PM
2 Oct. 1987
Bartow, FL

File Copy

IMC FERTILIZER GROUP • MINERALS DIVISION
P.O. Box 867 • Bartow, Florida 33830
Telephone: (813) 533-1121

IMC FERTILIZER, INC.
INTERNATIONAL MINERALS & CHEMICAL CORPORATION

September 30, 1987

Mr. William A. Thomas
Bureau of Air Quality Management
Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301

Dear Mr. Thomas:

Re: IMC Fertilizer, Inc., Lonesome Dryers, Nos. 1 and 2
USEPA Permit PSD-FL-088
FDER Permits AC29-49694 and AC29-49692

This is a request to modify the PSD application for the fuel conversion of the two Lonesome Dryers done by Brewster Phosphates in November 1981 in order to change the resulting construction permit conditions. The changes are based primarily on corrections to the original submittals and redefinition of operating condition specifications to be consistent with normal operating procedures. Based on the changes to the original construction permits, a subsequent request will be made to modify the current operating permits, AO29-111119 and AO29-111120. The same request is being made to the Florida Department of Environmental Regulation at this time.

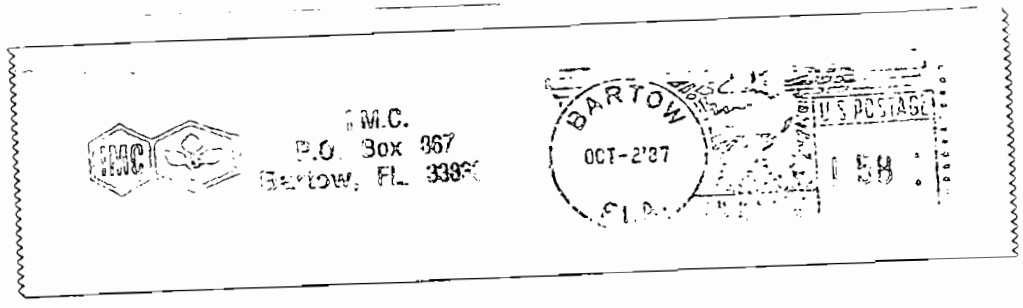
The attached document presents the review of the application and the corrections and changes to it. It was done in a manner consistent with an approach that would have been appropriate at the time of the application and then presents more recent information. It also presents a different manner in which some of the permit conditions are specified in order to be more consistent with the normal operating procedures used for this type of equipment.

If you require any additional information to complete the review of this request, please contact me so that it can be submitted to you. Thank you for your attention in this matter.

Very truly yours,

W. C. Cross
Vice President & General Manager
Florida Minerals Operations

cc: W. C. Thomas - FDER, Tampa (w/attachments)
W. A. Smith - EPA, (w/o attachments)
J. Campbell - HCEPC (w/ attachments)



IMC FERTILIZER, INC.
INTERNATIONAL MINERALS & CHEMICAL CORPORATION
P.O. BOX 867 • BARTOW, FLORIDA 33830

C. D. TURLEY

TO:

MR. WILLIAM A. THOMAS
BUREAU OF AIR QUALITY MGMT.
DEPT. OF ENVIRON. REG.
TWIN TOWERS OFFICE BLDG.
2600 BLAIR STONE ROAD
TALLAHASSEE, FL 32301

FORM 5-422 PRINTED IN U.S.A.

IMC FERTILIZER, INC

LONESOME DRYERS, NOS. 1 & 2

PSD PERMIT APPLICATION REVIEW

USEPA PERMIT

PSD-FL-088

FDER CONSTRUCTION PERMITS

AC29-49694 and AC29-49692

FDER OPERATING PERMITS

AO29-111119 and AO29-111120

Prepared by: C. D. Turley

9/30/87

TABLE OF CONTENTS

1. INTRODUCTION

2. REVISED PERMIT CONDITIONS

3. EXISTING CONDITIONS

4. PARTICULATE

5. SULFUR DIOXIDE

6. NITROGEN OXIDES

7. CARBON MONOXIDE

8. HYDROCARBONS

9. DRYER OPERATING CONDITION

10. MODELING CONSIDERATIONS

1. INTRODUCTION

This report contains the basis for the revision of the PSD permits for the IMC Lonesome No 1 and No 2 Phosphate Rock Dryers located in Hillsborough County, Florida. The original application was made by Brewster Phosphates in 1981 for the purpose of converting the dryer fuel from No 6 Oil to the use of either No 6 Oil, Coal-Oil Mixture (COM), or Coal. This analysis corrects or changes several items the original application and supplements and resulting permits and proposes changes to the permit conditions on several bases:

1. Improper calculation.
2. Improper method of estimation of existing emissions.
3. Corrected operating parameters.
4. Change in operating condition specification.
5. Simplification of emission limitation specifications.

History

The permitting actions occurred in the following manner:

05/23/79 No 2 - AO29-17813 exp 3/1/84
01/28/80 No 1 - AO29-25324 exp 1/15/85
11/16/81 Application for PSD Approval
01/01/82 Supplemental Information to Application
04/14/82 Technical Evaluation & Preliminary Determination
05/25/82 Final Determinations PSD permits
05/26/82 No 1 - AO29-49694 exp 4/15/84
05/26/82 No 2 - AO29-49692 exp 4/15/84
07/01/82 PSD-FL-088 Federal Permit
03/25/85 AC29-49492,49694 exp extended to 12/31/85
10/09/85 Certificates of Completion of Construction
12/05/85 No intention to use coal as fuel
01/27/87 No 1 - AO29-111119 expires 1/22/92
07/31/87 No 2 - AO29-111120 expires 7/31/92

Analysis

The proposed revision of the permit application addresses the information available at the time of the application, the method of estimating the existing emissions, proposed limitations, and additional information known to this point. In an attempt to reduce the size of this submittal, references are made to the various documents involved in the original application. Recent testing by IMC has been previously submitted. Brewster results were obtained from test reports submitted to the local agencies. If it is required, these identified documents can be reproduced. Note that all references to lb/hr refer to the emission of one dryer while TPY refer to both dryers as was done in the original documents.

It addresses the revision of the operating condition specification to be consistent with how the equipment is operated. The current permit conditionalizes on the resulting, dependent, condition of TPH to specify the maximum operation of the dryers. The set point, independent, condition of the dryers is the heat input rate and should be the basis of establishing the maximum condition if this is required.

It also proposes changes to the format of the specification of the limitations in the permit. The limitations should feature lb/hr with a secondary normalized rate for relation to operating rate if that is necessary. It is unnecessary to specify TPY in the limitations since limitation of lb/hr and total operating hours is equivalent. In the case of VOC emissions, it proposes a specified testing method modification.

The following two tables are those that appear in the PSD Determination with the corrections or revisions that result from the refinement of the application calculations and estimates. The following section presents the impact of these corrections or revisions on the current operating permit conditions. The remaining sections of this report are the analysis done for each to the topics.

TABLE I

SUMMARY OF EMISSION CHANGES RESULTING
FROM THE USE OF ALTERNATIVE FUELS

BREWSTER PHOSPHATES
HILLSBOROUGH COUNTY, FLORIDA

	Pollutant Increase (tons/year)				
Source	Part. Matter	SO2	NOx	CO	HC
Dryers (2)					
Present	175	794	396.2	41.0	8.2
correction			619.9		42.5
Proposed -oil	175	1365	396.2	41.0	8.2
correction			619.9		42.5
-coal	175	1365	742.9	51.6	15.5
correction			782.1		49.8
-COM	175	1365	576.5	40.6	12.0
correction			704.3		46.5
Max increase	0	571	346.7	10.6	7.3
correction			162.2		
Coal Handling					
Present	0				
Proposed -oil	0		NO CHANGE		
-coal	17.9				
-COM	0				
Max increase	17.9				
Rail (Fugitive)					
Max Increase (for coal)	0.3	0.7	4.6	1.6	1.2
Rock Loading	NO CHANGE				
Auto and Truck Traffic	NO CHANGE				
Total Increase	18.2	571.7	351.3	12.2	8.5
correction			166.8		
Significant Inc	25	40	40	100	40

TABLE II

Emissions of Criteria Pollutants from Each Modified Dryer

Pollutant		lb/hr	lb/mmBtu	PPM	Other	TPY
PM		25	--	--	--	87.5
SO2		195	1.1			682.5
Sulfur	Oil				1.7%S	
	Correction				2.2%S	
	Coal				1.33%S	
	Correction				2.2%S	
	COM				1.5%S	
	Correction				2.2%S	
NOx	Oil	56.6	--	81	--	198.1
	Correction	88.6		--		310.0
	Coal	106.6	--	152	--	371.5
	Correction	111.7		--		391.1
	COM	82.3	--	118	--	288.3
	Correction	100.6		--		352.2
CO		5.8	--	--	--	41.0(20.5)
	Oil	5.8	--	--	--	20.5
	Coal	7.4	--	--	--	25.9
	COM	6.6	--	--	--	23.3
VOC		1.2	--	--	--	8.2(4.1)
	Correction					
	Oil	6.1	--	--	--	21.3
	Coal	7.1	--	--	--	24.9
	COM	7.4	--	--	--	23.2
VE		--	--	--	20% opac	--
	Revision in permit				10% opac	

2. REVISED PERMIT CONDITIONS

The FDER permit conditions are presented as they currently appear on the current operating permits. The appropriate EPA PSD conditions are presented concurrently with the corresponding FDER condition. The PSD permit applied to both dryers while individual FDER permits were issued.

AO29-111119 and AO29-111120 SPECIFIC CONDITIONS:

1. Maximum allowable pollutant emissions shall not exceed:

Pollutant	Emission Limitations
TSP	25 pounds per hour ~~and 87.5 TPY~~ or 0.06 lbs./ton of phosphate rock feed, whichever is more restrictive.
SO2	195 pounds per hour ~~and 682.5 TPY,~~ or 1.1 lbs./MMBTU heat input, whichever is more restrictive.
VE	10% opacity.
NOx	~~56.6~~ 88.6 pounds per hour ~~or 81 ppm, whichever is more restrictive~~ when dryer is firing no. 6 fuel oil. ~~82.3~~ 100.6 lbs./hr. ~~or 118 ppm, whichever is more restrictive~~ when dryer is firing COM fuel. (Concentration reference ppm eliminated because of variability in dryer air flow)
CO	~~5.8 pounds per hour and 41 TPY~~ 5.9 pounds per hour when dryer is firing no. 6 fuel oil. 6.6 pounds per hour when dryer is firing COM fuel.
VOC	~~1.2 pounds per hour and 8.2 TPY~~ 6.1 pounds per hour when dryer is firing no. 6 fuel oil. 6.6 pounds per hour when dryer is firing COM fuel.

Proposed change for Hydrocarbons:

VOC	1.2 pounds per hour corrected for ambient VOC per test method when dryer is firing no. 6 fuel oil. 1.7 pounds per hour corrected for ambient VOC per test method when dryer is firing COM fuel.

No. 1 Dryer:

2. The sulfur content of the fuel shall not exceed:
   ~~1.7~~ 2.2 percent by weight in the No. 6 fuel oil;
   ~~1.7~~ 2.2 percent in the COM fuel.

