CARGILL
FERTILIZER, INC.

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DER - MAIL ROOM
1991 MAY -3 AM 11:06

8813 Highway 41 South - Riverview, Florida 33569 - Telephone 813-677-9111 - TWX 810-876-0648 - Telex 52666 - FAX 813-671-6146

CERTIFIED MAIL: P 303 004 606

May 1, 1991

Mr. Clair Fancy, P. E.
Bureau of Air Regulation
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Subject: Application For Air Construction Permit
No. 5 Diammonium Phosphate Unit

Dear Mr. Fancy:

Enclosed are four copies of an application for an air construction permit to modify the Cargill Fertilizer, Inc. No. 5 Diammonium Phosphate (DAP) production unit. Also enclosed is application fee check in amount of $1,000.00.

Cargill Fertilizer, Inc. plans to modify the subject plant to increase the potential production rate to 3500 TPD DAP.

If you have any questions, please feel free to call me at (813)671-6153.

Very truly yours,

E. O. Morris
Environmental Manger

:gf
cc: Jerry Campbell/HCEPC/TPA/Check $400.00
P-44A

00 1031

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CARGILL
FERTILIZER, INC.

8813 Highway 41 South - Riverview, Florida 33569 - Telephone 813-677-9111 - TWX 810-876-0648 - Telex 52666 - FAX 813-671-6146

I hereby certify that I am Secretary of CARGILL FERTILIZER, INC. a Delaware corporation; that as such Secretary I have custody of certain of the books and records of said corporation, including the minutes of meetings of the Board of Directors and Stockholders thereof; that the following is a true and correct copy of an excerpt of a resolution adopted by said Board of Directors on February 22, 1990, which resolution is still in full force and effect.

"WHEREAS, Pursuant to SECTION 3 of ARTICLE IV of the By-laws of the Company, the President is primarily responsible for the execution of corporate documents; and

"WHEREAS, In the judgment of the Board, it is deemed advisable to delegate some of the responsibility for executing and submitting various documents to certain other individuals of the Company;

"NOW THEREFORE, BE IT RESOLVED, That the Environmental Manager and the Mine Manager are hereby authorized, for and on behalf of the Company, to execute and submit all routine environmental reports, permit applications and follow-up responses, where signature of an officer is not otherwise mandated by law, statute or regulation..."

I further certify that as of this date, the following noted individuals currently hold the titles set opposite their names:

| | |
|---|---|
| Edgar Oswald Morris | Environmental Manager |
| John R. Schmedeman | Mine Manager |

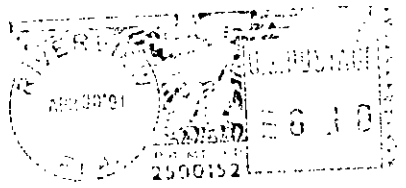
WITNESS MY HAND AND THE SEAL of CARGILL FERTILIZER, INC. 15th day of March, 19 90.

Secretary

recycled paper

CARGILL FERTILIZER, INC.
8813 HWY. 41 SOUTH
RIVERVIEW, FL 33569

GIBSONTON
DROP SHIPMENT
AUTHORIZATION #



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CERTIFIED

P 303 004 606

MAIL

FLORIDA DEPARTMENT ENVIRONMENTAL
REGULATION
2600 BLAIR STONE ROAD
TALAHASSEE, FL 32399

ATTENTION: MR. CLAIR FANCY

RECEIVED
MAY 3 1991
Division of Air
Resources Management

CARGILL FERTILIZER, INC.

| VENDOR NUMBER | INVOICE NUMBER | INVOICE DATE | GROSS AMOUNT | DISCOUNT | NET AMOUNT |
|---|---|---|---|---|---|
| 3351 | | 4 30 91 | 100000 | | 100000 |
| | #5 DAP Construction Permit | | | | |
| TOTAL | | | 100000 | | 100000 |

IF CORRECT, DETACH AND RETAIN STATEMENT. IF NOT CORRECT, RETURN WITH STATEMENT.

**CARGILL FERTILIZER, INC.**

NO. **577** 084348

64-1278
611

| DATE MO. | DAY | YR |
|---|---|---|
| 5/ | 02/ | 91 |

PAY EXACTLY ******1,000 DOLLARS AND 00 CENTS

| DOLLARS | CENTS |
|---|---|
| $ ******1,000 | 00 |

TO THE ORDER OF

STATE OF FLORIDA DEPARTMENT OF
ENVIRONMENTAL REGULATION
4520 OAK FAIR BOULEVARD
TAMPA FL 33610

CARGILL FERTILIZER, INC.

AUTHORIZED SIGNATURE

THE CITIZENS AND SOUTHERN NATIONAL BANK
Atlanta, DeKalb County, Georgia

⑈577084348⑈ ⑆061112788⑆ 011 07 093⑈

# CARGILL FERTILIZER, INC.

RECEIVED
DER - MAIL ROOM
1991 MAY -3 AM 11: 20

8813 Highway 41 South - Riverview, Florida 33569 - Telephone 813-677-9211 - TWX 810-876-0648 - Telex 52666 - FAX 813-671-6146

I hereby certify that I am Secretary of CARGILL FERTILIZER, INC. a Delaware corporation; that as such Secretary I have custody of certain of the books and records of said corporation, including the minutes of meetings of the Board of Directors and Stockholders thereof; that the following is a true and correct copy of an excerpt of a resolution adopted by said Board of Directors on February 22, 1990, which resolution is still in full force and effect.

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| | |
|---|---|
| Edgar Oswald Morris | Environmental Manager |
| John R. Schmedeman | Mine Manager |

WITNESS MY HAND AND THE SEAL of CARGILL FERTILIZER, INC. 15th day of March, 1990.

Secretary

recycled paper

# APPLICATION TO CONSTRUCT

# NO. 5 DIAMMONIUM PHOSPHATE PLANT PRODUCTION RATE INCREASE

**CARGILL FERTILIZER, INC.**
**MAY 1991**

**Prepared For:**

**Cargill Fertilizer, Inc.**
**8813 Highway 41 South**
**Riverview, FL 33569**

**Prepared By:**

**KBN Engineering and Applied Sciences, Inc.**
**1034 NW 57th Street**
**Gainesville, FL 32605**

**May 1991**
**91007B1**

STATE OF FLORIDA

# DEPARTMENT OF ENVIRONMENTAL REGULATION

$1,000 pd. 5-3-91 Recpt. #151269

AC 29-196763
PSD-FL-178

## APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Diammonium Phosphate Plant [ ] New[1] [x] Existing[1]

APPLICATION TYPE: [x] Construction [ ] Operation [ ] Modification

COMPANY NAME: Cargill Fertilizer, Inc. COUNTY: Hillsborough

Identify the specific emission point source(s) addressed in this application (i.e., Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) No. 5 Diammonium Phosphate Plant Stack

SOURCE LOCATION: Street 8813 Highway 41 South City Riverview

UTM: East 362.9 North 3082.5

Latitude 27 ° 51 ' 28 "N Longitude 82 ° 23 ' 15 "W

APPLICANT NAME AND TITLE: Ozzie Morris, Environmental Manager

APPLICANT ADDRESS: 8813 Highway 41 South, Riverview, Florida 33569

### SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of Cargill Fertilizer, Inc.

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

*Attach letter of authorization

Signed: O. Morris

Ozzie Morris, Environmental Manager
Name and Title (Please Type)

