**Farmland Hydro, L.P.**

**Charles W. Jenkins**
**Manager, Environmental/Safety Services**

Green Bay Plant
County Road 640
Post Office Box 960
Bartow, Florida 33831
Tele: 813 533-1141
Fax: 813 533-8793

November 14, 1997

RECEIVED
NOV 20 1997
BUREAU OF
AIR REGULATION

A. A. Linero, P.E.
Administrator
New Source Review Section
Bureau of Air Regulation
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399

RE: POLK COUNTY GREEN BAY COMPLEX
SULFURIC ACID PRODUCTION REALLOCATION
PERMIT I.D. NO. 1050053-018-AC, PSD-FL-225

1050053-019-AC
PSD-FL-243

Dear Mr. Linero:

Enclosed you will find our check in the amount of $7,250.00 per your letter of October 16, 1997, which is also enclosed for your convenience. We have sent to you $250.00 already, so this equals the $7,000.00 referred to in Koogler and Associates' cover letter, which is attached.

Also enclosed you will find eight (8) copies of the permit application along with a disk from Koogler and Associates.

If you have any questions or concerns, please do not hesitate to call John Koogler (352-377-5822) or me (941-533-1141, ext. 334).

Very truly yours,

Charles W. Jenkins

Charles W. Jenkins
Manager, Environmental/Safety Services

CWJ:jp\280-97
enclosures

**Department of**
**Environmental Protection**

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

October 16, 1997

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

Mr. Charles Jenkins, Manager
of Environmental & Safety Services
Farmland Hydro, L.P.
Post Office Box 960
Bartow, Florida 33831

RE: Polk County-AP, Green Bay Complex
Sulfuric Acid Production Reallocation
Permit I.D. No. 1050053-018-AC, PSD-FL-225

Dear Mr. Jenkins:

The Bureau of Air Regulation received your request for a minor modification of the above-referenced permit and has determined that a PSD permit application is required. An additional processing fee of $7250 pursuant to Rule 62-4.050(4)(r)5, F.A.C., must be submitted along with the PSD application.

If you have any questions, please call John Reynolds at (904)488-1344.

Sincerely,

AA Linero 10/16

A. A. Linero, P.E.
Administrator
New Source Review Section
Bureau of Air Regulation

AAL/kt

cc: John Reynolds, BAR
John Bunyak, NPS
Brian Beals, EPA
Bill Thomas, SWD
Roy Harwood, Polk Co.

make out to:
Florida Dept, of Environmental Prot.
Bureau of Air Regulations,
2600 Blairstone Rd,
Tallahassee, FL 32399

| VENDOR NO. |
|---|
| 101890 |

| VENDOR NAME |
|---|
| FLORIDA DEPT OF ENVIRONMENTAL |

Post Office Box 960 Bartow, Florida 33831

FHL
NBCDA
FHAP

| CODE | CHECK NO. |
|---|---|
| IO | 0000003958 |
| **DATE** | **PAGE** |
| 11/14/1997 | 1 of 1 |

**0000003958**

FARMLAND HYDRO, L.P. ACCOUNTS PAYABLE CHECK DETAIL

| B.A. | DATE | INVOICE NO. | DOCUMENT NO. | GROSS | DISCOUNT | NET |
|---|---|---|---|---|---|---|
| FHL<br>Return to Joan | 11/10/1997 | 111097 | 100005098 | 7,250.00 | | 7,250.00 |
| | | **Total** | | $7,250.00 | | $7,250.00 |

DETACH VOUCHER BEFORE DEPOSITING

Farmland.

**Farmland Hydro, L.P.**
Post Office Box 960 Bartow, Florida 33831

HYDRO

NationsBank, N.A. (South)
Atlanta, Dekalb County, Georgia
64-1278/611

**NO. 0000003958**

| DATE | CHECK NO. |
|---|---|
| 11/14/1997 | 0000003958 |

AMOUNT VOID AFTER 180 DAYS

| AMOUNT |
|---|
| *****$7,250.00 |

PAY EXACTLY *********7,250 DOLLARS AND 00 CENTS

TO THE ORDER OF

FLORIDA DEPT OF ENVIRONMENTAL
PROTECTION
BUREAU OF AIR REGULATIONS
TWIN TOWERS OFFICE BLDG
2600 BLAIRSTONE RD
TALLAHASSEE FL 32399-2400

FARMLAND HYDRO, L.P. ACCOUNTS PAYABLE

⑈0000003958⑈ ⑆061112788⑆ 3299910424⑈

KOOGLER & ASSOCIATES
ENVIRONMENTAL SERVICES
4014 NW THIRTEENTH STREET
GAINESVILLE, FLORIDA 32609
352/377-5822 ▪ FAX/377-7158

KA 123-97-02

November 12, 1997

RECEIVED
NOV 20 1997
BUREAU OF
AIR REGULATION

Mr. A. A. Linero
Florida Department of
Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Subject: Polk County-AP
Farmland Hydro, L.P.
Green Bay Complex
PSD Permit Application
Sulfuric Acid Plant Replacement

1050053-019-AC
PSD-FL-243

Dear Mr. Linero:

Farmland Hydro, L.P. is submitting this PSD permit application for the replacement of the existing 2100 tons per day (TPD) No. 3 Sulfuric Acid Plant with a new 2750 TPD sulfuric acid plant at the existing facility in Polk County, Florida.

Enclosed are eight (8) copies of the permit application, along with a check in the amount of $7500 (PSD application review fee). A disk, containing the modeling output of the air impact analysis associated with the proposed project, is also enclosed.

If you have any questions, please call Pradeep Raval or me.

Very truly yours,

KOOGLER & ASSOCIATES

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

JBK:par
Enc.

c: Charles Jenkins, Farmland Hydro, L.P.

cc: J. Arif
EPA
NPS
Polk Co
SWD
C. Holladay, BAR

# Department of
# Environmental Protection

RECEIVED
NOV 20 1997
BUREAU OF
AIR REGULATION

## DIVISION OF AIR RESOURCES MANAGEMENT

## APPLICATION FOR AIR PERMIT - LONG FORM

See Instructions for Form No. 62-210.900(1)

## I. APPLICATION INFORMATION

This section of the Application for Air Permit form identifies the facility and provides general information on the scope and purpose of this application. This section also includes information on the owner or authorized representative of the facility (or the responsible official in the case of a Title V source) and the necessary statements for the applicant and professional engineer, where required, to sign and date for formal submittal of the Application for Air Permit to the Department. If the application form is submitted to the Department using ELSA, this section of the Application for Air Permit must also be submitted in hard-copy.

### Identification of Facility Addressed in This Application

Enter the name of the corporation, business, governmental entity, or individual that has ownership or control of the facility; the facility site name, if any; and the facility's physical location. If known, also enter the facility identification number.

1. Facility Owner/Company Name: **Farmland Hydro, L.P.**

2. Site Name: **Green Bay Plant**

3. Facility Identification Number: **1050053** [ ] Unknown

4. Facility Location:
Street Address or Other Locator: **4390 County Road 640 West**
City: **Bartow** County: **Polk** Zip Code: **33830**

5. Relocatable Facility?
[ ] Yes [X] No

6. Existing Permitted Facility?
[X] Yes [ ] No

### Application Processing Information (DEP Use)

| | |
|---|---|
| 1. Date of Receipt of Application: | November 20, 1997 |
| 2. Permit Number: | 1050053-019-AC |
| 3. PSD Number (if applicable): | PSD-FL-243 |
| 4. Siting Number (if applicable): | |

## Owner/Authorized Representative or Responsible Official

1. Name and Title of Owner/Authorized Representative or Responsible Official:
**C. M. Farris, Vice President, Operations**

2. Owner/Authorized Representative or Responsible Official Mailing Address:

Organization/Firm: **Farmland Hydro, L.P.**
Street Address: **P.O. Box 960**
City: **Bartow** State: **FL** Zip Code: **33831**

3. Owner/Authorized Representative or Responsible Official Telephone Numbers:
Telephone: **( 941 ) 533-1141** Fax: **( 941 ) 533 - 8793**

4. Owner/Authorized Representative or Responsible Official Statement:

*I, the undersigned, am the owner or authorized representative* of the non-Title V source addressed in this Application for Air Permit or the responsible official, as defined in Rule 62-210.200, F.A.C., of the Title V source addressed in this application, whichever is applicable. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions unit.*

CMFarris
Signature

Nov. 13, 1997
Date

* Attach letter of authorization if not currently on file.

**Scope of Application**

This Application for Air Permit addresses the following emissions unit(s) at the facility. An Emissions Unit Information Section (a Section III of the form) must be included for each emissions unit listed.

| Emissions Unit ID | Description of Emissions Unit | Permit Type |
|---|---|---|
| 030 + 031 + 032 + 033 + 034 + 036 | MOLTEN SULFUR SYSTEM | AC1A |
| No Corresponding I.D. | SULFURIC ACID PLANT #6 | AC1A |
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## Purpose of Application and Category

Check one (except as otherwise indicated):

**Category I: All Air Operation Permit Applications Subject to Processing Under Chapter 62-213, F.A.C.**

This Application for Air Permit is submitted to obtain:

[ ] Initial air operation permit under Chapter 62-213, F.A.C., for an existing facility which is classified as a Title V source.

[ ] Initial air operation permit under Chapter 62-213, F.A.C., for a facility which, upon start up of one or more newly constructed or modified emissions units addressed in this application, would become classified as a Title V source.

Current construction permit number: ______________________________

[ ] Air operation permit renewal under Chapter 62-213, F.A.C., for a Title V source.

Operation permit to be renewed: ______________________________

[ ] Air operation permit revision for a Title V source to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number: ______________________________

Operation permit to be revised: ______________________________

[ ] Air operation permit revision or administrative correction for a Title V source to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application. Also check Category III.

Operation permit to be revised/corrected: ______________________________

[ ] Air operation permit revision for a Title V source for reasons other than construction or modification of an emissions unit. Give reason for the revision; e.g., to comply with a new applicable requirement or to request approval of an "Early Reductions" proposal.

Operation permit to be revised: ______________________________

Reason for revision: ______________________________

______________________________

**Category II: All Air Operation Permit Applications Subject to Processing Under Rule 62-210.300(2)(b), F.A.C.**

This Application for Air Permit is submitted to obtain:

[ ] Initial air operation permit under Rule 62-210.300(2)(b), F.A.C., for an existing facility seeking classification as a synthetic non-Title V source.

Current operation/construction permit number(s): ____________________

[ ] Renewal air operation permit under Rule 62-210.300(2)(b), F.A.C., for a synthetic non-Title V source.

Operation permit to be renewed: ____________________

[ ] Air operation permit revision for a synthetic non-Title V source. Give reason for revision; e.g., to address one or more newly constructed or modified emissions units.

Operation permit to be revised: ____________________

Reason for revision: ____________________

____________________

**Category III: All Air Construction Permit Applications for All Facilities and Emissions Units**

This Application for Air Permit is submitted to obtain:

[ X ] Air construction permit to construct or modify one or more emissions units within a facility (including any facility classified as a Title V source).

Current operation permit number(s), if any: NA

[ ] Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

Current operation permit number(s): ____________________

[ ] Air construction permit for one or more existing, but unpermitted, emissions units.

## Application Processing Fee

Check one:

[ X ] Attached - Amount: $ 7500.00 [ ] Not Applicable.

## Construction/Modification Information

1. Description of Proposed Project or Alterations:

**The proposed project consists of replacing the existing 2100 ton per day Sulfuric Acid Plant No. 3 with a new more efficient 2750 tpd Sulfuric Acid Plant No. 6.**

2. Projected or Actual Date of Commencement of Construction: **April 10, 1998**

3. Projected Date of Completion of Construction: **April 10, 2000**

## Professional Engineer Certification

1. Professional Engineer Name: : **John B. Koogler, Ph.D., P.E.**
Registration Number: **12925**

2. Professional Engineer Mailing Address:

Organization/Firm: **Koogler & Associates**
Street Address: **4014 NW 13th Street**
City: **Gainesville** State: **FL** Zip Code: **32609**

3. Professional Engineer Telephone Numbers:
Telephone: **( 352 ) 377 - 5822** Fax: **( 352 ) 377 - 7158**

4. Professional Engineer Statement:

*I, the undersigned, hereby certify, except as particularly noted herein*, that:*

*(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and*

*(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.*

*If the purpose of this application is to obtain a Title V source air operation permit (check here [ ] if so), I further certify that each emissions unit described in this Application for Air Permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance schedule is submitted with this application.*

*If the purpose of this application is to obtain an air construction permit for one or more proposed new or modified emissions units (check here [ X ] if so), I further certify that the engineering features of each such emissions unit described in this application have been ~~designed~~ or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.*

*If the purpose of this application is to obtain an initial air operation permit or operation permit revision for one or more newly constructed or modified emissions units (check here [ ] if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.*

Signature

Date 11/12/97

(seal)

* Attach any exception to certification statement.

## Application Contact

1. Name and Title of Application Contact:

**Pradeep Raval**

2. Application Contact Mailing Address:

Organization/Firm: **Koogler & Associates**
Street Address: **4014 NW 13th Street**
City: **Gainesville** State: **FL** Zip Code: **32609**

3. Application Contact Telephone Numbers:
Telephone: **( 352 ) 377 - 5822** Fax: **( 352 ) 377 - 7158**

## Application Comment

**This application is submitted in the format suggested by FDEP. Additional information will be submitted , as necessary, during the permitting process.**

# II. FACILITY INFORMATION

## A. GENERAL FACILITY INFORMATION

### Facility Location and Type

1. Facility UTM Coordinates:
Zone: **17** East (km): **410.3** North (km): **3079.7**

2. Facility Latitude/Longitude:
Latitude (DD/MM/SS): Longitude (DD/MM/SS):

| | | | |
|---|---|---|---|
| 3. Governmental Facility Code: | 4. Facility Status Code: **A** | 5. Facility Major Group SIC Code: **28** | 6. Facility SIC(s): **2874** |

7. Facility Comment (limit to 500 characters):

**Phosphate Fertilizer Plant**

### Facility Contact

1. Name and Title of Facility Contact:
**Charles Jenkins, Manager of Env. & Safety Services**

2. Facility Contact Mailing Address:
Organization/Firm: **Farmland Hydro, L.P., Green Bay Plant**
Street Address: **P.O. Box 960**
City: **Bartow** State: **FL** Zip Code: **33831**

3. Facility Contact Telephone Numbers:
Telephone: **( 941) 533-1141, ext. 334** Fax: ( **941** ) **533 - 8793**

**Facility Regulatory Classifications**

1. Small Business Stationary Source?
[ ] Yes [X] No [ ] Unknown

2. Title V Source?
[X] Yes [ ] No

3. Synthetic Non-Title V Source?
[ ] Yes [X] No

4. Major Source of Pollutants Other than Hazardous Air Pollutants (HAPs)?
[X] Yes [ ] No

5. Synthetic Minor Source of Pollutants Other than HAPs?
[ ] Yes [X] No

6. Major Source of Hazardous Air Pollutants (HAPs)?
[ ] Yes [X] No

7. Synthetic Minor Source of HAPs?
[ ] Yes [X] No

8. One or More Emissions Units Subject to NSPS?
[X] Yes [ ] No

9. One or More Emission Units Subject to NESHAP?
[X] Yes [ ] No

10. Title V Source by EPA Designation?
[ ] Yes [X] No

11. Facility Regulatory Classifications Comment (limit to 200 characters):

## B. FACILITY REGULATIONS

**Rule Applicability Analysis** (Required for Category II applications and Category III applications involving non Title-V sources. See Instructions.)

**NA**

**List of Applicable Regulations** (Required for Category I applications and Category III applications involving Title-V sources. See Instructions.)

| | |
|---|---|
| **FDEP CORE LIST** | |
| **FS 120, 403** | |
| **FAC 62-4, 204, 210, 212, 213, 214, 252, 256, 257, 281, 296, 297** | |
| **40 CFR 52, 55, 60, 61, 63, 82.** | |
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## C. FACILITY POLLUTANTS

**Facility Pollutant Information**

| 1. Pollutant Emitted | 2. Pollutant Classification |
|---|---|
| **PM/PM10** | **A** |
| **SO2** | **A** |
| **NOX** | **A** |
| **SAM** | **A** |
| **FL** | **B** |
| **CO** | **B** |
| **VOC** | **B** |
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## D. FACILITY POLLUTANT DETAIL INFORMATION

**Facility Pollutant Detail Information:** Pollutant ______ of ______

| | |
|---|---|
| 1. Pollutant Emitted: **NA** | |
| 2. Requested Emissions Cap: (lb/hour) | (tons/year) |
| 3. Basis for Emissions Cap Code: | |
| 4. Facility Pollutant Comment (limit to 400 characters): | |

**Facility Pollutant Detail Information:** Pollutant ______ of ______

| | |
|---|---|
| 1. Pollutant Emitted: **NA** | |
| 2. Requested Emissions Cap: (lb/hour) | (tons/year) |
| 3. Basis for Emissions Cap Code: | |
| 4. Facility Pollutant Comment (limit to 400 characters): | |

## E. FACILITY SUPPLEMENTAL INFORMATION

### Supplemental Requirements for All Applications

1. Area Map Showing Facility Location:
[ X ] Attached, Document ID: **Report** [ ] Not Applicable [ ] Waiver Requested

2. Facility Plot Plan:
[ X ] Attached, Document ID: **Report** [ ] Not Applicable [ ] Waiver Requested

3. Process Flow Diagram(s):
[ X ] Attached, Document ID: **Report** [ ] Not Applicable [ ] Waiver Requested

4. Precautions to Prevent Emissions of Unconfined Particulate Matter:
[ ] Attached, Document ID:_______ [X] Not Applicable [ ] Waiver Requested

5. Fugitive Emissions Identification:
[ ] Attached, Document ID:_______ [ ] Not Applicable [ X ] Waiver Requested

6. Supplemental Information for Construction Permit Application:
[X] Attached, Document ID: **Report** [ ] Not Applicable

### Additional Supplemental Requirements for Category I Applications Only

7. List of Proposed Exempt Activities:
[ ] Attached, Document ID:_________ [ X ] Not Applicable

8. List of Equipment/Activities Regulated under Title VI:

[ ] Attached, Document ID:________

[ ] Equipment/Activities On site but Not Required to be Individually Listed

[ X ] Not Applicable

9. Alternative Methods of Operation:
[ ] Attached, Document ID:________ [ X ] Not Applicable

10. Alternative Modes of Operation (Emissions Trading):
[ ] Attached, Document ID:________ [ X ] Not Applicable

11. Identification of Additional Applicable Requirements:
[ ] Attached, Document ID:________ [**X**] Not Applicable

12. Compliance Assurance Monitoring Plan:
[ ] Attached, Document ID:________ [**X**] Not Applicable

13. Risk Management Plan Verification:

[ ] Plan Submitted to Implementing Agency - Verification Attached, Document ID:________

[ ] Plan to be Submitted to Implementing Agency by Required Date

[**X**] Not Applicable

14. Compliance Report and Plan:
[ ] Attached, Document ID:_______ [**X**] Not Applicable

15. Compliance Certification (Hard-copy Required):
[ ] Attached, Document ID:_______ [**X**] Not Applicable

## III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through L as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application. Some of the subsections comprising the Emissions Unit Information Section of the form are intended for regulated emissions units only. Others are intended for both regulated and unregulated emissions units. Each subsection is appropriately marked.

### A. TYPE OF EMISSIONS UNIT
### (Regulated and Unregulated Emissions Units)

**Type of Emissions Unit Addressed in This Section**

1. Regulated or Unregulated Emissions Unit? Check one:

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

2. Single Process, Group of Processes, or Fugitive Only? Check one:

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

## B. GENERAL EMISSIONS UNIT INFORMATION
## (Regulated and Unregulated Emissions Units)

### Emissions Unit Description and Status

|  |  |  |
|---|---|---|
| 1. Description of Emissions Unit Addressed in This Section (limit to 60 characters):<br>**MOLTEN SULFUR SYSTEM** | | |
| 2. Emissions Unit Identification Number: **030** [ ] No Corresponding ID [ ] Unknown | | |
| 3. Emissions Unit Status Code: **A** | 4. Acid Rain Unit?<br>[ ] Yes [X] No | 5. Emissions Unit Major Group SIC Code:<br>**28** |
| 6. Emissions Unit Comment (limit to 500 characters): **TANKS / PITS**<br>**INCLUDES ITEMS 030, 031, 032, 033, 034, 036. WILL ALSO INCLUDE NEW TANK UPON COMPLETION OF CONSTRUCTION.** | | |

### Emissions Unit Control Equipment

**A.**

|  |
|---|
| 1. Description (limit to 200 characters): **NA** |
| 2. Control Device or Method Code: **NA** |

**Emissions Unit Information Section ( 1 of 2 )**

**B.**

| |
|---|
| 1. Description (limit to 200 characters): |
| 2. Control Device or Method Code: |

**C.**

| |
|---|
| 1. Description (limit to 200 characters): |
| 2. Control Device or Method Code: |

## C. EMISSIONS UNIT DETAIL INFORMATION
## (Regulated Emissions Units Only)

### Emissions Unit Details

| | |
|---|---|
| 1. Initial Startup Date: **NA** | |
| 2. Long-term Reserve Shutdown Date: **NA** | |
| 3. Package Unit: **NA**<br>Manufacturer: | Model Number: |
| 4. Generator Nameplate Rating: **NA** | MW |
| 5. Incinerator Information: **NA**<br>Dwell Temperature:<br>Dwell Time:<br>Incinerator Afterburner Temperature: | <br>°F<br>seconds<br>°F |

### Emissions Unit Operating Capacity

| | | |
|---|---|---|
| 1. Maximum Heat Input Rate: **NA** | | mmBtu/hr |
| 2. Maximum Incineration Rate: **NA** | lb/hr | tons/day |
| 3. Maximum Process or Throughput Rate: **2800 TPD Throughput Rate** | | |
| 4. Maximum Production Rate: **NA** | | |
| 5. Operating Capacity Comment (limit to 200 characters): | | |

### Emissions Unit Operating Schedule

Requested Maximum Operating Schedule:

**24** hours/day  **7** days/week

**52** weeks/year  **8760** hours/year

Emissions Unit Information Section ( 1 of 2 )

## D. EMISSIONS UNIT REGULATIONS
## (Regulated Emissions Units Only)

**Rule Applicability Analysis** (Required for Category II applications and Category III applications involving non Title-V sources. See Instructions.)

| |
|---|
| **N/A** |

**Emissions Unit Information Section ( 1 of 2 )**

**List of Applicable Regulations** (Required for Category I applications and Category III applications involving Title-V sources. See Instructions.)

| | |
|---|---|
| **SEE PAGE 12.** | |
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## E. EMISSION POINT (STACK/VENT) INFORMATION
## (Regulated Emissions Units Only)

### Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram:

2. Emission Point Type Code:
[ ] 1 [ ] 2 [X ] 3 [ ] 4

3. Descriptions of Emissions Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):

**TANK 1 - 6000 TON**
**TANK 2 - 2900 TON**
**TANK 3 - 2900 TON**
**TRUCK PIT - 72 TON**
**RAIL/TRUCK PIT -91 TON**
**SUPPLY PIT - 28 TON**
**TANK - 7700 TON**

4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common: **NA**

5. Discharge Type Code:
[ ] D [ ] F [ ] H [ ] P
[ ] R [ ] V [X ] W

6. Stack Height: **40** feet

7. Exit Diameter: **2.0** feet

8. Exit Temperature: **120** °F

| | |
|---|---|
| 9. Actual Volumetric Flow Rate: | **18** acfm |
| 10. Percent Water Vapor : | **NA** % |
| 11. Maximum Dry Standard Flow Rate: | **NA** dscfm |
| 12. Nonstack Emission Point Height: | **NA** feet |

13. Emission Point UTM Coordinates:
Zone: East (km): North (km):

14. Emission Point Comment (limit to 200 characters):

## F. SEGMENT (PROCESS/FUEL) INFORMATION
## (Regulated and Unregulated Emissions Units)

**Segment Description and Rate:** Segment 1 of 1

| | |
|---|---|
| 1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) (limit to 500 characters): **Chemical Manufacturing - Inorganic Chemicals - General Processes Storage/Transfer** | |
| 2. Source Classification Code (SCC): **3-01-070-02** | |
| 3. SCC Units: **Tons Product** | |
| 4. Maximum Hourly Rate: **580** | 5. Maximum Annual Rate: **924,000** |
| 6. Estimated Annual Activity Factor: **NA** | |
| 7. Maximum Percent Sulfur: **100** | 8. Maximum Percent Ash: **NA** |
| 9. Million Btu per SCC Unit: **NA** | |
| 10. Segment Comment (limit to 200 characters):<br>**Molten sulfur throughput increase to 924,000 tpy. No change in maximum hourly rates.** | |

## G. EMISSIONS UNIT POLLUTANTS
## (Regulated and Unregulated Emissions Units)

| 1. Pollutant Emitted | 2. Primary Control Device Code | 3. Secondary Control Device Code | 4. Pollutant Regulatory Code |
|---|---|---|---|
| **PM10** | **000** | **000** | **NS** |
| **PM** | **000** | **000** | **NS** |
| **VOC** | **000** | **000** | **NS** |
| **TRS** | **000** | **000** | **NS** |
| **SO2** | **000** | **000** | **NS** |
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## H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
## (Regulated Emissions Units Only - Emissions Limited Pollutants Only)

**Pollutant Detail Information:**

1. Pollutant Emitted: **NA**

2. Total Percent Efficiency of Control: %

3. Potential Emissions: lb/hour tons/year

4. Synthetically Limited?
[ ] Yes [ ] No

5. Range of Estimated Fugitive/Other Emissions:
[ ] 1 [ ] 2 [ ] 3 _______ to _______ tons/year

6. Emission Factor:
Reference:

7. Emissions Method Code:
[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

8. Calculation of Emissions (limit to 600 characters):

9. Pollutant Potential/Estimated Emissions Comment (limit to 200 characters):

**Emissions Unit Information Section ( 1 of 2 )**

**Allowable Emissions** (Pollutant identified on front of page)

**A.**

| | |
|---|---|
| 1. Basis for Allowable Emissions Code:**NA** | |
| 2. Future Effective Date of Allowable Emissions: | |
| 3. Requested Allowable Emissions and Units: | |
| 4. Equivalent Allowable Emissions: lb/hour | Tons/year |
| 5. Method of Compliance (limit to 60 characters): | |
| 6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters): | |

**B.**

| | |
|---|---|
| 1. Basis for Allowable Emissions Code: | |
| 2. Future Effective Date of Allowable Emissions: | |
| 3. Requested Allowable Emissions and Units: | |
| 4. Equivalent Allowable Emissions: lb/hr | tons/year |
| 5. Method of Compliance (limit to 60 characters): | |
| 6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters): | |

## I. VISIBLE EMISSIONS INFORMATION
## (Regulated Emissions Units Only)

**Visible Emissions Limitation:** Visible Emissions Limitation ___1___ of ___1___

| | |
|---|---|
| 1. Visible Emissions Subtype: **VE** | |
| 2. Basis for Allowable Opacity: [X] Rule [ ] Other | |
| 3. Requested Allowable Opacity:<br>Normal Conditions: **20%** Exceptional Conditions: %<br>Maximum Period of Excess Opacity Allowed: min/hour | |
| 4. Method of Compliance: **EPA METHOD 9** | |
| 5. Visible Emissions Comment (limit to 200 characters):<br>**VE at Each Vent on the Sulfur Storage Tank** | |

**Visible Emissions Limitation:** Visible Emissions Limitation ______ of ______

| | |
|---|---|
| 1. Visible Emissions Subtype: | |
| 2. Basis for Allowable Opacity: [ ] Rule [ ] Other | |
| 3. Requested Allowable Opacity:<br>Normal Conditions: % Exceptional Conditions: %<br>Maximum Period of Excess Opacity Allowed: min/hour | |
| 4. Method of Compliance: | |
| 5. Visible Emissions Comment (limit to 200 characters): | |

## J. CONTINUOUS MONITOR INFORMATION
### (Regulated Emissions Units Only)

**Continuous Monitoring System:** Continuous Monitor _____ of _____

| | |
|---|---|
| 1. Parameter Code: | 2. Pollutant(s): |
| 3. CMS Requirement: | [ ] Rule [ ] Other |
| 4. Monitor Information:<br>Manufacturer:<br>Model Number: | <br><br>Serial Number: |
| 5. Installation Date: | |
| 6. Performance Specification Test Date: | |
| 7. Continuous Monitor Comment (limit to 200 characters): | |

**Continuous Monitoring System:** Continuous Monitor _____ of _____

| | |
|---|---|
| 1. Parameter Code: | 2. Pollutant(s): |
| 3. CMS Requirement: | [ ] Rule [ ] Other |
| 4. Monitor Information:<br>Manufacturer:<br>Model Number: | <br><br>Serial Number: |
| 5. Installation Date: | |
| 6. Performance Specification Test Date: | |
| 7. Continuous Monitor Comment (limit to 200 characters): | |

## K. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENT TRACKING INFORMATION

### (Regulated and Unregulated Emissions Units)

**PSD Increment Consumption Determination**

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

If the emissions unit addressed in this section emits particulate matter or sulfur dioxide, answer the following series of questions to make a preliminary determination as to whether or not the emissions unit consumes PSD increment for particulate matter or sulfur dioxide. Check the first statement, if any, that applies and skip remaining statements.

[ ] The emissions unit is undergoing PSD review as part of this application, or has undergone PSD review previously, for particulate matter or sulfur dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after January 6, 1975. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after January 6, 1975, but before December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[NA ] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

2. Increment Consuming for Nitrogen Dioxide?

If the emissions unit addressed in this section emits nitrogen oxides, answer the following series of questions to make a preliminary determination as to whether or not the emissions unit consumes PSD increment for nitrogen dioxide. Check first statement, if any, that applies and skip remaining statements.

[ ] The emissions unit addressed in this section is undergoing PSD review as part of this application, or has undergone PSD review previously, for nitrogen dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after February 8, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after February 8, 1988, but before March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[NA ] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

| | | | | |
|---|---|---|---|---|
| 3. Increment Consuming/Expanding Code: | | | | |
| | PM | [ ] C | [ ] E | [ ] Unknown |
| | SO2 | [ ] C | [ ] E | [ ] Unknown |
| | NO2 | [ ] C | [ ] E | [ ] Unknown |
| 4. Baseline Emissions: | | | | |
| | PM | | lb/hour | tons/year |
| | SO2 | | lb/hour | tons/year |
| | NO2 | | | tons/year |
| 5. PSD Comment (limit to 200 characters): | | | | |

## L. EMISSIONS UNIT SUPPLEMENTAL INFORMATION
## (Regulated Emissions Units Only)

**Supplemental Requirements for All Applications**

1. Process Flow Diagram
   [ ] Attached, Document ID:________ [ ] Not Applicable [X ] Waiver Requested
2. Fuel Analysis or Specification
   [ ] Attached, Document ID:________ [X ] Not Applicable [ ] Waiver Requested
3. Detailed Description of Control Equipment
   [ ] Attached, Document ID:________ [X ] Not Applicable [ ] Waiver Requested
4. Description of Stack Sampling Facilities
   [ ] Attached, Document ID:________ [X ] Not Applicable [ ] Waiver Requested
5. Compliance Test Report
   [ ] Attached, Document ID:________

   [ ] Previously submitted, Date:______________

   [X ] Not Applicable
6. Procedures for Startup and Shutdown
   [ ] Attached, Document ID:________ [X ] Not Applicable
7. Operation and Maintenance Plan
   [ ] Attached, Document ID:________ [X ] Not Applicable
8. Supplemental Information for Construction Permit Application
   [ ] Attached, Document ID:________ [X ] Not Applicable
9. Other Information Required by Rule or Statute
   [ ] Attached, Document ID:________ [X ] Not Applicable

**Emissions Unit Information Section (_1_of_2_)**

## Additional Supplemental Requirements for Category I Applications Only

|  |
|---|
| 10. Alternative Methods of Operation<br>[ ] Attached, Document ID:_______ [X] Not Applicable |
| 11. Alternative Modes of Operation (Emissions Trading)<br>[ ] Attached, Document ID:________ [X ] Not Applicable |
| 12. Identification of Additional Applicable Requirements<br>[ ] Attached, Document ID:______ [X] Not Applicable |
| 13. Compliance Assurance Monitoring Plan<br>[ ] Attached, Document ID:______ [X] Not Applicable |
| 14. Acid Rain Application (Hard-copy Required)<br>[ ] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))<br>Attached, Document ID:________<br>[ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)<br>Attached, Document ID:________<br>[ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.)<br>Attached, Document ID:________<br>[ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)<br>Attached, Document ID:________<br>[X ] Not Applicable |

## III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through L as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application. Some of the subsections comprising the Emissions Unit Information Section of the form are intended for regulated emissions units only. Others are intended for both regulated and unregulated emissions units. Each subsection is appropriately marked.