Use of higher sulfur contents may be permitted upon approval by the Hillsborough County Environmental Protection Commission, the Department and the Environmental Protection Agency.

No. 2 Dryer:

2. The sulfur content of the fuel shall not exceed ~~1.7~~ 2.2 percent by weight. Use of higher sulfur contents may be permitted upon approval by the Hillsborough County Environmental Protection Commission, the Department and the Environmental Protection Agency.

3. The maximum production rate for the dryer shall not exceed 450 TPH dried product ~~(513 TPH wet feed)~~ and 3.15 million tons per year.

ADD: The estimated maximum fuel usage rate for the dryer shall not

exceed 177.1 mmBtu/hr. Use of higher fuel usage rate may be permitted upon approval by the Hillsborough County Environmental Protection Commission, the Department and the Environmental Protection Agency.

4. The hours of operation for this dryer shall not exceed 7000 hours per year.

5. Test the emissions for the following pollutant(s) at intervals of six months from 1-May 14, 1986, 2-June 8, 1987 and submit 2 copies of test data to the Air Section of the Hillsborough County Environmental Protection Commission Office within forty five days of such testing. Testing procedures shall be consistent with the requirements of Section 17-2.700, F.A.C.

(X)	Particulates	(X)	Sulfur Oxides*
( )	Fluorides	(X)	Nitrogen Oxides
(X)	Opacity	(X)	Volatile Organic Compounds**
(X)	Carbon Monoxides**	( )	Total Reduced Sulfur

* Fuel analysis shall be submitted with the sulfur dioxide emission test.
** Compliance testing for this pollutant shall be required when requested in writing by the Hillsborough County Environmental Protection Commission, Department, or EPA.

6. ~~Compliance with the emission limitations of Specific Condition No. 1 shall be determined using EPA Methods 1,2,4,5,6,7,9, and 10 contained in 40 CFR 60, Appendix A and adopted by reference in Section 17-2.700, F.A.C. The minimum requirements for stack sampling facilities, source sampling and reporting, shall be in accordance with Section 17-2.700, F.A.C. and 40 CFR 60, Appendix A. Testing for particulate matter and visible emissions should be conducted simultaneously.~~

Compliance with the emission limitations of Specific Condition No. 1 shall be determined using EPA Methods contained in 40 CFR 60, Appendix A and adopted by reference in Section 17-2.700, F.A.C. in the following manner. The minimum requirements for stack sampling facilities, source sampling and reporting, shall be in accordance with Section 17-2.700, F.A.C. and 40 CFR 60, Appendix A.

Pollutant	EPA Method
--	1,2,3, and 4 as required
TSP	5
VE	9 (Simultaneous with TSP test, 3 20 minute readings during each of the 3 TSP test runs or 1 60 minute reading during 1 TSP test run.)
SO2	6 or 6C
NOx	7 or 7E
CO	10
VOC	25A

Proposed change for Hydrocarbons:

VOC	25A modified to incorporate an ice bath moisture trap in the sample line. Concurrent measurement of the ambient VOC to be made during test period. Final corrected emission to be determined in the following manner:

lb/hr VOC corr = lb/hr VOC stack - lb/hr VOC ambient
where: lb/hr VOC ambient = ambient concentration x calculated dryer quench air for test run.

7. ~~Testing of emissions must be accomplished while the dryer is operating at 90 to 100 percent of the design capacity of 450 TPH of dried rock. The test should be conducted while processing the maximum percentage of pebble rock anticipated to be in the product. The process weight and production rates shall be specified in each test result. Failure to submit the input rates or operation at conditions which do not reflect actual operating conditions may invalidate the data (Section 403.161(1)(c), Florida Statutes).~~

Testing of emissions must be accomplished while the dryer is operating at or above a fuel usage rate of 150 mmBtu/hr or the previous 12 month average rate. The test should be conducted while processing the maximum percentage of pebble rock anticipated to be in the product. The process weight and production rates shall be specified in each test result. Failure to submit the input rates or operation at conditions which do not reflect actual operating conditions may invalidate the data (Section 403.161(1)(c), Florida Statutes).

8. The permittee shall calibrate, maintain, and operate the continuous monitoring devices required by 40 CFR 60.403(c) and (d).

9. Pursuant to 40 CFR 60.7, periods and quantities of excess emission shall be reported in a quarterly report. For purposes of this report, excess emissions shall be all air pollutant emissions in excess of the permitted levels stated in Specific Conditions 1 and 2 of this permit. In addition, pursuant to 40 CFR 60.403, each quarterly report shall include all scrubber pressure drop and scrubbing liquid supply pressure readings which are less than the average readings of ~~32~~ 18 "H_2O for the scrubber pressure drop and ~~575~~ 450 gpm for the scrubbing liquid supply. The aforementioned readings are the average levels maintained during the most recent performance test in which the dryer demonstrated compliance with the particulate and visible emissions standards. Quarterly reports shall be submitted no later than 30 days from the end of each calendar quarter.

Note: The readings cited were incorrect. The numbers supplied are the design parameters from the scrubber specifications. The scrubber pressure drops are generally in the range of 20-22 in HOH.

10. Submit for this facility, each calendar year, on or before March 1, an emission report for the preceding calendar year containing the following information as per Section 17-4.14, F.A.C.

(A) Annual amount of materials and/or fuels utilized.
(B) Annual emissions (note calculation basis).
(C) Any changes in the information contained in the permit application.

Duplicate copies of all reports shall be submitted to the Hillsborough County Environmental Protection Commission.

11. Pursuant to Section 17-4.09, F.A.C., an application for renewal of permit to operate this source shall be submitted to the Hillsborough

County Environmental Protection Commission at least 60 days prior to its expiration date.

12. All reasonable precautions shall be taken to prevent and control generation of unconfined emissions of particulate matter in accordance with the provision in Section 17-2.610(3), F.A.C. These provisions are applicable to any source, including, but not limited to, vehicular movement, transportation of materials, construction, alterations, demolition or wrecking, or industrial related activities such as loading, unloading, storing and handling. Reasonable precautions shall include but are not limited to regular sweeping of paved grounds, and regular application of water sprays or dust suppressants to unpaved areas.

13. The permittee shall apply for a modification of this permit if he decides during the duration of this permit to construct the coal handling facility and utilize this facility as an alternate fuel source for this dryer.

14. The following data from each Entoleter Centri Field Scrubber will be obtained each day each dryer operates and records of the data kept for two years for regulatory agency inspection:

a. pressure drop or inlet static pressure of the gas in inches of water,
b. flow rate of the scrubber water in gal./min.
   A weir or similar device may be used to obtain the flow rate,
c. pH of the scrubber water, and
d. pressure of the scrubber water.

The instruments used to obtain this data must meet applicable specifications listed in 40 CFR 60.403(c).

Note: Since the scrubber follows the ID fan of the system and vents to atmosphere, the scrubber inlet static pressure will be essentially equal to the pressure drop of the scrubber. This is a more reliable measurement to make. The performance of these particular scrubbers depends on the amount of water flow and not the supply pressure since they do not contain any water sprays. The pressure measurement is then incidental and not required for permitting purposes.

PSD-FL-088 SPECIFIC CONDITIONS:

1. This permit authorizes modifications required to burn alternate fuels (No. 6 fuel oil, COM and coal) in phosphate rock dryers no. 1 and no. 2 that are presently operating under state permits A029-25234 and A029-17813, respectively.

2. This permit is not valid until both EPA and the state issue permits authorizing the proposed modifications. In event of a difference in any specific condition in the state and federal permits, Brewster Phosphates must comply with the most restrictive operation or emission limit in either permit.

3. Construction of the coal handling facility must begin within 180 days of receiving the state and federal permits for the modification. The applicant shall report any delays in construction and completion of this project to the Department's Southwest District Office, Hillsborough County Environmental Protection Commission and EPA Region IV.

4. Construction shall reasonably conform to the plans submitted in the application. Final plans for the coal handling system, which may include alternate control or process equipment, must be approved by the Department and EPA Region IV.

5. Maximum production rate for each dryer shall not exceed 450 TPH dried product (513 TPH wet feed) and 3.15 million tons per year. Scale meeting the specifications listed in 40 CFR 60.403 shall be used to measure the phosphate rock feed during the compliance test.

6. Maximum operation time for each dryer is limited to 7,000 hours per year.

7. Particulate matter emission shall not exceed 0.06 pounds per ton of phosphate rock feed and 25 pounds per hour per dryer. Visible emissions shall not exceed 10 percent opacity. Test methods and procedures specified in 40 CFR 60.404 shall be used to determine compliance with these standards. Test for these pollutants simultaneously (3 20 minute readings during each of the 3 TSP test runs or 1 60 minute reading during 1 TSP test run) while the dryer is operating at 90 to 100 percent capacity or above a fuel usage rate of 150 mmBtu/hr or the previous 12 month average rate on coal or COM and processing the maximum percentage of pebble rock anticipated to be in the product. Test reports will be submitted semiannually to the Department's Southwest District Office and Hillsborough County Environmental Protection Commission.

8. Sulfur dioxide emission for each dryer, as determined by reference method 6 as specified in 40 CFR 60, Appendix A, shall not exceed 195 lb/hr. or 1.1 lb/MMBTU heat input, whichever is more restrictive. Test for this pollutant while the dryer is operating at 90 to 100 percent capacity or above a fuel usage rate of 150 mmBtu/hr or the previous 12 month average rate. Test reports will be submitted semiannually to the Department's Southwest District Office and Hillsborough County Environmental Protection Commission.

9. Sulfur content of the fuels shall not exceed:
2.2 percent in the No. 6 fuel oil;

~~1.5~~ 2.2 percent in the COM fuel;
~~1.33~~ 2.2 percent in the coal.

To use fuels with higher sulfur contents, Brewster Phosphates must obtain the Department's and EPA's approval. This can be accomplished by modifying the scrubber and providing data showing increased sulfur dioxide removal efficiency or by providing data showing a greater removal of sulfur dioxide by the pebble phosphate rock and coal ash than was predicted in the application.

10. Nitrogen oxide emission from each dryer shall not exceed:

56.6 lb/hr ~~or 81 ppm~~ when the dryer is firing No. 6 oil.
106.6 lb/hr ~~or 152 ppm~~ when the dryer is firing coal.
82.3 lb/hr ~~or 118 ppm~~ when the dryer is firing COM fuel.

Compliance will be determined by reference Method 7 or 7E as described in 40 CFR 60, Appendix A. Tests will be conducted when the dryer is operating at ~~90 to 100 percent permitted production~~ or above a fuel usage rate of 150 mmBtu/hr or the previous 12 month average rate with each fuel used by the dryer. Periodic tests will not be required for this pollutant unless requested in writing by the Department or EPA.

11. Water sprays or equivalent controls will be installed at all transfer points of the coal conveying system. Visible emissions from the coal handling system shall not exceed 10 percent opacity as determined by reference Method 9 of 40 CFR 60, Appendix A.

~~12. Carbon monoxide emission from each dryer shall not exceed 5.8 lb/hr or 41.0 TPY. Compliance tests are required when requested in writing by the Department or EPA.~~

12. Carbon monoxide emission from each dryer shall not exceed:

5.9 lb/hr when the dryer is firing No. 6 oil.
7.4 lb/hr when the dryer is firing coal.
6.6 lb/hr when the dryer is firing COM fuel.