Date: _____ Telephone No. (813) 677-9111

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)
This is to certify that the engineering features of this pollution control project have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that

[1]See Florida Administration Code Rule 17-2.100(57) and (104)

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

Signed David A. Buff

David A. Buff
Name (Please Type)

KBN Engineering and Applied Sciences, Inc.
Company Name (Please Type)

1034 NW 57th Street, Gainesville, FL 32605
Mailing Address (Please Type)

Florida Registration No. 19011 Date: April 30, 1991 Telephone No. (904) 331-9000

SECTION II: GENERAL PROJECT INFORMATION

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

See Attachment A for complete description

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

Start of Construction August, 1991 Completion of Construction August, 1992

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

Upgrade of existing emission control system: $300,000

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

Permit No. A029-154495

Issued 07/12/90

Expired 12/29/93

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

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

1. Is this source in a non-attainment area for a particular pollutant? Yes
   a. If yes, has "offset" been applied? No
   b. If yes, has "Lowest Achievable Emission Rate" been applied? No
   c. If yes, list non-attainment pollutants. Particulate Matter, Ozone
2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. Yes
3. Does the State "Prevention of Significant Deterioration" (PSD) requirement apply to this source? If yes, see Sections VI and VII. Yes
4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? Yes
5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? No

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? Yes
   a. If yes, for what pollutants? Particulate Matter
   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

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

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

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

| Description | Contaminants | | Utilization Rate - lbs/hr | Relate to Flow Diagram |
|---|---|---|---|---|
| | Type | % Wt | | |
| Phos Acid 100% + solids | Particulate | 100.0 | 212,500 | |
| | Fluoride | 1.8 | | |
| Anhydrous Ammonia | --- | --- | 64,210 | |
| | | | | |
| | | | | |

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

1. Total Process Input Rate (lbs/hr): 276,710 (dry basis)

2. Product Weight (lbs/hr): 292,000 (wet basis); 275,481 (dry basis)

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

| Name of Contaminant | Emission[1] | | Allowed[2] Emission Rate per Rule 17-2 | Allowable[3] Emission lbs/hr | Potential[4] Emission | | Relate to Flow Diagram |
|---|---|---|---|---|---|---|---|
| | Maximum lbs/hr | Actual T/yr | | | lbs/hr | T/yr | |
| Particulate | 15.0 | 65.7 | BACT | BACT | 15.0 | 65.7 | |
| Fluoride | 4.03 | 17.65 | 0.06 lb/ton | 4.03 | 4.03 | 17.65 | |
| Sulfur Dioxide | 7.6 | 33.3 | N/A | N/A | 7.6 | 33.3 | |
| Nitrogen Oxides | 2.1 | 9.2 | N/A | N/A | 2.1 | 9.2 | |
| Carbon Monoxide | 0.54 | 2.35 | N/A | N/A | 0.54 | 2.35 | |
| Volatile Org Cmpd | 0.041 | 0.18 | N/A | N/A | 0.041 | 0.18 | |

[1]See Section V, Item 2.

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

[3]Calculated from operating rate and applicable standard.

[4]Emission, if source operated without control (See Section V, Item 3).

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

| Name and Type (Model & Serial No.) | Contaminant | Efficiency | Range of Particles Size Collected (in microns) (If applicable) | Basis for Efficiency (Section V Item 5) |
|---|---|---|---|---|
| Two Packed Body, Up-flow scrubbers and three in venturi scrubbers Mfg. by D M Weatherly | Particulate | 98% | Submicron | Design |
| | Fluoride | 95% | N/A | Design |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

E. Fuels

| Type (Be Specific) | Consumption* | | Maximum Heat Input (MMBTU/hr) |
|---|---|---|---|
| | avg/hr | max./hr | |
| No. 2 Fuel Oil | -- | 107.1 gal/hr | 15.0 |
| Natural gas | -- | 14,634 scf/hr | 15.0 |
| | | | |
| | | | |

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

Fuel Analysis:

Percent Sulfur: Nil / 0.5% (max) Percent Ash: N/A / 0.1

Density: N/A / 8.0 lbs/gal Typical Percent Nitrogen: ≤1 / 0.2-0.9

Heat Capacity: 1,025 Btu/scf / 17,500 BTU/lb N/A / 140,000 BTU/gal

Other Fuel Contaminants (which may cause air pollution): _____

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

Annual Average N/A Maximum _____

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

There are no solid wastes. Scrubber water is recycled to a plant-wide water recycle system.

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

Stack Height: 132.5 ft. Stack Diameter: 7.0 ft.

Gas Flow Rate: 122,000 ACFM 103,000 DSCFM Gas Exit Temperature: 115 °F.

Water Vapor Content: 8 % Velocity: 50.5 FPS

## SECTION IV: INCINERATOR INFORMATION

Not Applicable

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

Description of Waste _____

Total Weight Incinerated (lbs/hr) _____ Design Capacity (lbs/hr) _____

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

Manufacturer _____

Date Constructed _____ Model No. _____

| | Volume $(ft)^3$ | Heat Release (BTU/hr) | Fuel | | Temperature (°F) |
|---|---|---|---|---|---|
| | | | Type | BTU/hr | |
| Primary Chamber | | | | | |
| Secondary Chamber | | | | | |

Stack Height: _____ ft. Stack Diameter: _____ Stack Temp. _____

Gas Flow Rate: _____ ACFM _____ DSCFM* Velocity: _____ FPS

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

Type of pollution control devices: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify) _____

Brief description of operating characteristics of control devices: _____

_____

_____

_____

_____

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

_____

_____

_____

_____

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

## SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
   See Attachment B
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods, 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.
   See Attachment B
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
   See Attachments B and C
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)
   See Attachment C
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).
   See Attachment C
6. An 8 ½" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.
   Attached
7. An 8 ½" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map).
   Attached
8. An 8 ½" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.
   Attached

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.

10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

## SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

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

[x] Yes [ ] No

| Contaminant | Rate or Concentration |
|---|---|
| Fluorides | 0.06 lb/ton $P_2O_5$ |
| | |
| | |
| | |

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

[x] Yes [ ] No

| Contaminant | Rate or Concentration |
|---|---|
| See Attachment A | |
| | |
| | |
| | |

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

| Contaminant | Rate or Concentration |
|---|---|
| See Attachment A | |
| | |
| | |
| | |

D. Describe the existing control and treatment technology (if any). See Attachment A

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

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

| Contaminant | Rate or Concentration |
|---|---|
| | |
| | |
| | |

10. Stack Parameters

a. Height: ft.

b. Diameter ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

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

1.

a. Control Devices:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

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

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

F. Describe the control technology selected: See Attachment A

1. Control Device:

2. Efficiency:[1]

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:[2]

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

| Contaminant | Rate or Concentration |
|---|---|
| | |
| | |
| | |
| | |

(8) Process Rate:[1]

b. (1) Company:

(2) Mailing Address:

(3) City: (4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

| Contaminant | Rate or Concentration |
|---|---|
| | |
| | |
| | |

(8) Process Rate:[1]

10. Reason for selection and description of systems: See Attachment A

[1]Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

## SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

Refer to Attachment A

A. Company Monitored Data

1. _____ no. sites _____ TSP _____( ) $SO^{2*}$ _____ Wind spd/dir

Period of Monitoring _____/_____/_____ to _____/_____/_____
month day year month day year

Other data recorded _____

Attach all data or statistical summaries to this application.

