Golder Associates

D.E.R.

AUG 02 1999

SOUTHWEST DISTRICT
TAMPA

# SOLID AND MOLTEN SULFUR HANDLING AND STORAGE FACILITIES CARGILL FERTILIZER, INC. RIVERVIEW, FLORIDA

**Prepared For:**

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

**Prepared By:**

**Golder Associates Inc.**
**6241 NW 23rd Street, Suite 500**
**Gainesville, Florida 32653-1500**

**July 1999**
*9837585Y/F1/WP*

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# PART A

# Department of
# Environmental Protection

## DIVISION OF AIR RESOURCES MANAGEMENT

### APPLICATION FOR AIR PERMIT - LONG FORM

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

## I. APPLICATION INFORMATION

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

### Identification of Facility Addressed in This Application

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

1. Facility Owner/Company Name: Cargill Fertilizer, Inc.

2. Site Name: Tampa Plant

3. Facility Identification Number: 0570008 [ ] Unknown

4. Facility Location Information:
Street Address or Other Locator: 8813 U.S. Highway 41 South
City: Riverview County: Hillsborough Zip Code: 33569

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

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

### Application Processing Information (DEP Use)

| | |
|---|---|
| 1. Date of Receipt of Application: | |
| 2. Permit Number: | |
| 3. PSD Number (if applicable): | |
| 4. Siting Number (if applicable): | |

## Owner/Authorized Representative or Responsible Official

1. Name and Title of Owner/Authorized Representative or Responsible Official:
   **David Jellerson, Environmental Superintendent**

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

Organization/Firm: **Cargill Fertilizer, Inc.**
Street Address: **8813 Highway 41 South**
City: **Riverview** State: **FL** Zip Code: **33569**

3. Owner/Authorized Representative or Responsible Official Telephone Numbers:

Telephone: **(813) 671-6297** Fax: **(813) 671-6149**

4. Owner/Authorized Representative or Responsible Official Statement:

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

David Jellerson 7-30-99

Signature Date

* Attach letter of authorization if not currently on file.

## Scope of Application

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

| Emissions Unit ID | | Description of Emissions Unit | Permit Type |
|---|---|---|---|
| Unit # | Unit ID | | |
| 1R | | Solid Sulfur Handling and Storage | AC1D |
| 2R | | Molten Sulfur Handling and Storage | AC1D |

**See individual Emissions Unit (EU) sections for more detailed descriptions.**
**Multiple EU IDs indicated with an asterisk (*). Regulated EU indicated with an "R".**

## Purpose of Application and Category

Check one (except as otherwise indicated):

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

This Application for Air Permit is submitted to obtain:

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

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

Current construction permit number: ______________________

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

Operation permit to be renewed: ______________________

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

Current construction permit number: ______________________

Operation permit to be renewed: ______________________

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

Operation permit to be revised/corrected: ______________________

______________________________________________

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

Operation permit to be revised: ______________________

Reason for revision: ______________________

______________________________________________

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

This Application for Air Permit is submitted to obtain:

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

Current operation/construction permit number(s): ______________________

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

Operation permit to be renewed: ______________________

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

Operation permit to be revised: ______________________

Reason for revision: ______________________

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

This Application for Air Permit is submitted to obtain:

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

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

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

Current operation permit number(s): ______________________

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

## Application Processing Fee

Check one:

[ ] Attached - Amount: $ ________________          [x] Not Applicable.

## Construction/Modification Information

1. Description of Proposed Project or Alterations:

**Construction of a Solid Sulfur Handling Facility including ship unloading, railcar unloading, material handling, melting, storage lime delivery system, and diatomaceous earth delivery system. Modification of existing Molten Sulfur Handling Facility system to increase the permitted ship unloading rate from 1,433 to 2,241 TPH of molten sulfur. Project includes installation of a scrubber to control emissions from storage tanks and a proposed truck loading operation.**

2. Projected or Actual Date of Commencement of Construction :
**1 Oct 1999**

3. Projected Date of Completion of Construction :
**1 Jun 2002**

## Professional Engineer Certification

1. Professional Engineer Name: **David A. Buff**
Registration Number: **19011**

2. Professional Engineer Mailing Address:
Organization/Firm: **Golder Associates Inc.**
Street Address: **6241 NW 23rd Street, Suite 500**
City: **Gainesville** State: **FL** Zip Code: **32653-1500**

3. Professional Engineer Telephone Numbers:
Telephone: **(352) 336-5600** Fax: **(352) 336-6603**

4. Professional Engineer's Statement:

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

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

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

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

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

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

David a. Buff

Signature
(seal)

7/29/99

Date

* Attach any exception to certification statement.

## Application Contact

1. Name and Title of Application Contact:
   Kathy Edgemon, Environmental Engineer

2. Application Contact Mailing Address:

   Organization/Firm: Cargill Fertilizer, Inc.
   Street Address: 8813 Highway 41 South
   City: Riverview State: FL Zip Code: 33569

3. Application Contact Telephone Numbers:

   Telephone: (813) 671-6369 Fax: (813) 671-6149

## Application Comment

# II. FACILITY INFORMATION

## A. GENERAL FACILITY INFORMATION

**Facility Location and Type**

1. Facility UTM Coordinates:
Zone: 17 East (km): 362.9 North (km): 3082.5

2. Facility Latitude/Longitude:
Latitude (DD/MM/SS): 27 / 51 / 28 Longitude: (DD/MM/SS): 82 / 23 / 15

| | | | |
|---|---|---|---|
| 3. Governmental Facility Code:<br>0 | 4. Facility Status Code:<br>A | 5. Facility Major Group SIC Code:<br>28 | 6. Facility SIC(s):<br>2874 |

7. Facility Comment (limit to 500 characters):

**Facility Contact**

1. Name and Title of Facility Contact:
David Jellerson, Environmental Superintendent

2. Facility Contact Mailing Address:
Organization/Firm: Cargill Fertilizer, Inc.
Street Address: 8813 U.S. Highway 41 South
City: Riverview State: FL Zip Code: 33569

3. Facility Contact Telephone Numbers:
Telephone: (813) 671-6297 Fax: (813) 671-6149

**Facility Regulatory Classifications**

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

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

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

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

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

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

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

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

9. One or More Emissions Units Subject to NESHAP?
[x] Yes [ ] No

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

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

## B. FACILITY REGULATIONS

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

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

## C. FACILITY POLLUTANTS

**Facility Pollutant Information**

| 1. Pollutant Emitted | | 2. Pollutant Classification |
|---|---|---|
| PM | Particulate Matter - Total | A |
| PM10 | Particulate Matter - PM10 | A |
| FL | Fluorides - Total | A |
| SO2 | Sulfur Dioxide | A |
| NOx | Nitrogen Oxides | A |
| H107 | Hydrogen fluoride | A |
| SAM | | A |

## D. FACILITY POLLUTANT DETAIL INFORMATION

**Facility Pollutant Detail Information:**

1. Pollutant Emitted:
2. Requested Emissions Cap: (lb/hr) (tons/yr)
3. Basis for Emissions Cap Code:
4. Facility Pollutant Comment (limit to 400 characters):

**Facility Pollutant Detail Information:**

1. Pollutant Emitted:
2. Requested Emissions Cap: (lb/hr) (tons/yr)
3. Basis for Emissions Cap Code:
4. Facility Pollutant Comment (limit to 400 characters):

## E. FACILITY SUPPLEMENTAL INFORMATION

### Supplemental Requirements for All Applications

1. Area Map Showing Facility Location:
   [ X ] Attached, Document ID: CR-FI-E1
   [ ] Not Applicable [ ] Waiver Requested

2. Facility Plot Plan:
   [ X ] Attached, Document ID: CR-FI-E2
   [ ] Not Applicable [ ] Waiver Requested

3. Process Flow Diagram(s):
   [ X ] Attached, Document ID(s): CR-FI-E3
   [ ] Not Applicable [ ] Waiver Requested

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

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

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

### Additional Supplemental Requirements for Category I Applications Only

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

8. List of Equipment/Activities Regulated under Title VI:
   [ ] Attached, Document ID: __________
   [ ] Equipment/Activities On site but Not Required to be Individually Listed
   [ ] Not Applicable

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

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

11. Identification of Additional Applicable Requirements:
[ ] Attached, Document ID: ____________________
[ ] Not Applicable

12. Compliance Assurance Monitoring Plan:
[ ] Attached, Document ID: ____________________
[ ] Not Applicable

13. Risk Management Plan Verification:

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

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

[ ] Not Applicable

14. Compliance Report and Plan
[ ] Attached, Document ID: ____________________
[ ] Not Applicable

15. Compliance Statement (Hard-copy Required)
[ ] Attached, Document ID: ____________________
[ ] Not Applicable

# ATTACHMENT CR-FI-E1

# AREA MAP

11-07-94

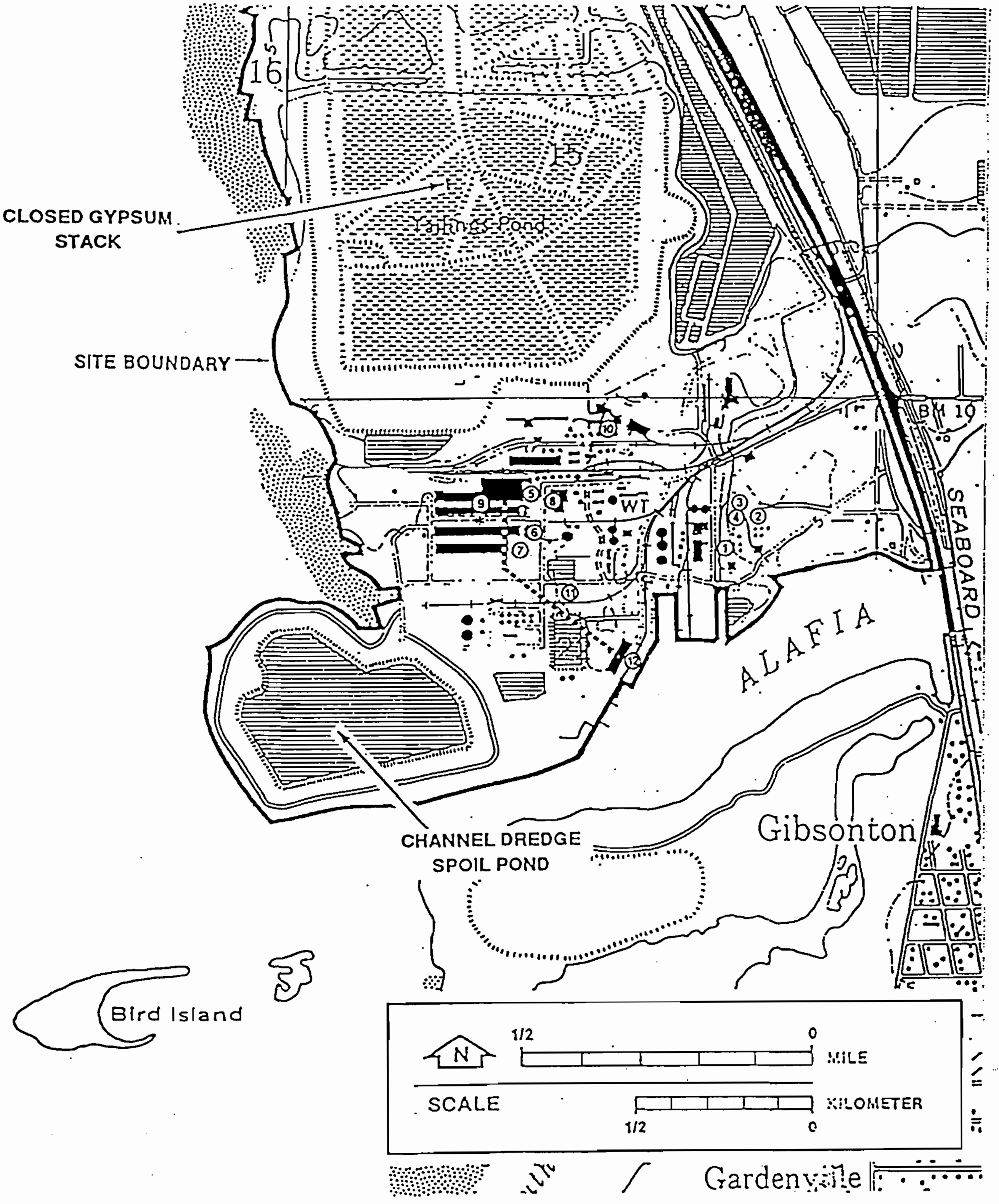


FIGURE 2-1
Site Location
Cargill Fertilizer, Inc.
Riverview Facility
Source: USGS, 1981.

Golder Associates

# ATTACHMENT CR-FI-E2
# FACILITY PLOT PLAN

KEY
1. TRANSFER POINT LOCATION (SHIP UNLOADER TO CONVEYOR 2102)
2. RAIL CAR UNLOADING HOPPER
3. STACK 2401
4. MELTER BUILDING SCRUBBER STACK 1702
5. MOLTEN SULFUR SCRUBBER STACK 1703
6. LIME SILO DUST COLLECTOR STACK 1704
7. DIATOMACEOUS EARTH SILO DUST COLLECTOR STACK 1705

| REFERENCE DRAWINGS | NO. | REVISION | REV. | DATE | NO. | REVISION | BY | DATE | DRAWING HISTORY | DATE | REV. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | FOR PERMITTING | 29 APR 99 | M |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| DRAWING HISTORY | DATE | REV. |
|---|---|---|
| FOR REVIEW | 21 MAR 99 | G |
| FOR REVIEW | 01 APR 99 | H |
| FOR REVIEW | 01 APR 99 | I |
| FOR REVIEW | 06 APR 99 | J |
| FOR PERMITTING | 12 APR 99 | K |

| SCALE 1"=150'-0" | DATE |
|---|---|
| DES. BY NRG | 01 OCT 97 |
| DRWN. BY JKC | 17 OCT 97 |
| CHKD. BY NRG | 18 FEB 98 |
| APPD. BY NRG | 18 FEB 98 |

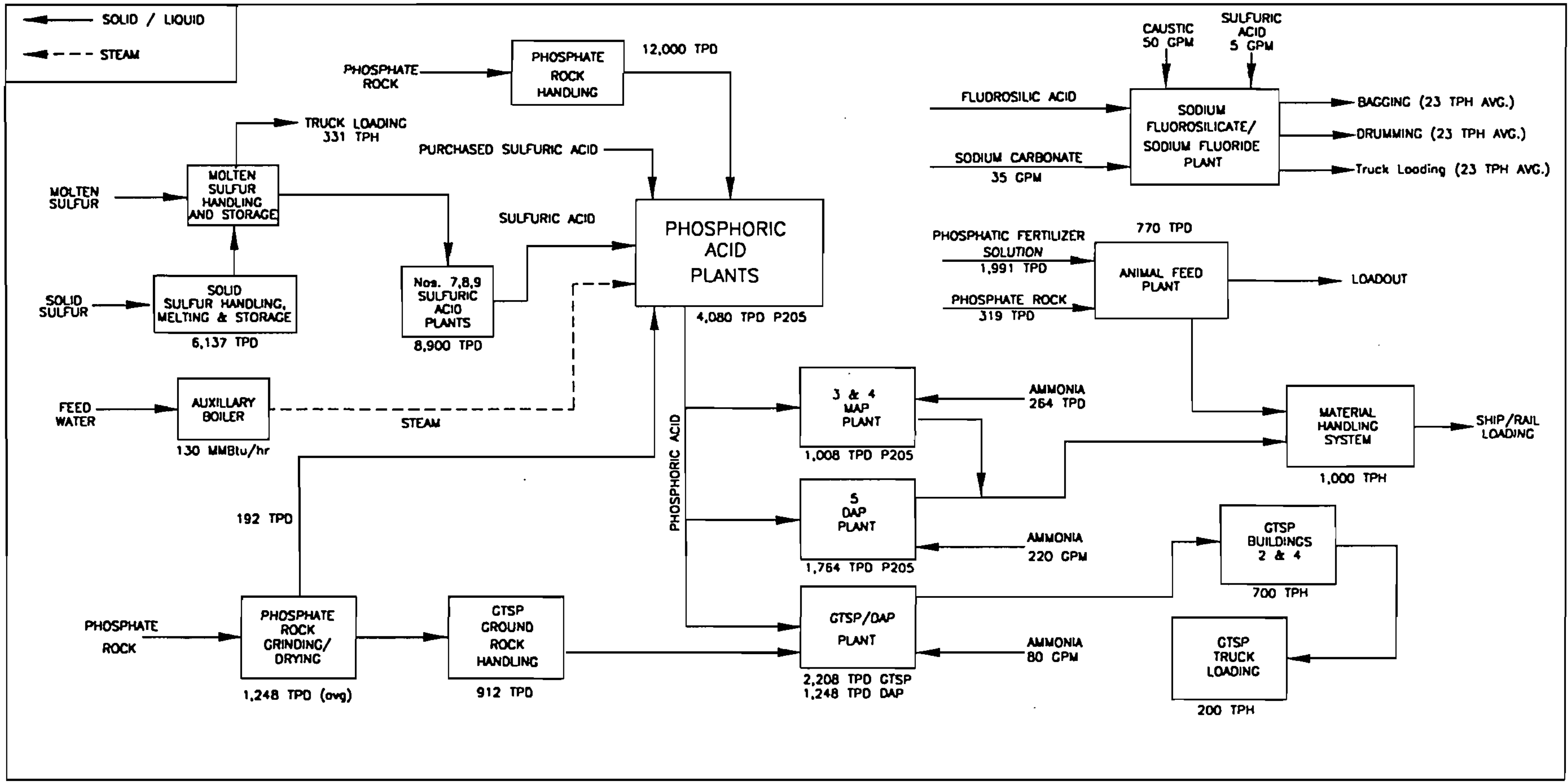
**KEMWorks**
Technology, Inc.
5925 IMPERIAL PARKWAY, SUITE 105
MULBERRY, FLORIDA USA
(941) 646-5369 FAX:(941) 647-5219
www.kemworks.com

CARGILL FERTILIZER, INC.
RIVERVIEW, FLORIDA
SULFUR STORAGE & MELTING
PLOT PLAN

| PROJ. MGR. | CLIENT | PROJ. NO. | DWG. NO. | REV. |
|---|---|---|---|---|
| NRG | CARGILL | 1155 | 1155-G-001 | M |

# ATTACHMENT CR-FI-E3

# FACILITY FLOW DIAGRAM



CARGILL FERTILIZER
TAMPA, FL
FACILITY FLOW DIAGRAM
CR–FI–E3

EMISSION UNIT: FACILITY WIDE
PROCESS AREA:
FILENAME: H:/CARGILL/RIVERVIEW/CRFLOW1C.DWG
LATEST REVISION: 04/15/99 by MJA

# III. EMISSIONS UNIT INFORMATION

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

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

### Type of Emissions Unit Addressed in This Section

1. Regulated or Unregulated Emissions Unit? Check one:

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

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

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

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

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

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

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

**Emissions Unit Description and Status**

1. Description of Emissions Unit Addressed in This Section (limit to 60 characters):
**Solid Sulfur Handling and Storage**

2. Emissions Unit Identification Number: [ ] No Corresponding ID [ ] Unknown

| | | |
|---|---|---|
| 3. Emissions Unit Status Code: **C** | 4. Acid Rain Unit?<br>[ ] Yes [X] No | 5. Emissions Unit Major Group SIC Code: **28** |

6. Emissions Unit Comment (limit to 500 characters):
**See Part B for description of process equipment to be installed as part of this application.**

## Emissions Unit Control Equipment Information

A.