Compliance will be determined by reference Method 10 as described in 40 CFR 60, Appendix A. Compliance tests are required when requested in writing by the Department or EPA.

~~13. Volatile Organic Compounds emission from each dryer shall not exceed 1.2 lb/hr or 8.2 TPY. Compliance tests are required when requested in writing by the Department or EPA.~~

13. Volatile Organic Compounds emission from each dryer shall not exceed:

6.1 lb/hr when the dryer is firing No. 6 oil.
7.1 lb/hr when the dryer is firing coal.
6.6 lb/hr when the dryer is firing COM fuel.

Compliance will be determined by reference Method 25A as described in 40 CFR 60, Appendix A. Compliance tests are required when requested in writing by the Department or EPA.

Proposed Hydrocarbon condition revision:
13. Volatile Organic Compounds emission from each dryer shall not exceed:

1.2 lb/hr	corrected for ambient VOC per test method when dryer is firing no. 6 fuel oil.
2.2 lb/hr	corrected for ambient VOC per test method when dryer is firing coal.
1.7 lb/hr	corrected for ambient VOC per test method when dryer is firing COM fuel.

Compliance will be determined by reference Method 25A, as described in 40 CFR 60, Appendix A, modified to incorporate an ice bath moisture trap in the sample line. Concurrent measurement of the ambient VOC to be made during test period. Final corrected emission to be determined in the following manner:

lb/hr VOC corr = lb/hr VOC stack - lb/hr VOC ambient

where: lb/hr VOC ambient = ambient concentration x calculated dryer quench air for test run.

Compliance tests are required when requested in writing by the Department or EPA.

14. Reasonable precautions to prevent fugitive particulate emission during construction, such as coating or spraying roads and construction sites used by contractors, will be taken by the applicant.

15. The applicant will demonstrate compliance with the conditions of this construction permit and submit test reports to EPA and a complete application for an operating permit to Hillsborough County Environmental Protection Commission prior to 90 days before the expiration date of this state permit. The applicant may continue to operate in compliance with all terms of this construction permit until its expiration or until issuance of an operating permit.

16. Upon obtaining an operating permit, the applicant will be required to submit annual reports to Hillsborough County Environmental Protection Commission and the Department on the actual operation of the facility. These reports will include, as minimum: type and quantity of phosphate rock processed; type, quantity and sulfur content (average and maximum for each type) of fuel used; and total hours of operation of the dryer.

17. Stack test facilities will meet the minimum specifications in Chapter 17-2.700 (4), FAC.

18. The following data from each Entoleter Centri Field Scrubber will be obtained each day each dryer operates and records of the data kept for 2 years for regulatory agency inspection.

a. Pressure drop or inlet static pressure of the gas in inches of water;
b. flow rate of scrubber water in volume per time, i.e. GPM. A weir or similar device may be used to obtain this flow;
c. pH of the scrubber water;
d. ~~pressure of the scrubber water;~~

The instruments used to obtain this data must meet any specification listed in 40 CFR 60.403(c).

Note: Since the scrubber follows the ID fan of the system and vents to atmosphere, the scrubber inlet static pressure will be essentially equal to the pressure drop of the scrubber. This is a more reliable measurement to make. The performance of these particular scrubbers depends on the amount of water flow and not the supply pressure since they do not contain any water sprays. The pressure measurement is then incidental and not required for permitting purposes.

19. The source shall comply with the provisions and requirements of the attached general conditions.

3. EXISTING CONDITIONS

The operating conditions used in the preparation of the PSD permit application are summarized in this section. The Application for Federal PSD Approval, Volume I, dated November 1981, is referred to in this analysis as "App" in the summary tables. A Subsequent document, Supplemental Information, Application of Federal PSD Approval PSD-FL-088, dated January 1982, is referred to as "Supp". "Final" will primarily refer to the Technical Evaluation and Preliminary Determination, dated April 14, 1982, or to the final permit conditions that were different from the determination. Information from the two permits that were in affect at the time of the application are also included for reference.

All the calculations refer to these numbers unless identified otherwise. The original proposed action was amended by the second submittal as identified.

Existing conditions				App 2A-1	Supp
Previous Permits				pg 1/8	Attch 1
AO29-	25324 NO 1	17813 NO 2	Average or Total		
gph avg	1048	1365		1170	
max	1206	1418			
mmBtu/hr	181.9	210.2	196.1	177.1	
gal/ton	2.60	3.03	2.82	2.6	
%s	2.3%	1.0%			2.37%
Btu/lb	17852	18250			17920
lb/gal	8.448	8.448		8.45	8.45
Btu/gal	150814	154176	152495	151400	
gal/yr	7795795	11498760	19294555		8313468
TPH dry	403	450		450	
TPY	2998320	3790800	6789120	6300000	
hr/yr	7440	8424	7932	7000	

Proposed operating conditions			
	App 2A-1 pg 3/8	Supp	Final
TPH	450	450	450
hr/yr	7000	7000	7000
ton/yr	6300000		
gal/ton	2.6		
mmBtu/hr	177.1		

4. PARTICULATE

The existing Particulate emissions were calculated based on the allowable emission of 45.8 lb/hr at the proposed operating hours. It was amended in the supplemental submittal based on a statistical analysis of average test results. The following are the emission calculations submitted in the various documents of the application:

Existing conditions				App 2A-1
Previous Permits				pg 1/8
AO29-	25324	17813		
	NO 1	NO 2	Average	
TPH	403	450		450
wet	469	525		
lb/hr*	46.3	47.15		45.8
* calculated by FDER on wet basis				
Calculated @ 450 TPH				46.0
act lb/hr	10	17		45.8
TPY	37	71.6		320.6

Proposed conditions			
	App 2A-1	Supp	Final
	pg 5/8	pg 2-5	TABLE I
lb/hr	45.8	25	25
TPY	320.6		175

The following are particulate testing results by Brewster and IMC since the application for the PSD permit. These calculation are based on the individual run determinations rather than the test average results as done in the Supplement calculations.

dryer	lb/hr	no runs	std dev	min	max
Supplement pg 2-5 for 23 tests					
both	14.0	--	8.4	2.7	43.0
Brewster testing since 1980					
no 1	12.7	33	5.7	2.8	27.1
no 2	12.0	30	4.8	6.4	25.1
both	12.4	63	5.3		
IMC testing in 1987					
no 1 4/3	14.8	3	3.0	12.3	19.1
no 1 6/10	12.5	3	1.6	10.8	14.6
no 2 6/9	12.0	3	1.1	10.8	13.4
both	13.1	9	2.4		

5. SULFUR DIOXIDE

The initial calculation of the existing SO_2 emission was based on the allowable emission at 0.8 lb/mmBtu at the proposed operating hours. It was amended in the supplemental submittal based on two years of fuel usage and the rock absorption curve. The following are the emission calculations submitted in the various documents of the application:

Existing	App 2A-1 pg 1/8	Supp Attch 1	Final TABLE I
Limit lb SO2/mmBtu	0.8		1.1
lb/hr	142		195
TPY	992	794	1364

The permits that were in effect at the time of the PSD application:

Dryer	No 1	No 2
AO29-	17813	25324
Limit lb SO2/mmBtu	0.8	0.8
lb/hr	53	201.4
TPY	223.2	749

The proposed SO_2 emission changes were revised several times during the application review process. In the original application, the following calculations were used to estimate the change in the fuels. The major basis of the analysis used was the absorption curve of SO_2 in the rock for various fuel oil sulfur contents. This had previously been investigated by Brewster at the time of the application. The underlining assumption for the fuel conversion was that this absorption would occur in the same manner for COM and coal firing. In the application the following calculations were presented:

App 2A-1 pg 4/8 and Attachment 2

Rock type	annual mix	absorption @2.6%S	@2.3%S
conc	60%	62.0%	65.0%
blend	35%	31.0%	35.0%
pebble	5%	31.0%	33.0%
overall absorption		49.6%	52.9%

fuel	%S	Btu/lb	com ratio	overall 1-abs	pebble 1-abs
oil	0.026	17917	0.48	0.504	0.69
com	0.026	14750		0.504	0.69
coal	0.023	12000	0.52	0.471	0.67

For the annual emissions, the calculation was based on the overall absorption rate for all rock types. For the hourly rate, the pebble rate was used as the worst case. The resulting annual increases were referenced to the annual allowable of 992 TPY.

	TPY SO2	lb/hr pebble	lb/hr average	increase TPY 992 Table 2-1	794
oil	1814	355	259	822	1020
COM	2203	431	315	1211	1409
coal	2239	455	320	1247	1445

In the supplemental submittal, the calculations were redone based on the annual fuel usage and a calculated annual absorption rate to establish the existing annual emissions. This absorption was based on the original production distribution. A worst case distribution was then used to project the new annual emissions for the coal. These and additional absorption rates are in the following table:

Supplement pg 6-2 worst case absorption, Attachment 3

	ann mix	@2.6%S	@2.3%S	@0.8%S	@1.7%S	@2.2%S
conc	60%	62.0%	64.0%	98.0%	75.0%	66.0%
blend	25%	31.0%	35.0%	87.0%	49.0%	47.0%
pebble	15%	31.0%	33.0%	75.5%	42.0%	35.0%
overall absorption		49.6%	52.1%	91.9%	63.5%	56.6%
1-abs			47.9%		36.5%	

The absorption rates were then assumed to apply to the different fuels in order to estimate the new emissions and what the equivalent fuel sulfur contents were for no absorption. These values were presented in Attachment 5 of the Supplement. These were based on the maximum operating condition stated of 177.1 mmBtu/hr and 7000 hours/yr/dryer.

Supplement, Attachment 5

177.1 mmBtu/hr

2479932 mmBtu/yr

				Emission SO2 TPY			equiv
fuel	%S	Btu/lb	absorp	potent	actual	lb/mmBtu	Fuel %S
oil	0.8%	18250	91.9%	1087	88	0.07	0.07%
oil	2.6%	17917	49.6%	3599	1814	1.46	1.31%
com	2.6%	14750	49.6%	4371	2203	1.78	1.31%
coal	2.3%	12000	52.1%	4753	2277	1.84	1.10%
Additional calculations							
oil	2.2%	17917	56.6%	3045	1322	1.07	0.95%
oil	1.7%	17917	63.5%	2353	858	0.69	0.62%
com	2.2%	14750	56.6%	3699	1605	1.29	0.95%
coal	2.2%	12000	56.6%	4547	1973	1.59	0.95%

The 1.6 to 1.8% Sulfur reference in the Preliminary Determination was based on the original permit limit of 0.8 lb/mmBtu or 147.2 lb/hr and not for the BACT determination made of 1.1 lb/mmBtu. The calculation in Attachment 5 should have been redone for the oil. A value of 2.2% Sulfur would have been determined for specification in the permit condition. That fuel specification was ignored in the new limit. The permit condition should be modified to reflect this.

