INTRODUCTION

In accordance with your P.O. No. 3567327 Particulate emission tests were conducted on the starch flash dryer located at your 1710 16th Street, S.E., Cedar Rapids, Iowa facility.

Tests were performed on February 24, 1993 by Paul Mangelsdorf and Walt Zuurdeeg. The tests were coordinated with Greg Hobby of Cargill Corporation. Mr. Sean Fitzsimmons of the Iowa DNR and Mr. Shawn Peters of the Linn County Health Department were present for the testing.

The tests were conducted and results evaluated in adherence to Environmental Protection Agency (EPA) Method 5 and Iowa Compliance Manual procedures.

DISCLAIMER

The results of this stack test reflect the conditions at the time the tests were conducted. Compliance to regulatory agencies' requirements are normally determined by those agencies.

SUMMARY OF RESULTS

The following Tables present a summary of the emission testing performed by Beling at the Cargill Corn Plant in Cedar Rapids, Iowa. See Appendices for data utilized and developed as part of the tests.

Iowa Compliance Full Work-up
Particulate Emissions
Starch Flash Dryer
Cargill Corn Plant
Cedar Rapids, Iowa
February 24, 1993

Test Number	Particulate Emissions	
	gr/dscf	lb/hr
1	0.0091	5.385
2	0.0101	5.916
3	0.0092	5.353
Average	0.0095	5.552
Stack Gas Average Velocity:		31.032 ft/sec
Stack Gas Average Flow Rate:		78,850 ACFM
Stack Gas Average Temperature:		113.3° F =
Stack Gas Average Moisture:		7.1%

$78850\ acfm \left| \frac{288\ ^\circ K}{318\ ^\circ K} \right| = \sim 71411\ scfm$

① From pA5, production rate = 20,300 lb/hr = 10.15 T/hr

② Mass emission rate calcn check - (average only)

$$\frac{lb}{hr} = \frac{0.0095\ gr}{dscf} * \frac{78,850\ Acf}{min} * (1-0.071)\left(\frac{528^\circ R}{573.3^\circ R}\right)\left(\frac{60\ min}{hr}\right) * \frac{1\ lb}{7000\ gr}$$

$= 5.493$ slight error but could be roundoff (~1%)

$$\text{Emission Factor} = \frac{5.552\ lb/hr}{10.15\ T/hr} = 0.55\ lb/T\ \text{starch processed}$$

TEST METHODS

The Starch Flash Dryer was tested for particulate emissions. The testing was conducted using EPA Method Five.

EPA METHOD 5 AND IOWA PARTICULATE METHOD

EPA Method 1, "Sample and Velocity Traverses for Stationary Sources", as revised August 14, 1986 is used to determine the quantity and location of velocity traverse points. The method accounts for flow disturbances, both upstream and downstream of the sampling points.

EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (type S Pitot Tube)", is used to determine the flue gas velocity and flow rate. An S-type pitot tube is connected to an inclined manometer (0.00-1.00 inches of water incline range and 1.0 to 10.0 inches water vertical range) to measure velocity pressures in the flue. Temperatures are measured with a type K thermocouple attached to a calibrated digital temperature indicator.

EPA Method 3, "Gas Analysis for CO_2, O_2, Excess Air, and Dry Molecular Weight" - Integrated gas samples are collected during each test period. An Orsat analyzer is used to determine the percent carbon dioxide and oxygen, which is subtracted from 100% to determine the percent nitrogen.

EPA Method 4, "Determination of Moisture Content in Stack Gases" is accomplished by weighing the impingers before and after tests. The weight gain is used to calculate the moisture content of the flue gas.

EPA Method 5 is the "Determination of Particulate Emissions from Stationary Sources". EPA reference methods One through Four are used to determine the sampling points, flue gas velocity, gas composition and moisture content. Based on these preliminary measurements, a sampling nozzle of appropriate diameter is selected to maintain isokinetic sampling.

The stack gas is drawn through a calibrated stainless steel nozzle into a heated, glass-lined probe and through a heated filter assembly held at 250 ± 25°F. The gas then goes through an ice-cooled impinger train. The moisture in the flue gas is condensed by passing it through the ice-cooled impinger train, maintaining a temperature of 70°F or less as it leaves the last impinger. The first, third and fourth impingers are modified by replacing the high velocity tip with a one-half inch inside diameter glass tube. The second impinger is of the standard Greenburg-Smith design. The gas then flows through a leakless vacuum pump, a dry gas meter and a calibrated orifice. The dry gas meter and orifice are calibrated before and after the tests.

The sampling rate is adjusted during the sampling period to maintain isokinetic conditions. At isokinetic conditions, the velocity of the stack gas entering the nozzle should be equal to the stack gas velocity at the sampling point. These conditions are maintained by adjusting the pressure drop across the orifice meter relative to the stack gas velocity pressure. The proper orifice differential is determined by calculation.