1. Description (limit to 200 characters):

**Water sprays at material transfer points**

2. Control Device or Method Code: **62**

B.

1. Description (limit to 200 characters):

**Melter Area Scrubber**

2. Control Device or Method Code: **2**

C.

1. Description (limit to 200 characters):

**Enclosures at transfer points**

2. Control Device or Method Code: **54**

## Emissions Unit Control Equipment Information

A.

1. Description (limit to 200 characters):

Lime Silo Baghouse

2. Control Device or Method Code: 18

B.

1. Description (limit to 200 characters):

Diatomaceous Earth Silo Baghouse

2. Control Device or Method Code: 18

C.

1. Description (limit to 200 characters):

2. Control Device or Method Code:

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

### Emissions Unit Details

1. Initial Startup Date:

2. Long-term Reserve Shutdown Date:

3. Package Unit:
Manufacturer: Model Number:

4. Generator Nameplate Rating: MW

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

### Emissions Unit Operating Capacity

1. Maximum Heat Input Rate: mmBtu/hr

2. Maximum Incineration Rate: lbs/hr tons/day

3. Maximum Process or Throughput Rate: **2,240,000 TPY Sulfur**

4. Maximum Production Rate: **2,240,000 TPY Sulfur**

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

**Throughput rate refers to solid sulfur.**

### Emissions Unit Operating Schedule

1. Requested Maximum Operating Schedule:

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

**52** weeks/yr **8,760** hours/yr

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

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

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

62-212.600 Sulfur Storage and Handling Facilities
62-212.600(1)
62-212.600(2)(a)
62-212.600(2)(b)
62-212.600(2)(c)
62-212.600(3)(a)
62-212.600(3)(b)
62-212.600(3)(c)
62-296.320(4)(b)1.
62-296.411(1)(a) Sulfur Storage and Handling Facility
62-296.411(1)(b)
62-296.411(1)(d)
62-296.411(1)(e)
62-296.411(1)(f)
62-296.411(1)(g)
62-296.411(1)(h)
62-296.411(1)(i)
62-296.411(1)(j)
62-296.411(2)(a)
62-296.411(2)(b)
62-296.411(2)(c)
62-296.411(2)(d)1.
62-296.411(2)(e)
62-296.411(2)(f)
62-297.310 General Compliance test requirements
62-297.401 Compliance Test Methods

## E. EMISSION POINT (STACK/VENT) INFORMATION
## (Regulated Emissions Units Only)

**Emission Point Description and Type**

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

   **Solid Sulfur**

2. Emission Point Type Code:

   [ ]1 [ ]2 [x ]3 [ ]4

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

   **Ship & Railcar Unloading, Mat. Handling, Melter Scr., Sulfur Storage, Lime & D.E. Silo Baghouses**

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

5. Discharge Type Code:

   [ ]D [ ]F [ ]H [ ]P
   [ ]R [x ]V [ ]W

6. Stack Height: **106** feet

7. Exit Diameter: **0.8** feet

8. Exit Temperature: **110** °F

| | | |
|---|---|---|
| 9. Actual Volumetric Flow Rate: | **3,000** | acfm |
| 10. Percent Water Vapor: | | % |
| 11. Maximum Dry Standard Flow Rate: | **1,800** | dscfm |
| 12. Nonstack Emission Point Height: | | feet |

13. Emission Point UTM Coordinates:

Zone: East (km): North (km):

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

**D.E. = Diatomaceous Earth. Exit Diameter = 0.83 (rounded to 0.8). Represents melter scrubber stack. See Table 3-6 of Part B for parameters for all sources.**

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

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

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) (limit to 500 characters):

   Mineral Products; Bulk Materials Unloading Operation; Sulfur

2. Source Classification Code (SCC):

   3-05-101-08

3. SCC Units:

   Tons Processed

| | |
|---|---|
| 4. Maximum Hourly Rate:<br>1,456 | 5. Maximum Annual Rate:<br>2,240,000 |

6. Estimated Annual Activity Factor:

| | |
|---|---|
| 7. Maximum Percent Sulfur: | 8. Maximum Percent Ash: |

9. Million Btu per SCC Unit:

10. Segment Comment (limit to 200 characters):

    Maximum hourly rate is based on ship unloading of solid sulfur.

**Segment Description and Rate**: Segment _____ of _____

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) (limit to 500 characters):

2. Source Classification Code (SCC):

3. SCC Units:

4. Maximum Hourly Rate:

5. Maximum Annual Rate:

6. Estimated Annual Activity Factor:

7. Maximum Percent Sulfur:

8. Maximum Percent Ash:

9. Million Btu per SCC Unit:

10. Segment Comment (limit to 200 characters):

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

| 1. Pollutant Emitted | 2. Primary Control Device Code | 3. Secondary Control Device Code | 4. Pollutant Regulatory Code |
|---|---|---|---|
| SO2 | | | NS |
| PM | | | EL |
| PM10 | | | NS |
| VOC | | | NS |
| H2S | | | NS |

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

**Pollutant Detail Information**:

1. Pollutant Emitted: SO2

2. Total Percent Efficiency of Control: %

3. Potential Emissions: 3.15 lb/hour 13.81 tons/year

4. Synthetically Limited? ☐ Yes ☒ No

5. Range of Estimated Fugitive/Other Emissions:

☐ 1 ☐ 2 ☐ 3 ________ to ________ tons/yr

6. Emission Factor: See Part B

Reference:

7. Emissions Method Code:

☐ 0 ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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

See Part B

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

Emissions Unit Information Section 1 of 2

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

**A.**

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

**B.**

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

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

**Pollutant Detail Information**:

1. Pollutant Emitted: PM

2. Total Percent Efficiency of Control: %

3. Potential Emissions: 5.05 lb/hour 14.8 tons/year

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

5. Range of Estimated Fugitive/Other Emissions:

[x] 1 [ ] 2 [ ] 3 ______ to ______ tons/yr

6. Emission Factor: See Part B

Reference:

7. Emissions Method Code:

[ ] 0 [x] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

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

See Part B

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

Emissions Unit Information Section 1 of 2

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

**A.**

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

**B.**

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

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

**Pollutant Detail Information:**

1. Pollutant Emitted: PM10

2. Total Percent Efficiency of Control: %

3. Potential Emissions: 3.73 lb/hour 13.79 tons/year

4. Synthetically Limited? [ ] Yes [ ] No

5. Range of Estimated Fugitive/Other Emissions:

[ ] 1 [ ] 2 [ ] 3 ______ to ______ tons/yr

6. Emission Factor:

Reference:

7. Emissions Method Code:

[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

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

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

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

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

**A.**

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

**B.**

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

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

**Pollutant Detail Information:**

1. Pollutant Emitted: VOC

2. Total Percent Efficiency of Control: %

3. Potential Emissions: 2.25 lb/hour 9.84 tons/year

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

5. Range of Estimated Fugitive/Other Emissions:

[ ] 1 [ ] 2 [ ] 3 ________ to ________ tons/yr

6. Emission Factor: See Part B

Reference:

7. Emissions Method Code:

[ ] 0 [X] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

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

See Part B

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

**Emissions Unit Information Section 1 of 2**

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

**A.**

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

**B.**

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

Emissions Unit Information Section 1 of 2

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

**Pollutant Detail Information**:

1. Pollutant Emitted: H2S

2. Total Percent Efficiency of Control: %

3. Potential Emissions: 1.51 lb/hour 6.62 tons/year

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

5. Range of Estimated Fugitive/Other Emissions:

[ ] 1 [ ] 2 [ ] 3 ____ to ____ tons/yr

6. Emission Factor: See Part B

Reference:

7. Emissions Method Code:

[ ] 0 [x] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

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

See Part B

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

Emissions Unit Information Section 1 of 2

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

A.

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

B.

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

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

**Visible Emissions Limitations**: Visible Emissions Limitation 1 of 4

1. Visible Emissions Subtype: **VE10**

2. Basis for Allowable Opacity: [x ] Rule [ ] Other

3. Requested Allowable Opacity
Normal Conditions: 10 % Exceptional Conditions: %
Maximum Period of Excess Opacity Allowed: min/hour

4. Method of Compliance:
**Annual VE Test using EPA Method 9.**

5. Visible Emissions Comment (limit to 200 characters):
**Applies to all emission points handling molten sulfur. Rule 62-296.411(1)(g).**

**Visible Emissions Limitations**: Visible Emissions Limitation 2 of 4

1. Visible Emissions Subtype: **VE05**

2. Basis for Allowable Opacity: [x ] Rule [ ] Other

3. Requested Allowable Opacity
Normal Conditions: 5 % Exceptional Conditions: %
Maximum Period of Excess Opacity Allowed: min/hour

4. Method of Compliance:
**Annual VE Test using EPA Method 9**

5. Visible Emissions Comment (limit to 200 characters):
**Applies to all emission points handling solid sulfur except ship unloading. Rule 62-296.411(2)(e).**

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

**Visible Emissions Limitations**: Visible Emissions Limitation 3 of 4

1. Visible Emissions Subtype: VE15

2. Basis for Allowable Opacity: [x] Rule [ ] Other

3. Requested Allowable Opacity
Normal Conditions: 15 % Exceptional Conditions: %
Maximum Period of Excess Opacity Allowed: min/hour

4. Method of Compliance:
**Annual VE Test using EPA Method 9.**

5. Visible Emissions Comment (limit to 200 characters):
**Applies to ship unloading of ~~solid~~ sulfur. Rule 62-296.411(1)(i).**
molten

**Visible Emissions Limitations**: Visible Emissions Limitation 4 of 4

1. Visible Emissions Subtype: VE20

2. Basis for Allowable Opacity: [x] Rule [ ] Other

3. Requested Allowable Opacity
Normal Conditions: 20 % Exceptional Conditions: %
Maximum Period of Excess Opacity Allowed: min/hour

4. Method of Compliance:
**Annual VE Test using EPA Method 9**

5. Visible Emissions Comment (limit to 200 characters):
**Applies to lime and diatomaceous earth silo baghouses. Rule 62-296.320(4)(b)1.**

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

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

| | |
|---|---|
| 1. Parameter Code: | 2. Pollutant(s): |

3. CMS Requirement: [ ] Rule [ ] Other

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

5. Installation Date:

6. Performance Specification Test Date:

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

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

| | |
|---|---|
| 1. Parameter Code: | 2. Pollutant(s): |

3. CMS Requirement: [ ] Rule [ ] Other

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

5. Installation Date:

6. Performance Specification Test Date:

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

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

### (Regulated and Unregulated Emissions Units)

**PSD Increment Consumption Determination**

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

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

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

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

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

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

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

2. Increment Consuming for Nitrogen Dioxide?

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

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

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

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

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

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

3. Increment Consuming/Expanding Code:

| | | | |
|---|---|---|---|
| PM | ☒ C | ☐ E | ☐ Unknown |
| $SO_2$ | ☒ C | ☐ E | ☐ Unknown |
| $NO_2$ | ☐ C | ☐ E | ☐ Unknown |

4. Baseline Emissions:

| | | |
|---|---|---|
| PM | 0 lb/hour | tons/year |
| $SO_2$ | 0 lb/hour | tons/year |
| $NO_2$ | | tons/year |

5. PSD Comment (limit to 200 characters):

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

**Supplemental Requirements for All Applications**

1. Process Flow Diagram

☒ Attached, Document ID: CR-EU1-L1
☐ Not Applicable ☐ Waiver Requested

2. Fuel Analysis or Specification

☐ Attached, Document ID: ____________
☒ Not Applicable ☐ Waiver Requested

3. Detailed Description of Control Equipment

☒ Attached, Document ID: Part B
☐ Not Applicable ☐ Waiver Requested

4. Description of Stack Sampling Facilities

☐ Attached, Document ID: ____________
☒ Not Applicable ☐ Waiver Requested

5. Compliance Test Report

☐ Attached, Document ID: ____________ ☒ Not Applicable
☐ Previously Submitted, Date: ____________

6. Procedures for Startup and Shutdown

☐ Attached, Document ID: ____________ ☒ Not Applicable

7. Operation and Maintenance Plan

☐ Attached, Document ID: ____________ ☒ Not Applicable

8. Supplemental Information for Construction Permit Application

☒ Attached, Document ID: Part B ☐ Not Applicable

9. Other Information Required by Rule or Statute

☒ Attached, Document ID: Part B ☐ Not Applicable

## Additional Supplemental Requirements for Category I Applications Only

10. Alternative Methods of Operation

[ ] Attached, Document ID: ____________ [ ] Not Applicable

11. Alternative Modes of Operation (Emissions Trading)

[ ] Attached, Document ID: ____________ [ ] Not Applicable

12. Identification of Additional Applicable Requirements

[ ] Attached, Document ID: ____________ [ ] Not Applicable

13. Compliance Assurance Monitoring Plan

[ ] Attached, Document ID: ____________ [ ] Not Applicable

14. Acid Rain Permit Application (Hard Copy Required)

[ ] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
Attached, Document ID: ____________

[ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
Attached, Document ID: ____________

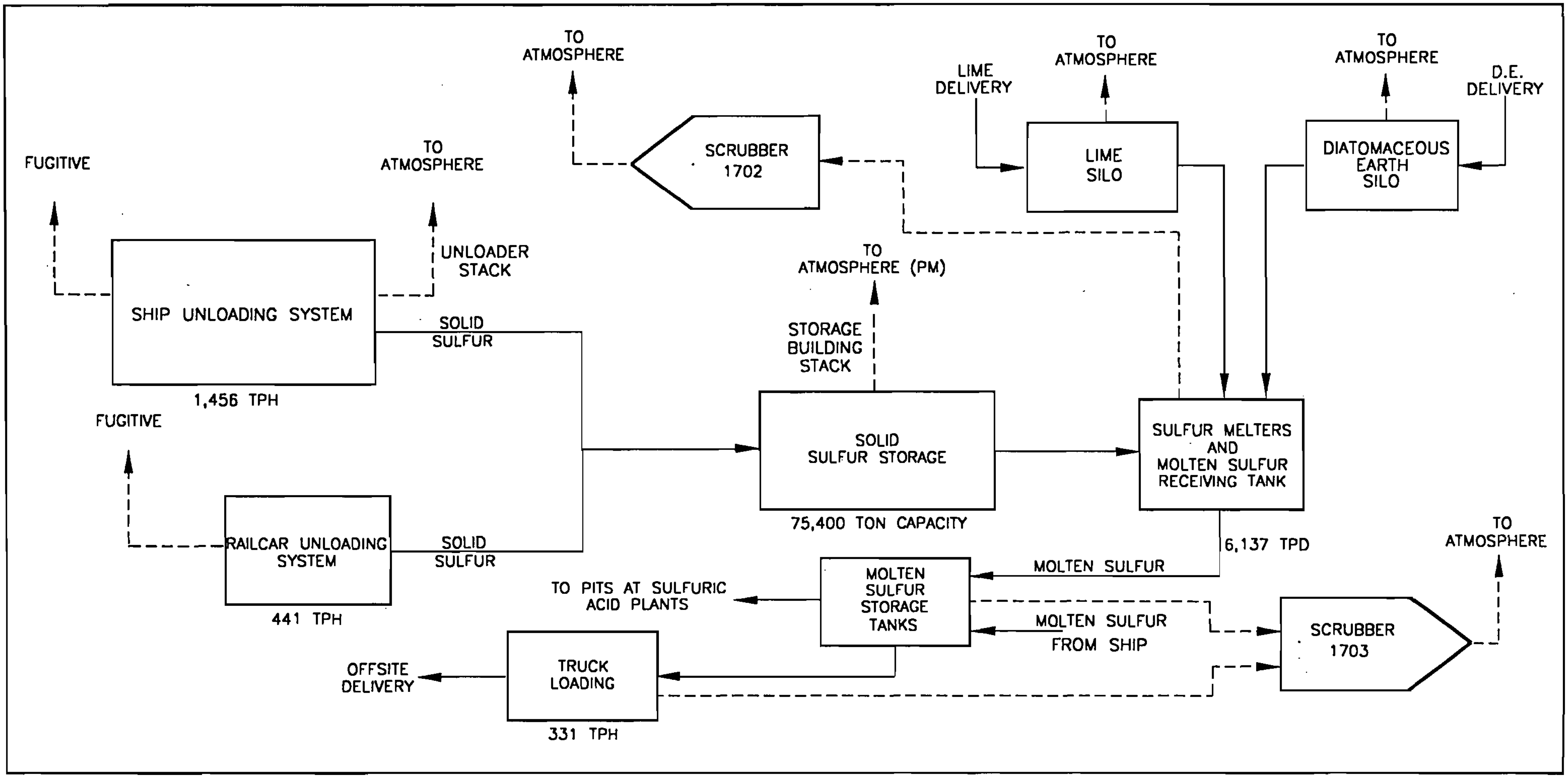
[ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.)
Attached, Document ID: ____________

[ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
Attached, Document ID: ____________

[ ] Not Applicable

# ATTACHMENT CR-EU1-L1

# PROCESS FLOW DIAGRAM



◄──── MATERIAL FLOW
◄- - - - AIR FLOW

CARGILL FERTILIZER
TAMPA, FL
FACILITY FLOW DIAGRAM
CR–EU1–LI

| | |
|---|---|
| EMISSION UNIT: | FACILITY WIDE |
| PROCESS AREA: | SOLID / MOLTEN SULFUR HANDLING AND STORAGE |
| FILENAME: | H:/CARGILL/RIVERVIEW/CRFLOW2A.DWG |
| LATEST REVISION: | 07/06/99 by MJA |

## III. EMISSIONS UNIT INFORMATION

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

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

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

1. Regulated or Unregulated Emissions Unit? Check one:

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

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

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

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

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

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

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

### Emissions Unit Description and Status

1. Description of Emissions Unit Addressed in This Section (limit to 60 characters):
**Molten Sulfur Handling and Storage**

2. Emissions Unit Identification Number: [ ] No Corresponding ID [ ] Unknown

3. Emissions Unit Status Code: **A**

4. Acid Rain Unit? [ ] Yes [x] No

5. Emissions Unit Major Group SIC Code: **28**

6. Emissions Unit Comment (limit to 500 characters):
**Consists of Molten Sulfur Tanks, pits and truck loading station. See Part B for description of modifications to this emissions unit included in this application.**

## Emissions Unit Control Equipment Information

A.

