SHOLTES & KOOGLER, ENVIRONMENTAL CONSULTANTS
1213 N.W. 6th Street Gainesville, Florida 32601 (904) 377-5822

SKEC 102-75-06

October 3, 1980

RECEIVED
OCT 1980
BUREAU AQM

Mr. Johnny Cole
State of Florida
Department of Environmental Regulation
3426 Bills Road
Jacksonville, FL 32207

Subject: Acid Feed Preparation Plant
Construction Permit Application
Occidental Chemical Company

Dear Johnny:

Enclosed are revised pages for the permit application recently delivered to you by Wes Atwood to cover the construction of a Phosphoric Acid Feed Preparation Plant. The modifications were made to more accurately represent the particulate matter sources within the facility. The modifications were prompted by a conversation Wes Atwood had with Willard Hanks in Tallahassee on October 1, 1980.

There are two potential sources of particulate matter in the proposed facilities; the diatomaceous earth receiving area and the acid defluorination scrubber stack. In the DE area the material is received and transferred by airveyor to a bulk storage facility. The air from the transfer and storage operations is vented through a bag collector for particulate matter control. This collector will control particulate matter emissions to 0.01 grains per standard cubic foot. The acid scrubber stack, in our opinion, will have no particulate matter emissions at all. To cover permitting requirements, however, we are proposing a particulate matter emission rate from this source of 1.05 pounds per hour (0.015 grains per standard cubic foot).

Since there are two separate vents for the proposed facility, each with potential to emit particulate matter, we feel more comfortable in having particulate matter emission rates specified for each source rather than having a combined particulate matter emission rate specified. We further feel that the two emission rates assigned to represent the facility as proposed better than a single emission rate for the acid scrubber stack; a source which we feel will have no particulate matter emissions.

Another matter brought up by Willard Hanks during his conversation with Mr. Atwood related to the PSD review. Willard stated that your office would conduct the PSD review and would ultimately issue the construction permit. Willard stated that his responsibility in the review related to the BACT determination. To clarify matters and to assist you in your review of the application, I would like to point out the following facts as related to PSD. The proposed phosphoric acid feed preparation plant will operate in conjunction with the modified "X" Train and the newly proposed dical storage and shipping facility. The only pollutants emitted from these facilities, which were not emitted previously are fluorides and particulate matter. An application for PSD approval for fluorides has been submitted to EPA. The increases in particulate matter emission rates are subject to neither State nor Federal PSD approval, since the proposed increases in emissions are below deminimus levels established by both agencies.

The total particulate matter emission rate proposed for the dical storage and shipping facility was 2.1 pounds per hour, or 9.3 tons per year. The total particulate matter emission rate proposed for the phosphoric acid feed preparation plant is 1.26 pounds per hour or 5.5 tons per year. The total increase in particulate matter emission rate is 3.36 pounds per hour or 14.8 tons per year. These emission rates are below the deminimus levels of five pounds per hour and 15 tons per year established by DER and below the 25 ton per year deminimus level established by EPA.

Since the particulate matter emission rates fall below the deminimus levels the particulate matter emitting sources should not be subject to either an air quality review (State PSD review) or a BACT determination.

If you have any questions regarding these modifications, please feel free to contact me.

Very truly yours,

SHOLTES & KOOGLER
ENVIRONMENTAL CONSULTANTS

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

JBK:bh
Enclosure

cc: Mr. Willard Hanks
Mr. W. W. Atwood

Revised page

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		
Diatomaceous Earth	Part.	1-2	703	1
Phosphoric Acid	F.	1.65	65,141	2
				(Attachment 1)

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

1. Total Process Input Rate (lbs/hr): 65,844
2. Product Weight (lbs/hr): 64,815

C. Airborne Contaminants Emitted:

	Name of Contaminant	Emission[1]		Allowed Emission[2] Rate per Ch. 17-2, F.A.C.	Allowable[3] Emission lbs/hr	Potential Emission[4]		Relate to Flow Diagram
		Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
	Fluoride	0.88	3.85	BACT 0.05#/ton	0.88	977.5	4281	3
				P_2O_5 Input				
**	Particulate	1.05	4.60	Best Technology	1.05	1.05	4.60	3
**	Particulate	0.21	0.92	17-2.05(1)	0.21	7.0	31	4

**V.E. observations instead of stack test on points 3 and 4.

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

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles[5] Size Collected (in microns)	Basis for Efficiency (Sec. V, It[5]
Spray, Cross-Flow	Fluoride	99.9%	N/A	Design
Packed Scrubber	Part.	N/A	N/A	(See Att.3)
Baghouse	Part.	97.0%	< 1 to 40	Mfr. Guar.

[1]See Section V, Item 2.

[2]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)

[3]Calculated from operating rate and applicable standard

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

[5]If Applicable

Revised page

Section V, 2 & 3

Calculation of Potential and Actual Emissions

Fluorides

Acid feed 782 STPD 54% phosphate acid at 1.65% F or 422 STPD P_2O_5

Potential

= 782 ton/day(1.65 - 0.15)/100 lbs F/lb acid
x 2000 x 1/24

= 977.5 lb/hour.

= 4281.5 ton/year

Actual

= 422 ton/day x 0.05 lbF/ton x 1/24

= 0.88 lb/hour

= 3.85 ton/year

Particulate Matter

Diatomaceous Earth Receiving

DE feed rate is 703 lb/hour

Potential

= 703 lb/hour x 10 lb/1000* lb DE

= 7.0 lb/hour

= 30.8 ton/year

Actual

= 2500 $ft.^3$/min x 0.01 gr/ft^3 x 60 x 1/7000

= 0.21 lb/hr

= 0.92 tons/year

Acid Scrubber

Potential and Actual

$= 8177\ ft^3/min \times 0.015\ gr/ft^3 \times 60 \times 1/7000$

$= 1.05\ lb/hr$

$= 4.60\ tons/year$

* Technical guidance for Control of industrial process fugitive particulate emissions.

Section V, 5

Control Efficiency

Fluoride

$E_f = (977.5-0.88) \times 100/977.5$

$= 99.91\%$

Particulate Matter

$E_p = (7.0 - 0.21) \times 100/7.0$

$= 97.0\%$

Revised page

10. Stack Parameters

a. Height: ft. b. Diameter: ft.

c. Flow Rate: ACFM d. Temperature: °F

e. Velocity: FPS

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

1.

a. Control Device: Cross-flow packed scrubber

b. Operating Principles: Impingment - absorption

c. Efficiency*: 99.91% d. Capital Cost: $250,000

e. Useful Life: 20 years f. Operating Cost: $6600/yr.

g. Energy*: 131 x 10^3 kwh/year h. Maintenance Cost: $25,000/yr.

i. Availability of construction materials and process chemicals: Available and proven.

j. Applicability to manufacturing processes: Proven applicability throughout industry.

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

2.

a. Control Device: Vertical - flow packed scrubber

b. Operating Principles: Same as above.

c. Efficiency*: Same d. Capital Cost: Higher

e. Useful Life: Same f. Operating Cost: Slightly higher

g. Energy**: Same h. Maintenance Costs: Slightly higher

i. Availability of construction materials and process chemicals: Same

j. Applicability to manufacturing processes: Same

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

*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.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

APPLICATION TO [redacted]/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Animal Feed Plant [X] New[1] [ ] Existing[1]

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

COMPANY NAME: Occidental Chemical Company COUNTY: Hamilton

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) Phosphoric Acid Feed Preparation

SOURCE LOCATION: Street S.R. 137 City White Springs

UTM: East 328.32 km E. North 3368.81 km N.

