

# New Wales Chemicals, Inc.

A Subsidiary of International Minerals & Chemical Corporation



P.O. Box 1035 • Mulberry, Florida 33860 • Phone: (813) 428-2531

*Skues*

**D.E.R.**

SEP 6 1979

**SOUTHWEST DISTRICT  
TAMPA**

August 31, 1979

Mr. Dan A. Williams, P. E.  
District Air Engineer  
Florida Department of Environmental Reg.  
7601 Highway 301 N.  
Tampa, Florida 33610

Dear Sir:

Enclosed please find the original and four (4) copies of an application to construct a DAP plant at New Wales.

Please note that the PSD portion of the application is not completed. We plan to submit the PSD data separately and would appreciate it if you could begin now your review of the construction and BACT portion of the application.

I am also enclosing the required fee of \$20.

Concurrently with this submitted to your office, we will also submit this application to EPA Region IV.

If you have any questions about this information, please do not hesitate to contact us.

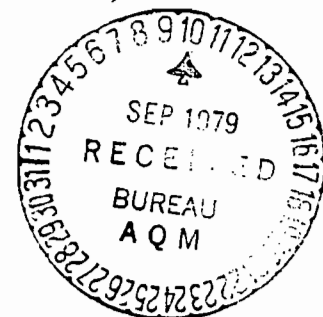
Sincerely,

*A. L. Girardin #*

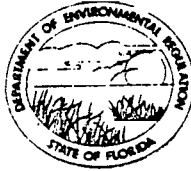
A. L. Girardin, III  
Environmental Services Supervisor

ALG:rc

Enclosures:



*juicy*



AC 23546

D.I.E.R.

SEP 6 1979

SOUTHWEST DISTRICT  
TAMPA

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL REGULATION  
APPLICATION TO OPERATE/CONSTRUCT  
AIR POLLUTION SOURCES

SOURCE TYPE: Air Pollution  New<sup>1</sup>  Existing<sup>1</sup>  
APPLICATION TYPE:  Construction  Operation  Modification  
COMPANY NAME: New Wales Chemicals, Inc. COUNTY: Polk

Identify the specific emission point source(s) addressed in this application (i.e. Lime Kiln No. 4 with Venturi Scrubber; Peeking Unit No. 2, Gas Fired): DAP Plant With Venturi And Tailgas Scrubbers

SOURCE LOCATION: Street Highway 640-Hillsborough & Polk City Mulberry  
UTM: East 396.7 County Line North 3079.4  
Latitude      °      '      "N Longitude      °      '      "W

APPLICANT NAME AND TITLE: Thomas L. Craig, Vice-President & General Manager  
APPLICANT ADDRESS: P. O. Box 1035, Mulberry, Florida 33860

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative\* of New Wales Chemicals, Inc.

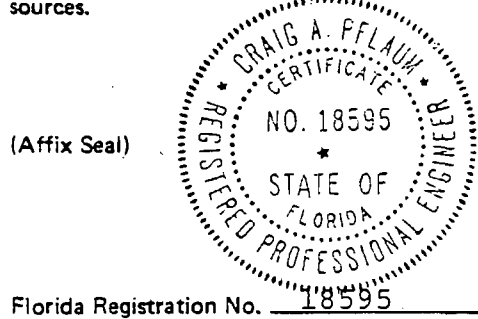
I certify that the statements made in this application for a construction permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision 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: Thomas L. Craig  
Thomas L. Craig, Vice-Pres. & Gen. Mgr.  
Name and Title (Please Type)  
Date: 8-31-79 Telephone No. 813-428-2531

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

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



(Affix Seal)

Florida Registration No. 18595

Signed: Craig A. Pflaum PE  
Craig A. Pflaum  
Name (Please Type)  
New Wales Chemicals, Inc.  
Company Name (Please Type)  
P. O. Box 1035, Mulberry, Fl. 33860  
Mailing Address (Please Type)  
Date: 8-31-79 Telephone No. 813-428-2531

<sup>1</sup>See Section 17-2.02(15) and (22), Florida Administrative Code, (F.A.C.)

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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.

A 140 TPH DAP plant is planned with coaxial venturi scrubbers followed by vertical packed bed scrubbers for fluoride removal. Emissions from this plant will meet NSPS.

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

Start of Construction July, 1980 Completion of Construction July, 1983

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.)

Estimated purchase and installation cost \$6,000,000. for scrubbing systems.

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

None

E. Is this application associated with or part of a Development of Regional Impact (DRI) pursuant to Chapter 380, Florida Statutes, and Chapter 22F-2, Florida Administrative Code? Yes X No

F. Normal equipment operating time: hrs/day 24 ; days/wk 6.6 ; wks/yr 50 ; if power plant, hrs/yr ;

if seasonal, describe: 24 x 6.6 x 50 = 7920 hrs/yr

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

- 1. Is this source in a non-attainment area for a particular pollutant? No
a. If yes, has "offset" been applied?
b. If yes, has "Lowest Achievable Emission Rate" been applied?
c. If yes, list non-attainment pollutants.
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) requirements 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

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		
Phosphoric acid	F	2.0	70 TPH (P2O5)	Reactors/Venturi Scrubbers
Ammonia	-	-	30 TPH	Reactors/Granulators

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

1. Total Process Input Rate (lbs/hr): 140 TPH

2. Product Weight (lbs/hr): 140 TPH

C. Airborne Contaminants Emitted:

Name of Contaminant	Emission <sup>1</sup>		Allowed Emission <sup>2</sup> Rate per Ch. 17-2, F.A.C.	Allowable <sup>3</sup> Emission lbs/hr	Potential Emission <sup>4</sup>		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
Fluoride	4.0/ ≤ 16.5		0.06 lbs F/ton P2O5	≤ 4.0	unknown		stacks
Particulate	38.0/ ≤ 150.0		process wt.	≤ 38.0	unknown		stacks/ bag coll.
Ammonia	10.0/ ≤ 40.0		not regulated	- - - - -	- - - - -		stacks
SO <sub>2</sub>	Intermittent		- - - - -	- - - - -	- - - - -		stacks

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

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles <sup>5</sup> Size Collected (in microns)	Basis for Efficiency (Sec. V, It <sup>5</sup> )
4/ea. Venturi Scrubbers	F	to comply		
	Part.	with std.		
4/ea. Tailgas Scrubbers	F			
	Part.			
1/ea. Bag Collector	Part.			

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

<sup>2</sup> Reference applicable emission standards and units (e.g., Section 17-2.05(6) Table II, E. (1), F.A.C. - 0.1 pounds per million BTU heat input)

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

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

<sup>5</sup> If Applicable

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E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
#6 Fuel Oil	Intermittent	- - - - -	- - - - -

\*Units Natural Gas, MMCF/hr; Fuel Oils, barrels/hr; Coal, lbs/hr

Fuel Analysis:

Percent Sulfur: 2.5 Percent Ash: 0.02  
 Density: 8.0 lbs/gal Typical Percent Nitrogen: 0.15  
 Heat Capacity: 18,000. BTU/lb 144,000. BTU/gal  
 Other Fuel Contaminants (which may cause air pollution): \_\_\_\_\_

F. If applicable, indicate the percent of fuel used for space heating. Annual Average \_\_\_\_\_ Maximum \_\_\_\_\_

G. Indicate liquid or solid wastes generated and method of disposal.  
All solid waste will be recycled to process.  
All liquid waste will be routed to cooling pond.