1. Description (limit to 200 characters):

**Wet Scrubber**

2. Control Device or Method Code: 2

B.

1. Description (limit to 200 characters):

2. Control Device or Method Code:

C.

1. Description (limit to 200 characters):

2. Control Device or Method Code:

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

### Emissions Unit Details

1. Initial Startup Date:

2. Long-term Reserve Shutdown Date:

3. Package Unit:
Manufacturer: Model Number:

4. Generator Nameplate Rating: MW

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

### Emissions Unit Operating Capacity

1. Maximum Heat Input Rate: mmBtu/hr

2. Maximum Incineration Rate: lbs/hr tons/day

3. Maximum Process or Throughput Rate: 3,352,576 TPY Sulfur

4. Maximum Production Rate: 3,352,576 TPY Sulfur

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

### Emissions Unit Operating Schedule

1. Requested Maximum Operating Schedule:

24 hours/day 7 days/week

52 weeks/yr 8,760 hours/yr

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

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

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

62-212.600(1) Sulfur Storage/Handling- Preconstruction Review
62-212.600(2)
62-212.600(3)(e)2.
62-212.600(3)(e)3.
62-212.600(3)(e)4.
62-296.411(1)(a) Sulfur Storage and Handling Facility
62-296.411(1)(b)
62-296.411(1)(d)
62-296.411(1)(e)
62-296.411(1)(f)
62-296.411(1)(g)
62-296.411(1)(h)
62-296.411(1)(i)
62-296.411(1)(j)
62-296.411(5)(b) Exemption from Emission Limit
62-297.310 General Compliance test requirements
62-297.401 Compliance Test Methods

## E. EMISSION POINT (STACK/VENT) INFORMATION
## (Regulated Emissions Units Only)

### Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram:
   Pit7-9; T1-T3,1703

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

3. Descriptions of Emissions Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):
   66=Pit 7; 67=Pit8; 68=Pit 9; 69=Ship Unloading dock; Scrubber 1703

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

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

6. Stack Height: 30 feet

7. Exit Diameter: 0.8 feet

8. Exit Temperature: 110 °F

| | |
|---|---|
| 9. Actual Volumetric Flow Rate: | **1,500** acfm |
| 10. Percent Water Vapor: | % |
| 11. Maximum Dry Standard Flow Rate: | **1,100** dscfm |
| 12. Nonstack Emission Point Height: | feet |

13. Emission Point UTM Coordinates:

Zone: East (km): North (km):

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

**Exit Diameter=0.83 (rounded to 0.8). A construction permit application has been submitted to rebuild Tank No. 1. Scrubber 1703 stack parameters are presented above. Exhaust is saturated with water.**

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

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

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) (limit to 500 characters):

**Mineral Products; Bulk Materials Unloading Operation; Sulfur**

2. Source Classification Code (SCC):

3. SCC Units:

**Tons Processed**

| | |
|---|---|
| 4. Maximum Hourly Rate:<br>**2,241** | 5. Maximum Annual Rate:<br>**3,352,576** |

6. Estimated Annual Activity Factor:

| | |
|---|---|
| 7. Maximum Percent Sulfur: | 8. Maximum Percent Ash: |

9. Million Btu per SCC Unit:

10. Segment Comment (limit to 200 characters):

**Maximum hourly rate is based on ship unloading of molten sulfur.**

**Segment Description and Rate**: Segment _____ of _____

| | |
|---|---|
| 1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) (limit to 500 characters): | |
| 2. Source Classification Code (SCC): | |
| 3. SCC Units: | |
| 4. Maximum Hourly Rate: | 5. Maximum Annual Rate: |
| 6. Estimated Annual Activity Factor: | |
| 7. Maximum Percent Sulfur: | 8. Maximum Percent Ash: |
| 9. Million Btu per SCC Unit: | |
| 10. Segment Comment (limit to 200 characters): | |

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

| 1. Pollutant Emitted | 2. Primary Control Device Code | 3. Secondary Control Device Code | 4. Pollutant Regulatory Code |
|---|---|---|---|
| PM | | | EL |
| PM10 | | | NS |
| VOC | | | NS |
| H2S | | | NS |
| SO2 | | | NS |

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

**Pollutant Detail Information:**

1. Pollutant Emitted: PM

2. Total Percent Efficiency of Control: %

3. Potential Emissions: 1.63 lb/hour 1.48 tons/year

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

5. Range of Estimated Fugitive/Other Emissions:

[ ] 1 [ ] 2 [ ] 3 ________ to ________ tons/yr

6. Emission Factor:

Reference:

7. Emissions Method Code:

[X] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

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

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

Emissions Unit Information Section 2 of 2

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

A.

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

B.

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

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

**Pollutant Detail Information**:

1. Pollutant Emitted: PM10

2. Total Percent Efficiency of Control: %

3. Potential Emissions: 1.63 lb/hour 1.48 tons/year

4. Synthetically Limited? [ ] Yes [ ] No

5. Range of Estimated Fugitive/Other Emissions:

[ ] 1 [ ] 2 [ ] 3 ________ to ________ tons/yr

6. Emission Factor:

Reference:

7. Emissions Method Code:

[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

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

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

**Emissions Unit Information Section 2 of 2**

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

**A.**

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

**B.**

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

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

**Pollutant Detail Information:**

1. Pollutant Emitted: VOC

2. Total Percent Efficiency of Control: %

3. Potential Emissions: 2.36 lb/hour 1.6 tons/year

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

5. Range of Estimated Fugitive/Other Emissions:

[ ] 1 [ ] 2 [ ] 3 ____________ to ____________ tons/yr

6. Emission Factor: See Part B

Reference:

7. Emissions Method Code:

[ ] 0 [ x ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

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

See Part B

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

**Emissions Unit Information Section 2 of 2**

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

**A.**

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

**B.**

1. Basis for Allowable Emissions Code:

2. Future Effective Date of Allowable Emissions:

3. Requested Allowable Emissions and Units:

4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance (limit to 60 characters):

6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) (limit to 200 characters):

Emissions Unit Information Section 2 of 2

Molten Sulfur Handling
Hydrogen Sulfide

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

**Pollutant Detail Information:**

1. Pollutant Emitted: H2S

2. Total Percent Efficiency of Control: %

3. Potential Emissions: 1.59 lb/hour 1.08 tons/year

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

5. Range of Estimated Fugitive/Other Emissions:

[ ] 1 [ ] 2 [ ] 3 ____________ to ____________ tons/yr

6. Emission Factor: See Part B

Reference:

7. Emissions Method Code:

[ ] 0 [X ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

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

See Part B

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

Emissions Unit Information Section 2 of 2

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

**A.**

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

**B.**

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

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

**Pollutant Detail Information**:

1. Pollutant Emitted: **SO2**

2. Total Percent Efficiency of Control: %

3. Potential Emissions: **3.31** lb/hour **2.25** tons/year

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

5. Range of Estimated Fugitive/Other Emissions:

[ ] 1 [ ] 2 [ ] 3 ____________ to ____________ tons/yr

6. Emission Factor: **See Part B**

Reference:

7. Emissions Method Code:

[ ] 0 [x] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

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

**See Part B**

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

Emissions Unit Information Section 2 of 2

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

A.

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

B.

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

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

**Visible Emissions Limitations**: Visible Emissions Limitation 1 of 2

1. Visible Emissions Subtype: **VE10**

2. Basis for Allowable Opacity: [x ] Rule [ ] Other

3. Requested Allowable Opacity
Normal Conditions: 10 % Exceptional Conditions: %
Maximum Period of Excess Opacity Allowed: min/hour

4. Method of Compliance:
**VE Test using EPA Method 9 within 180 days of Permit AO29-201635 expiration.**

5. Visible Emissions Comment (limit to 200 characters):
**Applies to all points except ship unloading. Rule 62-296.411(1)(g).**

**Visible Emissions Limitations**: Visible Emissions Limitation 2 of 2

1. Visible Emissions Subtype: **VE15**

2. Basis for Allowable Opacity: [x ] Rule [ ] Other

3. Requested Allowable Opacity
Normal Conditions: 15 % Exceptional Conditions: %
Maximum Period of Excess Opacity Allowed: min/hour

4. Method of Compliance:
**VE Test using EPA Method 9 within 180 days of Permit AO29-201635 expiration.**

5. Visible Emissions Comment (limit to 200 characters):
**Applies to ship unloading. Rule 62-296.411(1)(i)**

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

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

1. Parameter Code:

2. Pollutant(s):

3. CMS Requirement: [ ] Rule [ ] Other

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

5. Installation Date:

6. Performance Specification Test Date:

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

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

1. Parameter Code:

2. Pollutant(s):

3. CMS Requirement: [ ] Rule [ ] Other

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

5. Installation Date:

6. Performance Specification Test Date:

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

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

### PSD Increment Consumption Determination

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

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

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

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

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

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

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

2. Increment Consuming for Nitrogen Dioxide?

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

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

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

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

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

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

3. Increment Consuming/Expanding Code:

| | | | |
|---|---|---|---|
| PM | ☒ C | ☐ E | ☐ Unknown |
| $SO_2$ | ☒ C | ☐ E | ☐ Unknown |
| $NO_2$ | ☐ C | ☐ E | ☐ Unknown |

4. Baseline Emissions:

| | | |
|---|---|---|
| PM | lb/hour | tons/year |
| $SO_2$ | lb/hour | tons/year |
| $NO_2$ | | tons/year |

5. PSD Comment (limit to 200 characters):

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

**Supplemental Requirements for All Applications**

1. Process Flow Diagram

☒ Attached, Document ID: CR-EU2-L1
☐ Not Applicable ☐ Waiver Requested

2. Fuel Analysis or Specification

☐ Attached, Document ID: ____________
☒ Not Applicable ☐ Waiver Requested

3. Detailed Description of Control Equipment

☐ Attached, Document ID: ____________
☒ Not Applicable ☐ Waiver Requested

4. Description of Stack Sampling Facilities

☐ Attached, Document ID: ____________
☒ Not Applicable ☐ Waiver Requested

5. Compliance Test Report

☐ Attached, Document ID: ____________ ☒ Not Applicable
☐ Previously Submitted, Date: ____________

6. Procedures for Startup and Shutdown

☐ Attached, Document ID: ____________ ☒ Not Applicable

7. Operation and Maintenance Plan

☐ Attached, Document ID: ____________ ☒ Not Applicable

8. Supplemental Information for Construction Permit Application

☒ Attached, Document ID: Part B ☐ Not Applicable

9. Other Information Required by Rule or Statute

☐ Attached, Document ID: ____________ ☒ Not Applicable

## Additional Supplemental Requirements for Category I Applications Only

10. Alternative Methods of Operation

☐ Attached, Document ID: ____________ ☒ Not Applicable

11. Alternative Modes of Operation (Emissions Trading)

☐ Attached, Document ID: ____________ ☒ Not Applicable

12. Identification of Additional Applicable Requirements

☐ Attached, Document ID: ____________ ☒ Not Applicable

13. Compliance Assurance Monitoring Plan

☐ Attached, Document ID: ____________ ☒ Not Applicable

14. Acid Rain Permit Application (Hard Copy Required)

☐ Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
Attached, Document ID: ____________

☐ Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
Attached, Document ID: ____________

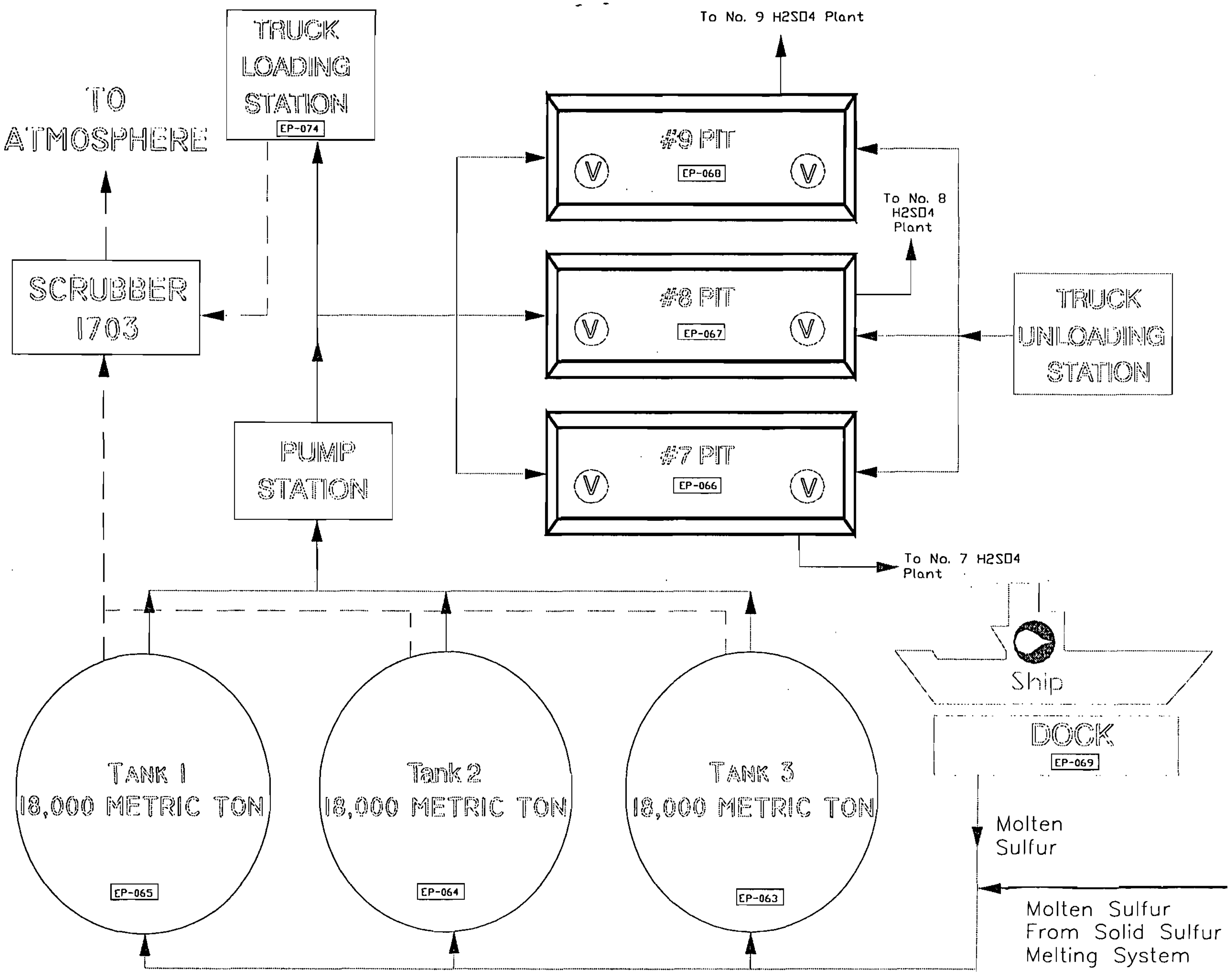
☐ New Unit Exemption (Form No. 62-210.900(1)(a)2.)
Attached, Document ID: ____________

☐ Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
Attached, Document ID: ____________

☒ Not Applicable

# ATTACHMENT CR-EU2-L1

# PROCESS FLOW DIAGRAM



| | |
|---|---|
| — — ▶ | Air Flow |
| ‥ ‥ ▶ | Sulfur Flow |
| (V) | Vent |

| | |
|---|---|
| Emissions unit: | EU2 |
| Process Area: | Molten Sulfur Unloading |
| Filename: | sulfur2dwg |
| Latest Revision: | 04/02/99 |
| Revision By: | Golder Associates |

**Cargill Fertilizer, Inc. - Tampa, FL**

# PART B

# 1.0 INTRODUCTION

Cargill Fertilizer, Inc. (Cargill) operates a fertilizer plant located in Riverview, Florida. Cargill is proposing to add a new emissions unit by constructing a solid sulfur handling and storage system. The proposed solid sulfur system consists of a ship unloading system, a railcar unloading system, material transfer and storage equipment, solid sulfur melting system, and lime and diatomaceous earth unloading and storage system. The proposed facility will have the capacity to produce 6,137 tons per day (TPD) or 2,240,000 tons per year (TPY) of molten sulfur. The molten sulfur produced by this facility will be used to replace that currently purchased and used in the sulfuric acid plants located at Cargill's Riverview and Bartow facilities.

In addition to installing a new solid sulfur handling and storage system, Cargill is proposing to modify its existing molten sulfur handling and storage system by adding a truck loading station and increasing their currently permitted molten sulfur ship unloading rate from 1,456 to 2,241 tons per hour (TPH). This modification includes installing a scrubber to control emissions from the molten sulfur storage tanks and proposed truck loading station. Emissions from the existing molten sulfur storage tanks are currently uncontrolled.

Although Cargill is classified as a major stationary source, the proposed solid sulfur handling facility and modification to the existing molten sulfur system do not constitute a major modification to a major stationary source as potential emission rates from the modification will not increase significantly above current actual emission rates as a result of this project. As such, this project does not require new source review under prevention of significant deterioration (PSD), pursuant to rules and regulations implementing the Clean Air Act (CAA) Amendments of 1977. However, this project is subject to state and federal permit regulations requiring Cargill to obtain a construction permit prior to beginning installation of the proposed facility or modification of existing equipment.

