



KOOGLER & ASSOCIATES  
ENVIRONMENTAL SERVICES  
4014 NW THIRTEENTH STREET  
GAINESVILLE, FLORIDA 32609  
904/377-5822 • FAX 377-7158

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DEC 1 1989

DER-BAQM

KA 230-89-01

November 30, 1989

Mr. C.H. Fancy  
Assistant Director  
Florida Department of  
Environmental Regulation  
2600 Blair Stone Road  
Tallahassee, Florida 32399-2400

Subject: Application for a PSD Construction Permit Review  
for Royster Phosphates, Inc., Manatee County, Florida

Dear Mr. Fancy:

Enclosed are four (4) copies of an application for a PSD Construction Permit Review, submitted on behalf of Royster Phosphates, Inc., in Manatee County, Florida, for a double absorption sulfuric acid plant.

Also enclosed is Royster's Check No. 82008524 in the amount of \$5000.00, the PSD application fee.

If you have any questions concerning the enclosed applications or if you require additional information, please do not hesitate to give me a call.

Very truly yours,

KOOGLER & ASSOCIATES

  
John B. Koogler, Ph.D., P.E.

JBK:mab

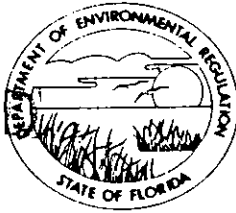
cc: Mr. Ivan Nance, Royster Phosphates, Inc.

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL REGULATION

#5000 pd.  
12-1-89  
Recpt. #117679

SOUTHWEST DISTRICT  
4520 OAK FAIR BLVD.  
TAMPA, FLORIDA 33610-7347  
813-623-5561  
Suncom-552-7612

RECEIVE



AC41-173305  
PSD-FL-144

BOB MARTINEZ  
GOVERNOR  
DALE TWACHTMANN  
SECRETARY  
DR. RICHARD D. GARRITY  
DISTRICT MANAGER

DEC 1 1989

DER-BAQM  
APPLICATION TO ~~OPERATE~~/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Double Absorption Sulfuric Acid Plant [X] New<sup>1</sup> [ ] Existing<sup>1</sup>  
APPLICATION TYPE: [X] Construction [ ] Operation [ ] Modification  
COMPANY NAME: Royster Phosphates, Inc. COUNTY: Manatee

Identify the specific emission point source(s) addressed in this application (i.e. Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) New Sulfuric Acid Plant

SOURCE LOCATION: Street U. S. Hwy 41 City Palmetto  
UTM: East 17-348.5 North 3057.3  
Latitude 27° 37' 58" N Longitude 82° 32' 8" W

APPLICANT NAME AND TITLE: Gary L. Dahms, Vice President & General Manager  
APPLICANT ADDRESS: P.O. Box 1329, Palmetto, Fl 34220

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative\* of Royster Phosphates, Inc.

I certify that the statements made in this application for a construction permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

\*Attach letter of authorization

Signed: Gary L. Dahms  
Gary L. Dahms, Vice President & General Manager  
Name and Title (Please Type)

Date: 11/30/89 Telephone No. (813) 722-4555

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)

This is to certify that the engineering features of this pollution control project have been ~~designed~~/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgment, that

<sup>1</sup> See Florida Administrative Code Rule 17-2.100(57) and (104)

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed \_\_\_\_\_

\_\_\_\_\_  
Name (Please Type)

\_\_\_\_\_  
Company Name (Please Type)

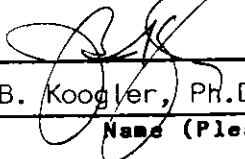
\_\_\_\_\_  
Mailing Address (Please Type)

Florida Registration No. \_\_\_\_\_ Date: \_\_\_\_\_ Telephone No. \_\_\_\_\_

**SECTION II: GENERAL PROJECT INFORMATION**

- A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- B. Schedule of project covered in this application (Construction Permit Application Only)
- Start of Construction \_\_\_\_\_ Completion of Construction \_\_\_\_\_
- C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.
- \_\_\_\_\_
- \_\_\_\_\_

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed   
John B. Koogler, Ph.D., P.E.  
Name (Please Type)  
Koogler & Associates, Environmental Services  
Company Name (Please Type)  
4014 N.W. 13th Street, Gainesville, FL 32609  
Mailing Address (Please Type) --  
Florida Registration No. 12925 Date: 11/30/89 Telephone No. (904) 377-5822

**SECTION II: GENERAL PROJECT INFORMATION**

Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

See Section 1.3 of attached report. This plant will operate in full compliance with applicable regulations.

B. Schedule of project covered in this application (Construction Permit Application Only)

Start of Construction July 1990 Completion of Construction December 1991

C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

Absorbing towers for SO<sub>2</sub> emissions are considered part of the production process rather than pollution control devices. Acid mist is controlled by Monsanto Enviro-Chem high efficiency mist eliminators which cost a total of \$355,000 for both absorbing towers.

Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

Operating permit for existing sulfuric acid plant.

Permit No. A041-121085; Issued: July 31, 1986; Expires: July 15, 1991

E. Requested permitted equipment operating time: hrs/day 24 ; days/wk 7 ; wks/yr 52 ;  
if power plant, hrs/yr \_\_\_\_\_ ; if seasonal, describe: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

F. If this is a new source or major modification, answer the following questions.  
(Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? NO  
a. If yes, has "offset" been applied? NA  
b. If yes, has "Lowest Achievable Emission Rate" been applied? NA  
c. If yes, list non-attainment pollutants. NA
2. Does best available control technology (BACT) apply to this source?  
If yes, see Section VI. YES (1)
3. Does the State "Prevention of Significant Deterioration" (PSD)  
requirement apply to this source? If yes, see Sections VI and VII. YES (1)
4. Do "Standards of Performance for New Stationary Sources" (NSPS)  
apply to this source? YES (1)
5. Do "National Emission Standards for Hazardous Air Pollutants"  
(NESHAP) apply to this source? NO
- H. Do "Reasonably Available Control Technology" (RACT) requirements apply  
to this source? NO  
a. If yes, for what pollutants? NA  
b. If yes, in addition to the information required in this form,  
any information requested in Rule 17-2.650 must be submitted.

Attach all supportive information related to any answer of "Yes". Attach any justifi-  
cation for any answer of "No" that might be considered questionable.

(1) Additional information is supplied in the attached report.

**SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)**

**A. Raw Materials and Chemicals Used in your Process, if applicable:**

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
Sulfur	Ash	0.005	73791	Furnace of Figure 3-1 (See attached report)

**B. Process Rate, if applicable: (See Section V, Item 1)**

1. Total Process Input Rate (lbs/hr): 73791 as sulfur

2. Product Weight (lbs/hr): 228,426 as 98.5% H<sub>2</sub>SO<sub>4</sub>

**C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)**

Name of Contaminant	Emission <sup>1</sup>		Allowed Emission Rate per Rule 17-2	Allowable <sup>3</sup> Emission lbs/hr	Potential <sup>4</sup> Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
SO <sub>2</sub>	450	1971	17-2.600(2)(b)	450	3380	14800	*
NO <sub>x</sub>	13.4	58.7	17-2.630	13.4	13.4	58.7	*
Acid Mist	16.9	74	17-2.600(2)(b)	16.9	169	740	*
VE	10%	-	17-2.600(2)(b)	10%	-	-	*

\*Discharge to Atmosphere of Figure 3-1 (see attached report).

<sup>1</sup>See Section V, Item 2.

<sup>2</sup>Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

<sup>3</sup>Calculated from operating rate and applicable standard.

<sup>4</sup>Emission, if source operated without control (See Section V, Item 3).

Potential SO<sub>2</sub> emissions are based on a 97.7% absorption efficiency for single absorption plant and acid mist emissions are based on a 90% overall mist eliminator efficiency.

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
Dual Absorption Towers	SO <sub>2</sub>	99.7%	NA	Design & Tes
High Efficiency Mist Eliminators	Acid Mist	95-98%	1 - 3 microns	Design & Tes
	Acid Mist	85-95%	0.75 - 1 microns	Desing & Tes
	Acid Mist	70-85%	0.5 - 0.75 microns	Desing & Tes

E. Fuels NOT APPLICABLE

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	

\*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, other--lbs/hr.

Fuel Analysis:

Percent Sulfur: \_\_\_\_\_ Percent Ash: \_\_\_\_\_

Density: \_\_\_\_\_ lbs/gal Typical Percent Nitrogen: \_\_\_\_\_

Heat Capacity: \_\_\_\_\_ BTU/lb \_\_\_\_\_ BTU/gal

Other Fuel Contaminants (which may cause air pollution): \_\_\_\_\_

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average NA Maximum \_\_\_\_\_

G. Indicate liquid or solid wastes generated and method of disposal.

None

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: 200 ft. Stack Diameter: 9.25 ft.  
 Gas Flow Rate: 126949 ACFM 106395 @ 68°F DSCFM Gas Exit Temperature: 170 °F.  
 Water Vapor Content: 0 % Velocity: 31.5 FPS

SECTION IV: INCINERATOR INFORMATION  
 NOT APPLICABLE

Type of Waste	Type 0 (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste \_\_\_\_\_

Total Weight Incinerated (lbs/hr) \_\_\_\_\_ Design Capacity (lbs/hr) \_\_\_\_\_

Approximate Number of Hours of Operation per day \_\_\_\_\_ day/wk \_\_\_\_\_ wks/yr. \_\_\_\_\_

Manufacturer \_\_\_\_\_

Date Constructed \_\_\_\_\_ Model No. \_\_\_\_\_

	Volume (ft) <sup>3</sup>	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: \_\_\_\_\_ ft. Stack Diameter: \_\_\_\_\_ Stack Temp. \_\_\_\_\_

Gas Flow Rate: \_\_\_\_\_ ACFM \_\_\_\_\_ DSCFM\* Velocity: \_\_\_\_\_ FPS

\*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control device:  Cyclone  Wet Scrubber  Afterburner  
 Other (specify) \_\_\_\_\_



Brief description of operating characteristics of control devices: \_\_\_\_\_

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.): \_\_\_\_\_

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

#### SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]  
(SEE SECTION 111B)
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.  
(SEE ATTACHED REPORT)
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).  
(SEE ATTACHED REPORT)
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)  
(SEE ATTACHED REPORT)
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).  
(SEE SECTION 111D AND ATTACHED REPORT)
6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.  
(SEE FIGURE 3-1 IN ATTACHED REPORT)
7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Example: Copy of relevant portion of USGS topographic map).  
(SEE FIGURES 2-1 AND 2-2 IN ATTACHED REPORT)
8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.  
(SEE FIGURES 3-1 AND 3-2 IN ATTACHED REPORT)

DER Form 17-1.202(1)

Effective November 30, 1982

Page 7 of 12

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.
10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

**SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY**  
SEE ATTACHED REPORT

- A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

Yes  No

Contaminant	Rate or Concentration

- B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

Yes  No

Contaminant	Rate or Concentration

- C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration

- D. Describe the existing control and treatment technology (if any).

- |                           |                          |
|---------------------------|--------------------------|
| 1. Control Device/System: | 2. Operating Principles: |
| 3. Efficiency:*           | 4. Capital Costs:        |

\*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant

Rate or Concentration

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height:

ft.

b. Diameter:

ft.

c. Flow Rate:

ACFM

d. Temperature:

°F.

e. Velocity:

FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary).

1.

a. Control Device:

b. Operating Principles:

c. Efficiency:<sup>1</sup>

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:<sup>2</sup>

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:<sup>1</sup>

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:<sup>2</sup>

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

<sup>1</sup>Explain method of determining efficiency.

<sup>2</sup>Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:<sup>1</sup>

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:<sup>2</sup>

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:<sup>1</sup>

d. Capital Costs:

e. Useful Life:

f. Operating Cost:

g. Energy:<sup>2</sup>

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected:

1. Control Device:

2. Efficiency:<sup>1</sup>

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:<sup>2</sup>

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

Explain method of determining efficiency.

<sup>2</sup>Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:<sup>1</sup>

Contaminant

Rate or Concentration


(8) Process Rate:<sup>1</sup>

b. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:<sup>1</sup>

Contaminant

Rate or Concentration


(8) Process Rate:<sup>1</sup>

10. Reason for selection and description of systems:

<sup>1</sup>Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

**SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION**

SEE ATTACHED REPORT

**A. Company Monitored Data**

1. \_\_\_\_\_ no. sites \_\_\_\_\_ TSP \_\_\_\_\_ ( ) SO<sub>2</sub>\* \_\_\_\_\_ Wind spd/dir

Period of Monitoring \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ to \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
month day year month day year

Other data recorded \_\_\_\_\_

Attach all data or statistical summaries to this application.

\*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

a. Was instrumentation EPA referenced or its equivalent?  Yes  No

b. Was instrumentation calibrated in accordance with Department procedures?  
 Yes  No  Unknown

B. Meteorological Data Used for Air Quality Modeling

1. \_\_\_\_\_ Year(s) of data from \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ to \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
month day year month day year

2. Surface data obtained from (location) \_\_\_\_\_

3. Upper air (mixing height) data obtained from (location) \_\_\_\_\_

4. Stability wind rose (STAR) data obtained from (location) \_\_\_\_\_

C. Computer Models Used

1. \_\_\_\_\_ Modified? If yes, attach description.
2. \_\_\_\_\_ Modified? If yes, attach description.
3. \_\_\_\_\_ Modified? If yes, attach description.
4. \_\_\_\_\_ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate
TSP	_____ grams/sec
SO <sub>2</sub>	_____ grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e., jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

REPORT IN SUPPORT OF  
AN APPLICATION FOR A PSD  
CONSTRUCTION PERMIT REVIEW

PREPARED FOR:

ROYSTER PHOSPHATES, INC.  
MANATEE COUNTY  
PALMETTO, FLORIDA

NOVEMBER 30, 1989

PREPARED BY:

KOGLER & ASSOCIATES  
4014 N.W. 13TH STREET  
GAINESVILLE, FLORIDA 32609  
(904) 377-5822

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## 1.0 SYNOPSIS OF APPLICATION

### 1.1 Applicant

Royster Phosphates, Inc.  
U.S. Highway 41  
P.O. Box 1329  
Palmetto, Florida 34220

### 1.2 Facility Location

Royster Phosphates, Inc. operates a phosphate chemical fertilizer manufacturing facility approximately nine miles north of Palmetto, Florida on U.S. Highway 41 in Manatee County. The complex occupies 660.7 acres and the UTM coordinates are Zone 17, 348.5 km east and 3057.3 km north.

### 1.3 Project Description

Royster Phosphates, Inc. is proposing to construct a Monsanto Enviro-Chem double absorption sulfuric acid plant and a cogeneration facility which will use export steam from the new sulfuric acid plant to generate electrical power. The new sulfuric acid plant will have a rated capacity of 2700 short tons per day of 100 percent  $H_2SO_4$ . The cogeneration facility will be rated at 20.8 megawatts average annual export of electrical power.

Royster has one existing double absorption sulfuric acid plant which has a permitted capacity of 2000 short tons per day of 100 percent  $H_2SO_4$ . This plant will be permanently shutdown when the new sulfuric acid plant

is operational. The proposed changes will result in a total increase of sulfuric acid capacity from 2000 tons per day to 2700 tons per day.

Due to the increased production capacity of the new sulfuric acid plant, there will be an increase in the hourly emission rate of sulfuric dioxide, acid mist and nitrogen oxides. In addition, the increase in production capacity along with the expected increase in the operating factor for the new plant will result in significant increases in the total annual emissions of sulfur dioxide and acid mist but a less than significant increase in the total annual emissions of nitrogen oxides.

Royster is submitting the material herein to support an application to the Florida Department of Environmental Regulation for constructing a new sulfuric acid plant. This report includes a description of the existing facility, a description of the proposed new sulfuric acid plant, a review of Best Available Control Technology, an air quality review and an evaluation of the impact of the proposed modifications on soils, vegetation and visibility.

## 2.0 DESCRIPTION OF EXISTING FACILITY

Royster Phosphates, Inc. operates a phosphate chemical fertilizer manufacturing facility approximately nine miles north of Palmetto, Florida, on U.S. Highway 41 in Manatee County (See Figures 2-1 and 2-2). The complex occupies 660.7 acres and the UTM coordinates are Zone 17, 348.5 km east and 3057.3 km north.

The existing fertilizer complex consists of one sulfuric acid plant, one phosphoric acid plant, one ammonium phosphate plant producing diammonium phosphate (DAP), an auxiliary steam boiler, storage facilities for phosphate rock and fertilizer products, and shipping facilities for fertilizer products. The plot plan of Figure 2-3 shows the location of the existing plants and the proposed new sulfuric acid plant. The proposed new sulfuric acid plant with cogeneration will result in a net increase in sulfuric acid production. This production rate increase will be used to replace current sulfuric acid purchases and will not affect the operation of the other plants. The Royster complex has an overall current permitted production capacity of approximately 302,220 tons per year of  $P_2O_5$ .

### 2.1 Sulfuric Acid Plant

There is one existing sulfuric acid plant at the Royster complex which has a maximum permitted capacity of 2000 tons per day of 100 percent acid.

The plant was originally owned by Borden, Inc. and permitted as a 1400 ton per day, single absorption sulfuric acid plant. On September 1, 1975, Borden was issued construction Permit AC41-2042B to convert the plant from a single absorption plant to a double absorption plant as required by rules promulgated by the Florida Department of Environmental Regulation. This modification was completed in August 1976 and operating Permit A041-2042B was issued for the operation of the plant as a double absorption, 2000 ton per day sulfuric acid plant. On October 20, 1980, Borden transferred the chemical complex to AMAX Chemical Corporation. On July 2, 1987, AMAX transferred the chemical complex to Consolidated Minerals, Inc. who operated the complex until July 8, 1988, when it was transferred to Royster Phosphates, Inc.

The existing sulfuric acid plant is subject to Federal New Source Performance Standards as set forth in 40CFR60, Subpart H (which are identical to standards by the State of Florida as set forth in Rule 17-2.600(2)(b),FAC). The emission limiting standards for this plant are:

Sulfur Dioxide	-	4 pounds per ton of 100 percent acid
Acid Mist	-	0.15 pounds per ton of 100 percent acid
Visible Emissions	-	10 percent opacity.