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):  
 Stack Height: blower discharge 80' ft. Stack Diameter: 6' ea. ft.  
 Gas Flow Rate: 250,000 DSCFM TOT. ACFM Gas Exit Temperature: 100° °F.  
 Water Vapor Content: 2-5 % Velocity: 65 FPS

*111244 ACCM ea solvent  
55622 ACCM house - 340°K*

### SECTION IV: INCINERATOR INFORMATION

Not applicable

Type of Waste	Type O (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Pathological)	Type V (Liq & Gas By-prod.)	Type VI (Solid By-prod.)
Lbs/hr Incinerated:							

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

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

Approximate Number of Hours of Operation per day \_\_\_\_\_ days/week

Manufacturer: \_\_\_\_\_

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

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

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

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

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

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

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

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

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### SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight — show derivation.
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.
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
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, etc.).
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).
6. An 8½" 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.
7. An 8½" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Example: Copy of relevant portion of USGS topographic map).
8. An 8½" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.

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9. An application fee of \$20, unless exempted by Section 17-4.05(3), F.A.C. 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?  
 Yes  No

Contaminant	Rate or Concentration
Fluorides	0.060 lbs/ton of P2O5 feed

B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)  Yes  No

Contaminant	Rate or Concentration

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

Contaminant	Rate or Concentration
Fluorides	≤ 0.060 lbs/ton P2O5 feed

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

1. Control Device/System: Teller design coaxial venturis with a horizontal packed bed scrubber.
2. Operating Principles: Condensation, absorption, and inertial impact.
3. Efficiency: \* to meet standards
4. Capital Costs: 3,000,000.00
5. Useful Life: life of plant
6. Operating Costs: 10-15% of raw material
7. Energy: 8.5 x 10<sup>6</sup> KWH/yr.
8. Maintenance Cost: cost
9. Emissions:

Contaminant	Rate or Concentration
Fluoride	≤ 0.06 lbs/ton P2O5 input
Particulate	≤ process wt. limits
Ammonia	≤ 6.5 lbs/hr

\* Explain method of determining D 3 above.

10. Stack Parameters

- a. Height: 100 ft. b. Diameter: 6 ft.  
c. Flow Rate: 100,000 *Per Design Parameter* ACFM d. Temperature: 100-110 °F  
e. Velocity: 60 FPS

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

1. Teller design low pressure drop coaxial venturi scrubbing with

- a. Control Device: crossflow wet packed bed tailgas scrubbing.  
b. Operating Principles: Condensation, absorption and inertial impact.  
c. Efficiency\*: to meet standards d. Capital Cost: dependent on plant size  
e. Useful Life: life of plant f. Operating Cost: operation and maintenance  
g. Energy\*: dependent on plant size h. Maintenance Cost: cost est. to be 10-15% of raw material cost  
i. Availability of construction materials and process chemicals:  
Good  
j. Applicability to manufacturing processes: Add on system to control emissions.  
k. Ability to construct with control device, install in available space, and operate within proposed levels:

Proven technology

2.

- a. Control Device: Coaxial venturi with vertical packed bed scrubber.  
b. Operating Principles: Condensation, absorption and inertial impact.  
c. Efficiency\*: to meet standards d. Capital Cost: dependent on plant size  
e. Useful Life: life of plant f. Operating Cost: & maintenance - 10-15%  
g. Energy\*\*: dependent on plant size h. Maintenance Costs: of raw material cost  
i. Availability of construction materials and process chemicals:  
Good  
j. Applicability to manufacturing processes: Add on system to control emissions.  
k. Ability to construct with control device, install in available space, and operate within proposed levels:

Proven technology

\*Explain method of determining efficiency.

\*\*Energy to be reported in units of electrical power - KWH design rate.

3.

- a. Control Device:  
b. Operating Principles:  
c. Efficiency\*:  
d. Capital Cost:  
e. Life:  
f. Operating Cost:  
g. Energy:  
h. Maintenance Cost:

\*Explain method of determining efficiency above.



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- 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\*:
  - d. Capital Cost:
  - e. Life:
  - f. Operating Cost:
  - g. Energy:
  - h. Maintenance Cost:
  - i. Availability of construction materials and process chemicals:
  - j. Applicability to manufacturing processes:
  - k. Ability to construct with control device, install in available space, and operate within proposed levels:

**F. Describe the control technology selected:**

1. Control Device: Coaxial venturi with vertical packed bed tailgas scrubber.
2. Efficiency\*: to meet standards
3. Capital Cost: \$6,000,000.00
4. Life: life of plant
5. Operating Cost: Estimated combined cost to be 10-15% of raw material cost
6. Energy: 16 x 10<sup>6</sup> KWH/yr.
7. Maintenance Cost: to be 10-15% of raw material cost
8. Manufacturer: Davy McKee Lakeland, Inc.
9. Other locations where employed on similar processes:
  - a. Similar scrubbing system designed by D. M. Weatherly.
    - (1) Company: USS Agri-Chemicals
    - (2) Mailing Address: Box 150
    - (3) City: Bartow
    - (4) State: Florida 33830
    - (5) Environmental Manager: Jim Carroll
    - (6) Telephone No.: 813-533-0471

\*Explain method of determining efficiency above.

Contaminant	Rate or Concentration
Fluoride	< 0.06 lbs/ton P2O5 process input
Particulate	process wt. limits
SO2	unknown
Ammonia	unknown
(8) Process Rate*:	72 TPH

- b.
  - (1) Company:
  - (2) Mailing Address:
  - (3) City:
  - (4) State:

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

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions\*:

Contaminant	Rate or Concentration
_____	_____
_____	_____
_____	_____

(8) Process Rate\*:

10. Reason for selection and description of systems:

New Wales has had extensive conversations with DAP plant operators and their environmental personnel in this area. Because of our contacts we have concluded that the vertical packed tailgas scrubber, which is currently in use at USS Agri-Chemicals, is the most efficient fluoride removal device currently available. ✓

\*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**

PSD data to be submitted separately.

**A. Company Monitored Data**

1. \_\_\_\_\_ no sites \_\_\_\_\_ TSP \_\_\_\_\_ ( ) SO<sup>2</sup>\* \_\_\_\_\_ 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.