Prior to each test run, the test trains are leak checked at ten inches of vacuum. At the conclusion of each test, the system is leak checked at the highest vacuum pulled during the sampling period. Allowable leakage rate under EPA reference methods is 0.02 cubic feet per minute.

After each test, the particulate samples are carefully recovered. The filter is removed from the holder with tweezers, placed in a petri-dish and sealed with tape. The nozzle, probe assembly and front half of the filter holder are rinsed with acetone. A probe brush is used to remove particles which adhere to the walls of the nozzle, probe and filter assemblies. The washing is collected in sample containers and transported to the laboratory for analysis.

The acetone washing of the front half of the particulate sampling train (nozzle, probe assembly and front half of the filter holder) is quantitatively transferred to a desiccated, tared 250 milliliter beaker. The volume of acetone is recorded and evaporated to dryness. The beaker with sample is desiccated and weighed to constant weight, to the nearest 0.1 milligram.

For purposes of definition, the term "constant weight" means a deviation of no more than ± 0.5 milligrams between consecutive weighings, conducted at intervals of no less than six hours apart.

A blank sample is obtained from each lot of acetone used during the test program. The blanks are processed and analyzed in the same manner as a particulate sample.

Filters from the particulate test runs are removed from their sample containers and placed in a desiccator for a 24 hour period prior to weighing to a constant weight.

The impinger contents (back half) are analyzed for organic and inorganic condensible matter as follows: the impinger contents are first extracted with three 25 milliliter portions of ethyl ether and three 25 milliliter portions of chloroform. the two extractions are combined in a single tared beaker, evaporated to dryness, then desiccated for 24 hours, and reweighed to the nearest 0.1 milligram constituting the organic portion. The remaining water is transferred to a tared beaker, evaporated and weighed to the nearest 0.1 milligram constituting the inorganic condensible material.

AIR POLLUTION CONTROL EQUIPMENT OPERATING DATA*

Plant CARGILL CORN PLANT Location CEDAR RAPIDS, IA
Source Type #2 FLASH DRYER EMISSION POINT #90 Rated Production 25,000 lb/hr
Date 2/24/93 Time _____ Actual Production 20,300 lb/hr
Air Flow Data _____ Run No. 1 - 3

Mechanical Collector:
Tube Dia. _____in. No. of Tubes _____. Design p _____in. H_2O @ Gas Temp _____°F
Observed Δp _____in H_2O. Design cfm/tube @ Observed Δp _____ @ _____°F.
Fan Rated H.P. _____. Operating Volts _____. Operating Amps _____.

Electrostatic Precipitator:

Field No.	Primary Voltage (volts)	Primary Current (amps)	Secondary Voltage (KV)	Secondary Current (ma)	Spark Rate (per min.)

Scrubber:
Type Entoleter. Δp (across scrubber) 6.31 in. H_2O.
Fan Rated H.P. 700. Operating Volts 4160. Operating Amps 547.
Liquid Circulation Rate 325 gal/min. % Make-up 2.81. Blowdown _____gpm.
Scrubbing Water Change Interval N/A
Settling Tank Cleaning Interval N/A

4160 v x 547 a = 22.75 kw ! 480 v ? => 262 kw
=> 352 hp

Baghouse:
Pressure-Positive _____. Negative _____. No. Compartments _____.
Type Cleaning _____. Clean Cycle _____min.
Avg. Baghouse Δp _____in H_2O. Δp Range _____in. H_2O.
Fan: Rated H.P. _____. Operating Volts _____. Operating Amps _____.

Cyclone:
Type _____. Δp _____in. H_2O. Diameter _____.
Fan: Rated H.P. _____. Operating Volts _____. Operating Amps _____.

Person Responsible for Data: GREGG HOBBY
Signature: Gregg Hobby
Title/Position: Environmental Coordinator

*Averages of operating data taken during actual test run unless requested otherwise.

PARTICULATE EMISSION TEST

_____ OPERATING DATA*

(Type of Source)

Owner CARGILL INC Run No. 1-3

Source I.D. #2 FLASH DRYER EMISSION POINT #90 Date 2/24/93

Maximum Continuous Process Weight (Manufacturer's Rating) 25,000 lbs./hr.

Historical Average Process Weight 20,000 - 24,000 lbs./hr.

Historical Maximum Process Weight 25,000 lbs./hr.

Type and Sources of Fuels Normally Burned STEAM HEATED

Approximate Quantities of Each of Above Fuels Burned Annually N/A

Recycling Capability: Yes X No _____

Process Data During Run (Averaged)

Process Weight (Dry) 18,067 lbs./hr.

Percent Moisture 11% %

Process Weight (Wet) 20,300 lbs./hr.

How Process Weight Determined NUMBER OF BATCHES PROCESSED THROUGH CENTRIFUGE.