### A. TYPE OF EMISSIONS UNIT
### (Regulated and Unregulated Emissions Units)

**Type of Emissions Unit Addressed in This Section**

1. Regulated or Unregulated Emissions Unit? Check one:

[ **X** ] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

2. Single Process, Group of Processes, or Fugitive Only? Check one:

[ **X** ] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

## B. GENERAL EMISSIONS UNIT INFORMATION
## (Regulated and Unregulated Emissions Units)

### Emissions Unit Description and Status

| | | |
|---|---|---|
| 1. Description of Emissions Unit Addressed in This Section (limit to 60 characters):<br>**Sulfuric Acid Plant No. 6** | | |
| 2. Emissions Unit Identification Number: [ X ] No Corresponding ID [ ] Unknown | | |
| 3. Emissions Unit Status Code: **C** | 4. Acid Rain Unit?<br>[ ] Yes [ X ] No | 5. Emissions Unit Major Group SIC Code:<br>**28** |
| 6. Emissions Unit Comment (limit to 500 characters):<br>**Proposed new plant to replace existing No. 3 sulfuric acid plant.** | | |

### Emissions Unit Control Equipment

**A.**

| |
|---|
| 1. Description (limit to 200 characters): **Double Absorption** |
| 2. Control Device or Method Code: **044** |

**B.**

|  |
|---|
| 1. Description (limit to 200 characters): **Mist Eliminators** |
| 2. Control Device or Method Code: **014** |

**C.**

|  |
|---|
| 1. Description (limit to 200 characters): |
| 2. Control Device or Method Code: |

## C. EMISSIONS UNIT DETAIL INFORMATION
## (Regulated Emissions Units Only)

### Emissions Unit Details

1. Initial Startup Date: **NA**

2. Long-term Reserve Shutdown Date: **NA**

3. Package Unit: **NA**
   Manufacturer: Model Number:

4. Generator Nameplate Rating: **NA** MW

5. Incinerator Information: **NA**
   Dwell Temperature: °F
   Dwell Time: seconds
   Incinerator Afterburner Temperature: °F

### Emissions Unit Operating Capacity

1. Maximum Heat Input Rate: **NA** mmBtu/hr

2. Maximum Incineration Rate: **NA** lb/hr tons/day

3. Maximum Process or Throughput Rate: **NA**

4. Maximum Production Rate: **2750 TPD 100% H2SO4**

5. Operating Capacity Comment (limit to 200 characters):

### Emissions Unit Operating Schedule

Requested Maximum Operating Schedule:

**24** hours/day **7** days/week

**52** weeks/year **8760** hours/year

**Emissions Unit Information Section ( 2 of 2 )**

## D. EMISSIONS UNIT REGULATIONS
## (Regulated Emissions Units Only)

**Rule Applicability Analysis** (Required for Category II applications and Category III applications involving non Title-V sources. See Instructions.)

**N/A**

**Emissions Unit Information Section (_2_ of _2_)**

**List of Applicable Regulations** (Required for Category I applications and Category III applications involving Title-V sources. See Instructions.)

| | |
|---|---|
| **See Page 12.** | |
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## E. EMISSION POINT (STACK/VENT) INFORMATION
## (Regulated Emissions Units Only)

### Emission Point Description and Type

| |
|---|
| 1. Identification of Point on Plot Plan or Flow Diagram:<br>**Sulfuric Acid Plant No. 6** |
| 2. Emission Point Type Code:<br>[**X**] 1   [ ] 2   [ ] 3   [ ] 4 |
| 3. Descriptions of Emissions Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point): **NA** |
| 4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:<br>**NA** |
| 5. Discharge Type Code:<br>[ ] D   [ ] F   [ ] H   [ ] P<br>[ ] R   [**X**] V   [ ] W |
| 6. Stack Height: **150** feet |
| 7. Exit Diameter: **9** feet |
| 8. Exit Temperature: **180** °F |

| | |
|---|---|
| 9. Actual Volumetric Flow Rate: | **133,000** acfm |
| 10. Percent Water Vapor : **NA** | % |
| 11. Maximum Dry Standard Flow Rate: **NA** | dscfm |
| 12. Nonstack Emission Point Height: **NA** | feet |
| 13. Emission Point UTM Coordinates:<br>Zone: East (km): North (km): | |
| 14. Emission Point Comment (limit to 200 characters): | |

## F. SEGMENT (PROCESS/FUEL) INFORMATION
## (Regulated and Unregulated Emissions Units)

**Segment Description and Rate:** Segment 1 of 1

| | |
|---|---|
| 1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) (limit to 500 characters): **Sulfuric Acid Production** | |
| 2. Source Classification Code (SCC): **3-01-023-04** | |
| 3. SCC Units: **Tons 100% H2SO4** | |
| 4. Maximum Hourly Rate: **114.6** | 5. Maximum Annual Rate: **1,003,750** |
| 6. Estimated Annual Activity Factor: **NA** | |
| 7. Maximum Percent Sulfur: **NA** | 8. Maximum Percent Ash: **NA** |
| 9. Million Btu per SCC Unit: **NA** | |
| 10. Segment Comment (limit to 200 characters):<br>**Hourly rate is based on 2,750 TPD of 100%H2SO4.** | |

Emissions Unit Information Section ( 2 of 2 )

## G. EMISSIONS UNIT POLLUTANTS
## (Regulated and Unregulated Emissions Units)

| 1. Pollutant Emitted | 2. Primary Control Device Code | 3. Secondary Control Device Code | 4. Pollutant Regulatory Code |
|---|---|---|---|
| **SO2** | **044** | **044** | **EL** |
| **SAM** | **044** | **014** | **EL** |
| **NOx** | **000** | **000** | **EL** |
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## H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
## (Regulated Emissions Units Only - Emissions Limited Pollutants Only)

**Pollutant Detail Information:**

1. Pollutant Emitted: **SO2**

2. Total Percent Efficiency of Control: **99.7 %**

3. Potential Emissions: **458.3** lb/hour **2007.5** tons/year

4. Synthetically Limited?
☐ Yes ☒ No

5. Range of Estimated Fugitive/Other Emissions:
☐ 1 ☐ 2 ☐ 3 _______ to _______ tons/year

6. Emission Factor: **4.0 LB/TON ACID**
Reference: **Permit**

7. Emissions Method Code:
☒ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

8. Calculation of Emissions (limit to 600 characters):

**SO2 = 4.0 LB/TON X 2750 TPD / 24 HRS/DAY = 458.3 LB/HR**
**X 8760 HRS/YR X TON/2000 LBS = 2007.5 TPY**

9. Pollutant Potential/Estimated Emissions Comment (limit to 200 characters):

**Emissions Unit Information Section ( 2 of 2 )**

**Allowable Emissions** (Pollutant identified on front of page)

**A.**

| |
|---|
| 1. Basis for Allowable Emissions Code: **Rule** |
| 2. Future Effective Date of Allowable Emissions: **NA** |
| 3. Requested Allowable Emissions and Units: **4.0 lb / Ton Produced** |
| 4. Equivalent Allowable Emissions: **458.3** lb/hour **2007.5** Tons/year |
| 5. Method of Compliance (limit to 60 characters): **EPA METHOD 8** |
| 6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters): **40 CFR 60, SUBPART H** |

**B.**

| |
|---|
| 1. Basis for Allowable Emissions Code: |
| 2. Future Effective Date of Allowable Emissions: |
| 3. Requested Allowable Emissions and Units: |
| 4. Equivalent Allowable Emissions: lb/hr tons/year |
| 5. Method of Compliance (limit to 60 characters): |
| 6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters): |

## H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
## (Regulated Emissions Units Only - Emissions Limited Pollutants Only)

**Pollutant Detail Information:**

1. Pollutant Emitted: **SAM**

2. Total Percent Efficiency of Control: **99** %

3. Potential Emissions: **17.2** lb/hour **75.3** tons/year

4. Synthetically Limited?
[ ] Yes [ X ] No

5. Range of Estimated Fugitive/Other Emissions:
[ ] 1 [ ] 2 [ ] 3 ______ to ______ tons/year

6. Emission Factor: **0.15 LB/TON ACID**
Reference: **Permit**

7. Emissions Method Code:
[X] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

8. Calculation of Emissions (limit to 600 characters):

**SAM = 0.15 LB/TON X 2750 TPD / 24 HRS/DAY = 17.2 LB/HR**
**X 8760 HRS/YR X TON/2000 LBS = 75.3 TPY**

9. Pollutant Potential/Estimated Emissions Comment (limit to 200 characters):

**Emissions Unit Information Section ( 2 of 2 )**

**Allowable Emissions** (Pollutant identified on front of page)

**A.**

1. Basis for Allowable Emissions Code:**Rule**
2. Future Effective Date of Allowable Emissions:**NA**
3. Requested Allowable Emissions and Units: **0.15 lb /Ton Produced**
4. Equivalent Allowable Emissions: **17.2** lb/hour **75.3** Tons/year
5. Method of Compliance (limit to 60 characters): **EPA METHOD 8**
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters): **40 CFR 60, SUBPART H**

**B.**

1. Basis for Allowable Emissions Code:
2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:
4. Equivalent Allowable Emissions: lb/hr tons/year
5. Method of Compliance (limit to 60 characters):
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

## H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
## (Regulated Emissions Units Only - Emissions Limited Pollutants Only)

**Pollutant Detail Information:**

1. Pollutant Emitted: **NOX**

2. Total Percent Efficiency of Control: %

3. Potential Emissions: **13.8** lb/hour **60.2** tons/year

4. Synthetically Limited?
[ ] Yes [**X**] No

5. Range of Estimated Fugitive/Other Emissions:
[ ] 1 [ ] 2 [ ] 3 _______ to _______ tons/year

6. Emission Factor: **0.12 LB/TON ACID**
Reference: **Similar Permit**

7. Emissions Method Code:
[X] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

8. Calculation of Emissions (limit to 600 characters):

**NOX = 0.12 LB/TON X 2750 TPD / 24 HRS/DAY = 13.8 LB/HR**
**X 8760 HRS/YR X TON/2000 LBS = 60.2 TPY**

9. Pollutant Potential/Estimated Emissions Comment (limit to 200 characters):

**Allowable Emissions** (Pollutant identified on front of page)

**A.**

| | | |
|---|---|---|
| 1. Basis for Allowable Emissions Code: **Rule** | | |
| 2. Future Effective Date of Allowable Emissions: **NA** | | |
| 3. Requested Allowable Emissions and Units: **0.12 lb /Ton Produced** | | |
| 4. Equivalent Allowable Emissions: | **13.8** lb/hour | **60.2** Tons/year |
| 5. Method of Compliance (limit to 60 characters): **EPA METHOD 7E** | | |
| 6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters): **BACT** | | |

**B.**

| | | |
|---|---|---|
| 1. Basis for Allowable Emissions Code: | | |
| 2. Future Effective Date of Allowable Emissions: | | |
| 3. Requested Allowable Emissions and Units: | | |
| 4. Equivalent Allowable Emissions: | lb/hr | tons/year |
| 5. Method of Compliance (limit to 60 characters): | | |
| 6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters): | | |

## I. VISIBLE EMISSIONS INFORMATION
## (Regulated Emissions Units Only)

**Visible Emissions Limitation:** Visible Emissions Limitation 1 of 1

| |
|---|
| 1. Visible Emissions Subtype: **VE10** |
| 2. Basis for Allowable Opacity: [ X ] Rule [ ] Other |
| 3. Requested Allowable Opacity:<br>Normal Conditions: **10%** Exceptional Conditions: %<br>Maximum Period of Excess Opacity Allowed: min/hour |
| 4. Method of Compliance: **EPA METHOD 9** |
| 5. Visible Emissions Comment (limit to 200 characters):<br>**40 CFR 60, SUBPART H** |

**Visible Emissions Limitation:** Visible Emissions Limitation ______ of ______

| |
|---|
| 1. Visible Emissions Subtype: |
| 2. Basis for Allowable Opacity: [ ] Rule [ ] Other |
| 3. Requested Allowable Opacity:<br>Normal Conditions: % Exceptional Conditions: %<br>Maximum Period of Excess Opacity Allowed: min/hour |
| 4. Method of Compliance: |
| 5. Visible Emissions Comment (limit to 200 characters): |

## J. CONTINUOUS MONITOR INFORMATION
### (Regulated Emissions Units Only)

**Continuous Monitoring System:** Continuous Monitor 1 of 1

1. Parameter Code: **EM**

2. Pollutant(s): **SO2**

3. CMS Requirement: [ X ] Rule [ ] Other

4. Monitor Information: **To Be Decided**
   Manufacturer:
   Model Number: Serial Number:

5. Installation Date:

6. Performance Specification Test Date:

7. Continuous Monitor Comment (limit to 200 characters): **40 CFR 60, SUBPART H**

**Continuous Monitoring System:** Continuous Monitor _____ of _____

1. Parameter Code:

2. Pollutant(s):

3. CMS Requirement: [ ] Rule [ ] Other

4. Monitor Information:
   Manufacturer:
   Model Number: Serial Number:

5. Installation Date:

6. Performance Specification Test Date:

7. Continuous Monitor Comment (limit to 200 characters):

## K. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENT TRACKING INFORMATION
## (Regulated and Unregulated Emissions Units)

### PSD Increment Consumption Determination

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

If the emissions unit addressed in this section emits particulate matter or sulfur dioxide, answer the following series of questions to make a preliminary determination as to whether or not the emissions unit consumes PSD increment for particulate matter or sulfur dioxide. Check the first statement, if any, that applies and skip remaining statements.

[ X ] The emissions unit is undergoing PSD review as part of this application, or has undergone PSD review previously, for particulate matter or sulfur dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after January 6, 1975. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after January 6, 1975, but before December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

2. Increment Consuming for Nitrogen Dioxide?

If the emissions unit addressed in this section emits nitrogen oxides, answer the following series of questions to make a preliminary determination as to whether or not the emissions unit consumes PSD increment for nitrogen dioxide. Check first statement, if any, that applies and skip remaining statements.

[ X ] The emissions unit addressed in this section is undergoing PSD review as part of this application, or has undergone PSD review previously, for nitrogen dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after February 8, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after February 8, 1988, but before March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

| | | | |
|---|---|---|---|
| 3. Increment Consuming/Expanding Code: | | | |
| PM | [ ] C | [ ] E | [ ] Unknown |
| SO2 | [ ] C | [ ] E | [ ] Unknown |
| NO2 | [ ] C | [ ] E | [ ] Unknown |
| 4. Baseline Emissions: | | | |
| PM | | lb/hour | tons/year |
| SO2 | | lb/hour | tons/year |
| NO2 | | | tons/year |
| 5. PSD Comment (limit to 200 characters): | | | |

## L. EMISSIONS UNIT SUPPLEMENTAL INFORMATION
## (Regulated Emissions Units Only)

### Supplemental Requirements for All Applications

1. Process Flow Diagram
[ X ] Attached, Document ID: Report [ ] Not Applicable [ ] Waiver Requested

2. Fuel Analysis or Specification
[ ] Attached, Document ID:________ [X] Not Applicable [ ] Waiver Requested

3. Detailed Description of Control Equipment
[ ] Attached, Document ID:________ [ ] Not Applicable [ X ] Waiver Requested
**Will be submitted when obtained from manufacturer.**

4. Description of Stack Sampling Facilities
[ ] Attached, Document ID:________ [ ] Not Applicable [ X ] Waiver Requested
**Will be submitted when obtained from manufacturer.**

5. Compliance Test Report
[ ] Attached, Document ID:________

[ ] Previously submitted, Date:________________

[ X ] Not Applicable

6. Procedures for Startup and Shutdown
[ ] Attached, Document ID:________ [ ] Not Applicable [ X ] Waiver Requested

7. Operation and Maintenance Plan
[ ] Attached, Document ID:________ [ X ] Not Applicable

8. Supplemental Information for Construction Permit Application
[ X ] Attached, Document ID: Report [ ] Not Applicable

9. Other Information Required by Rule or Statute
[ X ] Attached, Document ID: Report [ ] Not Applicable

**Emissions Unit Information Section (__2__ of __2__)**

**Additional Supplemental Requirements for Category I Applications Only**

| |
|---|
| 10. Alternative Methods of Operation<br>[ ] Attached, Document ID:________ [ **X** ] Not Applicable |
| 11. Alternative Modes of Operation (Emissions Trading)<br>[ ] Attached, Document ID:________ [ **X** ] Not Applicable |
| 12. Identification of Additional Applicable Requirements<br>[ ] Attached, Document ID:________ [ **X** ] Not Applicable |
| 13. Compliance Assurance Monitoring Plan<br>[ ] Attached, Document ID:________ [ **X** ] Not Applicable |
| 14. Acid Rain Application (Hard-copy Required)<br>[ ] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a)) Attached, Document ID:________<br>[ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.) Attached, Document ID:________<br>[ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.) Attached, Document ID:________<br>[ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.) Attached, Document ID:________<br>[ **X** ] Not Applicable |

# A REPORT IN SUPPORT OF
# PSD PERMIT APPLICATION

PREPARED FOR:

FARMLAND HYDRO, L.P.
GREEN BAY COMPLEX
POLK COUNTY, FLORIDA

NOVEMBER 1997

PREPARED BY:

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# 1.0 SYNOPSIS OF APPLICATION

## 1.1 APPLICANT

Farmland Hydro, L.P.
Green Bay Complex
P.O. Box 960
Bartow, FL 33831

## 1.2 FACILITY LOCATION

Farmland Hydro, L.P. (Farmland), Green Bay Complex, consists of a phosphate chemical fertilizer manufacturing facility approximately six miles southwest of Bartow, Florida, on County Road 640 in Polk County. The UTM coordinates of Farmland's sulfuric acid manufacturing complex are Zone 17; 410.3 km east and 3079.7 km north.

## 1.3 PROJECT SUMMARY

Farmland proposes to replace the existing 2100 tons per day (tpd) Sulfuric Acid Plant No. 3 (SAP3) with a new, more efficient SAP6 with a production rate of 2,750 tpd. This will increase the facility capacity from 7000 to 7650 tpd, or less than 10 percent. Please refer to Table 3-1 for proposed production rates. Thus, there will be a less than 10 percent increase in the molten sulfur throughput rates. No other plant at the facility will be affected by the change in sulfuric acid production rates.

The proposed project will result in a significant net increase (in accordance with Rule 62-212, Florida Administrative Code (FAC), in the emission rates of sulfur dioxide ($SO_2$), sulfuric acid mist (SAM), and nitrogen oxides (NOx).

Farmland is submitting this report in support of the application to the Florida Department of Environmental Protection (FDEP) for the construction of the new SAP6 and the shutdown of existing SAP3 at the Green Bay facility. This report, includes a description of the existing facility and the proposed project, a review of Best Available Control Technology, an ambient air quality analysis and an evaluation of the impact of the proposed project on soils, vegetation, visibility, and the Class I area.

## 2.0 FACILITY DESCRIPTION

The Farmland fertilizer manufacturing facility is located near Bartow in Polk County, Florida. The site location and area location maps are presented in Figures 2-1 and 2-2, respectively.

## 2.1 EXISTING FACILITY

The existing fertilizer complex processes wet phosphate rock into several different fertilizer products. This is accomplished by reacting the phosphate rock with sulfuric acid to produce phosphoric acid and then converting the phosphoric acid to fertilizer products. The chemical complex includes sulfuric acid plants, phosphoric acid plants, super phosphoric acid plant, monoammonium phosphate (MAP) and diammonium phosphate (DAP) plants, and storage, handling, grinding and shipping facilities for phosphate rock, ammonia, sulfur, and fertilizer products. Figure 2-3, Plot Plan, shows the location of the existing plants.

### 2.1.1 Sulfuric Acid Plants

There are three existing sulfuric acid plants. All three sulfuric acid plants utilize the double absorption process. Molten sulfur is fired into a furnace producing sulfur dioxide. Multiple beds of catalyst convert the sulfur dioxide to sulfur trioxide. Dual absorption towers use sulfuric acid to absorb the sulfur trioxide forming a concentrated acid (product). A significant amount of process waste heat is recovered by heat exchangers. There is also a turbogenerator which converts excess steam into electrical power.

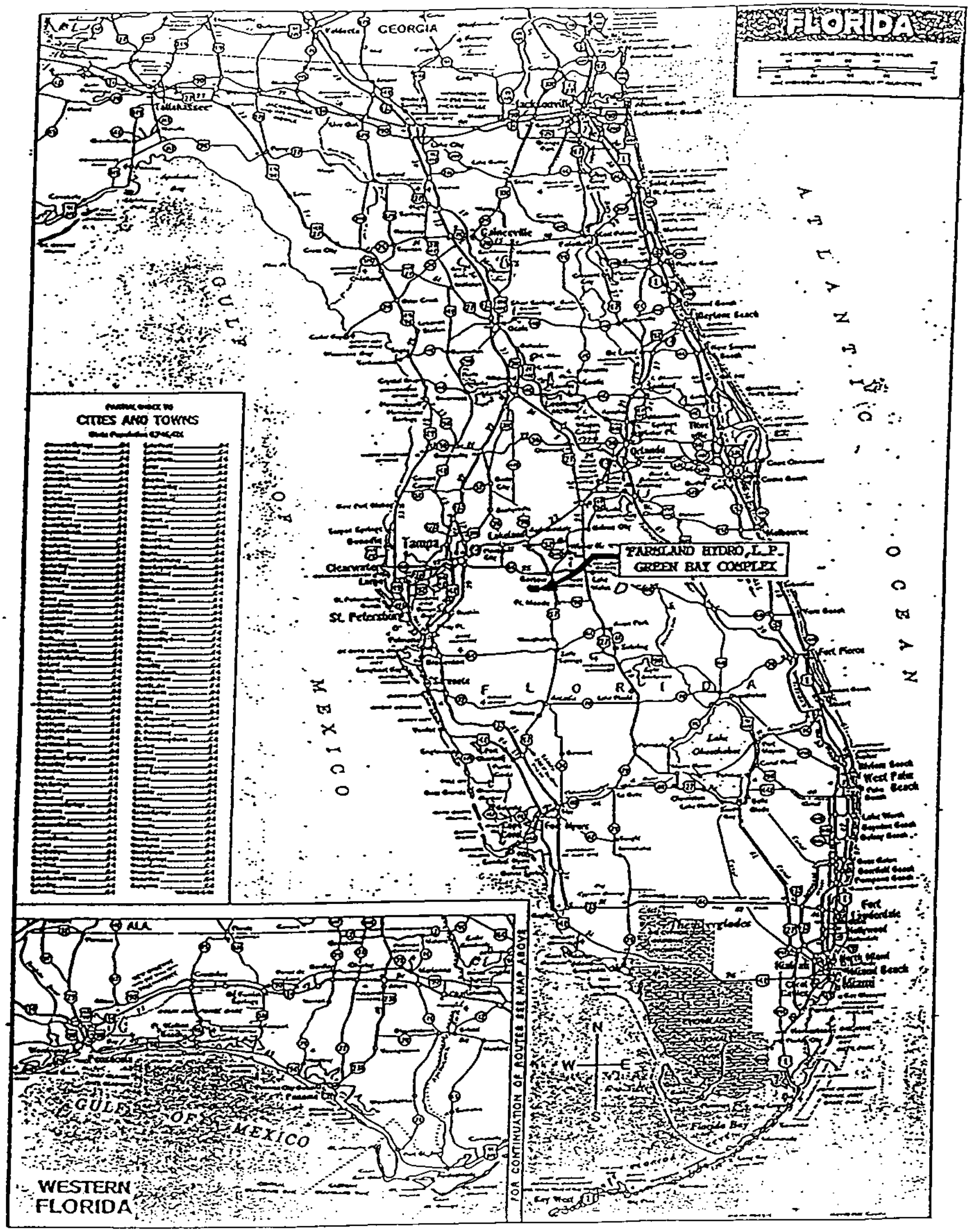
The emissions of SO2 are controlled by the dual absorption towers. The emissions of SAM are controlled by mist eliminators. NOx is emitted from the sulfur combustion process.

The existing sulfuric acid plants, subject to federal New Source Performance Standards as set forth in 40 CFR 60, Subpart H, are presently permitted under AC 53-265755, extended by Title V provisions.

FIGURE 2-1

SITE LOCATION MAP

FARMLAND HYDRO, L.P.



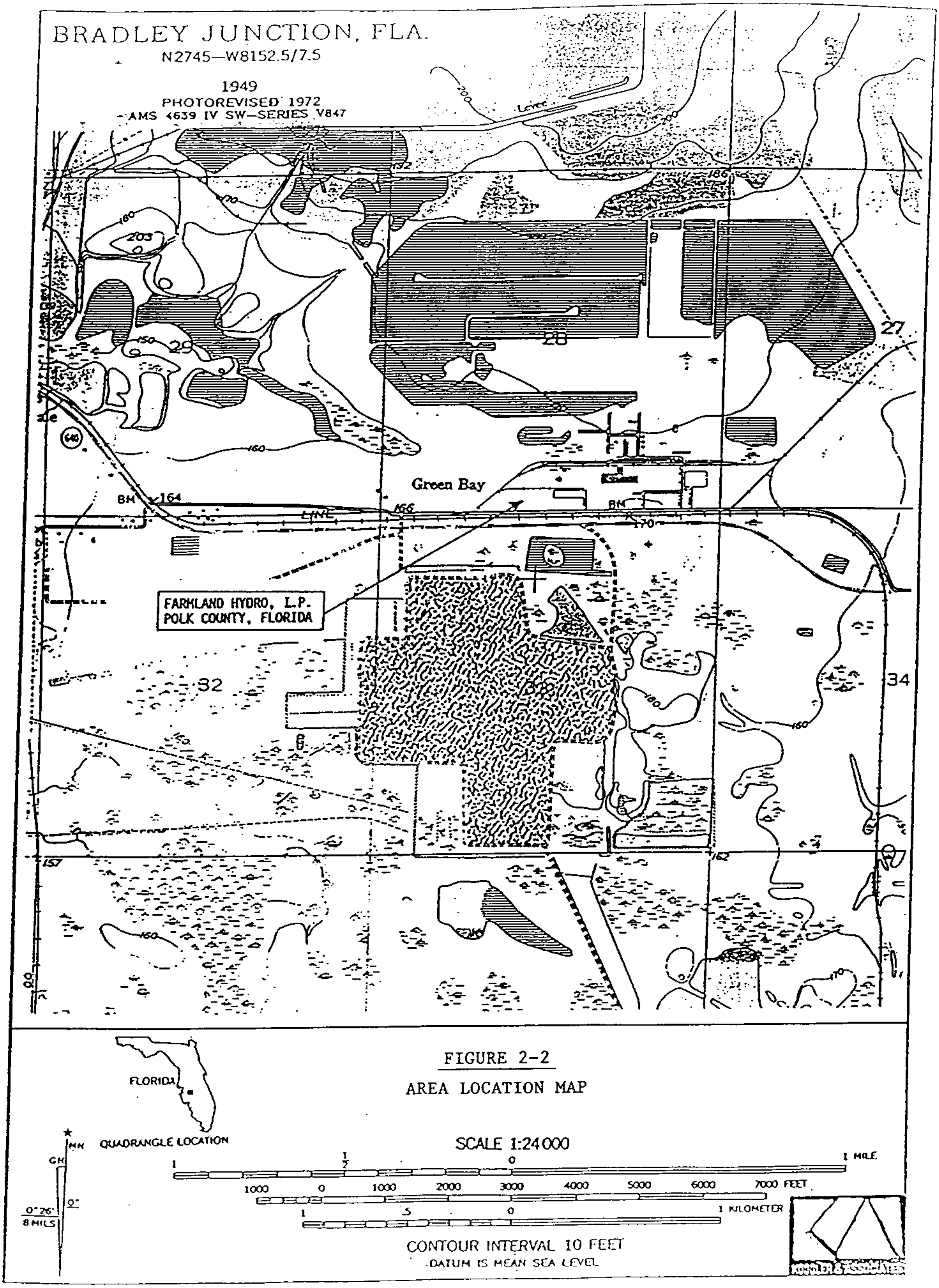


FIGURE 2-2

AREA LOCATION MAP

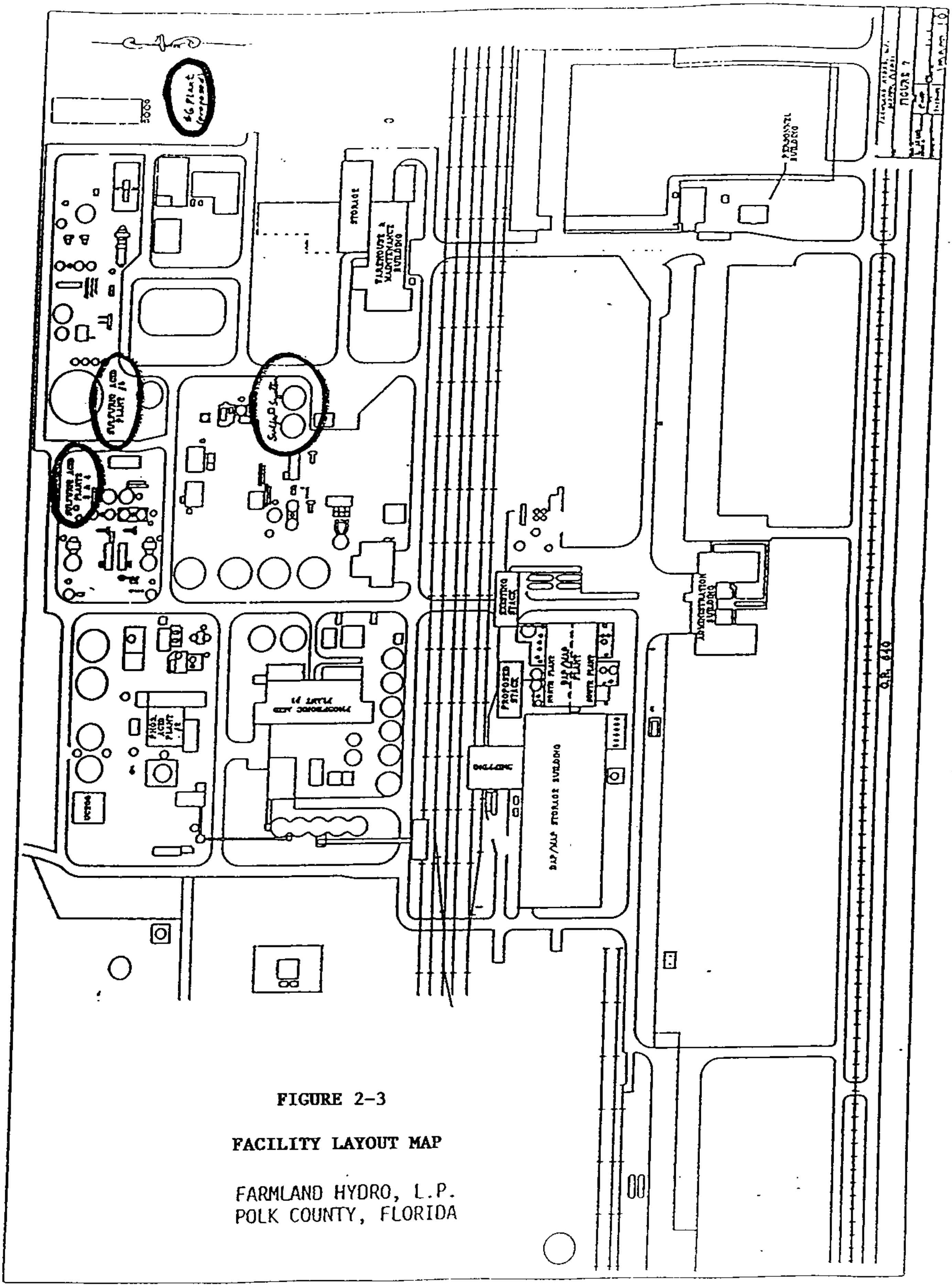


FIGURE 2-3

FACILITY LAYOUT MAP

FARMLAND HYDRO, L.P.
POLK COUNTY, FLORIDA

## 3.0 PROPOSED PROJECT

### 3.1 PROJECT DESCRIPTION

Farmland proposes to replace the existing 2100 tpd SAP3 with a new more efficient SAP6 capable of producing 2,750 tpd 100% sulfuric acid. This corresponds to a change in the facility capacity from 7000 to 7650 tpd, or less than 10 percent.

The new SAP6 will be a sulfur burning, double absorption plant similar to the existing SAP5. The new plant will be constructed close to the existing plants. SAP3 will be permanently shutdown and dismantled after SAP6 is operational.

The molten sulfur system throughput rate will increase by less than 10 percent and there will be installation of new piping to connect the existing molten sulfur system to the new SAP6 plant. No other plant at the facility will be affected by the proposed project.

The emission limits for the new sulfuric acid plant will be in accordance with the Federal NSPS and Rule 62-296, Florida Administrative Code (FAC); i.e., the SO2 and SAM emission limits will be 4.0 pounds per ton and 0.15 pounds per ton of 100 percent sulfuric acid, respectively. The emissions of NOx will be estimated based on an emission factor used in recent permitting of similar sources.

A process flow diagram, for the new sulfuric acid plant, is presented in Figure 3-1.

The net emission changes as a result of the proposed project are summarized in Table 3-2. The information presented in Table 3-2 shows there will be a significant net increase in the annual emissions of SO2, SAM and NOx, as defined in Rule 62-212, FAC.

### 3.2 RULE REVIEW

The following are the state and federal air regulatory requirements that apply to new or modified sources subject to a Prevention of Significant Deterioration (PSD) review.

In accordance with EPA and state of Florida PSD review requirements, all major new or modified sources of air pollutants regulated under the Clean Air Act (CAA) are subject to preconstruction review. Florida's State

Implementation Plan (SIP), approved by the EPA, authorizes the Florida Department of Environmental Protection (FDEP) to manage the air pollution program in Florida.