**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. Applicant's Maximum Allowable Emission Data**

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

**E. Emission Data Used in Modeling**

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

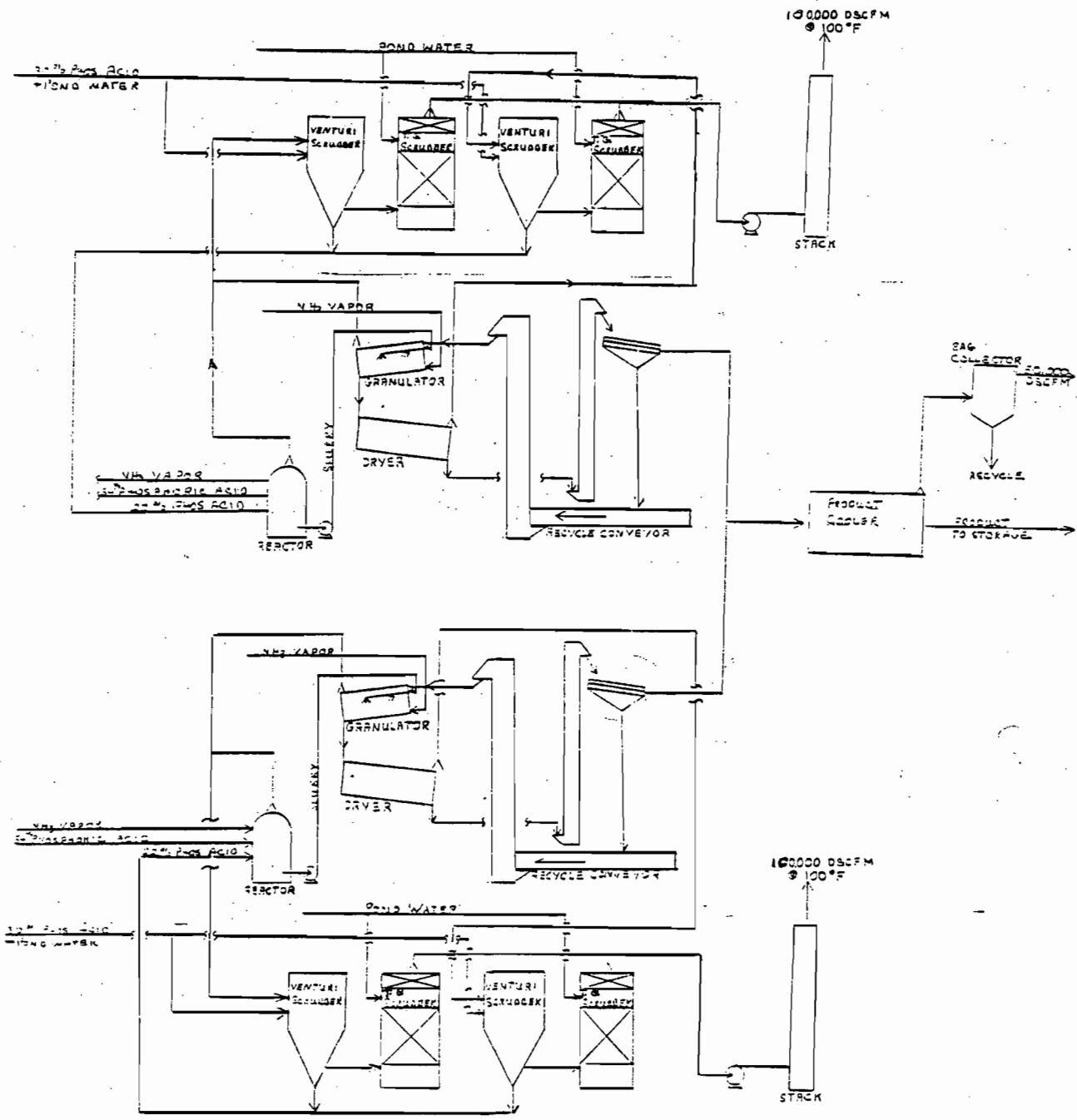
**F. Attach all other information supportive to the PSD review.**

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

**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.**

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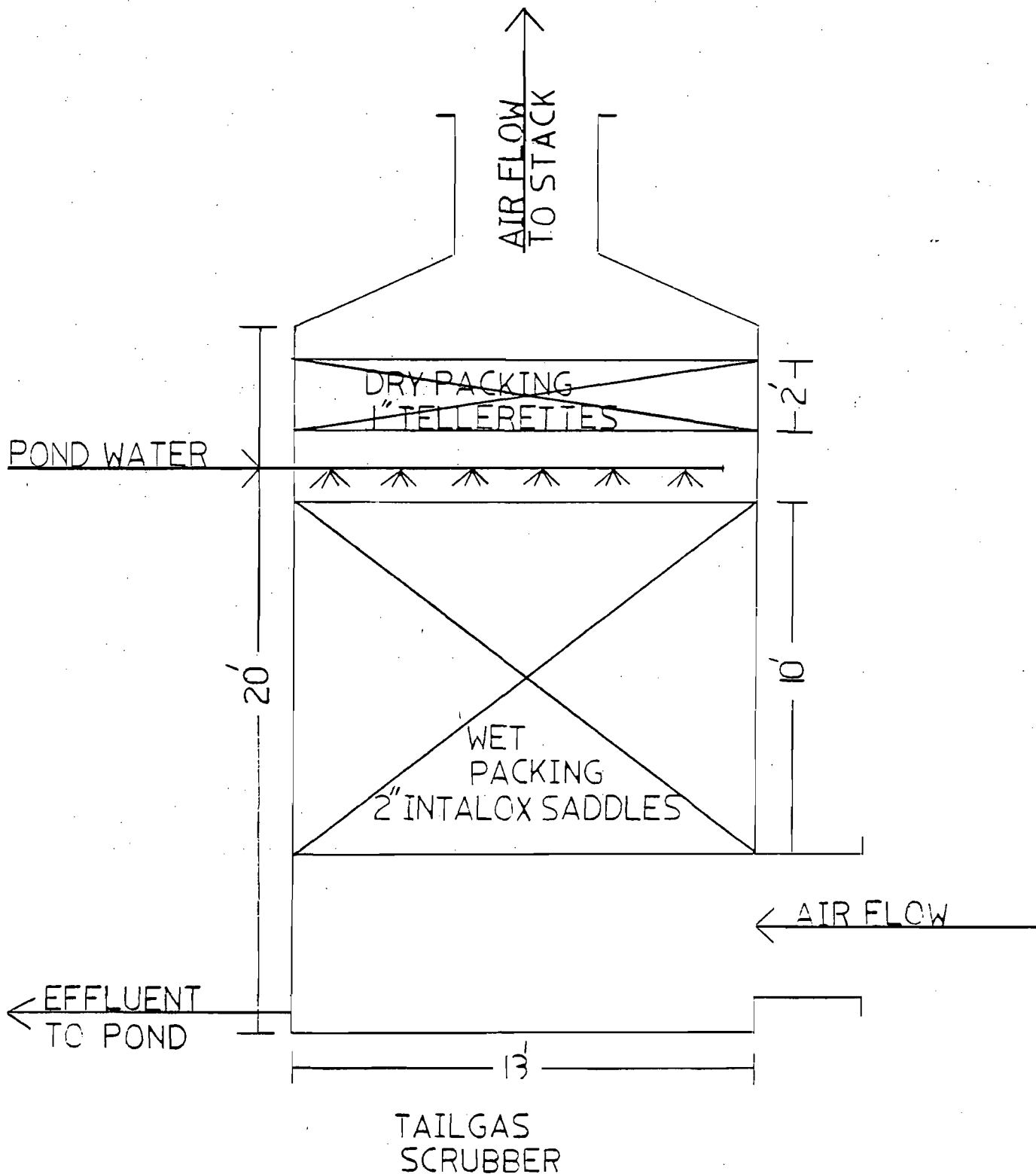


