10.55	436.52	11.19	.23	.30	6.70	330.11
11/06	40	188	6372	6.03	5.66	159	75.60	3054.29	76.36	12.12	470.22	11.76	11.50	448.02	11.20	.28	.30	8.74	338.85
11/07	41	176	6548	6.00	5.67	160	75.75	3130.04	76.34	11.67	481.89	11.75	11.17	459.19	11.20	.28	.30	8.22	347.07
11/08	42	186	6734	5.98	5.68	160	75.17	3205.21	76.31	11.30	493.19	11.74	10.51	469.70	11.18	.29	.30	9.01	356.08
11/09	43	186	6920	5.97	5.68	161	75.00	3280.21	76.28	10.70	503.89	11.72	10.15	479.85	11.16	.30	.30	9.34	365.42
WK 6		1248		6.00			75.54			11.01			10.64			.28		58.30	
MO			6920		5.68				76.28			11.72			11.16		.30		365.42
11/10	44	187	7107	5.99	5.69	162	74.00	3354.21	76.23	10.77	514.66	11.70	10.35	490.20	11.14	.30	.30	9.36	374.78
11/11	45	187	7294	6.01	5.70	162	75.00	3429.21	76.20	10.44	525.10	11.67	10.77	500.97	11.13	.27	.30	8.41	383.19
11/12	46	187	7481	6.10	5.71	163	77.00	3506.21	76.22	10.86	535.96	11.65	10.51	511.48	11.12	.30	.30	9.20	392.39
11/13	47	165	7646	5.98	5.71	163	77.00	3583.21	76.24	11.24	547.20	11.64	10.94	522.42	11.12	.32	.30	8.82	401.21
11/14	48	186	7832	5.99	5.72	163	75.67	3658.88	76.23	10.06	557.26	11.61	10.28	532.70	11.10	.28	.30	8.69	409.90
11/15	49	187	8019	5.99	5.73	164	75.33	3734.21	76.21	10.66	567.92	11.59	10.17	542.87	11.08	.25	.30	7.80	417.70
11/16	50	166	8185	5.99	5.73	164	80.00	3814.21	76.28	11.34	579.26	11.59	10.30	553.17	11.06	.32	.30	8.87	426.57
WK 7		1265		6.01			76.29			10.77			10.47			.29		61.15	
MO			8185		5.73				76.28			11.59			11.06		.30		426.57
11/17	51	182	8367	5.98	5.74	164	75.17	3889.38	76.26	10.99	590.25	11.57	11.46	564.63	11.07	.26	.30	7.92	434.49
11/18	52	184	8551	5.99	5.74	164	75.17	3964.55	76.24	11.15	601.40	11.57	10.81	575.44	11.07	.27	.30	8.29	442.78
11/19	53	184	8735	5.99	5.75	165	77.50	4042.05	76.27	11.62	613.02	11.57	10.42	585.86	11.05	.28	.30	8.60	451.38
11/20	54	160	8495	5.80	5.49	157	74.33	4116.38	76.23	10.70	623.72	11.55	10.27	596.13	11.04	.28	.30	7.73	459.11
11/21	55	167	8662	5.79	5.49	157	75.50	4191.88	76.22	11.11	634.83	11.54	10.49	606.62	11.03	.30	.30	8.65	467.76
11/22	56	155	8817	5.80	5.50	157	74.67	4266.55	76.19	10.88	645.71	11.53	10.35	616.97	11.02	.26	.30	6.95	474.71
11/23	57	156	8973	5.78	5.50	157	76.50	4343.05	76.19	11.08	656.79	11.52	10.13	627.10	11.00	.31	.30	8.37	483.08
WK 8		1188		5.88			75.55			11.08			10.56			.28		56.51	
MO			8973		5.50				76.19			11.52			11.00		.30		483.08

Filename: BEET24.WQ1
Date: 19-Jan-95
Facility: Michigan Sugar Company
Location: Carrollton, Michigan
Source: Pulp dryer with multiclones (Natural gas-fired)
Test date: November 14 and 16, 1989