Type of Fuel Burned During Run N/A

Recycling in Progress: Yes X No _____

Person Responsible for Data: GREGG HOBBY

Signature: Gregg Hobby

Title/Position: ENVIROMENTAL COORDINATOR

*Averages of operating data taken during actual test run unless requested otherwise.

#1

make up gpm

scrubbergal recirc

HARDCOPY REQUESTED ON STATION 1 BY USER: WASSER 24-FEB-1993 14:4

24-FEB-1993 14:44:47

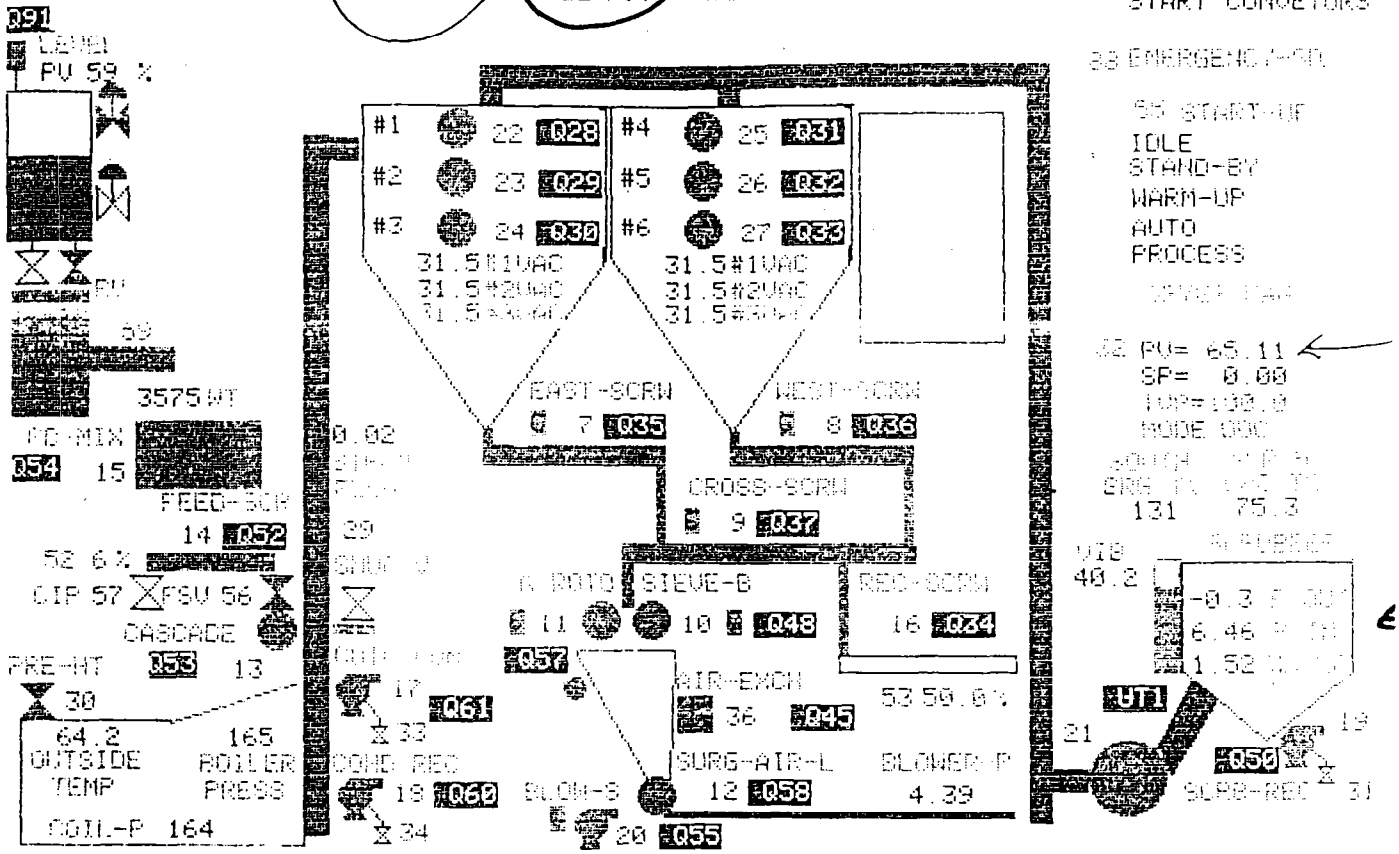
1 27 IUP | 2 | 3 | 4 | 5 | 6

1	2	3	4	5	6
INLET-T	OUTLET-T	SCRUB-HOT	SCRUB-REC	SCRUB-LEV	SCRUB-SG
PV= 319.5	PV= 116.5	PV= 1.52	PV= 328.7	PV= 79.83	PV= 0.00
SP= 325.0	SP= 116.0	SP= 1.78	SP= 325.0	SP= 80.00	SP= 0.10
IUP=48.64	IUP=32.68	IUP=45.79	IUP=41.32	IUP= 3.55	IUP= 7.11
MODE SUPV	MODE AUTO	MODE MAN	MODE AUTO	MODE AUTO	MODE MAN