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

2. Instrumentation, Field and Laboratory

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

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

B. Meteorological Data Used for Air Quality Modeling

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

2. Surface data obtained from (location)_____

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

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

C. Computer Models Used

1. _____ Modified? If yes, attach description.

2. _____ Modified? If yes, attach description.

3. _____ Modified? If yes, attach description.

4. _____ Modified? If yes, attach description.

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

D. Applicants Maximum Allowable Emission Data

| Pollutant | Emission Rate |
|---|---|
| TSP | _____ grams/sec |
| $SO^2$ | _____ grams/sec |

E. Emission Data Used in Modeling

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

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

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

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

# ATTACHMENT A

# PROJECT DESCRIPTION

# AND PSD REVIEW

ATTACHMENT A

## 1.0 PROJECT DESCRIPTION

Cargill Fertilizer, Inc., currently operates the No. 5 Diammonium Phosphate (DAP) plant at its phosphate fertilizer manufacturing facility in Riverview, Florida. The No. 5 DAP plant originally was permitted for construction by the Florida Department of Environmental Regulation (FDER) and U.S. Environmental Protection Agency (EPA) in 1980. The plant is currently operating under operating permit AO29-154495, issued July 12, 1990. Maximum DAP production capacity is 114 tons per hour (TPH) (dry basis), at a maximum $P_2O_5$ input rate of 55.2 TPH.

In the DAP manufacturing process, phosphoric acid and anhydrous ammonia are reacted in a sealed reaction tank. Ammonia is then further added to the ammoniated acid in a rotary reactor-granulator. The granulated, unsized DAP is then dried in a rotary dryer. The dryer is fired by natural gas as primary fuel and by No. 6 fuel oil as backup fuel.

The dried DAP material is sized and screened, and the oversized and undersized material is recycled back to the granulator. The product is then cooled in a rotary drum cooler, screened, and sent to storage.

Emissions from the reactor, granulator, dryer, cooler, and materials handling equipment are controlled by cyclones, three venturi scrubbers in parallel, and finally by two up-flow tail gas scrubbers operating in parallel. The exhaust gases are then ducted to the atmosphere through a single stack.

Cargill is now proposing to increase the DAP production capacity to 146 TPH. This would be accomplished at a $P_2O_5$ input rate of 67.16 TPH. The proposed increase would be realized primarily through an increase in the recycle system capacity. The recycle system will be upgraded by replacing the recycle elevator and adding additional screens and mills to the system. Other minor changes will be made to the granulator/reactor and

cooler, primarily in the evacuation systems for these units. An ammonia recovery system will be installed to reduce ammonia losses from the reactor/granulator exhaust gases. The product bucket elevator and belt conveyors will be upgraded to accommodate the increased throughput.

In addition to these changes, modifications will be implemented to recycle a portion of the DAP cooler exhaust gases, after exiting the cooler cyclone, back to the granulator and the dryer. This will result in no additional air flow through the process scrubbers than at present, as well as increasing energy efficiency.

A simplified process flow diagram of the No. 5 DAP plant is presented in Figure A-1. The air evacuation systems for current operation and proposed future operation are presented in Figures A-2 and A-3, respectively.

As part of the proposed project, the air pollution control system now in place for the No. 5 DAP plant will be upgraded. These upgrades will provide improved control of particulate matter (PM) and fluorides (Fl) emissions. Also, No. 2 distillate fuel oil will be used in the future as backup fuel instead of No. 6 fuel oil.

The maximum emissions from the modified No. 5 DAP plant are presented Attachment B. Information concerning the new/modified air pollution control equipment is provided in Attachment C.

A comparison of the current maximum permitted emission rates with the proposed maximum emission rates from the No. 5 DAP plant is presented in Table A-1. As shown, there will be a decrease in the maximum permitted rates for PM, $SO_2$, and $NO_x$. The maximum emissions of Fl, CO, and VOC will increase slightly, while the maximum ammonia emissions will remain the same.