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported						
			Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Average
1	Stack temperature	Deg F	178.17	197.92	203.75	190.92	191.5	195.17	
	Pressure	in. HG	29.33	29.34	29.30	28.85	28.85	28.85	
	Moisture	%	42.55	37.43	34.79	17.91	36.57	27.95	
	Oxygen	%	14.3	15.7	16.3	16.7	15.8	14.2	
	Volumetric flow, actual	acfm	71988	76622	76088	72117	75603	73115	
	Volumetric flow, standard*	dscfm	33670	37872	38798	46479	37617	41091	
	Isokinetic variation	%	110.19	101.67	101.88	79.7	101.38	95.31	
	Wet pulp feed rate	TPH	30.6	30.6	27.5	43.6	42.9	27.8	
	Pollutant concentrations:								
	Filterable PM	G/dscf	0.0643	0.0462	0.0703	0.0411	0.0478	0.0558	
	CO2	% dv	3.1	2.4	1.8	2	3.3	3.5	
	Pollutant mass flux rates:								
	Filterable PM	lb/hr	void	15.0	23.4	void	15.4	19.7	
	CO2	lb/hr	void	6229	4786	void	8507	9856	
	Emission factors (ENGLISH UNITS):								AVERAGE
	Filterable PM	lb/ton		0.49	0.85		0.36	0.71	0.60
	CO2	lb/ton		204	174		198	355	233
	Emission factors (METRIC UNITS):								AVERAGE
	Filterable PM	kg/Mg		0.25	0.43		0.18	0.35	0.30
	CO2	kg/Mg		102	87		99	177	116

*DSCFM BASED ON A STANDARD TEMPERATURE OF 70 DEGREES FAHRENHEIT

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03 Date/Time 12/9/94

Project Title ~~Sugar Beet Processing~~ - AP-42

Signature [signature] Verified by _____ (signature/date)

Phone Contact ☐ Meeting Notes ☐ Work Sheet ☒

CARROLLTON, MICHIGAN FACILITY

TEST DATES: 11/14/89 and 11/16/89

TEST No.	Time	
11/14/89		TOTAL DRY PULP PRODUCED = 186 tons
P-1	10:40 - 11:55	7.75 tons/hr. AVERAGE
P-2	NA (not available)	
P-3	NA (not available)	
11/16/89		TOTAL DRY PULP PRODUCED = 166 tons
P-1	11:11 - 12:20	6.92 tons/hr. AVERAGE
P-2	1:47 - 2:49	
P-3	3:29 - 7:11	

AVERAGE OVER TEST RUN

TEST No.	SLICE RATE (tons/hr)	PRESSED PULP MOISTURE (%)	DRIED PULP MOISTURE (%)
11/14/89			
P-1	130	77.5	11.0
P-2	130	77.5 (est.)	11.0 (est.)
P-3	130	74.5 (est.)	10.1 (est.)
11/16/89			
P-1	130	86.0	12.5
P-2	125	86.0	12.5
P-3	111	78.0	11.2

$$\%\ \text{Solids} = \frac{\text{Dry Pulp Produced} - \text{Dry Pulp Moisture} * \text{Pulp Produced}}{\text{Beets Sliced}}$$

11/14/89:

P-1:

$$\%\ \text{Solids} = \frac{7.75 - (0.11 * 7.75)}{130} = \frac{6.90}{130} \times 100 = 5.3\%$$

MRI

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03 Date/Time 12/9/94

Project Title SUGAR BEET PROCESSING AP-42

Signature _____ Verified by _____ (signature/date)

Phone Contact ☐ Meeting Notes ☐ Work Sheet ☒

P-2: % Solids = $\frac{7.75 - (0.11 * 7.75)}{130} = \frac{6.90}{130} \times 100 = 5.3\%$

P-3: % Solids = $\frac{7.75 - (0.101 * 7.75)}{130} = \frac{6.97}{130} \times 100 = 5.4\%$

11/16/89:

P-1: % Solids = $\frac{6.92 - (0.125 * 6.92)}{130} = \frac{6.05}{130} \times 100 = 4.7\%$

P-2: % Solids = $\frac{6.92 - (0.125 * 6.92)}{125} = \frac{6.05}{125} \times 100 = 4.8\%$

P-3: % Solids = $\frac{6.92 - (0.112 * 6.92)}{111} = \frac{6.14}{111} \times 100 = 5.5\%$

Process Rate (tons/hr) = $\frac{\text{Beets Sliced} * \%\ \text{Solids}}{1 - \left(\frac{\text{wet pulp moisture}(\%)}{100}\right)}$

11/14/89

P-1: Rate = $\frac{130 * 0.053}{1 - \left(\frac{77.5}{100}\right)} = \frac{6.89}{0.225} = 30.6$ tons/hr.

P-2: Rate = $\frac{130 * 0.053}{1 - \left(\frac{77.5}{100}\right)} = \frac{6.89}{0.225} = 30.6$ tons/hr

P-3: Rate = $\frac{130 * 0.054}{1 - \left(\frac{74.5}{100}\right)} = \frac{7.02}{0.255} = 27.5$ tons/hr.

11/16/89

P-1: Rate = $\frac{130 * 0.047}{1 - \left(\frac{86.0}{100}\right)} = \frac{6.11}{0.14} = 43.6$ tons/hr

P-2: Rate = $\frac{125 * 0.048}{1 - \left(\frac{86.0}{100}\right)} = \frac{6.00}{0.14} = 42.9$ tons/hr

P-3: Rate = $\frac{111 * 0.055}{1 - \left(\frac{78.0}{100}\right)} = \frac{6.11}{0.22} = 27.8$ tons/hr

MRI

APPENDIX X

REPORT EXCERPTS FROM REFERENCE 25

(Michigan Sugar Company, November 19, 1990)

PARTICULATE EMISSION STUDY

MICHIGAN SUGAR COMPANY
CROSWELL, MICHIGAN

Report Prepared For:

Michigan Sugar Company
P. O. Box 1348
Saginaw, Michigan 48605

November 19, 1990
MA-6482

SWANSON ENVIRONMENTAL INC.

24156 Haggerty Road • Farmington Hills, Michigan 48335
(313) 478-2700 Fax: (313) 478-3819

PARTICULATE EMISSION STUDY
MICHIGAN SUGAR COMPANY
CROSWELL, MICHIGAN
NOVEMBER 19, 1990
MA-6482

EXECUTIVE SUMMARY

Swanson Environmental, Inc. (SEI) was retained by Michigan Sugar Company to perform a particulate emissions study on the exhaust gases discharged from the Pulp Drier at their Croswell, Michigan facility.

The study took place on November 13, 1990 and was conducted in accordance with U.S. EPA Methods 1, 2, 3, 4 and MDNR Method 5B for the purpose of fulfilling compliance requirements. The results of the study are as follows:

Drier Exhaust

Test No.	Test Date	Stack Gas Flow Rate (DSCFM)	Lbs/1000 Lbs EG @ (Dry)	Lbs/1000 Lbs dry 50%E A*	Lbs/1000 Lbs EG @	Lbs/ Hour
P-1	11-13-90	32426	0.110	0.262	0.078	16.175
P-2	11-13-90	34044	0.102	0.263	0.072	15.819
P-3	11-13-90	33804	0.099	0.275	0.070	15.152
Average		33425	0.104	0.267	0.073	15.715