Latitude ____ ° ____ ' ____ "N Longitude ____ ° ____ ' ____ "W

APPLICANT NAME AND TITLE: Occidental Chemical Company

APPLICANT ADDRESS: Post Office Box 300, White Springs, FL 32096

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of Occidental Chemical Company

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: [signature]

M.P. McArthur, Vice President, General Manager
Name and Title (Please Type)

Date: 9.30.80 Telephone No. (904) 397-8101

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.

Signed: [signature]

John B. Koogler, Ph.D., P.E.
Name (Please Type)

(Affix Seal)

SHOLTES & KOOGLER, ENVIRONMENTAL CONSULTANTS
Company Name (Please Type)

1213 N. W. 6th Street, Gainesville, FL 32601
Mailing Address (Please Type)

Florida Registration No. 12925 Date: ________ Telephone No. (904) 377-5822

[1] See Section 17-2.02(15) and (22), Florida Administrative Code, (F.A.C.)

West Atwood

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.

Phosphoric acid feed preparation plant reacting diatomaceous earth with heated, air sparged, phosphoric acid is vented to a packed cross-flow scrubber. Facility produces a defluorinated acid feed suitable for further processing to dicalcium phosphate animal feed in an existing facility.

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

Start of Construction December 1, 1980 Completion of Construction June 1, 1981

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.)

$250,000.00

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

Not Applicable

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 7; wks/yr 52; if power plant, hrs/yr ____;

if seasonal, describe: ____

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 Deterioriation" (PSD) requirements apply to this source? If yes, see Sections VI and VII. No
4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? No
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 Type	Contaminants % Wt	Utilization Rate - lbs/hr	Relate to Flow Diagram
Diatomaceous Earth	Part.	1-2	703	1
Phosphoric Acid	F.	1.65	65,141 P_2O_5	2
				(Attachment 1)

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

1. Total Process Input Rate (lbs/hr): 65,844 MAX   325 AVG 420 MAX
2. Product Weight (lbs/hr): 64,815 MAX

C. Airborne Contaminants Emitted:

Name of Contaminant	Emission[1] Maximum lbs/hr	Emission[1] Actual T/yr	Allowed Emission[2] Rate per Ch. 17-2, F.A.C.	Allowable[3] Emission lbs/hr	Potential Emission[4] lbs/hr	Potential Emission[4] T/yr	Relate to Flow Diagram
Fluoride	0.88	3.85	BACT 0.05#F/ton	0.88	977.5	4281	3
			P_2O_5 Input				
Particulate	2.1	9.2	Best Technology	2.1/bag stack	7.0	31	3
** Particulate	---	---	17-2.05(1)	< 20.0%			4

**V.E. observations instead of stack test on point 4.

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

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles[5] Size Collected (in microns)	Basis for Efficiency (Sec. V, It[5]
Spray, Cross-Flow	Fluoride	99.9%	N/A	Design
Packed Scrubber				(See Att.3)
Baghouse	Part.	70%	< 1 to 40	Mfr. Guar.

[1]See Section V, Item 2.

[2]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)

[3]Calculated from operating rate and applicable standard

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

[5]If Applicable

E. Fuels None

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

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

Fuel Analysis:

Percent Sulfur: ______ Percent Ash: ______

Density: ______ lbs/gal Typical Percent Nitrogen: ______

Heat Capacity: ______ BTU/lb ______ BTU/gal

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

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

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

Scrubber effluent is pumped to recirculated gypsum/cooling pond.

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

Stack Height: 75'/35½ bag coll ft. Stack Diameter: 2/1 ft.

Gas Flow Rate: 8700*/2500 ACFM Gas Exit Temperature: 115/90 °F.

Water Vapor Content: 6/0.1 % Velocity: 46/53 FPS

*8177 SCFMD

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)^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 device: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner [ ] Other (specify) ______________

Brief description of operating characteristics of control devices: ______________

____

____

____

____

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

____

____

____

____

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.). (See Attachment 3)
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. (Attachment 1)
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. (Attachment 2)

SUPPLEMENTAL INFORMATION

Section V, 1

Total Process Input Rate

Product: Defluorinated phosphoric acid at about 54% P_2O_5

Product Rate: 420 short tons per day (STPD) of 100% P_2O_5 as 54% P_2O_5 acid

-or-

64,815 lbs/hr as 54% acid solution
(420 ÷ 0.54 x 2000 ÷ 24)

Process Input: 422 STPD of 100% P_2O_5 as 54% P_2O_5 acid solution (420 ÷ 0.995)

-or-

782 STPD of 54% P_2O_5 acid solution
(422 ÷ 0.54)

-or-

65,141 lbs/hr of 54% P_2O_5 acid solution
(782 ÷ 24 x 2000)

-or-

17.6 Short tons per hour of 100% P_2O_5.
(422 ÷ 24)

Diatomaceous Earth: 703 lbs/hr at a usage rate of 40 lbs/ton P_2O_5 and feed rate of 422 TPD P_2O_5
(422 ÷ 24 x 40)

Section V, 2 & 3

Calculation of Potential and Actual Emissions

Fluorides

Acid feed 782 STPD 54% phosphate acid at 1.65% F or 422 STPD P_2O_5

Potential

= 782 ton/day (1.65 - 0.15)/100 lbs F/lb acid
x 2000 x 1/24

= 977.5 lb/hour

= 4281.5 ton/year

Actual

= 422 ton/day x 0.05 lbF/ton x 1/24

= 0.88 lb/hour

= 3.85 ton/year

Particulate Matter

DE feed rate is 703 lb/hour

Potential

= 703 lb/hour x 10 lb/1000* lb DE

= 7.0 lb/hour

= 30.8 ton/year

Actual

= 8177 $ft.^3$/min x 0.03 gr/ft^3 x 60 x 1/7000

= 2.10 lb/hr

= 9.21 tons/year

* Technical guidance for Control of industrial process fugitive particulate emissions.

Section V, 5

Control Efficiency

Fluoride

$E_f = (977.5-0.88) \times 100/977.5$

$= 99.91\%$

Particulate Matter

$E_p = (7.0 - 2.10) \times 100/7.0$

$= 70.0\%$

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 [X] No

Contaminant	Rate or Concentration

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

Contaminant	Rate or Concentration

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

Contaminant	Rate or Concentration
Fluoride	0.05 lb F/ton P_2O_5 fed
Particulate Matter	2.1 lb/hour

D. Describe the existing control and treatment technology (if any). (Not Applicable - New Source)

1. Control Device/System:
2. Operating Principles:
3. Efficiency:*
4. Capital Costs:
5. Useful Life:
6. Operating Costs:
7. Energy:
8. Maintenance Cost:
9. Emissions:

Contaminant	Rate or Concentration

*Explain method of determining D 3 above.

Scrubber

10. Stack Parameters

a. Height: 75 ft. b. Diameter: 2 ft.

c. Flow Rate: 8700 ACFM d. Temperature: 115 °F

e. Velocity: 46 FPS

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

1.

a. Control Device: Cross-flow packed scrubber

b. Operating Principles: Impingment - absorption

c. Efficiency*: 99.91% d. Capital Cost: $250,000

e. Useful Life: 20 years f. Operating Cost: $6600/yr

g. Energy*: 131×10^3 kwh/year h. Maintenance Cost: $25,000/yr.

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: Vertical - flow packed scrubber

b. Operating Principles: Same as above

c. Efficiency*: d. Capital Cost:

e. Useful Life: f. Operating Cost:

g. Energy**: h. Maintenance Costs:

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:

*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.

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: (See Section E, 1)

1. Control Device:
2. Efficiency*:
3. Capital Cost:
4. Life:
5. Operating Cost:
6. Energy:
7. Maintenance Cost:
8. Manufacturer:
9. Other locations where employed on similar processes: The cross-flow packed scrubber is widely used by the entire phosphate industry for fluoride control.

a.