This plant will be permanently shutdown when the new sulfuric acid plant is operational.

The actual emission rates of sulfur dioxide and acid mist from the existing plant were determined from a review of emission measurements and production data from the past five years. The maximum measured sulfur

dioxide emission rate was 3.37 pounds per ton of 100 percent  $H_2SO_4$  produced and the maximum measured acid mist emission rate was 0.089 pounds per ton of 100 percent  $H_2SO_4$  produced. The maximum annual acid production from the plant (used to calculate annual emissions) was 538,046 tons per year (see Appendix 3-B for documentation of these data). These values will be used in evaluating the requested increases (or decreases) in emissions.

Nitrogen oxide emissions from the existing and proposed sulfuric acid plants were estimated from an emission factor of  $2.1 \times 10^{-6}$  pounds of nitrogen oxides per dry standard cubic foot of stack gas (at a reference temperature of 68°F) discharged from a sulfuric acid plant and typical stack gas flow rates for each of the plants.

## 2.2 Phosphoric Acid Plant

Royster operates one phosphoric acid plant. Wet phosphate rock is ground in a ball mill and fed to a Prayon reactor. The reactor slurry is then filtered to remove phosphoric acid from the gypsum. The plant has a permitted maximum rate of 27.08 tons per hour of  $P_2O_5$ . Recent stack test data will allow a rate increase to 34.5 tons per hour of  $P_2O_5$ . The production rate of this plant will not be affected by the production rate increase of the new sulfuric acid plant.



### 2.3 Ammonium Phosphate Plant

Royster operates one granular fertilizer plant. The diammonium phosphate plant (DAP) is permitted to operate at 14.4 tons per hour  $P_2O_5$  or approximately 31.3 tons per hour of DAP with a nominal NPK grade of 18-46-0. Recent stack test data may allow the DAP plant to operate at 36 tons per hour  $P_2O_5$ . The DAP plant is also permitted to produce granular triple superphosphate (GTSP) at a rate of 10.1 tons per hour of  $P_2O_5$  or approximately 21 tons per hour GTSP at a nominal NPK grade of 0-48-0. Royster, however, does not plan to product GTSP in the future. The change in sulfuric acid production will not affect these plants.

### 2.4 Other Operations

The Royster complex also includes an auxiliary boiler to provide steam when there is an insufficient amount of export steam available from the sulfuric acid plant, storage facilities for phosphate rock and fertilizer products, and shipping facilities for fertilizer products. None of these operations will be affected by the production rate increase requested for the sulfuric acid plants.

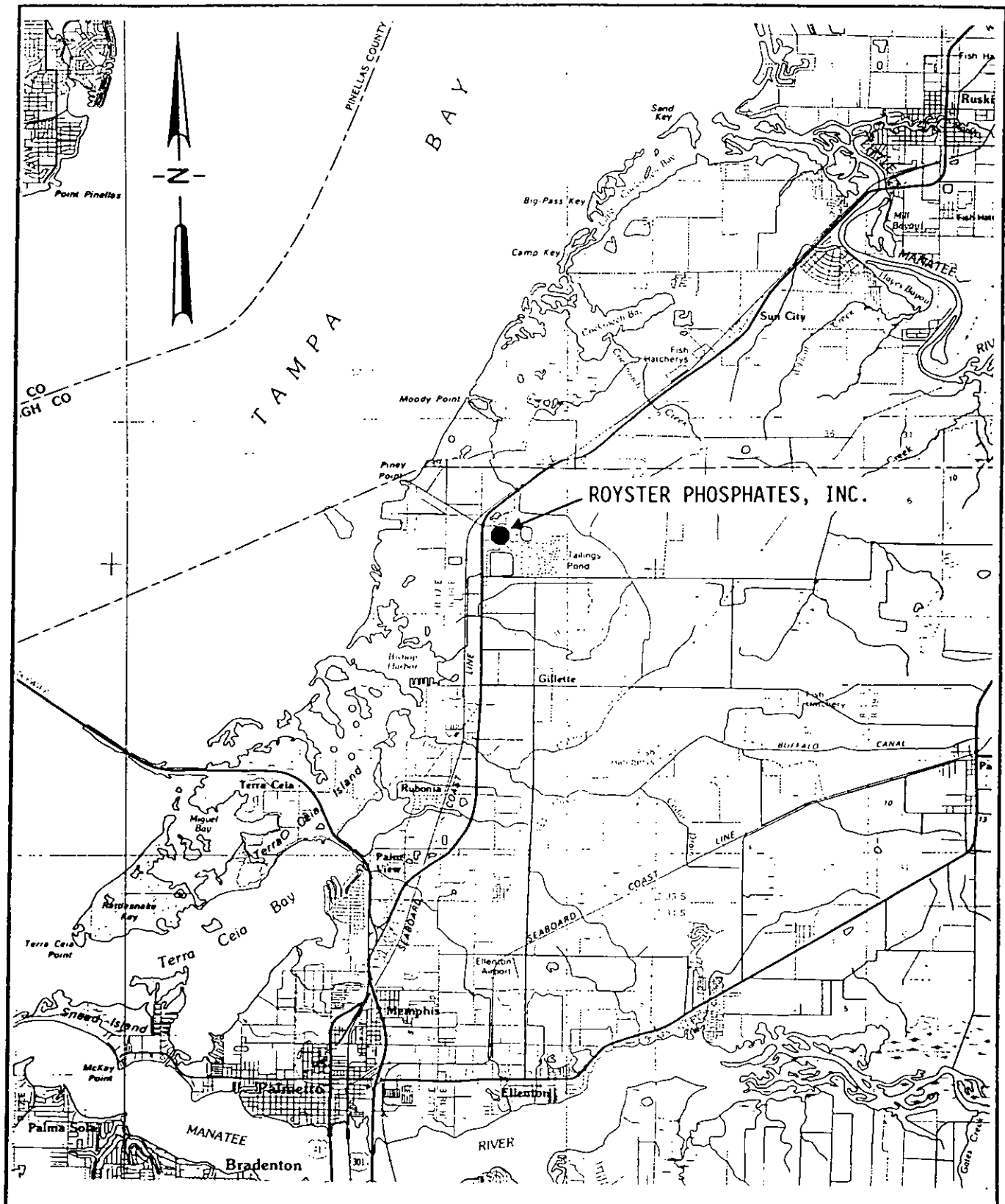


FIGURE 2-1  
 AREA LOCATION MAP  
 ROYSER PHOSPHATES, INC.



COCKROACH BAY, FLA.  
N2737.5-W8230/7.5

1956  
PHOTOREVISED 1969 AND 1972  
AMS 4439 II NE-SERIES V847

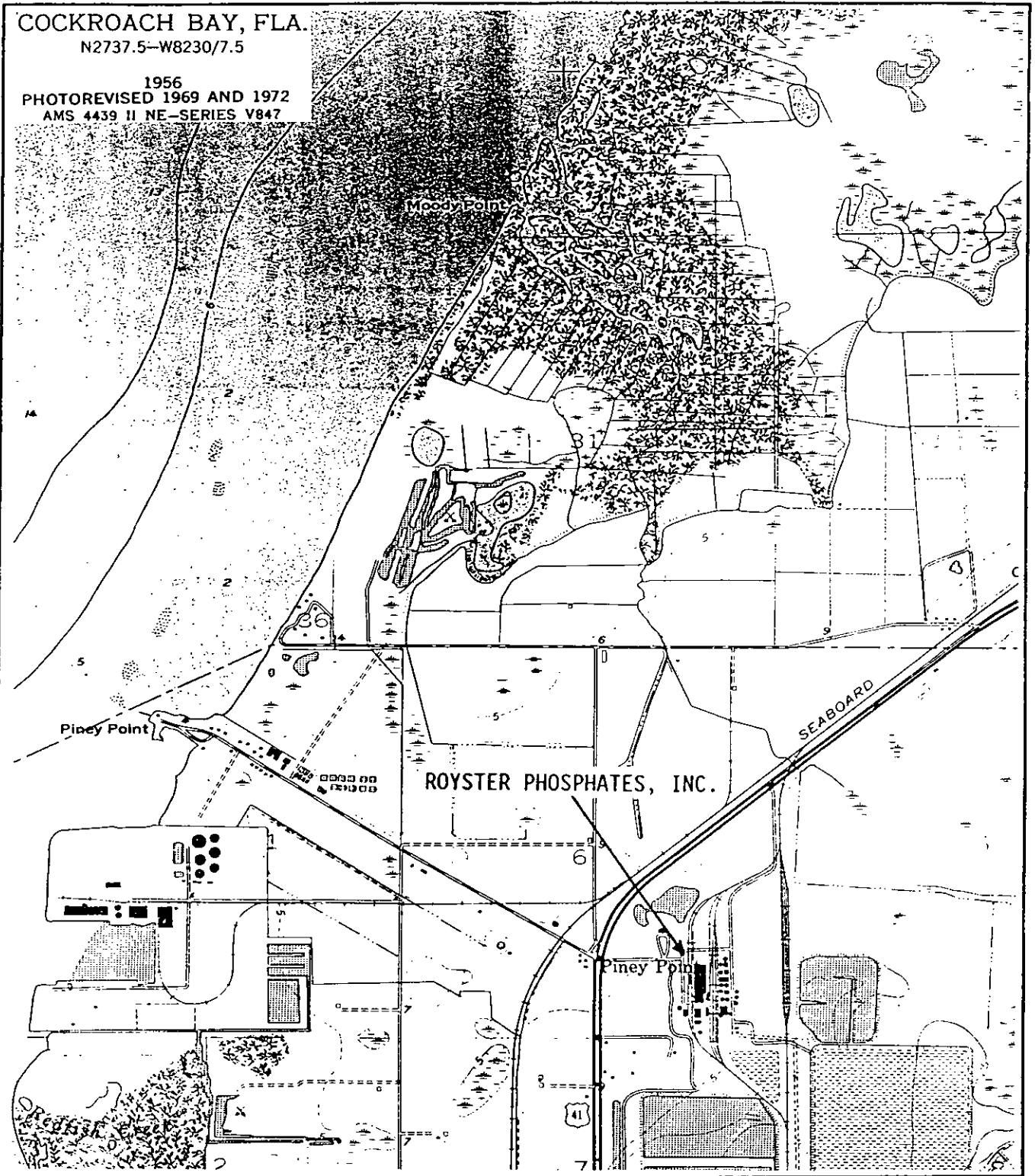
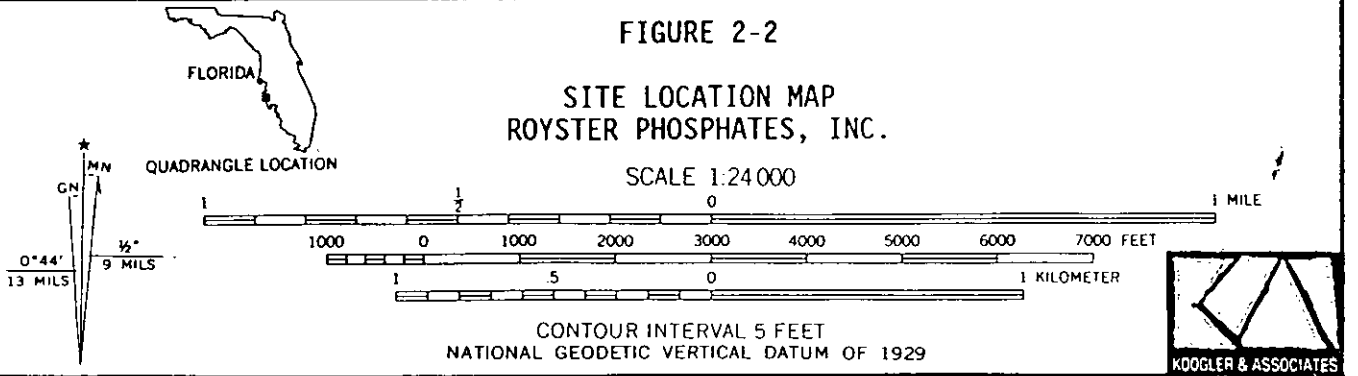


FIGURE 2-2

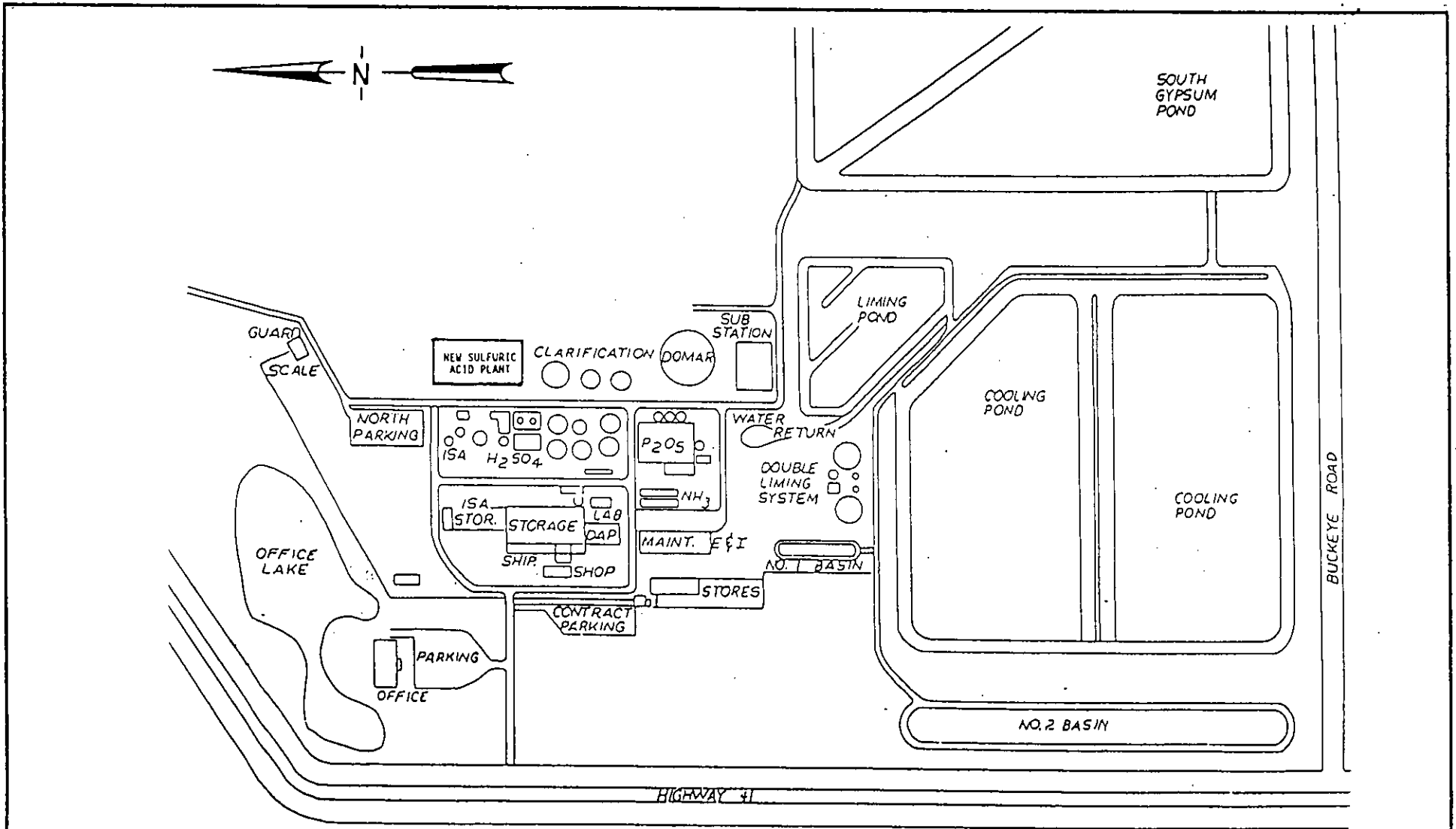
SITE LOCATION MAP  
ROYSTER PHOSPHATES, INC.

SCALE 1:24 000



CONTOUR INTERVAL 5 FEET  
NATIONAL GEODETIC VERTICAL DATUM OF 1929





6

FIGURE 2-3  
 PLOT PLAN  
 ROYSTER PHOSPHATES, INC.



### 3.0 PROPOSED PROJECT

Royster is proposing to construct a double absorption sulfuric acid plant rated at 2700 tons per day of 100 percent  $H_2SO_4$ . This plant will also have cogeneration capabilities to generate 20.8 megawatts of electrical power average annual export with excess steam from the new sulfuric acid plant. A typical process flow diagram for double absorption sulfuric acid plants is presented in Figure 3-1. Figure 3-2 shows the major equipment locations for the new plant.

When the new plant is operational, the existing sulfuric acid plant permitted at 2000 tons per day of 100 percent  $H_2SO_4$ , will be permanently shutdown. The emission limits for the new plant will be the Federal New Source Performance Standards as set forth in Rule 17-2.600(2)(b), FAC, i.e., the sulfur dioxide and acid mist emission limits will be 4.0 pounds per ton of 100 percent sulfuric acid and 0.15 pounds per ton of 100 percent sulfuric acid, respectively.

Table 3-1 summarizes the permitted, actual and proposed conditions at which the existing and new sulfuric acid plants presently operate and will operate. In Table 3-2, the annual air pollutant emission rate changes, based on present, actual and proposed operating conditions, are summarized for the two sulfuric acid plants.

The information tabulated in Tables 3-1 and 3-2 for the sulfuric acid plants shows there will be an increase in the hourly sulfur dioxide emission rate and acid mist emission rate. The data also show that there

will be a significant increase in the annual sulfur dioxide and acid mist emissions. There will be a less than significant increase in the annual nitrogen oxide emissions.

There are no other air pollution sources associated with the requested changes at Royster Phosphates, Inc. that would have to be considered in this permit application.

### 3.1 Rule Applicability

The existing sulfuric acid plant is subject to the New Source Performance Standards in Rule 17-2.600(2)(b), FAC. The plant will cease to be regulated, however, when it is permanently shutdown and the permit is surrendered.