EA * = Excess Air

EG @ = Exhaust Gas

SWANSON ENVIRONMENTAL, INC.
PARTICULATE SAMPLING DATA AND CALCULATIONS

PLANT: MI SUGAR SOURCE: DRYER EXH.
DATE: 11-13-90

	CLOCK TIME:	60.00	60.00	60.00
	1.00 NUMBER	P-1	P-2	P-3
B.	STACK DIAMETER, In	72.000	72.000	72.000
C.	STACK AREA, Sq.Ft	28.27	28.27	28.27
D.	No. SAMPLE POINTS	24.00	24.00	24.00
E.	TOTAL SAMPLE TIME, MIN.	60.00	60.00	60.00
F.	NOZZLE DIAMETER, In.	0.357	0.357	0.357
G.	NOZZLE AREA, Sq.Ft.	0.00070	0.00070	0.00070
H.	CALIBRATION FACTORS:			
	PITOT TUBE, Cp	0.8090	0.8090	0.8090
	GAS METER, y	0.970	0.970	0.970
I.	BAROMETRIC PRESSURE, In.Hg.	30.49	30.52	30.54
J.	STACK STATIC PRESSURE In.H20	0.32	0.32	0.32
K.	STACK GAS TEMP.	279.54	270.79	276.96
L.	AVG. Sq. Rt. VEL. HEAD	0.64	0.67	0.67
M.	AVG. METER TEMP.	76.75	77.50	77.38
N.	AVG. METER PRESS., H2O	2.16	2.43	2.36
O.	METER VOL., ACTUAL Cu. Ft.	47.29	50.51	46.81
P.	METER VOL., @STP	46.41	49.59	45.99
Q.	LIQUID VOL., H20 COND., Ml.	646.10	714.90	651.20
R.	VAPOR VOL., H20 COND., @STP, Cu.Ft.	30.63	33.89	30.87
S.	TOTAL GAS SAMPLED, @ STP, Cu.Ft.	77.04	83.47	76.85
T.	%MOISTURE IN EXHAUST GAS			
	1) AT TEST LOCATION	39.75	40.60	40.16
	2) BEFORE COLLECTOR	0.00	0.00	0.00
U.	DRY GAS COMP. %O2	15.4	15.8	16.2
	%CO2	4.0	4.2	3.8
	%CO	0.0	0.0	0.0
	%N2	80.6	80.0	80.0
V.	DENSITY & MOL. Wt. -STACK GAS			
	1)DRY, @ STP,Lbs/Cu.Ft.	0.0756	0.0758	0.0756
	2)WET, @ STP,Lbs/Cu.Ft.	0.0641	0.0639	0.0639
	3)WET @ STACK,Lbs/Cu.Ft.	0.0468	0.0473	0.0469
	4)MOL.Wt., @ STP,Lb/MOLE	29.26	29.31	29.26
W.	WEIGHT OF GAS SAMPLED:			
	1)DRY GAS,Lbs	3.51	3.76	3.48
	2)WET GAS,Lbs	4.93	5.33	4.91
X.	TOTAL PARTICULATE COLLECTED (GRAMS)	0.1752	0.1743	0.1560

Y. AVERAGE GAS VELOCITY, FPM	2607	2740	2722
Z. STACK GAS FLOW RATE			
1)AT STACK, Qa, ACFM	73698	77469	76959
2)AT Std.,Qstd, SCFM	53822	57310	56494
3)Std. DRY,Qdg, SCFM	32426	34044	33804
AA. PERCENT EXCESS AIR	262	297	329
BB. CONCENTRATION CONVERSION FACTORS:			
1)50% E.A.,AFTER COLLECTOR	1.70	1.76	1.83
2)50% E.A.,BEFORE COLLECTOR	3.35	3.66	3.93
3)MOISTURE BEFORE COLLECTOR	1.41	1.42	1.41
CC. PARTICULATE CONCENTRATION:			
1)Lbs/1000 Lbs., ACTUAL	0.078	0.072	0.070
2)Lbs/1000 Lbs., DRY	0.110	0.102	0.099
3)Lbs/1000 Lbs., WET @ 50%E.A	0.133	0.127	0.128
4)Lbs/1000 Lbs., DRY @ 50%E.A	0.262	0.263	0.275
5)GRAINS / DSCF	0.058	0.054	0.052
6)POUNDS / HOUR	16.175	15.819	15.152
DD. PERCENT ISOKINETIC	96.9	98.6	92.1