The PSD review determines whether or not significant air quality deterioration will result from a new or modified facility. Federal PSD regulations are contained in 40CFR52.21, Prevention of Significant Deterioration of Air Quality. The state of Florida has adopted PSD regulations which are essentially identical to the federal regulations and are contained in Chapter 62-212 of the Florida Administration Code (FAC). All new major sources and major modifications to existing sources are subject to control technology review, source impact analysis, air quality analysis and additional impact analyses for each pollutant subject to a PSD review. A facility must also comply with the Good Engineering Practice (GEP) stack height rule.

A major facility is defined in the PSD rules as any one of the 28 specific source categories (see Table 3-3) which has the potential to emit 100 tons per year (tpy) or more, or any other stationary facility which has the potential to emit 250 tpy or more, of any pollutant regulated under the CAA. A major modification is defined in the PSD rules as a change at an existing major facility which increases the actual emissions by greater than significant amounts (see Table 3-4).

### 3.2.1 Ambient Air Quality Standards

The EPA and the state of Florida have developed/adopted ambient air quality standards, AAQS (see Table 3-5). Primary AAQS protect the public health while the secondary AAQS protect the public welfare from adverse effects of air pollution. Areas of the country have been designated as attainment or nonattainment for specific pollutants. Areas not meeting the AAQS for a given pollutant are designated as nonattainment areas for that pollutant. Any new source or expansion of existing sources in or near these nonattainment areas are usually subject to more stringent air permitting requirements. Projects proposed in attainment areas are subject to air permit requirements which would ensure continued attainment status.

### 3.2.2 PSD Increments

In promulgating the 1977 CAA Amendments, Congress quantified concentration increases above an air quality baseline concentration levels for sulfur dioxide ($SO_2$) and particulate matter (PM/TSP) which would constitute significant deterioration. The size of the allowable increment depends on the classification of the area in which the source would be located or have an impact. Class I areas include specific national parks, wilderness areas and memorial parks. Class II areas are all areas not designated as Class I areas and Class III areas are industrial areas in which greater deterioration than Class II areas would be allowed. There are no designated Class III areas in Florida.

In 1988, EPA promulgated PSD regulations for nitrogen oxides (NOx) and PSD increments for nitrogen dioxide ($NO_2$) concentrations. FDEP adopted the $NO_2$ increments in July 1990 (see Table 3-6 for PSD increments).

In the PSD regulations, as amended August 7, 1980, baseline concentration is defined as the ambient concentration level for a given pollutant which exists in the baseline area at the time of the applicable baseline date and includes the actual emissions representative of facilities in existence on the applicable baseline date, and the allowable emissions of major stationary facilities which commenced construction before January 6, 1975, but were not in operation by the applicable baseline date.

The emissions not included in the baseline concentration and, therefore, affecting PSD increment consumption are the actual emissions from any major stationary facility on which construction commenced after January 6, 1975, for $SO_2$ and PM (TSP) and February 8, 1988, for $NO_2$, and the actual emission increases and decreases at any stationary facility occurring after the baseline date.

### 3.2.3 Control Technology Evaluation

The PSD control technology review requires that all applicable federal and state emission limiting standards be met and that Best Available Control Technology (BACT) be applied to the source. The BACT requirements are applicable to all regulated pollutants subject to a PSD review.

BACT is defined in Chapter 62-212, FAC as an emission limitation, including a visible emission standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case-by-case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of such pollutant. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of a source or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead, to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reductions achievable by implementation of such design, equipment, work practice or operation. Each BACT determination shall include applicable test methods or shall provide for determining compliance with the standard(s) by means which achieve equivalent results.

The reason for evaluating the BACT is to minimize as much as possible the consumption of PSD increments and to allow future growth without significantly degrading air quality. The BACT review also analyzes if the most current control systems are incorporated in the design of a proposed facility. The BACT, as a minimum, has to comply with the applicable New Source Performance Standard for the source. The BACT analysis requires the evaluation of the available air pollution control methods including a cost-benefit analysis of the alternatives. The cost-benefit analysis includes consideration of materials, energy, and economic penalties associated with the control systems, as well as environmental benefits derived from the alternatives.

EPA determined that the bottom-up approach (starting at NSPS and working up to BACT) was not providing the level of BACT originally intended. As a result, in December 1987, EPA strongly suggested changes in the implementation of the PSD program including the "top-down" approach to BACT. The top-down approach requires an applicant to start with the most stringent control alternative, often Lowest Achievable Emission Rate (LAER), and justify its rejection or acceptance as BACT. Rejection of control alternatives may be based on technical or economical infeasibility, physical differences, locational differences, and environmental or energy impact differences when comparing a proposed project with a project previously subject to that BACT.

### 3.2.4 Air Quality Monitoring

An application for a PSD permit requires an analysis of ambient air quality in the area affected by the proposed facility or major modification. For a new major facility, the affected pollutants are those that the facility would potentially emit in significant amounts. For a major modification, the pollutants are those for which the net emissions increase exceeds the significant emission rate.

Ambient air monitoring for a period of up to one year, but no less than four months, is required. Existing ambient air data for a location in the vicinity of the proposed project is acceptable if the data meet FDEP quality assurance requirements. If not, additional data would need to be gathered. There are guidelines available for designing a PSD air monitoring network in EPA's "Ambient Monitoring Guidelines for Prevention of Significant Deterioration."

FDEP may exempt a proposed major stationary facility or major modification from the monitoring requirements with respect to a particular pollutant if the emissions increase of the pollutant from the facility or modification would cause air quality impacts less than the de minimis levels (see Table 3-4).

### 3.2.5 Ambient Impact Analysis

A source impact analysis is required for a proposed major source subject to PSD for each pollutant for which the increase in emissions exceeds the significant emission rate. Specific atmospheric dispersion models are required in performing the impact analysis. The analysis should demonstrate the project's compliance with AAQS and allowable PSD increments. The impact analysis for criteria pollutants may be limited to only the new or modified source if the net increase in impacts due to the new or modified source is below significant impact levels.

Typically, a five-year period is used for the evaluation of the highest, second-highest short-term concentrations for comparison to AAQS or PSD increments. The term "highest, second-highest" refers to the highest of the second-highest concentrations at all receptors. The second-highest concentration is considered because short-term AAQS specify that the standard should not be exceeded at any location more than once a year. If less than five years of meteorological data are used in the modeling analysis, the highest concentration at each receptor is normally used.

### 3.2.6 Additional Impact Analysis

The PSD rules also require analyses of the impairment to visibility and the impact on soils and vegetation that would occur as a result of the project. A visibility impairment analysis must be conducted for PSD Class I areas. Impacts due to commercial, residential, industrial, and other growth associated with the source must be addressed. For Class I areas, an Air Quality Related Values Analysis is required by the National Park Service.

### 3.2.7 Good Engineering Practice Stack Height

In accordance with Rule 62-210.550, FAC, the degree of emission limitation required for control of any pollutant should not be affected by a stack height that exceeds GEP, or any other dispersion technique. GEP stack height is defined as the greater of:

1. 65 meters (m), or
2. A height established by applying the formula:
   Hg = H + 1.5 L
   where:
   Hg - GEP stack height,
   H - Height of the structure or nearby structure, and
   L - Lesser dimension, height or projected width of nearby structure(s)
3. A height demonstrated by a model or field study.

The GEP stack height regulations require that the stack height used in modeling for determining compliance with AAQS and PSD increments not exceed the GEP stack height. The actual stack height may be higher or lower.

## 3.3 RULE APPLICABILITY

The construction of a new sulfuric acid plant and redistribution of facility-wide allowable sulfuric acid production at Farmland are classified as a major modification to a major source subject to both state and federal regulations as set forth in Rule 62-212, FAC. The facility is located in an area classified as attainment for each of the regulated air pollutants in accordance with Rule 62-275, FAC. The proposed project will result in significant increases in the emissions of SO2, SAM and NOx, as defined in Rule 62-212, FAC; and, will therefore be subject to PSD preconstruction review requirements (see Table 3-2). This will include a determination of Best Available Control Technology, an air quality review, Good Engineering Practice stack height analysis and an evaluation of impacts on soils, vegetation and visibility.

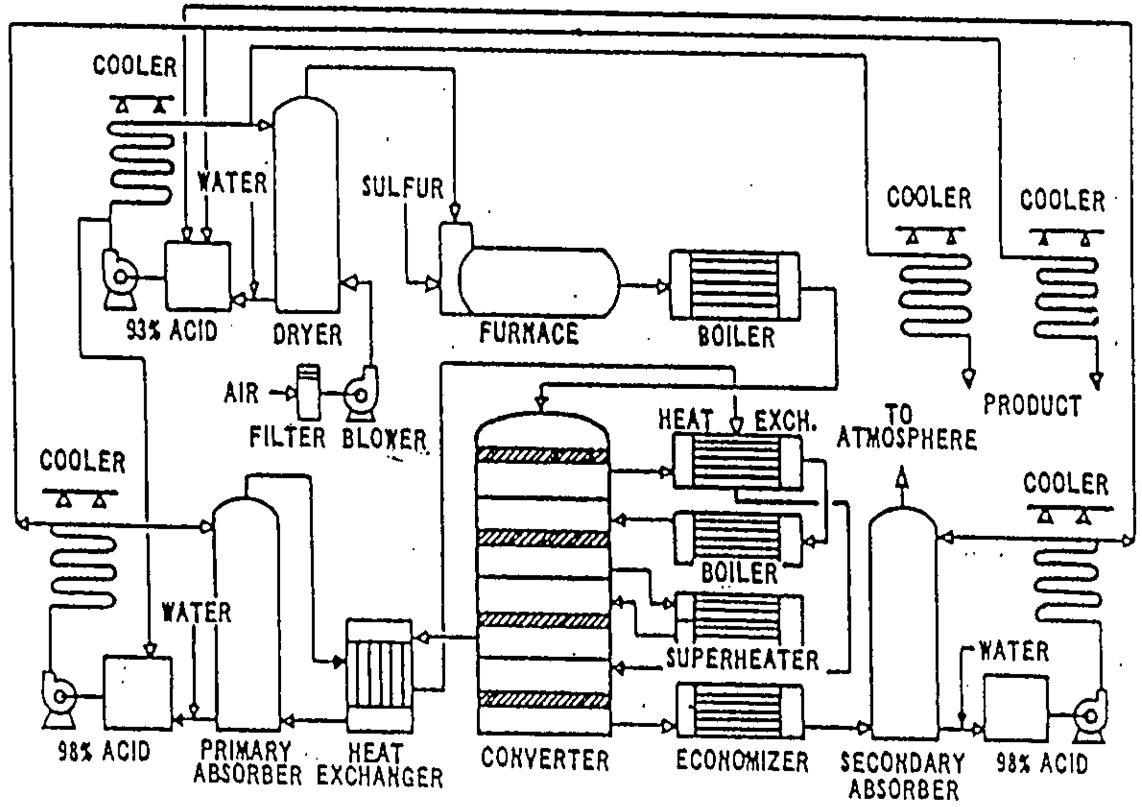


FIGURE 3-1

TYPICAL SULFURIC ACID
DOUBLE ABSORPTION PLANT
PROCESS FLOW DIAGRAM

$S + O_2 \rightarrow SO_2$ (BURNER)

$SO_2 + \frac{1}{2} O_2 \rightleftharpoons SO_3$ (CONVERTER)

$SO_3 + H_2O \rightarrow H_2SO_4$ (ABSORBER)

## TABLE 3-1
## SUMMARY OF EMISSION RATES

FARMLAND HYDRO, L.P.
POLK COUNTY, FLORIDA

| | EMISSIONS | | | | | |
|---|---|---|---|---|---|---|
| | PERMITTED | | ACTUALS | | PROPOSED | |
| | lb/hr | tpy | lb/hr | tpy | lb/hr | tpy |
| Sulfuric Acid Plant No. 3 (Existing) | | | | | | |
| Sulfur Dioxide | 350.0 | 1533.0 | 276.1 | 1209.4 | 0 | 0 |
| Acid Mist | 13.1 | 57.5 | 9.1 | 39.9 | 0 | 0 |
| Nitrogen Oxides | NA | NA | 8.5 | 37.2 | 0 | 0 |
| Annual Operating Hours | 8760 | | 8760 | | 0 | |
| Production Rate | 2100 | | NA | | 0 | |
| Sulfuric Acid Plant No. 6 (New) | | | | | | |
| Sulfur Dioxide | NA | NA | NA | NA | 458.3 | 2007.5 |
| Acid Mist | NA | NA | NA | NA | 17.2 | 75.3 |
| Nitrogen Oxides | NA | NA | NA | NA | 13.8 | 60.2 |
| Annual Operating Hours | NA | | NA | | 8760 | |
| Production Rate | NA | | NA | | 2750 | |
| Sulfur System Estimates (Existing) | | | | | | |
| Sulfur Dioxide | NA | 17.9 | NA | NA | NA | 19.7 |
| Acid Mist | NA | NA | NA | NA | NA | NA |
| Nitrogen Oxides | NA | NA | NA | NA | NA | NA |
| Particulates | NA | 9.7 | NA | NA | NA | 10.7 |
| Reduced Sulfur Cpds. | NA | 11.9 | NA | NA | NA | 13.1 |
| Hydrocarbons | NA | 17.7 | NA | NA | NA | 19.5 |
| Annual Operating Hours | 8760 | | 8760 | | 8760 | |
| Throughput Rate (tpy) | 840,000 | | 840,000 | | 924,000 | |

NOTE: (1) See Appendix for calculations of emission rates.

## TABLE 3-2
## NET EMISSIONS INCREASES(1)

FARMLAND HYDRO, L.P.
POLK COUNTY, FLORIDA

| Pollutant | Net Emissions Increase (TPY) | Significant Increase (TPY) | PSD Review |
|---|---|---|---|
| Acid Mist | 35.4 | 7 | YES |
| Nitrogen Oxides | 59.7 (2) | 40 | YES |
| Particulate Matter | 3.0 | 25 | NO |
| Reduced Sulfur Cpds. | 3.6 | 10 | NO |
| Sulfur Dioxide | 799.9 | 40 | YES |
| Volatile Organic Cpds. | 5.5 | 40 | NO |

NOTES:

(1) Calculations are presented in the Appendix.
(2) This includes the contemporaneous emissions increase associated with the previous PSD review to operate the facility at 7000 tpd 100% sulfuric acid.

## TABLE 3-3
## MAJOR FACILITY CATEGORIES

FARMLAND HYDRO, L.P.
POLK COUNTY, FLORIDA

Fossil fuel fired steam electric plants of more than 250 MMBTU/hr heat input
Coal cleaning plants (with thermal dryers)
Kraft pulp mills
Portland cement plants
Primary zinc smelters
Iron and steel mill plants
Primary aluminum ore reduction plants
Primary copper smelters
Municipal incinerators capable of charging more than 250 tons of refuse per day
Hydrofluoric acid plants
Sulfuric acid plants
Nitric acid plants
Petroleum refineries
Lime plants
Phosphate rock processing plants
Coke oven batteries
Sulfur recovery plants
Carbon black plants (furnace process)
Primary lead smelters
Fuel conversion plants
Sintering plants
Secondary metal production plants
Chemical process plants
Fossil fuel boilers (or combinations thereof) totaling more than 250 million BTU/hr heat input
Petroleum storage and transfer units with total storage capacity exceeding 300,000 barrels
Taconite ore processing plants
Glass fiber processing plants
Charcoal production plants

## TABLE 3-4
## REGULATED AIR POLLUTANTS - SIGNIFICANT EMISSION RATES

FARMLAND HYDRO, L.P.
POLK COUNTY, FLORIDA

| Pollutant | Significant Emission Rate tons/yr | De Minimis Ambient Impacts $\mu g/m^3$ |
|---|---|---|
| CO | 100 | 575 (8-hour) |
| NOx | 40 | 14 ($NO_2$, Annual) |
| $SO_2$ | 40 | 13 (24-hour) |
| Ozone | 40 (VOC) | - |
| PM | 25 | 10 (24-hour) |
| PM10 | 15 | 10 (24-hour) |
| TRS (including H2S) | 10 | 0.2 (1-hour) |
| $H_2SO_4$ mist | 7 | - |
| Fluorides | 3 | 0.25 (24-hour) |
| Vinyl Chloride | 1 | 15 (24-hour) |
|  | <u>pounds/yr</u> |  |
| Lead | 1200 | 0.1 (Quarterly avg) |
| Mercury | 200 | 0.25 (24-hour) |
| Asbestos | 14 | - |
| Beryllium | 0.8 | 0.001 (24-hour) |

# TABLE 3-5
# AMBIENT AIR QUALITY STANDARDS

## FARMLAND HYDRO, L.P.
## POLK COUNTY, FLORIDA

| | FDEP (State) | | USEPA (National) | | | |
|---|---|---|---|---|---|---|
| | | | Primary | | Secondary | |
| Pollutant | $\mu g/m^3$ | PPM | $\mu g/m^3$ | PPM | $\mu g/m^3$ | PPM |
| $SO_2$, 3-hour | 1,300 | 0.5 | - | - | 1300 | 0.5 |
| 24-hour | 260 | 0.1 | 365 | 0.14 | - | - |
| Annual | 60 | 0.02 | 80 | 0.03 | - | - |
| PM10, 24-hour | 150 | - | 150 | - | 150 | - |
| Annual | 50 | - | 50 | - | 50 | - |
| CO, 1-hour | 40,000 | 35 | 40,000 | 35 | - | - |
| 8-hour | 10,000 | 9 | 10,000 | 9 | - | - |
| Ozone, 1-hour | 235 | 0.12 | 235 | 0.12 | 235 | 0.12 |
| $NO_2$, Annual | 100 | 0.053 | 100 | - | 100 | - |
| Lead, Quarterly | 1.5 | - | 1.5 | - | 1.5 | - |

## TABLE 3-6
## PSD INCREMENTS

FARMLAND HYDRO, L.P.
POLK COUNTY, FLORIDA

| Pollutant | Allowable PSD Increments (State/National) Class I $\mu g/m^3$ | Class II $\mu g/m^3$ | Class III $\mu g/m^3$ |
|---|---|---|---|
| TSP, Annual | 5 | 19 | 37 |
| 24-hour | 10 | 37 | 75 |
| $SO_2$, Annual | 2 | 20 | 40 |
| 24-hour | 5 | 91 | 182 |
| 3-hour | 25 | 512 | 700 |
| $NO_2$, Annual | 2.5 | 25 | 50 |

## 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 (see Table 3-4 for significant emission levels).

The emission rate increases proposed by Farmland have been summarized in Table 3-2. The SO2, SAM and NOx emissions increase from the proposed project will represent a significant increase.

The SO2, SAM and NOx are present in the tail gas from all contact process sulfuric acid plants. In a typical plant with a single absorption system, the SO2 in the tail gas is approximately 30 pounds per ton of acid produced and the SAM is approximately 4 pounds per ton of acid produced. In a typical plant with a double absorption system, the SO2 in the tail gas is approximately 4 pounds per ton of acid produced and the SAM is approximately 0.15 pounds per ton of acid produced. The NOx emissions that are present in the tail gas are formed in the sulfur burners as a result of the fixation of atmospheric nitrogen. Recent measurements have indicated that the NOx in the tail gas from a sulfuric acid plant can be around 0.12 pound 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 SO2 emissions to be limited to no more than 4.0 pounds per ton of 100 percent acid produced and require that SAM 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 or modified sulfuric acid plants to less than 10 percent. There are no applicable emission standards for NOx from sulfuric acid plants.

EPA's most recent review of the New Source Performance Standards for sulfuric acid plants in 1985 (EPA-450/3-85-012), concluded that because of variations in SO2 emissions as a function of catalyst age:

> "... the level of $SO_2$ emissions as specified in the current NSPS (should) not be changed ...."

Regarding the NSPS for SAM, 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."

There has been no change in EPA philosophy related to sulfuric acid plants since the 1985 review.

A review of BACT/LAER determinations published in the EPA Clearinghouse indicates that no new control alternatives have been applied to the double absorption sulfuric acid plants as of 1997 that would result in a consistent reduction in SO2 emission below 4.0 pounds per ton of acid nor would result in a consistent reduction of SAM emissions below 0.15 pounds per ton of acid. No control technologies for NOx are discussed in either the NSPS review or in BACT/LAER determinations as there is typically no control of NOx from the double absorption sulfuric acid plants.

Farmland is proposing the double absorption process, as BACT, for the new SAP6.

## 4.2 CONTROL TECHNOLOGIES

The control of SO2 and SAM emissions from sulfuric acid plants can be achieved by various processes. The process of choice for SO2 control has been double absorption and the process of choice for controlling SAM 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.

In EPA's review of NSPS for sulfuric acid plants in March 1985 (EPA-450/3-85-012), 46 sulfuric acid plants built between 1971 and 1985 were reviewed. Of these 46 plants, 40 used the double absorption process for SO2 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. The control of NOx in sulfuric acid plants has not been addressed to date because the low concentration of NOx in the tail gases of sulfuric acid plants (10-20 parts per million) does not lend itself to cost effective controls.

Also in the EPA review, several potential control technologies that had been used to control S02 and SAM emissions from sulfuric acid plants were addressed. The alternatives included the double absorption process, ammonia scrubbing, sodium sulfite-bisulfite scrubbing, and molecular sieves for S02 control and filter type mist eliminators and electrostatic precipitators for SAM control. A review of the EPA BACT/LAER Clearinghouse information indicated that no other control alternatives have been considered for sulfuric acid plants. No control alternatives were addressed for NOx control in either the 1985 EPA NSPS review or in the BACT/LAER Clearinghouse.

### 4.2.1 Sulfur Dioxide Control

The control alternatives for S02 have been summarized based upon information compiled by EPA in the 1985 NSPS review for sulfuric acid plants and information recently submitted to FDEP by companies with similar sulfuric acid plants during review of production increase requests (refer to PSD-FL-225, 229, 235 and 238).

#### 4.2.1.1 Double Absorption Process

The double absorption process has become the S02 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 S02 control. The process offers the following advantages over other S02 control technologies:

1. 99.7 percent of the sulfur is converted to sulfuric acid compared with about 97.7 percent conversion with a single absorption plant;

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 S02 concentrations resulting in a reduction in equipment size;

5. there is no reduction in overall plant operating time or efficiency; and

6. there is no increase in manpower requirements.

The double absorption plant is capable of operating at a SO2 emission rate of 4.0 pounds per ton of acid or less as required by New Source Performance Standards (NSPS). However, in an effort to optimize plant performance, most plants in the fertilizer industry tend to run at SO2 emission levels close to the permitted rate.

It should be noted that when EPA adopted the NSPS for sulfuric acid plants in 1971, it was recognized that double absorption plants could operate with a SO2 emission rate in the range of 2-4 pounds per ton of acid. The SO2 emission limit, however, was set at 4.0 pounds per ton of acid to account for small fluctuations that invariably occur in operating plants.

Since the adoption of the NSPS, there have been design and operating changes in sulfur burning sulfuric acid plants as well as changes and improvements in catalyst technology. Changes have occurred in the composition of the vanadium/sodium/potassium catalyst and in the physical shape of the catalyst; from a pellet to a ring-type structure resulting in higher activity and lower pressure drop. These changes have allowed sulfur burning sulfuric acid plants to operate much more efficiently and still operate in compliance with the NSPS limit for SO2 of 4.0 pounds per ton of acid.

As in 1971, plants can still operate with SO2 emissions somewhat below 4.0 pounds per ton of acid but slight fluctuations do occur which result in SO2 emissions that approach the NSPS limit. It was the intent of EPA when the NSPS limits were adopted in 1971 and reviewed in 1985 that the SO2 emission limit should be set with a margin of safety that will allow for these slight fluctuations in plant emissions.

Typically, the time between turnarounds in double absorption sulfur burning sulfuric acid plants in Florida is in the range of 18-24 months. Suggestions have been made that if the time between turnarounds is reduced, the activity of the catalyst will be upgraded more frequently resulting in lower SO2 emissions. While catalyst activity may be improved as a result of screening and partial replacement, the plant production rate will also be increased. The effect of increasing the frequency of sulfuric acid plant turnaround from once every 18 months to once every nine months is not expected to substantially reduce SO2 emissions since the plant will be operating at an overall higher production rate and thus emitting more SO2.

Based on information in FDEP files on a similar plant, the cost of SO2 control using this approach is well above BACT cost guidelines. Therefore, more frequent catalyst changes/turnarounds are rejected as BACT.

#### 4.2.1.2 Ammonia Scrubbing

Five sulfuric acid plants constructed between 1971 and 1985 use ammonia scrubbing for S02 control. None of these plants were double absorption plants. The process can be effective for reducing S02 emissions to below 4.0 pounds per ton and also for controlling sulfuric acid mist emissions. The major disadvantages of ammonia scrubbing are:

1. a waste by-product is produced;
2. the scrubbing system is a high maintenance item and requires additional manpower for operation; and
3. no sulfuric acid production increase benefits are achieved with the scrubbing system.
4. the environmental liabilities of introducing a toxic air pollutant release point at another location in the plant.

Ammonia scrubbing uses anhydrous ammonia and water in a scrubbing system to convert S02 to ammonium sulfite/bisulfite and eventually to ammonium sulfate. The ammonium sulfate can be crystallized and sold as a market commodity, it can be blended in a MAP/DAP plant or it can be disposed of as a waste. One plant that operates ammonia scrubbers on sulfuric acid plants had an ammonium sulfate crystallizer but abandoned it because of the volatility of the market. Blending with MAP or DAP is viable only if the additional sulfate (from ammonium sulfate) does not adversely affect the grade of the MAP/DAP product. At Farmland, the additional sulfate cannot be added to the granular fertilizer as the grade of the fertilizer has to be maintained to be competitive in the market.

Due to the cost, reduced plant reliability from the scrubber system, and the environmental liability associated with the waste disposal and accidental release provisions of the Clean Air Act, ammonia scrubbing is rejected as BACT.

#### 4.2.1.3 Other Scrubbing Technologies

Between 1971 and 1985, two sulfuric acid plants were constructed employing sodium sulfite-bisulfite scrubbing to control SO2 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 SO2 control alternative.

Other scrubbing liquors that have a potential for reducing SO2 emissions include caustic, sodium carbonate, calcium oxide and hydrogen peroxide. Without going through a detailed cost analysis to evaluate these scrubbing technologies, it can be stated that the capital investment cost and many of the direct and indirect annual costs are expected to be very similar to the costs incurred with ammonia scrubbing. Because of higher chemical costs and/or waste disposal costs, these other technologies are expected to be more costly than ammonia scrubbing. For this reason, these technologies are rejected as BACT.

### 4.2.1.4 Molecular Sieves

A molecular sieve was installed at one sulfuric acid plant in Florida for SO2 control. The system was effective for controlling SO2; however, extensive operating problems were experienced as the molecular sieve also absorbed NOx. The molecular sieve regeneration process 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 abandoned. As a result, molecular sieves are not considered a viable alternative for SO2 control in sulfuric acid plants.

### 4.2.1.5 Catalyst Selection

Changes in catalyst composition and shape have occurred since the promulgation of the NSPS for sulfuric acid plants. The results of this improvement were to extend the time between plant turnarounds to 18-24 months.

A change in catalyst composition, beyond changes in the vanadium content of the catalyst, has been the reintroduction of the "cesium catalyst". The cesium catalyst is a 6-8 percent vanadium catalyst with a portion of the potassium promoter replaced by cesium. The introduction of cesium reduces the activation temperature of the catalyst by approximately 20°F (from about 770°F to 750°F). At temperatures above approximately 770°F, the performance of the cesium catalyst and the conventional catalyst are about the same.

The advantage of the cesium catalyst is that it allows the startup of a sulfuric acid plant at a lower entrance gas temperature. The disadvantage of the shift to a lower temperature is the reduction in the reaction rate which slows the approach to equilibrium. The reduction in reaction rate therefore could offset the more favorable conversion resulting in no appreciable overall improvement in plant conversion efficiency. Another disadvantage of the cesium catalyst is that the cesium catalyst cost is 2.5-3.0 times the cost of conventional catalyst and not a demonstrated technology for sulfur burning double absorption plants. For these reasons, the use of cesium catalyst in place of the traditional catalyst, is rejected as BACT.

### 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 SAM control. Operations demonstrated that these types of mist eliminators can control SAM emissions to 0.15 pounds per ton of sulfuric acid.

The mist eliminators are the control of choice for SAM 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

Electrostatic precipitators (ESPs) have the potential for controlling SAM emissions from sulfuric acid plants; however, there is no demonstrated application of ESPs. The disadvantages associated with ESPs and hence, the reason they have not been used, include the initial cost, size requirements, operating and maintenance requirements and the potential for corrosion.

### 4.2.3 Nitrogen Oxides Control

There are no demonstrated control technologies to reduce the nitrogen oxides that are present in the tail gas from sulfuric acid plants. No control alternatives were addressed for nitrogen oxides control in either the 1985 EPA NSPS review or in the BACT/LAER Clearinghouse. As the NOx concentration level in the exit gas stream from a sulfur burning double absorption sulfuric acid plant is low, there are no effective add on control technologies.

## 4.3 BACT CONCLUSION

Considering the above BACT analysis, Farmland proposes the use of the double absorption system for SO2 control with no restrictions on operating practices or on catalyst type. For SAM control, Farmland proposes the use of fiber mist eliminators and for NOx emissions, no control is proposed.

## 5.0 AIR QUALITY REVIEW

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 (see Table 3-4) 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 ambient air quality standards.

The air quality review for the proposed project included SO2, SAM and NOx emission increases associated with the sulfuric acid plant. The molten sulfur system was not included as no change in hourly rates are requested.

## 5.1 AIR QUALITY MODELING

### 5.1.1 Significant Impact Analysis

The emission rates used for air quality modeling purposes for Significant Impact Analysis (SIA) represent the proposed net increase in the emission rate associated with the construction of SAP6 and the shutdown of SAP3. Table 5-1 contains modeling input parameters used in the ambient air quality impacts analysis.

The impact analysis of the net increase in emissions was conducted using the Industrial Source Complex-Short Term air quality model, Version 96113 (ISC-ST3), in accordance with guidelines established by EPA and published in the document, Guideline for Air Quality Modeling. The meteorological data used with the model were for Tampa, Florida and represented the period 1987-1991.

The emissions from sulfuric acid plants 3 and 6 were modeled in the SIA. The SAP3 emission rates were represented as a negative input while the SAP6 emission rates were represented as a positive inputs to the model.

The SIA modeling included discrete receptors at the facility property boundary and additional receptors established by the polar grid system extending to 18 kilometers from the plant. The discrete receptors were placed along the property boundary at 100 meter intervals. Sixteen sets of receptor rings were placed at distances ranging from about 500 to 18,000 meters from the plant with receptors placed at 10 degree intervals from 10° to 360° on each receptor ring, with the exclusion of receptors within Farmland's property boundary. The downwind receptor distances were selected in order to provide a higher concentration of receptors closer to the source where the maximum impacts were expected. Receptor locations are shown in Figure 5-1.

The results of the SIA modeling, summarized in Table 5-2, demonstrate that the predicted ambient air quality impact of the SO2 emission increases from the proposed project for the Class II area are greater than significant for the 3-hour, 24-hour and annual periods; and, less than significant at the Class I area. The SIA modeling also demonstrated that the predicted SO2 impacts from the proposed project are significant upto a distance of about 8 kilometers. Consequently, additional modeling was required to determine compliance with the ambient air quality standards and allowable Class II area PSD increments.

The SIA modeling also demonstrated that the maximum predicted NOx impacts from the proposed project will not be significant.

No ambient air quality standards, PSD increments or significant impact levels have been established for SAM. FDEP's current permitting guideline for air toxics requires temporary facilities to evaluate short-term impacts for comparison with Air Reference Concentrations (ARC) listed in Version 3 of the Air Toxics List. However, permanent facilities have to evaluate annual impacts to compare with the ARCs. As there is no annual ARC for sulfuric acid mist, no comparisons are required.

It should be noted that the maximum sulfuric acid mist impacts from the proposed project are predicted to occur at locations which are both remote and far from the population centers (based on the results of the modeling for sulfur dioxide emissions). Also, the sulfuric acid mist will be controlled by the Best Available Control Technology. As a result, the sulfuric acid mist emissions are not expected to be of concern.