(1) Company: Occidental Chemical Company

(2) Mailing Address: P. O. Box 300

(3) City: White Springs (4) State: Florida

(5) Environmental Manager: Mr. W. W. Atwood

(6) Telephone No.: 392-8269

*Explain method of determining efficiency above.

(7) Emissions*:

Contaminant	Rate or Concentration
Fluoride	99.0 to 99.9

(8) Process Rate*:

b.

(1) Company: Occidental Chemical Company

(2) Mailing Address: P.O. Box 500

(3) City: Buffalo (4) State: Iowa

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

(5) Environmental Manager: Ronald Ingelby

(6) Telephone No.: (319) 381-1130

(7) Emissions*:

Contaminant	Rate or Concentration
Fluoride	Not Available

(8) Process Rate*: 325 TPD P_2O_5

10. Reason for selection and description of systems:

Packed scrubbers are used exclusively by the phosphate industry to control fluoride emissions. The configuration of the scrubber; i.e., whether it is a vertical counter-current flow scrubber or a cross-flow scrubber, seems to depend more on individual preference and/or physical constraints rather than on fluoride removal efficiency. In this particular case, Occidental has elected to use a cross-flow packed scrubber with a fluoride removal efficiency of 99.91 percent (See Section V,5).

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

This section [illegible]ot applicable since PSD is no[illegible]quired by Florida law for fluorides [illegible] the source is not significant[illegible] 5 lb/hr and <15 tons/year) for particulate matter.

SECTION VII – PREVENTION OF SIGNIFICANT DETERIORATION

Not Applicable

A. Company Monitored Data

1. ______ no sites ______ TSP ______ ( ) SO^2* ______ Wind spd/dir

Period of monitoring ____/____/____ (month day year) to ____/____/____ (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 ____/____/____ (month day year) to ____/____/____ (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 on point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

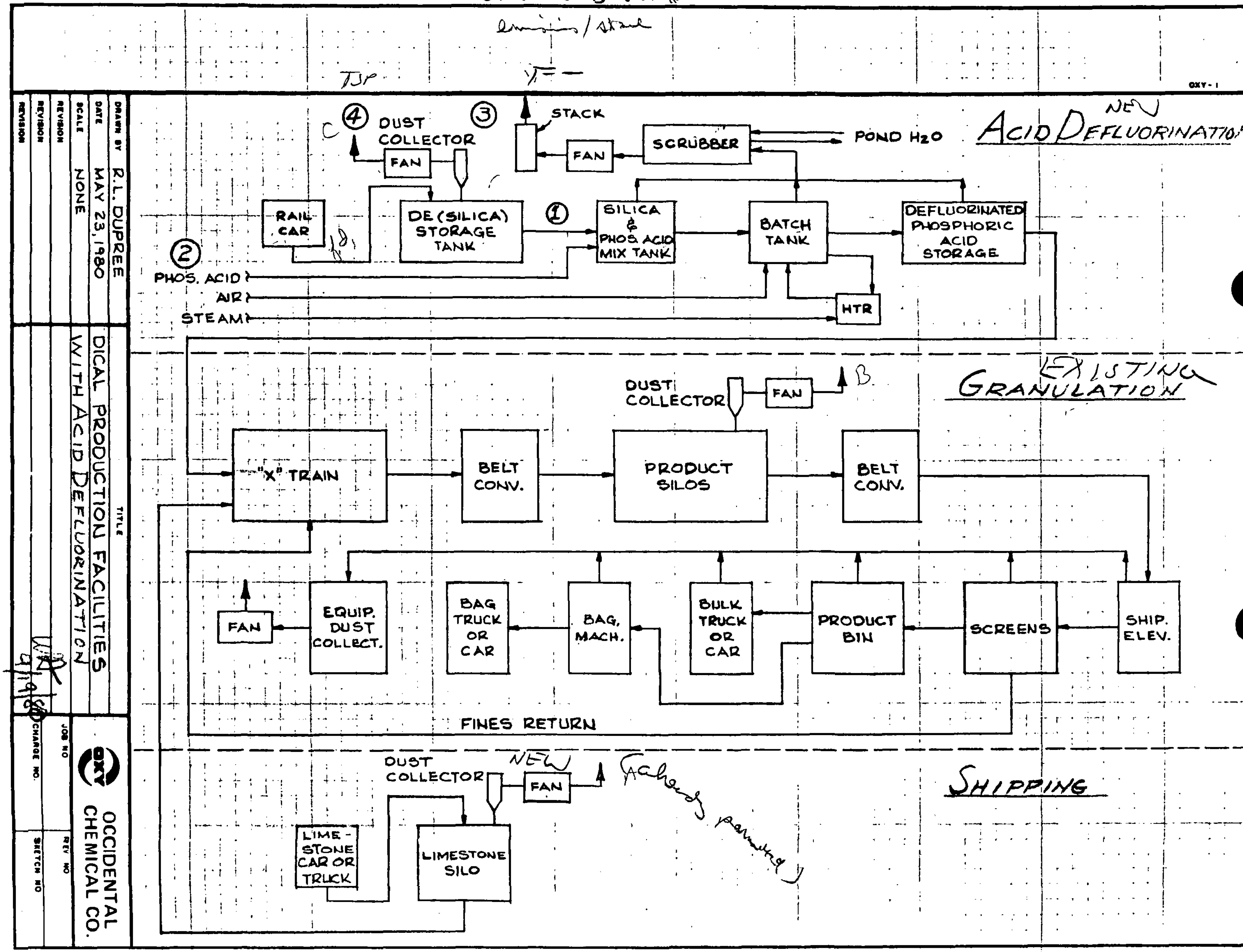
F. Attach all other information supportive to the PSD review.

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

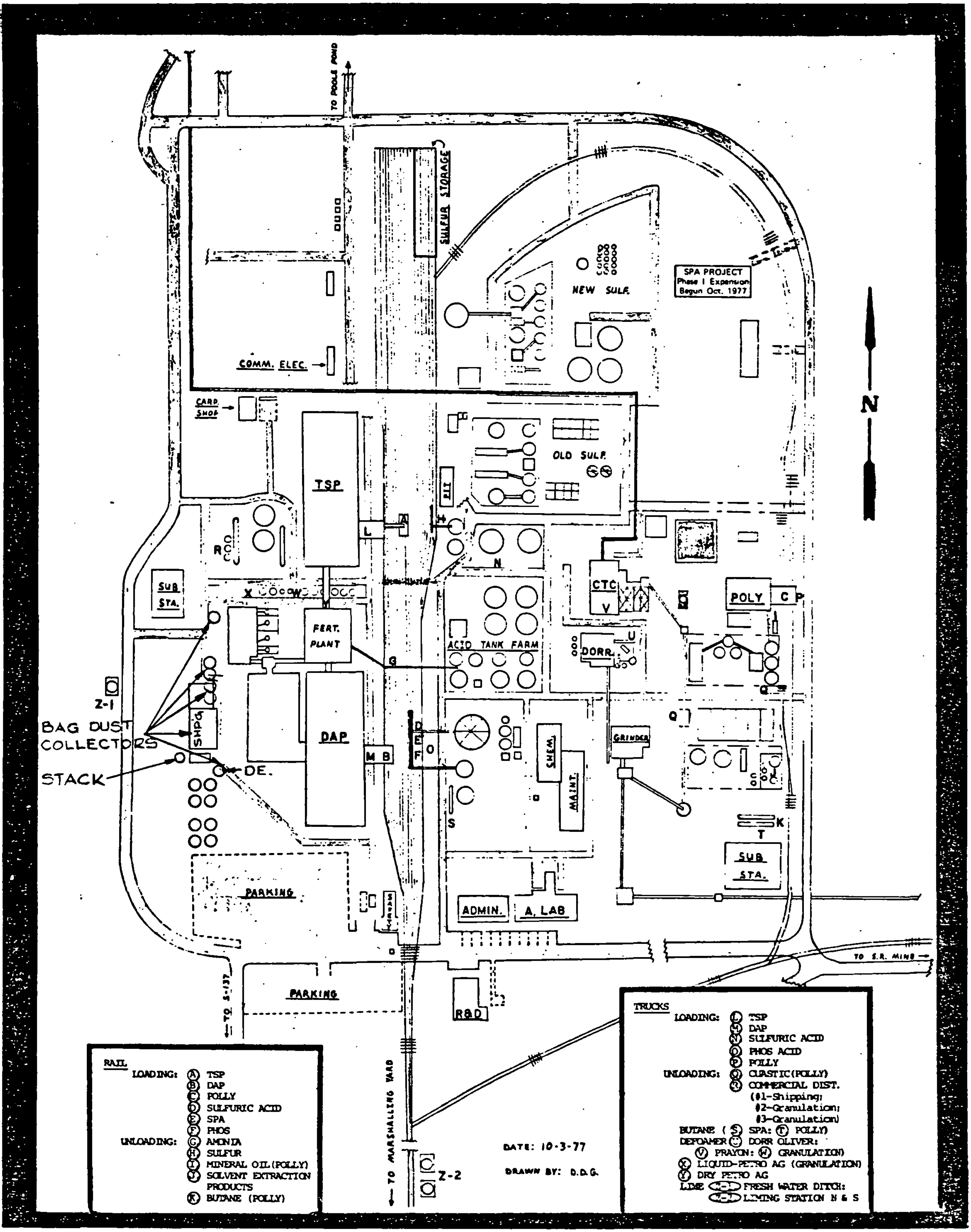
G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e., jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