The results of the recent SO_2 testing by Brewster and IMC since the application for the PSD permit. These calculation are based on the individual run determinations.

dryer	lb/hr	no runs	std dev	min	max
Brewster testing since 1980					
no 1	88.4	29	53.0	16.0	246.8
no 2	104.5	28	55.9	14.7	229.6
both	96.3	57	55.0		
IMC testing in 1987					
no 1 4/3	22.3	3	4.1	18.2	27.9
no 1 6/10	7.3	3	1.8	4.8	9.2

no 2 6/9	7.6	3	0.9	6.5	8.9
both	12.4	9	7.5		

There is no corresponding sulfur content information for the Brewster testing available. Fuel samples were collected for the IMC tests. The apparent absorption during this testing was higher than was indicated by the curve presented in the application.

Dryer	%S	gph	lb/gal	Fuel SO2 lb/hr	absorp	App curve
no 1 4/3	1.85%	881	8.176	267	92%	71%
no 1 6/10	1.25%	885	8.088	179	96%	87%
no 2 6/9	1.28%	929	8.100	193	96%	86%

During the two tests done in June by IMC an attempt was made to determine if there were any removal in the scrubber by measuring the sulfate content of the water entering and leaving the scrubber. In the permit submittals, it was indicated that there would be no absorption. This can only be confirmed by direct measurement of the SO_2 of the gas stream. Based on the sulfate measurements, the apparent rock absorption was 92% rather than the 96% indicated above. There seems to be removal in the scrubber based on sulfate change. This could, however, be material in solution that originated from the collected particulate in the scrubber. For the fuel tested, the system exhibits higher absorption than cited in the permit application.

Permit Standard

There is no basis for the revision of the emission limiting standard in the permits. The condition restricting the fuel sulfur content should be amended to reflect the BACT Determination of the review. It was clearly stated that it should be equivalent to 1% Sulfur fuel which occurs at 2.2% S for the absorption stated. The 1.7% S specification coincided to the original permit limit of 0.8 lb/mmBtu which was changed.

6. NITROGEN OXIDES

The initial calculation of the existing emission was based on the value determined from a single test on 1/13/81. The use of this result in the estimation of the existing nitrogen oxide emissions ignored several factors. The following is a recap of the numbers submitted in the various documents of the application:

Nitrogen oxides	App 2A-1 pg 2/8	recalc	Test result 1/13/81	Supp pg 10-1ff	Final TABLE I
nox ppm	61		61	81.3	81
acfm	150000		140486		
dscfm			93529	97218	
tstk	151		149	151	
%HOH			24.1%	25%	
lb/lb-mol	46				
1/385	0.00260			385.2	
pstk	29.921				
scfh nox	474	474	342		
lb/hr	56.6	56.7	40.9	42.5	
tph			345	333	
gal/ton			2.48	2.53	
ton adj			53.3	57.5	56.6
TPY	396.4				396.2

The calculation correction that was used in the Supplemental information submitted was based on a ratio of test tonnage to the stated maximum tonnage of 450 TPH. The corrected emissions changed from 56.6 to 57.4 lb/hr. This was then considered to be "very close" and required no further changes in the related modeling calculations.

It would have been more realistic to have related this change to a ratio of the fuel usage rates 856 to 1170 gph. This would have made a small difference also and supported the previous assumption of no model recalculation.

856 gph for test run of NOx measurement
55.9 lb/hr adjusted for fuel

Heat input comparisons: 151400 Btu/gal

450 TPH @ 2.60 gal/ton	177.1 mmBtu/hr	Stated maximum
450 TPH @ 2.53 gal/ton	172.4 mmBtu/hr	Max TPH @ test gph
345 TPH @ 2.48 gal/ton	129.5 mmBtu/hr	At test run condition

Based on the AP42 NO_2 factor of 60 lb/1000gal for oil and 18 lb/ton for coal, the two ratioing factors were developed. If the oil factor had been used for the test condition, the following emissions would have been calculated at the heat inputs stated:

Application calculations:	AP42			Heat input comparisons lb/hr for AP42 applied to:		
nox	lb/mmBtu	lb/hr	mmBtu/hr:	129.5	172.4	177.1
oil	0.40	56.6	lb/hr:	51.3	68.3	70.2
com		82.9		75.2	100.0	102.8
coal	0.75	107.2		97.2	129.3	132.9

Note that for the test condition, the actual emission exceeded the AP42 value used. The final permit conditions contained the original mass emission rates and the tonnage adjusted concentration limitations:

	ppm	lb/hr	tpy
	81	56.6	396.2
	118	82.3	576.6
	152	106.6	743.0
Max Increase App Table 2-1			346.8

The analysis ignored two elements from AP42 in the consideration of the existing nitrogen oxide emissions from these dryers. It considered only the lower bound of 60 lb/1000gal for oil and did not consider the applicability of the upper limit of 120 lb/1000gal. It also did not consider the emission dependency on the fuel nitrogen content as presented as in the equation (Table 1.3-1, note j):

$$\text{For oil lb/1000gal} = 22 + 400\%N^2.$$

From the numbers contained in the Supplemental Information:

The emission factor: 42.5/333/2.53*1000 lb/mgal =	50.5
For the test run: 40.9/345/2.48*1000 lb/mgal =	47.8

Based on the 50.5 factor, the apparent dryer reduction in emissions from the AP42 is: 84.1%

There were several alternative methods of estimating the actual emissions based on the single test run and AP42.

1. Consider the fuel nitrogen content by modifying the formula such that it matched the determined factor. This would have to have been based on the fuel supplier estimate of 0.27 to 0.29% cited in the Supplement.

$$50.5 \text{ lb/1000gal} = 19.1+400(0.28)^2 \text{ -OR- } 22+363(0.28)^2$$

2. Consider the fuel nitrogen content by assuming the dryer performance is only 84.1% of the AP42 formula.

$$\text{lb/1000gal} = 0.841(22+400(N\%)^2)$$

3. Compensate for the fuel nitrogen content by considering the lower and upper bounds of 60 to 120 lb/1000gal in AP42 at some average condition to reflect existing emissions.

$$\text{lb/1000gal} = 0.841(60+120)/2 = 75.7$$

The method of calculation also implied a reduction in the coal emission factor of 18 lb/ton from AP42. The ratioing technique over estimated the possible emissions at the test condition but under estimated the emission at the maximum stated.

@ 129.5 mmBtu/hr 107.2/97.2 =	110%
@ 177.1 mmBtu/hr 107.2/132.9 =	81%

Since the dryer has not fired coal and an apparent reduction would have been indicated for oil firing based on the single test run, it would have logical to have applied that apparent reduction of 84.1% to the coal factor also. The method of calculation should have been to work in terms of emission factors and then apply the new factors to the estimated maximum fuel firing rate rather than the production tonnage. Using the average factor since the fuel nitrogen content was only an estimate at the time of the application and supplement submittals. The two factors are:

oil 75.7 lb/1000gal
coal 18(0.841) = 15.1 lb/ton

			lb/hr per dryer			both
Fuel	com use	lb/mmBtu	at test	@177.1	change	TPY
oil	0.48	0.50	64.8	88.6	existing	619.9
com		0.57	73.6	100.6	12.1	704.3
coal	0.52	0.63	81.7	111.7	23.2	782.1

Using the formula developed in item 2, the implied fuel nitrogen content for the above factor is:

N% = square root ((75.7-22(0.841))/400/0.841) = 0.41%

Direct application of the AP42 formula to the factors cited implies that the considered range of fuel nitrogen content is:

N% = square root ((60-22)/400) = 0.31%
N% = square root ((120-22)/400) = 0.49%

Measurements

The amount of testing done for nitrogen oxides for these units has been limited. In fact the operation of these units has been limited since October 1986 when IMC took control of the units. For the testing done by IMC, fuel samples have been collected in order to determine the fuel nitrogen content for the purpose of evaluating the emission relationship. The following table presents the extent of the information known about the emissions and the fuel.

Nitrogen content determinations or citations:						Emission comparisons:			
						lb/1000gal		lb/hr @177.1	
Existing emissions	N%:	IMC samples				75.7		88.6	
test	Dryer	cited	Lab A	Lab B	used	meas	eqn2	meas	eqn2
Supplement	both	0.27-0.29%			0.28%	50.5	44.9	59.0	52.5
1/13/81	2	none				47.8			
11/17/82 (1)	1	0.43%			0.43%	63.3	80.7	74.1	94.4
4/10/86	1	none				32.6			
6/17/86	2	none				80.1			
2/26/87 (2)	1		0.77%		0.77%	44.0	218.0	51.5	255.0
3/12/87 (2)	1		0.19%		0.19%	52.8	30.6	61.8	35.9
4/3/87 1	1		0.41%	0.13%	0.27%	51.8	43.0	60.6	50.3
4/3/87 2	1		0.40%	0.27%	0.34%	45.9	56.3	53.8	65.8
6/8/87 1	2			0.25%	0.25%	45.7	39.5	53.4	46.2
6/9/87 2	2			0.14%	0.14%	37.2	25.1	43.6	29.4
6/9/87 3	2			0.28%	0.28%	37.0	44.9	43.3	52.5
6/9/87 4	2			0.23%	0.23%	40.6	36.3	47.5	42.5
6/10/87 5	1			0.15%	0.15%	33.3	26.1	38.9	30.5
6/10/87 6	1			0.23%	0.23%	33.7	36.3	39.4	42.5
6/10/87 7	1			0.30%	0.30%	36.7	48.8	42.9	57.1

(1) Incomplete test, Brewster testing
(2) Preliminary testing, IMC testing start

Because of the limited amount of information, it is difficult to form any conclusions about the approach used to estimate the existing emissions for these units. The assumption of the 84.1% reduction seems to be higher in the lower fuel content range and low in the higher ranges. Using the adjusted AP42 equation, the apparent N% for the 50.5 lb/1000gal was 0.27%. The analysis of the fuel content does not appear to be reliable. The final samples were taken to coincide with the sample test runs within intervals of approximately 1.5 hours. These should be samples of essentially the same fuel. On the 4/3/87 test, the two fuel samples were split and submitted to different laboratories.

The fuel tank which has been used to supply the dryers has a capacity of 200,000 gals. Since IMC operation of these dryers, 185,180 gals of oil have been used as of 9/10/87. This is insufficient volume to have flushed residual amounts of previously used oil from the tank. This could explain the analysis variability. The sulfur content of the same samples did not exhibit the same variations between coinciding sampling times.

Permit Standard

At the time the application for the fuel conversion for these dryers was made, the existing nitrogen oxide emissions for oil were not known. The foregoing analysis refines the estimation of what these emissions should be expected to be. The testing since the IMC operation of these dryers supports this new estimate to some degree. It also illustrates the complexity associated with these emissions and their prediction as compared with the emission of sulfur dioxide. Considerably more testing and research is needed to further refine the estimate of these existing emissions. The estimate presented here is however more reliable than the original approximation based on a single test run.