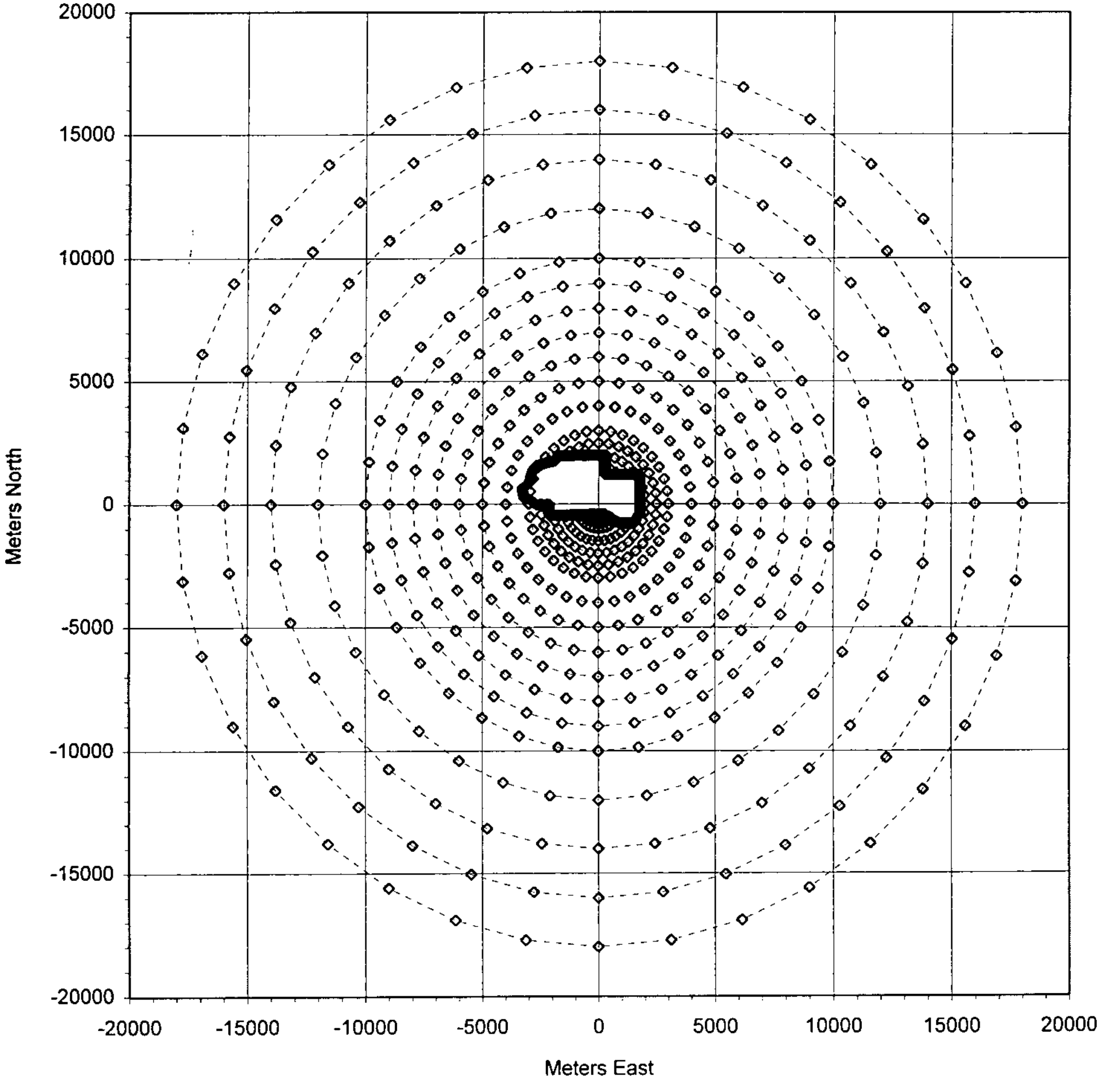
### 5.1.2 Class II Area AAQS and PSD Increment Analysis

The Ambient Air Quality Standards (AAQS) Analysis and the PSD Increment (PSD) Analysis were conducted to determine the combined ambient air impact of the proposed project and other nearby SO2 emitting sources. The significant facilities to be included in the analysis were determined based on the "20 D Rule" using the facility emission inventory most recently utilized by FDEP, with recent updates provided by FDEP staff.

A list of the significant facilities near the proposed project is presented in Table 5-3. The corresponding sources at the significant facilities which contribute to the ambient air concentration and the PSD increment consumption/expansion in the Class II area are presented in Tables 5-4 and 5-5, respectively. Although the ISC model is not recommended for modeling sources beyond 50 kilometers, some of the borderline sources were included to be conservative.

The results of the AAQS and PSD increment analysis indicate that the maximum predicted 3-hour, 24-hour and annual period impacts for the AAQS and Class II area PSD increment are within the standards, as shown in Table 5-6.

## Figure 5.1
## Modeling Receptor Network For Class 2 and FAAQS Significant Impact Analysis



# TABLE 5-1

# AIR QUALITY MODELING PARAMETERS

FARMLAND HYDRO, L.P.
POLK COUNTY, FLORIDA

| Emission Unit | Stack |  | Stack Gas |  | Emission Rates |  |
|---|---|---|---|---|---|---|
|  | Ht (m) | Dia (m) | Vel (mps) | Temp (°K) | SO2 (g/s) | NOx (g/s) |
| Existing SAP3 | 30.48 | 2.29 | 12.02 | 355 | 44.1 | 1.32 |
| Proposed SAP6 | 45.72 | 2.74 | 10.60 | 355 | 57.8 | 1.74 |

NOTES:

1. Building downwash effects, from the EPA approved BPIP program, were included in the modeling.

## TABLE 5-2

## SUMMARY OF SULFUR DIOXIDE AND NITROGEN OXIDES SIGNIFICANT IMPACT ANALYSIS

FARMLAND HYDRO, L.P.
POLK COUNTY, FLORIDA

| MET. | CLASS I AREA IMPACTS (1) | | | | CLASS II AREA IMPACTS (1) | | | |
|---|---|---|---|---|---|---|---|---|
| DATA | SO2 | | | NOx | SO2 | | | NOx |
| | ANNUAL | 3-HR | 24-HR | ANNUAL | ANNUAL | 3-HR | 24-HR | ANNUAL |
| 1987 | 0.001 | 0.54 | 0.08 | 0 | 1.55 | 192.5 | 47.7 | 0.05 |
| 1988 | 0 | 0.72 | 0.09 | 0 | 2.73 | 167.2 | 62.4 | 0.08 |
| 1989 | 0 | 0.66 | 0.09 | 0 | 2.38 | 169.9 | 68.7 | 0.07 |
| 1990 | 0 | 0.56 | 0.07 | 0 | 0.82 | 154.2 | 44.6 | 0.02 |
| 1991 | 0.003 | 0.59 | 0.10 | 0 | 1.69 | 157.6 | 42.8 | 0.05 |
| Sig. Impact (Proposed for Class I) | 0.03 | 1.0 | 0.2 | 0.1 | 1 | 25 | 5 | 1 |

NOTE:

(1) The impacts represent the highest-high impact.

(2) The impacts are based on the difference between the existing and proposed SO2 emissions from the sulfuric acid plants (see Table 5-1).

# Table 5-3
# Significant Sulfur Dioxide Emitting Facilities (20 D Table)
# Farmland Hydro, L.P.
# Green Bay, Florida

| SO2 "20 D" SOURCE INVENTORY FOR FARMLAND HYDRO PLANT | | | Source Location | 410.330 | 3079.655 |
|---|---|---|---|---|---|
| | UTM Coordinates (km) | | SO2 | Distance | 20-D Emission |
| SOURCE DESCRIPTION | EAST | NORTH | TPY | (Km) | (TPY) |
| AUBURNDALE | 420.800 | 3103.300 | 221 | 26 | 517 |
| BORDEN DRYER | 414.500 | 3109.000 | -184 | 30 | 593 |
| BORDEN DRYER | 394.800 | 3069.600 | -225 | 19 | 370 |
| BREWSTER/IMPERIAL | 404.800 | 3069.500 | -670 | 12 | 231 |
| CARGILL/GARDINIER | 363.400 | 3082.400 | 5870 | 47 | 940 |
| CARGILL/GARDINIER MINE | 415.300 | 3063.300 | 612 | 17 | 342 |
| CARGILL/SEMINOLE/W.R. GRACE | 409.770 | 3086.990 | 5007 | 7 | 147 |
| CF BARTOW | 408.500 | 3082.500 | 5145 | 3 | 68 |
| CF PLANT CITY | 388.000 | 3116.000 | 9048 | 43 | 853 |
| CITRUS WORLD | 441.000 | 3087.300 | 1604 | 32 | 632 |
| CLM CHLORIDE METALS | 361.800 | 3088.300 | 731 | 49 | 986 |
| CONSOLIDATED MINERALS | 393.800 | 3096.300 | 943 | 23 | 469 |
| COUCH CONST-ZEPHYRHILLS | 390.300 | 3129.400 | 123 | 54 | 1073 |
| DOLIME | 404.813 | 3069.548 | -355 | 12 | 230 |
| ESTECH/SWIFT | 411.500 | 3074.200 | -4856 | 6 | 112 |
| FARMLAND | 410.330 | 3079.655 | 5208 | 0 | 0 |
| FPC INTERSESSION CITY | 446.300 | 3126.000 | 8168 | 59 | 1173 |
| FPC OSCEOLA | 446.300 | 3126.000 | 4380 | 59 | 1173 |
| FPC POLK | 414.400 | 3073.910 | 1720 | 7 | 141 |
| FPL MANATEE | 367.200 | 3054.100 | 83410 | 50 | 1003 |
| GEN. PORT. CEMENT | 358.000 | 3090.600 | -4602 | 53 | 1069 |
| GULF COAST RECYCLING | 364.000 | 3093.500 | 1711 | 48 | 967 |
| HARDEE | 404.800 | 3057.400 | 9657 | 23 | 459 |
| HILLS. CO. RESOURCE RECOVERY | 368.200 | 3092.700 | 744 | 44 | 882 |
| IMC - AGRICO /NICHOLS/CONSERVE | 398.400 | 3084.200 | 1978 | 13 | 255 |
| IMC-AGRICO/NEW WALES | 396.600 | 3078.900 | 11416 | 14 | 275 |
| IMC-AGRICO/NORALYN | 414.700 | 3080.300 | 504 | 4 | 88 |
| IMC-AGRICO/PIERCE | 404.100 | 3078.950 | -1646 | 6 | 125 |
| IMC-AGRICO/SO. PIERCE | 407.500 | 3071.300 | 4676 | 9 | 176 |
| LAKELAND LARSEN | 409.300 | 3102.800 | 4944 | 23 | 463 |
| LAKELAND MCINTOSH | 409.200 | 3106.200 | 30563 | 27 | 531 |
| MOBIL BIG-4 | 394.850 | 3069.770 | 87 | 18 | 367 |
| MOBIL NICHOLS | 398.300 | 3084.300 | 971 | 13 | 258 |
| MOBILE ELECTROPHOS | 405.600 | 3079.400 | -3337 | 5 | 95 |
| MULBERRY COGENERATION | 413.600 | 3080.600 | 466 | 3 | 68 |
| MULBERRY PROSPHATES/ROYSTER | 406.700 | 3085.200 | 1280 | 7 | 133 |
| NITRAM | 363.100 | 3089.000 | 108 | 48 | 963 |
| PANDA KATHLEEN | 398.700 | 3101.400 | 25 | 25 | 493 |
| RIDGE COGENERATION | 416.700 | 3100.400 | 480 | 22 | 434 |
| SECI HARDEE | 404.900 | 3057.400 | 223 | 23 | 458 |
| SULFUR TERMINALS | 358.000 | 3090.000 | 104 | 53 | 1067 |
| TAMPA GENERAL HOSP | 356.400 | 3091.000 | 59 | 55 | 1102 |
| TAMPA MCKAY BAY RRF | 360.000 | 3091.000 | 744 | 52 | 1032 |
| TECO BIG BEND | 361.900 | 3075.000 | 372294 | 49 | 973 |
| TECO GANNON | 360.000 | 3087.500 | 127495 | 51 | 1019 |
| TECO HOOKERS POINT | 358.000 | 3091.000 | 13535 | 54 | 1071 |
| TECO POLK POWER | 402.488 | 3066.914 | 4031 | 15 | 299 |
| THATCHER GLASS | 361.800 | 3088.300 | 177 | 49 | 986 |
| USS AGRI-CHEM BARTOW | 413.200 | 3086.300 | -1580 | 7 | 145 |
| USSAC FT MEADE | 416.120 | 3068.620 | 3217 | 12 | 249 |

NOTE; Facilities with negative emissions represent shutdown facilities.

## Table 5-4

## AQS SO2 Source Inventory
## Farmland Hydro, L.P. - Green Bay, Florida

| SOURCE DESCRIPTION | Inventory Designation | NAAQS Designation | UTM Coordinates (km) | | Stack Centered Coordinat | | Emissions (g/s) | Height (m) | Temperature (°K) | Velocity (m/s) | Dimeter (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | EAST | NORTH | EAST | NORTH | | | | | |
| CARGILL/GARDINIER NaSiF MFG (U41) | NAAQS | CARG1 | 363.4 | 3082.4 | -46930 | 2745 | 0.16 | 12.2 | 333.1 | 13.37 | 2.8 |
| CARGILL/GARDINIER DAP (U55) | NAAQS | CARG2 | 363.4 | 3082.4 | -46930 | 2745 | 0.96 | 40.5 | 320 | 16.09 | 2.13 |
| CARGILL/GARDINIER GTSP (UAA) | NAAQS | CARG3 | 363.4 | 3082.4 | -46930 | 2745 | 1.9 | 38.4 | 328 | 11.56 | 2.44 |
| CARGILL/GARDINIER MINE ROCK DRYER | NAAQS | CARG4 | 415.3 | 3063.3 | 4970 | -16355 | 17.6 | 19.2 | 290 | 7 | 2.9 |
| CARGILL/GARDINIER SAP #7 (U04) | NAAQS | CARG5 | 363.4 | 3082.4 | -46930 | 2745 | 46.2 | 45.6 | 340 | 12.64 | 2.29 |
| CARGILL/GARDINIER SAP #8 (U05) | NAAQS | CARG6 | 363.4 | 3082.4 | -46930 | 2745 | 52.5 | 45.6 | 339 | 13.93 | 2.44 |
| CARGILL/GARDINIER SAP #9 (INCR9 OF8/9 | BOTH | CARG7 | 363.4 | 3082.4 | -46930 | 2745 | 67.2 | 45.6 | 350 | 12.66 | 2.74 |
| CARGILL/SEMINOLE/W.R. GRACE DAP 4 - Ba | NAAQS | CARG8 | 409.8 | 3087.0 | -560 | 7335 | 0.3 | 40.2 | 316 | 26.2 | 2.1 |
| CARGILL/SEMINOLE/W.R. GRACE SAP 4, 5 | BOTH | CARG9 | 409.8 | 3087.0 | -560 | 7335 | 143.64 | 60.96 | 347 | 34 | 1.52 |
| CF BARTOW DAP 1-3 | NAAQS | CFB1 | 408.5 | 3082.5 | -1830 | 2845 | 7.93 | 36.4 | 339 | 16.11 | 2.13 |
| CF BARTOW DAP 1-3 | BOTH | CFB2 | 408.5 | 3082.5 | -1830 | 2845 | 3.97 | 36.4 | 339 | 16.11 | 2.13 |
| CF BARTOW H2SO4 5 (2400 TPD) | BOTH | CFB3 | 408.5 | 3082.5 | -1830 | 2845 | 50.4 | 63.41 | 361 | 10.88 | 2.13 |
| CF BARTOW H2SO4 6 (2400 TPD) | BOTH | CFB4 | 408.5 | 3082.5 | -1830 | 2845 | 50.4 | 63.41 | 370 | 7.28 | 2.13 |
| CF BARTOW H2SO4 7 (2000 TPD) | BOTH | CFB5 | 408.5 | 3082.5 | -1830 | 2845 | 42 | 67.1 | 351 | 9.8 | 2.4 |
| CF PLANT CITY (U22) | NAAQS | CFP1 | 388.0 | 3116.0 | -22330 | 36345 | 0.12 | 2.44 | 373 | 0.33 | 0.61 |
| CF PLANT CITY (U22) | NAAQS | CFP2 | 388.0 | 3116.0 | -22330 | 36345 | 0.11 | 2.4 | 373.1 | 1.63 | 0.27 |
| CF PLANT CITY (U23-24) | NAAQS | CFP3 | 388.0 | 3116.0 | -22330 | 36345 | 0.17 | 3.7 | 373.1 | 1.65 | 0.09 |
| CF PLANT CITY DAP A (U10) | NAAQS | CFP4 | 388.0 | 3116.0 | -22330 | 36345 | 3 | 28.7 | 326 | 7.9 | 3 |
| CF PLANT CITY DAP X (U16) | NAAQS | CFP5 | 388.0 | 3116.0 | -22330 | 36345 | 13.2 | 54.9 | 325 | 9.8 | 2.8 |
| CF PLANT CITY DAP Z (U11) | NAAQS | CFP6 | 388.0 | 3116.0 | -22330 | 36345 | 13.2 | 54.9 | 331 | 13.1 | 2.8 |
| CF PLANT CITY GTSP X (U12) | NAAQS | CFP7 | 388.0 | 3116.0 | -22330 | 36345 | 13.2 | 54.9 | 314 | 7.9 | 2.8 |
| CF PLANT CITY H2SO4 A&B (U02&03) | BOTH | CFP8 | 388.0 | 3116.0 | -22330 | 36345 | 88.2 | 33.5 | 316 | 19.5 | 1.52 |
| CF PLANT CITY PROPOSED C & D (U07-08) | BOTH | CFP9 | 388.0 | 3116.0 | -22330 | 36345 | 109.2 | 60.35 | 353 | 17.77 | 2.44 |
| CF PLANT CITY Y-GTSP (U17) | NAAQS | CFP10 | 388.0 | 3116.0 | -22330 | 36345 | 11.33 | 54.9 | 333.1 | 13.37 | 2.8 |
| CF PLANT CITY Zephyrhills (U01) | NAAQS | CFP11 | 388.0 | 3116.0 | -22330 | 36345 | 19.98 | 7.62 | 560.8 | 17.74 | 1.07 |
| CITRUS WORLD DRYER 1 | NAAQS | CITRUS1 | 441.0 | 3087.3 | 30670 | 7645 | 11.8 | 22.9 | 323 | 10.7 | 1 |
| CITRUS WORLD DRYER 2 | NAAQS | CITRUS2 | 441.0 | 3087.3 | 30670 | 7645 | 23.74 | 22.9 | 325 | 12.2 | 0.8 |
| CITRUS WORLD DRYER 3 | NAAQS | CITRUS3 | 441.0 | 3087.3 | 30670 | 7645 | 23.74 | 24.4 | 313 | 21.9 | 0.8 |
| CONSOLIDATED MINERALS | NAAQS | CONSOL1 | 393.8 | 3096.3 | -16530 | 16645 | 0.12 | 6.1 | 605.2 | 20.21 | 0.37 |
| CONSOLIDATED MINERALS FLUID BED REACTOR | NAAQS | CONSOL2 | 393.8 | 3096.3 | -16530 | 16645 | 11.57 | 46.33 | 299.7 | 12.14 | 1.77 |
| CONSOLIDATED MINERALS KILNS 3, 4 & 5 | NAAQS | CONSOL3 | 393.8 | 3096.3 | -16530 | 16645 | 15.43 | 46.33 | 298 | 13.17 | 1.77 |
| FARMLAND | NAAQS | FARM1 | 410.3 | 3079.7 | 0 | 0 | 2.33 | 28.96 | 605.2 | 3.58 | 1.68 |
| FARMLAND SULFUR SYSTEM (EXISTING) | NAAQS | FARM2 | 410.3 | 3079.7 | 0 | 0 | 0.39 | 12.19 | 366.3 | 2.67 | 0.61 |
| FARMLAND SULFUR SYSTEM (PROPOSED) | NAAQS | FARM3 | 410.3 | 3079.7 | 0 | 0 | 0.16 | 12.19 | 366.3 | 2.67 | 0.61 |
| FPC BARTOW PEAKING 1-4 | NAAQS | FPC1 | 342.4 | 3082.6 | -67930 | 2945 | 192.89 | 13.7 | 772 | 22.3 | 5.3 |
| FPC BARTOW PIPELINE HEATER (U04) | NAAQS | FPC2 | 342.4 | 3082.6 | -67930 | 2945 | 1.8 | 9.1 | 541 | 5.2 | 0.9 |
| FPC BARTOW UNIT 1 & 2 (U01&02) | NAAQS | FPC3 | 342.4 | 3082.6 | -67930 | 2945 | 896.8 | 91.4 | 429 | 36.3 | 2.7 |
| FPC BARTOW UNIT 3 (U03) | NAAQS | FPC4 | 342.4 | 3082.6 | -67930 | 2945 | 710.54 | 91.4 | 408 | 34.4 | 3.4 |

# Table 5-4
## Continued
## AAQS SO2 Source Inventory
## Farmland Hydro, L.P. - Green Bay, Florida

| SOURCE DESCRIPTION | Inventory Designation | NAAQS Designation | UTM Coordinates (km) EAST | NORTH | Stack Centered Coordinat EAST | NORTH | Emissions (g/s) | Height (m) | Temperature (°K) | Velocity (m/s) | Dimeter (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FPC BAYBORO PEAKING 1-4 | NAAQS | FPC5 | 338.8 | 3071.3 | -71530 | -8355 | 197.8 | 12.2 | 755 | 6.4 | 7 |
| FPC INT. CITY PROP TURBINES/7EA @ 20°F | BOTH | FPC6 | 446.3 | 3126.0 | 35970 | 46345 | 124.4 | 15.24 | 819.8 | 56.21 | 4.21 |
| FPC INT. CITY PROP TURBINES/7FA @20°F | BOTH | FPC7 | 446.3 | 3126.0 | 35970 | 46345 | 110.4 | 15.24 | 880.8 | 32.07 | 7.04 |
| FPC OSCEOLA PEAKING 1-6 | NAAQS | FPC8 | 446.3 | 3126.0 | 35970 | 46345 | 273.06 | 7.9 | 703.7 | 18.06 | 4.24 |
| FPC OSCEOLA PEAKING 11-12 | BOTH | FPC9 | 446.3 | 3126.0 | 35970 | 46345 | 102.56 | 15.2 | 895.9 | 0.03 | 7.04 |
| FPC OSCEOLA PEAKING 7-10 | BOTH | FPC10 | 446.3 | 3126.0 | 35970 | 46345 | 111.88 | 15.2 | 834.8 | 0.05 | 4.21 |
| FPC POLK | BOTH | FPC11 | 414.4 | 3073.9 | 4070 | -5745 | 24.7 | 34.4 | 400 | 40.5 | 4.1 |
| FPL MANATEE UNIT 1 & 2 (U01&02) | NAAQS | FPL1 | 367.2 | 3054.1 | -43130 | -25555 | 2397.8 | 152.1 | 426 | 17.1 | 8 |
| GULF COAST LEAD | NAAQS | GULF1 | 364.0 | 3093.5 | -46330 | 13845 | 0.75 | 8.84 | 309.1 | 20.85 | 0.34 |
| GULF COAST LEAD (U01) | NAAQS | GULF2 | 364.0 | 3093.5 | -46330 | 13845 | 48.45 | 29.57 | 344.1 | 37.59 | 0.61 |
| HARDEE | BOTH | HARDEE1 | 404.8 | 3057.4 | -5530 | -22255 | 277.6 | 22.9 | 389 | 23.9 | 4.88 |
| IMC-AGRICO /NICHOLS/CONSERVE (2500 TP | BOTH | IMC1 | 398.4 | 3084.2 | -11930 | 4545 | 52.5 | 45.7 | 352 | 12 | 2.3 |
| IMC-AGRICO /NICHOLS/CONSERVE DAP DRYE | NAAQS | IMC2 | 398.4 | 3084.2 | -11930 | 4545 | 1.01 | 24.4 | 333 | 23.1 | 1.07 |
| IMC-AGRICO /NICHOLS/CONSERVE DRYER | NAAQS | IMC3 | 398.4 | 3084.2 | -11930 | 4545 | 3.34 | 24.69 | 327.4 | 3.77 | 2.29 |
| IMC-AGRICO/NEW WALES AFI PLANT | BOTH | IMC4 | 396.6 | 3078.9 | -13730 | -755 | 0.2 | 52.4 | 322 | 13.1 | 2.4 |
| IMC-AGRICO/NEW WALES DAP | BOTH | IMC5 | 396.6 | 3078.9 | -13730 | -755 | 5.54 | 36.6 | 319.1 | 20.15 | 1.83 |
| IMC-AGRICO/NEW WALES DAP 1 | NAAQS | IMC6 | 396.7 | 3079.4 | -13630 | -255 | 3.7 | 40.5 | 314 | 14.9 | 2.1 |
| IMC-AGRICO/NEW WALES GTSP | NAAQS | IMC7 | 396.7 | 3079.4 | -13630 | -255 | 9.2 | 40.5 | 316 | 20.4 | 1.8 |
| IMC-AGRICO/NEW WALES MULTIPHOS | BOTH | IMC8 | 396.6 | 3078.9 | -13730 | -755 | 4.8 | 52.4 | 314 | 15.8 | 1.4 |
| IMC-AGRICO/NEW WALES SAP #1, 2, 3 (3 | BOTH | IMC9 | 396.6 | 3078.9 | -13730 | -755 | 182.85 | 61 | 350 | 15.31 | 2.6 |
| IMC-AGRICO/NEW WALES SAP #4, 5 (2 AT | BOTH | IMC10 | 396.6 | 3078.9 | -13730 | -755 | 121.9 | 60.7 | 350 | 15.31 | 2.6 |
| IMC-AGRICO/NORALYN | NAAQS | IMC11 | 414.7 | 3080.3 | 4370 | 645 | 1.2 | 23.2 | 394 | 17.1 | 2 |
| IMC-AGRICO/NORALYN | NAAQS | IMC12 | 414.7 | 3080.3 | 4370 | 645 | 13.3 | 18.3 | 341 | 8.5 | 2.8 |
| IMC-AGRICO/SO. PIERCE DAP PLANT | BOTH | IMC13 | 407.5 | 3071.3 | -2830 | -8325 | 4.41 | 38.1 | 328 | 14.6 | 3.1 |
| IMC-AGRICO/SO. PIERCE GTSP PLANT | NAAQS | IMC14 | 407.5 | 3071.3 | -2830 | -8355 | 16.6 | 42.7 | 305 | 10.4 | 2.7 |
| IMC-AGRICO/SO. PIERCE H2SO4 (2 @ 2700 | BOTH | IMC15 | 407.5 | 3071.3 | -2830 | -8355 | 113.4 | 44.18 | 350 | 13.29 | 2.74 |
| LAKELAND LARSEN | NAAQS | LAKE1 | 409.3 | 3102.8 | -1030 | 23145 | 0.2 | 9.75 | 699.7 | 171.38 | 1.52 |
| LAKELAND LARSEN 4 | NAAQS | LAKE2 | 409.3 | 3102.8 | -1030 | 23145 | 93.37 | 50.29 | 433 | 5.64 | 3.05 |
| LAKELAND LARSEN 5 | NAAQS | LAKE3 | 409.3 | 3102.8 | -1030 | 23145 | 0.4 | 50.29 | 444.1 | 6.47 | 3.05 |
| LAKELAND LARSEN 6 | NAAQS | LAKE4 | 409.3 | 3102.8 | -1030 | 23145 | 0.35 | 50.29 | 444.1 | 6.47 | 3.05 |
| LAKELAND LARSEN 7 | NAAQS | LAKE5 | 409.3 | 3102.8 | -1030 | 23145 | 18.71 | 50.29 | 444.1 | 6.86 | 3.05 |
| LAKELAND LARSEN CT | BOTH | LAKE6 | 409.3 | 3102.8 | -1030 | 23145 | 29.11 | 30.48 | 783.2 | 28.22 | 5.79 |
| LAKELAND MCINTOSH | NAAQS | LAKE7 | 409.2 | 3106.2 | -1130 | 26545 | 8.32 | 10.97 | 791.3 | 0.39 | 2.8 |
| LAKELAND MCINTOSH | NAAQS | LAKE8 | 409.2 | 3106.2 | -1130 | 26545 | 2.94 | 6.1 | 652.4 | 23.54 | 0.79 |
| LAKELAND MCINTOSH 1 | NAAQS | LAKE9 | 409.3 | 3106.2 | -1030 | 26545 | 341.56 | 45.72 | 419.1 | 23.96 | 2.74 |
| LAKELAND MCINTOSH 2 | NAAQS | LAKE10 | 409.2 | 3106.2 | -1130 | 26545 | 25.68 | 47.55 | 402.4 | 21.29 | 3.17 |
| LAKELAND MCINTOSH 3 | BOTH | LAKE11 | 409.2 | 3106.2 | -1130 | 26545 | 500.1 | 76.2 | 350 | 19.7 | 4.88 |
| MOBIL NICHOLS DRYER 1 | NAAQS | MOBIL1 | 398.3 | 3084.3 | -12030 | 4645 | 12.73 | 25.9 | 342 | 14.1 | 2.29 |

# Table 5-4
## Concluded
## AAQS SO2 Source Inventory
## Farmland Hydro, L.P. - Green Bay, Florida

| SOURCE DESCRIPTION | Inventory Designation | NAAQS Designation | UTM Coordinates (km) |  | Stack Centered Coordinate |  | Emissions (g/s) | Height (m) | Temperature (°K) | Velocity (m/s) | Dimeter (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | EAST | NORTH | EAST | NORTH |  |  |  |  |  |
| MOBIL NICHOLS DRYER 2 | NAAQS | MOBIL2 | 398.3 | 3084.3 | -12030 | 4645 | 12.73 | 25.9 | 342 | 14.1 | 2.29 |
| MOBIL NICHOLS DRYER 4 | BOTH | MOBIL3 | 398.3 | 3084.3 | -12030 | 4645 | 2.44 | 25.9 | 339 | 16.05 | 2.29 |
| MULBERRY COGENERATION CT | BOTH | MULB1 | 413.6 | 3080.6 | 3270 | 945 | 13.4 | 38.1 | 377 | 9.31 | 1.98 |
| MULBERRY PROSPHATES/ROYSTER (1700 TPD | BOTH | MULB2 | 406.7 | 3085.2 | -3630 | 5545 | 35.7 | 61 | 360 | 12.2 | 2.13 |
| MULBERRY PROSPHATES/ROYSTER DAP | NAAQS | MULB3 | 406.7 | 3085.2 | -3630 | 5545 | 9.3 | 31.1 | 316 | 7.9 | 2.7 |
| RIDGE COGENERATION | BOTH | RIDGE1 | 416.7 | 3100.4 | 6370 | 20745 | 13.8 | 99.1 | 350 | 14.54 | 3.05 |
| TECO BIG BEND TURBINE 1 (U07) | NAAQS | TECO1 | 361.9 | 3075.0 | -48430 | -4655 | 11.3 | 10.7 | 816 | 136.2 | 1.5 |
| TECO BIG BEND TURBINE 2&3 (U05&06) | NAAQS | TECO2 | 361.9 | 3075.0 | -48430 | -4655 | 79.12 | 22.86 | 770.8 | 18.74 | 4.27 |
| TECO BIG BEND UNIT 1 (U01) | NAAQS | TECO3 | 361.9 | 3075.0 | -48430 | -4655 | 3309 | 149.35 | 404.7 | 13.74 | 7.32 |
| TECO BIG BEND UNIT 2 (U02) | NAAQS | TECO4 | 361.9 | 3075.0 | -48430 | -4655 | 3275.32 | 149.35 | 404.7 | 13.02 | 7.32 |
| TECO BIG BEND UNIT 3 (U03) | NAAQS | TECO5 | 361.9 | 3075.0 | -48430 | -4655 | 3372.92 | 149.35 | 410.2 | 14.47 | 7.32 |
| TECO BIG BEND UNIT 4 (U04) | BOTH | TECO6 | 361.9 | 3075.0 | -48430 | -4655 | 654.7 | 149.4 | 342.2 | 19.81 | 7.32 |
| TECO GANNON 1 & 2 (U01&02) | NAAQS | TECO7 | 360.0 | 3087.5 | -50330 | 7845 | 760.86 | 93.27 | 420.8 | 30.85 | 3.05 |
| TECO GANNON 3 (U03) | NAAQS | TECO8 | 360.0 | 3087.5 | -50330 | 7845 | 483.96 | 93.27 | 419.7 | 38.64 | 3.23 |
| TECO GANNON 4 (U04) | NAAQS | TECO9 | 360.0 | 3087.5 | -50330 | 7845 | 567.71 | 93.27 | 426.9 | 22.97 | 3.05 |
| TECO GANNON 5 (U05) | NAAQS | TECO10 | 360.0 | 3087.5 | -50330 | 7845 | 691.28 | 93.27 | 423.6 | 23.18 | 4.45 |
| TECO GANNON 6 (U06) | NAAQS | TECO11 | 360.0 | 3087.5 | -50330 | 7845 | 1149.41 | 93.27 | 433 | 24.74 | 5.36 |
| TECO GANNON TURBINE (U07) | NAAQS | TECO12 | 360.0 | 3087.5 | -50330 | 7845 | 11.9 | 10.67 | 816.3 | 136.61 | 1.52 |
| TECO HOOKERS POINT 1 & 2 (U01&02) | NAAQS | TECO13 | 358.0 | 3091.0 | -52330 | 11345 | 82.6 | 85.3 | 419 | 6.1 | 3.4 |
| TECO HOOKERS POINT 3 & 4 (U03&04) | NAAQS | TECO14 | 358.0 | 3091.0 | -52330 | 11345 | 114 | 85.3 | 434 | 7.9 | 3.7 |
| TECO HOOKERS POINT 5 (U05) | NAAQS | TECO15 | 358.0 | 3091.0 | -52330 | 11345 | 84.6 | 85.3 | 448 | 11 | 3.4 |
| TECO HOOKERS POINT 6 (U06) | NAAQS | TECO16 | 358.0 | 3091.0 | -52330 | 11345 | 107.9 | 85.3 | 434 | 22.3 | 2.9 |
| TECO POLK POWER | BOTH | TECO17 | 402.5 | 3067.0 | -7842 | -12701 | 5.42 | 22.86 | 812 | 27.43 | 5.49 |
| TECO POLK POWER | BOTH | TECO18 | 402.5 | 3067.4 | -7880 | -12305 | 49.68 | 45.72 | 400 | 16.76 | 5.79 |
| TECO POLK POWER | BOTH | TECO19 | 402.3 | 3067.5 | -8002 | -12183 | 8.2 | 60.7 | 1033 | 10.7 | 1.4 |
| TECO POLK POWER | BOTH | TECO20 | 402.4 | 3067.3 | -7910 | -12335 | 0.3 | 6.1 | 533 | 13.1 | 0.91 |
| TECO POLK POWER | BOTH | TECO21 | 402.0 | 3067.6 | -8314 | -12015 | 0.016 | 22.9 | 1000 | 20 | 1.2 |
| TECO POLK POWER | BOTH | TECO22 | 402.3 | 3067.3 | -8032 | -12358 | 1.27 | 60.7 | 1033 | 9.1 | 1.1 |
| TECO POLK POWER 4 CC | BOTH | TECO23 | 402.5 | 3067.2 | -7880 | -12439 | 17.6 | 45.72 | 389 | 16.15 | 4.42 |
| TECO POLK POWER 5 CT | BOTH | TECO24 | 402.5 | 3066.9 | -7842 | -12741 | 33.4 | 22.86 | 785 | 31.39 | 5.49 |
| USSAC FT MEADE H2SO4 1 & 2 (2200 TPD) | BOTH | USSAC1 | 416.1 | 3068.6 | 5790 | -11035 | 92.48 | 53.4 | 355 | 10 | 2.59 |