This report contains a construction permit application including supporting documentation and is organized in three additional sections. A complete description of the project including air emission sources is presented in Section 2.0. A description of the methods used to estimate emission rates for the proposed and modified sources, along with the estimated emissions, are presented in Section 3.0. The air quality review requirements and new source review applicability of the project are presented in Section 4.0. The air quality impact and deposition analysis is presented in Section 5.0.

## 2.0 PROJECT DESCRIPTION

Cargill is proposing to construct a solid sulfur handling and storage system at its phosphate fertilizer plant located in Riverview, Florida. The plant is located south of Tampa on Hillsborough Bay (see Figure 2-1). The location of the proposed solid sulfur system is shown on the plot plan of the facility presented in Attachment CR-FI-E2 of the permit application.

Cargill currently operates a molten sulfur handling facility with a capacity of 1,456 TPD. Molten sulfur is delivered by ship or truck and held in steam-heated tanks and pits prior to use in one of several sulfuric acid plants located at either Cargill's Riverview or Bartow facilities. Operations associated with the proposed solid sulfur facility include ship unloading of solid sulfur, railcar unloading of solid sulfur, transfer and storage of solid sulfur, and production of molten sulfur from solid sulfur through melting in steam-heated vessels. The molten sulfur from the melters will be transferred to the existing molten sulfur system for storage and eventually used in the facility's sulfuric acid plants or sent to the proposed truck loading station.

Cargill will utilize two existing tanks and one reconstructed tank to store the molten sulfur. Cargill recently made application for the reconstructed molten sulfur tank. A flow diagram of the existing molten sulfur operation plus reconstructed tank No. 1 is presented in Attachment CR-EU2-L1. The production capacity of the proposed melting system will be 6,137 TPD or 2,240,000 TPY of molten sulfur. As a result, Cargill intends to process up to 2,240,000 TPY of pelletized solid sulfur through the system.

A flow diagram of the proposed solid sulfur handling and storage process is presented in Attachment CR-EU1-L1. The solid sulfur will arrive at Cargill either by ship or railcar. The ship unloading process consists of removing solid sulfur pellets from the ship's hold using an enclosed bucket reclaimer. The design capacity of the ship unloader will be

1,456 TPH. Dust generated during removal of the solid sulfur from the ship's hold will be controlled using enclosures and water sprays. Dust generated during material handling within the unloader and at the drop from the unloader to the tubular conveyor will be controlled using enclosures and water sprays, and discharged to the atmosphere through a stack on the unloader.

Railcars will be unloaded by emptying (gravity flow) the solid sulfur pellets through doors on the bottom of the cars into a hopper that will feed a conveyor belt. The design capacity of the railcar unloading system will be 441 TPH. Dust generated during railcar unloading will be controlled using enclosures and water sprays.

From the ship and railcar unloading systems, the sulfur pellets will be transferred via a single conveyor (no additional transfer points) to the solid sulfur storage building. The transfer system will consist of a belt conveyor with an incline of less than 15 degrees. Cargill has selected tubular conveyors, which eliminate material transfer points between the ship and railcar unloading systems and the solid sulfur storage building.

Inside the storage building, the sulfur will discharge to the storage pile, never exceeding a five-foot vertical drop at any time. The building will have a ventilation system that will discharge to a stack. The solid sulfur pellets will be removed from storage by a reclaimer on to a conveyor belt leaving the building. The belt will be enclosed and the dust suppressed at each transfer point using a misting spray. The capacity of the solid sulfur storage building will be 78,400~~0~~ tons of solid sulfur.

From storage, the solid sulfur pellets are conveyed to the Melting System. In the Melting System, the solid sulfur is melted by means of indirect heating through use of steam. Vapors from the melting system, containing sulfur dioxide ($SO_2$), volatile organic compounds (VOCs), hydrogen sulfide ($H_2S$), and particulate matter ($PM/PM_{10}$) will be controlled using a wet scrubber and discharged to the atmosphere through a stack. The scrubber will be operated during molten sulfur ship unloading operations. As necessary, scrubbing the water will be recycled into the facility production process.

Lime may also be added in the Melting System. Lime will be delivered by truck and pneumatically transferred to a silo for storage prior to use in the melting system. Potential PM/$PM_{10}$ emissions generated during the unloading, storage, and transfer of lime will be controlled using a baghouse.

From the Melting System, the molten sulfur is pumped through a filter and into three storage tanks. Diatomaceous earth is used in the filtering process. Diatomaceous earth is delivered by truck and pneumatically transferred to a silo for storage. Potential PM/$PM_{10}$ emissions generated during the unloading, storage, and transfer of diatomaceous earth will be controlled using a baghouse.

The pipes used to transfer the molten sulfur from the Melting System will be steam jacketed and the tanks steam heated to maintain the sulfur in a molten state. The Melting System is designed with a maximum melting capacity of 6,137 TPD.

Any molten sulfur from the process that is not used at the Riverview sulfuric acid plants will be loaded into molten sulfur trucks by pumping from the molten sulfur storage tanks through steam jacketed pipes to a truck loading station.

Vapors from the storage tanks and proposed truck loading station, also containing $SO_2$, VOCs, $H_2S$, and PM/$PM_{10}$, will be controlled using a wet scrubber. $SO_2$, VOCs, $H_2S$, and PM/$PM_{10}$ emissions from these storage tanks are currently uncontrolled.

Sources of air emissions for the proposed solid sulfur storage and handling system are summarized below:

1. Fugitive PM/$PM_{10}$ emissions from the bucket reclaimer associated ship unloading system.

2. The ventilation stack for PM/$PM_{10}$ emissions from the unloader and transfer of the solid sulfur to the tubular conveyor.
3. Fugitive PM/$PM_{10}$ emissions from the railcar unloading system (material transfer to the receiving hopper and from the hopper to the tubular conveyor).
4. The PM/$PM_{10}$ ventilation stack for the solid sulfur storage building (material handling activities).
5. The stack for the scrubber controlling PM/$PM_{10}$, $SO_2$, $H_2S$, and VOC emissions from the sulfur melting area.
6. The baghouse stack for the lime delivery system.
7. The baghouse stack for the diatomaceous earth delivery system.

Sources of air emissions from the modified molten sulfur system are summarized below:

1. The stack for the scrubber controlling PM/$PM_{10}$, $SO_2$, $H_2S$, and VOC emissions from the molten sulfur storage tanks and truck loading station. Emissions from the two existing tanks are currently uncontrolled.
2. Fugitive PM/$PM_{10}$, $SO_2$, $H_2S$, and VOC emissions from the molten sulfur pits. Emission rates from the molten sulfur pits will not be affected by the proposed project.

11-07-94

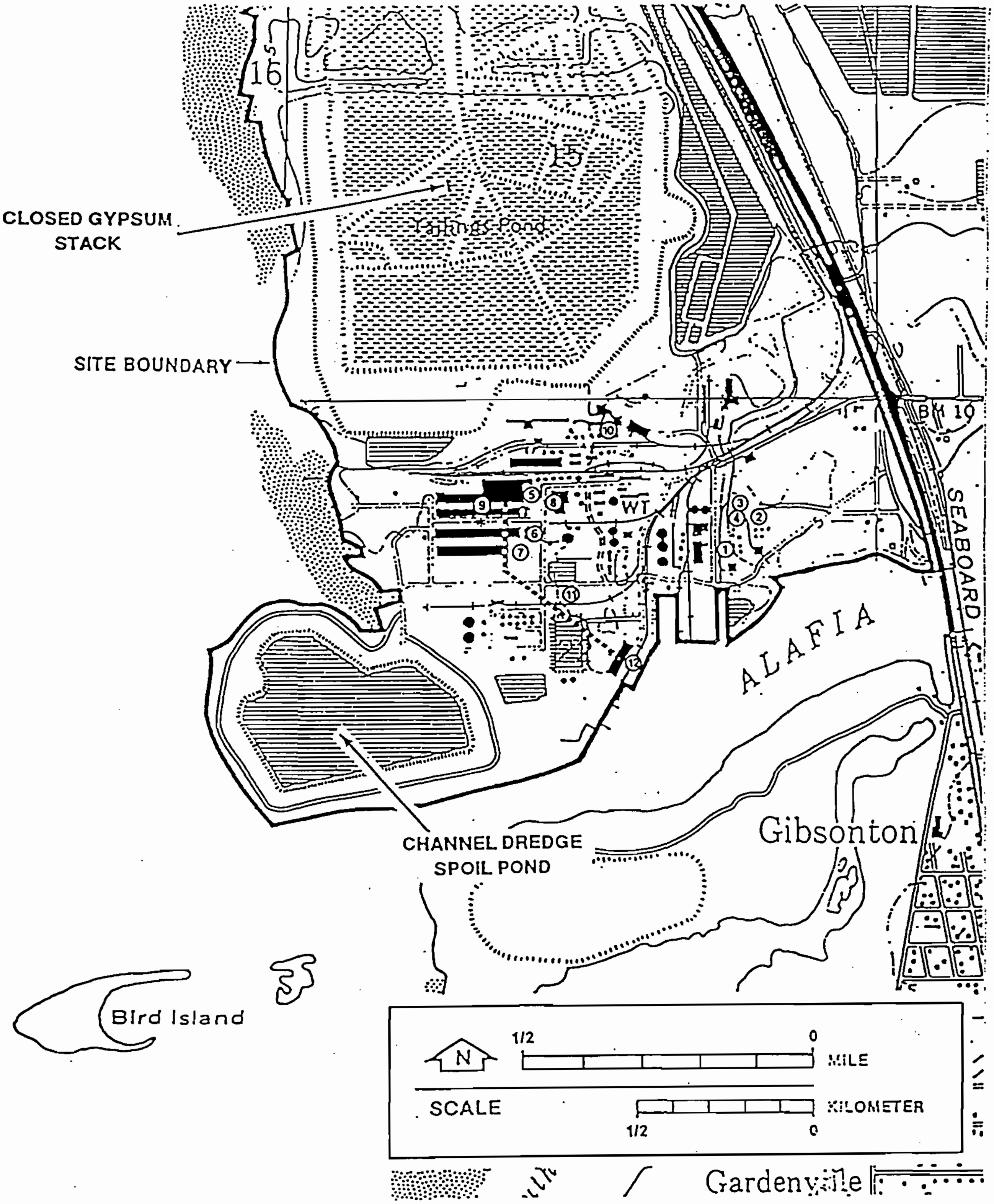


FIGURE 2-1
Site Location
Cargill Fertilizer, Inc.
Riverview Facility
Source: USGS, 1981.

Golder Associates

# 3.0 AIR EMISSIONS INVENTORY

## 3.1 SOLID SULFUR HANDLING AND STORAGE OPERATIONS

Emission rates for PM/$PM_{10}$ for solid sulfur handling were calculated in accordance with Rule 62-212.600(3)(a) which indicates the use of emission factor equations published by the U.S. Environmental Protection Agency. The rule specifically adopts by reference the equations published in Section 13.2 of AP-42, Compilation of Air Pollutant Emission Factors, 5th Edition, Volume 1, January 1995. Equation 1 of Section 13.2 is intended for calculating PM/$PM_{10}$ emission factors for material transfer points similar to those described as part of this project. This section of AP-42 is presented in Appendix A.

Equation 1 is a function of wind speed and the moisture content of the material. Equation 1 is applicable with an A quality rating when site specific data is used and the measured moisture and silt content of the transferred material, as well as the wind speed, is within specified parameters.

An emissions inventory for solid sulfur handling operations (ship and railcar unloading, conveying) is presented in Table 3-1. Since each of the transfer points are enclosed, the wind speed was assumed to be 1.3 miles per hour (mph) or the minimum wind speed that the equation is valid with an "A" quality rating. A moisture content of 0.5 percent was used in the equation based on the median value of 172 observations. The average silt content of the solid sulfur is 0.214 percent determined in accordance with the procedures specified in F.A.C. Rule 62-212.600(3)(a). Justification of the moisture and silt contents used in the determination of appropriate emission factors is presented in Appendix B.

The measured silt content is below the range specified for an "A" quality rating for the equation and results in the quality rating being dropped to "B". In accordance with a guidance memorandum prepared by Eric Noble of EPA and provided by Jim McDonald of FDEP, the emission factor determined using Equation 1 was increased by a factor 1.2 to account for reduction in the quality rating. The cited guidance document provided by FDEP is presented in Appendix C.

A PM/$PM_{10}$ control efficiency of 90 percent was used based on information presented in a document prepared by Environmental Research and Technology, Inc., for the Utility Air Regulatory Group showing that spraying is 70 to 95 percent efficient in reducing fugitive emission. A control efficiency on the upper end of the range was selected due to enclosure of the transfer points, which facilitates wetting of the solid sulfur. An excerpt from the cited document is presented in Appendix D.

## 3.2 MELTING OPERATIONS

An emissions inventory for the proposed solid sulfur melting operation is presented in Table 3-2. PM/$PM_{10}$, TRS, $SO_2$ and VOC emission rates from the solid sulfur melters were calculated using emission factors established for the existing molten sulfur storage tanks and determined through source testing (references provided in Appendix E). These emissions factors, in terms of lb/dscf, were used along with the vessel evacuation flow rate of 1,800 dscfm to determined hourly and annual potential uncontrolled emission. PM/$PM_{10}$, TRS, $SO_2$ and VOC control efficiencies for the proposed wet scrubber were provided by the vendor of the control equipment.

## 3.3 MOLTEN SULFUR HANDLING AND STORAGE OPERATIONS

An emissions inventory for the molten sulfur handling and storage operations to be modified as part of this project is presented in Table 3-3. Historically, PM/$PM_{10}$, TRS,

$SO_2$ and VOC emission rates from the molten sulfur storage tanks, existing molten sulfur pits, and the proposed truck loading operation were calculated using emission factors established for the existing molten sulfur storage tanks and pits as determined through source testing. Uncontrolled emissions rates for the pits were based on these emission factors and measured ventilation rates for storage and filling operations. Documentation of the emission factors and ventilation rates used to calculate emission rates for the pits are based on a permit application to increase the amount of molten sulfur unloaded from ships and installation of a molten sulfur truck loading station submitted October 8, 1993. Excerpts from the cited permit application are presented in Appendix E. Emission rates from the pits will not change as a result of this project.

Uncontrolled emission rates for the molten sulfur storage tanks were calculated using emission factors cited above and the ventilation rate of the proposed scrubber apportioned between the tanks and the proposed truck unloading station. $PM/PM_{10}$, TRS, $SO_2$ and VOC control efficiencies for the proposed wet scrubber were provided by the vendor of the control equipment. The scrubber will be operated at all times during loading of the tanks from either the ship or the melters.

Currently, $PM/PM_{10}$, TRS, $SO_2$ and VOC emissions from the two existing molten sulfur tanks are uncontrolled. An emissions inventory presenting actual emission rates (based on the average of annual molten sulfur loading rates for 1997 and 1998) is presented in Table 3-4. The emission rates in Table 3-4 are based on the same emission factors and ventilation rates contained in the excerpts from the permit application presented in Appendix E.

## 3.4 LIME AND DIATOMACEOUS EARTH DELIVERY SYSTEMS

$PM/PM_{10}$ emission rate calculations for the proposed lime and diatomaceous earth delivery systems are presented in Table 3-5. The $PM/PM_{10}$ emission rates calculated for the lime and diatomaceous earth delivery systems are based on an exhaust grain loading of 0.02 gr/dscf and design exhaust flow rates.

## 3.5 EMISSIONS SUMMARY

A summary of the source parameters and emission rates used on the permit application form and in the dispersion modeling analysis is presented in Table 3-6.

## 3.6 CONTROL EQUIPMENT INFORMATION

Some control equipment information is provided in this application. Detailed control equipment information will be provided 60 days prior to construction.

## Table 3-1. Summary of Particulate Matter Emission Rate Calculations for Handling and Storage of Solid Sulfur

| Process Description | Source Description | Number of Transfer Points | Maximum Solid Sulfur Throughput | | Moisture Content | Wind Speed(1) | Calculated Emission Factor(3) | Uncontrolled Emission Rate | | Control Equipment | Control Efficiency | Total PM Multiplier | Maximum Total PM Controlled Emission Rate | | PM10 Multiplier | Maximum PM10 Emission Rate | | Emission Point |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (TPH) | (TPY) | (%) | (mph) | (lb/ton) | (lb/hr) | (TPY) | | (%) | | (lb/hr) | (TPY) | | (lb/hr) | (TPY) | |
| Railcar Unloading System | Railcar to Hopper 2703 | 1 | 441 | 2,240,000 | 0.5 | 1.3 | 0.00464 | 2.047 | 5.199 | Misting Spray | 90 | 1.0 | 0.20 | 0.52 | 0.35 | 0.072 | 0.18 | Fugitive |
| Railcar Unloading System | Drop from Hopper 2703 to Conveyor 2110 | 1 | 441 | 2,240,000 | 0.5 | 1.3 | 0.00464 | 2.047 | 5.199 | Misting Spray | 90 | 1.0 | 0.20 | 0.52 | 0.35 | 0.072 | 0.18 | Fugitive |
| Ship Unloading System | Bucket Reclaimer (ship's hold) | 1 | 1,456 | 2,240,000 | 0.5 | 1.3 | 0.00464 | 6.758 | 5.199 | Misting Spray | 90 | 1.0 | 0.68 | 0.52 | 0.35 | 0.24 | 0.18 | Fugitive |
| Ship Unloading System | Ship Unloader 2101, Drop from Unloader to Conveyor | 2 | 1,456 | 2,240,000 | 0.5 | 1.3 | 0.00464 | 13.517 | 10.397 | Misting Spray | 90 | 1.0 | 1.35 | 1.04 | 0.35 | 0.47 | 0.36 | Unloader Stack |
| Solid Sulfur Storage and Reclaim System | Solid Sulfur Storage Building | | | | | | | | | None | -- | | 2.35 | 10.30 | | 2.35 | 10.30 | Sulfur Storage Building Stack |
| **Total Solid Sulfur Storage and Reclaim System and Railcar Unloading System** | | | | | | | | | | | | | **2.76** | **11.34** | | **2.49** | **10.66** | |
| **Total Solid Sulfur Storage and Reclaim System and Ship Unloading System** | | | | | | | | | | | | | **4.38** | **11.86** | | **3.06** | **10.85** | |

Notes:

1. The moisture content used in this analysis was the median value of 172 observations. See Appendix B of this application.
2. The PM emission rate for the Solid Sulfur Storage Building were provided by KEMWorks and based on a regulatory limit of 0.03 pounds of PM per hour per ton of solid sulfur storage capacity and a proposed storage capacity of 78,400 tons.