In the permit conditions, the standard cited was both in terms of lb/hr and concentration as ppm. The Supplemental implied that this was ppm of the dry stack gases. The inclusion of this type of limitation indirectly makes the amount of quench air used in the dryer an operating limitation. This air can vary over a broad range without a major impact on the drying performance of the unit. This is illustrated by the variation in the stack dscfm from previous test averages where the difference in the using the concentration limit could be as much as 17.7 lb/hr:

		@ 81 ppm			@ 81 ppm
no 1	dscfm	lb/hr	no 2	dscfm	lb/hr
Feb-81	94802		Jan-81	96250	
May-81	89468		May-81	98771	
May-82	92550		May-82	99225	
Nov-82	101301		Nov-82	103613	
May-83	85772		May-83	87836	
Dec-83	101336	58.8	Dec-83	106592	61.9
May-84	86685		May-84	94563	
Nov-84	82678		Nov-84	88329	
May-85	87966		May-85	89895	
Nov-85	79938		Nov-85	76096	44.2
May-86	77935		Apr-86	99951	
Jun-86	77912	45.2	May-86	91174	
Apr-87	87909		Jun-87	103563	
Jun-87	85622		Jun-87	97396	
difference		13.6			17.7
average	87991	51.1		95232	55.3
std dev	7234			7742	

In the simplest case, the limit should be specified as lb/hr only. If it is necessary to make it rate related, it should be defined in terms of fuel usage as lb/1000gal or lb/mmBtu rather than as concentration. The emission is related to fuel usage directly.

7. CARBON MONOXIDE

The existing emissions from the dryers was based on the use of the AP42 emission factor for Fuel Oil Combustion, Table 1.3-1, of 5 lb/1000gal. The factor is qualified for industrial and commercial boilers. The factor should represent the emissions resulting from the proper combustion of the fuel by the oil burner. The following numbers were submitted in the various documents of the application:

Existing			App 2A-1 pg 2/8	lb/hr	TPY
CO lb/1000gal			5	5.9	41.0
Proposed			App 2A-1 pg 7/8	lb/hr	tpy
oil	0.005	lb/gal		5.9	41.0
com				6.6	46.5
coal	1	lb/ton		7.4	51.7
Max Increase			App Table 2-1		10.7

Though the phosphate rock dryers are not accurately represented by boiler combustion in all cases, the Carbon Monoxide emission factor from AP42 is a legitimate indication of their emissions. The only source, existing or new, of CO for these units will be the combustion of the fuel. Because of the large amounts of extra air in these dryers and the relatively low energy required in the reaction of CO to CO_2, under normal operation, the CO concentration should be as estimated.

Permit Standard

The limit specified in the permit ignored the difference in the fuels to be used and the analysis in the permit application. The second limit should be added for the use of COM fuel.

8. HYDROCARBONS

The existing emissions from the dryers was based on the use of the AP42 emission factor for Fuel Oil Combustion, Table 1.3-1, of 1 lb/1000gal, expressed as methane. The factor is qualified for industrial and commercial boilers. The factor should represent the emissions resulting from the proper combustion of the fuel by the oil burner. The following is a recap of the numbers submitted in the various documents of the application:

Existing		App 2A-1 pg 3/8	lb/hr	TPY
VOC lb/1000gal		1	1.2	8.2
Proposed		App 2A-1 pg 8/8	lb/hr	TPY
oil	0.001	lb/gal	1.2	8.2
com			1.7	12.0
coal	0.3	lb/ton	2.2	15.5
Max Increase	App Table 2-1			7.3

This calculation addressed only the fuel combustion in the dryer and ignored two other existing sources of volatile organics that could be present in the emissions from the stack. The rock that is being dried will have been treated with reagents during the flotation process of recovery. One of these reagents is No 6 oil, some which could conceivably volatilize during drying. The ambient hydrocarbons in the large quantities of quench air used by the dryer can pass uncombusted to the stack. This should not be true of the combustion air supplied directly to the burner.

Rock Contribution

The estimation of the hydrocarbons associated with the rock is complicated by several factors. The main consideration would be the determination of the volatilizing temperature that the reagent residue would encounter. As a secondary consideration, it could be possible for the evaporation of the water from the rock to somehow cause a type of steam distillation of these residues. The final consideration would the amount that could reach the scrubber stack and not recondense at the operating temperature of the scrubber water.

The nominal operating temperatures and conditions for these dryers are as follows:

1. Combustion of oil -- >2200 deg F
2. Addition of Quench air -- 1600-1800 deg F
3. Rock drying:

	rock	air
in:	60-80	1600-1800 deg F
out:	170-190	180-200 deg F

4. Scrubber in: 180-200 deg F
   out: 150-160 deg F (Saturated)

The rock contribution to the scrubber emissions could considered as two components parts. The first would be those compounds that would be volatile between the rock temperature in and the scrubber exhaust temperature. If the assumption of volatilization is at approximately the boiling point and that molecular weight generally correlates to that

temperature, this group of compounds should have a range of molecular weight of 50-90 lb/lb-mole similar to the examples in the following table. These would result because of the drying. The second group would be those that are volatile below the input rock temperature with molecular weights less than 50 lb/lb-mole. These would evolve because of drying if they had not previously volatilized during storage. This would depend on length of storage time. These could also exist if heavier compounds had somehow changed during drying.

For comparison purposes, the following table contains boiling points for several hydrocarbon materials:

Compound	No C	bp deg F	Mole wt
methane	1	-259	16
ethane	2	-127	30
propane	3	-44	44
butane	4	31	58
pentane	5	97	72
hexane	6	156	86
heptane	7	209	100
octane	8	258	114

Fuels	deg API	bp deg F
gasoline	60	280
naphtha	50	340
kerosine	40	440
fuel oil	30	580

There has been no analysis to determine the portion of the hydrocarbons that would indicate the amounts of compounds associated with the rock for the temperatures specified. In an unrelated study, IMC has determined the amount reagent constituents remaining in the rock after flotation. The amount determined was 0.000092 lb/lb. The problem with this study was the method of analysis. The samples were dried at 105 deg C prior to analysis which would have eliminated the groups that would probably have been emissions in a drying process. The hydrocarbon determinations were then done based on extractions from the rock rather than a thermal removal. The extracted portions were analyzed by fourier transform-infrared and mass spectrometry and compared with samples of the reagents used. The sprectra of the sample extraction was identifiable as the original reagents implying that there had not been a significant change or loss of these materials in the rock.

The materials identified in this study are heavier, high molecular weight, compounds than are to be considered in estimating the emissions through the scrubber from the rock. As a matter of assumption, it seems that a small portion might exist along with the reagents or a small portion of the reagents might be distilled or changed into this emission range of compounds. This will be assumed to 5% of the 0.000092 lb/lb or 0.0092 lb/ton. At a rate of 450 TPH, this equals: 4.1 lb/hr.

Ambient Contribution

In order to compensate for the amount of the ambient hydrocarbon contribution to the stack emissions, it would have be necessary to estimate the amount of the stack flow that would have entered the dryer as quench air and the concentration of hydrocarbons in that air. For oil combustion, it is in the range of 65-80% of the stack dscfm. This will be dependent on the rock moisture content. Using the stack values cited in the calculation of the nitrogen oxide emissions and assuming an ambient concentration of 3 ppm of methane. The following emission factor for the ambient contribution to the stack emissions should have

been developed.

TPH	333				
gal/ton	2.53	gph =	842		
dscfm	97218	x 0.75 =	72913	scf/gal =	5193 quench air
ppm	3	5193x14.696x144/1544/528x16x3/1000 =			
mole wt	16	methane			0.65 lb/1000gal

Ambient contribution to the existing VOC emissions with an ambient concentration of 3 ppm as methane.

at test condition	0.5 lb/hr VOC
@ 177.1 mmBtu/hr	0.8 lb/hr VOC

The impact of the existing emissions from the ambient air and the rock will have the same impact regardless of the fuel being consumed. The predicted differences in combustion as done in the application should have been added to them for each case.

Existing VOC		lb/hr per dryer		change	both
	lb/mmBtu	at test	@177.1	lb/hr	TPY
Rock	0.0234	3.1	4.1	0	29.0
Ambient as methane	0.0043	0.6	0.8	0	5.3
Combustion		lb/hr per dryer			both
Fuel com use	lb/mmBtu	at test	@177.1		TPY
oil 0.48	0.0066	0.9	1.2	0	8.2
com	0.0097	1.3	1.7		12.0
coal 0.52	0.0125	1.6	2.2		15.5
Final emission prediction					
oil 0.48	0.0343		6.1	existing	42.5
com	0.0373		6.6	0.5	46.3
coal 0.52	0.0401		7.1	1.0	49.8
Maximum Increase					7.3

Measurements

Since IMC has operated these dryers, four attempts have been made to measure the VOC emissions as per USEPA requirement. Method 25A was used incorporating an ice bath cooled moisture trap in the sample line during the first three attempts. During the last attempt, a heated sample line was used. The analysis could not be completed due to condensation which occurred in the analyzer itself. The stack moisture content at that time was over 30% by volume.

Since IMC has operated these dryers, there has been no operation of the flotation plant at the Lonesome mine. No new rock has been added to wet rock storage since October 1986. Based on the above discussion of the possible contributions to the VOC emissions, the measurements completed would have indicated those that would be volatile at or below the 32 deg F of the ice bath in the sample line. The two that would have been detected are the ambient component in the quench air and the AP42 combustion component. If there were volatiles from rock present, those that would condense between the ice bath and stack temperatures would not have been detected provided there was not some type of decomposition of the heavier compounds during drying.

During the tests conducted on 6/9 and 6/10, the ambient air was passed through the analyzer and recorded for reference. Using the combustion calculations for the tests to estimate the amount of quench air through the dryers, the ambient concentrations would represent the following stack emissions.

test date	dscfm average stack	quench	meas lb/hr	ambient ppm CH4	lb/hr	lb/1000gal
6/9	97396	76404	0.53	5.85	1.11	1.53
Ambient to violate limit			1.20	6.31	ppm in quench air	
6/10	85622	65520	0.41	2.93	0.48	0.71
Ambient to violate limit			1.20	7.35	ppm in quench air	
					estimate	0.65

During these two tests, two attempts to use a heated sample were unsuccessful. As it was apparent this could not be done, the analyzer was operated using the moisture trap in order to acquire some type of result. The contents of the trap was recovered for the 6/10 test and analyzed for total carbon. No flow or time measurements were recorded for this sample. It was captured during the three runs of the test. It could be the condensibles from the rock discussed above or simply contamination from handling of the equipment by the testers. Based on the amount of carbon detected the following estimate is made:

6/10 test	0.75	mg total carbon in ice trap		
assume	5	hrs operation of train		
	3	lpm sampler flow rate		
	900	liters	0.03531	cf/liter
	31.78	cf		
	0.000053	scf of Carbon	1.67	ppm
	0.000040	scf of methane	1.25	ppm
	0.000014	scf of propane	0.46	ppm

6/10	gph	scfm	TPH			
Run 1	940	85575	450			
Run 2	919	86520	450			
Run 3	795	84772	452			
				lb/hr	lb/mgal	lb/ton
Ave	885	85622	450	0.27	0.30	0.0006
				estimate	3.54	0.0092

The test attempted on 8/28 incorporated the use of a new heated sample line. This line exhibited minor contamination which was to be used as a baseline for the stack measurement. Approximately 10 minutes of stack concentration readings were achieved during this attempted test. The ambient concentration was also determined at that time. Two velocity traverses were also done at that time. The indicated emissions from these limited measurements are as follows:

Stack conditions		Stack	Ambient	
Pstk	14.83 psia	1.53	1.69 ppm propane	
Tstk	621 deg R	4.20	4.65 ppm methane	
%HOH	32.6%		ppm as	
	Stk VOC:	lb/hr	propane	methane
acfm	86655	0.78	1.53	4.20
scfm	50085	0.78	2.27	6.23
Quench - ambient contribution				
scfm	32327	0.32	1.69	4.65

Permit Standard And Testing

In order to be consistent with the intent with the purpose of the PSD permits, the limit applied to the units should apply to the combustion related methane emissions from the fuel firing and ignore the rock and ambient components. The use of Method 25A with the ice bath moisture trap should allow the measurement of the fuel related methane and the ambient component and eliminate the presumed rock contribution. If the ambient concentration is measured and the amount of quench air is calculated, the amount of emission related to the fuel can be determined as the difference of the measured emission and the ambient portion in the quench air. The simplest method of specifying the dryer VOC limits consistent with the original PSD assumptions would be:

Allowable lb/hr VOC excluding ambient contribution in dryer quench air:

1.2 for oil
1.7 for com
2.2 for coal

Stack emissions determined by Method 25A using ice bath moisture trap. Ambient concentration to be determined at time of compliance test. Quench air to be calculated based on stoichiometric combustion of fuel. Compliance emission to be total stack VOC lb/hr minus quench VOC lb/hr.