The new sulfuric acid plant will be classified as a new major source subject to both State and Federal regulations as set forth in Rule 17-2.600(2)(b). The proposed increases in sulfur dioxide and acid mist emissions are significant as defined by Rule 17-2.500(2)(e)2, FAC. The construction of the new acid plant will therefore be subject to the full review required of a PSD construction permit application. This will include a determination of Best Available Control technology, an air quality review, and an evaluation of impacts on soils, vegetation and visibility.

The following sections of the application address the changes requested for constructing the new sulfuric acid plant and include all information

required for the PSD review. The air quality review will look at impacts of sulfur dioxide emissions and acid mist emissions. The review will focus on the changes to be expected from operating the new sulfuric acid plant and ceasing operations of the existing sulfuric acid plant.

TABLE 3-1

EXISTING PRODUCTION RATES AND  
EMISSION RATES AFFECTED BY PROPOSED  
SULFURIC ACID PLANT CHANGES (1)

ROYSTER INDUSTRIES, INC.  
MANATEE COUNTY, FLORIDA

	Existing Plant	Proposed Plant
Date Permitted	1966	NA
<u>Current Permit Conditions</u>		
Rate (TPD)	2000	0
SO <sub>2</sub> (lb/ton)	4.0	0
(lb/hr)	333.2	0
(TPY)	1459	0
Mist (lb/ton)	0.15	0
(lb/hr)	12.5	0
(TPY)	54.8	0
Operating Factor	1.0	0
<u>Actual Conditions</u>		
Rate (TPD)	2000	0
SO <sub>2</sub> (lb/ton)	3.37	0
(lb/hr)	280.8	0
(TPY)	906.4	0
Mist (lb/ton)	0.089	0
(lb/hr)	7.4	0
(TPY)	23.9	0
Operating Factor	0.737	0
<u>Proposed Conditions</u>		
Rate (TPD)	0	2700
SO <sub>2</sub> (lb/ton)	0	4.0
(lb/hr)	0	450
(TPY)	0	1971
Mist (lb/ton)	0	0.15
(lb/hr)	0	16.9
(TPY)	0	74.0
Operating Factor	0	1.0

(1) See Appendix 3-A for calculations of emission rates.



TABLE 3-2

ANNUAL AIR POLLUTANT EMISSION CHANGES RESULTING  
FROM THE PROPOSED SULFURIC ACID PLANT CHANGES(1)ROYSTER INDUSTRIES, INC.  
MANATEE COUNTY, FLORIDA

Pollutant Tons/year	Existing Plant	Proposed Plant
<b>S02</b>		
Present (actual)	906.4	0
Proposed	0	1971
Change	(906.4)	1971
Subtotal		1064.6
Significant Increase (2)		40
<b>MIST</b>		
Present (actual)	23.9	0
Proposed	0	74.0
Change	(23.9)	74.0
Subtotal		50.1
Significant Increase (2)		7
<b>NOX</b>		
Present (actual)	33.6	0
Proposed	0	58.7
Change	(33.6)	58.7
Subtotal		25.1
Significant Increase (2)		40

(1) Based on differences between present, actual and proposed operating conditions. See Appendix 3-A for calculation of emission rates.

(2) Defined in 17-2.500(2)(e)2, FAC.

NOTE: Rate changes in ( ) represent decreases in annual emissions.

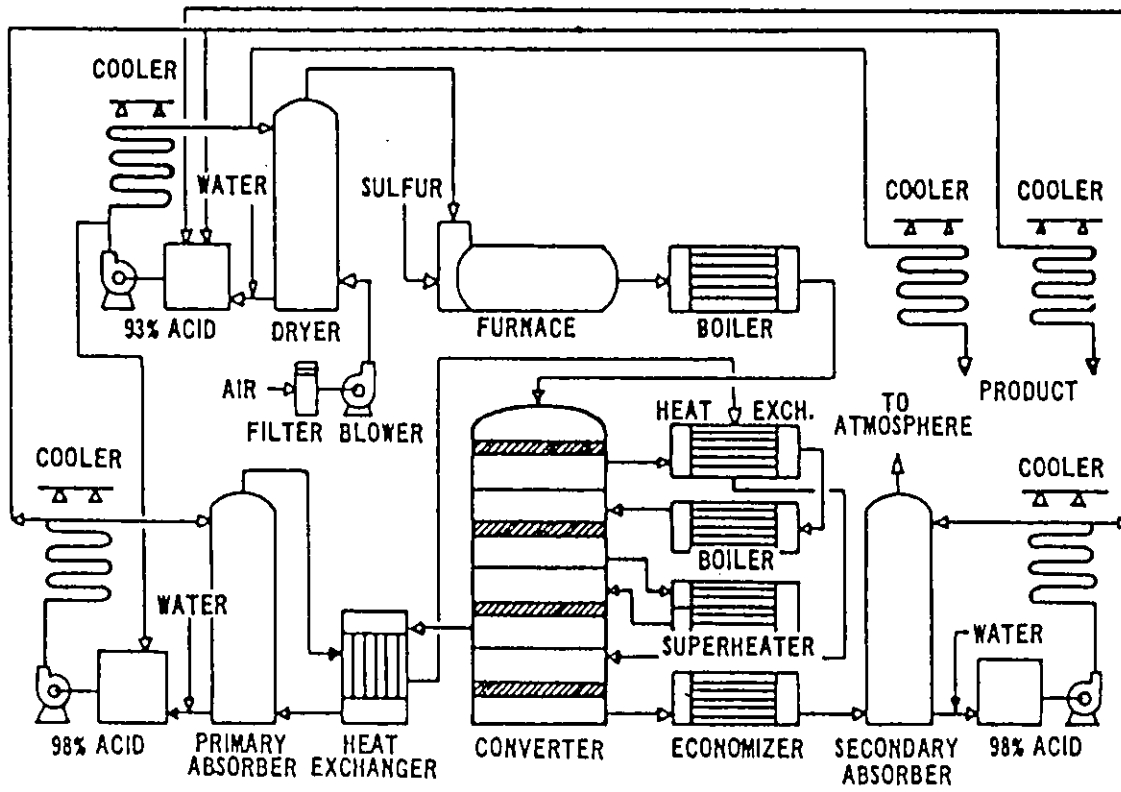
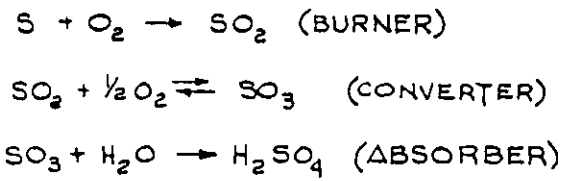


FIGURE 3-1  
TYPICAL SULFURIC ACID  
DOUBLE ABSORPTION PLANT  
PROCESS FLOW DIAGRAM





APPENDIX 3-A  
EMISSION RATE CALCULATIONS

## EMISSION RATE CALCULATIONS

### EXISTING SULFURIC ACID PLANT

PERMITTED: 2000 tons per day 100% acid  
SO<sub>2</sub> - 4.0 lb/ton, 333.2 lb/hr  
Mist - 0.15 lb/ton, 12.5 lb/hr  
Operating Factor - 1.0  
(Based on Permit No. A041-121085)

ACTUAL: 2000 tons per day 100% acid  
SO<sub>2</sub> - 3.37 lb/ton  
Mist - 0.089 lb/ton  
Operating Factor - 0.737, Annual  
(Based on historic production data documented in Appendix 3-B).

PROPOSED: Plant to be permanently shutdown

NOX: 59,394 dscf per ton of 100% acid (See Appendix 3-B)  
2.1 x 10<sup>(-6)</sup> lb NOX per dscf at 68°F (See IMC-New Wales PSD application for third train expansion)

### EMISSION RATES

#### Actual

SO<sub>2</sub>: Hourly = 3.37 lb/ton x 2000/24 ton/hr  
= 280.8 lb/hr  
  
Annual = 280.8 lb/hr x 8760 hr/yr x 1/2000 ton/lb  
x 0.737  
= 906.4 TPY

MIST: Hourly = 0.089 lb/ton x 2000/24 ton/hr  
= 7.4 lb/hr  
  
Annual = 7.4 lb/hr x 8760 hr/yr x 1/2000 ton/lb  
x 0.737  
= 23.9 TPY

NOX Hourly = 2000 ton/day x 59394 dscf/ton  
x 2.1 x 10<sup>(-6)</sup> lb/dscf x 1/24 day/hr  
= 10.4 lb/hr  
  
Annual = 10.4 lb/hr x 8760 hr/yr x 1/2000 ton/lb  
x 0.737  
= 33.6 TPY

## EMISSION RATE CALCULATIONS

### NEW SULFURIC ACID PLANT

PROPOSED: 2700 tons per day 100% acid  
SO<sub>2</sub> - 4.0 lb/ton  
Mist - 0.15 lb/ton  
Operating Factor - 1.0

NOX: 56744 dscf per ton of 100% acid (Based on Monsanto Enviro-  
Chem Systems, Inc. design adjusted to 68°F).  
2.1 x 10<sup>(-6)</sup> lb NOX per dscf at 68°F (See IMC-New Wales PSD  
application for third train expansion)

### EMISSION RATES

#### Proposed

SO<sub>2</sub>: Hourly = 2700 ton/day x 4.0 lb/ton x 1/24 day/hr  
= 450 lb/hr

Annual = 450 lb/hr x 8760 hr/yr x 1/2000 ton/lb  
x 1.0  
= 1971 TPY

MIST: Hourly = 2700 ton/day x 0.15 lb/ton x 1/24 day/hr  
= 16.9 lb/hr

Annual = 16.9 lb/hr x 8760 hr/yr x 1/2000 ton/lb  
x 1.0  
= 74.0 TPY

NOX Hourly = 2700 ton/day x 56744 dscf/ton  
x 2.1 x 10<sup>(-6)</sup> lb/dscf x 1/24 day/hr  
= 13.4 lb/hr

Annual = 13.4 lb/hr x 8760 hr/yr x 1/2000 ton/lb  
x 1.0  
= 58.7 TPY

APPENDIX 3-B

DOCUMENTATION OF ACTUAL EMISSION RATES  
AND OPERATING FACTORS FOR  
THE EXISTING SULFURIC ACID PLANT

SUMMARY OF ANNUAL OPERATING FACTORS FOR  
EXISTING SULFURIC ACID PLANT  
BASED ON 1984 DATA

Month	Hours of Operation (hours)	Acid Production (Tons)
January	705.83	42,458
February	666.75	45,060
March	734.42	48,292
April	699.50	44,687
May	731.42	42,990
June	701.75	46,802
July	724.25	42,897
August	738.50	43,617
September	720.00	49,651
October	658.17	41,497
November	701.75	42,720
December	733.58	47,375
TOTAL	8515.92 hr/yr	538,046 TPY

Annual Operating Factor  
Based on Operating Time =  $(8515.92 \text{ hr/yr}) / (8760 \text{ hr/yr})$   
= 0.972

Annual Operating Factor  
Based on Production =  $(538,046 \text{ TPY}) / (2000 \text{ TPD} \times 365 \text{ day/yr})$   
= 0.737



SUMMARY OF ACTUAL EMISSIONS  
 BASED ON 12 APRIL 1989 TEST DATA  
 FOR EXISTING SULFURIC ACID PLANT

Run	Rate (TPH)	Stack Gas Flow Rate (DSCF/Ton)	SO <sub>2</sub> (lb/ton)	Acid Mist (lb/ton)
1	71.75	62,588	3.64	0.097
2	71.75	58,954	3.37	0.082
3	71.75	56,639	3.11	0.087
AVERAGE		59,394	3.37	0.089

NOTE: Standard Reference Temperature = 68°F.

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JOB NO. LINEY POINT  
DATE 1984  
BY \_\_\_\_\_

SULFURIC ACID

DAILY

JANUARY

SUBJECT

DATE	PRODUCTION-N.T.		OPERATIONS			REMARKS
	DAILY	CUMULATIVE	HRS S/D	HRS OPER.	OPER. FACTOR	
S 1	1220	1230	0	24	100	
M 2	1503	2733	0	24	100	
T 3	1485	4218	0	24	100	
W 4	1572	5790	0	24	100	
T 5	1591	7381	0	24	100	
F 6	1512	8893	0	24	100	
S 7	1368	10261	0	24	100	
S 8	1417	11678	0	24	100	
M 9	1234	12912	0	24	100	
T 10	1180	14092	0	24	100	
W 11	1175	15267	0	24	100	
T 12	1185	16452	0	24	100	
F 13	1120	17572	0	24	100	
S 14	1259	18831	0	24	100	
S 15	1234	20065	0	24	100	
M 16	1501	21566	0	24	100	
T 17	496	22062	12-25	11-35	.483	Dis Leaked & Alarm Sounded
W 18	1668	23730	0	24	100	
T 19	1697	25427	0	24	100	
F 20	1701	27128	0	24	100	
S 21	1687	28815	0	24	100	
S 22	1696	30511	0	24	100	
M 23	1698	32209	0	24	100	
T 24	1631	33840	1-30	20-30	.938	Sch. Maint. Check Tower
W 25	266	34106	13-40	10-20	.429	Sch. Maint
T 26	1452	35558	0	24	100	
F 27	1471	37029	0	24	100	
S 28	781	37810	10-35	12-25	.558	Cooling Cost Peak Plugged sulfur burner
S 29	1533	39343	0	24	100	
M 30	1600	40943	0	24	100	
T 31	1535	42478	0	24	100	
			38-10	705-50	.45	

7-11-84

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DATE 1984  
BY clp

SUBJECT

SULFURIC ACID DAILY  
FEBRUARY

696 RS

PRODUCTION-N.T.			OPERATIONS			REMARKS
DATE	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
W 1	1491	1491	0	24	100	
T 2	1599	3090	0	24	100	
F 3	1617	4707	0	24	100	
S 4	1592	6299	0	24	100	
S 5	1103	7402	5-45	18-15	.760	Cooling coils
M 6	1673	9075	0	24	100	
T 7	1739	10814	0	24	100	
W 8	1759	12573	1-0	23-0	.958	Sch. Maint.
T 9	1004	13577	2-30	15-30	.646	Sch. Maint.
F 10	1697	15274	0	24	100	
S 11	1626	16870	0	24	100	
S 12	1704	18574	0	24	100	
M 13	1686	20260	0	24	100	
T 14	1703	21963	0	24	100	
W 15	1690	23653	0	24	100	
T 16	1698	25351	0	24	100	
F 17	1706	27057	0	24	100	
S 18	1709	28766	0	24	100	
S 19	1699	30465	0	24	100	
M 20	1694	32159	0	24	100	
T 21	1660	33819	1-30	23-30	.938	Sch. Maint.
W 22	157	34276	13-0	13-0	.500	" "
T 23	1705	35981	0	24	100	
F 24	1459	37440	0	24	100	
S 25	1494	38934	0	24	100	
S 26	1481	40415	0	24	100	
M 27	1574	41989	0-30	23-30	.979	Elliot
T 28	1678	43667	0	24	100	
W 29	1393	45060	0	24	100	
			29-15	666-45	959	

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JOB NO. ANCEY Point

DATE 1984

BY clp

SUBJECT

SULFURIC ACID

DAILY

MARCH

144 MW

PRODUCTION-N.T.			OPERATIONS			REMARKS
DATE	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
T 1	1621	1621	-0-	24	100	
F 2	1602	3223	-0-	24	100	
S 3	1339	4562	-0-	24	100	
S 4	1383	5945	-0-	24	100	
M 5	1487	7432	-0-	24	100	
T 6	1491	8923	-0-	24	100	
W 7	1487	10410	-0-	24	100	
T 8	1497	11911	-0-	24	100	
F 9	1506	13417	-0-	24	100	
S 10	1495	14912	-0-	24	100	
S 11	1517	16429	-0-	24	100	
M 12	1523	17952	-0-	24	100	
T 13	1508	19460	-0-	24	100	
W 14	1535	21017	-0-	24	100	
T 15	1599	22616	-0-	24	100	
T 16	1573	24189	-0-	24	100	
S 17	1587	25776	-0-	24	100	
S 18	1630	27406	-0-	24	100	
M 19	1690	29096	-0-	24	100	
T 20	1630	30726	6-34	23-35	.983	Sub. Mgmt.
W 21	838	31564	9-10	11-30	.617	Sub. Mgmt.
T 22	1687	33251	-0-	24	100	
F 23	1536	34787	-0-	24	100	
S 24	1696	36483	-0-	24	100	
S 24	1672	38155	-0-	24	100	
M 26	1702	39857	-0-	24	100	
T 27	1747	41604	-0-	24	100	
W 28	1677	43281	-0-	24	100	
T 29	1705	45006	-0-	24	100	
F 30	1699	46705	-0-	24	100	
S 31	1681	48386	-0-	24	100	
			9-35	94-25		9.5833

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JOB NO. Liney Point

DATE 1984

BY clp

SUBJECT

SULFURIC Acid  
APRIL

DAILY

100 hrs

DATE	PRODUCTION-N.T.		OPERATIONS			REMARKS
	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
S 1	1685	1685	-0-	24	100	
M 2	1708	3393	-0-	24	100	
T 3	1629	5022	-0-	24	100	
W 4	642	5670	17-0	17-0	70%	Process out of control
T 5	913	6583	7-0	14-0	68%	Process out of control
F 6	1699	8282	-0-	24	100	
S 7	1701	9983	-0-	24	100	
S 8	1681	11564	-0-	24	100	
M 9	1711	13275	-0-	24	100	
T 10	1741	15016	-0-	24	100	
W 11	1693	16709	-0-	24	100	
T 12	1611	18320	-0-	24	100	
F 13	1712	20032	-0-	24	100	
S 14	1690	21722	-0-	24	100	
S 15	1685	23407	-0-	24	100	
M 16	1700	25107	-0-	24	100	
T 17	1706	26813	-0-	24	100	
W 18	1708	28521	-0-	24	100	
T 19	1720	30241	-0-	24	100	
F 20	1707	32048	-0-	24	100	
S 21	1704	33752	-0-	24	100	
S 22	1692	35444	-0-	24	100	
M 23	1035	36479	6-0	13-0	75%	Down for 6 hrs
T 24	1420	37906	-0-	24	100	
W 25	1336	39242	-0-	24	100	
T 26	1310	40552	-0-	24	100	
F 27	1302	41854	-0-	24	100	
S 28	1248	43102	-0-	24	100	
S 29	1290	44392	-0-	24	100	
M 30	1295	45687	-0-	24	100	
			20-0	677-35		

**ENGINEERING  
CALCULATING  
SHEET**

**AMAX** CHEMICAL CORPORATION

A SUBSIDIARY OF AMAX INC.