DAP PLANT WITH DUAL REACTOR/GRANULATORS + COMMON COOLER



PROJECT DAP PLANT

FOR	AT	SKETCH NO.	1
DESCRIPTION		DATE	8/29/79
		BY	ALC



HARRY L. CARROLL

Vice President

Florida



INTERNATIONAL MINERALS & CHEMICAL CORPORATION

November 22, 1978

Mr. T. L. Craig  
Vice President & General Manager  
New Wales Chemicals, Inc.  
Post Office Box 1035  
Mulberry, Florida 33860

Dear Tom:

This letter is your authorization to sign on behalf of New Wales Chemicals, Inc. the various applications for permits, specifically the applications for operating permits from the Florida Department of Environmental Regulation.

Very truly yours,

A handwritten signature in cursive script that reads "Harry L. Carroll". The signature is written in dark ink and is positioned above the typed name.

Harry L. Carroll

t

# STATE OF FLORIDA

DEPARTMENT OF STATE • DIVISION OF CORPORATIONS

I certify from the records of this office that **EMC CHEMICALS CORP.**, changed its name to; **NEW WALES CHEMICALS, INC.**, is a corporation organized under the Laws of the State of Delaware, authorized to transact business within the State of Florida, qualified on the 1st day of June, 1977, under the new name.

I further certify that said corporation has paid all fees due this office through December 31, 1977 and its status is active.



GIVEN under my hand and the Great Seal of the State of Florida, at Tallahassee, the Capital, this the 1st day of June 1977.

*Buc. [Signature]*

SECRETARY OF STATE

Mr. Larry George  
Florida Department of Environmental Regulation

2

February 13, 1980

## 1.0 SUMMARY

Proposed particulate matter emission rates for new and proposed sources have been developed. These emission rates represent significant reductions over allowable emission rates, in many cases, and more closely reflect actual emission rates from the various sources. These emission rates are discussed in Section 2.0.

Total suspended particulate matter monitoring data from the New Wales monitoring site No. 1 were analyzed for a five-year period and annual and 24-hour average background levels developed. It was determined that a reasonable annual average total suspended particulate matter background concentration of 32.7 micrograms per cubic meter is appropriate for the area. The 24-hour total suspended particulate matter background level developed was 57.0 micrograms per cubic meter. The development of these background concentrations is presented in Section 3.0.

Air quality modeling was conducted to determine the annual and 24-hour average impact of new, existing and proposed sources at the New Wales Chemical Complex. The results of this modeling are summarized in Table 1 and Figure 1. The results show that the maximum new source impact will be 36.6 micrograms per cubic meter for a 24-hour period and 11.0 micrograms per cubic meter for the annual average period. These impacts compare with allowable Class II PSD increments of 37.0 micrograms per cubic meter for a 24-hour period and 19.0 micrograms per cubic meter for an annual average period.

The maximum total suspended particulate matter impact of all sources at the New Wales Chemical Complex was determined to be 148 micrograms per cubic meter for a 24-hour period and 69 micrograms per cubic meter for an annual average period. Both impacts include background concentrations. These predicted concentrations compare with ambient air quality standards of 150 micrograms per cubic meter for a 24-hour period and 60 micrograms per cubic meter for an annual average period.

It should be noted that all impacts occur on New Wales property well within the New Wales property line.

## 2.0 SOURCE EMISSION DATA

Air quality modeling at maximum allowable particulate matter emission rates from proposed and existing sources at the New Wales Chemical Complex indicates there will be predicted violations of the 24-hour and annual average ambient air quality standards. In many cases, however, the actual particulate matter emission rates from a source is much less than the maximum allowable emission rate. This is particularly true where a materials handling source is controlled with a bag collector and where allowable particulate matter emission rates have been established by the Process Weight Table (Chapter 17-2.05 Florida Administrative Code). In such cases, the allowable particulate matter emission rate might be in the range of 30 to 40 pounds per hour and the actual emission rate in the range of 2 to 5 pounds per hour.



TABLE 1

SUMMARY OF PARTICULATE MATTER IMPACTS  
ON AIR QUALITY

NEW WALES CHEMICALS, INC.  
POLK COUNTY, FLORIDA

Time Period	New Source Impact (ug/m <sup>3</sup> )	Class II PSD Increment (ug/m <sup>3</sup> )	All Source Impact* (ug/m <sup>3</sup> )	Air Quality Standard (ug/m <sup>3</sup> )
Annual	11	19	59	60
24-Hour				
1A	36.6	37	126.6	150
2	29.5		111.4	
3	22.9		93.1	
4	29.2		108.9	
5	35.2		147.6	

\* Includes background: Annual - 33 ug/m<sup>3</sup>  
24-Hour - 57 ug/m<sup>3</sup>

ASSESSMENT OF AIR POLLUTION  
CONTROL TECHNOLOGY FOR  
PROPOSED DIAMMONIUM PHOSPHATE  
FERTILIZER PLANT

NEW WALES CHEMICALS, INC.  
POLK COUNTY, FLORIDA

JANUARY 11, 1980

SHOLTES & KOGLER  
ENVIRONMENTAL CONSULTANTS  
1213 NW 6TH STREET  
GAINESVILLE, FLORIDA 32601  
(904) 377-5822

## 1.0 DIAMMONIUM PHOSPHATE PLANT SCRUBBER SYSTEM

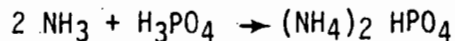
### 1.1 Introduction

The information in this section is related to the scrubber system that New Wales is proposing to control particulate matter, ammonia and fluoride emissions from the reactor/granulator and the dryer of the proposed DAP plant. Included is a brief description of the process chemistry as it relates to air pollution control and an evaluation of various scrubber systems.

### 1.2 Process Description

Diammonium phosphate is obtained by the reaction of ammonia with phosphoric acid. A flow diagram of the basic process is shown in Figure 1-1.

Anhydrous ammonia and phosphoric acid (about 40%  $P_2O_5$ ) are reacted in a preneutralizer. The primary reaction is:



The slurry thus produced flows into an ammoniator-granulator and is distributed over a bed of recycled fines. Ammoniation to the required mole ratio of 2.0 takes place in the granulator by injecting ammonia under the rolling bed of solids. It is necessary to feed excess ammonia

to the granulator to achieve a 2.0 mole ratio. Excess ammonia and water vapor driven off by the heat of reaction are directed to a scrubber which uses phosphoric acid as the scrubbing liquid. The ammonia is almost completely recovered by the phosphoric acid scrubbing liquid and recycled to the preneutralizer.

Granulated diammonium phosphate is then sent to a dryer, and is then screened. Undersized and crushed oversized material are recycled to the granulator. Product sized material is cooled and sent to storage.