++

Michigan Sugar Company

Pulp Drier Data

Date: 11-13-90

Operator:

Location: Croswell

Equip. No.:

Fuel Type: #6 oil

*Gallons on Oil, SCFH on Natural Gas
**If Applicable

AM

Time	Slice Rate (Tons/Hr)	Totalizer Fuel Reading (Gallons)*	% Fuel Rate (GPH)*	Furnace Temp. (°F)	Exit Temp. (°F)	Pressure Differential Across The Drum (In. Of Water)	Pressure Differential Across The Collector (In. Of Water)	flue gas recirculation FGR Flow Rate (ACFH)	Pressed Pulp Moisture (Feed) (% Water)	Dried Pulp Moisture (Product) % Water	**Feed Screw Speed Drier #1 (RPM)	Drier #2 (RPM)
600	168	60503	7.9	1590	266	1.03	8.1	11770	74.1	8.1	2530	.15
615	163	60630	8.5	1620	280	.80	7.7	11360	74.9	11.1	2410	.14
630	157	60726	6.5	1720	271	.60	5.2	12160	75.1	10.1	2010	.16
645	152	60838	7.3	1530	271	1.19	8.0	11930	73.8	3.7	2550	.16
700	156	60970	8.8	1530	250	1.25	8.2	11700	76.4	5.2	2560	.15
715	150	61083	7.5	1530	253	.97	7.9	11490	77.5	13.3	2510	.14
730	150	61224	9.4	1610	279	.80	8.3	11700	78.3	16.5	2560	.15
745	145	61332	7.2	1610	284	.92	8.2	11750	75.9	12.9	2530	.16
800	150	61447	7.7	1620	285	.94	8.2	11570	75.6	8.9	2570	.15
815	140	61590	9.5	1670	285	.95	8.2	11650	72.8	7.1	2600	.15
830	140	61690	6.7	1670	285	.95	8.2	11550	73.9	8.4	2600	1.5
845	147	61862	11.5	1640	284	.89	7.6	12570	73.7	6.5	2510	13
900	146	61990	8.5	1580	274	.95	7.4	12760	74.4	3.5	2470	.13
915	140	62128	9.2	1630	266	1.20	7.8	12600	74.5	6.9	2510	.15
930	143	62216	5.9	1610	264	.95	7.9	12510	72.2	8.9	2520	.15
945	150	62350	8.9	1590	266	.97	7.7	12760	75.9	11.2	2500	.14
10:00	145	62514	10.9	1590	276	.96	7.6	12560	74.0	11.1	2480	.15
1015	153	62617	6.9	1620	274	.81	6.1	12850	74.0	3.4	2200	.14
1030	153	62714	6.5	1560	271	.77	6.3	12480	68.1	2.8	2260	.14
1045	149	62828	7.6	1540	267	1.03	6.8	12840	[illegible]	[illegible]	[illegible]	[illegible]
1100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Michigan Sugar Company

Pulp Drier Data

Date: 11-13-90

Operator:

Location: Carrollton

Equip. No.:

Fuel Type: #6 Oil

*Gallons on Oil, SCFH on Natural Gas
**If Applicable

Time	Slice Rate (Tons/Hr)	Totalizer Fuel Reading (Gallons)*	Fuel Rate (GPH)*	Furnace Temp. (°F)	Exit Temp. (°F)	Pressure Differential Across The Drum (In. Of Water)	Pressure Differential Across The Collector (In. Of Water)	FGR Flow Rate (ACFH)	Pressed Pulp Moisture (Feed) (% Water)	Dried Pulp Moisture (Product) % Water	Drier #1 (RPH)	Drier #2 (RPH)
11:15	139	63057	7.7	1810	272	.72	5.1	12590	68.1	4.1	2010	.14
11:30	147	63153	6.4	1780	268	9.0	5.5	12590	72.1	3.3	2090	.14
11:45	140	63263	7.3	1770	269	.79	5.4	12550	73.3	2.2	2080	.15
12:00	142	63378	7.7	1760	259	.94	5.7	12570	75.6	2.2	2160	.14
12:15	136	63505	8.5	1750	265	.94	7.5	13200	73.9	4.8	2450	.16
12:30	145	63608	6.9	1720	260	.78	4.8	13270	73.7	6.3	1950	.16
12:45	138	63710	6.8	1630	259	.90	6.6	13310	69.0	3.2	2320	.14
1:00	130	63835	8.3	1650	267	.73	5.7	13260	75.2	2.6	2130	.15
1:15	144	63944	7.3	1630	262	.78	6.2	13620	69.1	3.3	2220	.14
1:30	140	64061	7.8	1550	262	.85	6.2	13200	74.1	2.5	2230	.14
1:45	140	64177	7.7	1630	263	.76	6.2	13500	73.5	2.5	2210	.14
2:00	140	64280	6.9	1690	284	.89	5.9	13590	74.1	2.5	2190	.15
2:15	147	64390	7.3	1680	264	.82	6.0	13840	73.2	2.5	2200	.14
2:30	151	64504	7.6	1710	265	.88	6.1	13700	73.4	2.2	2200	.14
2:45	146	64610	7.1	1670	264	.80	6.0	13720	72.4	2.2	2100	.14
3:00	142	64748	9.2	1650	262	.96	6.2	13600	72.7	2.2	2280	.14
3:15	147	64832	5.6	1630	259	.82	6.6	13640	73.3	2.5	2260	.14
3:30	133	64953	8.1	1650	260	.91	6.4	13470	72.0	3.3	2250	.14
4:00	138	40277		1370	260	.94	6.3	1400	OFF		2240	.18
5:00	160	40337		1530	270	.73	6.2	1411			2230	.15
6:00	142	40408		1520	263	.77	6.3	1370			2210	.15