# Table 5-5

## PSD Class 2 SO2 Source Inventory
## Farmland Hydro, L.P. - Green Bay, Florida

| SOURCE DESCRIPTION | INVENTORY Designation | Modeling Designation | UTM Coordinates (km) EAST | UTM Coordinates (km) NORTH | Stack Centered Coordinate EAST | Stack Centered Coordinate NORTH | Emissions (g/s) | Height (m) | Temperature (°K) | Velocity (m/s) | Dimeter (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BREWSTER/IMPERIAL DRYER | PSD | BREW1 | 404.8 | 3069.5 | -5530 | -10155 | -19.26 | 27.44 | 339 | 15.25 | 2.29 |
| CARGILL/GARDINIER DRYER | PSD | CARG1 | 363.4 | 3082.4 | -46930 | 2745 | -28.89 | 20.73 | 310 | 13.12 | 1.07 |
| CARGILL/GARDINIER SAP #4, 5, 6 | PSD | CARG2 | 363.4 | 3082.4 | -46930 | 2745 | -187.7 | 22.6 | 363 | 7 | 1.52 |
| CARGILL/GARDINIER SAP #7 | PSD | CARG3 | 363.4 | 3082.4 | -46930 | 2745 | -26.25 | 45.6 | 340 | 12.64 | 2.29 |
| CARGILL/GARDINIER SAP #8 | PSD | CARG4 | 363.4 | 3082.4 | -46930 | 2745 | -41.16 | 45.6 | 339 | 13.93 | 2.44 |
| CARGILL/GARDINIER SAP #9 | PSD | CARG5 | 363.4 | 3082.4 | -46930 | 2745 | -54.6 | 45.6 | 350 | 10.3 | 2.74 |
| CARGILL/GARDINIER SAP #9 (INCR IN9 OF8/9 U06) | BOTH | CARG6 | 363.4 | 3082.4 | -46930 | 2745 | 67.2 | 45.6 | 350 | 12.66 | 2.74 |
| CARGILL/SEMINOLE/W.R. GRACE DRYER | PSD | CARG7 | 409.77 | 3086.99 | -560 | 7335 | -39.66 | 15.24 | 327 | 17.32 | 2.04 |
| CARGILL/SEMINOLE/W.R. GRACE SAP #1 & #2 | PSD | CARG8 | 409.77 | 3086.99 | -560 | 7335 | -216 | 45.72 | 352 | 16.5 | 1.37 |
| CARGILL/SEMINOLE/W.R. GRACE SAP #3 | PSD | CARG9 | 409.77 | 3086.99 | -560 | 7335 | -52.5 | 45.72 | 311 | 16.7 | 1.52 |
| CARGILL/SEMINOLE/W.R. GRACE SAP 4, 5 & 6 | PSD | CARG10 | 409.77 | 3086.99 | -560 | 7335 | -121.07 | 60.96 | 347 | 25.1 | 1.52 |
| CARGILL/SEMINOLE/W.R. GRACE SAP 4, 5 & 6 | BOTH | CARG11 | 409.77 | 3086.99 | -560 | 7335 | 143.64 | 60.96 | 347 | 34 | 1.52 |
| CF BARTOW DAP 1-3 | BOTH | CFB1 | 408.5 | 3082.5 | -1830 | 2845 | 3.97 | 36.4 | 339 | 16.11 | 2.13 |
| CF BARTOW H2SO4 1 (400 TPD) | PSD | CFB2 | 408.5 | 3082.5 | -1830 | 2845 | -60.9 | 30.49 | 350 | 12.2 | 1.37 |
| CF BARTOW H2SO4 2 (500 TPD) | PSD | CFB3 | 408.5 | 3082.5 | -1830 | 2845 | -110.25 | 30.49 | 350 | 10.37 | 1.68 |
| CF BARTOW H2SO4 3 (600 TPD) | PSD | CFB4 | 408.5 | 3082.5 | -1830 | 2845 | -107.1 | 30.49 | 364 | 4.27 | 2.74 |
| CF BARTOW H2SO4 4 (900 TPD) | PSD | CFB5 | 408.5 | 3082.5 | -1830 | 2845 | -174.83 | 30.49 | 358 | 7.93 | 2.13 |
| CF BARTOW H2SO4 5 (2400 TPD) | BOTH | CFB6 | 408.5 | 3082.5 | -1830 | 2845 | 50.4 | 63.41 | 361 | 10.88 | 2.13 |
| CF BARTOW H2SO4 5 (900 TPD) | PSD | CFB7 | 408.5 | 3082.5 | -1830 | 2845 | -226.8 | 63.41 | 358 | 10.67 | 2.13 |
| CF BARTOW H2SO4 6 (2400 TPD) | BOTH | CFB8 | 408.5 | 3082.5 | -1830 | 2845 | 50.4 | 63.41 | 370 | 7.28 | 2.13 |
| CF BARTOW H2SO4 6 (900 TPD) | PSD | CFB9 | 408.5 | 3082.5 | -1830 | 2845 | -170.1 | 63.41 | 359 | 10.37 | 2.13 |
| CF BARTOW H2SO4 7 (2000 TPD) | BOTH | CFB10 | 408.5 | 3082.5 | -1830 | 2845 | 42 | 67.1 | 351 | 9.8 | 2.4 |
| CF PLANT CITY BASELINE A & B | PSD | CFP1 | 388 | 3116 | -22330 | 36345 | -105 | 23.8 | 316 | 18.8 | 1.52 |
| CF PLANT CITY BASELINE C & D | PSD | CFP2 | 388 | 3116 | -22330 | 36345 | -100.8 | 60.35 | 353 | 16.4 | 2.44 |
| CF PLANT CITY H2SO4 A&B (U02&03) | BOTH | CFP3 | 388 | 3116 | -22330 | 36345 | 88.2 | 33.5 | 316 | 19.5 | 1.52 |
| CF PLANT CITY PROPOSED C & D (U07-08) | BOTH | CFP4 | 388 | 3116 | -22330 | 36345 | 109.2 | 60.35 | 353 | 17.77 | 2.44 |
| DOLIME BOILER | PSD | DOLIME1 | 404.813 | 3069.548 | -5517 | -10107 | -4.52 | 27.43 | 494.1 | 7.25 | 0.61 |
| DOLIME DRYER | PSD | DOLIME2 | 404.813 | 3069.548 | -5517 | -10107 | -5.68 | 27.43 | 333 | 20.67 | 1.52 |
| ESTECH/SWIFT DRYER | PSD | ESTE1 | 411.5 | 3074.2 | 1170 | -5455 | -23.94 | 18.29 | 339 | 8.47 | 2.95 |
| ESTECH/SWIFT DRYER | PSD | ESTE2 | 411.5 | 3074.2 | 1170 | -5455 | -22.8 | 18.75 | 340 | 5.06 | 2.95 |
| ESTECH/SWIFT SAP (610 TPD & 29 LB/Ton) | PSD | ESTE3 | 411.5 | 3074.2 | 1170 | -5455 | -92.87 | 30.79 | 358 | 3.9 | 2.13 |
| FARMLAND 1, 2 H2SO4 | PSD | FARM1 | 410.33 | 3079.655 | 0 | 0 | -83.98 | 30.48 | 311 | 20.18 | 1.37 |
| FPC INT. CITY PROP TURBINES/7EA AT 20 DEG F | BOTH | FPC1 | 446.3 | 3126 | 35970 | 46345 | 124.4 | 15.24 | 819.8 | 56.21 | 4.21 |
| FPC INT. CITY PROP TURBINES/7FA AT 20 DEG F | BOTH | FPC2 | 446.3 | 3126 | 35970 | 46345 | 110.4 | 15.24 | 880.8 | 32.07 | 7.04 |
| FPC OSCEOLA PEAKING 11-12 | BOTH | FPC3 | 446.3 | 3126 | 35970 | 46345 | 102.56 | 15.2 | 895.9 | 0.03 | 7.04 |
| FPC OSCEOLA PEAKING 7-10 | BOTH | FPC4 | 446.3 | 3126 | 35970 | 46345 | 111.88 | 15.2 | 834.8 | 0.05 | 4.21 |
| FPC POLK | BOTH | FPC5 | 414.4 | 3073.91 | 4070 | -5745 | 24.7 | 34.4 | 400 | 40.5 | 4.1 |
| GEN. PORT. CEMENT KILN 4 | PSD | GENPORT1 | 358 | 3090.6 | -52330 | 10945 | -62.99 | 35.97 | 505.2 | 17.61 | 2.74 |

# Table 5-5
## Continued
## PSD Class 2 SO2 Source Inventory
## Farmland Hydro, L.P. - Green Bay, Florida

| SOURCE DESCRIPTION | INVENTORY Designation | Modeling Designation | UTM Coordinates (km) EAST | UTM Coordinates (km) NORTH | Stack Centered Coordinate EAST | Stack Centered Coordinate NORTH | Emissions (g/s) | Height (m) | Temperature (°K) | Velocity (m/s) | Dimeter (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GEN. PORT. CEMENT KILN 5 | PSD | GENPORT2 | 358 | 3090.6 | -52330 | 10945 | -69.3 | 45.42 | 494.1 | 5.8 | 3.81 |
| HARDEE | BOTH | HARDEE1 | 404.8 | 3057.4 | -5530 | -22255 | 277.6 | 22.9 | 389 | 23.9 | 4.88 |
| IMC-Agrico/Nichols/Conserve (2@ 1300TPD & 4lb/To | PSD | IMC1 | 398.4 | 3084.2 | -11930 | 4545 | -54.6 | 30.5 | 308 | 18.9 | 1.8 |
| IMC-Agrico/Nichols/Conserve (2000TPD @ 4LB/Ton) | PSD | IMC2 | 398.4 | 3084.2 | -11930 | 4545 | -42 | 45.7 | 352 | 10.3 | 2.3 |
| IMC-Agrico/Nichols/Conserve (2500TPD @ 4LB/Ton) | BOTH | IMC3 | 398.4 | 3084.2 | -11930 | 4545 | 52.5 | 45.7 | 352 | 12 | 2.3 |
| IMC-Agrico/Nichols/Conserve ROCK DRYER | PSD | IMC4 | 398.4 | 3084.2 | -11930 | 4545 | -3.88 | 24.4 | 339 | 12.9 | 1.52 |
| IMC-Agrico/NEW WALES AFI PLANT | BOTH | IMC5 | 396.6 | 3078.9 | -13730 | -755 | 0.2 | 52.4 | 322 | 13.1 | 2.4 |
| IMC-Agrico/NEW WALES DAP | BOTH | IMC6 | 396.6 | 3078.9 | -13730 | -755 | 5.54 | 36.6 | 319.1 | 20.15 | 1.83 |
| IMC-Agrico/NEW WALES MULTIPHOS | BOTH | IMC7 | 396.6 | 3078.9 | -13730 | -755 | 4.8 | 52.4 | 314 | 15.8 | 1.4 |
| IMC-Agrico/NEW WALES ROCK DRYER | PSD | IMC8 | 396.6 | 3078.9 | -13730 | -755 | -34.27 | 21 | 347 | 18.6 | 2.13 |
| IMC-Agrico/NEW WALES SAP #1, 2, 3 (3 AT 2900 TP | BOTH | IMC9 | 396.6 | 3078.9 | -13730 | -755 | 182.85 | 61 | 350 | 15.31 | 2.6 |
| IMC-Agrico/NEW WALES SAP #1, 2, 3 BASELINE | PSD | IMC10 | 396.6 | 3078.9 | -13730 | -755 | -146 | 61 | 350 | 14.28 | 2.6 |
| IMC-Agrico/NEW WALES SAP #4, 5 (2 AT 2900 TPD) | BOTH | IMC11 | 396.6 | 3078.9 | -13730 | -755 | 121.9 | 60.7 | 350 | 15.31 | 2.6 |
| IMC-Agrico/PIERCE DRYERS 1, 2 | PSD | IMC12 | 404.1 | 3078.95 | -6230 | -705 | -24.32 | 24.38 | 339 | 12.94 | 1.52 |
| IMC-Agrico/PIERCE DRYERS 3, 4 | PSD | IMC13 | 404.1 | 3078.95 | -6230 | -705 | -23 | 24.38 | 339 | 18.82 | 2.43 |
| IMC-Agrico/SO. PIERCE DAP PLANT | BOTH | IMC14 | 407.5 | 3071.33 | -2830 | -8325 | 4.41 | 38.1 | 328 | 14.6 | 3.1 |
| IMC-Agrico/SO. PIERCE H2SO4 (2 @ 2700 TPD) | BOTH | IMC15 | 407.5 | 3071.3 | -2830 | -8355 | 113.4 | 44.18 | 350 | 13.29 | 2.74 |
| IMC-Agrico/SO. PIERCE H2SO4 (2 @1800 TPD) | PSD | IMC16 | 407.5 | 3071.3 | -2830 | -8355 | -75.6 | 45.73 | 350 | 26.4 | 1.6 |
| LAKELAND LARSEN CT | BOTH | LAKE1 | 409.3 | 3102.8 | -1030 | 23145 | 29.11 | 30.48 | 783.2 | 28.22 | 5.79 |
| LAKELAND MCINTOSH 3 | BOTH | LAKE2 | 409.2 | 3106.2 | -1130 | 26545 | 500.1 | 76.2 | 350 | 19.7 | 4.88 |
| MOBIL Nichols 75 HP BOILER | PSD | MOBIL1 | 398.3 | 3084.3 | -12030 | 4645 | -0.87 | 4 | 522 | 1.8 | 0.8 |
| MOBIL Nichols CALCINER | PSD | MOBIL2 | 398.3 | 3084.3 | -12030 | 4645 | -13.89 | 28.4 | 340 | 19.24 | 1.09 |
| MOBIL Nichols DRYER 4 | BOTH | MOBIL3 | 398.3 | 3084.3 | -12030 | 4645 | 2.44 | 25.9 | 339 | 16.05 | 2.29 |
| MOBILE Electrophos 400HP BOILER | PSD | MOBILE1 | 405.6 | 3079.4 | -4730 | -255 | -6.53 | 7.32 | 464 | 3.23 | 0.91 |
| MOBILE Electrophos 600HP BOILER | PSD | MOBILE2 | 405.6 | 3079.4 | -4730 | -255 | -10.05 | 6.1 | 464 | 7.71 | 0.91 |
| MOBILE Electrophos CALCINER | PSD | MOBILE3 | 405.6 | 3079.4 | -4730 | -255 | -7.11 | 25.61 | 306 | 6.97 | 2.13 |
| MOBILE Electrophos COKE DRYER | PSD | MOBILE4 | 405.6 | 3079.4 | -4730 | -255 | -3.17 | 18.29 | 322 | 22.87 | 0.7 |
| MOBILE Electrophos Furnace (31.25TPH Rock@ 0.3%S) | PSD | MOBILE5 | 405.6 | 3079.4 | -4730 | -255 | -47.25 | 29.27 | 314 | 8.52 | 2.13 |
| MOBILE Electrophos ROCK DRYER | PSD | MOBILE6 | 405.6 | 3079.4 | -4730 | -255 | -21.81 | 18.29 | 350 | 6.79 | 1.83 |
| MULBERRY COGENERATION CT | BOTH | MULB1 | 413.6 | 3080.6 | 3270 | 945 | 13.4 | 38.1 | 377 | 9.31 | 1.98 |
| Mulbeerry Phosphates/Royster (1003TPD @29 LB/Ton) | PSD | MULB2 | 406.7 | 3085.2 | -3630 | 5545 | -152.71 | 51 | 356 | 9.9 | 2.13 |
| Mulberry Phosphates/Royster (1700TPD @4 LB/Ton) | BOTH | MULB3 | 406.7 | 3085.2 | -3630 | 5545 | 35.7 | 61 | 360 | 12.2 | 2.13 |
| RIDGE COGENERATION | BOTH | RIDGE1 | 416.7 | 3100.4 | 6370 | 20745 | 13.8 | 99.1 | 350 | 14.54 | 3.05 |
| TECO BIG BEND UNIT 3 (24-HR) | PSD | TECO1 | 361.9 | 3075 | -48430 | -4655 | -1218 | 149.4 | 418 | 14.33 | 7.32 |
| TECO BIG BEND UNIT 4 (U04) | BOTH | TECO2 | 361.9 | 3075 | -48430 | -4655 | 654.7 | 149.4 | 342.2 | 19.81 | 7.32 |
| TECO BIG BEND UNITS 1&2 (24-HR) | PSD | TECO3 | 361.9 | 3075 | -48430 | -4655 | -2436 | 149.4 | 422 | 28.65 | 7.32 |
| TECO POLK POWER | BOTH | TECO4 | 402.42 | 3067.32 | -7910 | -12335 | 0.3 | 6.1 | 533 | 13.1 | 0.91 |
| TECO POLK POWER | BOTH | TECO5 | 402.298 | 3067.297 | -8032 | -12358 | 1.27 | 60.7 | 1033 | 9.1 | 1.1 |

## Table 5-5
## Concluded
## PSD Class 2 SO2 Source Inventory
## Farmland Hydro, L.P. - Green Bay, Florida

| SOURCE DESCRIPTION | INVENTORY Designation | Modeling Designation | UTM Coordinates (km) EAST | UTM Coordinates (km) NORTH | Stack Centered Coordinates EAST | Stack Centered Coordinates NORTH | Emissions (g/s) | Height (m) | Temperature (°K) | Velocity (m/s) | Dimeter (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TECO POLK POWER | BOTH | TECO6 | 402.328 | 3067.472 | -8002 | -12183 | 8.2 | 60.7 | 1033 | 10.7 | 1.4 |
| TECO POLK POWER | BOTH | TECO7 | 402.45 | 3067.35 | -7880 | -12305 | 49.68 | 45.72 | 400 | 16.76 | 5.79 |
| TECO POLK POWER | BOTH | TECO8 | 402.488 | 3066.954 | -7842 | -12701 | 5.42 | 22.86 | 812 | 27.43 | 5.49 |
| TECO POLK POWER | BOTH | TECO9 | 402.016 | 3067.64 | -8314 | -12015 | 0.016 | 22.9 | 1000 | 20 | 1.2 |
| TECO POLK POWER 4 CC | BOTH | TECO10 | 402.45 | 3067.216 | -7880 | -12439 | 17.6 | 45.72 | 389 | 16.15 | 4.42 |
| TECO POLK POWER 5 CT | BOTH | TECO11 | 402.488 | 3066.914 | -7842 | -12741 | 33.4 | 22.86 | 785 | 31.39 | 5.49 |
| USS AGRI-CHEM BARTOW DRYER | PSD | USSAG1 | 413.2 | 3086.3 | 2870 | 6645 | -3.41 | 15.8 | 332 | 10.01 | 1.83 |
| USS AGRI-CHEM BARTOW SAP (800 TPD & 10 LB/Ton) | PSD | USSAG2 | 413.2 | 3086.3 | 2870 | 6645 | -42 | 28.96 | 305 | 7.5 | 2.12 |
| USSAC FT MEADE GTSP | PSD | USSAC1 | 416 | 3069 | 5670 | -10655 | -18.27 | 28.35 | 330 | 17.6 | 1.52 |
| USSAC FT MEADE H2SO4 (1500 TPD @ 10 LB/Ton) | PSD | USSAC2 | 416.21 | 3068.74 | 5880 | -10915 | -78.8 | 29 | 314 | 6.77 | 3.02 |
| USSAC FT MEADE H2SO4 1 & 2 (2200 TPD) | BOTH | USSAC3 | 416.12 | 3068.62 | 5790 | -11035 | 92.48 | 53.4 | 355 | 10 | 2.59 |

## TABLE 5-6
## SUMMARY OF CLASS II AREA SULFUR DIOXIDE IMPACTS ANALYSIS

FARMLAND HYDRO, L.P.
POLK COUNTY, FLORIDA

| MET DATA | SULFUR DIOXIDE IMPACT ($\mu g/m^3$) PSD ANNUAL(1) | PSD 3-HOUR(2) | PSD 24-HOUR(2) | AAQS ANNUAL(1) | AAQS 3-HOUR(2) | AAQS 24-HOUR(2) |
|---|---|---|---|---|---|---|
| 1987 | 0 | 132.1 | 35.7 | 43.6 | 552.4 | 189.1 |
| 1988 | 0 | 146.1 | 56.1 | 41.3 | 560.2 | 182.4 |
| 1989 | 0 | 172.1 | 49.7 | 42.6 | 524.0 | 206.4 |
| 1990 | 0 | 150.4 | 28.7 | 45.1 | 554.4 | 202.0 |
| 1991 | 0 | 176.2 | 33.4 | 43.6 | 486.8 | 175.9 |
| MAX. INCL. BACKGROUND (3) | 0 | 176.2 | 56.1 | 56.1 | 571.2 | 217.4 |
| INCREMENT & STD. | 20 | 512 | 91 | 60 | 1300 | 260 |
| STD. EXCEEDED | NO | NO | NO | NO | NO | NO |

NOTE:

(1) The impact represents the highest-high impact.

(2) The impact represents the highest second-high impact.

(3) A background concentration of 11 ug/m3 was included in the AAQS analysis to account for any minor sources not modeled.

## 6.0 GOOD ENGINEERING PRACTICE STACK HEIGHT

The criteria for good engineering practice stack height in Rule 62-210, FAC, 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 sources addressed in this application is 213 feet. The Farmland sulfuric acid plant stacks are all less than 213 feet in height above-grade. This satisfies the good engineering practice (GEP) stack height criteria.

## 7.0 IMPACTS ON SOILS, VEGETATION AND VISIBILITY

### 7.1 IMPACT ON SOILS AND VEGETATION

The U. S. Environmental Protection Agency was directed by Congress to develop primary and secondary ambient air quality standards. The primary standards were to protect human health and the secondary standards were to:

> "... protect the public welfare from any known or anticipated adverse effects of a pollutant."

The public welfare was to include soils, vegetation and visibility.

As a basis for promulgating the air quality standards, EPA undertook studies related to the effects of all major air pollutants and published criteria documents summarizing the results of the studies. The studies included in the criteria documents were related to both acute and chronic effects of air pollutants. Based on the results of these studies, the criteria documents recommended air pollutant concentration limits for various periods of time that would protect against both chronic and acute effects of air pollutants with a reasonable margin of safety.

The air quality modeling that has been conducted as a requirement for the PSD application demonstrates that the levels of SO2 expected in the vicinity of the proposed project are below the ambient air quality standards. As a result, it is reasonable to conclude that there will be no adverse effect to the soils, vegetation or visibility of the area.

The Farmland plant property and the surrounding areas are comprised of mining lands (phosphate), flatwoods, marshes, and sloughs. The soils of the area are primarily sandy and are typically low in both clay and silt content. These characteristics and the semi-tropic climatic factors of high temperature and rainfall are the natural factors which determine the terrestrial communities of the region.

The land in the vicinity of the Farmland plant supports various plant communities. Much of the natural vegetation on the site and the surrounding areas has been altered due to mining and industrial use; primarily the phosphate fertilizer industry. As a result of mining and industrial activity, there is very little undisturbed land in existence in the vicinity of the plant. As a result, no adverse impacts from the proposed project are expected on the soils and vegetation in the vicinity of the facility.

## 7.2 GROWTH RELATED IMPACTS

The proposed modification will require no increase in personnel to operate the facility. Also, the increase in sulfuric acid production may cause a slight increase in delivery truck tanker traffic but will have a negligible impact on traffic in the area as compared with traffic levels that presently exist. Therefore, no additional growth impacts are expected as a result of the proposed project.

## 7.3 VISIBILITY IMPACTS

The proposed project will result in an increase in air emissions and therefore has the potential for adverse impacts on visibility.

A screening approach suggested by EPA (Workbook for Plume Visual Impact Screening and Analysis, 1988) and computerized in a model referred to as VISCREEN was used for the analysis. The emissions of acid mist and nitrogen oxides were input to the model. In the case of sulfur dioxide however, EPA has noted in discussions on visibility models that the sulfates formation resulting from sulfur dioxide emissions becomes a factor beyond 200 kilometers and so the sulfur dioxide emissions were not included in the analysis. The VISCREEN - Level 1 modeling results, presented in Table 7-1, indicate that there will be no adverse visibility impacts from the proposed project.

## 7.4 IMPACTS ON AIR QUALITY RELATED VALUES FOR CLASS I AREA

The analysis addressed in this section addresses the review of the impact of increased emissions on air quality related values associated with the Chassahowitzka Wildlife Refuge, a Class I area located in excess of 100 kilometers northwest of the Farmland plant.

### 7.4.1 Impact on Vegetation

The response of vegetation to air pollutants is influenced by the concentration of the pollutant, the duration of the exposure and the frequency of the exposure. The pattern of exposure expected from a single facility is that of a few episodes of relatively high concentrations interdispersed with long periods of no exposure or extremely low concentrations. This is the pattern of exposure that would be expected from SO2, NOx and SAM emissions from the proposed project impacting the Class I area.

Vegetation responds to a dose of an air pollutant with a dose being defined as the product of the concentration of the pollutant and the duration of the exposure. The impact of the S02 emissions on Chassahowitzka regional vegetation was assessed by comparing pollutant doses that have been projected with air quality modeling to threshold doses reported in the literature.

S02 damage to vegetation can be grouped into two general categories: acute and chronic. Acute damage is caused by short-term exposure to relatively high concentrations of S02. This damage is usually characterized by a yellowing of leaf tips with a sharp, well defined separation between the damaged and healthy areas of a leaf. In pine trees, injury usually first occurs at the base of the youngest needles (the newest tissue on the plant).

Damaged plants typically show decreased growth and yield. These effects vary widely between species but studies have shown a rough correlation between the loss and yield and the exposure dose. These studies showed approximately a 10 percent yield loss for each 10-fold increase in S02 dose beyond 260 micrograms per cubic meter-hour.

Susceptibility to acute damage varies widely with plant species and also with the time of exposure. For example, alfalfa can tolerate 3250 micrograms per cubic meter for one hour (3250 micrograms per cubic meter-hour dose), but only 1850 micrograms per cubic meter for two hours (3700 micrograms per cubic meter-hour dose). Table 7-3 shows the sulfur dioxide concentration/time thresholds for several plant species common to Florida.

The vegetation in the Chassahowitzka area is characterized by flatwoods, brackish-water, marine and halothytic terrestrial species. Predominant tree species are slash pine, laurel oak, sweet gum and palm. Other plants in the area include needlegrass rush, seashore saltgrass, marsh hay and red mangrove.

A study of the tolerance of native Florida species to S02 (Woltz and Howe, 1981) demonstrated that cypress, slash pine, live oak and mangrove exposed to 1300 micrograms per cubic meter of S02 for 8-hours were not visibly damaged. This is consistent with the results reported in Table 7-3. Another study (McLaughlin and Lee, 1974) demonstrated that approximately 20 percent of a broad range of plants ranging from sensitive to tolerant were visibly injured when exposed to a S02 concentration of 920 micrograms per cubic meter for a 3-hour period.

Acute injury results from a plants inability to quickly convert absorbed S02 into the sulfate ion; an essential nutrient to plants. Chronic injury, on the other hand, results from a build-up of sulfate in tissue to the point where it becomes toxic. This sulfate build-up occurs over a relatively long period of time. Symptoms include a reduction in chlorophyll production resulting in decreased photosynthesis and yellow or reddish areas on leaves in a mottled pattern. In pines, sulfate injury is typically shown first at tips of older needles (the oldest tissue in the needle).

Chronic injury can result from S02 exposures that are much lower than is required for acute injury. Unfortunately, there is a lack of quantitative experimental data for long term effects of S02 exposure. The lowest average concentration for which chronic injury has been shown is 80 micrograms per cubic meter. The Environmental Protection Agency has therefore established an ambient air quality standard of 80 micrograms per cubic meter, annual average. The Florida Department of Environmental Protection adopted a more conservative standard of 60 micrograms per cubic meter, annual average. Although the predicted maximum impacts exceed the Class I PSD increments, the S02 impacts from the proposed project are expected to be well below the ambient air quality standards (see Table 5-6).

The maximum expected concentrations of acid mist in the Chassahowitzka area resulting from the increased emissions from Farmland will be less than four percent of the expected sulfur dioxide impacts. Furthermore, it would be expected that by the time acid mist droplets have traveled over 100 kilometers from Farmland to the Chassahowitzka area, the droplets may react with particles in the atmosphere to produce a sulfate salt.

Salt deposition concentrations in coastal areas are in the range of 25-300 pounds per acre per year and may be as high as 4000 pounds per acre per year on exposed shorelines. Sulfates can account for 5 - 6 percent of the total salt; resulting in a deposition rate in the range of 1-200 pounds per acre per year.

One study (Mulchi Armbruster, 1975) demonstrated leaf damage in reduced yields in corn and soybeans with a salt deposition of 169 - 339 pounds per acre per year. Another study (Curtis, 1975) reported that broad leaf plants absorbed greater amounts of salt than do pines, probably due to leaf shape. It has been found that deciduous trees begin to exhibit adverse effects to salt exposure concentrations in the range of 100 micrograms per cubic meter (DeVine, 1975). The same study reported no observed injury to plants with long-term exposures to salt spray of 40 micrograms per cubic meter.

The sulfate concentrations resulting from acid mist emissions from Farmland are well below concentrations which have been reported to produce vegetation damage.

Given that the maximum predicted Class I area NOx impacts are less than significant, no adverse impact to the Class I area vegetation are expected from the NOx emissions from the proposed project.

### 7.4.2 Impact on Soils

The major soil classification in the Chassahowitzka area is Weeki Wachee-Durbin muck. This is an euic, hyderthermic typic sufihemist that is characterized by high levels of sulfur and organic matter. This soil is flooded daily with the advent of high tide and the pH ranges between 6.1 and 7.8. The upper level of this soil may contain as much as four percent sulfur (USDA, 1991).

Based upon the expected SO2 and sulfate concentrations in the Chassahowitzka area resulting from the increased emissions from the Farmland plant, it is not expected that there will be any adverse impact on the native soils. A recent study (1994), coordinated by the National Park Service, supports this position.

Given that the maximum predicted Class I area NOx impacts are less than significant, no adverse impact to the Class I area soils are expected from the NOx emissions from the proposed project.

### 7.4.3 Impacts on Wildlife

As the predicted SO2 and NOx levels are below those known to affect vegetation, the proposed project is not expected to have any adverse impact on the wildlife in the Chassahowitzka area.

### 7.4.4. Visibility Impairment Analysis

Visibility impairment analysis was performed to determine potential impact of the proposed project in the Chassahowitzka area. The VISCREEN - Level 1 modeling results, presented in Table 7-1, and the regional haze analysis, presented in Table 7-2, indicate that no adverse visibility impacts are expected as a result of the proposed project.