Footnotes:

[1] All drop/transfer points are enclosed, therefore the wind speed is assumed to be 1.3 mph or the minimum wind speed recommended for use in the emission factor equation.

[2] Silt content determined in accordance with the procedures presented in Rule 62-212.600 of the F.A.C.

[3] Calculated using the following equation presented in Section 13.2 of AP-42, Compilation of Air Pollutant Emission Factors, January 1995.

$$E = k\,(0.0032)(U/5)^{1.3}/(M/2)^{1.4}$$

where,

E = emission factor [lb/ton]
k = particulate size multiplier [dimensionless]
= 1.0 for all particles and 0.35 for particles smaller than 10 microns
U = mean wind speed [mph]
M = moisture content [%]

and applicable with an A quality rating when,

The silt content is between 0.44 and 19%,
The moisture content is between 0.25 and 4.8%
The wind speed is between 1.3 and 15 mph.

Because the actual range of silt contents of the solid sulfur (0.186 to 0.229%) is outside the range specified for an "A" quality rating, the emission factor determined using the above equation was multiplied by a factor of 1.2 in accordance with the memorandum from Eric Noble (Subject: Using AP-42 Data Base for Making Exclusionary Rule Applicability Determinations), dated March 2, 1995 and presented in Appendix E.

## Table 3-2. Summary of Emission Rate Calculations for Melting Solid Sulfur

| | Vessel | Particulate Matter | | | | | | | Total Reduced Sulfur | | | | | | | Sulfur Dioxide | | | | | | | Volatile Organic Compounds | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Evacuation Flow Rate | Emission Factor | Uncontrolled Emission Rate | | Control Efficiency[a] | Controlled Emission Rate[b] | | Emission Factor | Emission Rate | | Control Efficiency | Controlled Emission Rate | | Emission Factor | Emission Rate | | Control Efficiency | Controlled Emission Rate | | Emission Factor | Emission Rate | | Control Efficiency | Controlled Emission Rate | | Emission |
| Source Description | (dscfm) | (grains/dscf) | (lb/hr) | (TPY) | (%) | (lb/hr) | (TPY) | (lb/dscf) | (lb/hr) | (TPY) | (%) | (lb/hr) | (TPY) | (lb/dscf) | (lb/hr) | (TPY) | (%) | (lb/hr) | (TPY) | (lb/dscf) | (lb/hr) | (TPY) | (%) | (lb/hr) | (TPY) | Point |
| Drop from Conveyor 2108 to the Melters, Melters, and Sulfur Receiving Tank 2302 | 1,800 | 0.20 | 3.09 | 13.52 | 85 | **0.46** | **2.03** | 3.50E-05 | 3.78 | 16.56 | 60 | **1.51** | **6.62** | 7.30E-05 | 7.88 | 34.53 | 60 | **3.15** | **13.81** | 5.20E-05 | 5.62 | 24.60 | 60 | **2.25** | **9.84** | Scrubber 1702 |

Note:

1. Uncontrolled emission rates are based on established emission factors for the existing molten sulfur system storage tanks based on industry test data presented in Appendix C.

Footnote:

[a] Calculated based on estimated loading and maximum outlet emissions.

[b] Controlled PM emission rates are based on an outlet loading of 0.03 grains/dscf as provided by KEMWorks.

## Table 3-3. Summary of Emission Rate Calculations for the Molten Sulfur Handling System Based on a Proposed Emission Control System (Scrubber 1703) and an Increase in the Ship Unloading Rate to 2,240 Short Tons of Molten Sulfur per Hour

|  |  | Rebuilt Tank No. 1 |  |  |  |  | Existing Tank No. 2 |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameters | Units | Tank Loading from Ship/Melters | Unloading into Pit | Storage/ Idle | Total Emissions (TPY) | Max Emissions (lb/hr) | Tank Loading from Ship/Melters | Unloading into Pit | Storage/ Idle | Total Emissions (TPY) | Max Emissions (lb/hr) |
| **SULFUR FLOW RATES** |  |  |  |  |  |  |  |  |  |  |  |
| Maximum loading rate | long tons/hour | 2,000 | 300 | 0 |  |  | 2,000 | 300 | 0 |  |  |
|  | TPH | 2,240 | 336 |  |  |  | 2,240 | 336 |  |  |  |
| Annual loading rate | long tons/year | 997,790 | 997,790 | — |  |  | 997,790 | 997,790 | — |  |  |
|  | TPY | 1,117,525 | 1,117,525 |  |  |  | 1,117,525 | 1,117,525 |  |  |  |
| **VENTILATION RATES** |  |  |  |  |  |  |  |  |  |  |  |
| Loading/Unloading | dscfm | 250[b] | 0 | 0 |  |  | 250[b] | 0 | 0 |  |  |
| Natural Ventilation through vents | dscfm | 0 | 0 | 0 |  |  | 0 | 0 | 0 |  |  |
| Total Ventilation | dscfm | 250 | 0 | 0 |  |  | 250 | 0 | 0 |  |  |
| **TRANSFER TIMES** |  |  |  |  |  |  |  |  |  |  |  |
| Loading/Unloading time | hr/yr | 499 | 3,326 | — |  |  | 499 | 3,326 | — |  |  |
| Idle time | hr/yr | — | — | 4,935 |  |  | — | — | 4,935 |  |  |
| Operating time | hr/yr | — | — | — |  |  | — | — | — |  |  |
| **EMISSION FACTORS** |  |  |  |  |  |  |  |  |  |  |  |
| Sulfur particulate | grains/dscf | 0.03 | 0.03 | 0.03 |  |  | 0.03 | 0.03 | 0.03 |  |  |
| TRS (as H2S) | lb/dscf | 3.5E-05 | 3.5E-05 | 3.5E-05 |  |  | 3.5E-05 | 3.5E-05 | 3.5E-05 |  |  |
| SO2 | lb/dscf | 7.3E-05 | 7.3E-05 | 7.3E-05 |  |  | 7.3E-05 | 7.3E-05 | 7.3E-05 |  |  |
| VOC | lb/dscf | 5.2E-05 | 5.2E-05 | 5.2E-05 |  |  | 5.2E-05 | 5.2E-05 | 5.2E-05 |  |  |
| **SCRUBBER REMOVAL EFFICIENCY** |  |  |  |  |  |  |  |  |  |  |  |
| Sulfur particulate | % | [a] | [a] | [a] |  |  | [a] | [a] | [a] |  |  |
| TRS (as H2S) | % | 60 | 60 | 60 |  |  | 60 | 60 | 60 |  |  |
| SO2 | % | 60 | 60 | 60 |  |  | 60 | 60 | 60 |  |  |
| VOC | % | 60 | 60 | 60 |  |  | 60 | 60 | 60 |  |  |
|  |  |  |  |  | Annual Emission Rate (TPY) | Maximum Hourly Emission Rate (lb/hr) |  |  |  | Annual Emission Rate (TPY) | Maximum Hourly Emission Rate (lb/hr) |
| **EMISSION RATES** |  |  |  |  |  |  |  |  |  |  |  |
| Sulfur Particulate | lb/hr | 0.064 | 0.0000 | 0.0000 | — | 0.064 | 0.064 | 0.0000 | 0.0000 | — | 0.064 |
|  | TPY | 0.0160 | 0.0000 | 0.0000 | 0.016 | — | 0.0160 | 0.0000 | 0.0000 | 0.016 | — |
| TRS (as H2S) | lb/hr | 0.21 | 0.0000 | 0.0000 | — | 0.21 | 0.21 | 0.0000 | 0.0000 | — | 0.21 |
|  | TPY | 0.0210 | 0.0000 | 0.0000 | 0.021 | — | 0.0210 | 0.0000 | 0.0000 | 0.021 | — |
| Sulfur Dioxide | lb/hr | 0.44 | 0.0000 | 0.0000 | — | 0.44 | 0.44 | 0.0000 | 0.0000 | — | 0.44 |
|  | TPY | 0.044 | 0.0000 | 0.0000 | 0.044 | — | 0.044 | 0.0000 | 0.0000 | 0.044 | — |
| Volatile Organic Compounds | lb/hr | 0.31 | 0.0000 | 0.0000 | — | 0.31 | 0.31 | 0.0000 | 0.0000 | — | 0.31 |
|  | TPY | 0.031 | 0.0000 | 0.0000 | 0.031 | — | 0.031 | 0.0000 | 0.0000 | 0.031 | — |

|  |  | Existing Tank No. 3 |  |  |  |  | Pit 7 |  | Pit 8 |  | Pit 9 |  | Truck Loading Station |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameters | Units | Tank Loading from Ship/Melters | Unloading into Pit | Storage/ Idle | Total Emissions (TPY) | Max Emissions (lb/hr) | Loading | Unloading/ Idle | Loading | Unloading/ Idle | Loading | Unloading/ Idle | Loading |
| **SULFUR FLOW RATES** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Maximum loading rate | long tons/hour | 2,000 | 300 | 0 |  |  | 300 | 0 | 300 | 0 | 300 | 0 | 268 |
|  | TPH | 2,240 | 336 |  |  |  | 336 | 0 | 336 | 0 | 336 | 0 | 300 |
| Annual loading rate | long tons/year | 997,790 | 997,790 | — |  |  | 439,887 | — | 439,887 | — | 439,887 | — | 2,000,000 |
|  | TPY | 1,117,525 | 1,117,525 |  |  |  | 492,673 | 0 | 492,673 | 0 | 492,673 | 0 | 2,240,000 |
| **VENTILATION RATES** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Loading/Unloading | dscfm | 250[b] | 0 | 0 |  |  | 95[d] | — | 95[d] | — | 95[d] | — | 350 |
| Natural Ventilation through vents | dscfm | 0 | 0 | 0 |  |  | 5[d] | 5[d] | 5[d] | 5[d] | 5[d] | 5[d] | 0 |
| Total Ventilation | dscfm | 250 | 0 | 0 |  |  | 100 | 5 | 100 | 5 | 100 | 5 | 350 |
| **TRANSFER TIMES** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Loading/Unloading time | hr/yr | 499 | 3,326 | — |  |  | 1,466 | — | 1,466 | — | 1,466 | — | 7,467 |
| Idle time | hr/yr | — | — | 4,935 |  |  | — | 7,294 | — | 7,294 | — | 7,294 | — |
| Operating time | hr/yr | — | — | — |  |  | — | — | — | — | — | — | — |
| **EMISSION FACTORS** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sulfur particulate | grains/dscf | 0.03 | 0.03 | 0.03 |  |  | 0.51 | 0.29 | 0.51 | 0.29 | 0.51 | 0.29 | 0.03 |
| TRS (as H2S) | lb/dscf | 3.5E-05 | 3.5E-05 | 3.5E-05 |  |  | 3.5E-05 | 3.5E-05 | 3.5E-05 | 3.5E-05 | 3.5E-05 | 3.5E-05 | 3.5E-05 |
| SO2 | lb/dscf | 7.3E-05 | 7.3E-05 | 7.3E-05 |  |  | 7.3E-05 | 7.3E-05 | 7.3E-05 | 7.3E-05 | 7.3E-05 | 7.3E-05 | 7.3E-05 |
| VOC | lb/dscf | 5.2E-05 | 5.2E-05 | 5.2E-05 |  |  | 5.2E-05 | 5.2E-05 | 5.2E-05 | 5.2E-05 | 5.2E-05 | 5.2E-05 | 5.2E-05 |
| **SCRUBBER REMOVAL EFFICIENCY** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sulfur particulate | % | [a] | [a] | [a] |  |  | [c] | [c] | [c] | [c] | [c] | [c] | [a] |
| TRS (as H2S) | % | 60 | 60 | 60 |  |  | [c] | [c] | [c] | [c] | [c] | [c] | 60 |
| SO2 | % | 60 | 60 | 60 |  |  | [c] | [c] | [c] | [c] | [c] | [c] | 60 |
| VOC | % | 60 | 60 | 60 |  |  | [c] | [c] | [c] | [c] | [c] | [c] | 60 |
|  |  |  |  |  | Annual Emission Rate (TPY) | Maximum Hourly Emission Rate (lb/hr) |  |  |  |  |  |  |  |
| **EMISSION RATES** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sulfur Particulate | lb/hr | 0.064 | 0.0000 | 0.0000 | — | 0.064 | 0.44 | 0.012 | 0.44 | 0.012 | 0.44 | 0.012 | 0.090 |
|  | TPY | 0.0160 | 0.0000 | 0.0000 | 0.016 | — | 0.32 | 0.045 | 0.32 | 0.045 | 0.32 | 0.045 | 0.34 |
| TRS (as H2S) | lb/hr | 0.21 | 0.0000 | 0.0000 | — | 0.21 | 0.21 | 0.011 | 0.21 | 0.011 | 0.21 | 0.011 | 0.29 |
|  | TPY | 0.0210 | 0.0000 | 0.0000 | 0.021 | — | 0.15 | 0.038 | 0.15 | 0.038 | 0.15 | 0.038 | 0.44 |
| Sulfur Dioxide | lb/hr | 0.44 | 0.0000 | 0.0000 | — | 0.44 | 0.44 | 0.022 | 0.44 | 0.022 | 0.44 | 0.022 | 0.61 |
|  | TPY | 0.044 | 0.0000 | 0.0000 | 0.044 | — | 0.32 | 0.080 | 0.32 | 0.080 | 0.32 | 0.080 | 0.92 |
| Volatile Organic Compounds | lb/hr | 0.31 | 0.0000 | 0.0000 | — | 0.31 | 0.31 | 0.016 | 0.31 | 0.016 | 0.31 | 0.016 | 0.44 |
|  | TPY | 0.031 | 0.0000 | 0.0000 | 0.031 | — | 0.23 | 0.057 | 0.23 | 0.057 | 0.23 | 0.057 | 0.65 |

Notes:

Total Sulfur Throughput = 2,993,371 long tons/yr = 3,352,576 tons/yr

Total Sulfur to Each Pit = 446,667 metric tons/yr (current permit limit) = 492,673 tons/yr.

Total Sulfur to Truck Loading Station = 2,240,000 tons/yr = 2,000,000 long tons/yr

Long Ton = 2,240 lbs

Short ton = 2,000 lbs

TPY = Short tons per year

TPH = Short tons per hour

Density of Sulfur (280 F) = 112 lb / cf

Footnotes:

[a] Emission rate based on a controlled grain loading of 0.03 grains per dscf.

[b] The total flowrate of 1,100 dscfm (1,500 acfm) for Scrubber 1703 was divided in the following manner based on information received from KEMWorks:

|  | Flow |  |
|---|---|---|
| Source | (acfm) | (dscfm) |
| Existing No. 2 Molten Sulfur Tank | 333 | 250 |
| Existing No. 3 Molten Sulfur Tank | 333 | 250 |
| Rebuilt Molten Sulfur Tank | 333 | 250 |
| Truck Loading Operation | 500 | 350 |

To reduce annual emissions, the scrubber will be operated during molten sulfur ship unloading operations. Since the tanks will be vented to the scrubber, there are no emissions due to natural ventilation.

[c] Proposed Scrubber 1703 does not control emissions from this source.

[d] Documentation of the ventilation rates used for the pits are presented in Appendix C.

| Total Emission Rates from Molten Sulfur Storage Tanks and Truck Loading Station | Total Annual Emission Rate (TPY) | Maximum Hourly Emission Rate (lb/hr) |
|---|---|---|
| Sulfur Particulate | 0.38 | 0.28 |
| TRS (as $H_2S$) | 0.50 | 0.92 |
| Sulfur Dioxide | 1.05 | 1.93 |
| Volatile Organic Compounds | 0.75 | 1.37 |

| Total Emission Rates from All Sources | Total Annual Emission Rate (TPY) | Maximum Hourly Emission Rate (lb/hr) |
|---|---|---|
| Sulfur Particulate | 1.48 | 1.63 |
| TRS (as $H_2S$) | 1.08 | 1.59 |
| Sulfur Dioxide | 2.25 | 3.31 |
| Volatile Organic Compounds | 1.60 | 2.36 |

## Table 3-4. Summary of Actual Emission Rate Calculations for the Existing Molten Sulfur Storage Tanks

| | | Existing Tank No. 2 | | | | | Existing Tank No. 3 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameters | Units | Loading from Ship | Unloading into Pit | Storage | Total Emissions (TPY) | Max Emissions (lb/hr) | Loading from Ship | Unloading into Pit | Storage | Total Emissions (TPY) | Max Emissions (lb/hr) |
| SULFUR FLOW RATES | | | | | | | | | | | |
| Maximum loading rate | long tons/hour | 1,300 | 300 | 0 | | | 1,300 | 300 | 0 | | |
| | TPH | 1,456 | 336 | | | | 1,456 | 336 | | | |
| Annual loading rate[a] | long tons/hour | 371,635 | 371,635 | ... | | | 371,635 | 371,635 | ... | | |
| | TPY | 416,231 | 416,231 | | | | 416,231 | 416,231 | | | |
| VENTILATION RATES | | | | | | | | | | | |
| Loading/Unloading | dscfm | 429[b] | 0 | ... | | | 429[b] | 0 | ... | | |
| Natural Ventilation through vents | dscfm | 30[b] | 30[b] | 30[b] | | | 30[b] | 30[b] | 30[b] | | |
| Total Ventilation | dscfm | 459 | 30 | 30 | | | 459 | 30 | 30 | | |
| TRANSFER TIMES | | | | | | | | | | | |
| Loading/Unloading time | hr/yr | 286 | 1,239 | ... | | | 286 | 1,239 | ... | | |
| Idle time | hr/yr | ... | ... | 7,235 | | | ... | ... | 7,235 | | |
| Operating time | hr/yr | ... | ... | ... | | | ... | ... | ... | | |
| EMISSION FACTORS | | | | | | | | | | | |
| Sulfur particulate | grains/dscf | 0.66 | 0.29 | 0.29 | | | 0.66 | 0.29 | 0.29 | | |
| TRS (as H2S) | lb/cf | 3.5E-05 | 3.5E-05 | 3.5E-05 | | | 3.5E-05 | 3.5E-05 | 3.5E-05 | | |
| SO2 | lb/cf | 7.3E-05 | 7.3E-05 | 7.3E-05 | | | 7.3E-05 | 7.3E-05 | 7.3E-05 | | |
| VOC | lb/cf | 5.2E-05 | 5.2E-05 | 5.2E-05 | | | 5.2E-05 | 5.2E-05 | 5.2E-05 | | |
| EMISSION RATES | | | | | Annual Emission Rate (TPY) | Maximum Hourly Emission Rate (lb/hr) | | | | Annual Emission Rate (TPY) | Maximum Hourly Emission Rate (lb/hr) |
| **Sulfur Particulate** | lb/hr | 2.60 | 0.075 | 0.075 | ... | 2.60 | 2.60 | 0.075 | 0.075 | ... | 2.60 |
| | TPY | 0.37 | 0.046 | 0.27 | 0.69 | ... | 0.37 | 0.046 | 0.27 | 0.69 | ... |
| **TRS (as H2S)** | lb/hr | 0.96 | 0.063 | 0.063 | ... | 0.96 | 0.96 | 0.063 | 0.063 | ... | 0.96 |
| | TPY | 0.14 | 0.039 | 0.23 | 0.40 | ... | 0.14 | 0.039 | 0.23 | 0.40 | ... |
| **Sulfur Dioxide** | lb/hr | 2.01 | 0.131 | 0.13 | ... | 2.01 | 2.01 | 0.131 | 0.13 | ... | 2.01 |
| | TPY | 0.29 | 0.081 | 0.48 | 0.84 | ... | 0.29 | 0.081 | 0.48 | 0.84 | ... |
| **Volatile Organic Compounds** | lb/hr | 1.43 | 0.094 | 0.094 | ... | 1.43 | 1.43 | 0.094 | 0.094 | ... | 1.43 |
| | TPY | 0.20 | 0.058 | 0.34 | 0.60 | ... | 0.20 | 0.058 | 0.34 | 0.60 | ... |

Actual emissions of Pits 7, 8 & 9 are not included in this Table. Taking a ratio of 371,635/439,887 = 0.84 & calc. emission from pits gives actual # > future #

| Total Emission Rates from Molten Sulfur Storage Tanks | Total Annual Emission Rate (TPY) | Maximum Hourly Emission Rate (lb/hr) |
|---|---|---|
| **Sulfur Particulate** | 1.37 | 5.19 |
| **TRS (as H2S)** | 0.81 | 1.93 |
| **Sulfur Dioxide** | 1.69 | 4.02 |
| **Volatile Organic Compounds** | 1.20 | 2.86 |

Notes:

long ton = 2,240 lbs
short ton = 2,000 lbs
TPH = short tons per hour
TPY = short tons per year

Footnotes:

[a] Based on the average annual amount of molten sulfur processed in 1997 (724,698 long tons) and 1998 (761,842 long tons), divided equally among the two tanks.