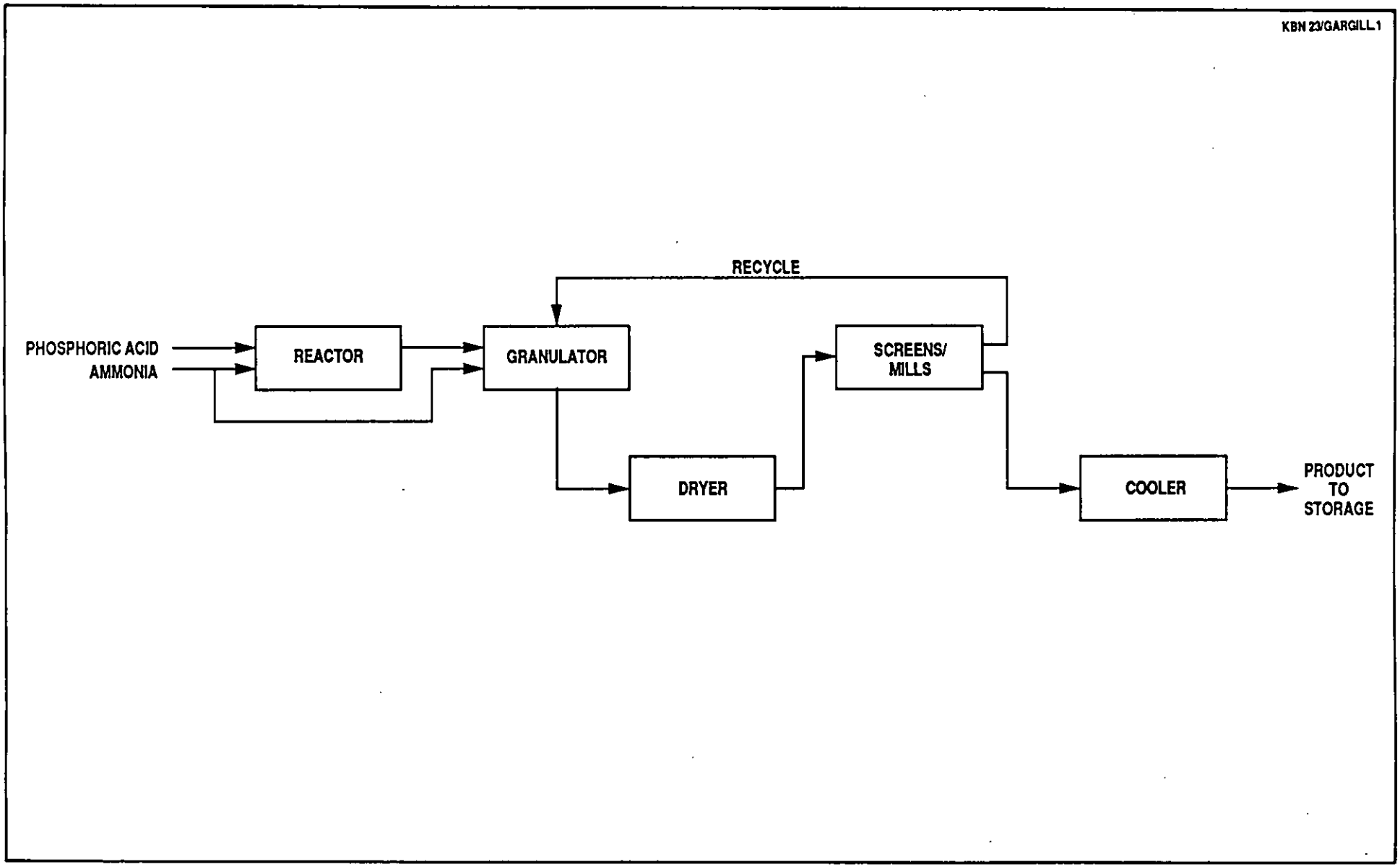


Figure A-1 PROCESS FLOW DIAGRAM, NO. 5 DAP PLANT

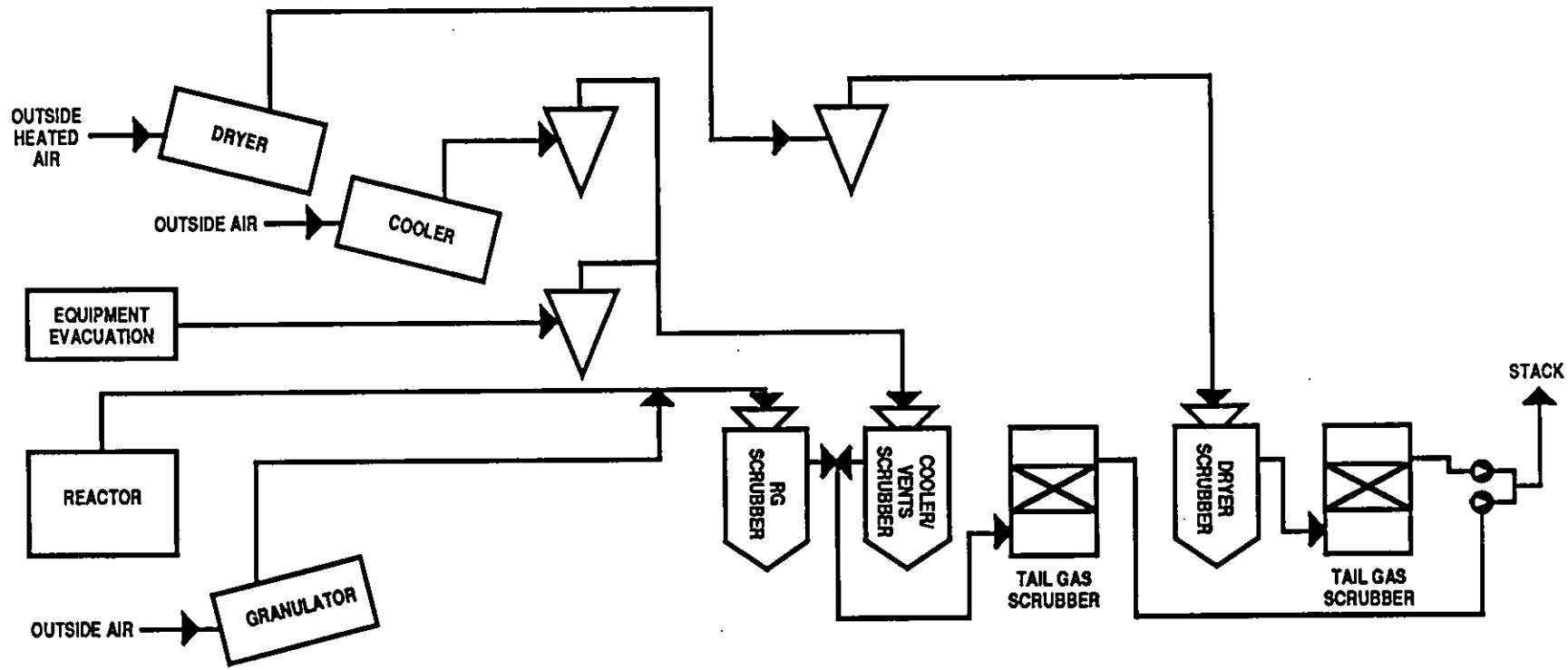


Figure A-2 AIR EVACUATION SYSTEM, EXISTING NO.5 DAP PLANT

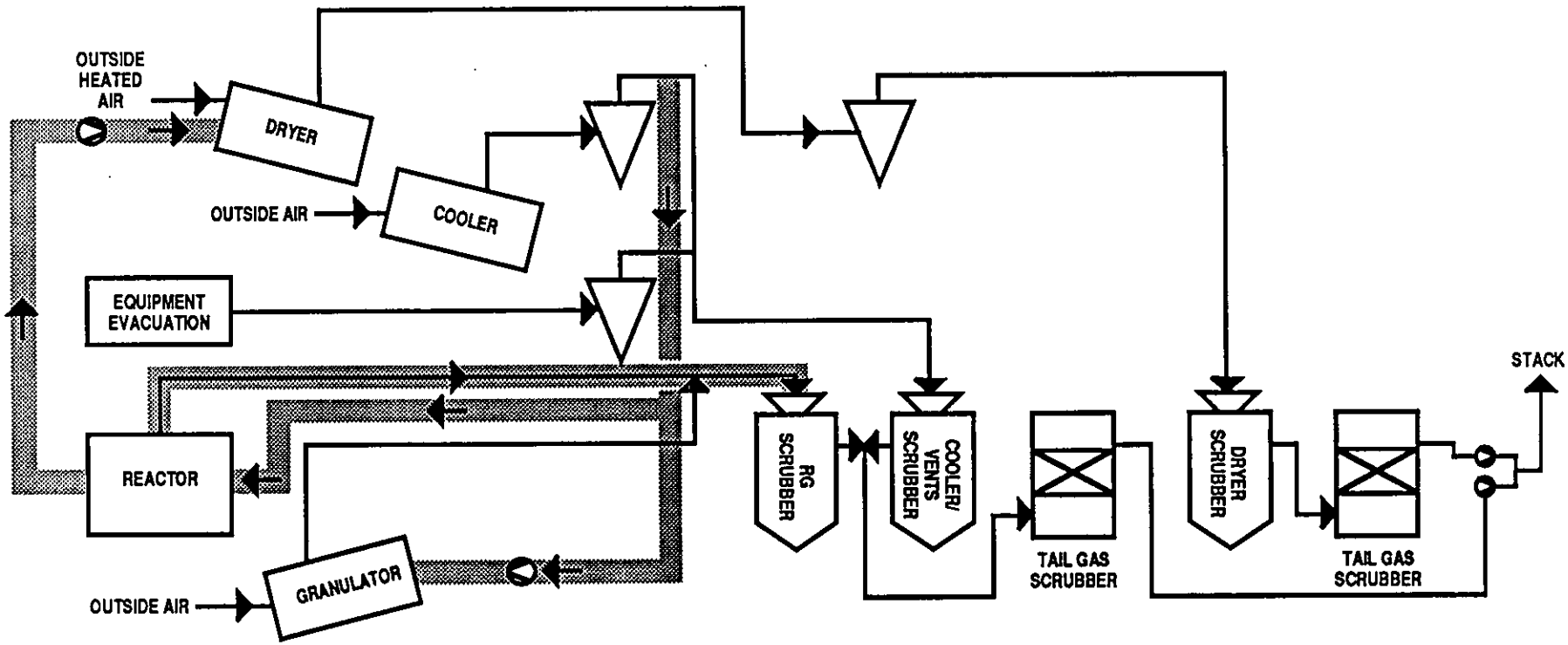


Figure A-3 AIR EVACUATION SYSTEM, EXPANDED NO. 5 DAP PLANT

Table A-1. Comparison of Current and Proposed Maximum Permitted Emission Rates, No. 5 DAP Plant

| Pollutant | Current Permitted or Maximum[a] | | Proposed Permitted or Maximum | |
|---|---|---|---|---|
| | lb/hr | TPY | lb/hr | TPY |
| Particulate Matter | 20.0 | 87.6 | 15.0 | 65.7 |
| Fluorides | 3.3 | 14.5 | 4.03 | 17.7 |
| Sulfur Dioxide | 32.4 | 83.7 | 7.6 | 33.3 |
| Nitrogen Oxides | 4.5 | 19.5 | 2.1 | 9.2 |
| Carbon Monoxide | 0.41 | 1.80 | 0.54 | 2.35 |
| Volatile Organic Compounds | 0.033 | 0.14 | 0.041 | 0.18 |
| Ammonia | 20.0 | 87.6 | 20.0 | 87.6 |

[a]Basis: A029-154495, PSD-FL-026, and permit application dated May 1987.

## 2.0 EMISSION LIMITING STANDARDS

Federal New Source Performance Standards (NSPS) for phosphate fertilizer plants, 40 CFR 60, Subpart V, Diammonium Phosphate plants, limits emissions of fluorides from the No. 5 DAP plant. The NSPS is 0.06 pounds per ton (lb/ton) of equivalent $P_2O_5$ feed to the process. The No. 5 DAP plant, after the proposed modification, will comply with the NSPS.

Particulate matter emissions from the No. 5 DAP plant currently are limited to 20.0 lb/hr and 0.36 lb/ton $P_2O_5$. These limits were set based on the previous PSD permit issued in 1988. The modified No. 5 DAP plant will be limited to 15.0 lb/hr and 0.22 lb/ton $P_2O_5$ through improvements in the air pollution control equipment.

Emissions of other pollutants are not limited by any specific emission limiting standards. The current operating permit and PSD permit specifies an $SO_2$ emission limit of 32.4 lb/hr and 83.7 TPY, based on No. 6 fuel oil burning. The modified plant will be limited to 7.6 lb/hr and 33.3 TPY, based on No. 2 fuel oil burning.

## 3.0 NEW SOURCE REVIEW APPLICABILITY

The Cargill phosphate fertilizer plant is located in an area designated as nonattainment for ozone and attainment for all other pollutants. New source review, either for prevention of significant deterioration (PSD) or nonattainment, would apply to the modification if an increase in emissions greater than the significant emission rate for any pollutant would occur as a result of the modification. Significant emission rates are defined in Table 500-2 of Rule 17-2.500, Florida Administrative Code (FAC). Also considered in determining the net increase in emissions are any contemporaneous increases or decreases in emissions occurring at the facility within the past 5 years, except that issuance of a PSD or nonattainment permit for a particular pollutant would wipe the slate clean for that pollutant as of the permit issuance date.