12 PAGE LAB REPORT MICHIGAN SUGAR COMPANY PLANT: CROSWELL PAGE: 5

1991

		PULP PRODUCED				PRESSED PULP			DRY PULP			PELLET PULP			% SUGAR IN PRESSED PULP			
		---TONS---	% ON BEETS			-----% MOISTURE-----			-----% MOISTURE-----			-----% MOISTURE-----			-% SUGAR-		---TONS---	
DATE	DAY	DAY TODATE	DAY	TD	AVE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TD	DAY	TD
10/26	32	122 4279	3.99	4.58	134	74.48	2210.24	73.67	11.35	291.30	9.71	11.56	328.86	10.96	.30	.36	9.17	334.80
10/27	33	180 4459	5.00	4.59	135	73.26	2283.50	73.66	9.15	300.45	9.69	12.24	341.10	11.00	.31	.36	11.16	345.96
10/28	34	150 4609	4.50	4.59	136	73.85	2357.35	73.67	9.75	310.20	9.69	11.32	352.42	11.01	.37	.36	12.35	358.31
10/29	35	178 4787	4.99	4.60	137	75.93	2433.28	73.74	9.83	320.03	9.70	12.18	364.60	11.05	.43	.36	15.33	373.64
10/30	36	152 4939	4.49	4.60	137	76.85	2510.13	73.83	11.23	331.26	9.74	11.78	376.38	11.07	.40	.36	13.55	387.19
10/31	37	146 5085	4.50	4.60	137	73.16	2583.29	73.81	10.05	341.31	9.75	10.19	386.57	11.04	.33	.36	10.71	397.90
11/01	38	92 5177	4.00	4.58	136	71.66	2654.95	73.75	9.50	350.81	9.74	11.14	397.71	11.05	.40	.36	9.21	407.11
WK 5		1020	4.53			74.17			10.12			11.49			.36		81.48	
TD		5177	4.58					73.75			9.74			11.05		.36		407.11
11/02	39	158 5335	5.01	4.60	137	73.90	2728.85	73.75	10.22	361.03	9.76	11.26	408.97	11.05	.42	.36	13.24	420.35
11/03	40	163 5498	4.99	4.61	137	75.24	2804.09	73.79	9.53	370.56	9.75	11.39	420.36	11.06	.43	.36	14.04	434.39
11/04	41	145 5643	5.01	4.62	138	74.23	2878.32	73.80	10.10	380.66	9.76	11.65	432.01	11.08	.35	.36	10.13	444.52
11/05	42	88 5731	4.95	4.62	136	76.60	2954.92	73.87	8.43	389.09	9.73	10.96	442.97	11.07	.42	.36	7.46	451.98
11/06	43	93 5824	5.00	4.63	135	74.98	3029.90	73.90	9.09	398.18	9.71	11.06	454.03	11.07	.37	.36	6.89	458.87
11/07	44	111 5935	4.99	4.63	135	69.55	3099.45	73.80	8.12	406.30	9.67	11.38	465.41	11.08	.30	.36	6.67	465.54
11/08	45	85 6020	2.97	4.60	134	67.55	3167.00	73.65	7.26	413.56	9.62	10.96	476.37	11.08	.35	.36	10.02	475.56
WK 6		843	4.67			73.15			8.96			11.24			.38		68.45	
TD		6020	4.60					73.65			9.62			11.08		.36		475.56
11/09	46	168 6188	5.01	4.61	135	70.48	3237.48	73.58	9.03	422.59	9.60	10.58	486.95	11.07	.31	.36	10.40	485.96
11/10	47	159 6347	4.99	4.62	135	73.86	3311.34	73.59	10.15	432.74	9.62	11.34	498.29	11.07	.37	.36	11.79	497.75
11/11	48	132 6479	4.49	4.61	135	74.74	3386.08	73.61	9.17	441.91	9.61	10.51	508.80	11.06	.45	.36	13.23	510.98
11/12	49	144 6623	4.50	4.61	135	74.81	3460.89	73.64	9.93	451.84	9.61	10.86	519.66	11.06	.44	.37	14.07	525.05
11/13	50	165 6788	5.00	4.62	136	73.70	3534.59	73.64	9.94	461.78	9.62	10.74	530.40	11.05	.34	.36	11.22	536.27
11/14	51	155 6943	4.98	4.63	136	72.92	3607.51	73.62	9.87	471.65	9.63	11.62	542.02	11.06	.37	.37	11.51	547.78
11/15	52	171 7114	4.99	4.63	137	73.72	3681.23	73.62	9.97	481.62	9.63	11.48	553.50	11.07	.48	.37	16.46	564.24
WK 7		1094	4.86			73.46			9.72			11.02			.39		88.68	
TD		7114	4.63					73.62			9.63			11.07		.37		564.24
11/16	53	144 7258	4.98	4.64	137	75.05	3756.28	73.65	10.11	491.73	9.64	10.32	563.82	11.06	.47	.37	13.60	577.84
11/17	54	151 7409	5.00	4.65	137	70.40	3826.68	73.59	8.13	499.86	9.61	10.96	574.78	11.05	.38	.37	11.48	589.32
11/18	55	151 7560	5.00	4.65	137	75.36	3902.04	73.62	9.31	509.17	9.61	11.22	586.00	11.06	.37	.37	11.17	600.49
11/19	56	152 7712	4.97	4.66	138	74.39	3976.43	73.64	9.84	519.01	9.61	11.81	597.81	11.07	.40	.37	12.23	612.72
11/20	57	145 7857	4.98	4.67	138	73.27	4049.70	73.63	8.41	527.42	9.59	10.56	608.37	11.06	.54	.37	15.71	628.43
11/21	58	160 8017	4.94	4.67	138	72.94	4122.64	73.62	7.81	535.23	9.56	11.16	619.53	11.06	.43	.37	13.94	642.37
11/22	59	90 8107	4.93	4.67	137	74.23	4196.87	73.63	6.66	541.89	9.51	10.59	630.12	11.05	.54	.38	9.86	652.23
WK 8		993	4.97			73.66			8.61			10.95			.44		87.99	
TD		8107	4.67					73.63			9.51			11.05		.38		652.23