9. DRYER OPERATION

Phosphate Dryer Operation

Drying of phosphate rock prepares it for either dry grinding or for shipment via railcar or vessel. In general, the rock reports to a dryer from the wet rock storage pile at 10-15 percent moisture. The rock discharges from the dryer at a nominal moisture of 2 percent. This target moisture has been established historically because of the increasing fuel cost at lower moisture levels. A dryer operator will maintain a discharge rock temperature that has been established by past experience to achieve the target moisture content. In most cases, this moisture is not measured until the material is shipped.

The present drying technology in the phosphate industry relies on the use of fluid bed type dryers. The older rotary type dryers are still used in some instances. They are less fuel efficient than the fluid bed type. The rock dryers operate with large amounts of auxiliary air in order to maintain sufficient volumetric flow through the dryer to remove the evaporated water through the exhaust system. A drying system consists of ID and exhaust fans, a burner, a windbox or plentum, a drying region, cyclones, and an emission control device. The burner is used to heat the quench air in the windbox. Generally, the ID fan supplies both the quench air and the combustion air needed by the burner. The exhaust fan supplies the energy to move the gas through the cyclones and the control device. In general, the power of this fan will determine the volumetric capacity of the drying system. The operator will set this fan to its maximum limit and adjust the ID fan to the balance point for the dryer by adjusting the system pressure. This may be done by observing leakage at the dryer feed chute. The operator will also set the temperature to be maintained in the windbox by the fuel supply system to the burner. The target rock temperature is achieved by automatic variation of the feed rate to the dryer by the rock feeder system.

The operator maintains the system at the required settings and records readings from the various instrumentation located in his control room. These readings are made hourly for the purpose of having the capability to review operating conditions. The operators make these readings to the nearest 15 minute interval. The product tonnage rate is usually determined by scale on the dry product conveyor to dry storage. This is an informational type measurement and is not required for the operation of the drying system. The accounting measurement is made by calibrated scales as the final product is shipped. Drying is an intermediate step in the process.

Drying performance

Each drying system will have a basic physical characteristic based on the system components that will determine its volumetric capacity. For this system, the operating temperature in the windbox will determine the fuel usage rate for a particular operating period. This temperature has been established historically. It is basically the maximum temperature that can be used that will not cause excessive long term wear to the dryer refractory. This is in effect the operating maximum condition for a particular dryer and the maximum amount of water that it can

evaporate.

The dryer production tonnage, given that the heat input is at its maximum condition, depends on the type and moisture content of the material being dried. The only basic type difference for phosphate rock is in the size of the individual particles. Larger particles dry more slowly than small ones. The moisture content depends on the length of time the rock has had to drain on the storage pile or the amount of recent rain fall on the storage pile. The larger materials are dried to a higher final target rock temperature that has been established from past experience. As the system drys wetter material, the tonnage is simply reduced since the fuel is at its maximum. This occurs automatically and cannot be controlled by the operator.

Dryer Analysis

The operating logs of four IMC dryers have been analyzed in order to compare the fuel usage rate and the rock production tonnage. The No 1 and No 2 Dryers are located at the Noralyn Mine near Bartow. No 1 Dryer is a rotary type dryer. The other three are fluid bed type. The Kingsford Mine is located south of Mulberrry. The IMC Terminal is located at Port Sutton in Tampa. The period of analysis was calendar year 1986. All the dryers fired natural gas.

The analysis was conducted for all operating periods of 4 or more hours within an 8 hour shift. This period would be the minimum to complete a particulate test and should minimize the impact of recording to the nearest 15 minute interval. In the cases where operation periods were interrupted with down time due to problems, the usage was adjusted to make continuous operating periods in the calculations. All scales are located on the dry side of the dryers. There are no records of the feed moisture content for any of the logs. The calibration status of the scales and fuel meters is likely to be relatively consistent even though the absolute values could be different. The Terminal log gas usage rate was multiplied by a factor to equate it to the monthly gas supply bill. For part of September, the gas meter did not work so there were no readings to consider.

The four graphs present a comparison of the tonnage and fuel rate for each operating period of 4 hours or more. These graphs illustrate the existence of the fuel maximum while showing the variation of the tonnage due largely to moisture content. The data used to produce this analysis is basically in the state it appears on the logs. If the moisture content had been known, it could be refined further. Knowledge of system status could be used to further evaluate some of the pairs that appear well beyond the physical ranges of the systems.

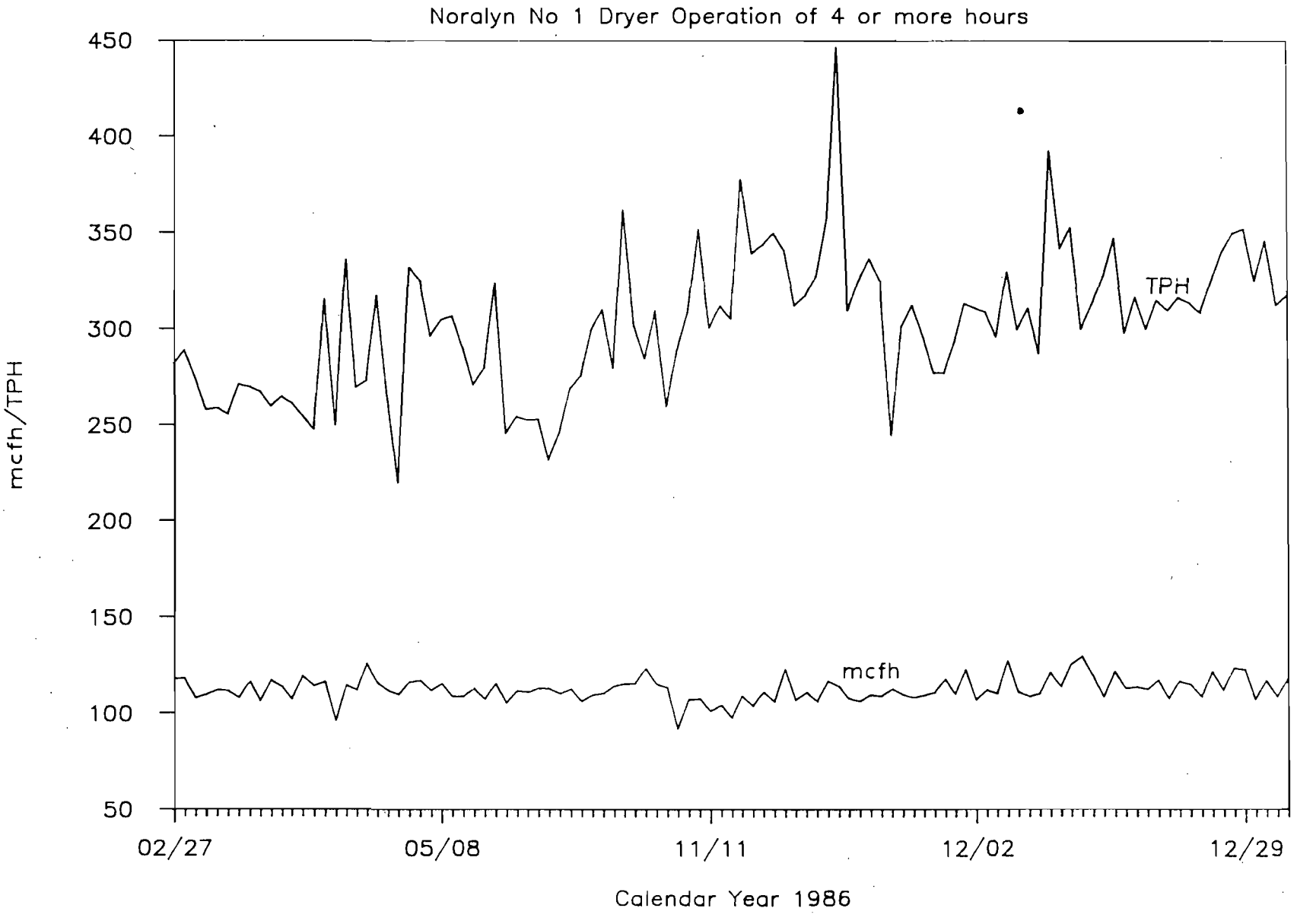
The final graph was generated based on a model developed based on volumetric flow, water, and heat balances for a dryer. The basis is the recent particulate tests of several of these dryers by collecting the information that is needed beyond the normal records for the tests and because of the volumetric determination of the test. The model is a qualitative indication of the operation. It can be further refined with additional information in future testing. The graph presents the likely tonnage for varying moisture content and feed type. The two curves show the difference between a rock temperature of 170 and 200 deg F which