# TABLE 7-1

## Visual Effects Screening Analysis for
## Farmland Hydro, L.P.
## Class I Area: Chassahowitzka

```
 User-selected Screening Scenario Results
 Input Emissions for SAP6 - SAP3

    Particulates       .53  G  /S (acid mist)
    NOx (as NO2)       .42  G  /S
    Primary NO2        .00  G  /S
    Soot               .00  G  /S
    Primary SO4        .00  G  /S

Default Particle Characteristics Assumed
Transport Scenario Specifications:

     Background Ozone:                    .04 ppm
     Background Visual Range:           65.00 km
     Source-Observer Distance:         105.00 km
     Min. Source-Class I Distance:     105.00 km
     Max. Source-Class I Distance:     125.00 km
     Plume-Source-Observer Angle:       11.25 degrees
     Stability:   6
     Wind Speed:   1.00 m/s

_____________________________R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

          Maximum Visual Impacts INSIDE  Class I Area
           Screening Criteria ARE NOT Exceeded
                                              Delta E        Contrast
                                           ===========    ===========
 Backgrnd Theta Azi Distance Alpha Crit   Plume    Crit  Plume
 ======== ===== === ======== ===== ====   =====    ====  =====
  SKY       10.  84.  105.0     84.  2.00   .021     .05   .000
  SKY      140.  84.  105.0     84.  2.00   .004     .05  -.000
  TERRAIN   10.  84.  105.0     84.  2.00   .010     .05   .000
  TERRAIN  140.  84.  105.0     84.  2.00   .002     .05   .000

          Maximum Visual Impacts OUTSIDE Class I Area
           Screening Criteria ARE NOT Exceeded
                                              Delta E        Contrast
                                           ===========    ===========
 Backgrnd Theta Azi Distance Alpha Crit   Plume    Crit  Plume
 ======== ===== === ======== ===== ====   =====    ====  =====
  SKY       10.  30.   79.6    139.  2.00   .026     .05   .000
  SKY      140.  30.   79.6    139.  2.00   .005     .05  -.000
  TERRAIN   10.  50.   91.7    119.  2.00   .013     .05   .000
  TERRAIN  140.  50.   91.7    119.  2.00   .003     .05   .000
```

# Table 7-2

## Regional Haze Analysis For
## Farmland Hydro L.P. – Green Bay, Florida
## CLASS I CHASSAHOWITZKA N.W.R.

| (1) SO2 (µg/m^3) | (2) Background Visibility (km) | (3) Ambient b(ext)a | (4) Acid Mist Impact H2SO4 (µg/m^3) | (5) SO4 (µg/m^3) | (6) (NH4)SO2 (µg/m^3) | (7) Transport Time (hrs) | (8) Conversion |
|---|---|---|---|---|---|---|---|
| 0.0930 | 65 | 0.0602 | 0.00342 | 0.1395 | 0.1965 | 12.96 | **34.8%** |
| (9) AT 34.8% (NH4)SO2 CONVERSION (µg/m^3) | (10) Relative Humidity FACTOR @ 83% | (11) PM-10 (µg/m^3) | (12) Source b(ext)s (NH4)SO2 | (13) Source b(ext)s PM10 | (14) **Total** Source b(ext)s | (15) Deciview | Is Deciview Greater than 1 |
| 0.0684 | 4.2 | 0.0000 | 0.00086 | 0.00000 | **0.00086** | 0.1423 | NO |

(1) Maximum 24-hour SO2 Impact at Class I Receptor (Table 5-2).
(2) Measured Background Visibility Range as recomended by FWS
(3) Ambient b(ext)a = 3.912/Background Visibility
(4) Acid Mist Impact = 0.15/4 * SO2 Impact * 96/98.
(5) SO4 = SO2 Impact * 1.5
(6) 100 % (NH4)SO2 Impact = 1.375 * ( SO4 + Acid Mist)
(7) Transport Time (hours) = Maximum Distance / Average daily wind speed – From 1996 Modeling.
(8) Conversion = Transport Time * 0.03 (% / hour) – From 1996 Modeling.
(9) (NH4)SO2 Conversion = % Conversion * (NH4)SO2)
(10) Relative Humidity Factor From Meteorology and Figure B-1 IWAQM
(11) Maximum 24-hour PM10 Impact at Class I Receptor. (None)
(12) Source b(ext)s (NH4)SO4 = 0.003 * Relative Humidity Factor * (NH4)SO4
(13) Source b(ext)s PM10 = 0.003 * Relative Humidity Factor (1) * PM10
(14) Total Source b(ext)s = b(ext)s (NH4)SO4 + b(ext)s PM10
(15) Deciview = 10 * LN [ 1 + ( Total b(ext)s / b(ext)a ) ]

## TABLE 7-3

## SENSITIVITY OF VEGETATION TO SULFUR DIOXIDE

### CONCENTRATION - TIME EXPOSURES TO SULFUR DIOXIDE RESULTING IN DAMAGE TO SEVERAL SPECIES COMMON TO FLORIDA

---

Sensitive Plants

- Poplar
- Lombardy Poplar
- Black Willow
- Elm
- American Elm
- Southern pines
- Red Oak
- Black Oak
- Sumac
- Radish
- Cucumber
- Squash
- Bean
- Pea
- Soybean
- Cotton
- Eggplant
- Celery
- Cabbage
- Broccoli
- Spinach
- Wheat
- Begonia
- Zinnia
- Rubber plant
- Bluegrass
- Ryegrass

Intermediate Plants

- Basswood
- Red Oxier Dogwood
- Maples
- Red Maple
- Elm
- Pine
- White Oak
- Pin Oak
- Yellow Poplar
- Sweetgum
- Locust
- Eastern Cottonwood
- Saltgrass
- Cucumber
- Tobacco
- Potato
- Virginia creeper
- Rose
- Hibiscus
- Gladiolus
- Honeysuckle
- Wisteria
- Chrysanthemum

Tolerant Plants

- Juniper
- Ginkgo
- Dogwood
- Oak
- Live Oak
- Pine
- Sumac
- Cantaloupe
- Corn
- Lily
- Gardenia
- Citrus
- Celery

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(Continued)

TABLE 7-3 (CONTINUED)

| Exposure Time, Hours | Concentration Needed to Produce Injury ($\mu g/m^3$) Sensitive | Intermediate | Tolerant |
|---|---|---|---|
| 0.5 | 2,620 - 10,480 | 9,170 - 31,440 | >26,200 |
| 1.0 | 1,310 - 7,860 | 6,550 - 26,200 | >20,960 |
| 2.0 | 655 - 5,240 | 3,930 - 19,650 | >15,720 |
| 4.0 | 262 - 2,620 | 1,310 - 13,100 | >10,480 |
| 8.0 | 131 - 1,310 | 524 - 6,550 | > 5,240 |

## 8.0 CONCLUSION

It can be concluded from the information in this report that the proposed construction of SAP6 and the shutdown of SAP3, as described in this report, will not cause or significantly contribute to an exceedance of any air quality standard, PSD increment, or any other provision of Chapter 62, FAC.

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# APPENDIX A - EMISSION RATE CALCULATIONS

# APPENDIX A - EMISSION RATE CALCULATIONS

## 1.0 PERMITTED SAP3 EMISSION RATES

SO2 = 350 lbs/hr
x 8760 hrs/yr x ton/2000 lbs
= 1533 TPY

ACID MIST = 13.1 lbs/hr
(SAM) x 8760 hrs/yr x ton/2000 lbs
= 57.5 TPY

The estimated emissions from the sulfur system, projected for PSD inventory purposes:

PM = 9.7 tpy

SO2 = 17.9 tpy

H2S = 11.9 tpy

VOC = 17.7 tpy

## 2.0 ACTUAL SAP3 EMISSION RATE CALCULATIONS

Sulfuric acid plant emissions were estimated using December 29, 1996 compliance test results and 8,760 as the representative annual hours of operation. Sulfur system emissions assumed to be same as above.

SO2 = 276.1 lbs/hr
x 8760 hrs/yr x ton/2000 lbs
= 1209.4 TPY

SAM = 9.1 lbs/hr
x 8760 hrs/yr x ton/2000 lbs
= 39.9 TPY

NOx emissions based on the nominal permitted production rate and a NOx emission factor used previously by FDEP of 0.12 lb/ton:

NOx = 1791 tpd x 1 day/24 hrs x 0.12 lb/ton
= 9.0 lbs/hr
x 8760 hrs/yr x ton/2000 lbs
= 39.2 TPY

## 3.0 PROPOSED SAP6 EMISSION RATE CALCULATIONS:

SO2 = 2750 tons/day x day/24 hrs x 4.0 lbs/ton
= 458.3 lbs/hr
x 8760 hrs/yr x ton/2000 lbs
= 2007.5 TPY

SAM = 2750 tons/day x day/24 hrs x 0.15 lb/ton
= 17.2 lbs/hr
x 8760 hrs/yr x ton/2000 lbs
= 75.3 TPY

NOx = 2750 tons/day x day/24 hrs x 0.12 lb/ton
= 13.8 lbs/hr
x 8760 hrs/yr x ton/2000 lbs
= 60.2 TPY

The estimated emissions from the sulfur system, projected for PSD inventory purposes, are based on a 10 percent increase in H2SO4 rates:

PM = 9.7 tpy x 1.1 = 10.7 tpy

SO2 = 17.9 tpy x 1.1 = 19.7 tpy

H2S = 11.9 tpy x 1.1 = 13.1 tpy

VOC = 17.7 tpy x 1.1 = 19.5 tpy

The net estimated emissions increase from the molten sulfur system:

PM = 9.7 tpy x 0.1 = 1 tpy

SO2 = 17.9 tpy x 0.1 = 1.8 tpy

H2S = 11.9 tpy x 0.1 = 1.2 tpy

VOC = 17.7 tpy x 0.1 = 1.8 tpy

## 4.0 NET ANNUAL EMISSION CHANGES

Net Emissions = Proposed + Contemporaneous - Actual

| POLLUTANT | ESTIMATED EMISSIONS (TPY) | | | | |
|---|---|---|---|---|---|
| | No.3 (Actuals) | No.6 (Proposed) | SULFUR SYSTEM (Net) | CONTEMPORANEOUS | NET |
| SO2 | 1209.4 | 2007.5 | 1.8 | 0 | 799.9 |
| SAM | 39.9 | 75.3 | 0 | 0 | 35.4 |
| NOx | 39.2 | 60.2 | 0 | 38.7 | 59.7 |
| H2S | 0 | 0 | 1.2 | 2.4 | 3.6 |
| PM/PM10 | 0 | 0 | 1.0 | 2.0 | 3.0 |
| VOC | 0 | 0 | 1.8 | 3.7 | 5.5 |

# APPENDIX B - MODELING OUTPUT ON DISK

THE FOLLOWING SIA FILES ARE PROVIDED:

```
F2ASI87  OUT        201,211 11-08-97    SO2 CLASS 2 AND FAAQS SIA FOR 1987
F2ASI88  OUT        201,211 11-08-97    SO2 CLASS 2 AND FAAQS SIA FOR 1988
F2ASI89  OUT        201,211 11-08-97    SO2 CLASS 2 AND FAAQS SIA FOR 1989
F2ASI90  OUT        201,211 11-08-97    SO2 CLASS 2 AND FAAQS SIA FOR 1990
F2ASI91  OUT        201,211 11-08-97    SO2 CLASS 2 AND FAAQS SIA FOR 1991

C2NX87   OUT        114,765 11-09-97    NOX CLASS 2 AND FAAQS SIA FOR 1987
C2NX88   OUT        114,765 11-09-97    NOX CLASS 2 AND FAAQS SIA FOR 1988
C2NX89   OUT        114,765 11-09-97    NOX CLASS 2 AND FAAQS SIA FOR 1989
C2NX90   OUT        114,765 11-09-97    NOX CLASS 2 AND FAAQS SIA FOR 1990
C2NX91   OUT        114,765 11-09-97    NOX CLASS 2 AND FAAQS SIA FOR 1991
```

NO SIGNIFICANCE WAS FOUND FOR NOX AT THE PSD CLASS 1 AREA

PSD CLASS 2 AND FAAQS INVENTORIES WERE COMPILED AND APPLIED TO THE RECEPTOR GROUPS THAT DEMONSTRATED SIGNIFICANCE. FOR THE FIVE YEARS MODELED, EACH AVERAGING PERIOD DEMONSTRATED MAXIMUM SIGNIFICANCE AT DIFFERENT RECEPTOR DISTANCES;

| | |
|---|---|
| 3-HOUR & 24-HOUR | 8 KILOMETERS |
| ANNUAL | DISCRETE RECEPTORS |

IN THE INCREMENT ANALYSIS FOR THE 3-HOUR AND 24-HOUR AVERAGING PERIOD, ALL DISCRETE RECEPTORS MENTIONED ABOVE WERE USED WITH POLAR RECEPTOR RINGS @ 3000 4000 5000 6000 7000 AND 8000 METERS.

```
FP-2487  OUT        264,685 11-12-97   PSD CLASS 2 FOR 1987
FP-2488  OUT        264,685 11-12-97   PSD CLASS 2 FOR 1988
FP-2489  OUT        264,685 11-12-97   PSD CLASS 2 FOR 1989
FP-2490  OUT        264,685 11-12-97   PSD CLASS 2 FOR 1990
FP-2491  OUT        264,685 11-12-97   PSD CLASS 2 FOR 1991

FQ-2487  OUT        271,663 11-08-97   FAAQS FOR 1987
FQ-2488  OUT        271,663 11-09-97   FAAQS FOR 1988
FQ-2489  OUT        271,663 11-09-97   FAAQS FOR 1989
FQ-2490  OUT        271,663 11-09-97   FAAQS FOR 1990
FQ-2491  OUT        271,663 11-09-97   FAAQS FOR 1991
```

IN THE INCREMENT ANALYSIS FOR THE ANNUAL AVERAGING PERIOD, ONLY THE DISCRETE RECEPTORS MENTIONED ABOVE WERE REQUIRED.

```
FP-AN87  OUT        146,093 11-12-97 PSD CLASS 2 1987
FP-AN88  OUT        146,093 11-12-97 PSD CLASS 2 1988
FP-AN89  OUT        146,091 11-12-97 PSD CLASS 2 1989
FP-AN90  OUT        146,091 11-12-97 PSD CLASS 2 1990
FP-AN91  OUT        146,091 11-12-97 PSD CLASS 2 1991

FQ-AN87  OUT        153,161 11-09-97 FAAQS FOR 1987
FQ-AN88  OUT        153,161 11-09-97 FAAQS FOR 1988
FQ-AN89  OUT        153,161 11-09-97 FAAQS FOR 1989
FQ-AN90  OUT        153,161 11-09-97 FAAQS FOR 1990
FQ-AN91  OUT        153,161 11-09-97 FAAQS FOR 1991
```

BUILDING INPUT PROFILE PROGRAM (BPIP) FILES ARE PROVIDED IN BPIP-DW.EXE. BUILDING DOWNWASH CALCULATIONS ARE USED IN ALL MODELING. THE FOLLOWING BPIP FILES ARE PROVIDED;

```
FRM      INP         2,812 09-06-97  INPUT FOR SO2  SOURCES
FRM      OUT         5,836 09-06-97  OUTPUT FOR SO2 SOURCES
FRM      SUM        93,651 09-06-97  SUMMARY FOR SO2 SOURCES
```

IF THERE ARE ANY QUESTIONS OR IF I MAY PROVIDE ADDITIONAL FILES, OR CLARIFICATION PLEASE CALL ME.

NOVEMBER 12, 1997
MARK KOLETZKE, P.E.
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# APPENDIX C - TECHNICAL PAPERS

# Comparison of Sulfuric Acid Plant Catalysts

by

Leonard J. Friedman

Acid Engineering & Consulting, Inc.
Lakeland, Florida

# Comparison of Sulfuric Acid Plant Catalysts

By

Leonard J. Friedman
Acid Engineering & Consulting, Inc.
Lakeland, Florida

## Introduction

The contact process for the production of sulfuric acid is based on the oxidation of sulfur dioxide to sulfur trioxide in the presence of a vanadium catalyst. From its beginnings in 1831 when Phillips of Bristol, England patented the oxidation of SO2 to SO3 over a platinum catalyst, to the modern plants of today using high activity, low pressure drop, ribbed rings of vanadium catalyst, the contact process and the catalyst it is based on have undergone significant (but subtle) changes, with the vast majority of developments in the last thirty years.

This paper will review the basic principals of the catalytic sulfuric acid process, and using a summary of operating data compare the three catalysts normally used in North America in the areas of conversion efficiency, activity, ignition temperature, loss in activity over time and screening losses. The paper will also review the advantages and problems with extensive plant converter testing using gas chromatography, Reich or other test methods.

## Background

Before 1900, essentially all sulfuric acid was produced by the "Chamber" process, where nitrogen oxides were used to catalyze the oxidation of sulfur dioxide to sulfur trioxide. Plant size was small, unusually less than 50 STPD, and product acid strength limited to 65% to 75% sulfuric acid. The development of the chemical (dye) industry and the need for gun powder in the late 1800's necessitated a process to produce high strength sulfuric acid and Oleum. Early work (1870's - 1910) based on platinum as a solid catalyst, usually as platinum impregnated asbestos gauze, was the first technical and economic application of the "Contact" process. The high cost of platinum and its susceptibility to poisoning by many materials (notably arsenic present in the roaster gas streams of the day), led to the development of vanadium pentoxide based catalysts using alkali metal prompters on a porous silica carrier in the early 1900's (BASF patent of 1913). This is essentially the vanadium based catalyst used today. The following table shows the transition from the Chamber to Contact process:

THIS DISK CONTAINS SULFUR DIOXIDE (SO2) AND NITROGEN OXIDES (NOX) MODELING FILES FOR THE FARMLAND HYDRO, L.P. FACILITY IN GREEN BAY, FLORIDA. THE FOLLOWING ARE OUTPUT FILES ARE IN SELF EXTRACTING ARCHIVE FORMAT.

THE FOLLOWING FILES CONTAIN ISCST3 MODELING OF:
      SIGNIFICANT IMPACT ANALYSIS (SIA) FOR FAAQS, PSD CLASS 2 AREAS
      SIA FOR PSD CLASS I AREA CHASSAHOWITZKA NWR, AND
      ANALYSIS FOR FAAQS AND PSD CLASS 2 AREAS
      BUILDING DOWNWASH PROFILE INPUT PROGRAM (BPIP) FILES.

SO2 ASI ANALYSIS OF CHASSAHOWITZKA NWR PSD CLASS I AREA:

```
F1ASI    EXE         49,975 11-11-97
```

SO2 ASI ANALYSIS OF CLASS 2 AREA:

```
F2ASI    EXE        166,006 11-11-97
```

NOX ASI ANALYSIS OF CLASS 1 AND CLASS 2 AREAS:

```
FNX      EXE        107,622 11-11-97
```

ANALYSIS OF PSD CLASS 2 AND FAAQS AREA:

```
C2-INV   EXE        283,756 11-12-97  PSD CLASS 2 AREA
FQ-INV   EXE        295,046 11-11-97  FAAQS AREA
```

AND:

```
BPIP-DW  EXE         20,828 11-11-97   BUILDING DOWNWASH CALCULATIONS
```

TO UNARCHIVE THESE FILES COPY THEM TO A HARD DISK DRIVE AND TYPE THE FILE NAME. FOR EXAMPLE TO UNARCHIVE THE SO2 ASI CLASS 2 ISCST3 OUTPUT FILES, TYPE "ASI-C2" AND PRESS ENTER. THE FILES WILL AUTOMATICALLY UNARCHIVE TO THE HARD DISK DRIVE. THESE ARCHIVED FILES CONTAIN THE MODELING AND ANALYSIS FILES IN ASCII FORMAT DESCRIBED AS FOLLOWS:

CLASS 1 MODELING OF SIGNIFICANT IMPACT ANALYSIS (SIA) FOR CHASSAHOWITZKA NWR PSD CLASS 1 AREAS ARE PROVIDED IN THE FOLLOWING FILES:

```
F1ASI87  OUT         50,072 11-08-97 SO2 CLASS 1 SIA FOR 1987
F1ASI88  OUT         50,087 11-08-97 SO2 CLASS 1 SIA FOR 1988
F1ASI89  OUT         49,997 11-08-97 SO2 CLASS 1 SIA FOR 1989
F1ASI90  OUT         49,997 11-08-97 SO2 CLASS 1 SIA FOR 1990
F1ASI91  OUT         50,087 11-08-97 SO2 CLASS 1 SIA FOR 1991

C1NX87   OUT         33,380 11-09-97 NOX CLASS 1 SIA FOR 1987
C1NX88   OUT         33,395 11-09-97 NOX CLASS 1 SIA FOR 1988
C1NX89   OUT         33,305 11-09-97 NOX CLASS 1 SIA FOR 1989
C1NX90   OUT         33,305 11-09-97 NOX CLASS 1 SIA FOR 1990
C1NX91   OUT         33,395 11-09-97 NOX CLASS 1 SIA FOR 1991
```

POLAR RECEPTORS ARE CENTERED AT UTMS X=410,330 METERS EAST Y=3074,655 METERS NORTH ON SULFURIC ACID PLANT NUMBER 5

Transition to the Contact Process

| | 1910 | 1930 | 1950 | 1960 | 1980 |
|---|---|---|---|---|---|
| Contact Process % | 20 | 27 | 75 | 85 | 100 |
| Chamber Process % | 80 | 73 | 25 | 15 | 0 |

## Vanadium Catalyst

Vanadium catalyst usually contains 6% - 9% vanadium pentoxide with alkali metal promoters. The promoters are potassium sulfate with an atomic ratio of potassium to vanadium of 2 - 4 and a small amount of sodium sulfate to adjust (lower) the eutectic melt temperature of the mixture. The active components are supported on a highly porous silica base (diatomaceous earth).

In 1948 Topsoe & Nielsen demonstrated catalyst at operating temperatures exists as a melt within the pores of the silica support. The melt consists of vanadium sulfur complexes dissolved in pyrosulfates. In other words, the oxidation of sulfur dioxide to sulfur trioxide is a homogeneous reaction in the liquid film covering the surfaces of the support and not the heterogeneous reaction it would appear to be. The activity of the catalyst is from active species of vanadium pentoxide (V2O5), with the mechanism involving changes in the valence of vanadium.

The reaction rate is the result of many factors, including; the solubility of SO2, SO3 and oxygen in the melt, mass transfer limitations, the concentration of the active catalyst components and their solubility's in the melt, the porosity and pore size distribution of the silica support, as well as other less obvious factors (manufacturing process, etc.). The effect and interaction of each variable is not completely defined, so changes leading to improvements are more by trial and error than science. The difference between conversion predicted by rate equations and conversion actually obtained is accounted for by adding a so called "catalyst effectiveness factor" or fudge factor to the rate equation. The reaction rate can be described by the following relationship:

$$r = k\,[p(SO2)^{l}\,p(O2)^{m}\,p(SO3)^{-n}]\;K\,act\;\;K\,eff$$

r = reaction rate - g mole SO2/g catalyst, sec
k = rate constant - function on catalyst properties
$p()^{x}$ = partial pressure of components
K act = adjustment factor for catalyst activity
K eff = adjustment factor for system unknowns

The acknowledgment of the reaction taking place in the liquid melt leads to an understanding of catalyst ignition temperature as the temperature at which the melt first forms. The decrease in activity at low temperature is explained by the precipitation of some of the vanadium compounds reducing the concentration of the vanadium in the melt. The loss in catalyst activity at high temperature is attributed to the melt exceeding the capacity of the catalyst pores, with the liquid melt forming large inactive globules. The "old wives tale" of catalyst having a memory - once operated at high temperature, it must always be operated at high temperature - is explained by the loss in activity from melt components flowing out of the catalyst.

Sulfur dioxide to sulfur trioxide equilibrium is determined by the following equation:

$$Kp = \frac{p(SO3)}{p(SO2)\,p(O2)^{.5}}$$

A typical equilibrium curve showing operating lines for a four bed single or double absorption system is shown in Figure 1. The figure shows the change in the equilibrium curve resulting from the removal of SO3 in the interstage absorber (upper equilibrium line), and the reason the double absorption process increases conversion of SO2 to SO3 from 98.5% to 99.7%.

A review of the equilibrium equation indicates increasing pressure will increase equilibrium conversion. Figure 2 shows the effect of increasing pressure. In the example shown, increasing pressure from 1.3 bar (3.8 psi) to 10 bar (127 psi) will increase equilibrium conversion in a first catalyst stage from 63% to 75%. In the late 1960's, I did extensive work developing and evaluating a pressure process for sulfuric acid production - looking at single absorption at pressure versus double absorption. The conclusion of that work indicated double absorption could not be avoided at reasonable pressures to meet 99.7% conversion, eliminating the pressure process from economic consideration. In the mid 1970's, Krebs built a plant at PCUK in France based on the pressure process. The plant was a double absorption unit operating at 70 psi. Analysis indicated capital cost savings compared to the conventional double absorption route to be small (< 10%), with the plant experiencing extremely high corrosion and low energy efficiency.

Another route to increased conversion is to increase the oxygen concentration in the converter gas by using enriched air or pure oxygen. Analysis indicates improved conversion efficiency, but not enough to eliminate double absorption. A process using pure oxygen was evaluated in the late 1960's as an alternate to double absorption. The system was not economically sound due to the continuing cost of oxygen. No plants based on pure oxygen have been built. A number of spent acid regeneration plants use enriched air to overcome capacity limitations in the gas cleaning sections of the plant, and oxygen use to enrich the gas in the contact section is being used in a few places. The cost is a balance of the need for additional capacity versus the continuing cost of oxygen.

## Catalyst Shape and Composition

In the 1960's and early 1970's catalyst was in the form of pellets, usually 1/4" and 5/32" diameter by 0.3" to 0.6" long (6 mm & 4 mm diameter by 8 mm - 15 mm long). The catalyst normally contained 6% to 8% V2O5, and was sold in North America by many vendors:

Stauffer
Cyanamid
BASF
Catalyst & Chemicals
Allied
Monsanto
Topsoe
Imperial Smelting

In the mid to late 1970's lower pressure drop through the catalyst bed was achieved by the use of a larger diameter pellet, 8 mm in diameter or 5/16" rather than 6 mm diameter.. This size pellet was heavily promoted by Monsanto as 516 catalyst. At about the same time Topsoe introduced the ring shape catalyst to the North American market. Topsoe claimed significantly lower pressure drop and greater dust holding capacity. Initial installations used ring catalyst to top off the pellets in the first catalyst bed. Data showed lower initial pressure drop, and lower rate of pressure drop build-up (greater dust holding capacity). Complete first beds of ring catalyst showed acceptable activity and conversion while maintaining the low pressure drop and pressure drop build-up. Ring catalyst allowed an increase in operating time between turnarounds from 12 months to 18 - 24 months. It took a number of years for ring catalyst to be accepted and used in the entire converter. Now the three principal catalyst suppliers to North America (Topsoe, BASF, Monsanto) all offer ring shaped catalyst - with pellet and 516 catalyst essentially obsolete. The most recent change in catalyst shape has been the ribbed ring, offered by Topsoe as "Daisy" and BASF as "Star" rings, providing about 20% lower pressure drop than the normal 10 mm rings.

In addition to catalyst shape changes, in the last twenty years catalyst composition changes have provided improved performance permitting 99.7% conversion in a double absorption plant with increasing $SO_2$ gas strengths (9.5% - 10% in the 1970's to 11.5% - 11.75% today). A catalyst with 6% - 8% $V_2O_5$ is used in the first and second beds of the converter to attain resistance to activity loss at high temperature and maintain high temperature strength (reduced screening loss). The lower vanadium content - lower activity is offset by the higher average operating temperature of the upper beds, resulting in a high reaction rate and acceptable catalyst loading and approach to equilibrium. A catalyst with 7% to 9% $V_2O_5$ is used in the third and fourth catalyst beds to provide higher activity, lower ignition temperature and high reaction rate at the lower average operating temperature. The higher vanadium, lower bed catalyst has 10% to 20% greater activity than the 6% - 8% $V_2O_5$ upper bed catalyst.

The most recent catalyst development (re-invention of a 1948 discovery) is the so called "Cesium Catalyst". Cesium catalyst is really a 6% - 8% $V_2O_5$ catalyst with the formulation adjusted by substituting cesium for a portion of the potassium promoter. The use of cesium doubles the activity of the catalyst in the low temperature region, permitting continuous operation at bed inlet temperatures in the 720 F - 730 F region. The high cost of cesium promoted catalyst (about 2.5 times standard catalyst) limits its use to special applications.

The various catalyst shapes are shown in Figures 3 and 4. The following tables compare catalyst size and composition.

Shape

| | Pellet | Pellet | Ring | Ribbed Ring |
|---|---|---|---|---|
| Diameter mm | 6 | 8 | 10 | 12 |
| Length mm | 8 | 12 - 15 | 9 - 14 | 10 |
| Pressure Drop "H2O | 1.0 | 0.9 - 0.95 | 0.5 | 0.4 |

**Composition**

| | **V2O5 Content** | **Comments** |
|---|---|---|
| Upper Bed Catalyst | 6% to 8% | High Temperature Operation<br>Hardness & Temperature Resistance |
| Lower Bed Catalyst | 7% to 9% | Low Temperature Operation<br>High Activity - Softer Catalyst |
| Cesium Catalyst | 6% to 8% | High Activity at Low Temperature (720 F)<br>Can be Sticky at High Temperature |

## Catalyst Operation Analysis

Over the last ten years Acid Engineering & Consulting, Inc. has been involved with the operation of over one-hundred sulfuric acid plants around the world. In many cases data collected included information on various catalysts, including conversion efficiency, ignition temperature, loss in activity, screening loss, pressure drop and pressure drop build-up. A statistical analysis was performed on the data and the resulting observations are presented below. The analysis was made for the three main North America catalyst suppliers, Topsoe, BASF, and Monsanto, identified and supplier "A", "B", and "C". Note: If the analysis is on target, acid plant operators should be able to connect the supplier with their performance data.

**Conversion Efficiency** - The data suggests little significant difference in overall conversion efficiency between the three suppliers. Conversion efficiency analysis was complicated by many operating plants with more than one manufacturers catalyst in the converter, and many with two or three suppliers catalyst in a particular bed. Although there was some statistical difference, one could not use the conversion efficiency difference to tell which catalyst was in a particular converter.

**Loss in Activity** - The reduction in activity of a particular catalyst over time was determined by a review of catalyst suppliers activity test results and operating data showing changes in bed inlet and exit temperatures and conversions over time. The results were based on plants operating with high converter inlet SO2 concentrations resulting in bed 1 exit temperatures of 1140 F to 1160 F. The table below summarizes the activity loss over an 18 month to 24 month period for ring catalyst.

Loss in Activity (18 - 24 Months)

| | Supplier "A" | Supplier "B" | Supplier "C" |
|---|---|---|---|
| Bed 1 | 20% - 35% | 9% - 12% | 9% - 13% |
| Bed 2 | 8% - 12% | 5% - 8% | 5% - 8% |
| Bed 3 | < 5% | < 5% | < 5% |
| Bed 4 | < 5% | < 5% | < 5% |

The data indicates supplier "A" upper bed catalyst looses activity at a significantly higher rate than the others, about 2 to 3 times the activity loss between turnarounds. This would suggest a formulation problem resulting in the melt solution leaving the pores of the catalyst when operating at high temperature. The data is consistent over many years, eliminating the possibility of a bad batch or run of catalyst causing the results. In fact, for many years this supplier recommended limiting first bed exit temperature to less than 1125 F.

**Screening Loss** - Data for screening loss was based on ring catalyst, vacuum screened per suppliers instructions, usually by the same two commercial catalyst screening companies. The wide variation in the data for a particular supplier is attributed to operating time at high temperature, screening rate and the amount of broken pieces returned to the converter.

Screening Loss (% of Bed)

| | Supplier "A" | Supplier "B" | Supplier "C" |
|---|---|---|---|
| Bed 1 | 25% - 40% | 10% - 15% | 11% - 16% |
| Bed 2 | 20% - 30% | 9% - 15% | 10% - 15% |
| Bed 3 | 15% - 20% | 8% - 14% | 8% - 14% |
| Bed 4 | 12% - 17% | 8% - 12% | 8% - 12% |

The data is consistent, indicating a problem with supplier "A" catalyst, especially in the high temperature area, suggesting a formulation problem (high screening loss and loss in activity). The data is from many plants over a number of years with more data points for beds 1 and 2, and limited data for beds 3 and 4.

**Pressure Drop Build-up** - Data for sulfur burning plants was analyzed to determine differences in the rate of pressure drop build-up over an 18 month operating period between turnarounds. The analysis was complicated by unknown variations in the ash content of the sulfur and the amount of broken pieces returned to the converter after screening. After some adjustment for bed area, gas velocity, etc., the data indicated no significant difference in the rate of pressure drop build-up between the three catalysts.

## Comparison Summary

Overall the catalyst comparison indicates supplier "A" has a problem with its upper bed ring catalyst when operated at high gas strength - high temperature (exit temperatures above 1130 F), resulting in excessive loss of activity over time and screening losses two to three times the others. In fact, the high screening loss and subsequent make-up with fresh catalyst obscures the activity loss problem, so overall plant conversion efficiency is maintained. Based on the analysis, supplier "B" and "C" catalyst are close in all aspects studied, with supplier "A" upper bed catalyst of lower overall performance.

## Cesium Promoted Catalyst

Cesium promoted catalyst is offered by the three North American suppliers. The high cost, about 2.5 - 3 times conventional catalyst, has limited use to special situations. Cesium catalyst is rarely used in sulfur burning plants, but has found some advantages in spent acid regeneration and metallurgical plants. The catalyst has been used as a top layer of the first catalyst bed to provide operation at 720 F - 730 F, reducing gas heat exchanger requirements, while allowing restart of the plant when the catalyst bed is at 600 F.

Early installations of cesium promoted catalyst experienced severe pressure drop build-up. Pressure drop in some plants increased 30" to 60" H2O in a few months. Investigation indicated the plants experiencing the problem were operating at first bed inlet temperature of 780 F to 820 F, while plants without problems operated at 720 F to 740 F. The operating data indicates the cesium catalyst becomes very sticky at elevated temperatures. Recently, Topsoe has reformulated their cesium catalyst so it can be operated at low or high temperature without the pressure drop build-up problem. The other suppliers are expected to produce an adjusted formulation in the near future.

## Converter Testing

Traditionally catalyst performance evaluations are made by reviewing bed inlet temperatures and temperature rise, inlet SO2 gas strength and overall conversion efficiency. Changes in these operating variables, although small from day to day, are good indicators of catalyst bed performance over time. Recently, one catalyst supplier has offered portable gas chromatograph testing of converter systems. The tests provide the composition of gas into and out of each catalyst bed. Comparing actual bed conversion with calculated conversion and equilibrium would be a superior way of determining catalyst activity - performance.