P.O. BOX 908 • PALMETTO, FLORIDA 33561

PAGE \_\_\_\_\_

JOB NO. Pinet Point

DATE 1984

BY \_\_\_\_\_

SUBJECT

SULFURIC ACID

DAILY

1984

PRODUCTION-N.T.		OPERATIONS				REMARKS
DATE	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
T 1	1280	1280	-0-	24	100	
W 2	1316	2596	-0-	24	100	
T 3	1391	3987	-0-	24	100	
F 4	1301	5188	-0-	24	100	
S 5	1307	6495	-0-	24	100	
S 6	1204	7801	-0-	24	100	
M 7	1142	9244	-0-	24	100	
T 8	1038	10282	5-30	18-30	.771	Perking
W 9	1211	11532	-0-	24	100	
T 10	1008	12751	-0-	24	100	
T 11	1007	13760	-0-	24	100	
S 12	1009	15167	-0-	24	100	
S 13	1017	16381	-0-	24	100	
M 14	1147	17533	1-20	24-40	.946	
T 15	1009	18762	-0-	24	100	
W 16	1034	19996	-0-	24	100	
T 17	1121	21117	5-45	18-15	.760	Preping
T 18	1684	22801	-0-	24	100	
S 19	1621	24482	-0-	24	100	
S 20	1669	26151	-0-	24	100	
M 21	1611	27822	-0-	24	100	
T 22	1729	29597	-0-	24	100	
W 23	1482	31080	-0-	24	100	
T 24	1482	32562	-0-	24	100	
F 25	1530	34091	-0-	24	100	
S 26	1489	35580	-0-	24	100	
S 27	1511	37091	-0-	24	100	
M 28	1521	38612	-0-	24	100	
T 29	1601	40213	-0-	24	100	
W 30	1512	41725	-0-	24	100	
T 31	1452	42910	-0-	24	100	
			11-25	131-25		

11/14 HW

**ENGINEERING  
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SHEET**

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PAGE \_\_\_\_\_

JOB NO. Liney Point

DATE 1984

BY alp

PROJECT

SULFURIC ACID

DAILY

JUNE

PRODUCTION-N.T.			OPERATIONS			REMARKS
DATE	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
F 1	851	851	10-15	13-15	.552	Sch. Maint.
S 2	1580	2431	-0-	24	100	
S 3	1579	4010	-0-	24	100	
M 4	1648	5658	-0-	24	100	
T 5	1665	7323	-0-	24	100	
W 6	1630	8953	-0-	24	100	
T 7	1681	10634	-0-	24	100	
F 8	1677	12311	-0-	24	100	
S 9	1683	13994	-0-	24	100	
S 10	1671	15665	-0-	24	100	
M 11	1687	17352	-0-	24	100	
T 12	1687	19039	-0-	24	100	
W 13	1690	20729	-0-	24	100	
T 14	1683	22412	-0-	24	100	
F 15	1702	24114	-0-	24	100	
S 16	1667	25781	-0-	24	100	
S 17	1670	27451	-0-	24	100	
M 18	1644	29095	-0-	24	100	
T 19	1662	30757	-0-	24	100	
W 20	1465	32222	-0-	24	100	
T 21	1512	33734	0-30	23-30	.979	Sch. Maint.
F 22	967	34701	7-0	17-0	.708	Sch. Maint.
S 23	1476	36177	-0-	24	100	
S 24	1469	37646	-0-	24	100	
M 25	1440	39086	-0-	24	100	
T 26	1487	40573	-0-	24	100	
W 27	1516	42089	-0-	24	100	
T 28	1536	43625	-0-	24	100	
F 29	1540	45165	-0-	24	100	
S 30	1545	46710	-0-	24	100	
			16-15	701-45		

**ENGINEERING  
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SHEET**

**AMAX** CHEMICAL CORPORATION

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PAGE \_\_\_\_\_

JOB NO. LINEY PLANT

DATE 1984

BY clp

SUBJECT SULFURIC ACID

DAILY

JULY

PRODUCTION-N.T.			OPERATIONS			REMARKS
DATE	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
S 1	1279	1279	3-40	20-20	.846	Abs. Tower
m 2	1547	2826	-0-	24	100	
T 3	1575	4401	-0-	24	100	
W 4	1591	5992	-0-	24	100	
T 5	1543	7535	-0-	24	100	
F 6	1072	8607	6-45	17-15	.719	Draining tanks
S 7	1472	10,080	-0-	24	100	
S 8	1460	11,540	-0-	24	100	
m 9	1235	12,775	3-30	20-30	.854	HLA Tower
T 10	1429	14,204	-0-	24	100	
W 11	1489	15,693	-0-	24	100	
T 12	1473	17,166	-0-	24	100	
F 13	1472	18,638	-0-	24	100	
S 14	1483	20,121	-0-	24	100	
S 15	1439	21,560	-0-	24	100	
m 16	960	22,520	5-30	18-10	.757	Dist
T 17	1231	23,751	-0-	24	100	
W 18	1210	24,961	-0-	24	100	
T 19	1228	26,189	-0-	24	100	
F 20	1235	27,424	-0-	24	100	
S 21	1234	28,658	-0-	24	100	
S 22	1220	29,878	-0-	24	100	
m 23	1222	31,100	-0-	24	100	
T 24	1466	32,566	-0-	24	100	
W 25	1472	34,038	-0-	24	100	
T 26	1535	35,573	-0-	24	100	
F 27	1466	37,039	-0-	24	100	
S 28	1423	38,462	-0-	24	100	
S 29	1477	39,939	-0-	24	100	
m 30	1470	41,409	-0-	24	100	
T 31	1307	42,716	-0-	24	100	
			19-45	124-15		

744 hrs



**ENGINEERING  
CALCULATING  
SHEET**

**AMAX** CHEMICAL CORPORATION

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PAGE \_\_\_\_\_

JOB NO. PINEY POINT

DATE 1984

BY ole

SULFURIC ACID

DAILY

AUGUST

744 hrs

PRODUCTION-N.T.		OPERATIONS			REMARKS	
DATE	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.		OPER. FACTOR
W 1	1301	1301	-0-	24	100	
T 2	1303	2603	-0-	24	100	
F 3	1033	3636	-0-	24	100	
S 4	972	4604	-0-	24	100	
S 5	1195	5799	-0-	24	100	
M 6	1070	6869	-0-	24	100	
T 7	1153	8022	-0-	24	100	
W 8	1153	9175	-0-	24	100	
T 9	1153	10328	-0-	24	100	
F 10	1301	11629	-0-	24	100	
S 11	1407	13036	-0-	24	100	
T 12	1400	14436	-0-	24	100	
W 13	870	15306	5-30	18-30	.771	Scheduled
T 14	1493	16799	-0-	24	100	
W 15	1463	18262	-0-	24	100	
T 16	1493	19755	-0-	24	100	
F 17	1493	21248	-0-	24	100	
S 18	1493	22741	-0-	24	100	
S 19	1493	24234	-0-	24	100	
M 20	1493	25727	-0-	24	100	
T 21	1643	27370	-0-	24	100	
W 22	1652	29022	-0-	24	100	
T 23	1777	30799	-0-	24	100	
F 24	573	31372	-0-	24	100	
S 25						
S 26						
M 27						
T 28	1164	32536	-0-	24	100	
W 29	1661	40197	-0-	24	100	
T 30	1675	41872	-0-	24	100	
F 31	1651	43523	-0-	24	100	
			5-30	738-30	99.3%	

**ENGINEERING  
CALCULATING  
SHEET**

**AMAX** CHEMICAL CORPORATION

A SUBSIDIARY OF AMAX INC  
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PAGE \_\_\_\_\_  
JOB NO. Liney Point  
DATE 1984  
BY RAM/clp

SUBJECT

SULFURIC ACID DAILY  
SEPTEMBER

120 hrs

PRODUCTION-N.T.			OPERATIONS			REMARKS
DATE	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
S 1	11627	11627	-0-	24	100	
S 2	11627	23254	-0-	24	100	
M 3	11651	34905	-0-	24	100	
T 4	11658	46563	-0-	24	100	
W 5	11628	58191	-0-	24	100	
T 6	11651	69842	-0-	24	100	
F 7	11651	81493	-0-	24	100	
S 8	-	-	-	-	-	
S 9	11646	93139	-0-	24	100	
M 10	11641	104780	-0-	24	100	
T 11	11635	116415	-0-	24	100	
W 12	11629	128044	-0-	24	100	
T 13	11624	139668	-0-	24	100	
F 14	11651	151319	-0-	24	100	
S 15	11657	162976	-0-	24	100	
S 16	11657	174633	-0-	24	100	
M 17	11666	186299	-0-	24	100	
T 18	11658	197957	-0-	24	100	
W 19	11655	209612	-0-	24	100	
T 20	11658	221270	-0-	24	100	
F 21	11662	232932	-0-	24	100	
S 22	11662	244594	-0-	24	100	
S 23	11659	256253	-0-	24	100	
M 24	11650	267903	-0-	24	100	
T 25	11650	279553	-0-	24	100	
W 26	11636	291203	-0-	24	100	
T 27	11651	302854	-0-	24	100	
F 28	11661	314515	-0-	24	100	
S 29	11676	326191	-0-	24	100	
S 30	11676	337867	-0-	24	100	
				720	1.000	

Not 11655 TPD  
Rate

**ENGINEERING  
CALCULATING  
SHEET**

**AMAX** CHEMICAL CORPORATION

A SUBSIDIARY OF AMAX INC.

P.O. BOX 908 • PALMETTO, FLORIDA 33561

PAGE \_\_\_\_\_  
JOB NO. LINEY POINT  
DATE 1984  
BY clp

SUBJECT

SULFURIC ACID

DAILY

October

744 100

DATE	PRODUCTION-N.T.		OPERATIONS			REMARKS
	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
M 1	1683	1683	-0-	324	100	
T 2	1681	3364	-0-	324	100	
W 3	1681	5045	-0-	324	100	
T 4	1527	6572	-0-	324	100	
F 5	1349	7921	-0-	324	100	
S 6	1315	9236	-0-	324	100	
- 7	1309	10545	-0-	324	100	
M 8	1105	11650	-0-	324	100	
T 9	1010	12660	-0-	324	100	
W 10	185	12845	7-0	14-0	.708	Also. TOURN
T 11	1139	14084	-0-	324	100	
F 12	251	14335	20-15	3-45	.150	Boiler
S 13	105	14440	15-0	5-0	.250	"
- 14	861	15301	-0-	324	100	
M 15	1632	16933	-0-	324	100	
T 16	134	17067	0-35	24-35	.35	Ch. Maint.
W 17	0	17067	31	-0-	0	" "
T 18	1053	18120	2-30	1-0	.876	" "
F 19	1647	19767	-0-	324	100	
S 20	1661	21428	-0-	324	100	
S 21	145	21573	-0-	324	100	
M 22	1604	23177	0-45	33-15	.969	Piping
T 23	1637	24814	-0-	324	100	
W 24	1667	26481	-0-	324	100	
T 25	1659	28140	-0-	324	100	
F 26	1663	29803	-0-	324	100	
S 27	1209	31012	1-10	30-50	.920	Also. TOURN
S 28	1960	32972	11-45	12-15	.510	" "
M 29	1673	34645	-0-	324	100	
T 30	1673	36318	-0-	324	100	
W 31	1684	38002	-0-	324	100	
			45-15	1658-15	.15	

**ENGINEERING  
CALCULATING  
SHEET**

**AMAX** CHEMICAL CORPORATION

A SUBSIDIARY OF AMAX INC.  
P.O. BOX 908 • PALMETTO, FLORIDA 33561

PAGE \_\_\_\_\_

JOB NO. Piney Point

DATE 1984

BY clp

SUBJECT

SULFURIC ACID  
November

DAILY

100 lbs

DATE	PRODUCTION-N.T.		OPERATIONS			REMARKS
	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
T 1	1657	1657	-0-	24	100	
F 2	1554	3211	1-30	22-30	.932	Abs. Town
S 3	1665	4876	-0-	24	100	
S 4	1652	6528	-0-	24	100	
M 5	1418	7946	-0-	24	100	
T 6	1044	8990	-0-	24	100	
W 7	1116	10106	-0-	24	100	
T 8	1167	11273	-0-	24	100	
F 9	1361	12634	-0-	24	100	
S 10	1500	14134	-0-	24	100	
S 11	1502	15636	-0-	24	100	
M 12	1453	17090	-0-	24	100	
T 13	1404	18494	-0-	24	100	
W 14	1406	19900	-0-	24	100	
T 15	1046	20946	5-0	19-0	.772	Sulfurization
F 16	1562	22508	-0-	24	100	
S 17	1556	24064	-0-	24	100	
S 18	1663	25727	-0-	24	100	
M 19	1641	27368	-0-	24	100	
T 20	1571	28939	-0-	24	100	
W 21	1382	30321	2-10	21-50	.908	Filter off
T 22	1526	31847	-0-	24	100	
F 23	1212	33059	3-0	21-0	.897	Filter off
S 24	1526	34585	-0-	23-0	.952	100% off
S 25	1349	35934	-0-	24	100	
M 26	1243	37177	-0-	24	100	
T 27	1140	38317	-0-	20-0	.839	Filter off
W 28	1101	39418	-0-	24	100	
T 29	1517	41035	-0-	23-20	.929	Filter off
F 30	1650	42685	-0-	24	100	
			12-15	101-45		

**ENGINEERING  
CALCULATING  
SHEET**

**AMAX** CHEMICAL CORPORATION

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PAGE \_\_\_\_\_

JOB NO. PINEY POINT

DATE 1984

BY clp

SUBJECT

SULFURIC ACID

DAILY

December

744 No

DATE	PRODUCTION-N.T.		OPERATIONS			REMARKS
	DAILY	CUMULATIVE	HRS. S/D	HRS. OPER.	OPER. FACTOR	
S 1	1661	1661	0	24	100	
S 2	1535	3196	1-10	23-50	.950	Abn. Tower
M 3	1660	4856	0	24	100	
T 4	1199	6055	1-30	19-30	.813	130 0-30 2-30
W 5	1645	7700	0	24	100	
T 6	1675	9375	0	24	100	
F 7	1681	11056	0	24	100	
S 8	1679	12735	0	24	100	
S 9	1666	14401	0	24	100	
M 10	1661	16062	0	24	100	
T 11	1641	17703	0	24	100	
W 12	1645	19348	0	24	100	
T 13	1638	21086	0	24	100	
F 14	1634	22720	0	24	100	
S 15	1634	24354	0	24	100	
S 16	1632	25986	0	24	100	
M 17	1317	27303	0	24	100	
T 18	1071	28374	0	24	100	
W 19	1091	29465	0	24	100	
T 20	1061	30526	0	24	100	
F 21	1375	31901	0	24	100	
S 22	1630	33531	0	24	100	
S 23	1629	35160	0	24	100	
M 24	1633	36793	0	24	100	
T 25	1034	37827	0-45	23-15	.969	Abn. Tower
W 26	1256	39083	0	24	100	
T 27	1066	40149	3-0	21-0	.875	Elect
F 28	1498	41647	1-0	23-0	.958	Abn. Tower
S 29	1642	43289	0	24	100	
S 30	1631	44920	0	24	100	
M 31	1642	46562	0	24	100	
			10-25	733-35		

**Royster** Phosphates, Inc.

P. O. Box 1329  
Palmetto, Florida 34220  
(813) 722-4555

April 20, 1989

Mr. C. S. Lee  
Florida Department of Environment Regulation  
4520 Oak Fair Blvd.  
Tampa, Fl 33610-7347

Re: Permit Number A041-121085

Dear Mr. Lee:

Please find attached, the results and data for compliance tests performed per the above referenced permit. The tests were conducted on 12 April 1989.

The stack test and analytical tests were performed by Royster Phosphates, Inc. personnel. The tests results are as follows:

	Acid Mist		S02
Run 1	6.96 lb/hr	0.097 lb/ton	261 lb/hr 3.64 lb/ton
Run 2	5.90 lb/hr	0.082 lb/ton	242 lb/hr 3.37 lb/ton
Run 3	6.27 lb/hr	0.087 lb/ton	223 lb/hr 3.11 lb/ton
Average	6.38 lb/hr	0.089 lb/ton	242 lb/hr 3.37 lb/ton

Production rate at the Piney Point Sulfuric Acid Plant was 71.75 tons/hr H<sub>2</sub>SO<sub>4</sub> (100% basis). This is an average rate based on the sulfuric acid production calculated from the change in inventory of the west (product) H<sub>2</sub>SO<sub>4</sub> storage tank.

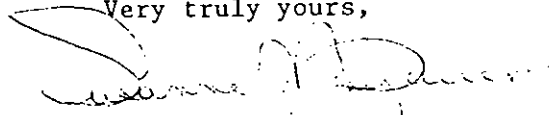
	Time	Tank Dip	Tons
Beginning inventory	4/12/89	0:600 14'0"	7679
Ending inventory	4/13/89	0:600 3'11"	9436
		<u>10'1"</u>	<u>1757</u>

1757 Tons H<sub>2</sub>SO<sub>4</sub> ÷ 24 hours = 73.21 Tons/hr @ 98%.

73.21 Tons/hr X .98 = 71.75 Tons/hr @ 100%.

To the best of my knowledge the above data is true and correct. Should further information be required, please contact our office.