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.

Process description



Attachment 1


TO POOLE POND
SULFUR STORAGE
COMM. ELEC.
NEW SULF.
SPA PROJECT
Phase I Expansion
Begun Oct. 1977
N
CARP. SHOP
TSP
OLD SULF.
SUB STA.
FERT. PLANT
ACID TANK FARM
CTC
POLY
DORR
GRINDER
BAG DUST COLLECTORS
STACK
SHPG.
DAP
DE.
CHEM.
MAINT.
SUB STA.
PARKING
ADMIN.
A. LAB
TO S.R. MINE
PARKING
R&D
TO S-137
TO MARSHALLING YARD
Z-1
Z-2
DATE: 10-3-77
DRAWN BY: D.D.G.
RAIL
LOADING: (A) TSP
(B) DAP
(C) POLLY
(D) SULFURIC ACID
(E) SPA
(F) PHOS
UNLOADING: (G) AMONIA
(H) SULFUR
(I) MINERAL OIL (POLLY)
(J) SOLVENT EXTRACTION PRODUCTS
(K) BUTANE (POLLY)
TRUCKS
LOADING: (L) TSP
(M) DAP
(N) SULFURIC ACID
(O) PHOS ACID
(P) POLLY
UNLOADING: (Q) CUASTIC (POLLY)
(R) COMMERCIAL DIST.
(#1-Shipping;
#2-Granulation;
#3-Granulation)
BUTANE ((S) SPA: (T) POLLY)
DEFOAMER (U) DORR OLIVER:
(V) PRAYON: (W) GRANULATION)
(X) LIQUID-PETRO AG (GRANULATION)
(Y) DRY PETRO AG
LIME FRESH WATER DITCH:
LIMING STATION N & S

Attachment 3

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Support Data and Calculations for Best Available Control Technology (BACT) for Fluoride Scrubbing.

Reference is made to EPA Bulletin No. 340/1-77-0099.

This Bulletin describes EPA's standards for new source emissions and procedures for inspection and enforcement.

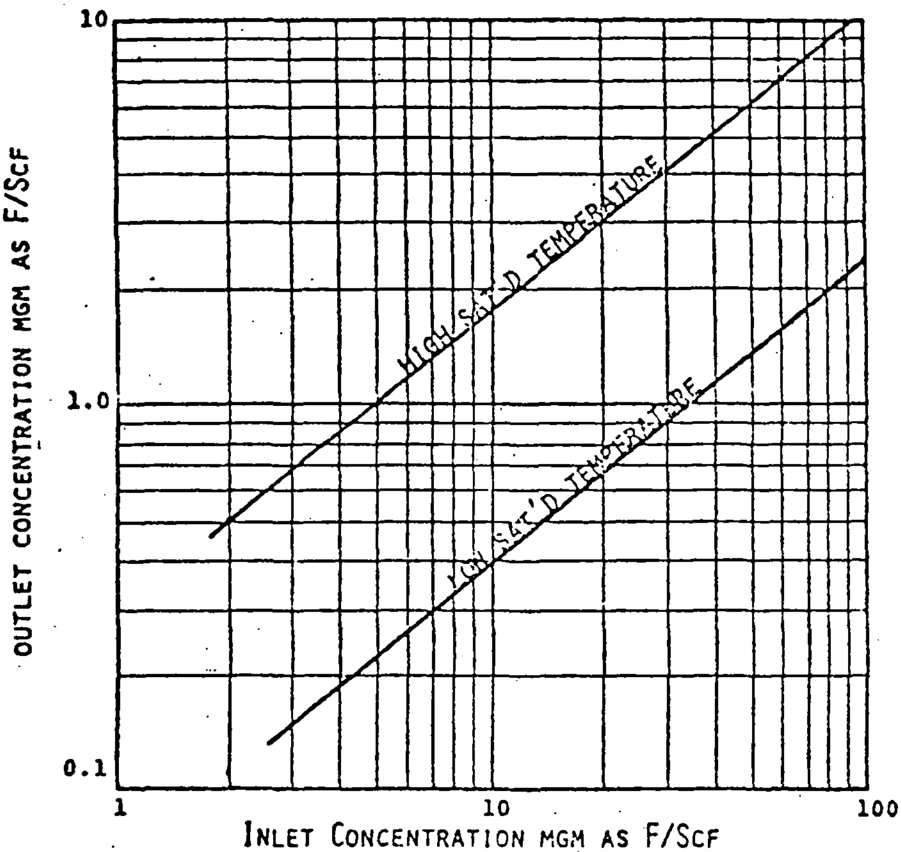
Section 4.0 deals with fluoride scrubbing in Phosphoric Acid Plants. The general comments of this section and sub-section 4.3 are quoted below:

"4.0 BACT - FLUORINE

In general, the extent of the fluorine abatement system required is determined by the following parameters:

1. Inlet fluorine concentration,
2. Allowable fluorine emissions,
3. Outlet or saturated gas temperature,
4. Composition and temperature of the scrubbing liquid,
5. Scrubber effectiveness and number of transfer units,
6. Fluorine compounds present, and
7. Effectiveness of entrainment separation.

The inlet concentration and allowable outlet fluorine emissions must first be established to determine the overall scrubbing requirement. Figure 4-3 shows the relationship between saturated gas temperatures and the overall removal efficiency of the scrubbing device. The gas stream leaving the scrubber is saturated with water vapor. When the scrubber is operated at a relatively low



FLUORINE SCRUBBING
WITH
LOW FLUORINE CONTENT LIQUOR

FLUORINE REMOVAL TRANSFER UNIT FORMULA

$$Nt = \ln \frac{Y_1 - Y_a}{Y_2 - Y_a}$$

N_t = Number of transfer units

Y = Concentration of fluoride in gas
- 1 - at inlet
- 2 - at outlet
- a - content based upon gas phase equilibrium with concentration of fluoride in scrubbing liquor in concentrations below 5,000 ppm as F this effect is neglected.