Filename: BEET25.WQ1
Date: 19-Jan-95
Facility: Michigan Sugar Company
Location: Croswell, Michigan
Source: Pulp dryer with multiclones (fuel-oil fired)
Test date: November 19, 1990

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Average
1	Stack temperature	Deg F	279.54	270.79	276.96	
	Pressure	in. HG	30.49	30.52	30.54	
	Moisture	%	39.75	40.6	40.16	
	Oxygen	%	15.4	15.8	16.2	
	Volumetric flow, actual	acfm	73698	77469	76959	
	Volumetric flow, standard*	dscfm	32428	34042	33806	
	Isokinetic variation	%	96.9	98.6	92.1	
	Wet pulp feed rate	TPH	24.1	23.7	24.9	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.058	0.054	0.052	
	CO2	% dv	4	4.2	3.8	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	16.2	15.8	15.2	
	CO2	lb/hr	8890	9799	8804	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.67	0.67	0.61	0.65
	CO2	lb/ton	369	413	354	379
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.34	0.33	0.30	0.32
	CO2	kg/Mg	184	207	177	189

*DSCFM BASED ON A STANDARD TEMPERATURE OF 70 DEGREES FAHRENHEIT

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03 Date/Time 12/9/94

Project Title Sugar Beet Processing AP-42

Signature [signature] Verified by _____ (signature/date)

Phone Contact ☐ Meeting Notes ☐ Work Sheet ☒

CROSWELL, MICHIGAN FACILITY

TEST DATE: 11/13/90

TEST NO.	TIME (ESTIMATED)*
P-1	11:00 - 12:00
P-2	12:15 - 1:15
P-3	2:00 - 3:00

* ESTIMATED BASED ON 60 MINUTES PER TEST RUN AND INDICATED TIMES ON PULP DRIER DATA SHEET FOR 11-13-90

TOTAL DRY PULP PRODUCED ON 11/13/90 = 165 TONS = 6.9 TONS/HR. AVERAGE

AVERAGE OVER 60 MINUTE TEST RUN

TEST NO.	SLICE RATE (TONS/HR)	PRESSED PULP MOISTURE (%)	DRIED PULP MOISTURE (%)
P-1	142	72.3	3.0
P-2	139	71.8	3.9
P-3	147	72.9	2.3

$$\%\ \text{SOLIDS} = \frac{\text{DRY PULP PRODUCED} = \text{DRY PULP MOISTURE} * \text{PULP PRODUCED}}{\text{BEETS SLICED}}$$

P-1: $\%\ \text{SOLIDS} = \frac{6.9 - (0.03 * 6.9)}{142} = \frac{6.69}{142} \times 100 = 4.7\%$

P-2: $\%\ \text{SOLIDS} = \frac{6.9 - (0.039 * 6.9)}{139} = \frac{6.63}{139} \times 100 = 4.8\%$

P-3: $\%\ \text{SOLIDS} = \frac{6.9 - (0.023 * 6.9)}{147} = \frac{6.74}{147} \times 100 = 4.6\%$

MRI

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03 Date/Time 12/9/94

Project Title Sugar Beet Processing AP-42

Signature _____ Verified by _____ (signature/date)

Phone Contact ☐ Meeting Notes ☐ Work Sheet ☒

$$\text{Process Rate (tons/hr)} = \frac{\text{Beets Sliced} \times \% \text{ Solids}}{1 - \left(\frac{\text{Wet Pulp Moisture (\%)}}{100}\right)}$$

P-1: Rate $= \frac{142 * 0.047}{1 - \left(\frac{72.3}{100}\right)} = \frac{6.67}{0.277} = 24.1$ tons/hr.

P-2: Rate $= \frac{139 * 0.048}{1 - \left(\frac{71.8}{100}\right)} = \frac{6.67}{0.282} = 23.7$ tons/hr.

P-3: Rate $= \frac{147 * 0.046}{1 - \left(\frac{72.9}{100}\right)} = \frac{6.76}{0.271} = 24.9$ tons/hr.

MRI