[b] Documentation for the ventilation rates used for the tanks are presented in Appendix C.

Table 3-5. Summary of PM/PM10 Emission Rate Estimates for the Lime and Diatomaceous Earth Unloading and Storage Systems

| Source | Control Equipment | Design Capacity (dscfm) | Control Efficiency (%) | Operating Hours (hours) | PM/PM10 Emission Rate | | |
|---|---|---|---|---|---|---|---|
| | | | | | (gr/dscf) | (lb/hr) | (TPY) |
| Lime Silo | Baghouse | 691 | 99.9 | 8,760 | 0.02 | 0.12 | 0.52 |
| Diatomaceous Earth Silo | Baghouse | 518 | 99.9 | 8,760 | 0.02 | 0.089 | 0.39 |

Notes:
dscfm = dry standard cubic feet per minute
gr/dscf = grains per dry standard cubic feet
lb/hr = lb/hr
TPY = tons per year

## Table 3-6 Summary of Source Parameters Used for the Deposition and Ambient Air Quality Standards Analysis

| Source Description | Source Map Location Number | Modeled Source Number | Source Type | Release Orientation | Release Elevation (feet) | Stack Diameter (feet) | Exhaust Temperature (degrees F) | Exhaust Flow (acfm) | Exhaust Velocity (ft/sec) | Enclosure Dimensions (ft) | | | Total PM Emission Rate (lb/hr) | Maximum PM10 Emission Rate (lb/hr) | Deposition PM Emission Rate (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Length | Width | Height | | | |
| Drop From Railcar to Hopper 2703 | 2 | RAIL2HOP | Volume | N/A | 0[b] | N/A | N/A | N/A | N/A | 100[d] | 25[d] | 25[d] | 0.20 | 0.072 | 0.32[a] |
| Drop from Hopper 2703 to Conveyor 2110 | 2 | HOP2CONV | Volume | N/A | 0[b] | N/A | N/A | N/A | N/A | 100[d] | 25[d] | 25[d] | 0.20 | 0.072 | 0.32[a] |
| Bucket Reclaimer | 1A | BUCKRECL | Volume | N/A | 37.5[c] | N/A | N/A | N/A | N/A | 30[e] | 15[e] | 30[e] | 0.68 | 0.24 | 1.05[a] |
| Ship Unloader Stack | 1 | SHIPUNLD | Point | Vertical | 40 | 0.83 | 80 | 1,500 | 45.86 | N/A | N/A | N/A | 1.35 | 0.47 | 2.10[a] |
| Sulfur Storage Building Stack | 3 | SULFTERM | Point | Vertical | 115 | 4.00 | 80 | 35,000 | 46.44 | N/A | N/A | N/A | 2.35 | 2.35 | 2.35 |
| Scrubber 1702 Stack | 4 | 1702 | Point | Vertical | 106 | 0.83 | 110 | 3,000 | 91.72 | N/A | N/A | N/A | 0.46 | 0.46 | 0.46 |
| Scrubber 1703 Stack | 5 | 1703 | Point | Vertical | 30 | 0.83 | 110 | 1,500 | 45.86 | N/A | N/A | N/A | 0.28 | 0.28 | 0.28 |
| Lime Storage Silo | 6 | LIMESTOR | Point | Vertical | 70 | 1.00 | 90 | 800 | 16.99 | N/A | N/A | N/A | 0.12 | 0.12 | 0.12 |
| Diatomaceous Earth Silo | 7 | DE_STOR | Point | Vertical | 80 | 1.00 | 90 | 600 | 12.74 | N/A | N/A | N/A | 0.089 | 0.089 | 0.089 |

**Footnotes:**

[a] Calculated by multiplying the emission rate of total particulate matter less by 0.74 to get the emission rate of particulate matter less than 30 microns in diameter, and then by a factor of 2.1 to obtain the deposition emission rate, in accordance with Rule 62-212.600(3)(c)1.a. for emission rates calculated using Equation 1 in AP-42, Section 13.2.4.

[b] These emission points are below grade and within the railcar unloading building. Although the building likely results in a mixing zone which would result in a non-zero release height for the volume source, the height of release was conservatively assumed to be zero (i.e., assumption resulting in higher predicted impacts).

[c] The release height for the bucket unloader is based the height of the top of the ship hold (30 ft.) plus half the height of an assumed mixing zone of 15 feet.

[d] Dimensions of the railcar unloading building.

[e] Dimensions of a hold on the ship.

# 4.0 SOURCE APPLICABILITY

## 4.1 PSD APPLICABILITY DETERMINATION

Cargill's Riverview facility is considered to be a major stationary source because potential emissions of certain regulated pollutants exceed 100 TPY (for example potential PM emissions currently exceed 100 TPY). As a result, PSD review is required if the net increase in emissions due to the proposed modification exceeds the PSD significant emission rates for any regulated pollutant. A debottlenecking analysis is required if the proposed project could result in an increase of actual emissions from existing emission sources. To determine the applicability of PSD regulations, the emission increase from the proposed project must be added to any resulting increase in emissions from existing sources and compared to significant emission rates.

A summary of potential emissions from the proposed project is presented in Table 4-1. As shown in Table 4-1, the increase in potential emissions of regulated pollutants attributable to the proposed project is below PSD significant emission rates. Potential emission rate increases due to facility debottlenecking have not been addressed in this application because the additional heat needed to melt the solid sulfur and maintain it in a molten state will come from steam currently used for cogeneration and the molten sulfur generated from the proposed system will only be used to replace molten sulfur currently purchased for the Riverview and Bartow facilities. As such, no increase in actual emissions from existing emission units due to the proposed project is anticipated. The proposed project will not allow the existing sulfuric acid plants or other units utilizing sulfuric acid at the Riverview or Bartow facilities to operate at higher rates. These units are currently supplied through purchase of molten sulfur.

## 4.2 AMBIENT MONITORING

Based upon the increase in emissions from Cargill's proposed solid/molten sulfur handling system being below PSD significant emission rates, and, as such, not triggering PSD, a preconstruction ambient monitoring analysis is not required

## 4.3 GOOD ENGINEERING PRACTICE STACK HEIGHT ANALYSIS

The Good Engineering Practice stack height regulations allow any stack to be at least 65 m (213 feet) above grade without additional justification. The height of all existing and proposed stacks associated within the molten and solid sulfur facilities are below 65 m.

## 4.4 NON-ATTAINMENT REVIEW

The Cargill facility is located in Hillsborough County, which has been designated as attainment for $PM/PM_{10}$, F, $SO_2$, $H_2S$, and ozone. As a result, non-attainment review does not apply to the proposed project. The facility is located within 5 km of an air quality maintenance area for PM, and, as such, is subject to Rule 67-296.700 (Reasonably Available Control Technology).

## 4.5 NEW SOURCE PERFORMANCE STANDARDS

Federal New Source Performance Standards (NSPS) have not been promulgated for new and modified sulfur handling, melting and storage systems. As a result, NSPS do not apply to the proposed project.

## 4.6 NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

Federal National Emission Standards for Hazardous Air Pollutants (NESHAPs) have not been promulgated for new and modified sulfur handling, melting and storage systems. As a result, NESHAPS do not apply to the proposed project.

## 4.7 STATE SPECIFIC REGULATIONS

Two State of Florida regulations, 62-212.600 and 62-296.411, specifically apply to sulfur storage and handling facilities. Regulation 62-212.600 applies to any sulfur handling and storage facility with an annual throughput of elemental sulfur of 5,000 TPY or greater. Regulation 62-212.600 has two preconstruction and one postconstruction requirements:

- Section 62-212.600(a) requires that an ambient air quality analysis be performed prior to construction if the proposed facility is located within five kilometers of a PM air quality maintenance area or PSD Class I area. The purpose of the ambient air quality analysis is to determine the probable impact that could result from operation of the facility.
- Section 62-212.600(b) requires that a preconstruction sulfur deposition analysis be conducted to determine the deposition rates that could occur as a result of operation of the facility.
- Section 62-212.600(c) requires postconstruction air quality and deposition monitoring of sulfur PM emissions for two years from the issuance of the operation permit.

The proposed Cargill sulfur handling and storage facility has an annual throughput of greater than 5,000 TPY and is within five kilometers of a PM air quality maintenance area, triggering the need to provide FDEP with probable ambient air quality and sulfur deposition impacts. These requirements are addressed in Section 5.0 of this application. Postconstruction monitoring requirements will be addressed prior to beginning operation of the proposed sulfur handling and storage facility.

Regulation 62-296.411 also applies to any sulfur handling and storage facilities with an annual throughput of elemental sulfur of 5,000 TPY or greater. This regulation establishes operating and maintenance practices, test methods, and emission limitations, as well as equipment design standards, to minimize emissions from sulfur handling and storage facilities. Specifically, this regulation addresses the operation and design of the marine unloading systems, solid and molten sulfur transfer systems, solid and molten sulfur storage systems, truck and railcar unloading systems, and sulfur vatting and reclaim systems. Cargill's proposed sulfur handling and storage facility is specifically designed to comply with the requirements of this regulation.

Table 4-1 PSD Source Applicability Analysis

| Emission Scenario | Emission Rate (TPY) | | | | |
|---|---|---|---|---|---|
| | PM | $PM_{10}$ | $SO_2$ | TRS | VOC |
| **Current Actual Emission Rate** | | | | | |
| **Molten Sulfur Facility**[a] | | | | | |
| Molten Sulfur Tanks | 1.37 | 1.37 | 1.69 | 0.81 | 1.20 |
| **Proposed Potential Emission Rate** | | | | | |
| **Molten Sulfur Facility**[a] | | | | | |
| Molten Sulfur Tanks & Truck Loading Station | 0.38 | 0.38 | 1.05 | 0.50 | 0.75 |
| **Solid Sulfur Facility** | | | | | |
| Solid Sulfur Handling & Storage | 11.86 | 10.85 | -- | -- | -- |
| Solid Sulfur Melting System | 2.03 | 2.03 | 13.81 | 6.62 | 9.84 |
| Lime Delivery System | 0.52 | 0.52 | -- | -- | -- |
| Diatomaceous Earth Delivery System | 0.39 | 0.39 | -- | -- | -- |
| Emission Unit Total | 14.80 | 13.79 | 13.81 | 6.62 | 9.84 |
| Project Total | 15.18 | 14.17 | 14.86 | 7.12 | 10.59 |
| **Total Net Increase** | 13.81 | 13.15<br>12.80 | 13.17 | 6.31 | 9.39 |
| **PSD Significant Emission Rates** | 25 | 15 | 40 | 10 | 40 |

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[a] Does not include molten sulfur pits at the sulfuric acid plants since these sources are not affected by the proposed project.

# 5.0 AIR QUALITY IMPACT ANALYSIS

## 5.1 GENERAL

Rule 62-212.600, sulfur storage and handling facilities requires that the owner or operator of any proposed new or modified sulfur storage and handling facility that is within 5 km of either an air quality maintenance area for PM or a PSD Class I area provided the Department with an analysis of probable PM ambient air quality impacts that could result from operation of the facility. The Cargill facility is within 5 km of an air quality maintenance area. Rule 62-212.600 further requires that the owner or operator of a proposed new or modified sulfur storage and handling facility to provide the department with an analysis of the probable annual and maximum monthly deposition rates. The following ambient air quality and deposition analysis is intended to meet these requirements.

## 5.2 METHODOLOGY

### 5.2.1 PROJECT AMBIENT IMPACT ANALYSIS

The general modeling approach followed EPA and FDEP modeling guidelines for determining compliance with AAQS and PSD increments. Current FDEP policies stipulate that the highest annual average and highest short-term (i.e., 24 hours or less) concentrations are to be determined for a proposed project. Based on the screening modeling analysis results, additional modeling refinements with a denser receptor grid are performed, as necessary, to obtain the maximum concentration. Modeling refinements are performed with a receptor grid spacing of 100 meters (m) or less.

A deposition analysis was performed to determine the maximum monthly and annual deposition rates that would result from the proposed solid sulfur process. The maximum monthly and annual rates were based on emissions for the proposed process only in the vicinity of the Riverview Plant.

In general, when 5 years of meteorological data are used, the highest annual and the highest, second-highest (HSH) short-term concentrations are to be compared to the applicable AAQS and allowable PSD increments. The HSH is calculated for a receptor field by:

1. Eliminating the highest concentration predicted at each receptor,
2. Identifying the second-highest concentration at each receptor, and
3. Selecting the highest concentration among these second-highest concentrations.

This approach is consistent with AAQS and allowable PSD increments, which permit a short-term average concentration to be exceeded once per year at each receptor.

To develop the maximum short-term concentrations for the proposed project, the modeling approach was divided into screening and refined phases to reduce the computation time required to perform the modeling analysis. For this study, the only difference between the two phases is the density of the receptor grid spacing employed when predicting concentrations. Concentrations are predicted for the screening phase using a coarse receptor grid and a 5-year meteorological data record.

If the original screening analysis indicates that the highest concentrations are occurring in a selected area(s) of the grid and the area's total coverage is too vast to directly apply a refined receptor grid, then an additional screening grid(s) will be used over that area. The additional screening grid(s) will employ a greater receptor density than the original screening grid, so refinements can be performed if necessary.

Refinements of the maximum predicted concentrations are typically performed for the receptors of the screening receptor grid at which the highest and/or HSH concentrations occurred over the 5-year period. Generally, if the maximum concentration from other years in the screening analysis are within 10 percent of the overall maximum concentration, those other concentrations are refined as well. Typically, if the highest and HSH concentrations are in different locations, concentrations in both areas are refined.

Modeling refinements are performed for short-term averaging times by using a denser receptor grid, centered on the screening receptor to be refined. The angular spacing between radials is 2 degrees and the radial distance interval between receptors is 100 m. Annual modeling refinements employ an angular spacing between radials of 2 degrees and a distance interval from 100 to 300 m, depending on the concentration gradient in the vicinity of the screening receptor to be refined. If the maximum screening concentration is located on the plant property boundary, additional plant boundary receptors are input, spaced at a 2 degree angular interval and centered on the screening receptor. The domain of the refinement grid will extend to all adjacent screening receptors. The air dispersion model is then executed with the refined grid for the entire year of meteorology during which the screening concentration occurred. This approach is used to ensure that a valid HSH concentration is obtained. A more detailed description of the model used, along with the emission inventory, meteorological data, and screening receptor grids used in the analysis, are presented in the following sections.

### 5.2.2 MODEL SELECTION

The Industrial Source Complex Short-term (ISCST3, Version 98356) dispersion model (EPA, 1995) was used to evaluate the maximum pollutant concentrations and deposition rate due to Cargill's proposed solid sulfur project. This model is maintained on the EPA's Technical Transfer Network (TTN) bulletin board service. A listing of ISCST3 model features is presented in Table 5-1. The ISCST3 model is applicable to sources located in either flat or rolling terrain where terrain heights do not exceed stack heights. The ISCST3 model is designed to calculate hourly concentrations based on hourly meteorological parameters (i.e., wind direction, wind speed, atmospheric stability, ambient temperature, and mixing heights). In this analysis, the EPA regulatory default options were used to predict all maximum impacts. Based on the land-use within a 3-km radius of the Cargill facility, the rural dispersion coefficients were used in the modeling analysis. The ISCST3 model was used to provide maximum concentrations for the annual and 24-hour averaging times.

### 5.2.3 METEOROLOGICAL DATA

Meteorological data used in the ISCST3 model to determine air quality impacts consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper air soundings from the National Weather Service (NWS) stations at Tampa International Airport and Ruskin, respectively. The 5-year period of meteorological data was from 1987 through 1991. The NWS station at Tampa International Airport, located approximately 18 km to the northwest of the Cargill plant site, was selected for use in the study because it is the closest primary weather station to the study area which is representative of the plant site.