The sources of air pollutants in a DAP plant are identified in Figure 1-1. The sources include the reactor/granulator, the drier and the screens and cooler. Ammonia,  $\text{SiF}_4$  and HF are emitted from the reactor/granulator. These same three pollutants plus particulate matter are emitted from the dryer and particulate matter only is emitted from the screens and cooler.

### 1.3. Scrubber Considerations

Because of the characteristics of the emissions from these three sources, New Wales proposes to use scrubbers to control the emissions from the reactor/granulator and dryer systems and a bag collector to control emissions from the cooler. The bag collector will be discussed in Section 2.0.

Emission control technology applied to DAP production serves three purposes: (1) recovery of ammonia; (2) recovery of particulate matter; and (3) prevention of emissions of ammonia, fluorides and particulate

matter. Reactor/granulator emissions are vented directly to a wet scrubber system, while emissions from the dryer pass through cyclone collectors for product recovery and recycle before passing to a wet scrubber system.

Because of the multipurpose of the scrubber system, a dual system is used throughout the industry. There is a primary scrubber system designed to recover ammonia and particulate matter and a secondary system designed to control fluoride emissions.

The chemistry for ammonia recovery is identical to the process chemistry discussed earlier. Ammonia is scrubbed from offgases with excess phosphoric acid where it reacts to form ammonium phosphates which are retained in the scrubbing liquor. Particulate matter is also controlled with these scrubbers.

Equipment commonly used for primary scrubbing includes venturis and cyclonic spray towers. Primary scrubbers generally use 20 percent to 30 percent  $P_2O_5$  phosphoric acid as scrubbing liquor principally to recover ammonia.

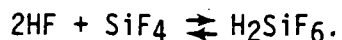
The common practice in industry is to use a venturi scrubber for the primary scrubbing system because of the efficiencies which can be obtained with these units, the fact that sprays are not necessary to distribute the phosphoric acid scrubbing liquor in the scrubber, and the fact that venturi scrubbers are self-cleaning.

With cyclonic scrubbers spray nozzles are required to distribute the scrubbing liquor in the scrubber. Because of impurities in the acid and the possibility of reaction products (ammonium phosphates, ammonium fluorosilicates and silicates) developing, the potential for nozzle plugging is very high. From a practical standpoint; therefore, cyclonic scrubbers have not been widely used.

The New Wales Chemical Company is proposing to use a coaxial venturi scrubber. A schematic diagram of one of these scrubbers is presented as Figure 1-2.

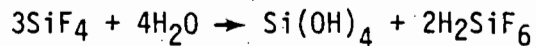
The coaxial venturi scrubber gets its name from the fact that it is a cylindrical scrubber with the separator constructed concentrically around the venturi. The scrubbing liquor is flooded into the throat and atomization occurs as a result of the velocity of the gas passing through the throat. The scrubber will operate at a pressure drop in the range of 12 to 14 inches of water. As stated previously, the primary function of this scrubber is to remove and recover ammonia and particulate matter prior to the gases passing into a tail gas scrubber for fluoride control.

Fluorides are scrubbed from offgases in the secondary scrubbing system according to the reactions:



High temperature tends to increase the vapor pressure at both HF and SiF<sub>4</sub> in the HF-SiF<sub>4</sub>-scrubber water system and, hence drive the reaction to the left. These vapor pressures set the lower limit of concentration in the gas phase leaving the scrubber.

In addition to the reactions given, hydrolysis of SiF<sub>4</sub> occurs when the concentration of this component is higher than the vapor pressure equilibrium values, according to:



This reaction tends to occur as the temperature of a gas stream is reduced in the presence of water, or the pH of the water is increased. This leads to the formation of gelatinous deposits of polymeric silica which tend to plug scrubber packings. The types of scrubbers which are likely to perform well in this service are:

- (1) Spray sections
- (2) Wet cyclonic scrubbers
- (3) Venturi scrubbers
- (4) Packed scrubbers

Spray sections are not capable of the high efficiencies required for compliance with present regulations. They may; however, be useful as a preconditioner to cool the gas stream and remove fluorides at relatively high concentration levels. They have relatively little pressure drop and can be used to bring large volumes of pond water into contact with the gas to reduce the temperature and improve the absorption equilibrium.

Wet cyclones are also limited in efficiency, but may be used as precoolers. They have a higher pressure drop requirement at high liquid flows than do the spray chambers and are therefore not commonly used.

Venturi scrubbers can bring about effective contact and gas absorption when sufficient energy is imparted to the gas to atomize the scrubbing liquor and create very small droplets. The contact time in a venturi is very short, and it has been found that the power requirements at a given level of fluoride absorption are high as compared with packed scrubbers.

The spray packed bed scrubber is the most commonly used scrubber for fluoride control. These scrubbers consist of two sections--a spray chamber and a packed bed. Both spray and packed sections are equipped with a gas inlet. Effluent streams with relatively high fluoride concentrations--particularly those rich in silicon tetrafluoride--are treated in the spray chamber before entering the packing. This preliminary scrubbing removes silicon tetrafluoride, thereby minimizing bed plugging. It also reduces packed stage loading and provides some solids handling capacity.

The spray section consists of a series of counter-current spray manifolds followed by a system of irrigated baffles or a dewatering section. The baffles or dewatering section remove precipitated silica and prevent the formation of scale in the spray chamber and plugging of the packed section.

Counter-current packed scrubbers have an inherent advantage over concurrent or cross-flow scrubbers for gas absorption applications where the concentration of contaminant leaving the scrubber approaches equilibrium with the scrubbing liquor. This advantage is most clearly explained by reference to Figure 1-3.

Here the concentration of contaminant in the gas phase is plotted as a function of position in the scrubber.  $Y_1$  represents the inlet concentration and  $Y_2$  the outlet concentration. In a counter-current scrubber, the liquor contains some of the contaminant and has a composition such that gas in equilibrium with it would have a concentration  $Y_2'$  at the gas outlet, and  $Y_1'$  at the gas inlet. The difference between  $Y$  and  $Y'$  at any point in the scrubber is the absorption driving force.



The counter-current scrubber has the highest potential removal efficiency, because it contacts the gas leaving the scrubber with the cleanest scrubbing liquor.

The concurrent scrubber does just the opposite and tends to bring the discharge gas into equilibrium with the most contaminated liquor. However, the concurrent scrubbers are considerably less prone to plugging with solids than the counter-current, and also require less gas pressure drop to operate.

The cross-flow scrubber is a compromise between the counter-current and concurrent flow scrubbers. With these scrubbers the gas flow is horizontal through the scrubber with water being sprayed on the top of the packing and flowing vertically through the scrubber. There is an increase in the fluoride concentration of the scrubber water as it passes from the top to the bottom of the scrubber. This gradient is essentially constant throughout the length of the packing. This results in the flat vapor pressure curve for the scrubber water in a cross-flow scrubber as shown in Figure 1-3.