Very truly yours,



Susanne Neupauer  
Environmental Engineer

SN/dam  
Attachments: Fourteen (14)  
cc: W. L. Priesmeyer, MCPHU

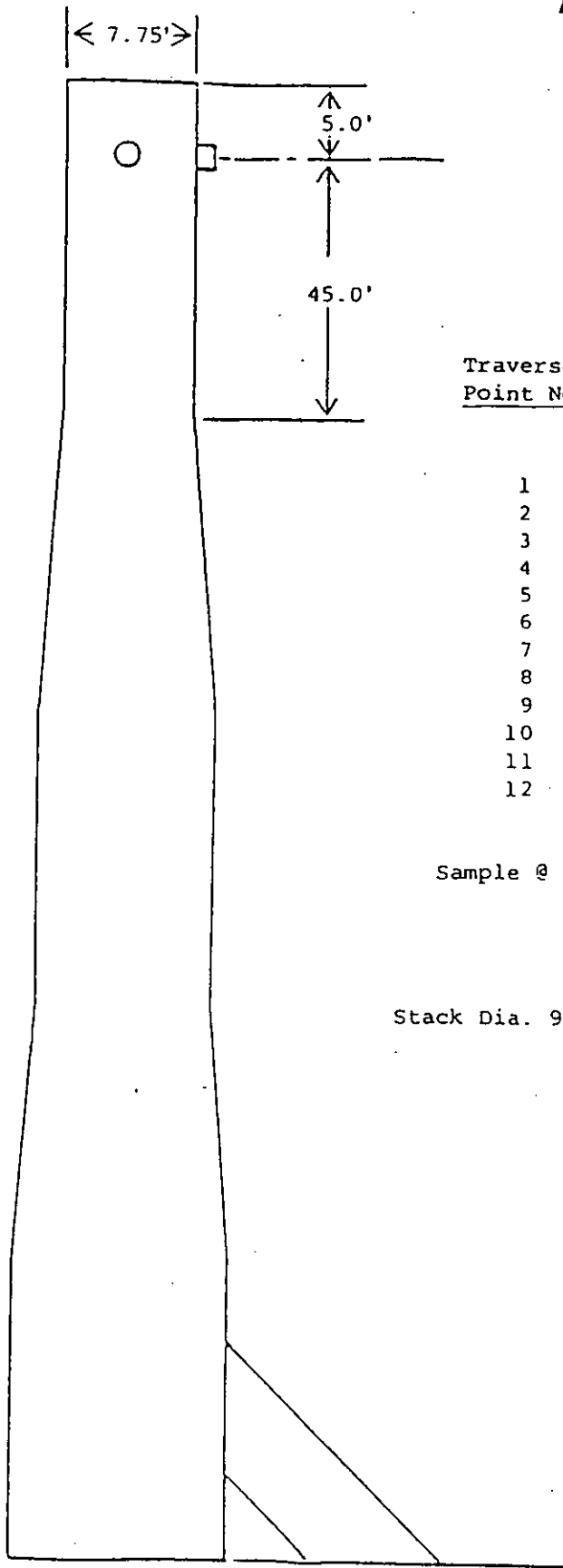
PREVIOUS READ 0600		2400	10.8	290	280
STORAGE TANK	0600	1400	2200	0600	
50 DRY DIP EAST	5'6"	9'9"	14-6 1/2"	19'5"	
60 INST EAST					
100 DRY DIP WEST	14'0"	10 3/4"	6-5"	3'11"	
18 INST WEST SALT	4'4"	4'2"	4-3"	4'3"	
20 PRODUCT TO	WEST	WEST	WEST	East	
20 PRODUCT FROM	EAST	EAST	EAST	West	
50 DRY DIP SULFUR	19'11"	20 1/2"	11-4"	13'11"	
00 INST SULFUR	207	40	68	43	227
20 BAUME	0900	1700	0100		
20 RECORDER IP	9850	98.52	98.50		
50 LAB SAMPLE IP	9848	98.49	98.22		
RECORDER FT	9844	98.60	98.53		
LAB SAMPLE FT	9739	98.55	98.18		
93%					
INVENTORY	0600	1400	2200	0600	
EAST TANK	4528	3854	3095	2323	
WEST TANK	3181	3768	4382	4778	
TOTAL TONS	7709	7622	7477	7101	
SULFUR TONS	270.9	271.2	569	480.3	

So1 9AS 765  
 (1700) ANHL 283 REICH 300  
 (0100) Anal. 287 REICH 300

(1015) FT REC 9849 LAB 9775  
 (1220) FT REC 9853 LAB 9773  
 98.53 LAB 98.51  
 (1605) FT REC 98162 LAB 9852

587 614 396

**Royster** Phosphates, Inc.  
 SULFURIC ACID PLANT  
 Palmetto, Florida



<u>Traverse Point No.</u>	<u>Distance Inside Stack Wall w/5" Port</u>
1	6.98
2	11.23
3	15.99
4	21.48
5	28.25
6	38.08
7	64.92
8	74.75
9	81.51
10	87.02
11	91.77
12	96.02

Sample @ each Point 3 Minutes.

Stack Dia. 93.0"-----Area 47.1730 sq. ft.

Stack Height 200'



Meter Orifice Calibration Check

Console Type & No. PM 100

$\Delta H\theta$  of Orifice 1.84

Metered Volume

Corrected Volume

Final - 641.50

Initial - 633.90

7.6 ft<sup>3</sup> x  $\frac{[528]}{535} \frac{[30.12]}{29.92} = \underline{7.551} ft<sup>3</sup> (cv)$

Time - 10 min. 4.5 sec.

Total minutes = 10.075

7.551 ft<sup>3</sup> (cv)  $\div$  10.075 Total minutes = 0.749 He<sub>2</sub>

$\frac{0.75}{\Delta H\theta_2}$  x 100 = 100.1 % Orifice Check

Date: April 14, 1989

Signature: J. Hejzner

Procedure: Allow console to run approximately 10 minutes and leak check @ 15" Hg. Set flow rate of console at the  $\Delta H\theta$  of orifice from the most recent full scale calibration. Stop the dry gas meter at a convenient point. Start the vaccum pump and a stopwatch simultaneously and run for approximately ten minutes.

Tolerance + 5.0% - if orifice check is not within 5% of  $\Delta H\theta$ , recalibrate orifice.

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test numbers 2, 3 Date APRIL 12, 1989 Meter box number PM-100 Plant SULFURIC ACID Plant  
 Barometric pressure,  $P_b = 30.12$  in. Hg Dry gas meter number # 1 Pretest Y 0.976

Orifice manometer setting, ( $\Delta H$ ), in. H <sub>2</sub> O	Gas volume		Temperature				Time ( $\theta$ ), min	Vacuum setting, in. Hg	Y <sub>i</sub>	Y <sub>i</sub>	$\frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$ ΔH <sub>2</sub> O
	Wet test meter (V <sub>w</sub> ), ft <sup>3</sup>	Dry gas meter (V <sub>d</sub> ), ft <sup>3</sup>	Wet test meter (t <sub>w</sub> ), °F	Dry gas meter							
				Inlet (t <sub>d<sub>i</sub></sub> ), °F	Outlet (t <sub>d<sub>o</sub></sub> ), °F	Average <sup>a</sup> (t <sub>d</sub> ), °F					
1.0	10 10.7	686.93 676.23	75 75	48 106 102	82 84 83	92.5	18:24	5	.963	$\frac{10(30.12)(552.5)}{10.7(30.19)(535)}$	1.85
1.0	10 10.6	609.90 680.32	75 75	110 112 111	86 90 88	99.5	18:32	5	.984	$\frac{10(30.12)(551.5)}{10.6(30.19)(535)}$	1.85
1.0	10 10.6	710.40 700.80	75 75	110 112 111	88 88	99.5	18:20	5	.981	$\frac{10(30.12)(551.5)}{10.6(30.19)(535)}$	1.81
Y = .976										1.84	

<sup>a</sup> If there is only one thermometer on the dry gas meter, record the temperature under t<sub>d</sub>.

- V<sub>w</sub> = Gas volume passing through the wet test meter, ft<sup>3</sup>.
- V<sub>d</sub> = Gas volume passing through the dry gas meter, ft<sup>3</sup>.
- t<sub>w</sub> = Temperature of the gas in the wet test meter, °F.
- t<sub>d<sub>i</sub></sub> = Temperature of the inlet gas of the dry gas meter, °F.
- t<sub>d<sub>o</sub></sub> = Temperature of the outlet gas of the dry gas meter, °F.
- t<sub>d</sub> = Average temperature of the gas in the dry gas meter, obtained by the average of t<sub>d<sub>i</sub></sub> and t<sub>d<sub>o</sub></sub>, °F.
- ΔH = Pressure differential across orifice, in. H<sub>2</sub>O.
- Y<sub>i</sub> = Ratio of accuracy of wet test meter to dry gas meter for each run.
- Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ± 0.05Y
- P<sub>b</sub> = Barometric pressure, in. Hg.
- θ = Time of calibration run, min.

$$\Delta H_{O_2} = \frac{.0317 \Delta H}{P_b (t_d + 460)} \left[ \frac{(t_w + 460) \theta}{V_w} \right]^2$$



PITOT TUBE CALIBRATION DATA

Calibration pitot tube: type STD size (OD) 5/16" ID number 1

Type S pitot tube ID number 8-009  $C_p(\text{std}) = \underline{0.99}$

Calibration: date April 12, 1989 performed by NEUPAUER & JOINER

High A-Side Calibration

	$\Delta p_{\text{std}}$ (in.) $H_2O$	$\Delta p_s$ (in.) $H_2O$	$C_p(S)^a$	DEV. <sup>b</sup>
1.	.89	1.35	.8119	
2.	.89	1.35	.8119	
3.	.89	1.35	.8119	
Average				

Low B-Side Calibration

	$\Delta p_{\text{std}}$ (in.) $H_2O$	$\Delta p_s$ (in.) $H_2O$	$C_p(S)^a$	DEV. <sup>b</sup>
1.	.02	.035	.7559	
2.	.02	.035	.7559	
3.	.02	.035	.7559	
Average				

$$^a C_p(S) = C_p(\text{std}) \sqrt{\frac{\Delta p_{\text{std}}}{\Delta p_s}}$$

$$^b \text{DEV} = C_p(S) - \bar{C}_p \quad (\text{must be } \leq 0.01)$$

$$\bar{C}_p(A) - \bar{C}_p(B) = \underline{\hspace{2cm}} \quad (\text{must be } \leq 0.01).$$

$$\text{High A } \bar{C}_p(S) + \text{Low A } \bar{C}_p(S) = \underline{.7839} \text{ Avg.}$$

NOZZLE I.D. NO. 5

DATE: 4-11-89

NOZZLE DIA. INCHES: 0.240

MEASUREMENT NO.

INSIDE DIAMETER (INCHES)

1. 0.240

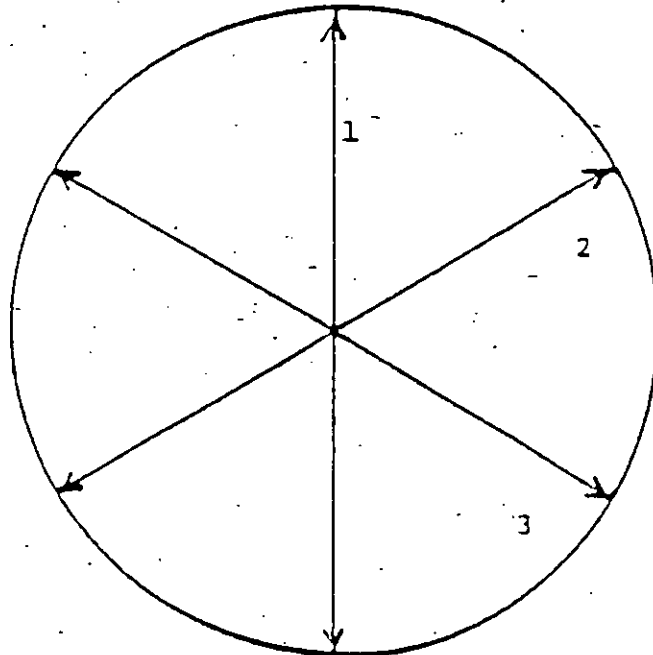
2. 0.240

3. 0.239

AVERAGE: 0.240

AREA OF NOZZLE: 0.0003142 FT.<sup>2</sup>

CALIBRATED BY: S. VELLA-NEUPAIER



NOZZLE CROSS-SECTION

Source: SAP Double Absorption

Date: 4-12-89 Stack Diam. (in.) = 93.0 Stack Area (ft.<sup>2</sup>) = 47.17 C<sub>p</sub> = 0.7839

Rate: 157 Tons/Day H2SO4

Probe 10 ft. SS liner Nozzle Diam. = 0.240 in.

Meter # HE 184

Method 13B Filter Position - Back Bar. Press. (P<sub>b</sub>) 30.18 Assumed Moist. X 0 (M<sub>a</sub> 29.0)

Static Press. (P<sub>s</sub>) 0 in. H<sub>2</sub>O ÷ 13.6 = 0 in. Hg Stack Press. (P<sub>s</sub>) = P<sub>b</sub> 30.18 + P<sub>s</sub> 0 = 30.18 in. Hg

Probe Heater 5 Stack Sensor Check (T<sub>c</sub> = 58 °F, T<sub>amb</sub> = 56 °F (1.51) (T<sub>in</sub> = 76 °F, T<sub>out</sub> = 74 °F, T<sub>amb</sub> = 75 °F (5 F)

Pitot Leak Check  Dry Gas Corr. Factor (Y) 0.976

Final Leak Rate 0 CFM @ 10 in. Hg

Calc.  $Q_H = 17389 X \text{ } \mu\text{H} X (D_w)^4 X (1 - B_w)^2 X T_m X \Delta P =$

$\frac{K_s}{T_s}$

SO <sub>2</sub> Monitor	285	290	295																
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Notes

Clock Time (min.)	V <sub>m</sub> Meter Volume (ft. <sup>3</sup> )	μH Orifice Press. (in. H <sub>2</sub> O)	Vac. in. Hg	Gas Sample Temp. At Dry Gas Meter			Temp. Exit Inp. (°F)	Filt. Temp. (°F)	T <sub>s</sub> Stack Temp. (°F)	Trav. Point No.	Dist. In to Stack (in.)	ΔP Vel. Head in. H <sub>2</sub> O	V <sub>op</sub>
				T <sub>in</sub> (°F)	T <sub>out</sub> (°F)	T <sub>avg</sub> (°F)							
North													
0930													
0	5781	.81	2.4	78	76	77	60	60	122	1	6.98	.22	.47
3	5793	.82	2.5	95	77	86	61	57	107	2	11.23	.22	.47
6	5809	.86	2.5	101	77	89	61	57	147	3	15.98	.24	.49
9	5824	.94	2.7	103	77	90	62	57	155	4	21.48	.26	.51
12	5841	1.01	3.0	105	78	91.5	62	57	155	5	28.25	.28	.53
15	5859	1.01	3.0	106	78	92	62	57	155	6	38.08	.28	.53
18	5875	1.01	3.0	107	78	92.5	62	57	157	7	64.92	.28	.53
21	5892	1.04	3.4	108	80	94	62	57	157	8	74.75	.30	.55
24	5904	1.24	3.7	109	80	94.5	62	57	157	9	81.51	.34	.58
27	5927	1.24	3.7	110	80	95	62	57	157	10	87.02	.34	.58
30	5946	1.24	3.7	111	81	96	62	58	157	11	91.77	.31	.58
33	5963	1.17	3.6	111	82	96.5	62	58	157	12	96.02	.32	.57
36	5982												
	201	12.44							17.3				
West													
0830													
0	5567	.78	2.2	64	62	63	60	58	127	1	6.98	.22	.47
3	5582	.89	2.5	78	62	70	60	55	108	2	11.23	.24	.49
6	5597	.91	2.6	84	62	73	62	55	147	3	15.98	.26	.51
9	5615	1.06	2.8	89	64	76.5	62	56	151	4	21.48	.30	.55
12	5631	.99	2.7	92	65	78.5	62	57	151	5	28.25	.28	.53
15	5649	1.06	2.8	95	67	81	63	57	151	6	38.08	.30	.55
18	5666	1.07	2.8	98	68	83	65	57	151	7	64.92	.30	.55
21	5683	1.14	3.2	100	70	85	65	57	155	8	74.75	.32	.57
24	5701	1.22	3.6	101	71	86	67	58	152	9	81.51	.34	.58
27	5718	1.29	3.7	103	72	87.5	67	58	152	10	87.02	.36	.60
30	5737	1.37	3.9	104	73	88.5	68	57	151	11	91.77	.38	.62
33	5756	1.30	4.1	105	75	90.0	67	58	151	12	96.02	.36	.60
36	5776												
	754												
Time	V <sub>m</sub> (ft. <sup>3</sup> )	Avg. μH (in. H <sub>2</sub> O)	Max Vacuum in. Hg	T <sub>in</sub> (°F)	T <sub>out</sub> (°F)	T <sub>avg</sub> (°F)	Max. Exit Temp.	Filter Temp. Avg.	T <sub>s</sub> Avg.	Total Number Trav. Points = 24			Avg V <sub>op</sub>
	410	1.06	4.1	54	86	68	57	57	177	Net V <sub>op</sub> = 1371			.54

Meter Volume, Dry Cubic Feet @ 68° F, 1 ATM.

$$V_n(\text{Corr.}) = (K = 17.64) \times (V_m \underline{410}) \times (Y \underline{.976}) \times \left( \frac{V_{\text{bar}} \underline{30.18} \text{ in. Hg} + \frac{H \underline{1.06} \text{ in. H}_2\text{O}}{13.6}}{T_n \underline{546} \cdot R} \right) = \underline{39.12} \text{ CF}$$

Average Stream Velocity, Feet/Second

$$V_n = (K_p = 85.49) \times (C_p = 0.7839) \times (\text{avg} \sqrt{P} \underline{.54}) \times \sqrt{\frac{(T_n(\text{Avg}) \underline{607} \cdot R)}{(P_n \underline{30.18}) \times (H_n \underline{29.0})}} = \underline{30.14} \text{ Feet/Second}$$

Average Stack Volume, Dry CFM @ 68° F, 1 ATM:

$$Q_{\text{std}} = 60 \times (1 - \frac{0}{B_{\text{std}}}) \times (V_n \underline{30.14}) \times (A \underline{47.17}) \times \left( \frac{(T(\text{std}) - 528 \cdot R) \times (P_n \underline{30.18})}{(T_n(\text{avg}) \underline{607} \cdot R) \times (P(\text{std}) \underline{29.92})} \right) = \underline{748.45} \text{ CFM @ 68° F, 1 ATM}$$

SO<sub>2</sub> Concentration, ppm by volume @ 68° F, 1 ATM.

$$C_{\text{SO}_2} = (K = 7.061 \times 10^{-6} \text{ lb/eq}) \times (N = \underline{2.0103} \text{ eq/ml}) \times (V_n \underline{94.7}) \times \left( \frac{V_{\text{std}} \underline{330}}{V_n \underline{100}} \right) = \underline{5.21 \times 10^{-5}} \text{ lb/CF} \times 385.1 \times 10^6 = \underline{350} \text{ ppm}$$

$V_n(\text{Corr.}) \underline{39.12} \text{ CF}$  SO<sub>2</sub> by volume @ 68° F, 1 ATM.