The surface and upper air data were preprocessed into ISCST3 modeling format using the EPA PCRAMMET meteorological preprocessor. The processed variables include for each hour: the date, time, wind flow vector, wind speed, temperature, atmospheric stability class, and mixing height. For calculating maximum dry deposition rates, PCRAMMET was used to calculate additional meteorological parameters required for deposition analysis. The additional parameters included are the friction velocity, the Monin-Obukhov length, the roughness length, the global horizontal radiation, and the relative humidity. The global horizontal radiation and relative humidity were obtained from the Solar and Meteorological Surface Observations Network (SAMSON) data.

### 5.2.4 EMISSION INVENTORY

Source parameter data and emission rates for Cargill's proposed solid and molten sulfur operations are presented in Table 3-6. The six stacks were input to the ISCST3 model as point sources, while the fugitive sources were input to the ISCST3 model as volume sources. For the deposition analysis, particle sizing information for each source was determined from source testing information. A summary of the particle sizing data for each source is included in Appendix F.

### 5.2.5 RECEPTOR LOCATIONS

For predicting maximum $PM_{10}$ concentrations in the vicinity of the plant, a polar receptor grid comprised of 119 discrete and 144 regular grid receptors was used for the screening analysis. These receptors included 36 receptors located on the plant property boundary at 10 degree intervals, plus 83 additional off-property receptors at distances of 0.5, 0.8, 1.1, and 1.5 km from the No. 9 $H_2SO_4$ stack, which is the origin of the air modeling coordinate system. The 36 property boundary receptors used for the screening analysis are presented in Table 5-2. Additional regular grid receptors were located at a distance of 1.7 km. For the deposition analysis addition receptors were included at 2.0 km.

Modeling refinements were performed by employing a polar receptor grid with a maximum spacing of 100 m along each radial and an angular spacing between radials of 2 degrees.

### 5.2.6 BUILDING DOWNWASH EFFECTS

All significant existing and proposed building structures located at the Cargill facility were included in the air modeling analysis. The primary structure for the proposed solid/molten sulfur process is the 95-ft-tall Sulfur Storage Building. All existing and proposed building structure information was processed in the EPA Building Input Profile (BPIP, Version 95086) program to determine direction- specific building heights and projected widths for each 10-degree azimuth direction for each source that was included in the modeling analysis. The dimensions for the structures are presented in Table 5-3.

## 5.3 MODELING RESULTS

### 5.3.1 AMBIENT AIR IMPACTS

The screening modeling analysis results for the vicinity of the plant are summarized in Table 5-4. Based on the screening modeling results, refinements were performed. The maximum refined modeling results are provided in Table 5-5. The maximum predicted $PM_{10}$ impacts are 2.08 and 12.73 $\mu g/m^3$ for the annual and 24-hour average, respectively.

This maximum annual impact is predicted to occur at a receptor located at 206°, 600 m. The mximum 24-hour average impact is predicted to occur at a receptor located at 204°, 600 m.

### 5.3.2 DEPOSITION RATES

The maximum monthly and annual predicted PM deposition rates due to the proposed solid sulfur process only are summarized in Table 5-6. The maximum monthly and annual PM deposition rates are 5.04 and 0.95 $g/m^2$, respectively.

Table 5-1. Major Features of the ISCST3 Model

| ISCST3 Model Features |
|---|
| Polar or Cartesian coordinate systems for receptor locations |
| Rural or one of three urban options which affect wind speed profile exponent, dispersion rates, and mixing height calculations |
| Plume rise due to momentum and buoyancy as a function of downwind distance for stack emissions (Briggs, 1969, 1971, 1973, and 1975; Bowers et al., 1979) |
| Procedures suggested by Huber and Snyder (1976) and Huber (1977); Schulman and Scire (1980) for evaluating building wake effects |
| Procedures suggested by Briggs (1974) for evaluating stack-tip downwash |
| Separation of multiple point sources |
| Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations |
| Capability of simulating point, line, volume and area and open pit sources |
| Capability to calculate dry and wet deposition, including both gaseous and particulate precipitation scavenging for wet deposition |
| Variation of wind speed with height (wind speed-profile exponent law) |
| Concentration estimates for 1-hour to annual average times |
| Terrain-adjustment procedures for elevated terrain including a terrain truncation algorithm for ISCST3; a built-in algorithm for predicting concentrations in complex terrain |
| Consideration of time-dependent exponential decay of pollutants |
| The method of Pasquill (1976) to account for buoyancy-induced dispersion |
| A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used) |
| Procedure for calm-wind processing including setting wind speeds less than 1 m/s to 1 m/s. |

Note: ISCST3 = Industrial Source Complex Short-Term. Source: EPA, 1995.

Table 5-2. Cargill Property Boundary Receptors Used in the Modeling Analysis

| Direction (deg) | Distance (m) | Direction (deg) | Distance (m) |
|---|---|---|---|
| 10 | 965 | 190 | 362 |
| 20 | 805 | 200 | 390 |
| 30 | 675 | 210 | 796 |
| 40 | 597 | 220 | 971 |
| 50 | 550 | 230 | 1,296 |
| 60 | 525 | 240 | 1,512 |
| 70 | 517 | 250 | 1,494 |
| 80 | 524 | 260 | 1,019 |
| 90 | 550 | 270 | 1,064 |
| 100 | 596 | 280 | 1,151 |
| 110 | 414 | 290 | 1,296 |
| 120 | 338 | 300 | 1,421 |
| 130 | 294 | 310 | 1,623 |
| 140 | 285 | 320 | 1,962 |
| 150 | 293 | 330 | 2,000 |
| 160 | 311 | 340 | 1,843 |
| 170 | 343 | 350 | 1,759 |
| 180 | 347 | 360 | 1,245 |

Note: Distances are relative to the $H_2SO_4$ No. 9 stack location.
deg = degree.
m = meter.

Table 5-3. Building Dimensions for Cargill Riverview Plant Structures Used in the Modeling Analysis

| Structure | Height | | Length | | Width | |
|---|---|---|---|---|---|---|
| | (ft) | (m) | (ft) | (m) | (ft) | (m) |
| Phosphoric Acid Plant | | | | | | |
| South Building | 100 | 30.48 | 73 | 22.25 | 33 | 10.06 |
| North Building | 100 | 30.48 | 76 | 23.16 | 46 | 14.02 |
| Dry Rock Processing Plant | | | | | | |
| No. 5/9 Mills Building | 35 | 10.67 | 40 | 12.19 | 30 | 9.14 |
| No. 7 Rock Mill Building | 35 | 10.67 | 26 | 7.92 | 30 | 9.14 |
| Ground Rock Silo | 63 | 19.20 | 32 | 9.75 | 32 | 9.75 |
| No. 5/9 Dust Collectors | 84 | 25.60 | 9 | 2.74 | 9 | 2.74 |
| Animal Feed Process Plant | | | | | | |
| AFI Building | 120 | 36.58 | 120 | 36.58 | 30 | 9.14 |
| AFI Loadout Silos | 100 | 30.48 | 298 | 90.83 | 37 | 11.28 |
| Material Storage Area | | | | | | |
| Building No. 6 | 74 | 22.56 | 812 | 247.50 | 122 | 37.19 |
| Building No. 5 | 54.7 | 16.67 | 879 | 267.92 | 174 | 53.04 |
| Building No. 4 | 54.7 | 16.67 | 799 | 243.54 | 105 | 32.00 |
| Building No. 2 (Bottom) | 62 | 18.90 | 919 | 280.11 | 102 | 31.09 |
| Building No. 2 (Top) | 70.1 | 21.37 | 402 | 122.53 | 126 | 38.40 |
| GTSP Building | 127 | 38.71 | 127 | 38.71 | 64 | 19.51 |
| DAP 5 Building Tier A | 86.5 | 26.37 | 100 | 30.48 | 46 | 14.02 |
| DAP 5 Building Tier B | 126.5 | 38.56 | 37 | 11.28 | 27 | 8.23 |
| Map 3/4 Building | 90 | 27.43 | 109 | 33.22 | 54 | 16.46 |
| Docks | | | | | | |
| West Building | 30 | 9.14 | 126 | 38.40 | 100 | 30.48 |
| East Building Tier A | 30 | 9.14 | 130 | 39.62 | 80 | 24.38 |
| East Building Tier B | 50 | 15.24 | 60 | 18.29 | 50 | 15.24 |
| Sulfuric Acid Plant | | | | | | |
| Auxiliary Boiler Building | 18 | 5.49 | 46 | 14.02 | 45 | 13.72 |
| Solid Sulfur Storage & Handling | | | | | | |
| Sulfur Storage | 95 | 28.96 | 510 | 155.45 | 229 | 29.80 |
| Sulfur Melting | 40 | 12.19 | 50 | 15.24 | 39 | 11.89 |

Source: Golder Associates Inc., 1998.

Table 5-4. Maximum Predicted $PM_{10}$ Concentrations Due to the Proposed Solid Sulfur Process in the Vicinity of the Cargill Plant - Screening Analysis

| Averaging Time | Concentration ($\mu g/m^3$) | Receptor Location[a] Direction (degrees) | Distance (m) | Period Ending (YYMMDDHH) |
|---|---|---|---|---|
| Annual | | | | |
| | 1.16 | 200. | 500 | 87123124 |
| | 1.19 | 210. | 796. | 88123124 |
| | 1.42 | 210. | 796. | 89123124 |
| | 1.16 | 200. | 500. | 90123124 |
| | 1.11 | 200. | 500. | 91123124 |
| High 24-Hour | | | | |
| | 7.88 | 200. | 500. | 87050824 |
| | 5.47 | 200. | 800. | 88120124 |
| | 7.85 | 200. | 800. | 89030924 |
| | 6.66 | 200. | 500. | 90062024 |
| | 6.28 | 200. | 500. | 91080424 |

Note: YY=Year, MM=Month, DD=Day, HH=Hour.

[a] All receptor coordinates are reported with respect the No. 9 $H_2SO_4$ stack location.

Table 5-5. Maximum Predicted $PM_{10}$ Concentrations Due to the Proposed Solid Sulfur Process in the Vicinity of the Cargill Plant – Refined Analysis

| Averaging Time | Concentration ($\mu g/m^3$) | Receptor Location[a] Direction (degrees) | Receptor Location[a] Distance (m) | Period Ending (YYMMDDHH) |
|---|---|---|---|---|
| Annual | 2.08 | 206. | 600. | 89123124 |
| 24-Hour | 12.73 | 204. | 600. | 89030724 |

Note: YY=Year, MM=Month, DD=Day, HH=Hour.

[a] All receptor coordinates are reported with respect to the No. 9 $H_2SO_4$ stack location.

Table 5-6. Maximum Predicted $PM_{10}$ Deposition Rate Due to the Proposed Solid Sulfur Process in the Vicinity of the Cargill Plant

| Averaging Time | Depositions ($g/m^2$) | Receptor Location[a] Direction (degrees) | Receptor Location[a] Distance (m) | Period Ending (YYMMDDHH) |
|---|---|---|---|---|
| Annual | | | | |
| | 5.04 | 200 | 500 | 87123124 |
| | 3.84 | 200 | 500 | 88123124 |
| | 3.92 | 200 | 500 | 89123124 |
| | 4.78 | 200 | 500 | 90123124 |
| | 4.58 | 200 | 500 | 91123124 |
| Monthly | | | | |
| | 0.95 | 200 | 500 | 87043024 |
| | 0.83 | 200 | 500 | 88053124 |
| | 0.49 | 200 | 500 | 89053124 |
| | 0.77 | 200 | 500 | 90063024 |
| | 0.64 | 200 | 500 | 91022824 |

Note: YY=Year, MM=Month, DD=Day, HH=Hour.

[a] All receptor coordinates are reported with respect the No. 9 $H_2SO_4$ stack location.

# APPENDIX A

# AGGREGATE HANDLING AND STORAGE PILES

# SECTION 13.2, AP-42

## 13.2.4 Aggregate Handling And Storage Piles

### 13.2.4.1 General

Inherent in operations that use minerals in aggregate form is the maintenance of outdoor storage piles. Storage piles are usually left uncovered, partially because of the need for frequent material transfer into or out of storage.

Dust emissions occur at several points in the storage cycle, such as material loading onto the pile, disturbances by strong wind currents, and loadout from the pile. The movement of trucks and loading equipment in the storage pile area is also a substantial source of dust.

### 13.2.4.2 Emissions And Correction Parameters

The quantity of dust emissions from aggregate storage operations varies with the volume of aggregate passing through the storage cycle. Emissions also depend on 3 parameters of the condition of a particular storage pile: age of the pile, moisture content, and proportion of aggregate fines.

When freshly processed aggregate is loaded onto a storage pile, the potential for dust emissions is at a maximum. Fines are easily disaggregated and released to the atmosphere upon exposure to air currents, either from aggregate transfer itself or from high winds. As the aggregate pile weathers, however, potential for dust emissions is greatly reduced. Moisture causes aggregation and cementation of fines to the surfaces of larger particles. Any significant rainfall soaks the interior of the pile, and then the drying process is very slow.

Silt (particles equal to or less than 75 micrometers [$\mu$m] in diameter) content is determined by measuring the portion of dry aggregate material that passes through a 200-mesh screen, using ASTM-C-136 method.[1] Table 13.2.4-1 summarizes measured silt and moisture values for industrial aggregate materials.

### 13.2.4.3 Predictive Emission Factor Equations

Total dust emissions from aggregate storage piles result from several distinct source activities within the storage cycle:

1. Loading of aggregate onto storage piles (batch or continuous drop operations).
2. Equipment traffic in storage area.
3. Wind erosion of pile surfaces and ground areas around piles.
4. Loadout of aggregate for shipment or for return to the process stream (batch or continuous drop operations).

Either adding aggregate material to a storage pile or removing it usually involves dropping the material onto a receiving surface. Truck dumping on the pile or loading out from the pile to a truck with a front-end loader are examples of batch drop operations. Adding material to the pile by a conveyor stacker is an example of a continuous drop operation.

Table 13.2.4-1. TYPICAL SILT AND MOISTURE CONTENTS OF MATERIALS AT VARIOUS INDUSTRIES[a]

| Industry | No. Of Facilities | Material | Silt Content (%) | | | Moisture Content (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | No. Of Samples | Range | Mean | No. Of Samples | Range | Mean |
| Iron and steel production | 9 | Pellet ore | 13 | 1.3 - 13 | 4.3 | 11 | 0.64 - 4.0 | 2.2 |
| | | Lump ore | 9 | 2.8 - 19 | 9.5 | 6 | 1.6 - 8.0 | 5.4 |
| | | Coal | 12 | 2.0 - 7.7 | 4.6 | 11 | 2.8 - 11 | 4.8 |
| | | Slag | 3 | 3.0 - 7.3 | 5.3 | 3 | 0.25 - 2.0 | 0.92 |
| | | Flue dust | 3 | 2.7 - 23 | 13 | 1 | — | 7 |
| | | Coke breeze | 2 | 4.4 - 5.4 | 4.9 | 2 | 6.4 - 9.2 | 7.8 |
| | | Blended ore | 1 | — | 15 | 1 | — | 6.6 |
| | | Sinter | 1 | — | 0.7 | 0 | — | — |
| | | Limestone | 3 | 0.4 - 2.3 | 1.0 | 2 | ND | 0.2 |
| Stone quarrying and processing | 2 | Crushed limestone | 2 | 1.3 - 1.9 | 1.6 | 2 | 0.3 - 1.1 | 0.7 |
| | | Various limestone products | 8 | 0.8 - 14 | 3.9 | 8 | 0.46 - 5.0 | 2.1 |
| Taconite mining and processing | 1 | Pellets | 9 | 2.2 - 5.4 | 3.4 | 7 | 0.05 - 2.0 | 0.9 |
| | | Tailings | 2 | ND | 11 | 1 | — | 0.4 |
| Western surface coal mining | 4 | Coal | 15 | 3.4 - 16 | 6.2 | 7 | 2.8 - 20 | 6.9 |
| | | Overburden | 15 | 3.8 - 15 | 7.5 | 0 | — | — |
| | | Exposed ground | 3 | 5.1 - 21 | 15 | 3 | 0.8 - 6.4 | 3.4 |
| Coal-fired power plant | 1 | Coal (as received) | 60 | 0.6 - 4.8 | 2.2 | 59 | 2.7 - 7.4 | 4.5 |
| Municipal solid waste landfills | 4 | Sand | 1 | — | 2.6 | 1 | — | 7.4 |
| | | Slag | 2 | 3.0 - 4.7 | 3.8 | 2 | 2.3 - 4.9 | 3.6 |
| | | Cover | 5 | 5.0 - 16 | 9.0 | 5 | 8.9 - 16 | 12 |
| | | Clay/dirt mix | 1 | — | 9.2 | 1 | — | 14 |
| | | Clay | 2 | 4.5 - 7.4 | 6.0 | 2 | 8.9 - 11 | 10 |
| | | Fly ash | 4 | 78 - 81 | 80 | 4 | 26 - 29 | 27 |
| | | Misc. fill materials | 1 | — | 12 | 1 | — | 11 |

[a] References 1-10. ND = no data.

The quantity of particulate emissions generated by either type of drop operation, per kilogram (kg) (ton) of material transferred, may be estimated, with a rating of A, using the following empirical expression:[11]

$$E = k(0.0016) \frac{\left[\frac{U}{2.2}\right]^{1.3}}{\left[\frac{M}{2}\right]^{1.4}} \text{ (kg/megagram [Mg])}$$

$$E = k(0.0032) \frac{\left[\frac{U}{5}\right]^{1.3}}{\left[\frac{M}{2}\right]^{1.4}} \text{ (pound [lb]/ton)} \qquad (1)$$

where:

E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (m/s) (miles per hour [mph])
M = material moisture content (%)

The particle size multiplier in the equation, k, varies with aerodynamic particle size range, as follows:

| Aerodynamic Particle Size Multiplier (k) For Equation 1 | | | | |
|---|---|---|---|---|
| < 30 μm | < 15 μm | < 10 μm | < 5 μm | < 2.5 μm |
| 0.74 | 0.48 | 0.35 | 0.20 | 0.11 |

The equation retains the assigned quality rating if applied within the ranges of source conditions that were tested in developing the equation, as follows. Note that silt content is included, even though silt content does not appear as a correction parameter in the equation. While it is reasonable to expect that silt content and emission factors are interrelated, no significant correlation between the 2 was found during the derivation of the equation, probably because most tests with high silt contents were conducted under lower winds, and vice versa. It is recommended that estimates from the equation be reduced 1 quality rating level if the silt content used in a particular application falls outside the range given:

| Ranges Of Source Conditions For Equation 1 | | | |
|---|---|---|---|
| Silt Content (%) | Moisture Content (%) | Wind Speed | |
| | | m/s | mph |
| 0.44 - 19 | 0.25 - 4.8 | 0.6 - 6.7 | 1.3 - 15 |

To retain the quality rating of the equation when it is applied to a specific facility, reliable correction parameters must be determined for specific sources of interest. The field and laboratory procedures for aggregate sampling are given in Reference 3. In the event that site-specific values for correction parameters cannot be obtained, the appropriate mean from Table 13.2.4-1 may be used, but the quality rating of the equation is reduced by 1 letter.