In order to determine if a net increase in emissions will occur as a result of the proposed modification, it is first necessary to define the contemporaneous emission increases and decreases. Presented in Table A-2 are all construction permits issued to Cargill (formerly Gardinier) within the past 5 years. For each permit, the documented net change in emissions is shown. Also shown are the emissions associated with a permit application recently submitted to FDER for the monoammonium phosphate (MAP) plant. The total contemporaneous emission change for PM is an increase of 12.21 TPY; for Fl, a decrease of 17.21 TPY; and for $SO_2$, a decrease of 98.9 TPY.

The current baseline emissions must be established to determine if a net significant net increase will occur. The baseline emissions are summarized for the No. 5 DAP plant in Table A-3. These are based on the Annual Operating Reports submitted to FDER for 1989 and 1990.

The total net change in emissions is determined by taking the future maximum emissions, in TPY, minus the baseline emissions, plus the previous contemporaneous emissions. This calculation is shown in Table A-4. The net change in PM emissions as a result of the proposed modification is 53.9 TPY, which is above the PSD significant emission rate of 15 TPY. As a result, new source review applies for PM.

The net change in Fl emissions is -11.1 TPY because of previous reductions in Fl emissions and, as a result, Fl is not subject to new source review. Similarly, the net increase in emissions of all other pollutants is either negative or below the respective PSD significant emission rate levels. As a result, PSD review does not apply to these pollutants.

The PSD source applicability analysis also must consider any effects that the proposed modifications will have on other facility production units. The No. 5 DAP plant uses only ammonia and phosphoric acid. There are no air emission sources associated with the ammonia system. Concerning

Table A-2. History of Construction Permits at Cargill Fertilizer, Inc.

| Date | Project | PM (TPY) Previous Actual | PM (TPY) Permitted Maximum | PM (TPY) Net Change | Fluoride (TPY) Previous Actual | Fluoride (TPY) Permitted Maximum | Fluoride (TPY) Net Change | $SO_2$ (TPY) Previous Actual | $SO_2$ (TPY) Permitted Maximum | $SO_2$ (TPY) Net Change |
|---|---|---|---|---|---|---|---|---|---|---|
| 5/29/87 | No. 8 Sulfuric Acid expansion (2,500 TPD) AC29-130371; PSD-FL-118 | – | – | – | – | – | – | 1,606.0 | 1,826.4 | 219.0 |
| 10/14/87 | No. 5 DAP Plant Expansion AC29-135083 | 100.7[a] | 87.6 | -13.1 | 43.3[a] | 14.5 | -28.8 | 238.3 | 139.4 | -98.9 |
| 11/3/87 | Dock Conveying System AC29-136776 | 7.7 | 13.44 | 5.74 | – | – | – | – | – | – |
| 1/25/88 | Vessel Loading-Phosphate Products AC29-140201 | 10.1 | 7.4 | -2.7 | – | – | – | – | – | – |
| 2/3/89 | Phosphoric Acid Clarifier/Stg. Tank AC29-156206 | – | – | – | 0.0 | 0.0053 | 0.0053 | – | – | – |
| 4/20/90 | GTSP Truck Loading AC29-175044 | 0.0 | 0.94 | 0.94 | – | – | – | – | – | – |
| 2/91 | Phosphoric Acid Rate Increase AC29-186726 | – | – | – | 7.51 | 10.29 | 2.78 | – | – | – |
| 03/29/91 | $Na_2SiF_6$ Bagging AC29-190669 (Intent to Issue) | 0.05 | 1.34 | 1.29 | – | – | - | – | – | – |
| 03/91 | MAP PLant Expansion (Applied for) | 73.46 | 93.50 | 20.04 | 3.95 | 12.75 | 8.8 | – | – | – |
| | | | Total = | 12.21 | | Total = | -17.21 | | Total = | -98.9[b] |

[a]Includes emissions from sources to be shut down.