Sulfuric Mist (including SO<sub>2</sub>) concentration, ug/M<sup>3</sup>

$$C_{\text{H}_2\text{SO}_4} = (K = .08) \times 10^{-4} \text{ lb/eq} \times (N = \underline{0.1103} \text{ eq/ml}) \times (V_n \underline{21.3}) \times \left( \frac{V_{\text{std}} \underline{255}}{V_n \underline{100}} \right) = \underline{1.55 \times 10^{-6}} \text{ lb/CF} \times 1.062 \times 10^6 = \underline{16.5} \text{ ug Mist/M}^3$$

$V_n(\text{Corr.}) \underline{39.12} \text{ CF}$

Percent Isokinetic Sampling

$$I = (K = 0.09450) \times (T_n \underline{607} \cdot R) \times (V_n(\text{Corr.}) \underline{39.12} \text{ CF}) \times \frac{109}{(P_n \underline{30.18}) \times (V_n \underline{30.14}) \times (A_n \underline{0.0003142}) \times (0.72) \times (1 - \frac{0}{B_{\text{std}}})}$$

Analytical Data

SO<sub>2</sub> Monitor Average 295 ppm SO<sub>2</sub>

	Mist	SO <sub>2</sub>
Sample Volume	<u>255</u> ml.	<u>330</u> ml.
Aliquot V <sub>n</sub>	100 ml.	(25/100) × 10 ml.
Titration #1	<u>21.30</u> ml.	<u>94.8</u> ml.
Titration #2	<u>21.31</u> ml.	<u>94.6</u> ml.
Avg. Titration V <sub>n</sub>	<u>21.31</u> ml.	<u>94.7</u> ml.

SO<sub>2</sub>  
 $(5.21 \times 10^{-5}) (748.45) (60) = 2611 \text{ lb/ton}$   
 $= 3.64 \text{ lb/ton}$

Acid Mist  
 $(1.55 \times 10^{-6}) (748.45) (60) = 6.9$   
 $= .097 \text{ lb/ton}$

Source SAP Double Absorption  
 Rate 1757 Tons/Day H2SO4

Date 4-12-89 Stack Diam. (in.)= 93.0 Stack Area (ft.<sup>2</sup>)= 47.17 C<sub>p</sub>=0.7839  
 Probe 10 ft. SS liner Nozzle Diam.=0.240 in.

Meter #HE 184 Method 13B Filter Position - Back Bar. Press. (P<sub>b</sub>) 30.18 Assumed Moist. X 0 (M<sub>a</sub> 29.0)  
 Static Press. (P<sub>s</sub>) 0 in. H<sub>2</sub>O ÷ 13.6 = 0 in. Hg Stack Press. (P<sub>s</sub>) = P<sub>b</sub> 30.18 + P<sub>s</sub> 0 = 30.18 in. Hg  
 Probe Heater 5 Stack Sensor Check (T<sub>c</sub>= 64°F, T<sub>amb</sub>= 62°F (1.5X) (T<sub>in</sub>= 82°F, T<sub>out</sub>= 80°F, T<sub>amb</sub>= 79°F (5 F)  
 Pilot Leak Check ✓ Dry Gas Corr. Factor (Y) 0.976 Final Leak Rate 0 CFM @ 10 in. Hg  
 Calc.  $\Delta H = 17389 \times \Delta H \times (D_m)^4 \times (1 - B_{wm})^2 \times T_m \times \Delta P$   
 $N_s$   $T_m$

SO <sub>2</sub> Monitor	290	295	285										
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Notes

Clock Time (min.)	V <sub>m</sub> Meter Volume (ft. <sup>3</sup> )	ΔH Orifice Press. (in. H <sub>2</sub> O)	Vac. in. Hg	Gas Sample Temp. At Dry Gas Meter			Temp. Exit Lap. (°F)	Fill. Temp. (°F)	T <sub>s</sub> Stack Temp. (°F)	Trav. Point No.	Dist. Into Stack (in.)	ΔP Vel. Head in. H <sub>2</sub> O	V <sup>op</sup>
				T <sub>in</sub> (°F)	T <sub>out</sub> (°F)	T <sub>ave</sub> (°F)							
1030										North			
0	5985	.67	1.3	82	80	81	64	64	117	1	6.98	.18	.42
3	5198	.70	1.4	99	82	40.5	62	60	103	2	11.23	.18	.42
6	6014	.86	2.2	104	82	93	68	60	157	3	15.98	.24	.49
9	6027	.86	2.2	106	82	94	64	61	157	4	21.48	.24	.49
12	6043	.93	2.4	108	82	45	69	62	157	5	28.25	.26	.51
15	6039	1.00	2.5	109	82	95.5	69	63	157	6	38.08	.28	.53
18	6077	1.08	2.5	111	82	46.5	69	63	157	7	64.92	.30	.53
21	6094	1.08	2.5	112	83	47.5	69	63	157	8	74.75	.30	.55
24	6111	1.08	2.5	113	84	48.5	70	64	157	9	81.51	.30	.55
27	6128	1.14	2.1	114	84	49	70	65	157	10	87.02	.32	.57
30	6146	1.16	2.6	114	85	44.5	70	65	157	11	91.77	.32	.57
33	6165	1.01	2.5	115	86	100.5	72	66	156	12	96.02	.28	.53
36	6182												
	197	1.59											
1130										West			
0	6183	.60	1.3	84	84	84	80	78	122	1	6.98	.16	.40
3	6196	.62	1.3	102	86	94	82	72	108	2	11.23	.16	.40
6	6208	.79	1.4	107	86	46.5	82	70	157	3	15.98	.22	.47
9	6223	.86	2.0	110	86	98	82	72	157	4	21.48	.24	.49
12	6234	.94	2.4	112	86	94	84	72	157	5	28.25	.26	.51
15	6256	.94	2.4	113	86	99.5	84	74	157	6	38.08	.26	.51
18	6273	1.01	2.5	115	87	101	87	73	157	7	64.92	.28	.53
21	6290	1.01	2.5	116	88	102	86	73	157	8	74.75	.28	.53
24	6307	1.04	2.5	117	88	102.5	87	75	157	9	81.51	.30	.55
27	6323	1.16	2.7	118	89	103.5	88	76	157	10	87.02	.32	.57
30	6343	1.16	2.7	119	89	104	90	77	157	11	91.77	.32	.57
33	6360	1.16	2.7	119	90	104.5	92	78	157	12	96.02	.32	.57
36	6380												
	197												
Time	V <sub>m</sub> (ft. <sup>3</sup> )	Avg. ΔH (in. H <sub>2</sub> O)	Max Vacuum in. Hg	T <sub>in</sub> (°F)	T <sub>out</sub> (°F)	T <sub>ave</sub> (°F)	Temp. Exit Temp.	Filter Temp. Avg.	T <sub>s</sub> Avg.	Total Number Trav. Points = 24 Avg V <sup>op</sup> = .51			
72	394	.96	3.7	97	97	97	92	69	150	Net V <sup>op</sup> = 12.28			



Meter Volume, Dry Cubic Feet @ 68° F, 1 ATM.

$$V_m (\text{Corr.}) = (K = 17.64) \times (V_m \underline{39.4}) \times (Y \underline{.976}) \times \left[ \frac{V_{\text{bar}} \underline{30.18} \text{ in. Hg} + ^{\text{H}} \underline{.96} \text{ in. H}_2\text{O}}{13.6} \right] \times \left[ \frac{760}{T_m \underline{557} \text{ } ^\circ\text{R}} \right] = \underline{36.84} \text{ CF}$$

Average Stream Velocity, Feet/Second

$$V_s = (K_s = 85.49) \times (C_s = 0.7839) \times (\text{avg } \sqrt{^{\text{AP}} \underline{.51}}) \times \sqrt{\frac{(T_m (\text{Avg}) \underline{610} \text{ } ^\circ\text{R})}{(P_m \underline{30.18}) \times (H_m \underline{29.0})}} = \underline{28.53} \text{ Feet/Second}$$

Average Stack Volume, Dry CFM @ 68° F, 1 ATM.

$$V_{\text{std}} = 60 \times (1 - \underline{0} B_{\text{ws}}) \times (V_s \underline{28.53}) \times (A \underline{47.17}) \times \left[ \frac{(T_{\text{std}} \underline{528} \text{ } ^\circ\text{R}) \times (P_m \underline{30.18})}{(T_m (\text{avg}) \underline{610} \text{ } ^\circ\text{R}) \times (P_{\text{std}} \underline{29.92})} \right] = \underline{70499} \text{ CFM @ 68° F, 1 ATM}$$

SO<sub>2</sub> Concentration, ppm by volume @ 68° F, 1 ATM.

$$C_{\text{SO}_2} = (K = 7.061 \times 10^{-5} \text{ lb/req}) \times (N = \underline{0.0103} \text{ req/ml}) \times (V_t \underline{18.7}) \times \left[ \frac{V_{\text{std}} \underline{415}}{V_s \underline{10}} \right] = \underline{5.71 \times 10^{-5}} \text{ lb/CF} \times \frac{385.1 \times 10^6}{84} = \underline{344} \text{ ppm}$$

V<sub>m</sub>(Corr.) 36.84 CF

SO<sub>2</sub> by volume @ 68° F, 1 ATM.

Sulfuric Mist (including SO<sub>2</sub>) concentration, ag/M<sup>3</sup>

$$C_{\text{H}_2\text{SO}_4} = (K = 1.081 \times 10^{-4} \text{ lb/req}) \times (N = \underline{0.0103} \text{ req/ml}) \times (V_t \underline{13.39}) \times \left[ \frac{V_{\text{std}} \underline{345}}{V_s \underline{100}} \right] = \underline{1.40 \times 10^{-6}} \text{ lb/CF} \times 1.062 \times 10^7 = \underline{14.8} \text{ ag Mist/M}^3$$

V<sub>m</sub>(Corr.) 36.84 CF

Percent Isokinetic Sampling

$$I = (K = 0.09450) \times (T_m \underline{610} \text{ } ^\circ\text{R}) \times (V_m (\text{Corr.}) \underline{36.84} \text{ CF}) \times \left[ \frac{760}{(P_m \underline{30.18}) \times (V_s \underline{28.53}) \times (A_m \underline{0.0003142}) \times (10 \text{ } ^\circ\text{F}) \times (1 - \underline{0} B_{\text{ws}})} \right] = \underline{109} \%$$

Analytical Data

SO<sub>2</sub> Monitor Average 295 ppm SO<sub>2</sub>

	Mist	SO <sub>2</sub>
Sample Volume	<u>345</u> ml.	<u>415</u> ml.
Aliquot V <sub>a</sub>	100 ml.	(25/100) × 10 ml.
Titration #1	<u>13.4</u> ml.	<u>17.40</u> ml.
Titration #2	<u>13.37</u> ml.	<u>17.44</u> ml.
Avg. Titration V <sub>t</sub>	<u>13.39</u> ml.	<u>17.42</u> ml.

$$\text{SO}_2 \text{ (} 5.71 \times 10^{-5} \text{)} (70499) (60) = 242 \text{ lb/hr.} \\ = 3.37 \text{ lb/ton}$$

$$\text{Acid Mist (} 1.4 \times 10^{-6} \text{)} (70499) (60) = 5.90 \text{ lb/hr} \\ \frac{5.91}{70.53} = .082 \text{ lb/ton}$$

Source SAP Double Absorption

Date 4-12-89

Stack Dia. (in.) = 93.0

Stack Area (ft.<sup>2</sup>) = 47.17  $C_p = 0.7839$

Rate 1757 Tons/Day H<sub>2</sub>SO<sub>4</sub>

Probe 10 ft. SS liner

Nozzle Dia. = 0.24 in.

Meter # HE 184

Method 13B Filter Position - Back

Bar. Press. (P<sub>a</sub>) = 30.18

Assumed Moist. 0

(M<sub>a</sub>) 29.0

Static Press. (P<sub>s</sub>) 0 in. H<sub>2</sub>O = 0 in. Hg Stack Press. (P<sub>1</sub>) = P<sub>a</sub> + P<sub>s</sub> = 30.18 in. Hg

Probe Heater 5 Stack Sensor Check (T<sub>1</sub> = 69 °F, T<sub>2</sub> = 68 °F (1.51) (T<sub>1</sub> = 84 °F, T<sub>2</sub> = 84 °F, T<sub>3</sub> = 80 °F (5 F)

Pitot Leak Check  Dry Gas Corr. Factor (Y) 0.976

Final Leak Rate 0 CFM @ 10 in. Hg

Calc.  $\Delta H = 17389 \times \Delta H_e \times (D_w)^2 \times (1 - B_w)^2 \times T_m \times \Delta P =$

H<sub>s</sub>

T<sub>s</sub>

SO <sub>2</sub> Monitor	295	290	285										
-------------------------	-----	-----	-----	--	--	--	--	--	--	--	--	--	--

Notes

Clock Time (min)	V <sub>m</sub> Meter Volume (ft. <sup>3</sup> )	ΔH Orifice Press. (in. H <sub>2</sub> O)	Vac. in. Hg	Gas Sample Temp. At Dry Gas Meter			Temp. Exit Inp. (°F)	Fill. Temp. (°F)	T <sub>s</sub> Stack Temp. (°F)	Tray. Point No.	Dist. Into Stack (in.)	ΔP Vel. Head in. H <sub>2</sub> O	V <sub>sp</sub>
				T <sub>1m</sub> (°F)	T <sub>out</sub> (°F)	T <sub>avg</sub> (°F)							
North													
1330													
0	6591	.31	1.0	96	92	94	80	75	98	1	6.98	.08	.28
3	6601	.33	1.0	110	93	101.5	80	70	78	2	11.23	.08	.28
6	6609	.51	1.0	115	93	104	80	69	147	3	15.98	.14	.317
9	6621	.60	1.3	117	93	105	80	68	157	4	21.48	.18	.42
12	6635	.73	1.4	119	93	106	81	67	154	5	28.25	.20	.45
15	6650	.80	1.4	120	93	106.5	80	67	159	6	38.08	.22	.47
18	6666	.88	1.8	121	93	107	81	66	159	7	64.92	.24	.49
21	6683	1.03	2.4	122	94	108	80	66	159	8	74.75	.27	.53
24	6700	1.03	2.4	123	94	108.5	81	66	154	9	81.51	.28	.53
27	6717	1.10	2.5	124	94	109	83	66	157	10	87.02	.30	.55
30	6735	1.18	2.6	124	95	109.5	84	66	157	11	91.77	.32	.57
33	6753	1.03	2.4	125	95	110	83	66	157	12	96.02	.28	.53
36	6772												
West													
1230													
0	6383	.56	1.2	97	87	89	75	75	137	1	6.98	-.16	.40
3	6395	.71	1.3	106	89	97.5	75	68	137	2	11.23	.20	.45
6	6410	.87	1.5	111	89	100	72	68	155	3	15.98	.24	.49
9	6425	.94	2.3	113	89	101	72	68	157	4	21.48	.26	.51
12	6442	1.02	2.4	116	90	103	72	68	157	5	28.25	.28	.53
15	6459	1.02	2.4	117	90	103.5	72	68	157	6	38.08	.28	.53
18	6477	1.02	2.4	118	90	104	72	68	157	7	64.92	.28	.53
21	6494	1.02	2.4	119	91	105	72	69	159	8	74.75	.28	.53
24	6512	1.09	2.5	120	91	105.5	72	68	159	9	81.51	.30	.55
27	6531	1.17	2.6	121	91	106	72	69	157	10	87.02	.32	.57
30	6548	1.24	2.7	121	92	106.5	74	70	157	11	91.77	.34	.58
33	6567	1.24	2.7	122	92	107	74	69	157	12	96.02	.34	.57
36	6586												
	384	.90	2.7										
Time	V <sub>m</sub> (ft. <sup>3</sup> )	Avg. ΔH (in. H <sub>2</sub> O)	Max Vacuum in. Hg	T <sub>m</sub> (°F)	Avg. (°F)	104	84	68	150				
					564 (°F)	+ 460	Max. Exit Temp.	Filter Temp. Avg.	T <sub>s</sub> Avg.	Total Number Tray. Points = 24			
										Avg V <sub>sp</sub> = 11.72			
										Avg V <sub>sp</sub> = .49			

Meter Volume, Dry Cubic Feet @ 68° F, 1 ATM.

$$V_n(\text{Corr.}) = (K = 17.64) \times (V_n = 38.4) \times (Y = 0.976) \times \left[ \frac{V_{\text{bar}} 30.18 \text{ in. Hg} + 4H \frac{.90}{13.6} \text{ in. H}_2\text{O}}{T_n 56.4 \text{ }^\circ\text{R}} \right] = 35.45 \text{ CF}$$

Average Stream Velocity, Feet/Second

$$V_n = (K_p = 85.49) \times (C_p = 0.7839) (\text{avg } \sqrt{AP} = .49) \times \sqrt{\left( \frac{T_n(\text{Avg}) 610 \text{ }^\circ\text{R}}{(P_n 30.18) \times (H_n 29.0)} \right)} = 27.41 \text{ Feet/Second}$$

Average Stack Volume, Dry CFM @ 68° F, 1 ATM.

$$Q_{68} = 60 \times (1 - 0 B_{68}) \times (V_n 27.41) \times (A 47.17) \times \left[ \frac{(T(\text{std}) 528 \text{ }^\circ\text{R}) \times (P_n 30.18)}{(T_n(\text{avg}) 610 \text{ }^\circ\text{R}) \times (P(\text{std}) 29.92)} \right] = 6773 \text{ CFM @ 68 }^\circ\text{F, 1 ATM}$$

SO<sub>2</sub> Concentration, ppa by volume @ 68° F, 1 ATM.

$$C_{\text{SO}_2} = (K = 7.06) \times 10^{-6} \text{ lb/req} \times (N = 0.103 \text{ req/ml}) \times (V_n 55.2) \times \left[ \frac{V_{\text{mol}} 485}{V_n 10} \right] = 5.49 \times 10^{-5} \text{ lb/CF} \times 385.1 \times 10^6 = 330 \text{ ppa}$$

$V_n(\text{Corr.}) 35.45 \text{ CF}$  SO<sub>2</sub> by volume @ 68° F, 1 ATM.