51 START-EQUIP
SHUTDOWN
START ALL
START SCRUBBER
START FAN
START CONVEYORS

88 EMERGENCY-ON

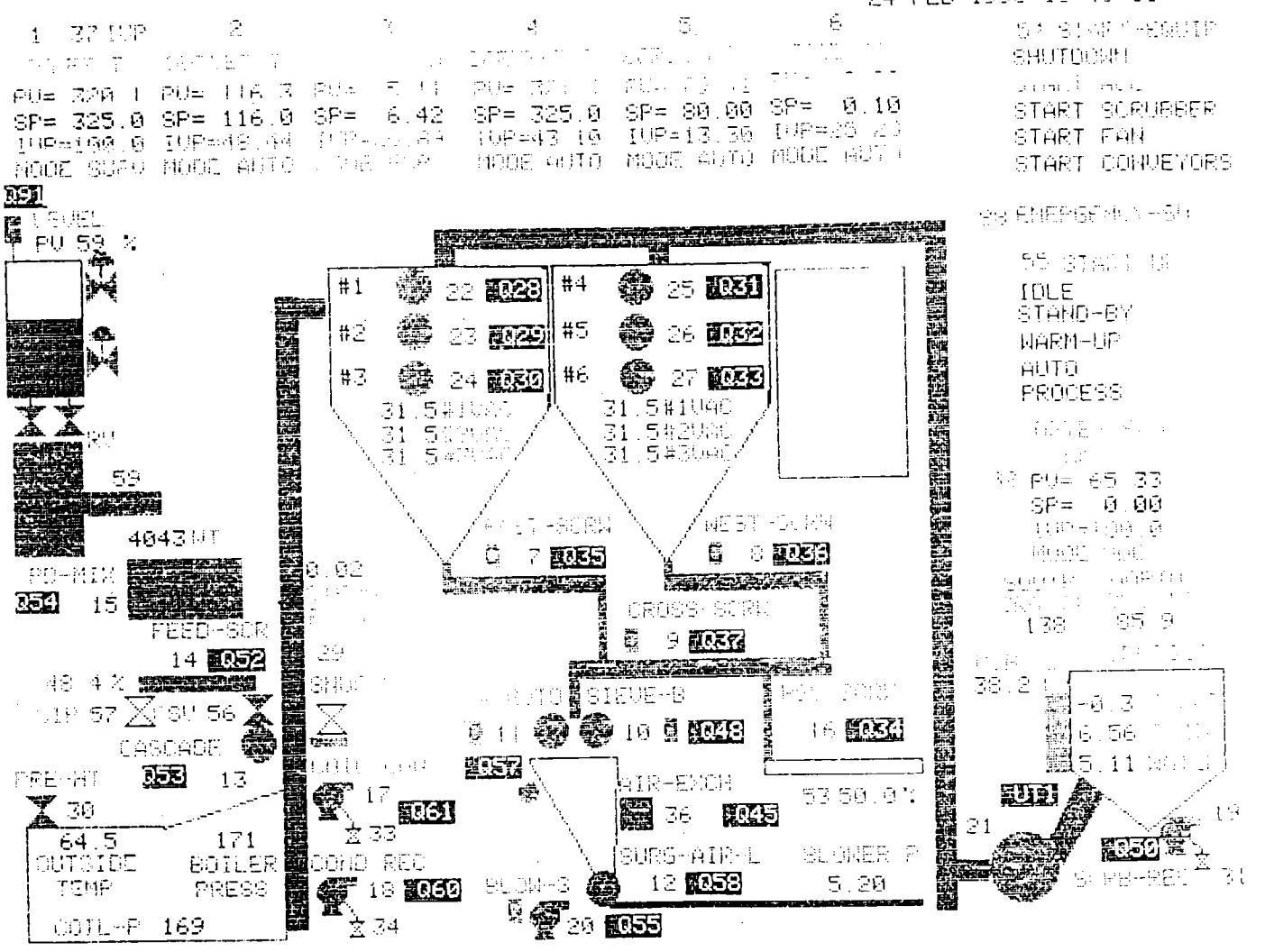
95 START-UP
IDLE
STAND-BY
WARM-UP
AUTO
PROCESS



DSPLY:DRYER 2 PRINT

#2

HARDCOPY REQUESTED ON STATION 1 BY USER CRUSHER 24-FEB-1993 16:48



#3

HARDCOPY REQUESTED ON STATION 1 BY USER CRUSHER 24-FEB-1993 18:31