Figure 4-3: Relationship Between Gas Temperature and Scrubber Removal Efficiency (Reprint with Permission of the McIlvaine Company from McIlvaine Scrubber Manual, 1976, p. 42, 511)

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saturated temperature (gas temperature close to the gypsum pond water temperature), the efficiency is high. Since absorption decreases with temperature increase, efficiency is lower at a higher saturated temperature. An additional advantage of scrubber operation at low temperatures is that silica is kept in a gelatinous stage which is easily washed from the scrubbing device. At higher temperature, the silica is crystallized on the scrubber and removed with great difficulty.

The scrubber effectiveness, or the number of transfer units, will determine the overall scrubbing requirements. Figure 4-3 shows the fluorine removal transfer unit formula.

Transfer units are defined by the following formula:

$$NTU = \ln \frac{\text{Inlet F}}{\text{Outlet F} + a}$$

where: a = vapor pressure contribution of fluorine from scrubbing media. For water solutions at low F concentration the F vapor pressure is negligible and is taken as zero.

Once the overall transfer unit requirements are determined, the number of scrubbing stages may then be set based upon the ability of each scrubbing device employed.

The scrubbers which are likely to perform well in phosphate fertilizer plants include spray towers, ventrui scrubbers, cross-flow packed scrubbers, and impingement scrubbers.

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4.3 Spray-Crossflow Packed Scrubbers

The spray-crossflow packed bed scrubber has been accepted as the most satisfactory fluoride control device available for wet process phosphoric acid plants. The spray-crossflow packed bed scrubber consists of two sections, a spray chamber and a packed bed, (sometimes followed by a demisting section). Gas streams with high fluoride and particularly high SiF_4 concentrations are treated in the spray chamber before entering the packing. This reduces the danger of plugging in the bed, reduces the loading on the packed stage, and provides some solids handling capacity. The crossflow design operates with the gas stream moving horizontally through the bed with the scrubbing liquid flowing vertically through the packing. Solids deposited near the front of the bed are washed off by a cleaning spray. Pressure losses through the scrubber range from 1-8 inches of water, the average being about five inches.

Recycled gypsum pond water is normally used as the scrubbing liquid in both the spray and packed sections, the ratio of scrubbing liquid to gas ranging from 0.02 to 0.07 gpm/scfm (.045 - .156 $lpm/m^3/hr$) depending on the fluoride content of the gas stream.

Provided that the solids loading of the effluent stream has been reduced enough to prevent plugging, the fluoride removal efficiency of the spray-crossflow packed bed scrubber is limited

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only by the amount of packing used and the scrubbing liquid. Efficiencies as high as 99.9% have been reported."

It is noted that the spray-cross flow packed bed scrubber has been accepted by EPA as BACT for fluoride scrubbing. This is the device chosen by OXY for the White Springs, Florida Defluorination Plant.

The drawings and diagrams in Figs. 1, 2, 3, & 4 describe the process and arrangement. Design basis is described in the accompanying pages, sketches, and calculations.

As will be seen on review, large safety factors have been provided in this design:

1. the scrubber inlet fluorine loading is based on receipt of process gas under the highest possible fluoride loading with each of the eight units in operation and maximum air flow. This factor is 30-40% higher than expected.
2. maximum scrubbing temperature is allowed - with 95°F recycled pond water containing 5000 PPM fluoride at a pH of 2.0.
3. generous allowance is provided for gas duct heating and air in-leakage.
4. a larger than needed degree of defluorination in process is provided. Process requires that the ratio of phosphorus to fluorine be (P/F) 100, while 157 is allowed in the design calculations.

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Occidental has for several years operated a system at Davenport, Ia., similar but somewhat smaller than the one described herein. Under actual tests, it has exceeded the standards set by regulating authorities.

(NOTE: Operation in Iowa is governed by "0.4 lb" rule. The referenced scrubber system has measured efficiencies in the range of 99.9%; the efficiency proposed for this system.)

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Design Calculation

1. Number of Transfer Units

Fluoride loading inlet to scrubber at 170°F is 0.8%* by volume (8,000 PPM) as SiF_4. Fluoride loading outlet from scrubber at 115°F is 6.8 PPM* as SiF_4, or 5 PPM as elemental F. Effieiency of Fluoride Removal:

$$\frac{8,000 - 6.8}{8,000} \times 100 = 99.91\%$$

At this exit gas loading, daily fluoride emissions are determined to be:

$8720 \text{ ACFM} \times 1440 \text{ min/day} \times 6.8 \times 10^{-6}$ = 85 cu. ft./day @ 115°F
6600
= 0.204 mols/day
= 21.2 lbs. SiF_4/day
= 15.5 lbs. F/day ÷24 = 0.65 lb/hr

This compares with comparable warehouse emission standards of .05# F/day per ton P_2O_5. At design rate of 420 TPD allowable emissions are 420 x .05 = 21 lbs/day.

Number of transfer units required to achieve 99.91% efficiency, based on gas phase is:

NTU EQUATION: $N_{OG} = \ln \frac{Y_1}{Y_2} = \ln \frac{8,000}{6.8} = \ln 1176$

$\ln 1176 = 7.06$

Number of transfer units required 7.06
Number of transfer units designed 8.00

The NTU equation derives from the fundamental mass transfer equation: $N_A = K_G A P \quad Y$

where N_A = moles transferred per hour
K_G = mass transfer coefficient, moles/hr/sq. ft./atm
P = total pressure
Y = driving force differential, expressed in gas phase concentration units
A = interfacial area

in which each term is defined mathematically.

*These values are used for design and may differ slightly from those in Section V of Application.

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(The reviewer is referred to Chemical Engineering texts for complete discussion.)

This equation leads to the transfer unit theory and defines the number as

$$N_{OG} = \int_{Y_2}^{Y_1} = \frac{Y_1}{Y_2 - Y^o}$$

where Y_1 or Y_2 is a gas phase concentration.

In the simple case of no resistance, i.e., very water soluble gas, the Y^o becomes zero and the basic equation for NTU becomes

$$N_{OG} \int_{Y_2}^{Y_1} \frac{dy}{y} = \ln \frac{Y_1}{Y_2}$$

The absorption of fluoride in water or water-solutions of low fluoride concentration is described in the EPA manual, Bull. 340/1-77-0099.

The volume (ht.) of packing required for a specified performance is

$$\text{Volume, } V - (G_M \div K_G AP)\ N_{OG}$$

where: V = packed depth, ft., or volume, $ft.^3$

G_M = molar in gas (mass) volocity based on tower cross section, lb mole/ (hr)(sq ft)

K_GA = mass transfer coefficient, lb mole/ (hr) (cu ft) (atm)

P = total pressure, atm

Once the number of mass transfer units is determined, it is necessary to establish the "volume" or dimension of the system through the mass transfer coefficient, as K_g in the above equation.

The area term A refers to the interfacial area of the system. In packed towers, it is the total of interfacial surface area and is expressed on a volumetric basis (as a combined term K_GA), although these values are all based on gas phase.

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White Springs, Florida

2. Scrubber Dimensions:

From flow sheet, Fig. 2, inlet gas flow to scrubber is 12,672 ACFM at 170°F and 8720 ACFM at the outlet.

For design pressure drop of 1/2" H_2O column per foot of packing depth, the superficial flow velocity (without area deduction for packing) is 225 FPM;* therefore the inlet X-section is

$$12{,}672 \frac{\text{ft.}^3}{\text{min.}} \div 225 \frac{\text{ft.}}{\text{min.}} = 56 \text{ ft.}^2$$

Lay-out and structural considerations require a rectangular section. A X-section 9.5' deep and 6' wide is chosen, 9.5' x 6' = 57 ft.^{2}

In the spray/cross-flow packed scrubber, it has been found empiracally that the spray section, at a water-to-gas ratio of 30:1 (GPM/MCF), provides the equivalent of 1 to 2 transfer units.