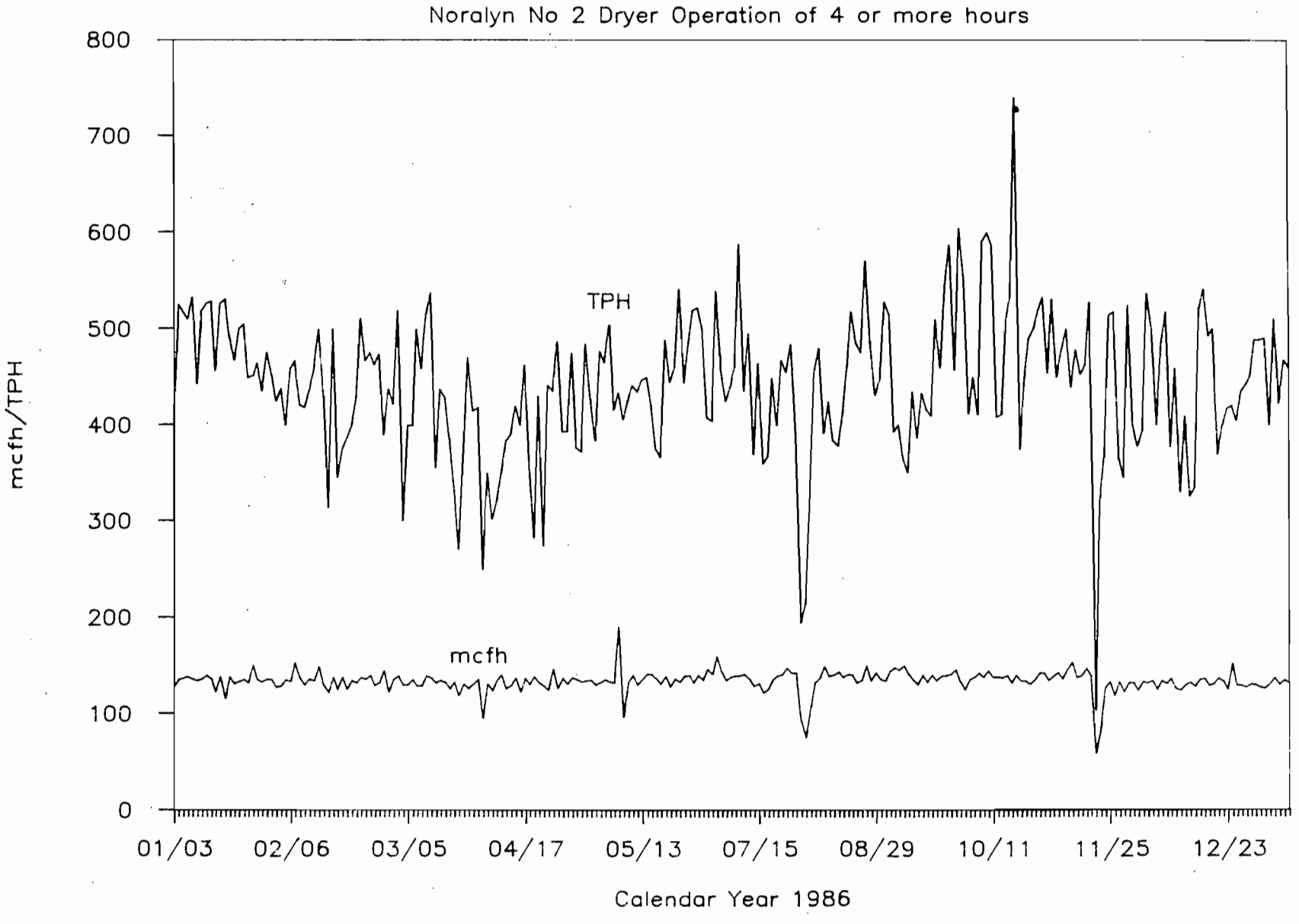
represents the impact of the size of the material. The major impact on the tonnage from the dryer will be caused by the incoming moisture content of the feed material.

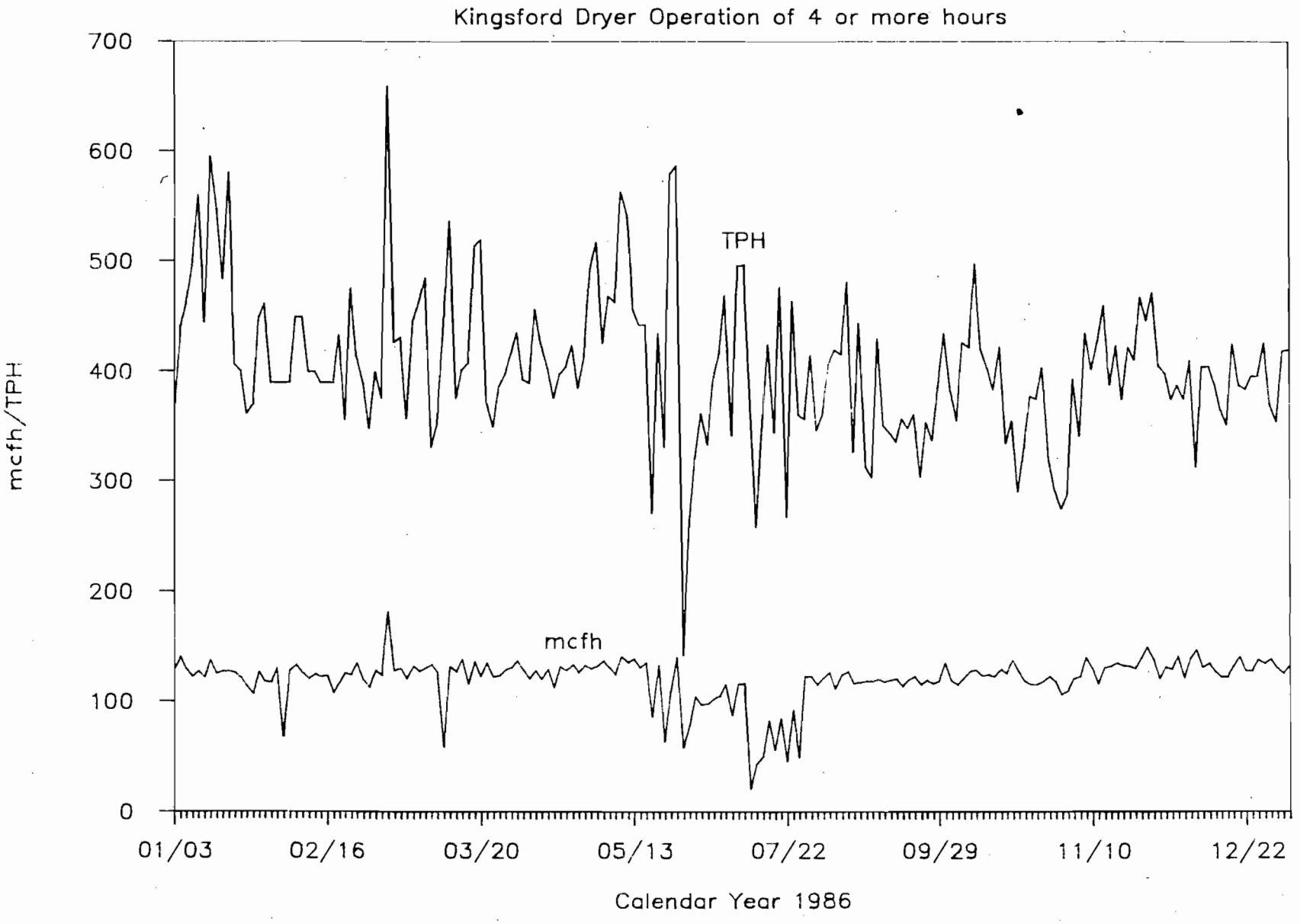
The following table presents various statistical parameters for the dryer operation for 1986.

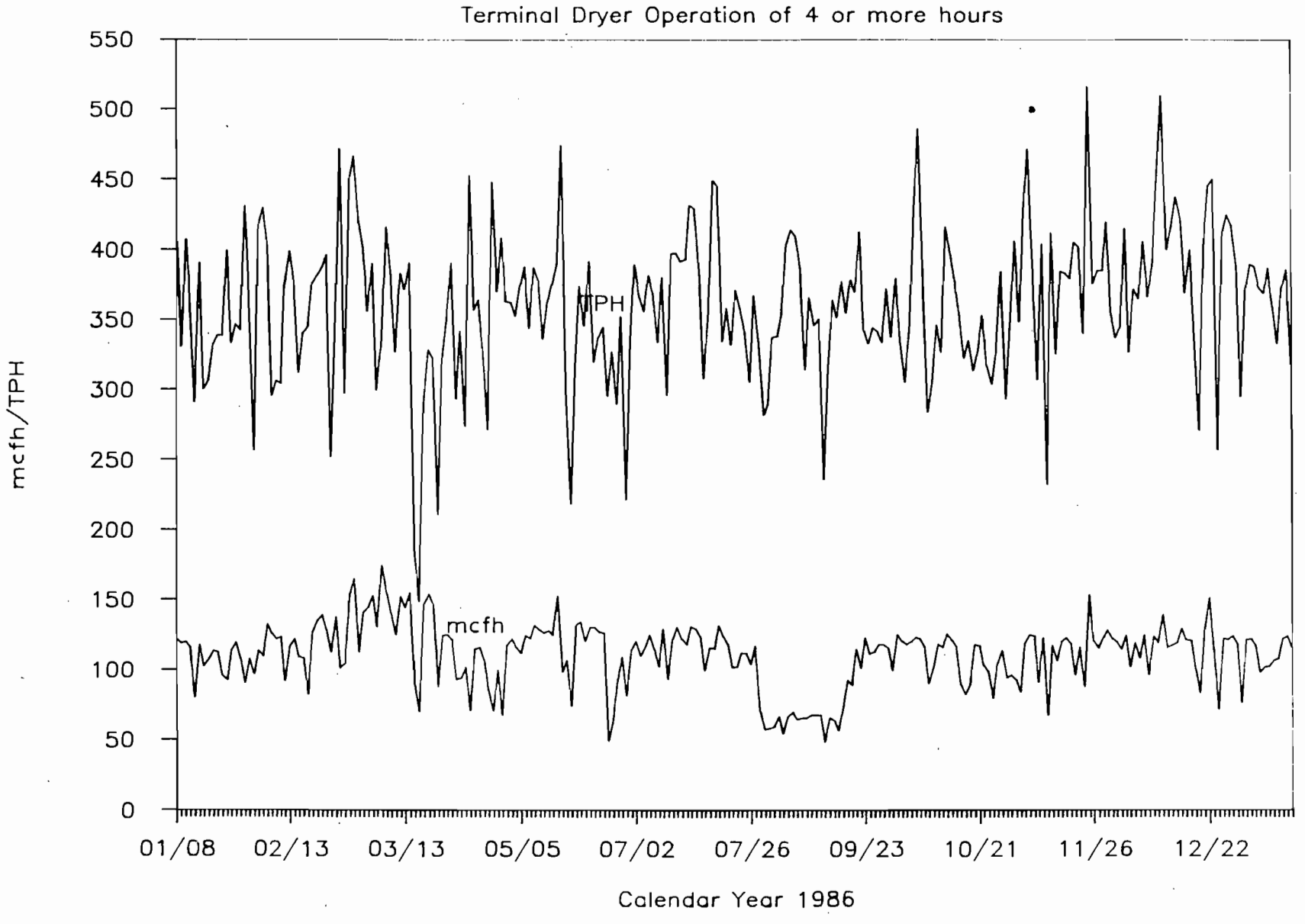
Calendar Year 1986	Dryer Operation Comparison							
Tonnage	Noralyn No 1		Noralyn No 2		Kingsford Dryer		Terminal Dryer	
Operation hours	4 or more	All	4 or more	All	4 or more	All	4 or more	All
No readings	105	431	239	1207	185	372	257	758
No adjustments	1	3	0	8	34	62	61	136
Total tons	176140	360070	537671	1369676	462641	603652	529440	890635
Total hours	583.3	1163.0	1221.3	3039.0	1146.1	1491.5	1468.3	2494.8
Total/hours tph	302.0	309.6	440.3	450.7	403.7	404.7	360.6	357.0
Average individual	302.9 tph		442.3 tph		405.5 tph		361.0 tph	
Minimum	220.0 tph		103.6 tph		142.5 tph		149.3 tph	
Maximum	446.7 tph		740.0 tph		659.4 tph		516.3 tph	
Std deviation	36.4 tph		74.1 tph		68.9 tph		52.6 tph	
Per cent	12.0%		16.8%		17.0%		14.6%	
No > Total/hours	55		125		87		135	
Average avg + dev	339.3 tph		516.4 tph		474.4 tph		413.6 tph	
No > avg + dev	17		37		24		34	
Per cent	16.2%		15.5%		13.0%		13.2%	