[b]Total change since last PSD for $SO_2$ was issued.

Note: TPY = Tons per year.

Table A-3. Current Emissions - No. 5 DAP Plant

| Pollutant | 1989 | 1990 | Average |
|---|---|---|---|
| Particulate Matter | 12.69 | 35.28 | 24.0 |
| Fluorides | 9.91 | 13.38 | 11.6 |
| Sulfur Dioxide | 0.02 | 0.02 | 0.02 |
| Nitrogen Oxides | 3.26 | 2.53 | 2.90 |
| Carbon Monoxide | 0.65 | 0.51 | 0.58 |
| Volatile Organic Compounds | 0.17 | 0.13 | 0.15 |
| Ammonia | 2.05 | 1.82 | 1.94 |

Table A-4. PSD Source Applicability Analysis, No. 5 DAP Expansion

| Pollutant | A Baseline Average 1989-1990[a] (TPY) | B Proposed Emissions (TPY) | C Previous Contemporaneous (TPY) | Net Change (B-A+C) (TPY) | PSD Significant Emissions (TPY) |
|---|---|---|---|---|---|
| Particulate Matter | 24.0 | 65.7 | 12.21 | 53.9 | 15 |
| Fluorides | 11.6 | 17.7 | -17.21 | -11.1 | 3 |
| Sulfur Dioxide | 0.02 | 33.3 | -98.9 | -65.6 | 40 |
| Nitrogen Oxides | 2.90 | 9.2 | – | 9.2 | 40 |
| Carbon Monoxide | 0.58 | 2.35 | – | 2.35 | 100 |
| Volatile Organic Compounds | 0.15 | 0.18 | – | 0.18 | 40 |

[a]Based on Annual Air Operating Reports submitted to FDER.

phosphoric acid, the expanded No. 5 DAP plant will require more phosphoric acid raw material. However, the phosphoric acid plant at Cargill recently was issued an air construction permit for an expansion (February 1991; refer to Table A-2), and this permitted capacity will satisfy the needs of the No. 5 DAP plant. Because there is no historical operating data for the expanded phosphoric acid plant (the permit was just issued), the plant's allowable emissions can be considered to be its actual emissions. Therefore, there will be no increase in emissions from the phosphoric acid plant as a result of the proposed modification.

## 4.0 NEW SOURCE REVIEW FOR PARTICULATE MATTER

### 4.1 REQUIREMENTS

According to Rule 17-2.410 (2) FAC, the Hillsborough County TSP nonattainment area was to be redesignated as an attainment or unclassifiable area for TSP on the date that EPA redesignates the area as unclassifiable. On February 1, 1990, EPA published in the Federal Register the approval that redesignated the TSP nonattainment areas in both Jacksonville and Hillsborough County as unclassifiable. As a result, Hillsborough County is now designated as unclassifiable for TSP, and new sources locating in this area are subject to PSD review requirements.

Under PSD new source review requirements, a proposed modification that results in a significant net emissions increase must undergo the following reviews:

1. Best Available Control Technology (BACT) evaluation;
2. Air quality impact analysis;
3. Ambient monitoring analysis; and
4. Additional impact analysis.

These requirements are addressed in the following sections.

### 4.2 BACT ANALYSIS

The No. 5 DAP plant is an existing plant that uses cyclones and wet scrubbers to control PM emissions. As part of the proposed project, upgrades and changes to the air pollution control equipment will be made to

result in improved PM and Fl control. The total cost of these improvements is estimated at $300,000.

Wet scrubbers typically are used in DAP plants throughout Florida where water is readily available from process ponds, and where Fl control also is required to meet Florida or NSPS emission standards. Although dry PM controls (i.e., fabric filters) could be employed, these would not control Fl, and an additional wet scrubbing system would have to be added.

A review was conducted of prior BACT/LAER determinations made for PM emissions from DAP plants. Three determinations were found and are summarized below.

| | | | | | |
|---|---|---|---|---|---|
| Agrico Chemical | 1/21/81 | PSD-FL-061 | 0.50 lb/ton DAP | Scrubber | BACT |
| Chevron USA (WY) | 6/13/84 | CT-550 | 0.0180 gr/acf | Scrubber | BACT |
| W.R. Grace | 7/1/80 | AC53-24460 | 0.50 lb/ton $P_2O_5$ | Scrubber | BACT |

All three determinations employed wet venturi scrubbers. In the case of W. R. Grace, initially BACT was required and was determined to be 0.5 lb/ton $P_2O_5$. Subsequently, the company amended the permit to include PM offsets, and PSD for PM was no longer required, but the 0.5 lb/ton limit was retained. It is noted that the plant currently is permitted for 176 TPH DAP (81 TPH $P_2O_5$) and 29.9 lb/hr PM, which is equivalent to 0.37 lb/ton $P_2O_5$ (AO-53-167639).

In comparison to these previously determined BACT levels, Cargill's proposed emission rate of 15 lb/hr is equivalent to 0.22 lb/ton $P_2O_5$ and 0.0143 gr/acf. These PM levels are well below those previously determined as BACT.

Actual historic PM emissions from Cargill's No. 5 DAP plant have ranged up to 9 lb/hr at production rates of 115 TPH DAP. This would equate to approximately 0.17 lb/ton $P_2O_5$. The requested PM emissions are lower than presently permitted. The existing control equipment will be extensively upgraded. Considering those aspects and an adequate margin of safety to

consistently demonstrate compliance, Cargill's proposed limit of 0.22 lb/ton $P_2O_5$, achieved by wet scrubbing, is considered as BACT.

### 4.3 AIR QUALITY IMPACT ANALYSIS

The No.5 DAP plant currently is permitted to emit 20 lb/hr of PM. The allowable PM emission for the expanded DAP plant will be 15 lb/hr. The existing stack serving the No. 5 DAP plant will continue to be used. Stack parameters will remain essentially unchanged. Since the allowable PM emissions are decreasing (and the stack height and other stack parameters are essentially unchanged), a net reduction in PM impacts will result from this project.

### 4.4 AMBIENT MONITORING ANALYSIS

Since a net reduction in PM impacts will result from the proposed project, the project can be exempted from preconstruction ambient monitoring requirements.

### 4.5 ADDITIONAL IMPACT ANALYSIS

Also, since a net reduction in PM impacts will result from the proposed project, there will no impacts upon soils and vegetation and no reduction in visibility. Minimal associated growth will occur as a result of this production increase.