Theoretically, it is the fluoride vapor pressure over pond water at the exit of the packing in a tail gas scrubber that establishes the minimum fluoride concentration that can be achieved by scrubbing. The degree to which this concentration is approached depends upon the number of transfer units designed into a scrubber. In the case of New Wales, approximately six to seven transfer units are designed into the tail gas scrubbers. This will be adequate to meet New Source Performance Standards which is the requirement for fluoride control in the sources proposed by

New Wales. The New Source Performance Standards are the limiting standards since the total actual fluoride emission increase will be less than 50 tons per year.

#### 1.4 Summary

The overall scrubbing system, consisting of the primary scrubber and the secondary scrubber, in the DAP plant must be designed with Best Available Control Technology for particulate matter in mind since the actual increase in particulate matter emissions resulting from the proposed expansion will exceed 50 tons per year. As previously discussed in this section, ~~the primary scrubbing system - the coaxial venturi scrubber - was designed to reduce the concentration of particulate matter emissions in the gas stream to approximately 0.01 grains per standard cubic foot, dry.~~ This scrubber was also designed to remove and recover ammonia. The secondary scrubber - the packed bed scrubber - was designed to remove fluorides from the tail gas stream before the gas stream is exhausted to the atmosphere. As discussed; however, there is a reaction that creates particulate matter [ $\text{Si(OH)}_2$  and  $\text{SiO}_2$ ] within the tail gas scrubber. This particulate matter causes the packing to plug and is responsible for a periodic shut down of the DAP plant for scrubber cleaning.

In addition to plugging the tail gas scrubber, ~~some of this particulate matter breaks through the scrubber and increases the particulate matter concentration in the tail gas stream being exhausted to the atmosphere to a maximum of 0.02 grains per standard cubic foot, dry.~~ It should be noted that this maximum concentration will occur just prior to the shutdown of the scrubber for cleaning. Immediately after cleaning ~~the particulate matter concentration in the tail gas stream will approach~~

~~0.01 grains per standard cubic foot, dry. This concentration will then increase to the 0.02 grains per standard cubic foot, dry as the packing plugs.~~

As reported herein, the plugging of the tail gas scrubber is due to the formation of silicon hydroxide and silicon dioxide. Both occur as levels of  $\text{SiF}_4$  in the tail gas stream exceed equilibrium concentrations. This occurs when the temperature of the tail gas stream is reduced or when the pH of the scrubber water increases. The latter would occur when ammonia breaks through the primary scrubber as a result of slight upsets in plant operating conditions.

To summarize the control of air pollutant emissions from the reactor/granulator and dryer it can be stated that the particulate matter and ammonia are well controlled by the primary scrubbing system and that fluorides are well controlled by the packed secondary scrubber. The problem inherent with DAP scrubbing systems is the formation of silicon compounds in the packed secondary scrubber which cause scrubber plugging and increase the concentration of particulate matter in the tail gas stream. The effectiveness of the overall scrubbing system; therefore, depends upon the design and operation of the tail gas scrubber in a manner that will reduce the effects of the silicon compounds. Both the design and the operation are more dependent upon experience than theory.

#### 1.5 Proposed New Wales DAP Scrubber System

In view of the above considerations, experience New Wales has had with their existing DAP plant and experience other phosphate fertilizer companies have had with other control systems, New Wales is proposing the following control system:

1. A coaxial venturi scrubber - separator operating at 12 to 14 inches of water pressure drop to control ammonia and particulate matter emissions from the reactor/granulators. There will be two such scrubbers, one for each of the two identical reactor/granulator systems.
2. Identical coaxial venturi scrubber - separators will be used to control ammonia and particulate matter emissions from the two identical dryers.
3. Counter-current flow packed tail gas scrubbers will follow each of the venturi scrubbers for fluoride control. Each of the packed scrubbers will be preceded by a spray chamber to precondition the gas. The spray chamber will reduce the temperature of the gas stream, reduce to some extent the fluoride level in the gas stream and provide some capability for particulate matter control. The pond water introduced in the spray chamber will be removed in a dewatering section at the base of the tail gas scrubber. The dewatering section will consist of a section of scrubber shell containing no packing. The gas velocity in this section will be low enough to permit the separation of water droplets and precipitated silicon compounds from the gas stream before the gas stream enters the packing.

The gas stream will then pass through the packed section counter-current to pond water introduced at the top of the packing. Mist eliminators will follow the packing section to eliminate water droplets prior to the tail gas being discharged to the atmosphere.

The venturi scrubbers were selected because of the particulate matter and ammonia removal efficiencies which can be obtained with these scrubbers. The venturi scrubber is also self-cleaning and the fact that spray nozzles are not required to distribute the scrubbing liquor in the scrubber eliminates another potential operational problem.

The counter-current flow tail gas scrubber was selected because it can effectively reduce fluoride emissions required by New Source Performance Standards with a minimum pressure drop. The counter-current design was selected because recent applications of this type scrubber within the industry have proved to have fewer operating problems than the conventional cross-flow packed scrubber. One serious problem with cross-flow packed scrubbers is the potential for a void to develop at the top of the packing as the packing settles. This problem is magnified by the fact that the packing has to be removed periodically for cleaning. The use of a counter-current flow scrubber minimizes the chance of voids in the packing and hence the channeling of tail gas through the scrubber.

~~The particulate matter concentration in the tail gas stream that New Wales is proposing as Best Available Control Technology, taking into consideration all of the aforementioned factors, is 0.02 grains per standard cubic foot, dry.~~ The fluoride concentration in the tail gas stream will satisfy New Source Performance Standards of 0.06 pounds of fluoride emitted per ton of  $P_2O_5$  input to the plant.