Water flow in this unit is higher than required for spray or packing irrigation because of additional heat effect not associated with scrubbing. A flow rate gpm water/MCFM gas of 73:1, is designed (cf EPA 70.1). This is additional safety factor that one transfer unit is provided in the spray section, leaving seven (7) for the packed section.

At the gas flow rate and dimensions designed, as above, 65 to 70 cu. ft. of 1"-2" intalox or tellerette packing are equivalent to one transfer unit (cf the term $G_M \div K_G A$) in cross-flow.

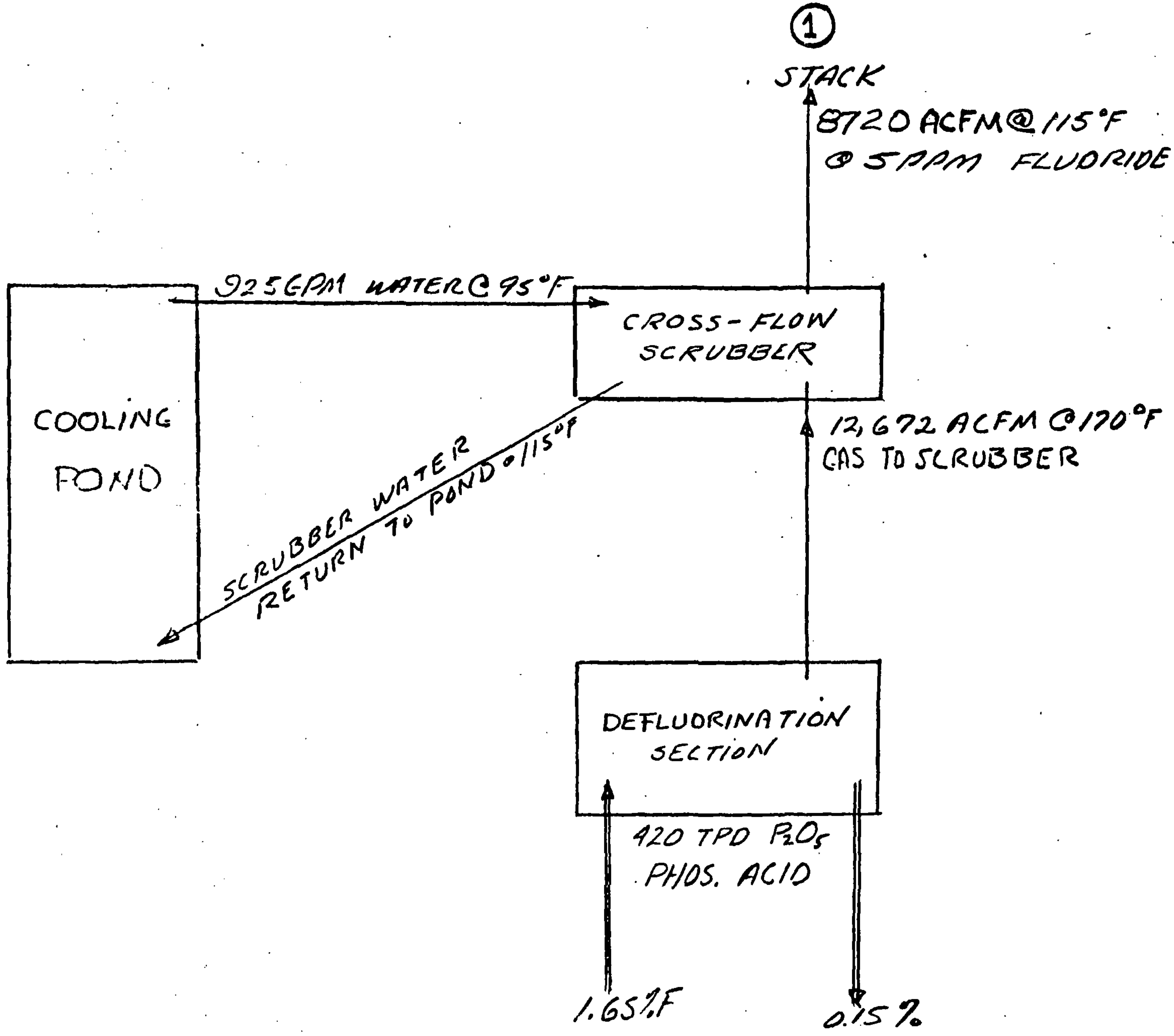
In another expression, at stated conditions of inlet-outlet, 2.15# of fluoride per hour are absorbed for each cubic foot of packing in the irrigated section. This is a conservative, empiracally established value.

This gives 67 X 7 = 469 cu. ft. for the irrigated packed section, 8'-4" in length.

An additional 2'-9" of 4" tellerette packing is provided for demisting downstream of the irrigated section.

See Fig. 4 for further details of the arrangement.

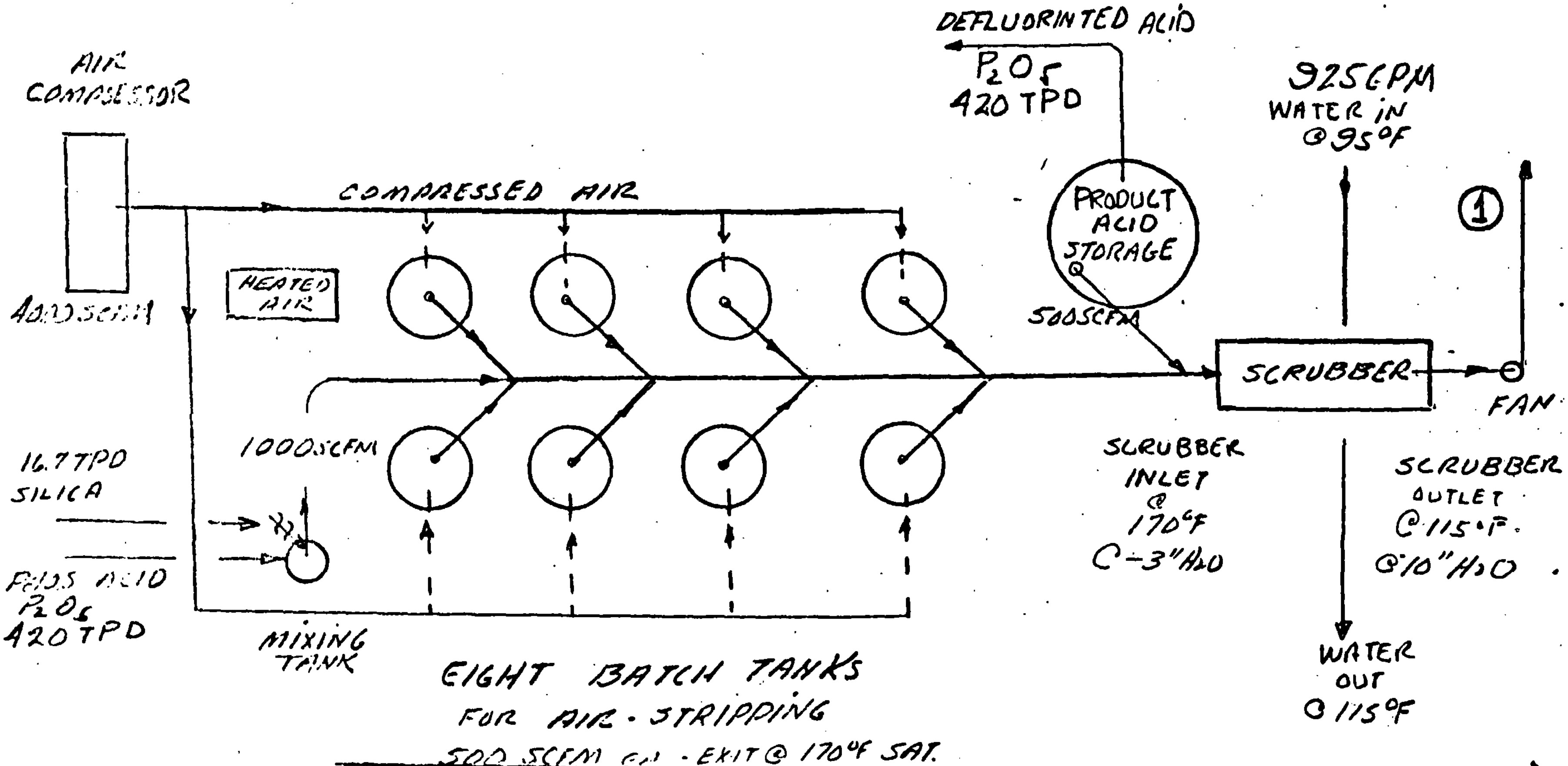
*CLARKE-DAVIDSON, "MANUAL FOR PROCESS ENGINEERING CALCULATIONS", pp. 460-461.