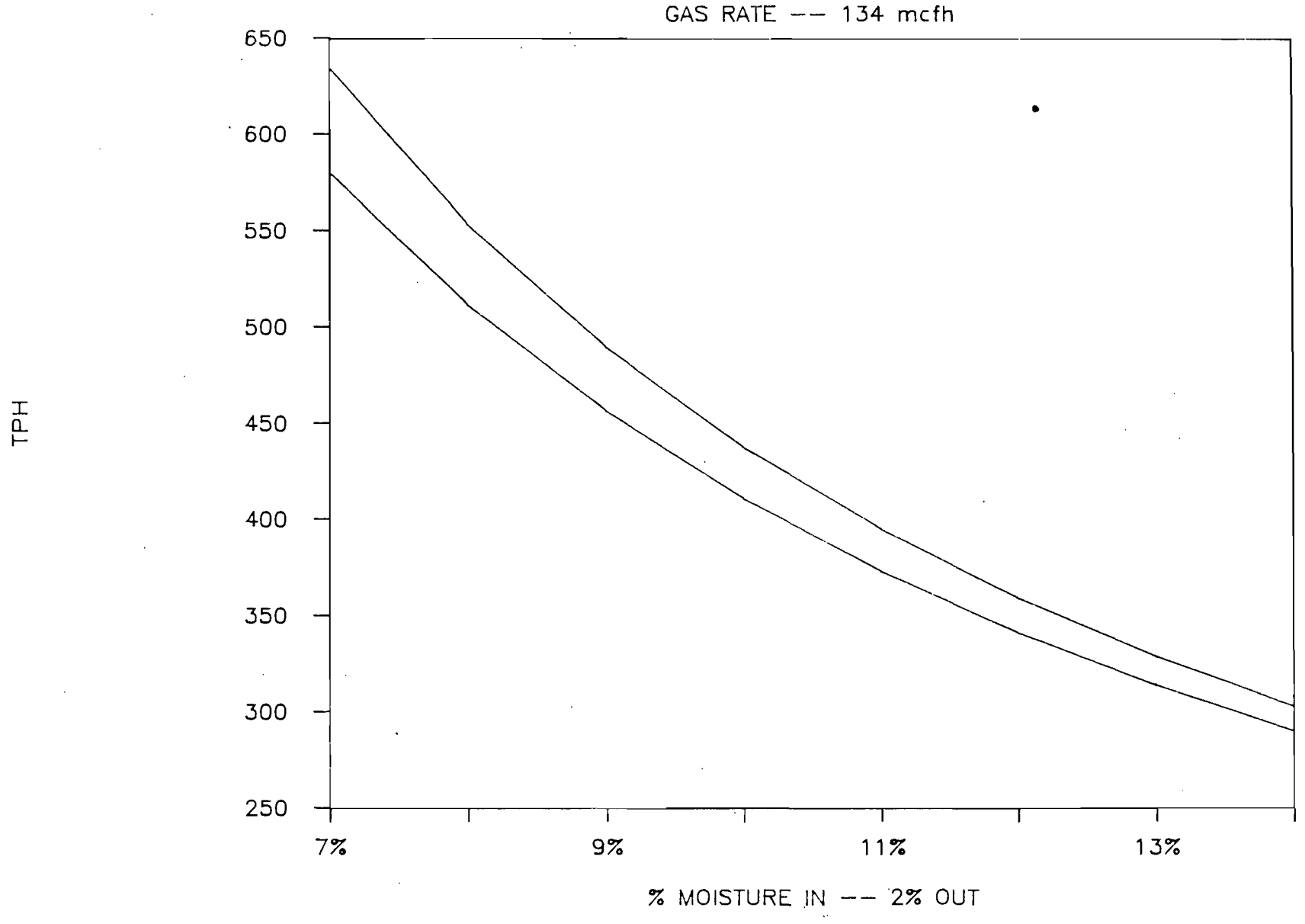
Gas Usage								
Operation hours	4 or more	All	4 or more	All	4 or more	All	4 or more	All
No readings	105	431	239	1207	183	367	244	725
No adjustments	1	3	0	8	34	62	61	136
Total 100cf	655493	1334652	1631231	4078730	1361517	1770537	1088095	1823195
Total hours	583.3	1163.0	1221.3	3039.0	1133.8	1474.5	1391.5	2382.0
Total/hours mcfh	112.4	114.8	133.6	134.2	120.1	120.1	78.2	76.5
Average individual	112.7 mcfh		133.9 mcfh		120.8 mcfh		110.8 mcfh	
Minimum	92.2 mcfh		59.0 mcfh		21.0 mcfh		49.0 mcfh	
Maximum	129.8 mcfh		190.8 mcfh		182.5 mcfh		174.9 mcfh	
Std deviation	6.2 mcfh		11.3 mcfh		20.7 mcfh		22.9 mcfh	
Per cent	5.5%		8.5%		17.2%		20.7%	
No > Total/hours	49		138		125		215	
Average avg + dev	118.8 mcfh		145.3 mcfh		141.5 mcfh		133.8 mcfh	
No > avg + dev	14		18		4		22	
Per cent	13.3%		7.5%		2.2%		9.0%	


Noralyn No 1 Dryer Operation of 4 or more hours
450
400
350
300
250
200
150
100
50
mcfh/TPH
TPH
mcfh
02/27
05/08
11/11
12/02
12/29
Calendar Year 1986


Noralyn No 2 Dryer Operation of 4 or more hours
800
700
600
500
400
300
200
100
0
mcfh/TPH
TPH
mcfh
01/03
02/06
03/05
04/17
05/13
07/15
08/29
10/11
11/25
12/23
Calendar Year 1986


Kingsford Dryer Operation of 4 or more hours
700
600
500
400
300
200
100
0
mcfh/TPH
TPH
mcfh
01/03
02/16
03/20
05/13
07/22
09/29
11/10
12/22
Calendar Year 1986


Terminal Dryer Operation of 4 or more hours
mcfh/TPH
550
500
450
400
350
300
250
200
150
100
50
0
TPH
mcfh
01/08
02/13
03/13
05/05
07/02
07/26
09/23
10/21
11/26
12/22
Calendar Year 1986


GAS RATE -- 134 mcfh
650
600
550
500
450
400
350
300
250
TPH
7%
9%
11%
13%
% MOISTURE IN -- 2% OUT

Maximum Condition

The reproducable maximum for a phosphate rock dryer will that of the fuel usage. It is dictated by the physical constraints of the system, usually be the capacity of the exhaust fan. In the ultimate, if all the other system components had sufficient capacity, it would be the design limit of the burner. In the practical case, if this were true, the burner would be replaced by a larger one. The maximum tonnage for a dryer will occur when, with the maximum fuel, the driest rock from the storage pile is dried. This cannot be predicted in advance. When it occurs, it may or not be reproducable in the next hour or day of operation. From one operation to another, it is more likely that the amount of water evaporated will be the same. It would be more to legitimate to specify a maximum tonnage for a specified moisture change that is equivalent to the maximum heat input.

Lonesome Dryer Operating Condition

The 450 TPH operating condition served as the basis for the PSD application for the fuel conversion of the two dryers. These dryers had fired only oil prior to the application. A fuel usage of 2.6 gal/ton was used to calculate a rate of 177.1 mmBtu/hr or 1170 gph to coincide with the dryer tonnage of 450 TPH. For comparison, the three fuild bed dryers analyzed above had annual averages of 451, 405, and 357 TPH in 1986. These dryers are physically smaller than those at Lomesome. Based on the analysis results, they achieve an equivalent fuel usage of 2.05 gal/ton during drying:

Analysis results

	Nor 2	Kin	PTC	for:	1026 Btu/cf
TPH	442	406	361		151400 Btu/gal
mcfh	134	121	111		
mmBtu/hr	137	124	114		
gph	907	819	751		
gal/ton	2.05	2.02	2.08	average	2.05

Potential Lonesome tonnage: 1170/2.05 = 571 @ 2% HOH
559 dry

The tonnages in the analysis were on a dried basis as measured by scales located on the dryer discharge belts. The drying target moisture for these dryers was 2%. It is not measured at this point before storage. The input rock tonnage is measured at the Lonesome dryers which means that the 571 TPH would actually be higher on a wet basis and 559 TPH on a dry basis. This is significantly different the stated design of 450 TPH.

The design tonnage was the original number used prior to the construction of the dryers. The original heat input specified for these dryer prior to construction was 190 mmBtu/hr. This is equivalent to a fuel usage of 2.8 gal/ton. For the emission testing done by Brewster from 1981 to 1986, the average fuel usage reported was 2.3 gal/ton implying that the dryers were operated at less than the rated heat input capacity. It is not known why the original rate of 190 mmBtu/hr was not achieved.

In order to be consistent with operating procedures for the proper operation of a fluid bed type phosphate rock dryer, the permit for those dryers should be based on the heat input rate which is the maximum operating condition rather than the resulting rock tonnage. The original specification of 190 mmBtu/hr has not been verified. At this time, the 177 mmBtu/hr may be more related to operating experience than any other number available. This maximum needs to be established in operation. The annual average for the dryer fuel usage should be within 10-15% of the maximum value. If the 177 value is used, then the annual average fuel usage should be at least 150 mmBtu/hr.

The 150 mmBtu/hr should be used as a nominal starting point for the permit if it modified to reflect the actual operating procedure for the dryer instead of the specification of a maximum tonnage rate. Permit provision should be made to revise this condition as operating experience is obtained.

10. MODELING CONSIDERATIONS

The corrections to the original emission estimates has essentially no impact on the the parameters modeled to establish the various ambient air quality impacts required in the PSD review. These revised estimates would apparently effected the exemption from the preconstruction ambient monitoring requirement for Nitrogen Oxides when considering the use of coal as the worst case emission condition. As the operating permits are currently issued by the FDER, the dryers are not permitted to use coal as fuel unless the permits are modified to permit its use. Under this constraint, no impact determinations have been changed in conclusion.

The following are the various tables from the Determination document showing the changes that the emission corrections result in:

pg B-5	Air Quality Impact		new	De Minimus
			microgram/cm^3	
	SO2		14.8	13
	NOx		13.7	14.4	14
	Comparisons:			
		oil	7.3	11.4	
		com	10.6	12.9	
		coal	13.7	14.4	

pg B-5	Existing Air Quality		
			microgram/cm^3
	SO2	Annual	3.8
	SO2	24-hour	35
	SO2	3-hour	112
	NOx	Annual	16

pg B-8	Projected Air Quality			new
			microgram/cm^3	
	SO2	Annual	7.8	
	SO2	24-hour	121.8	
	SO2	3-hour	231.5	
	NOx	Annual	17	17.05

Using an impact value of 1 which was stated as <1