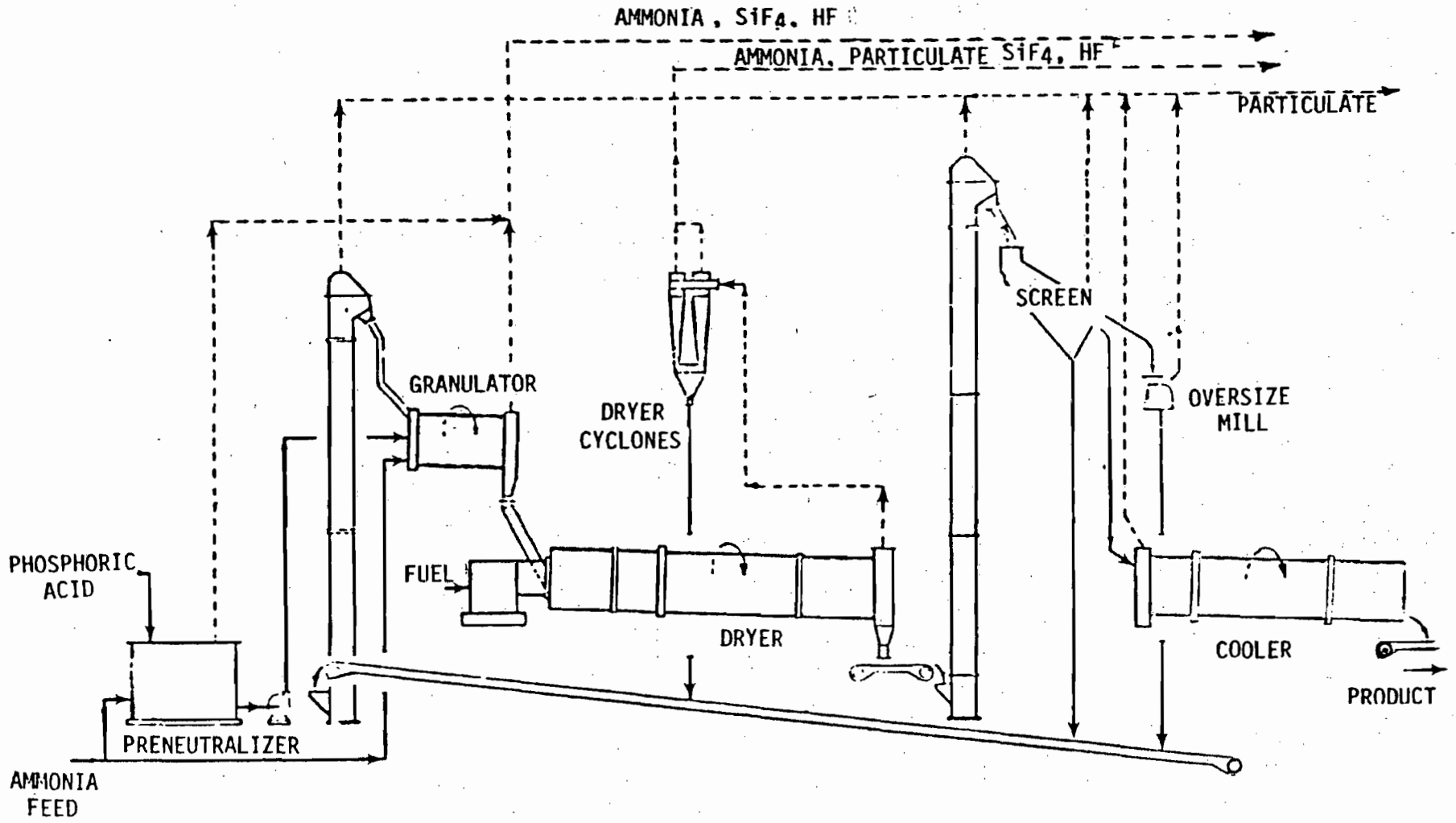


FIGURE 1-1 DIAMMONIUM PHOSPHATE PROCESS

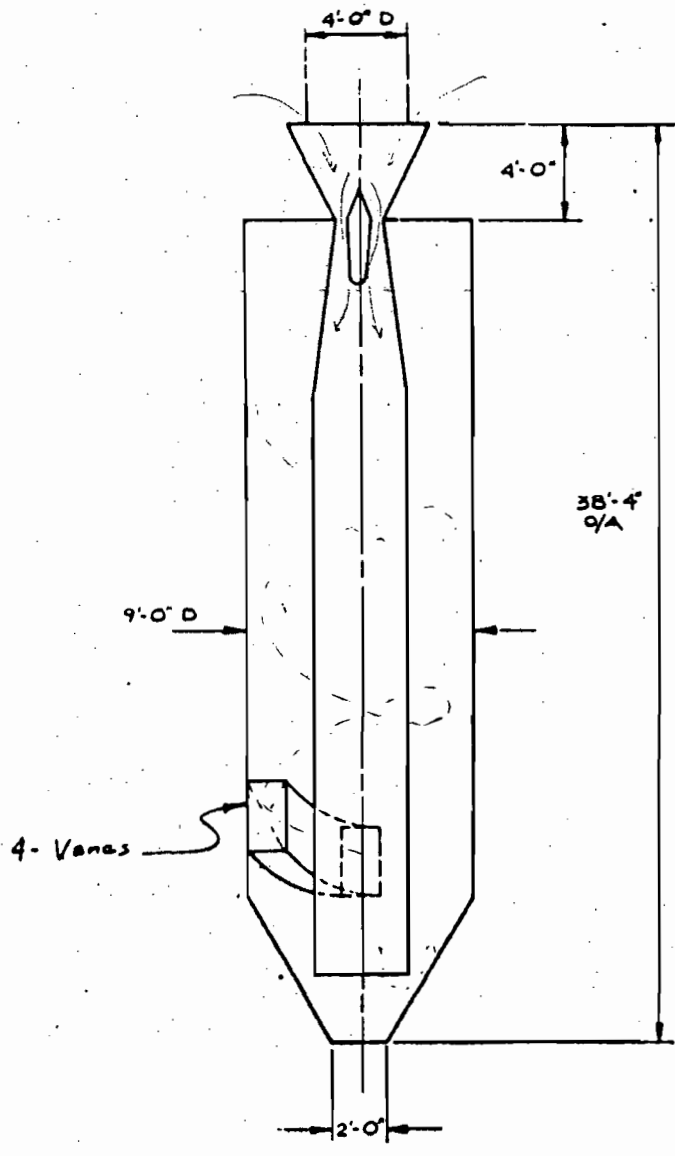


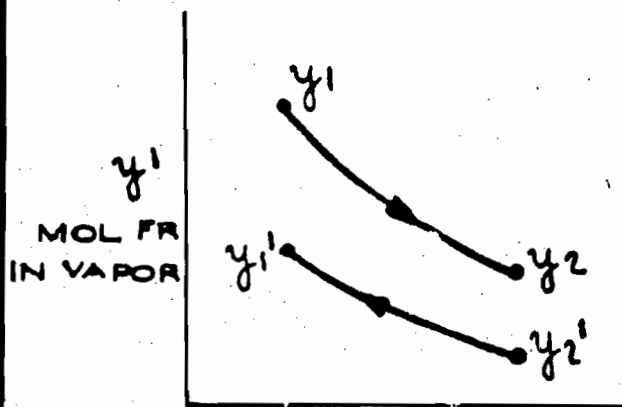
FIGURE 1-2

COAXIAL VENTURI SCRUBBER  
 NEW WALES CHEMICAL COMPANY  
 POLK COUNTY, FLORIDA

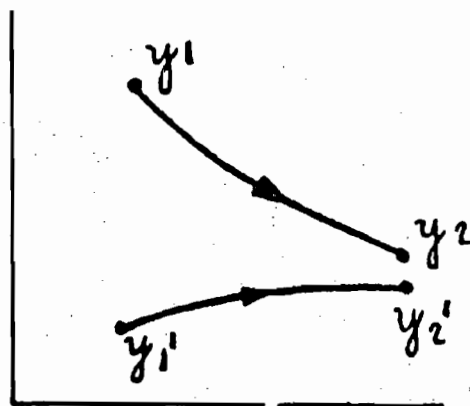
FIGURE 1-3

COMPARISON OF SCRUBBER TYPES

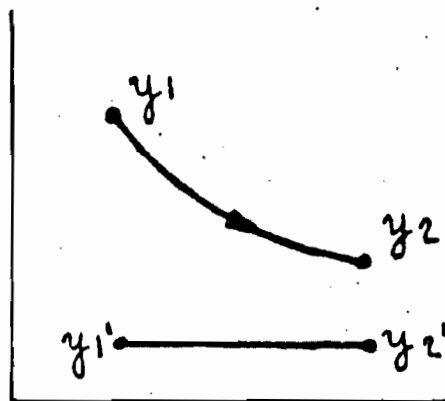
NEW WALES CHEMICAL COMPANY  
POLK COUNTY, FLORIDA



a. COUNTER CURRENT SCRUBBER



b. CON-CURRENT SCRUBBER



c. CROSS FLOW SCRUBBER



## 2.0 DIAMMONIUM PHOSPHATE PLANT BAG COLLECTOR

As discussed in Section 1.0, the air pollutant emissions from a DAP plant consist of ammonia and fluorides from the reactor/granulator system, ammonia, fluorides and particulate matter from the dryer system and particulate matter only from the cooler.