Sulfuric Mist (including SO<sub>2</sub>) concentration, ag/M<sup>3</sup>

$$C_{\text{H}_2\text{SO}_4} = (K = 1.08) \times 10^{-4} \text{ lb/req} \times (N = 0.0103 \text{ req/ml}) \times (V_n 13.1) \times \left[ \frac{V_{\text{mol}} 375}{V_n 100} \right] = 1.54 \times 10^{-6} \text{ lb/CF} \times 1.062 \times 10^7 = 16.4 \text{ ag Mist/M}^3$$

$V_n(\text{Corr.}) 35.45 \text{ CF}$

Percent Isokinetic Sampling

$$I = (K = 0.09450) \times (T_n 610 \text{ }^\circ\text{R}) \times (V_n(\text{Corr.}) 35.45 \text{ CF}) \times \left[ \frac{109}{(P_n 30.18) \times (V_n 27.41) \times (A_n 0.000342) \times (0.72) \times (1 - 0 B_{68})} \right]$$

Analytical Data

SO<sub>2</sub> Monitor Average 295 ppa SO<sub>2</sub>

	Mist	SO <sub>2</sub>
Sample Volume	375 ml.	485 ml.
Aliquot V <sub>n</sub>	100 ml.	(25/100) × 10 ml.
Titration #1	13.0 ml.	13.8 ml.
Titration #2	13.15 ml.	13.7 ml.
Avg. Titration V <sub>n</sub>	13.1 ml.	(13.8)4 ml.

$$\text{SO}_2 = (5.49 \times 10^{-5}) (6773) (60) = 223 \text{ lb/hr.} \\ 3.11 \text{ lb/ton}$$

$$\text{Acid Mist} = (1.54 \times 10^{-6}) (6773) (60) = 6.27 \text{ lb/hr} \\ = .087 \text{ lb/ton}$$

0.01 N Barium Chloride Standardization

Using 0.01 N  $H_2SO_4$

Made From 1.00 N  $H_2SO_4$  Solution Prepared From

J.T. Baker Diluted Concentration

① 25.00 ml 0.01 N  $H_2SO_4$

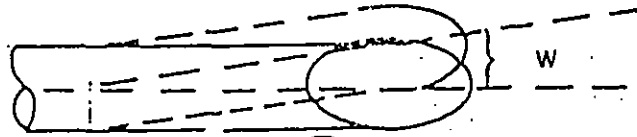
24.27 ml  $BaCl_2$  Soln Titrant

② 25.00 = 0.0103 N

24.27

SOURCE SAMPLING PITOT TUBE CALIBRATION  
ALIGNMENT MEASUREMENT OF FACE OPENINGS

SIDE "A"



$W = \text{Ø} \text{ cm}$

SIDE "B"

$W < 0.08 \text{ cm}$

REFERENCE POINT

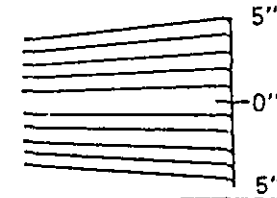
LONGITUDINAL  
TUBE AXIS

REFERENCE POINT



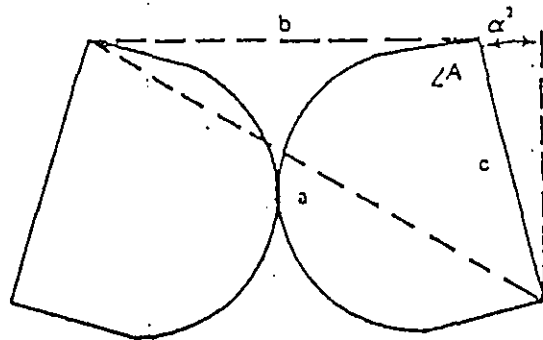
$\beta^2 = \text{Ø}^\circ$

$\beta^2 < 5^\circ$



$\beta^1 = 3^\circ$

SIDE "A"



$a = 2.86 \text{ cm}$

$\alpha^2 = 180^\circ - (180^\circ - \angle A) + 90^\circ$

$b = 2.70 \text{ cm}$

$\alpha^2 = \text{Ø}^\circ$

$c = .94 \text{ cm}$

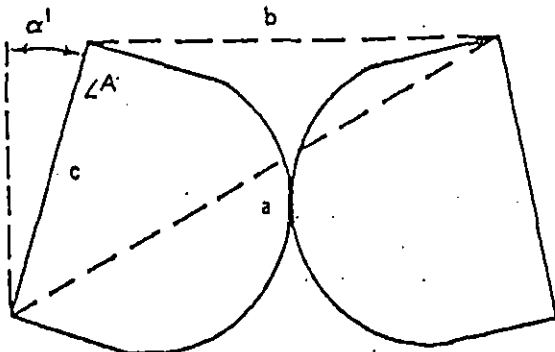
$\alpha^2 < 10^\circ$

$\angle A = 90.0^\circ$

$Z = .25 \text{ cm}$

$Z < 0.32 \text{ cm}$

SIDE "B"



$a = 3.02 \text{ cm}$

$\alpha^1 = 180^\circ - (180^\circ - \angle A) + 90^\circ$

$b = 2.70 \text{ cm}$

$\alpha^1 = 4.0^\circ$

$c = 1.54 \text{ cm}$

$\alpha^2 < 10^\circ$

$\angle A = 86^\circ$

DATE: 4-12-89

S/N: SMD-271125

P/N/C

# Visible Emissions Observation Form

YES NO

Source/Process Information				Opacity Readings										
FACILITY NAME <b>Royster Phosphates Inc</b>				OBSERVATION DATE <b>4-12-89</b>				START TIME <b>12:00 PM</b>		STOP TIME <b>12:30 PM</b>				
SOURCE NAME <b>Sulfuric Acid Plant</b>		PERMIT NO. <b>A041-121085</b>		SEC	5	10	30	45	SEC	5	10	30	45	
LOCATION/ADDRESS <b>US 415 Piney Point FL 34220</b>				1	0	0	0	0	31					
CONTACT <b>S. NEUPAUER</b>		PHONE NO. <b>813 722 4555</b>		2	0	0	0	0	32					
PROCESS/PRODUCTION RATE <b>Contact Sulfuric Acid Plant</b>				3	0	0	0	0	33					
CONTROL EQUIPMENT <b>OPEKATOR</b>		OPERATING MODE <b>Continuous</b>		4	0	0	0	0	34					
FUEL TYPE/RATE		MATERIAL TYPE/RATE <b>1710 ton/day</b>	PERMITTED RATE <b>2000 ton/day</b>	5	0	0	0	0	35					
DESCRIBE EMISSION POINT <b>STACK</b>				6	0	0	0	0	36					
HEIGHT ABOVE GROUND LEVEL <b>200</b> FT.		HEIGHT RELATIVE TO OBSERVER <b>200</b> FT.		7	0	0	0	0	37					
Emissions Description				8	0	0	0	0	38					
DESCRIBE EMISSIONS <b>NONE</b>				9	0	0	0	0	39					
PLUME COLOR <b>NONE</b>		PLUME TYPE <b>NONE</b>		10	0	0	0	0	40					
WATER DROPLETS PRESENT YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>		IF YES, IS PLUME: ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>		11	0	0	0	0	41					
Meteorological Information				12	0	0	0	0	42					
BACKGROUND <b>SKY</b>		BACKGROUND COLOR <b>Gray</b>		13	0	0	0	0	43					
ANY CONDITIONS? CLOUD COVER <b>75% Clouds Cover</b>		AMBIENT TEMP. <b>108°</b>		14	0	0	0	0	44					
WIND SPEED <b>5</b> MPH		WIND DIRECTION <b>NE</b>		15	0	0	0	0	45					
Observation Data, Site Diagram				16	0	0	0	0	46					
<p>Observed Emission Point</p> <p>Distance 450'</p> <p>Sun Shadow Line</p> <p>70° 70°</p> <p>Observers Position</p> <p>WIND</p> <p>Key: Sun   Wind </p>				17	0	0	0	0	47					
				18	0	0	0	0	48					
				19	0	0	0	0	49					
				20	0	0	0	0	50					
				21	0	0	0	0	51					
				22	0	0	0	0	52					
				23	0	0	0	0	53					
				24	0	0	0	0	54					
				25	0	0	0	0	55					
				26	0	0	0	0	56					

Compliance Information				Certification Data, Signatures			
RANGE OF OPACITY READINGS: MIN: <b>0</b> MAX: <b>0</b>		OBSERVERS NAME <b>Swanne Vella-Neupauer</b>		OBSERVERS SIGNATURE <i>Swanne Vella-Neupauer</i>		DATE <b>4-12-89</b>	
AVERAGE OF HIGHEST 12 CONSECUTIVE READINGS <b>0</b>				ORGANIZATION <b>Royster Phosphates, Inc</b>			
SHORT TERM AVERAGE DATA AVERAGING PERIOD <b>30</b> MINUTES ACTUAL AVERAGE <b>0</b>				CERTIFIED BY <b>ETA</b>		DATE <b>3-89</b>	
COMMENTS:				I HAVE RECEIVED A COPY OF THESE OBSERVATIONS: SIGNATURE			

# VISIBLE EMISSIONS EVALUATOR

This is to certify that

*Alvarado Villa Newspaper*

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 15% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate is valid for six months from date of issue.

*Thomas Rose*

*Will [Signature]*

*David Savage*

Vice President

Program Manager

222403

Certificate Number

Tampa

Location

March 10, 1989

Date of Issue

#### 4.0 BEST AVAILABLE CONTROL TECHNOLOGY

Best Available Control Technology (BACT) is required to control air pollutants emitted from newly constructed major sources or from modification to the major emitting facilities if the modification results in significant increase in the emission rate of regulated pollutants. The significance of an emission rate increase is defined by Rule 17-2.500(2)(e)(2), FAC.

The emission rate increases and decreases resulting from the activities proposed by Royster have been summarized in Table 3-2. The activities include the construction of a new 2,700 ton per day double absorption sulfuric acid plant and the retirement of the existing 2,000 ton per day double absorption sulfuric acid plant. From Table 3-2 it will be noted that sulfuric dioxide and sulfuric acid mist emissions from the new sulfuric acid plant will represent a significant increase over emissions from the existing 2,000 ton per day plant.

Sulfur dioxide and acid mist are present in the tail gas from all contact processed sulfuric acid plants. In a typical plant with the single absorption system, the sulfur dioxide in the tail gas is approximately 30 pounds per ton of acid produced and the acid mist is approximately four pounds per ton of acid produced.



#### 4.1 Emission Standards for Sulfuric Acid Plants

Federal New Source Performance Standards (NSPS) for sulfuric acid plants became effective on August 17, 1971. These standards are codified in 40 CFR 60, Subpart H and require sulfur dioxide emissions to be limited to no more than 4.0 pounds per ton of 100 percent acid produced and require that sulfuric acid mist emissions be limited to no more than 0.15 pounds per ton of 100 percent acid produced. Additionally, the standards limit the opacity of the emissions from new sulfuric acid plants to less than 10 percent.

When EPA reviewed the New Source Performance Standards for sulfuric acid plants in 1985 (EPA-450/3-85-012), it was concluded that because of variations in sulfur dioxide emissions as a function of catalyst age, "... the level of SO<sub>2</sub> emissions as specified in the current NSPS (should) not be changed at this time." Regarding the NSPS for sulfuric acid mist, EPA concluded, "Making the acid mist standard more stringent is not believed to be practical at this time because of the need to provide a margin of safety due to in-plant operating fluctuations, which introduce variable quantities of moisture into the sulfuric acid production line."

A review of BACT/LAER determinations published in the EPA Clearinghouse indicates that no new control alternatives have been applied to sulfuric acid plants since 1985 that would result in a consistent reduction in sulfur dioxide emission below 4.0 pounds per ton of acid nor would result in a consistent reduction of sulfuric acid mist emissions below 0.15 pounds per ton of acid.

## 4.2 Control Technologies

The control of sulfur dioxide and sulfuric acid mist emissions from sulfuric acid plants can be achieved by various processes. The process of choice for sulfur dioxide control has been dual absorption and the process of choice for controlling sulfuric acid mist emission has been one of the various types of fiber mist eliminators. These processes have been selected based on cost, product recovery, the formation of no undesirable by-products and the fact that neither introduces operating processes that are foreign to plant personnel.

EPA published a review of NSPS for sulfuric acid plants in March 1985 (EPA-450/3-85-012). Another review of NSPS by EPA is currently due but probably will not be published before the early 1990's. In the 1985 report, EPA reviewed 46 sulfuric acid plants built between 1971 and 1985. Of these 46 plants, 40 used the dual absorption process for sulfur dioxide control with the remaining six using some type of acid gas scrubbing. All 46 plants used the high efficiency mist eliminators for acid mist control.

In the March 1985 review (EPA-450/3-85-012), EPA reviewed the control technologies that had been used to control sulfur dioxide and sulfuric acid mist emissions from sulfuric acid plants. The alternatives included the dual absorption process, ammonia scrubbing, sodium sulfite-bisulfite scrubbing, and molecular sieves for sulfur dioxide control and filter type mist eliminators and electrostatic precipitators for sulfuric acid mist control. A review of the EPA BACT/LAER Clearinghouse information

indicated that no other control alternatives have been considered for sulfuric acid plants.

#### 4.2.1 Sulfur Dioxide Control

The control alternatives for sulfur dioxide have been summarized based upon information compiled by EPA in the 1985 NSPS review for sulfuric acid plants. As stated earlier, EPA is due to review these standards again but will probably not publish the results of their review until sometime in the early 1990's.

##### 4.2.1.1 Dual Absorption Process

The dual absorption process has become the SO<sub>2</sub> control system of choice within the sulfuric acid industry since the promulgation of NSPS in 1971. Of the 46 new sulfuric acid plants constructed between 1971 and 1985, 40 employed this process for sulfur dioxide control. The process offers the following advantages over other SO<sub>2</sub> control technologies:

1. 99.4 percent of the sulfur is converted to sulfuric acid compared with 97.7 percent conversion with a single absorption plant followed by scrubbing;
2. there are no by-products produced;
3. there are no new operating processes that plant personnel must become familiar with;

4. the process permits higher inlet sulfur dioxide concentrations resulting in a reduction in equipment size;
5. there is no reduction in overall plant operating time efficiency; and
6. there is no increase in manpower requirements.

The dual absorption process is capable of reducing sulfur dioxide emission rates to less than 4.0 pounds per ton of acid as required by New Source Performance Standards. The information reviewed by EPA indicates that even lower sulfur dioxide emission levels occur with new catalyst but as the catalyst ages, the conversion efficiency drops and sulfur dioxide emission rates begin to approach the 4.0 pound per ton limit.

#### 4.2.1.2 Sodium Sulfite-Bisulfite Scrubbing

Between 1971 and 1985, two sulfuric acid plants were constructed employing sodium sulfite-bisulfite scrubbing to control sulfur dioxide emissions. One of the plants was subsequently converted to ammonia scrubbing and the second plant has never been used. As a result, sodium sulfite-bisulfite scrubbing is not considered a demonstrated sulfur dioxide control alternative.

#### 4.2.1.3 Ammonia Scrubbing

Ammonia scrubbing uses anhydrous ammonia and water in a scrubbing system to convert sulfur dioxide to ammonium sulfate. Depending upon the market, the ammonium sulfate can be converted to a fertilizer grade product.

Five sulfuric acid plants constructed between 1971 and 1985 use ammonia scrubbing for sulfur dioxide control. The process has proved effective for reducing sulfur dioxide emissions to below 4.0 pounds per ton and also for controlling sulfuric acid mist emissions.

The major disadvantages of the ammonia scrubbing system, when compared with the dual absorption process are:

1. a waste by-product is produced unless there is a market for fertilizer grade ammonium sulfate;
2. the scrubbing system introduces a process that is foreign to sulfuric acid plant operators;
3. the scrubbing system is a high maintenance item and requires additional manpower for operation; and
4. no sulfuric acid plant size reduction benefits are achieved with the scrubbing system.

#### 4.2.1.4 Molecular Sieves

A molecular sieve was installed at one sulfuric acid plant in Florida for sulfur dioxide control. Extensive operating problems were experienced as the molecular sieve absorbed nitrogen oxides as well as sulfur dioxide. The regeneration of these gases resulted in the formation of nitric acid within the sulfuric acid plant. The nitric acid/sulfuric acid mixture resulted in severe corrosion problems which caused the molecular sieve system to be scrapped. As a result, molecular sieves are not considered a viable alternative for sulfur dioxide control in the sulfuric acid industry.

#### 4.2.2 Sulfuric Acid Mist Control

Control alternatives that were reviewed by EPA in the 1985 New Source Performance Standards review are summarized in the following sections.

##### 4.2.2.1 Fiber Mist Eliminators

The 46 new sulfuric acid plants constructed between 1971 and 1985, all used the fiber type mist eliminators for sulfuric acid mist control. Operations demonstrated that these types of mist eliminators can control sulfuric acid mist emissions to less than 0.15 pounds per ton of sulfuric acid.

The mist eliminators are the choice of control for sulfuric acid mist within the sulfuric acid industry because they require very little

operation and maintenance attention and because of the small space requirement associated with these devices. The disadvantage of this type of mist eliminator is that the pressure drop across the elements varies from five to 15 inches of water; resulting in an increase in operating utility costs.