Acid Engineering & Consulting, Inc. has reviewed the results of a number of gas chromatograph tests of converter systems. In most cases, the test data was consistent with evaluations based on traditional methods, and was a useful tool in determining catalyst activity - replacement requirements for an upcoming turnaround. In a number of cases, the test results were obviously incorrect and the interpretation of the results flawed and self-serving. Objectivity comes into question when the one doing the testing is selling catalyst or testing his own catalyst to show how good it is, or how bad a competitors is. In one case, the test data indicated 7% to 8% conversion of SO2 to SO3 in the sulfur furnace - well above equilibrium. This was coupled with extremely low conversion in the first catalyst bed, indicating low catalyst activity and the need for additional replacement catalyst. In another case, a spent acid regeneration plant was experiencing conversion efficiency problems (very low first bed temperature rise) after a major plant modification. The catalyst in the first bed was changed, but the same problem persisted. Gas chromatograph tests (purchased with the replacement bed of catalyst) were run at various O2/SO2 ratios (0.72 to 0.92) and SO2 gas strengths (9.4% - 10.7%). Note: Most sulfur burning plants operate at O2/SO2 ratios of 0.75 to 0.77 and SO2 gas strengths of 11.5% - 11.75%. The test results are summarized below:

Plant Test Data

| | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| O2/SO2 Ratio | 0.72 | 0.86 | 0.92 |
| Overall Conversion | 90.8% | 94.2% | 95.4% |
| Bed 1 Catalyst Activity | 104% | 83% | 82% |

Note: Catalyst activity dropped 22% between test runs 1 and 3. This was reported as "catalyst activities are in the normal range".

The conclusion presented by the testing company - catalyst supplier was the plant design at 0.75 O2/SO2 ratio and 97% conversion in a single absorption plant was not possible with the catalyst type, volume and O2/SO2 ratio. However, the catalyst supplier - testing company would be happy to study ways to achieve plant conversion and capacity, although they stated "there are no clear cut, low cost ways to do this". Note: Acid Engineering & Consulting, Inc. adjusted plant operating conditions and in four hours the plant was able to meet design capacity at an O2/SO2 ratio of 0.75 with conversion exceeding 98%. In this case, knowledge and experience was able to do what blind or self-serving testing could not do - get the plant operating at or above design without additional catalyst or costly modifications.

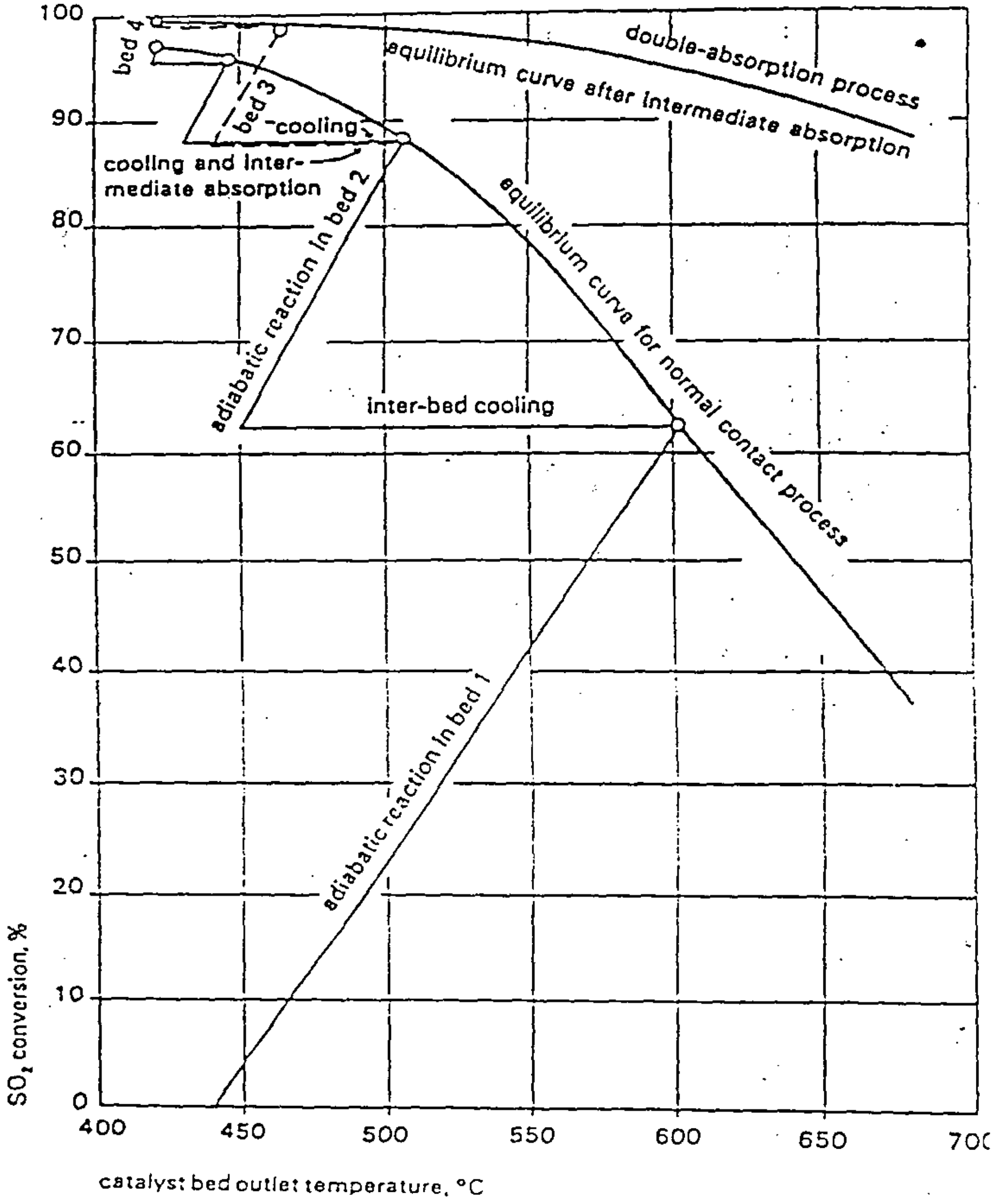
## Conclusion

This work was intended to provide an understanding of sulfuric acid plant catalysts and to present a comparison of the three catalysts used in North America. Data from many plants over a number of years was reviewed, adjusted and evaluated to obtain comparative catalyst performance. The data indicated suppliers "B" and "C" catalyst to be about equal in each of the areas examined, with supplier "A" catalyst of lower performance (activity loss over time and high screening loss).

If some have a better understanding of sulfuric acid plant converter operation and catalysts, and supplier "A" is encouraged to improve their catalyst, the time and effort spent on this work will have been justified.

## Figure 1

## Converter Equilibrium



## Figure 2

## Pressure Effect on Equilibrium

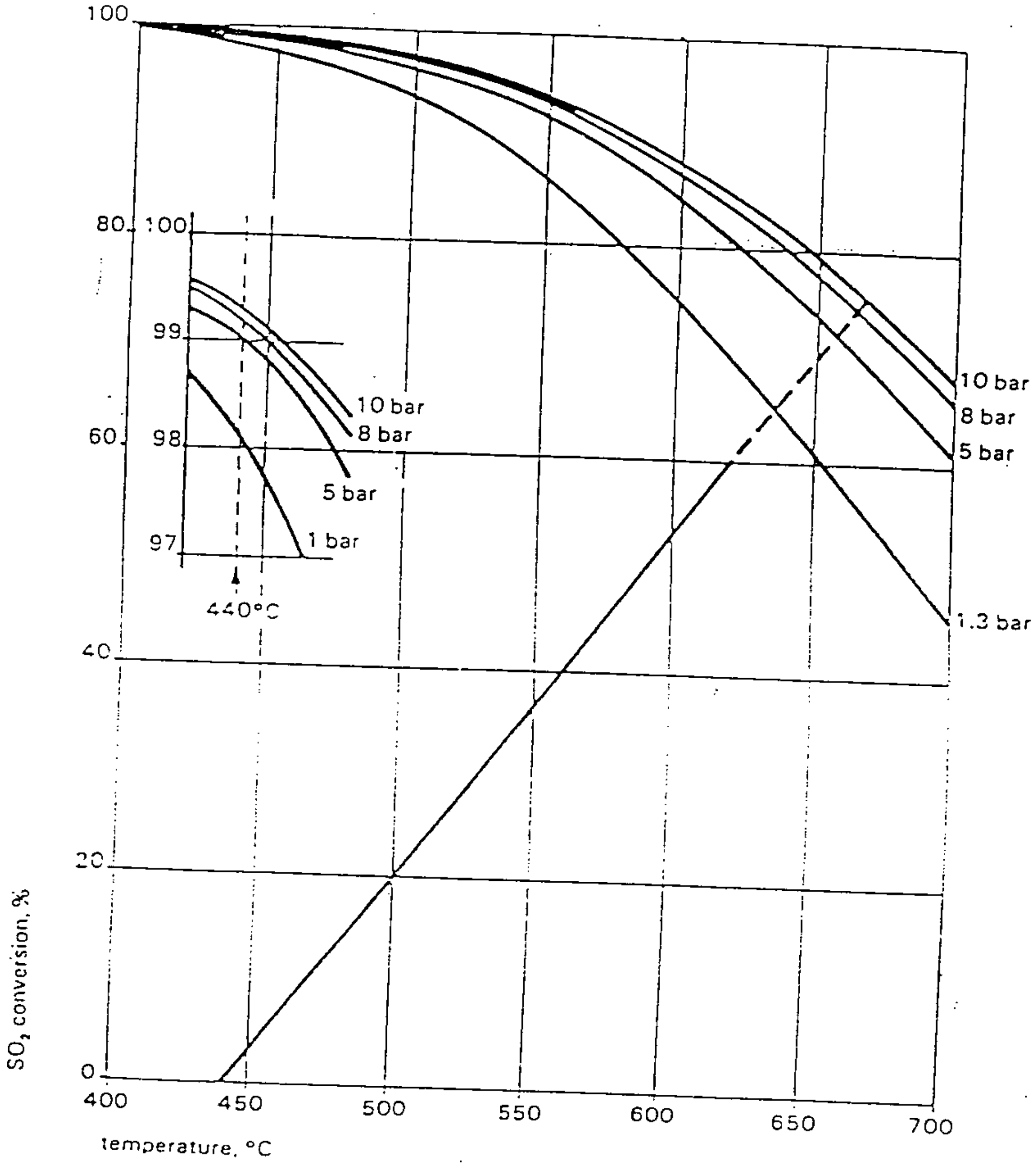


Figure 3

Catalyst Shapes & Sizes

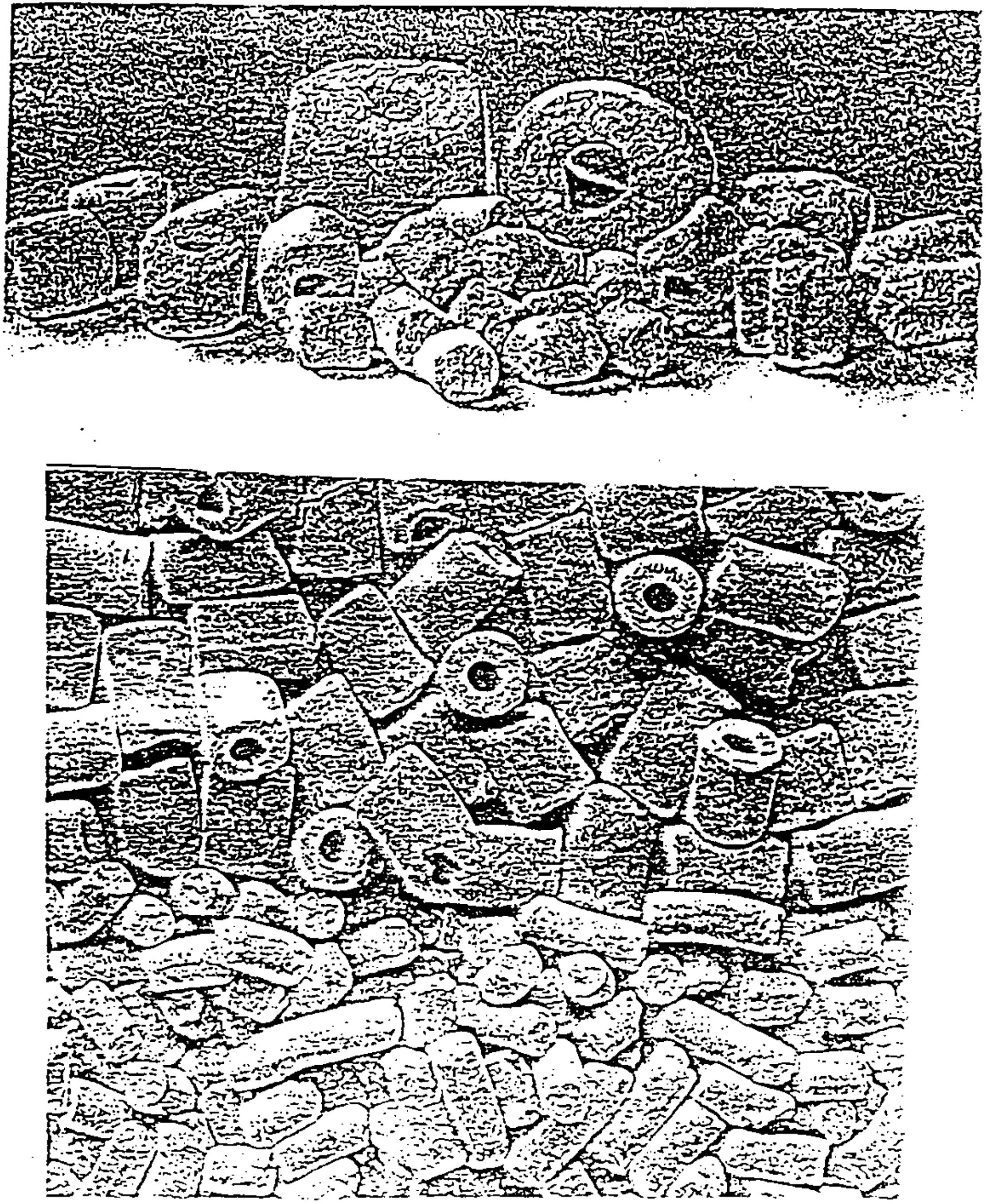
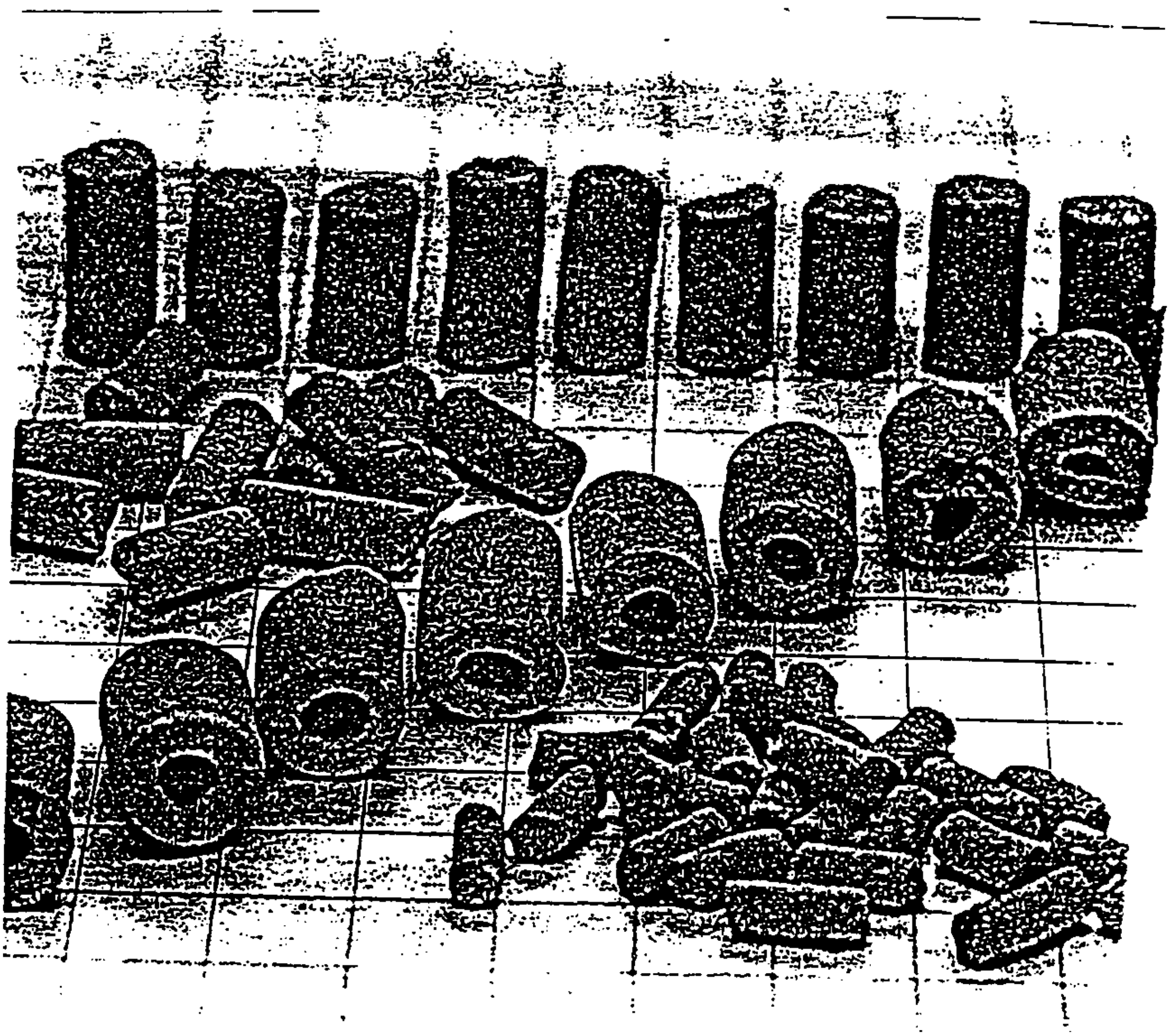


Figure 4

Catalyst Shapes & Sizes



# $SO_2$ EMISSIONS REDUCTIONS IN SULFURIC ACID PLANTS

by

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St. Louis, MO 63178-4547

## ABSTRACT

The current trend in the sulfuric acid industry is to reduce the emission of sulfur dioxide ($SO_2$) to the atmosphere while maintaining or increasing acid production. Utilizing Monsanto cesium-modified catalysts, a number of sulfuric acid producers have effectively reduced their $SO_2$ emissions in both single absorption and double absorption cases. This paper will present the realized possibilities for the reduction in emissions using Monsanto Cesium Catalyst and the optimization of plant operations utilizing the Monsanto Portable Gas Analysis System (PeGASyS). The portable gas analyzer has served as an invaluable tool to optimize plant operations and demonstrate the advantages of the cesium catalyst in reducing emissions. The utilization of both the Monsanto Cesium Catalyst and the Portable Gas Analysis System in many plant applications will set the new standard for sulfuric converter performance.

## INTRODUCTION

The trends in sulfuric acid plant design have changed dramatically over the last several decades. The demand for operations with minimal $SO_2$ emissions has required the development of the double absorption contact process for $SO_2$ oxidation which is capable of generating greater than 99.7 % conversion of the sulfur dioxide fed to the plant. Pollution reduction commitments by many major corporations as well as government regulatory requirements are responsible for the continuing trend to develop new and cost effective technologies to further reduce the $SO_2$ emission levels from sulfuric acid plants.

There are still a large number of sulfuric acid plants in the world which operate in the single absorption mode with $SO_2$ conversion levels near 98 %. Although these plants are operating within authorized conversion limits, many companies are striving to reduce the $SO_2$ emissions as much as is technically and economically feasible. Until recently, the technologies to accomplish this goal were limited. Plant operations were "optimized" using crude chemical techniques and often inaccurate temperature measurements, resulting in less than ideal performance in the plants. Over the years, conventional sulfuric acid catalyst improvements have enhanced the plant performance significantly, but further advances were limited by thermodynamic and kinetic barriers.

This paper presents the results of implementing two new technologies in the sulfuric acid industry. Monsanto Enviro-Chem has developed a low temperature cesium-promoted catalyst which eases some of the aforementioned limitations and improves the overall conversion in both single and double absorption plants, resulting in significantly less $SO_2$ emissions to the stack. A discussion of some case histories of cesium (Cs) catalyst installations and the potential applications of the technology are presented. The second technology developed by Monsanto Enviro-Chem is the Portable Gas Analysis System (PeGASyS) which is used to measure and optimize sulfuric acid plant converter/heat exchanger performance. Using this state-of-the-art instrumentation, plant problems are quickly and easily identified and resolved. Catalyst performance can be quickly determined and optimum operation conditions can be determined based on the catalyst quality and desired conversion results. Examples of the applications of the PeGASyS technology are presented in this paper. When utilized together, the cesium catalyst technology and the PeGASyS system can generate the optimum performance from any sulfuric acid plant and lead to lower $SO_2$ emissions.

## CATALYST DEVELOPMENT AND APPLICATIONS

In the contact sulfuric acid process, there is often an interest in lowering the inlet temperatures to the various adiabatic catalyst beds in order to provide more favorable equilibrium conditions. The addition of cesium (Cs) to the conventional alkali-vanadium sulfuric acid catalyst has long been known to enhance the low temperature properties of the catalyst (1). The cesium salt promoter stabilizes the vanadium +5 oxidation state at temperatures below 420°C (790°F) and keeps the vanadium species solubilized in the melt and available for reaction. In the conventional K-V catalyst, vanadium compounds precipitate out of the molten salt at lower temperatures, causing loss of catalyst activity (2,3). The stabilizing effects of the cesium appear at relatively low Cs concentrations. A qualitative display of this effect is shown in Figure 1. At high temperatures ( > 430°C/806°F), the activity of the conventional catalyst and the cesium-promoted catalysts are fairly similar. However, near 410°C (770°F), the reaction rate of the conventional catalyst drops off dramatically due to the precipitation of vanadium compounds (curve breakpoint # 1). As the temperature is further lowered (moving to the right on the graph), the cesium-promoted catalyst maintains a higher reaction rate until the temperature drops well below 400°C (750°F) when its activity finally begins to decline due to vanadium salt precipitation (curve breakpoint # 2). Although the reaction rate of the cesium-promoted catalyst drops off at relatively low temperatures, it is still sufficiently high to generate good conversion at acceptable catalyst loadings. Over the last several years, Monsanto Enviro-Chem has utilized its strong base in cesium catalyst studies (4-7) to develop an optimized and affordable cesium promoted catalyst (Cs-120 and Cs-110). These products contain the optimum levels of alkali metal salts (potassium and cesium) to provide excellent ***low*** and ***high*** temperature performance in the converter. Following extensive lab development and field testing, the products were commercialized in 1989 and have been installed in over 20 sulfuric acid plants worldwide.

There are many applications for the cesium-promoted catalyst in sulfuric acid plants. The smaller 9.5 mm (3/8 in.) Cs-110 rings can be loaded into the lower beds and allow for lower bed inlet temperatures and higher overall conversion. Figure 2 shows a graphical display of the advantage of using the Cs-110 catalyst in the 4th pass of a single absorption plant. The lower inlet temperature with Cs-110 catalyst opens a larger thermodynamic "window" which permits greater overall conversion. This higher level of conversion is not possible with the conventional catalyst at the lower inlet temperature as the catalyst loadings would have to be extremely high, creating excessive pressure drop. A similar scenario can be devised for the lower beds of double absorption plants, resulting in lower stack emissions.

Another cesium-promoted catalyst application involves installing a 33-50 % cap of Cs-120 rings in the first pass of a sulfuric acid plant. This catalyst configuration will dramatically lower the required inlet temperature for good conversion in this bed. Figure 3 shows that the conversion versus bed depth profile for a capped Cs-120 bed with an inlet temperature of 380°C (715°F). A full bed of conventional catalyst will produce very little conversion with this low inlet temperature at any reasonable catalyst loading. A full first bed of Cs-120 rings is not required in this application as the outlet temperature from the cesium catalyst portion of the bed is high enough to ignite the remaining conventional catalyst layer. The lower first pass inlet temperature is advantageous for plants with very high inlet $SO_2$ strength. In this case, the lower inlet temperature will lead to a lower outlet temperature, therefore extending the life of the first pass exit posts and grids. Furthermore, the overall conversion in the first pass will also be increased over that possible with conventional catalyst. The use of the Cs-120 rings in Pass 1 will also reduce or eliminate the need for startup gas pre-heating in spent acid and metallurgical plants following short shutdowns.

The cesium-promoted catalyst can also be utilized in situations where heat exchanger deficiencies (undersized or plugged) limit the inlet temperatures to lower passes. The Cs-110 rings can effectively operate at the reduced temperatures and hence maintain the needed conversion in the lower beds. Also, the Cs-120 first pass caps and the full beds of Cs-110 in the lower passes can greatly reduce the time required to startup the sulfuric acid plant. The cesium catalyst beds will ignite at much lower temperatures than conventional catalyst beds and hence require less pre-heating. Also, due to the high activity at low temperatures, the cesium catalyst beds help to minimize the stack $SO_2$ emissions during plant startup operations. Examples of many of these cesium catalyst applications are presented in subsequent sections.

## Cs-110/Cs-120 CATALYST APPLICATIONS

The applications of the Cs-110 and Cs-120 catalysts in reducing $SO_2$ emissions will be presented as a series of case histories. Although the applications vary from plant to plant, the common threads in each case are lower stack emissions and improved operating versatility. The following are five examples of Monsanto cesium promoted catalyst performance: (Note: STPD = Short Tons acid produced Per Day)

## Case 1: *Single Absorption Spent Acid Plant*

Pre-Cs Data:

(1) Conventional catalyst in Pass 4.
(2) Pass 4 operating at 430°C (806°F) inlet temperature.
(3) Conversion at 98.0 % with 9 % $SO_2$ feed gas.
(4) Stack $SO_2$ emissions were over 25 lbs./STPD.

Post-Cs Information:

(1) Installed full bed of Cs-110 ring in Pass 4.
(2) Pass 4 inlet temperature optimized at 410°C (770°F).
(3) Conversion measured at 98.5 % with 9 % $SO_2$ fed.
(4) Stack $SO_2$ emissions at 19 lbs./STPD (24 % reduction).

## Case 2: *Single Absorption Sulfur Burning Plant*

Pre-Cs Data:

(1) Aging, conventional catalyst in all beds.
(2) Pass 4 operating at 427°C (800°F) inlet temperature.
(3) Conversion at 97.5 % with 8 % $SO_2$ feed gas.
(4) Stack $SO_2$ emissions at 33 lbs./STPD.

Post-Cs Information:

(1) Screened all beds; full fourth pass of Cs-110.
(2) Pass 4 operating at 395-405°C (743-760°F).
(3) Conversion measured at 98.4 % with 8 % $SO_2$ fed.
(4) Stack $SO_2$ emissions at 21 lbs./STPD (36 % reduction).

## Case 3: *Single Absorption Sulfur Burning Plant*

Pre-Cs Data:

(1) Used conventional catalyst in all five passes.
(2) Pass 5 operating near 430°C (806°F) inlet temp.
(3) Conversion at 98 % (air dilution plant).
(4) Stack $SO_2$ emissions at 26 lbs./STPD.

Post-Cs Information:

(1) Fresh catalyst in all beds; Cs-110 in Passes 4 and 5.
(2) Passes 4 and 5 operating at 410°C (770°F) inlet temp.
(3) Conversion reaches *99.1* % with 8 % $SO_2$ fed.
(4) Stack $SO_2$ emissions at 12 lbs./STPD (*50 % reduction)*.

### Case 4: *Double Absorption Spent Acid Plant*

Pre-Cs Data:

(1) Standard catalyst in all beds; 12 % $SO_2$ gas strength.
(2) Pass 1 at 405°C (760°F); Pass 3 at 400°C (750°F).
(3) Heat exchanger pluggage limited Pass 3 inlet temp.
(4) Pre-heater required, especially after short shutdowns.
(5) Rate reduced to stay with $SO_2$ stack requirements.

Post-Cs Information:

(1) Cs-120 cap in Pass 1; full 3rd bed of Cs-110 rings.
(2) Pass 1 inlet at 360°C (680°F); outlet at 600°C (1110°F).
(3) Pass 3 operating well at 400°C (750°F).
(4) Need for pre-heater virtually eliminated.
(5) Rate dramatically increased with low $SO_2$ emissions.

### Case 5: *Double Absorption Spent Acid Plant*

Pre-Cs Data:

(1) Used conventional catalyst in all beds; 7 % $SO_2$ fed.
(2) Pass 3 inlet at 410°C (770°F); heat exchange limits.
(3) Pass 4 inlet at 390°C (735°F) due to low 3rd pass temp.
(4) Emissions high (especially at startup);rate limited.

Post-Cs Information:

(1) Installed full bed of Cs-110 rings in Pass 3.
(2) Pass 3 operating very well at 410°C (770°F) inlet.
(3) Pass 4 operating very well at 425°C (800°F) inlet.
(4) Very low startup emissions; production rate increased;
no gas pre-heating required after short shutdown.

Several other applications for the cesium promoted catalyst are under consideration. Scenarios have been developed for increasing the acid production rates for double absorption plants and yet maintaining the same permitted hourly $SO_2$ emissions. Using Cs-110 rings in the bottom pass of double absorption plants, it is possible to reduce the lbs. $SO_2$ per ton of acid and hence allowing for greater production at the same $SO_2$ ppm level in the stack.

In order to take advantage of the benefits of the cesium-promoted Cs-120 and Cs-110 catalysts, there are some considerations that need to be evaluated prior to installation. Firstly, the heat exchange capacity in the plant must be evaluated in order to insure the feasibility of reaching the lower inlet temperatures required for the cesium catalyst beds. Secondly, there may be a greater tendency for pressure drop buildup in first passes equipped with cesium catalyst caps if the incoming gas stream is very dust-laden or contains acid mist. The highly active cesium-promoted catalyst has a more mobile molten salt than that of the conventional catalyst, which has a slightly greater tendency for accumulating incoming converter dust. The larger Cs-120 rings (12.5 mm, 1/2 in.) were developed to minimize the potential pressure drop buildup and yet maintain the required performance. The low temperature benefits of the Cs-120 rings in the first pass must be weighed against the slight possibility of higher pressure drop. Cs-110 applications in all other passes have been in operation for over two years without any indication of pressure drop buildup and/or loss of activity.

Overall, the use of the cesium-promoted catalyst in sulfuric acid converters has contributed to the significant reduction in $SO_2$ emissions and improved operability of the acid plants.

## PORTABLE GAS ANALYSIS SYSTEM (*PeGASyS*)

The Monsanto Enviro-Chem Portable Gas Analysis System was developed several years ago to provide sulfuric acid producers with the means to fully characterize their plant operations. The PeGASyS system consists of a highly specialized gas sampling system and the state-of-the-art gas analyzer. Figure 4 shows a photograph of a portion of the gas analyzer system, including the specially design gas syringe. The analyzer is generally set up near a control room or laboratory and occupies a desk-sized space. A gas sample is taken from a slip stream of gas at the converter, heat exchanger, or absorbing tower pressure tap (or any available sampling port). The gas sample is then injected into the analyzer ( state-of-the-art gas chromatograph ) which accurately determines the $SO_2$ and $O_2$ levels. The PeGASyS method for characterizing the sulfuric acid plant operations is much more reliable and accurate than the standard wet chemical Reich test method. A typical sulfur burning plant can be completely analyzed in only a few hours with the PeGASyS system.

The results obtained with the PeGASyS system consist of an analysis report of the $SO_2$ and $O_2$ levels in each sample and a conversion calculation for each specific converter sample based on the inlet gas to the first bed. Figure 5 shows a typical Converter Performance Summary for a sulfur burning double absorption plant. The custom PeGASyS software also calculates gas flow rates based on the given production rates. Utilizing the PeGASyS data, the converter performance can be effectively simulated using the Monsanto Enviro-Chem proprietary modeling software. This information can then be used to optimize the plant operations, adjusting bed inlet temperatures, upgrading catalyst charges to maximize conversion and minimize $SO_2$ emissions.

Another important application of the PeGASyS system is in gas-gas heat exchanger leak detection. The exchanger must have shell side and tube side gas streams which contain different $SO_2$ levelsin order for the analysis to be effective. Figure 6 shows the typical output for a heat exchanger analysis. Often, leaking heat exchangers contribute to high $SO_2$ emissions by bleeding high $SO_2$ gas directly to the stack or flooding lower pass catalyst beds with $SO_2$-rich gas. Once the leaking exchanger is identified, it can be repaired, leading to a direct reduction in the stack emissions.

The following are case histories of typical applications of the PeGASyS service to reducing stack emissions:

Case 1: *Spent Acid Double Absorption Plant*

Issue: $SO_2$ emissions higher than expected.

Result: PeGASyS analysis indicated that the aging first pass was operating at a reduced efficiency. Replacement of the first pass resulted in significant reduction in stack emissions.

Case 2: *Sulfur Burning Double Absorption Plant*

Issue: $SO_2$ emissions were approaching permitted limit.

Result: PeGASyS analysis indicated a severe leak in the cold heat exchanger. Following exchanger repair, $SO_2$ emissions decreased from 3.9 lbs./STPD to 2.0 lbs./STPD.

Case 3: *Sulfur Burning Single Absorption Plant*

Issue: Emissions extremely high; poor conversion.