New Wales has selected scrubber systems to control the multiple emissions from the reactor/granulator and dryer systems as discussed in Section 1.0. A bag collector is proposed to control the emissions from the cooler since only particulate matter is emitted from this source.

The fertilizer diammonium phosphate (DAP) consists of two moles of ammonia for each mole of  $P_2O_5$ , hence the name DAP. In order to obtain this mole ratio excess ammonia must be added to the system. This excess ammonia reacts with and neutralizes all of the phosphoric acid, the free sulfuric acid and the free fluoride acids (HF and  $H_2SiF_6$ ). The resulting product therefore has a pH of approximately 7.2.

Because of the neutralization of all of the acids and in particular the fluoride acids, there is no chance for gaseous fluoride compounds to evolve from the DAP product. As a result of this ~~there are no gaseous fluoride emissions from the DAP cooler nor from the DAP storage building.~~

Since there are only particulate matter emissions from the DAP cooler, it is the opinion of New Wales that ~~BACT~~ for the ~~particulate matter~~ would be a ~~bag collector~~. With a bag collector the particulate matter concentration in the tail gas stream from the cooler can be reduced to ~~0.01 grains per standard cubic foot, dry.~~

If a scrubber were used for the particulate matter control, the gas stream would be brought into intimate contact with pond water. Since the pond water contains approximately 8500 ppm of fluoride at New Wales, some of this fluoride would be stripped from the water and introduced to the gas stream. This would create a source of fluoride emissions where none had previously existed. Furthermore, the particulate matter concentration in the gas stream cannot be significantly reduced below 0.01 grains per standard cubic foot with a scrubber. Therefore, there is no advantage to be gained by considering a scrubber; only the disadvantage of adding fluorides to a gas stream previously free of fluorides.

Based on these considerations a bag collector is proposed as BACT for reducing particulate matter emissions from the DAP plant product cooler.

### 3.0 FUEL RELATED AIR POLLUTANT EMISSIONS IN THE DAP PLANT

#### 3.1 Introduction

Heat is required in the DAP product dryer to remove excess water from the product. New Wales is designing the dryers to use fuel oil combustion for the heat source.

For design purposes it is assumed that two gallons of fuel oil will be required to dry one ton of product. The rated production capacity of the proposed DAP plant is 140 tons per hour total (70 tons per hour in each of two identical trains). This production rate will require a maximum of 280 gallons per hour of fuel oil. New Wales is proposing to use a residual No. 6 fuel oil with a maximum 2.5 percent sulfur content.

*294 T DAP*  
*2-70 TPH Sulfur*  
*1-40 TPH TOTAL*  
*280 GPH FUEL*

#### 3.2 SO<sub>2</sub> Emissions

Since there is free ammonia in the product entering the dryer, it is expected that sulfur dioxide will be partially absorbed by a reaction with the ammonia. New Wales has conducted emission measurements and can commit to a maximum sulfur dioxide emission rate from the total DAP plant of 44 pounds per hour. This will be a maximum SO<sub>2</sub> emission rate of 22 pounds per hour from each of the two dryers.

This commitment is equivalent to a 60 percent reduction in the SO<sub>2</sub> emission rate with the dryers burning a 2.5 percent sulfur fuel at a combined rate of 280 gallons per hour. This is also equivalent to burning a fuel oil with 1.0 percent sulfur.

This commitment will reduce the actual sulfur dioxide emissions from the DAP plant from 457 tons per year to 183 tons per year which is only four percent of the total sulfur dioxide emissions from the "new sources" at the New Wales Chemical Complex. Because of the SO<sub>2</sub> sorption capacity inherent with the DAP process the combustion of fuel with a 2.5 percent sulfur is equivalent to using a 1.0 percent sulfur fuel. No expenditure of energy is required to achieve the sorption and the SO<sub>2</sub> remaining in the tail gas has been shown not to cause or contribute to a violation of secondary air quality standards or PSD increments. Because of these factors the use of a 2.5 percent sulfur fuel is considered BACT.

### 3.3 NO<sub>x</sub> Emissions

The combination of fuel oil in the DAP dryer will generate some NO<sub>x</sub> as a result of the oxidation of atmospheric nitrogen at the peak temperatures achieved in the flame. The quantity of NO<sub>x</sub> generated is expected to be low; however, because of the nature of the dryer performance.

The purpose of the burner in the DAP dryer is to heat and which in turn is used to drive excess moisture from the granular DAP product. If the temperature is too high the DAP will decompose. This performance differs from that of a boiler where the intent is to transfer the heat of combustion to water. The latter requires as little excess combustion air as possible since the heat transferred to the excess air is lost.

In a DAP dryer burner the heavy fuel oil is steam atomized. Additionally about 150 percent stoichiometric combustion air (50 percent excess air) is fed through the burner. Downstream of the burner nozzle quench air is added resulting in a total air flow equivalent to 300-500 percent excess air.

The use of steam atomization of the fuel and the addition of quench air results in a burner that functions much like a low  $\text{NO}_x$  burner(1). The addition of less than 50 percent excess air at the burner would probably result in lower  $\text{NO}_x$  emissions but it would also result in higher temperatures in the front of the kiln which in turn would cause DAP decomposition.

Because of the nature of the drying operation the DAP burner functions much like a low  $\text{NO}_x$  burner. Further modification of the burner to reduce  $\text{NO}_x$  emissions, such as by reducing primary combustion air is not possible. Temperatures resulting from the reduction in primary air would cause an increase in temperature at the end of the dryer that would cause product decomposition. Flue gas recirculation, likewise is not feasible because of the high excess air flow used in the dryer. The flue gas has an oxygen content not significantly lower than that of air.

It is the opinion of New Wales and the burner supplier (John Zink, Inc.) that the burners used in DAP plants represent BACT for  $\text{NO}_x$  control in this type source.

In response to a specific EPA request for information, the air flow to the burner and the quench air orifices is controlled by fixed orifices in the air line. The fuel flow rate is controlled by an orifice and the pressure of the oil pump.

REFERENCES  
SECTION 3

1. Personal communication with Lee Massey, John Zink, Inc., Tulsa, Oklahoma, December 7, 1979.