# ATTACHMENT B

# EMISSION ESTIMATES FOR NO. 5 DAP PLANT

**ATTACHMENT B**

I. Process Data

Production rate = 146 tons/hr = 292,000 lb/hr
$P_2O_5$ content = 46%
$P_2O_5$ production rate = 146 TPH x 0.46 = 67.16 TPH = 134,320 lb/hr
Maximum operating hours = 8,760 hr/yr

II. Fuel Usage Data

Maximum heat input rate = 15.0 x $10^6$ Btu/hr
Fuel oil @ 140,000 Btu/gal, 0.5% S max
15.0 x $10^6$ Btu/hr ÷ 140,000 Btu/gal = 107.1 gal/hr
Natural gas @ 1,025 Btu/scf
15.0 x $10^6$ Btu/hr ÷ 1,025 Btu/scf = 14,634 scf/hr

III. Emission Calculations

a. Fluorides

Emission limit = NSPS = 0.06 lb/ton $P_2O_5$ input
FL emissions = 67.16 TPH x 0.06 lb/ton = 4.03 lb/hr
4.03 lb/hr x 8,760 hr/yr ÷ 2,000 lb/ton = 17.65 TPY

b. Particulate Matter

Proposed emission limit = 15.0 lb/hr
15.0 lb/hr x 8,760 hr/yr ÷ 2,000 lb/ton = 65.7 TPY
Unit emission rate = 15.0 lb/hr ÷ 67.16 ton/hr
= 0.22 lb/ton $P_2O_5$

c. Sulfur Dioxide

Theoretical emissions from distillate fuel oil burning, based upon AP-42 factors:
Factor = 142 S lb/1,000 gal = 142 x 0.5
= 71 lb $SO_2$/1,000 gal
Emissions = 107.1 gal/hr x 71 lb/1,000 gal
= 7.6 lb/hr
7.6 lb/hr x 8,760 hr/yr ÷
2,000 lb/ton = 33.3 TPY
Natural gas burning: AP-42 factor = 0.6 lb/$10^6$ scf
14,634 scf/hr x 0.6 lb/$10^6$ scf = 0.009 lb/hr

d. Nitrogen Oxides

Fuel oil burning: AP-42 factor = 20 lb/1,000 gal
107.1 gal/hr x 20 lb/1,000 gal = 2.1 lb/hr

Natural gas burning: AP-42 factor = 140 lb/$10^6$ scf
14,634 scf/hr x 140 lb/$10^6$ scf = 2.05 lb/hr

Maximum annual emissions based upon worst-case fuel:
2.1 lb/hr x 8,760 hr/yr / 2,000 lb/ton = 9.2 TPY

e. Carbon Monoxide

Fuel oil burning: AP-42 factor = 5 lb/1,000 gal
107.1 gal/hr x 5 lb/1,000 gal = 0.54 lb/hr

Natural gas burning: AP-42 factor = 35 lb/$10^6$ scf
14,634 scf/hr x 35 lb/$10^6$ scf = 0.51 lb/hr

Annual emissions:
0.54 lb/hr x 8,760 hr/yr / 2,000 lb/ton = 2.35 TPY

f. Nonmethane Volatile Organic Compounds

Distillate fuel oil burning: AP-42 factor (nonmethane)
= 0.2 lb/1,000 gal
107.1 gal/hr x 0.2 lb/1,000 gal = 0.021 lb/hr

Natural gas burning: AP-42 factor (nonmethane)
= 2.8 lb/$10^6$ scf
14,634 scf/hr x 2.8 lb/$10^6$ scf = 0.041 lb/hr

Maximum annual emissions based upon worst-case fuel:
0.041 lb/hr x 8,760 hr/yr / 2,000 lb/ton = 0.18 TPY

# ATTACHMENT C

# AIR POLLUTION CONTROL EQUIPMENT

ATTACHMENT C

Several improvements to the existing scrubber system will be implemented to provide improved control of PM and Fl emissions. These improvements will include the following:

1. Replacing existing cyclone discharge airlock with improved airlock to increase cyclone efficiency and reliability.
2. Venturi scrubbers:
   a. Improve liquid distribution to the venturi throats by installing a larger central spray nozzle and fewer side inlets.
   b. Modify the reactor-granulator venturi scrubber to achieve proper pressure drop at the increased air flow rate.
   c. Modify the cooler/vents venturi scrubber to achieve proper pressure drop at the increased air flow rate.
   d. Add instrumentation in the cooler/vents scrubber to improve level control and reliability.
   e. Maintain the scrubber water quality within proper range.
   f. Maintain current gas-to-liquid ratio in reactor-granulator scrubbers and increase liquor recirculation rate.
3. Tailgas scrubbers:
   a. Increase scrubber water flow rate to control water exit temperature.
   b. Add one flowmeter to allow measurement of water flow to each tailgas scrubber.
   c. Increase number of liquid feed points to ensure optimum efficiency.
   d. Replace packed bed mist eliminator with 6 inches of woven polypropylene mesh.
   e. Increase openings in packing support plate to reduce pluggage.

Provided in Table C-1 are revised scrubber operating data, based on preliminary design data. These data are subject to change upon final design, but the final design scrubber performance will be equivalent to, or better than, the design provided in Table C-1.

Table C-1. Preliminary Scrubber Design Parameters, Expanded No. 5 DAP Plant

| Source | Scrubber Type | Manufacturer | Design Inlet Flow (acfn) | Design Efficiency | Pressure Drop (in. w.g.) | Liquid-Gas Ratio (acf/gal) | Scrubbing Liquid |
|---|---|---|---|---|---|---|---|
| Reactor/Granulator/ Cooler/Vents | Packed Up-flow Tailgas | D.M. Weatherly & Co. | 95,700 | 98.0 | 2.5-10 | 33.6 | Singlepass Pond Water |
| Dryer | Packed Up-flow Tailgas | D.M. Weatherly & Co. | 69,700 | 98.0 | 2.5-10 | 33.6 | Singlepass Pond Water |
| Reactor/Granulator | Venturi | D.M. Weatherly & Co. | 40,000 | 95.0 | 13-18 | 16.0 | Recirculating Phos. Acid |
| Cooler/Vents | Venturi | D.M. Weatherly & Co. | 40,000 | 95.0 | 13-18 | 26.7 | Recirculating Phos. Acid |
| Dryer | Venturi | D.M. Weatherly & Co. | 60,000 | 95.0 | 13-18 | 30.0 | Recirculating Phos. Acid |