Result: PeGASyS analysis determined that Passes 2 and 3 were performing very poorly. It was determined that low bed inlet temperatures were responsible. Raising the temperatures led to a dramatic reduction in $SO_2$ emissions. The results also indicated that a 4th pass Cs-110 application was justified. With a full 4th pass of Cs-110 rings, this plant now has extremely low $SO_2$ emissions.

Case 4: *Spent Acid Double Absorption Plant*

Issue: $SO_2$ emissions approaching allowed limit.

Result: PeGASyS analysis of the cold heat exchanger identified a minute leak which was allowing some first pass feed gas to bypass directly to the final tower. This leak added over 200 ppm $SO_2$ to the stack. Repairs to this exchanger resolved the problem.

As can be seen from these examples, the Portable Gas Analysis System is an extremely effective tool for optimizing sulfuric plant operations and reducing stack $SO_2$ emissions. In a number of cases, the PeGASyS results have led to the installation of Monsanto cesium-promoted catalyst which resulted in the best overall conversion and the lowest level of sulfur dioxide escaping to the atmosphere.

## CONCLUSIONS

The effectiveness of the Monsanto Enviro-Chem cesium-promoted catalysts (Cs-120 and Cs-110 rings) in improving sulfur dioxide conversion and reducing stack emissions has been demonstrated in a number of applications. The cesium catalyst can be applied in a variety of situations which can reduce emissions as well as enhance the versatility of the plant operations. In many situations, the catalyst can be used to reduce the impact of heat exchanger limitations. Cesium catalyst effectiveness in both single absorption and double absorption plants has been demonstrated and novel applications are still under development.

The Monsanto Enviro-Chem Portable Gas Analysis System (PeGASyS) has effectively been used in a variety of plants to optimize converter performance and identify problem areas. The results of the gas analyses are often used to identify the most effective applications of the Monsanto Cesium Catalyst in order to minimize $SO_2$ emissions and maximize converter performance. The use of these products and services allows for not only a positive impact on the environment but also improved performance and profitability for the sulfuric acid producer.

## ACKNOWLEDGMENTS

The authors would like to acknowledge and thank David A. Berkel of Monsanto Enviro-Chem Systems, Inc. for developing the Portable Gas Analysis System and refining the unit into an extremely effective tool for our sulfuric acid customers.

The authors would like to acknowledge the St. Louis R&D Team and the Manufacturing Team in Martinez, CA for their work on the cesium-promoted catalyst development.

## REFERENCES

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(2) Villadsen, J., and Livbjerg, H., *Catal. Rev. Sci. Eng.*, 17, 203 (1978).

(3) Boghosian, S., Fehrmann, R., Bjerrum, N. J., and Papatheodorou, G. N., *J. Catalysis* 119, 121 (1989).

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(5) Doering, F. J. and Berkel, D. A., *J. Catalysis* 103, 126 (1987).

(6) Doering, F. J., Yuen, H. K., Berger, P. A., and Unland, M. L., *J. Catalysis* 104, 186 (1987).

(7) Doering, F. J., Unland, M. L., and Berkel, D. A., *Chem. Eng. Sci.* 43, 221 (1988).

Figure 1

# $SO_2$ OXIDATION RATE VERSUS TEMPERATURE

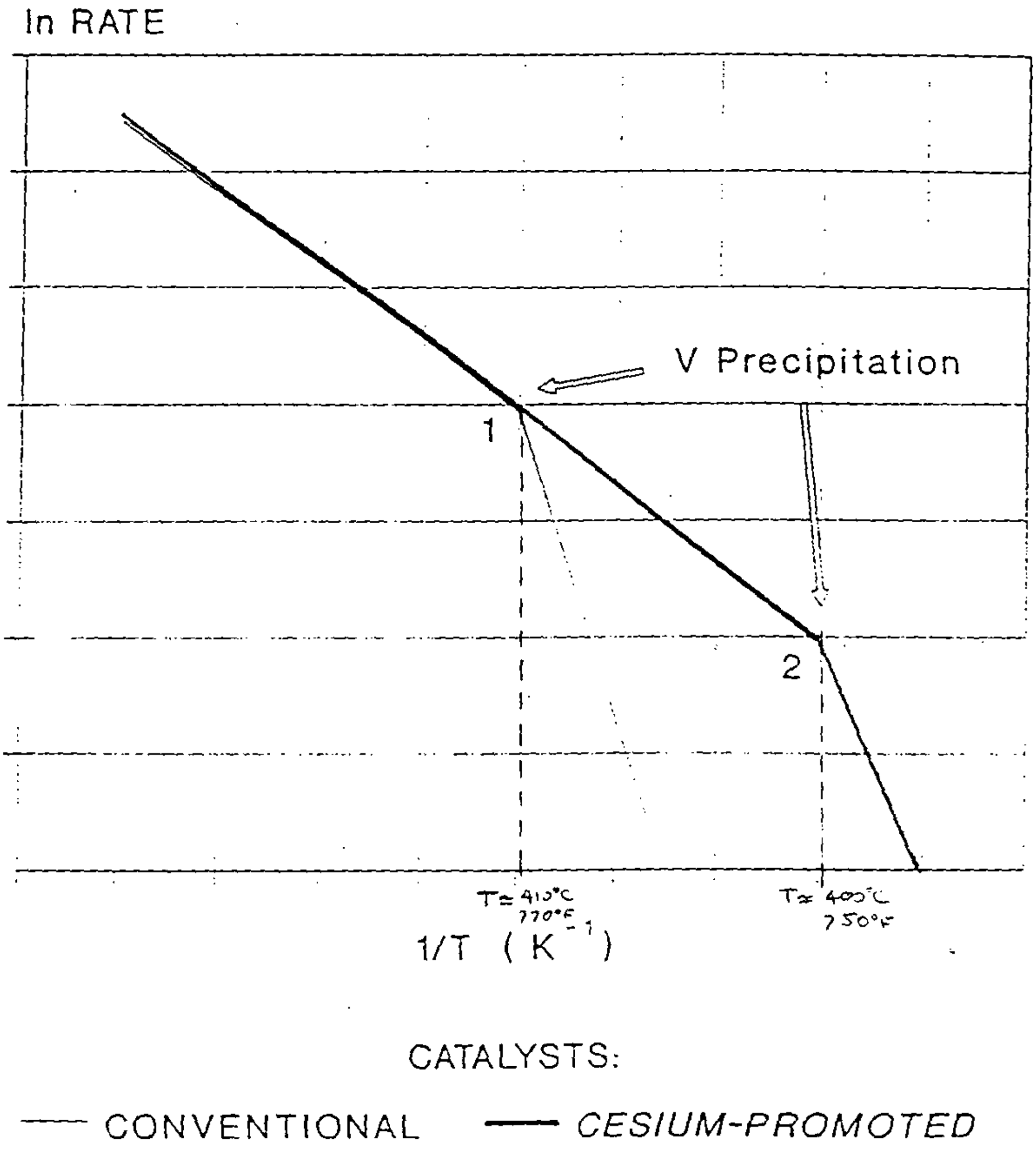
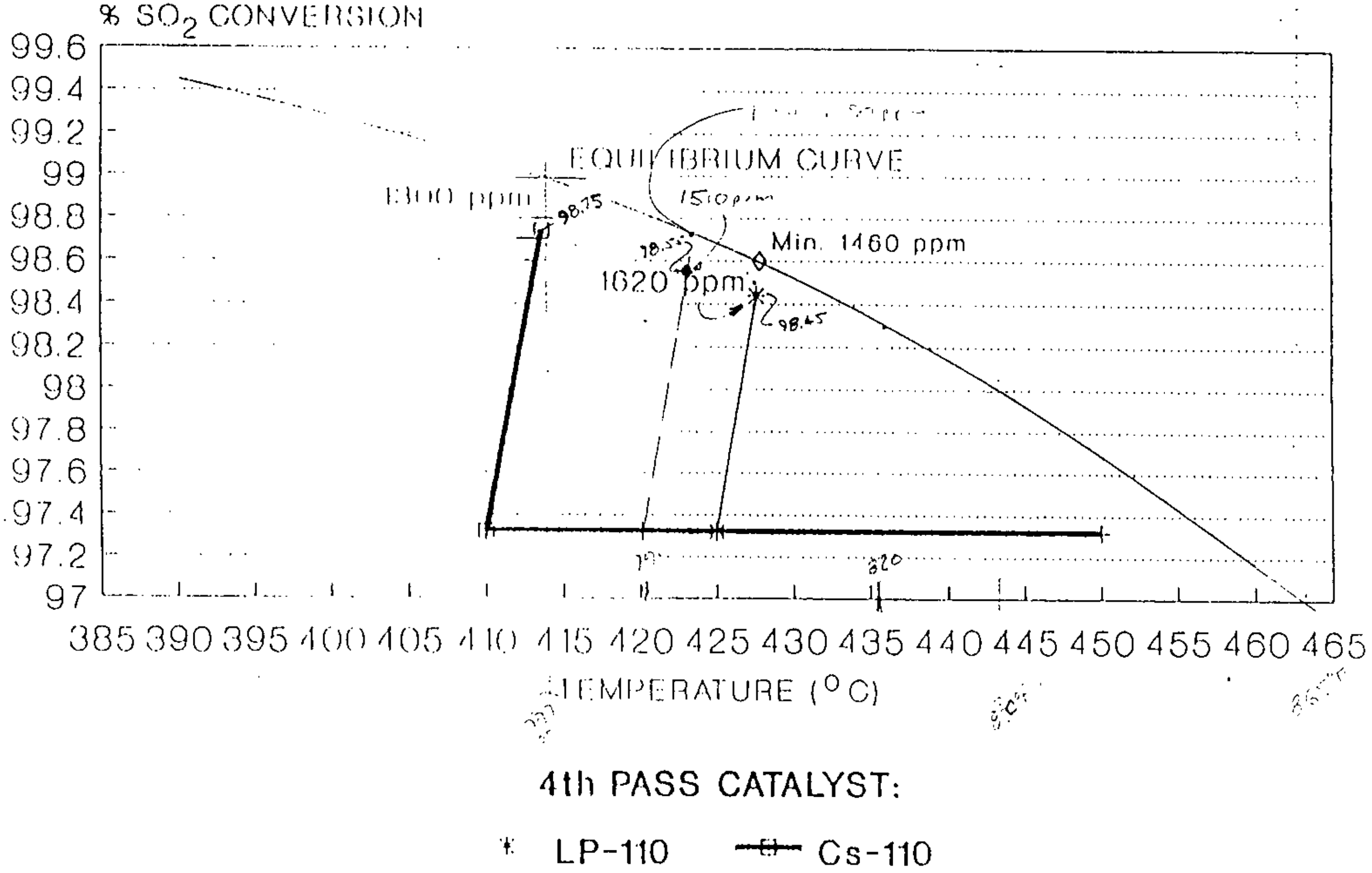


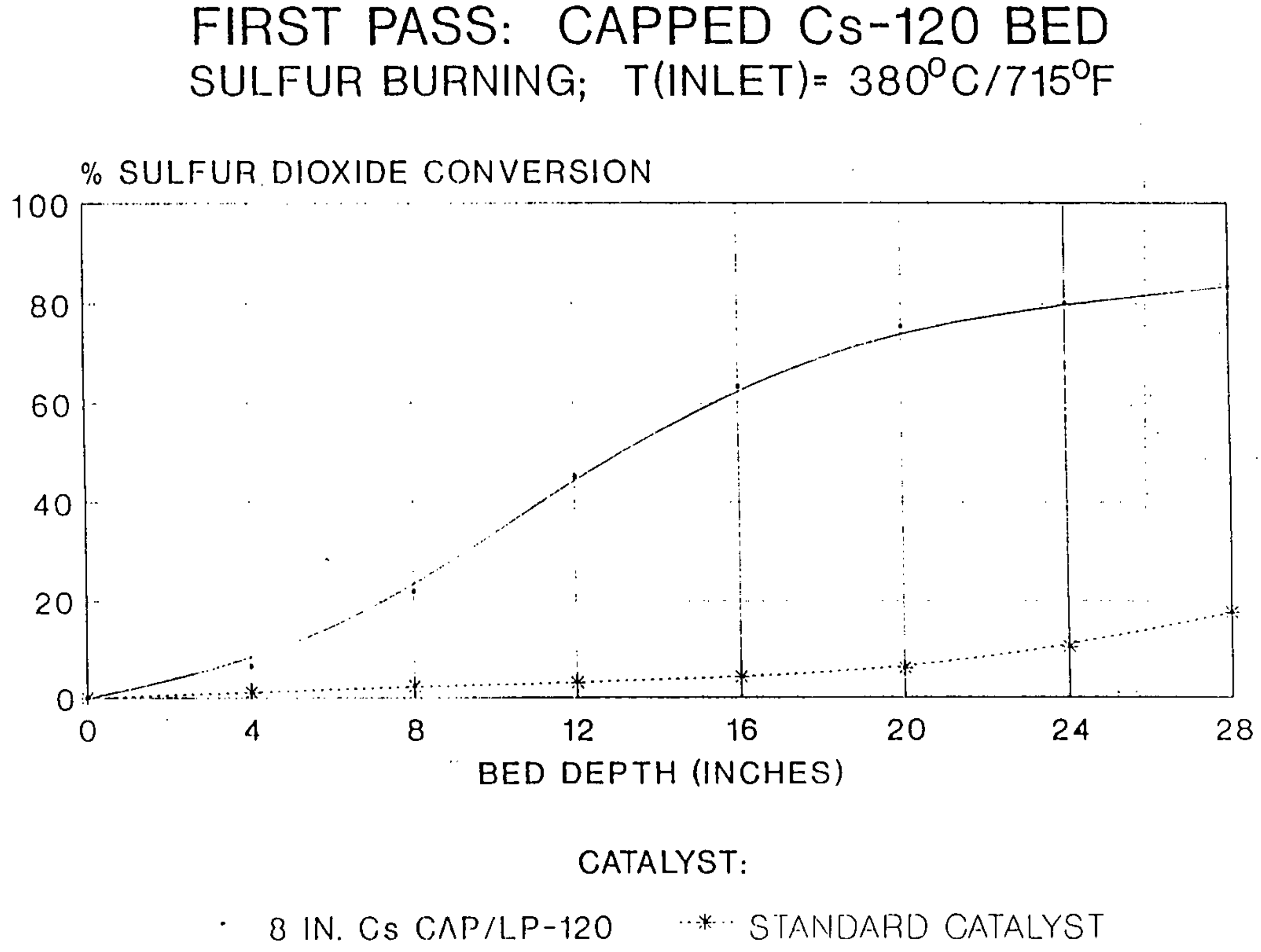
Figure 2

# SINGLE ABSORPTION: Cs ADVANTAGE



FEED GAS = 9 % $SO_2$, 11.9 % $O_2$
410°C = 770°F; 425°C = 797°F

Figure 3



FIRST PASS: CAPPED Cs-120 BED

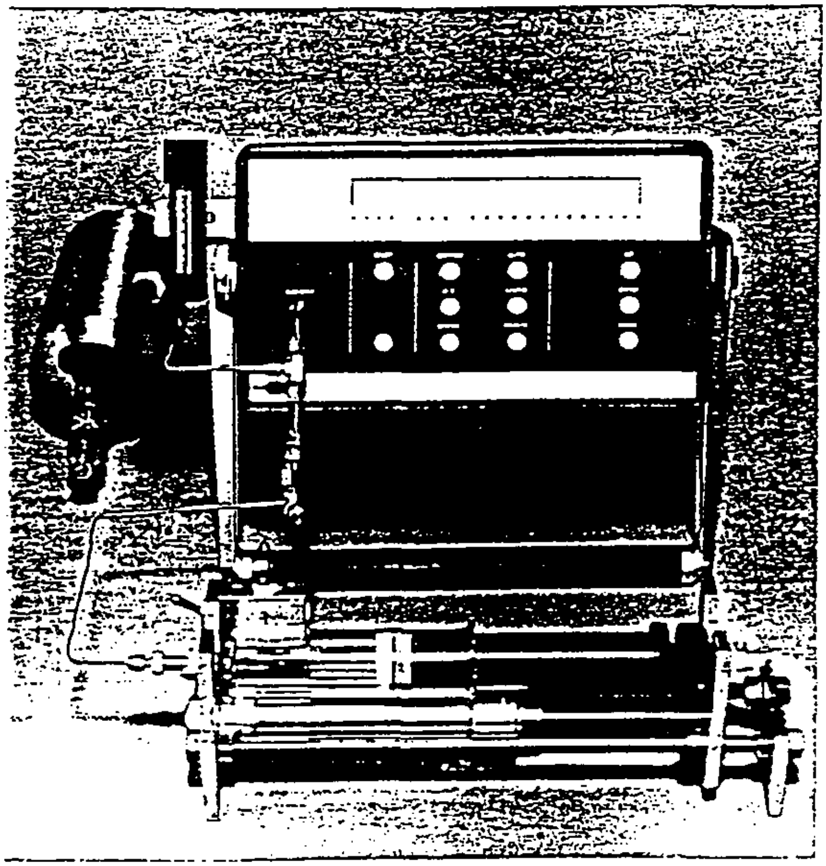
SULFUR BURNING; T(INLET)= 380°C/715°F

8 IN. Cs-120 CAP ON LP-120 RINGS

Figure 4

# PeGASyS

## Portable Gas Analysis System



Monsanto Enviro-Chem Systems, Inc.

Figure 5

## MONSANTO ENVIRO-CHEM SYSTEMS, INC.

### CONVERTER PERFORMANCE SUMMARY

CUSTOMER NAME: EXAMPLE 3 DATA FILE: XXX003.SAM

PLANT LOCATION: U. S. A.

PLANT NUMBER: 3

PLANT TYPE: SULFUR BURNER DOUBLE ABSORPTION

| SAMPLE NO. | SAMPLE IDENTIFICATION | DATE / TIME OF SAMPLE | | % $SO_2$ | % $O_2$ | % CONV. |
|---|---|---|---|---|---|---|
| 5 | SULFUR BURNER OUTLET | 4-1-91 | 1600 | 11.209 | 9.506 | 1.563 |
| 4 | FIRST PASS OUTLET | 4-1-91 | 1600 | 5.135 | 6.998 | 59.394 |
| 3 | SECOND PASS OUTLET | 4-1-91 | 1600 | 2.088 | 5.638 | 84.269 |
| 2 | THIRD PASS OUTLET | 4-1-91 | 1600 | 0.911 | 5.144 | 93.257 |
| 1 | FOURTH PASS OUTLET | 4-1-91 | 1600 | 0.035 | 4.771 | 99.744 |
| | | SULFUR BURNER GAS | | 11.366 | 9.580 | |

| SAMPLE NO. | SAMPLING POINT |
|---|---|
| 1 | OUTLET OF FINAL TOWER ABOVE MIST ELIM. |
| 2 | PASS 4 INLET AT CONVERTER TAP |
| 3 | PASS 3 INLET AT CONVERTER TAP |
| 4 | PASS 2 INLET AT CONVERTER TAP |
| 5 | PASS 1 INLET AT CONVERTER TAP |

| | KG/HR. | LBS./HR. |
|---|---|---|
| SULFUR FEED RATE | 26054.80 | 57441.31 |
| $SO_2$ EMISSIONS | 133.04 | 293.30 |

LBS. $SO_2$/TON = 3.35 KG $SO_2$/TON = 1.67

| | $NM^3$/HR | SCFM |
|---|---|---|
| AIR TO SULFUR BURNER | 160139.22 | 94243.89 |
| CONVERTER INLET GAS | 160139.22 | 94243.89 |
| CONVERTER OUTLET GAS | 132907.50 | 78217.69 |
| DILUTION AIR | 0.00 | 0.00 |
| TOTAL GAS TO PLANT | 160139.22 | 94243.89 |

PRODUCTION RATE = 2100.00 SHORT TONS PER DAY

NOTE: ALL GAS VOLUMES ARE BASED ON DRY, $SO_3$-FREE GAS.

CATALYST BED TEMPERATURES

| L/STPD | BED | °F | °C |
|---|---|---|---|
| | 1 IN | 779 | 415 |
| 31.5 | 1 OUT | 1130 | 610 |
| | RISE | 351 | 195 |
| | 2 IN | 824 | 440 |
| 33.0 | 2 OUT | 986 | 531 |
| | RISE | 164 | 91 |
| | 3 IN | 831 | 444 |
| 38.5 | 3 OUT | 891 | 477 |
| | RISE | 60 | 33 |
| | 4 IN | 795 | 424 |
| 50.5 | 4 OUT | 844 | 451 |
| | RISE | 49 | 27 |
| | 5 IN | | |
| | 5 OUT | | |
| | RISE | | |
| | TOTAL R | 624 | 346 |

Figure 6

## MONSANTO ENVIRO-CHEM SYSTEMS, INC.

### *HEAT EXCHANGER EVALUATION*

DATE / TIME: 4-1-91 / 1500 FILE: INTHEX.HEX

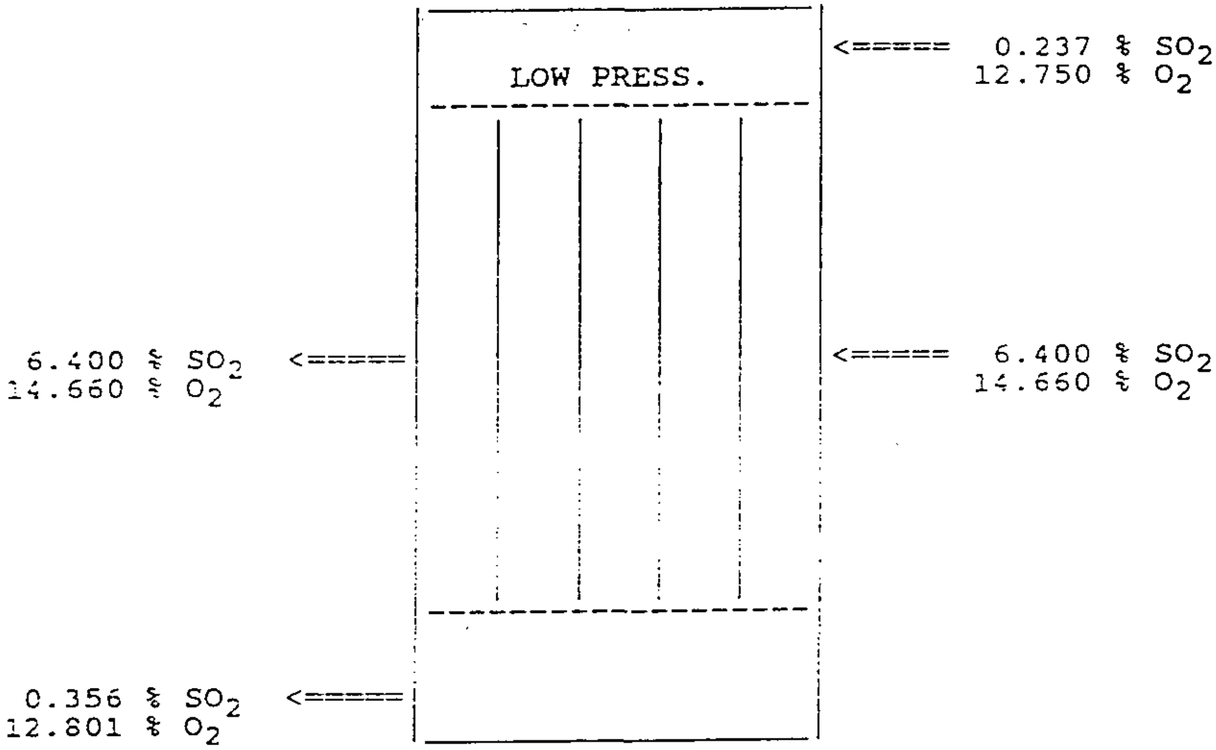
CUSTOMER: EXAMPLE

PLANT LOCATION: U. S. A.

PLANT NUMBER: 1

PLANT TYPE: METALLURGICAL; SINGLE ABSORPTION

HEAT EXCHANGER: INTERMEDIATE HEX



2.0 % OF SHELL SIDE GAS IS LEAKING INTO TUBE SIDE

TUBE SIDE INLET GAS WAS SAMPLED AT:
INLET TO INTERMEDIATE HEX

TUBE SIDE OUTLET GAS WAS SAMPLED AT:
PASS 4 INLET AT CONVERTER

# APPENDIX D - CURRENT SAP3 PERMIT

Department of
Environmental Protection

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Lawton Chiles
Governor

Virginia B. Wetherell
Secretary

**PERMITTEE:**
Farmland Hydro, L.P.
County Road 640 West
Bartow, Florida 33830

**Permit Number:** AC 53-265755
PSD-FL-225
**Expiration Date:** Dec. 31, 1996
**County:** Polk
**UTM Coordinates:** 17-410.3 km E
17-3079.7 km N
**Project:** Sulfuric Acid Plant Production Increase

This permit is issued under the provisions of Chapter 403, Florida Statutes; Chapters 62-210, 212, 272, 296 and 297, Florida Administrative Code (F.A.C.); and, Chapter 62-4, F.A.C. The above named permittee is hereby authorized to perform the work or operate the emission unit/source shown on the application and approved drawings, plans, and other documents attached hereto or on file with the Department of Environmental Protection (Department) and specifically described as follows:

For the increase in production rate of the Nos. 3, 4 and 5 sulfuric acid plants from a total of 5,640 tons of sulfuric acid product/day to 7,000 tons/day. No major physical changes are required for this modification. The sources are located at the permittee's facility in Bartow, Polk County, Florida.

The modification shall be in accordance with the permit application, plans, documents, amendments and drawings, except as otherwise noted in the General and Specific Conditions.

Attachments are listed below:

1. Application received February 21, 1995
2. Department's letter dated March 22, 1995
3. USDOI's letter dated March 29, 1995
4. Koogler & Assoc. letter dated May 10, 1995
5. Memorandum of Understanding Regarding Best Operational Start-up Practices for Sulfuric Acid Plants, 1989

*"Protect, Conserve and Manage Florida's Environment and Natural Resources"*

GENERAL CONDITIONS:

arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Rules 62-4.120 and 62-30.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

(x) Determination of Best Available Control Technology (BACT)
(x) Determination of Prevention of Significant Deterioration (PSD)
(x) Compliance with New Source Performance Standards (NSPS)

14. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application

GENERAL CONDITIONS:

for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurements;
- the dates analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and,
- the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

SPECIFIC CONDITIONS:

1. Unless otherwise indicated, the subject modification shall be in accordance with the capacities and specifications stated in the application.

2. The maximum production rates for the Nos. 3 and 4 sulfuric acid plants shall be 2,100 tons/day each while that for the No. 5 sulfuric acid plant shall be 2,800 tons/day, based on 100% sulfuric acid ($H_2SO_4$). [Rule 62-212.200(56), F.A.C.]

3. The Nos. 3, 4 and 5 sulfuric acid plants may operate on a full-time basis (8,760 hours per year). [Rule 62-212.200(56), F.A.C.]

4. Emissions of sulfur dioxide ($SO_2$), sulfuric acid mist (SAM) and visible emissions (VE) from the Nos. 3, 4 and 5 sulfuric acid plants shall not exceed the following limits [Rule 62-212.410, F.A.C.]:

| | $SO_2$ | | SAM | | VE |
|---|---|---|---|---|---|
| Plant | lb/hr | TPY | lb/hr | TPY | % |
| 3 | 350 | 1,533 | 13.1 | 57.5 | 10 |
| 4 | 350 | 1,533 | 13.1 | 57.5 | 10 |
| 5 | 467 | 2,044 | 17.5 | 76.7 | 10 |

SPECIFIC CONDITIONS:

5. Before this permit expires, performance testing of emissions from each unit shall be conducted with the emission unit operating at permitted capacity. Permitted capacity is defined as 90-100% of the maximum operating rate allowed by the permit. If it is impracticable to test at permitted capacity, then emission units may be tested at less than 90% of the maximum operating rate allowed by the permit. In this case, subsequent emission unit operation is limited to 110% of the test load until a new test is conducted. Once the emission unit is so limited, then operation at higher capacities (with prior notification provided to the Department) is allowed for no more than 15 consecutive days for the purpose of additional compliance testing to regain the permitted capacity in the permit. [Rule 62-297.340(1)(a), F.A.C.]

6. Performance testing shall be conducted and compliance determined using the test methods and procedures set forth in 40 CFR 60.85(a) through (c). Pursuant to Rule 62-297.340(1)(i), the Department's Southwest District office shall be notified in writing at least 15 days prior to performance testing. Pursuant to Rule 62-297.570(1) and (2), written reports of the test results shall be submitted to that office within 45 days of test completion.

7. A continuous monitoring system for the measurement of sulfur dioxide emissions shall be installed, calibrated, operated and maintained as described in 40 CFR 60.84(a) through (e). [Rule 62-296.800, F.A.C.; 40 CFR 60.84]

8. Objectionable odors associated with air emissions shall be prohibited. [Rule 62-296.320(2), F.A.C.]

9. Pursuant to Rule 62-210.700(1), F.A.C., excess emissions from the sulfuric acid plants resulting from startup, shutdown, malfunction, or load change shall be permitted providing (1) best operational practices to minimize emissions are adhered to and (2) the duration of excess emissions shall be minimized but in no case exceed three hours in any 24-hour period unless specifically authorized by the Department for a longer duration. Best operational start-up practices shall be followed as described in the attached Memorandum of Understanding signed in 1989.

10. Stack sampling facilities shall be provided by the permittee in accordance with Rule 62-297.345, F.A.C.

SPECIFIC CONDITIONS:

11. The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Department's Bureau of Air Regulation prior to 60 days before the expiration of the permit. [Rule 62-4.090, F.A.C.].

12. An application for an operation permit must be submitted to the Department's Southwest District office at least 90 days prior to the expiration date of this construction permit or within 45 days after completion of compliance testing, whichever occurs first. The operation permit application shall include a set of conditions acceptable to the Department for startup/shutdown of the permittee's sulfuric acid plant. To properly apply for an operation permit, the applicant shall submit the appropriate application form, fee, certification that construction was completed noting any deviations from the conditions in the construction permit, and compliance test reports as required by this permit. [Rules 62-4.055 and 62-4.220, F.A.C.].

**STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION**

Howard L Rhodes

Howard L. Rhodes, P.E.
Director
Division of Air Resources
Management

# Best Available Control Technology (BACT) Determination
Farmland Hydro, L.P.
Polk County
Permit Number AC 53-265755
PSD-FL-225

The applicant proposes to increase the total production of the No. 3, 4 and 5 Sulfuric Acid Plants (SAP) from 5,640 tons per day (TPD) to 7,000 TPD at the applicant's phosphate fertilizer manufacturing facility on County Road 640 West in Polk County, Florida. The proposed project will result in a significant increase in emissions of sulfur dioxide ($SO_2$) and sulfuric acid mist. The project is therefore subject to Prevention of Significant Deterioration (PSD) review in accordance with Rule 62-212.400, Florida Administrative Code (F.A.C.). The BACT determination is part of the PSD review requirements in accordance with Rule 62-212.410, F.A.C.

Date Application Received: February 21, 1995

Date Application Complete: May 11, 1995

BACT Determination Proposed by Applicant:

Control Technology: Double Absorption/Fiber Mist Eliminators

| | |
|---|---|
| Emission Limits: $SO_2$: | 4 lbs/ton of 100% $H_2SO_4$ produced |
| Acid Mist: | 0.15 lb/ton of 100% $H_2SO_4$ produced |
| Visible Emissions: | 10% opacity |

BACT Determination Procedure:

In accordance with Chapter 62-212, F.A.C., this determination is based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques. In addition, the regulations state that in making the BACT determination the Department shall give consideration to:

(a) Any Environmental Protection Agency determination of Best Available Control Technology pursuant to Section 169, and any emission limitation contained in 40 CFR Part 60 (Standards of Performance for New Stationary Sources) or 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants).

(b) All scientific, engineering, and technical material and other information available to the Department.

(c) The emission limiting standards or BACT determinations of any other state.

(d) The social and economic impact of the application of such technology.

The EPA currently stresses that BACT should be determined using the "top-down" approach. The first step in this approach is to determine for the emission source in question the most stringent control available for a similar or identical source or source category. If it is shown that this level of control is technically or economically infeasible for the source in question, then the next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections.

BACT Determined by the Department: Same as proposed by applicant

BACT Determination Rationale

The Department's BACT determination is the same as that proposed by the applicant. This is consistent with determinations completed by other states and the Standards of Performance for Sulfuric Acid Plants, 40 CFR 60 Subpart H, (double absorption process). The process itself is the control technology for $SO_2$. For this reason, more stringent limits have not been required. The emission limits reflect a conversion efficiency of around 99.4% of $SO_2$ to $H_2SO_4$. High efficiency mist eliminators are considered BACT for sulfuric acid mist. BACT/LAER Clearinghouse information indicates that double absorption technology and the use of high efficiency mist eliminators are representative of BACT using the top-down approach.

Conclusion

The emission limits are equivalent to those in other BACT determinations and are in compliance with all air pollution regulations. It is concluded that the emission limits established herein represent BACT.

BACT Analysis Details Available From:

John Reynolds, Permit Engineer
New Source Review Section
Bureau of Air Regulation
Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Recommended by:

CH Fancy
C. H. Fancy, P.E., Chief
Bureau of Air Regulation

9/20, 1995
Date

Approved by:

Howard L Rhodes
Howard L. Rhodes, P.E., Director
Division of Air Resources Management

9/22/95, 1995
Date