#### 4.2.2.2 Electrostatic Precipitators

The electrostatic precipitators have the potential for controlling sulfuric acid mist emissions from sulfuric acid plants; however, there is no demonstrated application of precipitators. The disadvantages associated with precipitators, and hence, the reason they have not been used, include the initial cost, size requirements, operating and maintenance requirements and the potential for corrosion. The advantage of the precipitator is that it would operate at a low pressure drop; approximately 0.5 inches of water.

#### 4.3 Cost Analysis

In reviewing the cost analyses presented in this section, it should be recognized that the two control alternatives that have been analyzed for sulfur dioxide achieved about the same degree of efficiency; i.e., there is no advantage of one system over the other from the standpoint of the level of sulfur dioxide control that can be achieved. The same holds true for the control alternatives evaluated for sulfuric acid mist; both alternatives (fiber mist eliminators and electrostatic precipitators) are capable of achieving approximately the same degree of acid mist control.

Hence, the choice of the control alternative for sulfur dioxide and the control alternative for sulfuric acid mist can be made on the basis of cost, operating familiarity and operating convenience.

In Tables 4-1 and 4-2, the capital costs and annual costs of controlling sulfur dioxide emissions by dual absorption and by ammonia scrubbing are presented. In Table 4-3 and 4-4, similar costs are presented for controlling sulfuric acid mist emissions by fiber mist eliminators and electrostatic precipitators. The cost data are based upon analyses presented in EPA-450/3-85-012 and in EPA-450/3-76-014 (Capital and Operating Costs of Selected Air Pollution Control Systems); both updated to 1989 costs. The capital recovery in the annual cost calculation is based upon a 10 percent rate of return and a 10 year equipment life.

The cost analyses demonstrate that the annual cost of the dual absorption process for sulfur dioxide is less than half the annual cost for ammonia scrubbing. Similarly the annual cost for sulfuric acid mist with the fiber type mist eliminators is approximately one-fourth the annual cost of controlling acid mist with electrostatic precipitators. As the two control alternatives for sulfur dioxide and the two control alternatives for sulfuric acid mist are capable of the same level of control, it is evident why the dual absorption and the fiber type mist eliminators have been the control alternatives of choice for sulfur dioxide and sulfuric acid mist, respectively.



#### 4.4 Conclusion

Based upon the analysis presented in previous sections, the dual absorption process had been selected by Royster as the control alternative for sulfur dioxide control and the fiber type high efficiency mist eliminator has been selected for sulfuric acid mist control. The dual absorption system will be operated with catalyst screening and make up every three to five years as is typical in the industry.

TABLE 4-1

COST ANALYSIS FOR SO<sub>2</sub> CONTROL BY DUAL ABSORPTION  
2700 TPD CONTACT SULFURIC ACID PLANT

ROYSTER PHOSPHATES, INC.  
MANATEE COUNTY, FLORIDA

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CAPITAL COST

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Direct			
Absorber	\$ 1,402,650		
Pumps	280,800		
Piping	421,200		
Heat Exchanger	<u>702,000</u>		\$2,806,650
Indirect			
Engineering and Supervision	280,800		
Construction	156,600		
Contractor	168,750		
Contingency	<u>336,150</u>		<u>942,300</u>
TOTAL CAPITAL COST			\$3,748,950

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ANNUAL COST

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Direct			
Operating Labor and Supervision	10,800		
Maintenance Labor	8,775		
Maintenance Materials	8,775		
Utilities	2,991,600		
Catalyst	<u>40,500</u>		\$3,060,450
Indirect			
OH	10,800		
Payroll	<u>5,400</u>		16,200
Capital Recovery			611,550
Insurance and Taxes			149,850
Credit for Acid Recovery			<u>(1,147,500)</u>
TOTAL ANNUAL COST			\$2,690,550

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TABLE 4-2

COST ANALYSIS FOR SO<sub>2</sub> CONTROL BY AMMONIA SCRUBBING  
2700 TPD CONTACT SULFURIC ACID PLANT

ROYSTER PHOSPHATES, INC.  
MANATEE COUNTY, FLORIDA

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**CAPITAL COST**

---

Direct		
	Scrubber and Auxiliaries	\$4,276,800
Indirect		
	Engineering and Supervision	427,950
	Construction	341,550
	Contractor	256,500
	Contingency	<u>513,000</u>
		<u>1,539,000</u>
<b>TOTAL CAPITAL COST</b>		<b>\$5,815,800</b>

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**ANNUAL COST**

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Direct		
	Operating Labor and Supervision	729,000
	Maintenance Labor	108,000
	Maintenance Materials	108,000
	Utilities	310,500
	Chemicals	<u>2,624,400</u>
		<b>\$3,879,900</b>
Indirect		
	OH	418,500
	Payroll	<u>167,400</u>
		<b>585,900</b>
Capital Recovery		<b>947,700</b>
Insurance and Taxes		<u>232,200</u>
<b>TOTAL ANNUAL COST</b>		<b>\$5,645,700</b>

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TABLE 4-3

COST ANALYSIS FOR ACID MIST CONTROL BY FIBER TYPE MIST ELIMINATORS  
2700 TPD CONTACT SULFURIC ACID PLANT

ROYSTER PHOSPHATE, INC.  
MANATEE COUNTY, FLORIDA

<u>CAPITAL COST</u>		
Direct		\$ 86,400
Indirect		<u>40,500</u>
TOTAL CAPITAL COST		\$ 126,900
<u>ANNUAL COST</u>		
Direct		
Utilities		\$ 197,100
Indirect		
Capital Recovery	20,250	
Insurance and Taxes	<u>5,400</u>	
		25,650
Credit for Acid Recovery		<u>(128,250)</u>
TOTAL ANNUAL COST		\$ 94,500

TABLE 4-4

COST ANALYSIS FOR ACID MIST CONTROL BY ELECTROSTATIC PRECIPITATOR  
2700 TPD CONTACT SULFURIC ACID PLANT

ROYSTER PHOSPHATES, INC.  
MANATEE COUNTY, FLORIDA

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**CAPITAL COST**

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Direct		
Collector	429,300	
Auxiliaries	<u>148,500</u>	\$ 577,800
Indirect		
Engineering and Supervision	58,050	
Construction	45,900	
Contractor	35,100	
Contingency	<u>68,850</u>	<u>207,900</u>
TOTAL CAPITAL COST		\$ 785,700

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**ANNUAL COST**

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Direct		
Operating Labor and Supervision	31,050	
Maintenance Labor	27,000	
Maintenance Materials	40,500	
Utilities	<u>67,500</u>	\$ 166,050
Indirect		
OH	28,350	
Payroll	<u>12,150</u>	40,500
Capital Recovery		128,250
Insurance and Taxes		<u>31,050</u>
TOTAL ANNUAL COST		\$ 365,850

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## 5.0 IMPACTS ON SOILS, VEGETATION AND VISIBILITY

The land-use in the vicinity of Royster Phosphates, Inc. is a mixture of unimproved land, pasture land and land used for small industries. The town of Palmetto is located about nine miles south of the site and Sun City is located about five miles northeast of the site. Additionally, there are scattered residences between Royster and the two population centers. The proposed new sulfuric acid plant is not expected to have any significant impact on activities in the area. Air quality modeling has demonstrated that sulfur dioxide levels which will exist after the proposed modifications will not be a significant impact. Also, modeling has indicated that there will not be a significant impact from sulfuric acid mist emissions. Thus it is expected that the proposed expansion will not adversely impact soils, vegetation and visibility in the area.

The proposed modification will require a minimal increase in personnel to operate the cogeneration facility. Also, the proposed 35 percent increase in sulfuric acid production may cause a slight increase in truck deliveries of molten sulfur. However, current deliveries of needed sulfuric acid of up to 12 trucks per day will cease. These changes will have a slight impact on traffic in the area but when compared with traffic levels that presently exist, the increases will not be significant.

## 6.0 GOOD ENGINEERING PRACTICE STACK HEIGHT

The criteria for good engineering practice stack height in Rule 17-2.270 states that the height of a stack should not exceed the greater of 65 meters (213) feet or the height of nearby structures plus the lesser of 1.5 times the height or cross-wind width of the nearby structure. This stack height policy is designed to prevent achieving ambient air quality goals solely through the use of excessive stack heights and air dispersion.

Based on this policy, the limiting height for the new sulfuric acid plant stack is 213 feet. Royster intends to construct a stack which will be 200 feet in height above-grade. This stack will satisfy the good engineering practice stack height criteria and will not result in excessive concentrations of air pollutants as a result of plume downwash as the stack will be at least 2.5 times the height of nearby structures.

## 7.0 AIR QUALITY REVIEW

The project proposed by Royster will result in significant emission rate increases of sulfur dioxide and sulfuric acid mist but a less than significant increase in nitrogen oxides emissions. Hence, the air quality review required for the project permit application will address only sulfur dioxide and sulfuric acid mist emissions.

The air quality review required of a PSD construction permit application potentially requires both air quality modeling and air quality monitoring. The air quality monitoring is required when the impact of air pollutant emission increases and decreases associated with a proposed project exceed the de minimis impact levels defined by Rule 17-2.500(3)(e)1, FAC or in cases where an applicant wishes to define existing ambient air quality by monitoring rather than by air quality modeling. The air quality modeling is required to provide assurance that the increases and decreases in air pollutant emissions associated with the project, combined with all other applicable air pollutant emission rate increases and decreases associated with new sources affecting the project area, will not cause or contribute to an exceedance of the applicable PSD increments (defined by Rule 17-2.310, FAC). Additionally, the air quality modeling is required to provide assurance that the emissions from the proposed project, together with the emissions of all other air pollutants in the project area, will not cause or contribute to a violation of any ambient air quality standard (AAQS).



The de minimis impact levels of the air pollutants associated with the proposed project are:

Sulfur Dioxide	-	13.0 micrograms per cubic meter, 24-hour average
Sulfuric Acid Mist	-	NA

The modeling that has been conducted demonstrates that the net impact of the sulfur dioxide emissions increases and decreases addressed in this application are less than the de minimis impact levels defined by Rule 17-2.500(3)(e)1, FAC and summarized above. Furthermore, the applicant does not intend to define existing ambient sulfur dioxide levels by air quality monitoring. Hence, air quality monitoring is not a requirement of this application.

The air quality modeling that has been conducted demonstrates that the net impact sulfur dioxide emissions from the sulfuric acid plants (increased emissions from proposed plant and the decrease in emissions resulting from the shut-down of the existing plant) is significant for the three-hour and 24-hour periods but is not significant for the annual period. The distance to which the impacts are significant is less than 3.0 kilometers. Significant, as used in this instance, is defined by Rule 17-2.100(171)(a), FAC. The modeling of sulfur dioxide emissions shows, however, that the impacts of the emissions are well below the incremental increases allowed by the PSD Rule (17-2.310, FAC). Additional sulfur dioxide modeling is necessary to evaluate the impact of other sources on

the project area to assure that AAQS and PSD increments are not exceeded. The modeling of sulfuric acid mist emissions associated with the proposed project shows a maximum net impact that is approximately one-tenth of the Acceptable Ambient Level (AAL) where the AAL is defined as a multiple of the Threshold Limit Value for sulfuric acid mist.

In the following sections, the air quality modeling for sulfur dioxide and sulfuric acid mist is described.

#### 7.1 Air Quality Modeling for Sulfur Dioxide

The net change in the emissions rate of sulfur dioxide associated with the proposed project is defined as the emission rate increase associated with the new sulfuric acid plant minus the actual sulfur dioxide emissions associated with the shut-down of the existing sulfuric acid plant. These emission rates are addressed in Section 3.0 of this application.

The impact of the net change in sulfur dioxide emissions was assessed with the Industrial Source Complex - Short Term (ISC-ST) air quality model. The modeling was conducted in accordance with guidelines established by EPA and published in the document, Guideline for Air Quality Modeling, (Revised), July 1986. The meteorological data used with the model were for Tampa, Florida and represented the period 1973, 1974, 1975, 1978 and 1979.

The sulfur dioxide emissions associated with the project included the

increase in emissions associated with the new sulfuric acid plant and the decrease in emissions associated with the shut-down of the existing plant. The sulfur dioxide emissions from the new plant were based upon a sulfur dioxide emission limit of 4.0 pounds per ton of 100 percent sulfuric acid and a production rate of 2,700 tons of 100 percent acid per day. This resulted in an hourly sulfur dioxide emission rate of 450.0 pounds per hour. For modeling purposes, it was assumed that the plant would operate 8,760 hours a year.

The decreases in sulfur dioxide emissions were defined as the decrease in actual sulfur dioxide emissions from the existing sulfuric acid plant. This emission rate (see Section 3.0) was based on a sulfuric acid production rate of 2000 tons of 100 percent sulfuric acid per day, a sulfur dioxide emission rate of 3.37 pounds per ton of 100 percent acid produced and an annual production-based operating factor of 0.737. These conditions result in a decrease in actual sulfur dioxide emissions of 280.8 pounds per hour and 906.4 tons per year. Plant characteristics used for the modeling are summarized in Table 7-1.

The modeling conducted with the ISC-ST air quality model was conducted in accordance with EPA guidelines and included receptors established by the polar grid system extending to 7.5 kilometers from the plant. Seven sets of receptor rings were placed at distances ranging from 0.3 to 7.5 kilometers from the plant with receptors placed at 10 degree intervals on each receptor ring.

The results of the air quality modeling, summarized in Table 7-2, demonstrate that the impact of the proposed project is significant for the three-hour and 24-hour periods but is not significant for the annual period. As the net impacts of the sulfur dioxide emission rate changes resulting from the proposed project are significant for the 3-hour and 24-hour time periods, additional air quality modeling is required to demonstrate that AAQS and PSD increments are not exceeded.

### 7.2 Air Quality Modeling for Nitrogen Oxides

The net change in nitrogen oxides emissions associated with the project is not significant (i.e., is less than 40 tons per year). Hence, no air quality modeling is required for nitrogen oxides.

### 7.3 Air Quality Modeling for Sulfuric Acid Mist

No ambient air quality standards, PSD increments or significant impact levels have been established for sulfuric acid mist. For purposes of this permit application, an Acceptable Ambient Level (AAL) was developed by dividing the Threshold Limit Value of 1,000 micrograms per cubic meter by 210. The factor of 210 consists of a factor of 4.2 to convert the eight-hour per day, five day per week exposure allowed by the Threshold Limit Value to a 24-hour per day, seven day per week exposure; that is,  $(24 \times 7)/(8 \times 5)$ . In addition to this factor, a safety factor of 50 was applied to reduce the exposure established for the working population to an exposure that is applicable to the general population. The factor of 50

was selected as sulfuric acid mist is not considered a highly toxic material. The 24-hour AAL that has been established based upon these factors is 4.8 micrograms per cubic meter.

The air quality modeling that was conducted to evaluate the impact of sulfuric acid mist emissions from the Royster facility on was conducted with ISC-ST air quality model using the guidelines used for sulfur dioxide modeling and described in Section 7.1 of this application. The receptor grid used was identical to the polar coordinate system used in the sulfur dioxide modeling. The modeling was conducted to determine the net impact of the emission increases and decreases associated with the proposed project.

The results of the air quality modeling are summarized in Table 7-3. The result of the modeling demonstrate that the maximum expected increase in ambient sulfuric acid mist levels associated with the proposed project will be approximately 0.4 micrograms per cubic meter over a 24-hour period. The modeling results also show that the maximum expected sulfuric acid mist impact resulting from the operations of the proposed new plant will be approximately 1.4 microgram per cubic meter, 24-hour average, at a distance of 1.0 kilometers from the plants. These impacts compare with the AAL for sulfuric acid mist of 4.8 micrograms per cubic meter, 24-hour average.

The impact of sulfuric acid mist emissions from sources outside the Royster chemical complex were not included in the air quality review based

upon an engineering judgment. It was estimated that because of the expected magnitude of the sulfuric acid mist emissions from other sources and the distances of these sources from Royster it would be very unlikely that any of the sources, individually or collectively, will result in a significant contribution to ambient acid mist levels in the project area.

TABLE 7-1

## PLANT CHARACTERISTICS USED FOR AIR QUALITY MODELING

ROYSTER, INC.  
MANATEE COUNTY, FLORIDA

PLANT	STACK		STACK GAS		EMISSION RATES (1)			
	Ht (ft)	Dia (ft)	Vel (FPS)	Temp (°F)	SO <sub>2</sub>		Acid Mist	
					(lb/hr)	(TPY)	(lb/hr)	(TPY)
Existing H <sub>2</sub> SO <sub>4</sub> #1	200	7.75	28.7	150	280.8	906	7.4	23.9
New H <sub>2</sub> SO <sub>4</sub> #2	200	9.25	31.5	170	450.0	1971	16.9	74.0

(1) Annual emission rates are based on the following assumptions:

- (a) Existing H<sub>2</sub>SO<sub>4</sub> - An annual operating factor, based on production, of 0.737.
- (b) New H<sub>2</sub>SO<sub>4</sub> - Operating time will be 8760 hours/year.

TABLE 7-2  
 SUMMARY OF SULFUR DIOXIDE IMPACT ANALYSIS  
 ROYSTER, INC.  
 MANATEE, FLORIDA

METEOROLOGICAL DATA	SULFUR DIOXIDE IMPACT ( $\mu\text{g}/\text{m}^3$ )		
	ANNUAL	3-HOUR	24-HOUR
1973	0.4	23.8	4.8
1974	0.5	24.2	5.8*
1975	0.5	24.7	4.6
1978	0.5	32.5*	5.0*
1979	0.6	28.0*	6.1*
Significant Impact (17-2.100(171)(a), FAC	1.0	25.0	5.0
De minimis Impact 17-2.500(3)(e)1, FAC	NA	NA	13.0
PSD Increment 17-2.310, FAC	20.0	512	91

\*Significant Impact



TABLE 7-3  
 SUMMARY OF ACID MIST IMPACT ANALYSIS  
 ROYSTER, INC.  
 MANATEE COUNTY, FLORIDA

METEOROLOGICAL DATA	24-HR ACID MIST IMPACT ( $\mu\text{g}/\text{m}^3$ )	
	CHANGE	NEW PLANT
1973	0.40	0.9
1974	0.42	1.1
1975	0.44	1.1
1978	0.42	1.1
1979	0.52	1.4
AAL (1)	4.8	4.8

(1) AAL = TLV/210, 24-Hour Average