DIAGRAMATIC LAYOUT - PLANT/SCRUBBER/POND
OXY'S DEFLUORINATION PLANT
WHITE SPRINGS, FLORIDA

OXY
OCCIDENTAL CHEMICAL CO.

CONSTRUCTION PERMIT
FIG. 1
BLOCK DIAGRAM



SCRUBBER MATERIAL BALANCE

	INLET lbs/MIN	INLET MOLS/MIN	OUTLET lbs/MIN.	OUTLET MOLS/MIN
COMP. AIR	311	4000 SCFM 10.85	311	10.85
SAT. MOIST.	137	2750 SCFM 7.65	21	1.17
TANK VENTS	114	1500 SCFM 3.96	114	3.96
HOT AIR	123	1530 SCFM 4.27	123	4.27
ATM. H_2O	10	195 SCFM .54	10	0.54
FLUORINE (SiF_4)	23	80 SCFM .22 1378 lb/hr	TRACE	6.8 PPM SiF_4 (5PPM@F)
TOTALS	718	10,055 SCFM 27.49	579	20.79

x 0.21 1649 mol/HR

≅ 12,672 ACFM

8720 ACFM

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DEFLUORINATION PLANT
WHITE SPRINGS
FLORIDA

CONSTRUCTION PERMIT
2
FLOW SHEET
DESIGN BASIS

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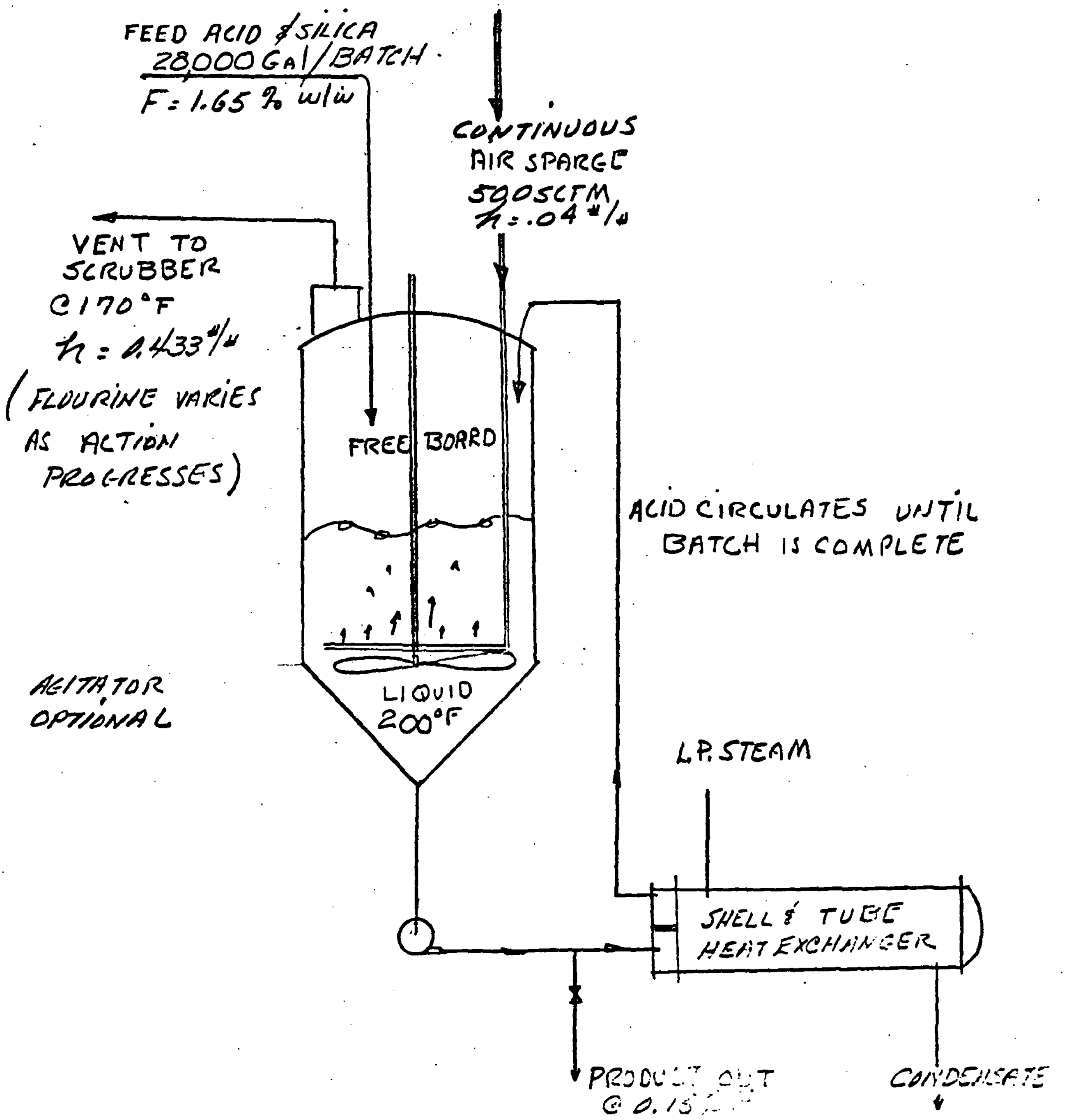