# AP-42 EMISSION FACTORS

# TABLE 1.3-1. UNCONTROLLED EMISSION FACTORS FOR FUEL OIL COMBUSTION

## EMISSION FACTOR RATING: A

| Boiler Type[a] | Particulate[b] Matter | | Sulfur Dioxide[c] | | Sulfur Trioxide | | Carbon Monoxide[d] | | Nitrogen Oxide[e] | | Volatile Organics[f] Nonmethane | | Methane | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $kg/10^3$ l | $lb/10^3$ gal | $kg/10^3$ l | $lb/10^3$ gal | $kg/10^3$ l | $lb/10^3$ gal | $kg/10^3$ l | $lb/10^3$ gal | $kg/10^3$ l | $lb/10^3$ gal | $kg/10^3$ l | $lb/10^3$ gal | $kg/10^3$ l | $lb/10^3$ gal |
| Utility Boilers | | | | | | | | | | | | | | |
| Residual Oil | g | g | 19S | 157S | 0.34S[h] | 2.9S[h] | 0.6 | 5 | 8.0 (12.6)(5)[i] | 67 (105)(42)[i] | 0.09 | 0.76 | 0.03 | 0.28 |
| Industrial Boilers | | | | | | | | | | | | | | |
| Residual Oil | g | g | 19S | 157S | 0.24S | 2S | 0.6 | 5 | 6.6[j] | 55[j] | 0.034 | 0.28 | 0.12 | 1.0 |
| Distillate Oil | 0.24 | 2 | 17S | 142S | 0.24S | 2S | 0.6 | 5 | 2.4 | 20 | 0.024 | 0.2 | 0.006 | 0.052 |
| Commercial Boilers | | | | | | | | | | | | | | |
| Residual Oil | g | g | 19S | 157S | 0.24S | 2S | 0.6 | 5 | 6.6 | 55 | 0.14 | 1.13 | 0.057 | 0.475 |
| Distillate Oil | 0.24 | 2 | 17S | 142S | 0.24S | 2S | 0.6 | 5 | 2.4 | 20 | 0.04 | 0.34 | 0.026 | 0.216 |
| Residential Furnaces | | | | | | | | | | | | | | |
| Distillate Oil | 0.3 | 2.5 | 17S | 142S | 0.24S | 2S | 0.6 | 5 | 2.2 | 18 | 0.085 | 0.713 | 0.214 | 1.78 |

[a] Boilers can be approximately classified according to their gross (higher) heat rate as shown below:
Utility (power plant) boilers: >106 x $10^9$ J/hr (>100 x $10^6$ Btu/hr)
Industrial boilers: 10.6 x $10^9$ to 106 x $10^9$ J/hr (10 x $10^6$ to 100 x $10^6$ Btu/hr)
Commercial boilers: 0.5 x $10^9$ to 10.6 x $10^9$ J/hr (0.5 x $10^6$ to 10 x $10^6$ Btu/hr)
Residential furnaces: <0.5 x $10^9$ J/hr (<0.5 x $10^6$ Btu/hr)

[b] References 1-7 and 24-25. Particulate matter is defined in this section as that material collected by EPA Method 5 (front half catch).

[c] References 1-5. S indicates that the weight % of sulfur in the oil should be multiplied by the value given.

[d] References 3-5 and 8-10. Carbon monoxide emissions may increase by factors of 10 to 100 if the unit is improperly operated or not well maintained.

[e] Expressed as $NO_2$. References 1-5, 8-11, 17 and 26. Test results indicate that at least 95% by weight of $NO_x$ is NO for all boiler types except residential furnaces, where about 75% is NO.

[f] References 18-21. Volatile organic compound emissions are generally negligible unless boiler is improperly operated or not well maintained, in which case emissions may increase by several orders of magnitude.

[g] Particulate emission factors for residual oil combustion are, on average, a function of fuel oil grade and sulfur content:
Grade 6 oil: 1.25(S) + 0.38 $kg/10^3$ liter [10(S) + 3 $lb/10^3$ gal] where S is the weight % of sulfur in the oil. This relationship is based on 81 individual tests and has a correlation coefficient of 0.65.
Grade 5 oil: 1.25 $kg/10^3$ liter (10 $lb/10^3$ gal)
Grade 4 oil: 0.88 $kg/10^3$ liter (7 $lb/10^3$ gal)

[h] Reference 25.

[i] Use 5 $kg/10^3$ liters (42 $lb/10^3$ gal) for tangentially fired boilers, 12.6 $kg/10^3$ liters (105 $lb/10^3$gal) for vertical fired boilers, and 8.0 $kg/10^3$ liters (67 $lb/10^3$ gal) for all others, at full load and normal (>15%) excess air. Several combustion modifications can be employed for $NO_x$ reduction: (1) limited excess air can reduce $NO_x$ emissions 5-20%, (2) staged combustion 20-40%, (3) using low $NO_x$ burners 20-50%, and (4) ammonia injection can reduce $NO_x$ emissions 40-70% but may increase emissions of ammonia. Combinations of these modifications have been employed for further reductions in certain boilers. See Reference 23 for a discussion of these and other $NO_x$ reducing techniques and their operational and environmental impacts.

[j] Nitrogen oxides emissions from residual oil combustion in industrial and commercial boilers are strongly related to fuel nitrogen content, estimated more accurately by the empirical relationship:
kg $NO_2/10^3$ liters = 2.75 + 50(N)$^2$ [lb $NO_2/10^3$gal = 22 + 400(N)$^2$] where N is the weight % of nitrogen in the oil. For residual oils having high (>0.5 weight %) nitrogen content, use 15 kg $NO_2/10^3$ liter (120 lb $NO_2/10^3$gal) as an emission factor.

## TABLE 1.4-1. UNCONTROLLED EMISSION FACTORS FOR NATURAL GAS COMBUSTION[a]

| Furnace size & type ($10^6$ Btu/hr heat input) | Particulate[b] | | Sulfur dioxide[c] | | Nitrogen oxides[d] | | Carbon monoxide[e] | | Volatile organics | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Nonmethane | | Methane | |
| | $kg/10^6 m^3$ | $lb/10^6 ft^3$ | $kg/10^6 m^3$ | $lb/10^6 ft^3$ | $kg/10^6 m^3$ | $lb/10^6 ft^3$ | $kg/10^6 m^3$ | $lb/10^6 ft^3$ | $kg/10^6 m^3$ | $lb/10^6 ft^3$ | $kg/10^6 m^3$ | $lb/10^6 ft^3$ |
| Utility boilers (> 100) | 16 - 80 | 1 - 5 | 9.6 | 0.6 | 8800[h] | 550[h] | 640 | 40 | 23 | 1.4 | 4.8 | 0.3 |
| Industrial boilers (10 - 100) | 16 - 80 | 1 - 5 | 9.6 | 0.6 | 2240 | 140 | 560 | 35 | 44 | 2.8 | 48 | 3 |
| Domestic and commercial boilers (< 10) | 16 - 80 | 1 - 5 | 9.6 | 0.6 | 1600 | 100 | 320 | 20 | 84 | 5.3 | 43 | 2.7 |

[a]Expressed as weight/volume fuel fired.
[b]References 15-18.
[c]Reference 4. Based on avg. sulfur content of natural gas, 4600 $g/10^6$ $Nm^3$ (2000 $gr/10^6$ scf).
[d]References 4-5, 7-8, 11, 14, 18-19, 21.
[e]Expressed as $NO_2$. Tests indicate about 95 weight % $NO_x$ is $NO_2$.
[f]References 4, 7-8, 16, 18, 22-25.
[g]References 16, 18. May increase 10 - 100 times with improper operation or maintenance.
[h]For tangentially fired units, use 4400 $kg/10^6$ $m^3$ (275 $lb/10^6$ $ft^3$). At reduced loads, multiply factor by load reduction coefficient in Figure 1.4-1. For potential $NO_x$ reductions by combustion modification, see text. Note that $NO_x$ reduction from these modifications will also occur at reduced load conditions.