CONSTRUCTION PERMIT

FIG. 3

FLUORINE STRIPPER

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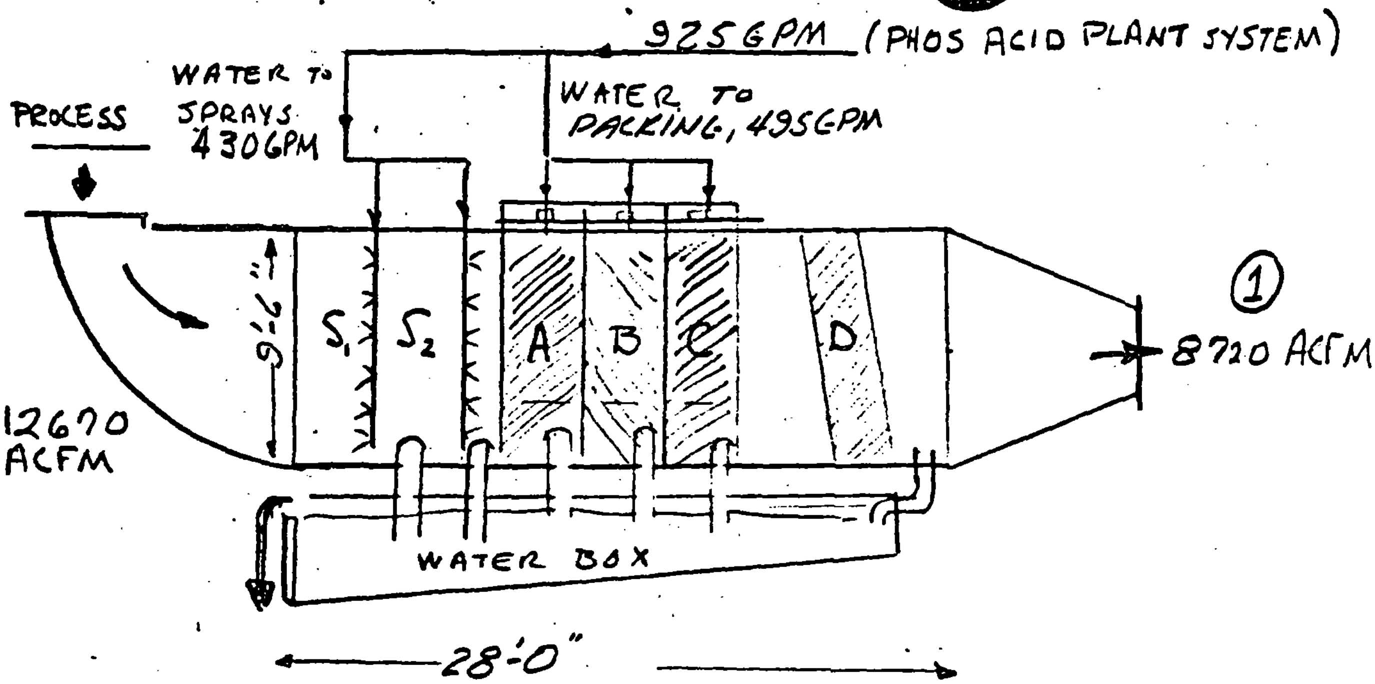

SCRUBBER DIMESIONS
6'-0" WIDE; 9-6" DEEP; 28'-0" STRAIGHT LONG. SECTION
FLOW CROSS SECTION 57 ft²

SCRUBBER SECTIONS

S_1 - Spray toward Gas 280 GPM; 20 SPRAYS @ 14 GPM ea

S_2 · PACKING WASH 150 GPM 10 SPRAYS @ 15 GPM ea

A - 156 Cu. Ft., 2" INTALOX PACKING, 2'-9"

B - 156 Cu. Ft., 1" INTALOX PACKING, 2'-9"

C - 156 Cu. Ft 1" TELLERETTE ", 2-9"

D - 156 Cu. Ft. 1" TELLERETTE ", 2'-9"

SECTION D IS NOT IRRIGATED

GAS INLET @ 170°F, ~3" H₂O col, [illegible] 15° [illegible]

CONST[illegible]ON PERMIT

FIG 4

DESIGN DIMENSIONS
FLUOR OF SCRUBBER

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CONSTRUCTION PERMIT APPLICATION
WHITE SPRINGS FLORIDA

SUPPORT DATA & CALCULATIONS · DICAL PROJECT

FLUORIDE SCRUBBER LOADING & SERVICE

BASIS: FLOW SHEET & DIAGRAMS FIGS. 1, 2, & 3

EIGHT BATCH TANKS SCHEDULE FOR MAXIMUM PRODUCTION OF 420 TPD of P_2O_5 AS DEFLUORINATED PHOSPHORIC ACID

1 A. ACID IN - 778 TPD LIQ @ 1.65% F MAX

B. ACID OUT 765 TPD LIQ. @ 0.15% F

FLUORINE EVOLUTION IS: 778 × .0165 = 12.837 TPD

− 765 × .0015 = 1.1475 TPD

EVOLUTION = 11.6895 TPD

= 23,379 lbs/DAY

FOR DESIGN: USE 1000 lbs/hr.

2. FLUORINE IS EVOLVED AS SiF_4, Mol. wt 104
1000 lbs F equiv. to 1370 lbs of SiF_4 equiv to 13.17 mols/hr
From FIG. 2, TOTAL GAS TO SCRUBBER is 27.49 mols/min
= 1649 mols/hr.

% SiF_4 in Scrubber inlet is $\frac{13.17 \text{ mols } SiF_4}{1649 \text{ mols}} \times 100 = 0.8\%$
= 8000 PPM

Scrubber outlet Loading is designed by the number of transfer units required for F 91%, or 5 PPM F, which is equivalent to 6.8 PPM SiF_4.

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WHITE SPRINGS, FLORIDA

3. WATER SUPPLY

SUPPORT DATA AND CALCULATIONS

FLORIDA SCRUBBER WATER REQUIREMENTS

A. FOR HEAT LOAD, CONDENSATION OF MOISTURE AND COOLING
B. SPRAY PERFORMANCE AND PACKING IRRIGATION

A. HEAT LOAD.

Q_1 cooling gas from 170 °F to 115 °F, $Q_1 = WC_p \Delta T$ *

FROM FIG 2 $W = 718$ lb/min
C_p 0.27 for humid air
$\Delta T = 65$ °F

$\therefore Q_1 = 718 \times 0.27 \times 55 = 10,662$ BTU/min

Q_2 CONDENSATION @115°F is 1040 BTU/#

WATER IN (MOISTURE) 147 lbs (From Fig 2
- WATER OUT (") - 31
CONDENSATION = 116 lbs/min

$\therefore Q_2 = 116 \times 1040 = 120,640$ BTU/min

$Q_T = 10,662 + 120,640 = 131,302$ BTU/min.

B. WATER DESIGN: IN @ 95°F
OUT @ 115°F - $\Delta T = 20°$, 20 BTU/lb.

WATER FLOW IS: $\frac{131,302 \text{ BTU/min}}{20 \text{ BTU/lb}} = 6565$ lb/min ÷ 8.34 = 787
= 787 GPM

At irrigation rate of 50 GPM per MCFM GAS (50:1),
WATER FLOW IS 12.762 × 50 = 638 GPM

A SAFETY FACTOR OF 925 GPM is USED IN THIS DESIGN

* DESIGN FOR SAFETY FACTOR, colder inlet water temperature would IMPROVE RESULTS

ORIGINAL BY: SPE	**OCCIDENTAL CHEMICAL CO.**	DATE:
APPROVED BY:	SPECIFICATIONS FOR: CAPITAL COST CONSTRUCTION PERMIT APPLICATION DEFLUORINATION SCRUBBER	REVISION NO.:
PROJECT NO.: DKAL		EQUIPMENT NO.: ALL

COST OF POLLUTION CONTROL EQUIPMENT
REFERENCES: PROJ. SCOPE & DWGS. 00-002, 02-002#

1 TIE-INS ELECTRICAL - 175 HP ------ 14,000
WATER - 750' 10" R/L STEEL PIPE - 29,000

2. SUMP - 8'x8'x7'

3. PLENUMS & FANS - WITH MOTORS

4. COLLECTING DUCT - FRP - VARIOUS - 30' @ 30" -
25' @ 24" -
16' @ 12" -
180' @ 6" -
SET 33,000

5 SCRUBBER - 6'x9-6"x28'
INCL SPRAYS, PIPING & PACKING - 120,000

6 STACK - 24" x 75' FRP - 12,000

7 [illegible] - SCRUBBER, [illegible] 8 000

8. DUCT INSULATION 9 000

TOTAL - SUB 225,000

CONTINGENCY 25,000

TOTAL 250,000