For emissions from equipment traffic (trucks, front-end loaders, dozers, etc.) traveling between or on piles, it is recommended that the equations for vehicle traffic on unpaved surfaces be used (see Section 13.2.2). For vehicle travel between storage piles, the silt value(s) for the areas among the piles (which may differ from the silt values for the stored materials) should be used.

Worst-case emissions from storage pile areas occur under dry, windy conditions. Worst-case emissions from materials-handling operations may be calculated by substituting into the equation appropriate values for aggregate material moisture content and for anticipated wind speeds during the worst case averaging period, usually 24 hours. The treatment of dry conditions for Section 13.2.2, vehicle traffic, "Unpaved Roads", follows the methodology described in that section centering on parameter p. A separate set of nonclimatic correction parameters and source extent values corresponding to higher than normal storage pile activity also may be justified for the worst-case averaging period.

### 13.2.4.4 Controls[12-13]

Watering and the use of chemical wetting agents are the principal means for control of aggregate storage pile emissions. Enclosure or covering of inactive piles to reduce wind erosion can also reduce emissions. Watering is useful mainly to reduce emissions from vehicle traffic in the storage pile area. Watering of the storage piles themselves typically has only a very temporary slight effect on total emissions. A much more effective technique is to apply chemical agents (such as surfactants) that permit more extensive wetting. Continuous chemical treating of material loaded onto piles, coupled with watering or treatment of roadways, can reduce total particulate emissions from aggregate storage operations by up to 90 percent.[12]

### References For Section 13.2.4

1. C. Cowherd, Jr., *et al.*, *Development Of Emission Factors For Fugitive Dust Sources*, EPA-450/3-74-037, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

2. R. Bohn, *et al.*, *Fugitive Emissions From Integrated Iron And Steel Plants*, EPA-600/2-78-050, U. S. Environmental Protection Agency, Cincinnati, OH, March 1978.

3. C. Cowherd, Jr., *et al.*, *Iron And Steel Plant Open Dust Source Fugitive Emission Evaluation*, EPA-600/2-79-103, U. S. Environmental Protection Agency, Cincinnati, OH, May 1979.

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5. C. Cowherd, Jr., and T. Cuscino, Jr., *Fugitive Emissions Evaluation*, MRI-4343-L, Midwest Research Institute, Kansas City, MO, February 1977.

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9. *PM-10 Emission Inventory Of Landfills In the Lake Calumet Area*, EPA Contract No. 68-02-3891, Midwest Research Institute, Kansas City, MO, September 1987.

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# APPENDIX B

# SILT AND MOISTURE CONTENT DATA & ANALYSIS

UNIVERSITY OF
FLORIDA

Dr. Chang-Yu Wu
University of Florida
Department of Environmental Engineering Sciences
PO Box 116450
Gainesville, FL 32611
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FAX: (352) 392-3076
Email: cywu@ufl.edu

February 3, 1999

David A. Buff, PE
Principal Engineer
Golder Associates Inc.
6241 NW 23rd Street, Suite 500
Gainesville, FL 32653

Dear Mr. Buff:

Please find enclosed our report of the mass fraction of the raw powder with particle sizes smaller than 75 µm. If you have any question on the data, please do not hesitate to contact me. It is my pleasure to have the opportunity to work with you and I look forward to our future collaboration opportunities.

Sincerely,

Chang-Yu Wu

Chang-Yu Wu
Assistant Professor

## OBJECTIVE

The objective of this study was to determine the mass percentage of the fertilizer powder with diameter less than 75 μm.

## INSTRUMENT AND METHODS

### Drying

To determine the appropriate drying time of the fertilizer powder in the oven, the 200-g fertilizer was baked at 75 °C (ASTM method : C136-84a) and weighed every 10 minutes. It was found that after 50 minutes, the weight of the fertilizer powder reached equilibrium. Therefore, the fertilizer powder was baked at 75 °C for 1 hour before each test.

### Weighing

Three tests were conducted in this study. In each test, about 200 g of the fertilizer powder was weighed using an Ohaus balance (Model CT 1200, Ohaus Corp., Florham Park, NJ), which has a 0.1 g readability. The net weight of the powder with diameter less than 75 μm collected onto an aluminum foil was determined using a Sartorius balance (Model 2355, Germany), with a readability of 0.001 g, before and after the sieving test.

### Sieving

Sieving was conducted according to the ASTM method C136-84a. A mechanical sieve shaker, Sieve Tester ( Model SS-15, Gilson Company Inc., Worthington, OH), was used to shake the fertilizer powder. To prevent overloading a single stage, four sieve stages were used : 3.35 mm, 1.70 mm, 300 μm, and 75 μm. To catch the powders with diameter less than 75 μm, an aluminum foil was used at the bottom of the last stage.

## RESULTS

**Test 1 :**

Mass % less than 75 μm = 0.430 g / 190.1 g = 0.226%

**Test 2 :**

Mass % less than 75 μm = 0.477 g / 208.2 g = 0.229%

**Test 3 :**

Mass % less than 75 μm = 0.407 g / 218.6 g = 0.186%

**Average = (1/3)(0.226% + 0.229% + 0.186%) = 0.214%**

**SHELL CANADA LIMITED**
**Marketing & Transportation**
**400 - 4th Avenue S.W. T2P 0J4**
**P.O. Box 1480, Station M T2P 0L6**
**FAX No. (403) 269-8814**

| | |
|---|---|
| **To: Co.:** Cargill Fertilizer, Inc. | **Page 1 of** 8 |
| **Attention:** Terry Kerr | **Date:** January 11, 1999 **Time:** |
| **Location:** Tampa, Florida | **Sent by:** TED TRAYNOR |
| **FAX:** 813-671-6146 | **Phone No:** (403) 691-2908 |

Dear Terry:

Subject: Your request for moisture and sieve analysis

I am sending you the following information in response to the December 21st memo from Kathy Edgemon, which you sent to me last week. Cargill requires moisture and sieve analysis, as well as two 5-gallon samples of pastilles.

Moisture Analysis: Sultran arranges for moisture testing at PCT upon unloading of our rail cars. The data that I am sending you shows, for the first three quarters of 1998, the moisture levels of sulphur taken from our railcars as tested in Vancouver, as well as the precipitation level at the time of testing. The moisture quantity would then be different from the level that would be measured at our production facility in Shantz, Alberta, and different from what would be loaded into a vessel. Since sulphur is stored outside, the precipitation level changes the results of the tests.

Sieve Analysis: Shell Canada Limited does sieve analysis testing of the pastilles produced at Shantz, Alberta. I am sending you the test results from three samples taken in October 1998. I am also sending you the test methodology that was given to me by Agra laboratories. Your laboratory personnel can check this methodology against the ASTM tests that you provided, and determine if it is acceptable.

Samples: Two 5-gallon samples were requested on January 6th. These samples will be taken from the pastille stockpile at PCT in Vancouver. They will be shipped 'air freight' directly to you at your Riverview office.

I hope this information is sufficient to conduct your tests. Please let me know if you require any further assistance.

Regards

Ted Traynor

Ted Traynor
Sulphur Marketing Manager – North America

SULTR N LTD.

**VANCOUVER PRODUCT QUALITY REPORT UPDATED TO:** JAN/98 - OCT/98

BEST AVAILABLE COPY

| DUMP DATE | TERM | UNIT | % SLATE | OTHER FORM | PRECIP | % MOIST UNL'D |
|---|---|---|---|---|---|---|
| Jan-98 | PCT | 607-001 | 0 | ROTO | R | 1.73 |
| Jan-88 | PCT | 607-002 | 0 | ROTO | O | 1.68 |
| Jan-98 | PCT | 607-003 | 0 | ROTO | C | 1.66 |
| 1-Jan-98 | PCT | 607-004 | 0 | ROTO | C | 0.85 |
| 3-Jan-98 | PCT | 607-005 | 0 | ROTO | R | 2.14 |
| 3-Jan-98 | PCT | 007-006 | 0 | ROTO | O | 1.80 |
| 8-Jan-88 | PCT | 607-007 | 0 | ROTO | R | 1.85 |
| 8-Jan-98 | PCT | 807-008 | 0 | ROTO | R | 1.64 |
| 0-Jan-98 | PCT | 607-009 | 0 | ROTO | O | 1.31 |
| 0-Jan-88 | PCT | 007-010 | 0 | ROTO | O | 1.32 |
| 2-Jan-98 | PCT | 607-011 | 0 | ROTO | O | 1.70 |
| 6-Jan-08 | PCT | 607-012 | 0 | ROTO | O | 1.03 |
| 7-Jan-90 | PCT | 607-013 | 0 | ROTO | O | 0.70 |
| 8-Jan-98 | PCT | 607-014 | 0 | ROTO | R | 0.77 |
| 0-Jan-98 | PCT | 607-015 | 0 | ROTO | O | 0.78 |
| -Feb-98 | PCT | 607-016 | 0 | ROTO | O | 0.55 |
| -Feb-98 | PCT | 607-017 | 0 | ROTO | O | 0.89 |
| -Feb-98 | PCT | 607-018 | 0 | ROTO | O | 0.60 |
| -Feb-98 | PCT | 607-019 | 0 | ROTO | O | 0.74 |
| -Feb-98 | PCT | 607-020 | 0 | ROTO | O | 0.69 |
| 10-Feb-98 | PCT | 607-021 | 0 | ROTO | O | 0.08 |
| 12-Feb-98 | PCT | 607-022 | 0 | ROTO | O | 0.72 |
| 18-Feb-98 | PCT | 607-023 | 0 | ROTO | O | 1.05 |
| 21-Feb-98 | PCT | 607-024 | 0 | ROTO | R | 0.77 |
| 19-Feb-98 | PCT | 607-025 | 0 | ROTO | O | 0.59 |
| 22-Feb-98 | PCT | 607-026 | 0 | ROTO | O | 0.95 |
| 24-Feb-98 | PCT | 607-027 | 0 | ROTO | C | 0.47 |
| 20-Feb-98 | PCT | 607-028 | 0 | ROTO | O | 1.07 |
| 28-Feb-98 | PCT | 607-029 | 0 | ROTO | O | 0.79 |
| 3-Mar-98 | PCT | 607-030 | 0 | ROTO | R | 0.28 |
| 5-Mar-98 | PCT | 607-031 | 0 | ROTO | C | 0.36 |
| 11-Mar-98 | PCT | 607-032 | 0 | ROTO | O | 0.70 |
| 14-Mar-98 | PCT | 607-033 | 0 | ROTO | O | 0.71 |
| 14-Mar-98 | PCT | 607-034 | 0 | ROTO | O | 0.65 |
| 17-Mar-98 | PCT | 607-035 | 0 | ROTO | C | 0.71 |
| 19-Mar-98 | PCT | 607-036 | 0 | ROTO | C | 1.02 |
| 20-Mar-98 | PCT | 607-037 | 0 | ROTO | O | 0.75 |
| 23-Mar-98 | PCT | 607-038 | 0 | ROTO | O | 0.92 |
| 23-Mar-88 | PCT | 607-039 | 0 | ROTO | O | 0.74 |
| 25-Mar-98 | PCT | 607-040 | 0 | ROTO | O | 0.37 |
| 27-Mar-98 | PCT | 607-041 | 0 | ROTO | O | 0.33 |
| 29-Mar-98 | PCT | 607-042 | 0 | ROTO | C | 0.53 |
| 31-Mar-98 | PCT | 607-043 | 0 | ROTO | R | 0.56 |
| 1-Apr-98 | PCT | 607-044 | 0 | ROTO | O | 0.21 |
| 3-Apr-98 | PCT | 607-045 | 0 | ROTO | O | 0.48 |
| 6-Apr-98 | PCT | 607-046 | 0 | ROTO | O | 0.52 |
| 10-Apr-98 | PCT | 607-047 | 0 | ROTO | O | 0.39 |
| 12-Apr-98 | PCT | 607-048 | 0 | ROTO | O | 0.71 |
| 12-Apr-98 | PCT | 607-049 | 0 | ROTO | O | 0.79 |
| 15-Apr-98 | PCT | 607-050 | 0 | ROTO | O | 0.35 |
| 18-Apr-98 | PCT | 607-051 | 0 | ROTO | O | 0.53 |
| 20-Apr-98 | PCT | 607-052 | 0 | ROTO | C | 0.56 |
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| 23-Apr-98 | PCT | 607-054 | 0 | ROTO | O | 0.48 |
| 23-Apr-98 | PCT | 607-055 | 0 | ROTO | R | 0.65 |
| 26-Apr-98 | PCT | 607-056 | 0 | ROTO | O | 1.11 |
| 27-Apr-98 | PCT | 607-057 | 0 | ROTO | O | 0.08 |
| 30-Apr-98 | PCT | 607-058 | 0 | ROTO | C | 0.19 |
| 2-May-98 | PCT | 607-059 | 0 | ROTO | C | 0.70 |
| 3-May-98 | PCT | 607-060 | 0 | ROTO | C | 0.77 |
| 7-May-98 | PCT | 607-001 | 0 | ROTO | O | 0.56 |
| 7-May-98 | PCT | 607-002 | 0 | ROTO | R | 0.74 |
| 10-May-98 | PCT | 607-063 | 0 | ROTO | O | 0.35 |
| 11-May-98 | PCT | 607-064 | 0 | ROTO | O | 0.55 |
| 12-May-98 | PCT | 607-065 | 0 | ROTO | C | 0.35 |
| 17-May-98 | PCT | 607-066 | 0 | ROTO | O | 0.47 |
| 18-May-98 | PCT | 607-007 | 0 | ROTO | R | 0.42 |
| 21-May-98 | PCT | 607-068 | 0 | ROTO | O | 0.66 |
| 23-May-98 | PCT | 607-069 | 0 | ROTO | O | 0.39 |
| 24-May-98 | PCT | 607-070 | 0 | ROTO | O | 0.67 |
| 25-May-98 | PCT | 607-071 | 0 | ROTO | O | 0.82 |
| 28-May-98 | PCT | 607-072 | 0 | ROTO | R | 0.90 |
| 1-Jun-98 | VW | 607-073 | 0 | ROTO | C | 2.18 |
| 29-May-98 | PCT | 607-074 | 0 | ROTO | C | 1.44 |
| 1-Jun-98 | PCT | 607-075 | 0 | ROTO | O | 0.96 |
| 2-Jun-98 | PCT | 607-076 | 0 | ROTO | C | 0.29 |
| 3-Jun-98 | PCT | 607-077 | 0 | ROTO | C | 0.47 |
| 4-Jun-98 | PCT | 607-078 | 0 | ROTO | O | 0.84 |
| 8-Jun-98 | PCT | 607-079 | 0 | ROTO | C | 0.50 |
| 9-Jun-98 | PCT | 607-080 | 0 | ROTO | O | 0.29 |
| 11-Jun-98 | PCT | 607-081 | 0 | ROTO | C | 0.49 |
| 20-Jun-98 | VW | 607-081 | 0 | ROTO | C | 1.22 |
| 17-Jun-98 | VW | 607-082 | 0 | ROTO | O | 1.81 |
| 20-Jun-98 | VW | 607-082 | 0 | ROTO | O | 0.85 |
| 19-Jun-98 | VW | 607-083 | 0 | ROTO | O | 0.92 |
| 20-Jun-98 | VW | 607-083 | 0 | ROTO | C | 0.50 |

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| DUMP DATE | TERM | UNIT | % SLATE | OTHER FORM | PRECIP | % MOIST UNL'D |
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| 30-Jun-98 | PCT | 607-084 | 0 | ROTO | C | 1.22 |
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| 3-Jul-98 | PCT | 607-086 | 0 | ROTO | R | 0.7 |
| 6-Jul-98 | PCT | 607-087 | 0 | ROTO | O | 0.50 |
| 7-Jul-98 | PCT | 607-088 | 0 | ROTO | C | 0.42 |
| 10-Jul-98 | PCT | 607-089 | 0 | ROTO | C | 0.78 |
| 24-Aug-98 | PCT | 607-089 | 0 | ROTO | C | 0.52 |
| 12-Jul-98 | PCT | 607-090 | 0 | ROTO | R | 0.35 |
| 14-Jul-98 | PCT | 607-091 | 0 | ROTO | O | 0.49 |
| 17-Jul-98 | PCT | 607-092 | 0 | ROTO | C | 0.31 |
| 19-Jul-98 | VW | 607-093 | 0 | ROTO | O | 0.23 |
| 21-Jul-98 | VW | 607-093 | 0 | ROTO | C | 0.20 |
| 20-Jul-98 | PCT | 607-094 | 0 | ROTO | C | 0.23 |
| 21-Jul-98 | PCT | 607-095 | 0 | ROTO | C | 0.33 |
| 23-Jul-98 | PCT | 607-096 | 0 | ROTO | C | 0.67 |
| 24-Jul-98 | PCT | 607-097 | 0 | ROTO | C | 0.34 |
| 27-Jul-98 | PCT | 607-098 | 0 | ROTO | C | 0.33 |
| 29-Jul-98 | PCT | 607-099 | 0 | ROTO | C | 0.48 |
| 31-Jul-98 | PCT | 607-100 | 0 | ROTO | O | 0.20 |
| 1-Aug-98 | PCT | 607-101 | 0 | ROTO | O | 0.14 |
| 3-Aug-98 | PCT | 607-102 | 0 | ROTO | C | 0.62 |
| 4-Aug-98 | PCT | 607-103 | 0 | ROTO | C | 0.35 |
| 7-Aug-98 | PCT | 607-104 | 0 | ROTO | O | 0.41 |
| 24-Aug-98 | PCT | 607-104 | 0 | ROTO | C | 0.52 |
| 10-Aug-98 | PCT | 607-105 | 0 | ROTO | C | 0.48 |
| 11-Aug-98 | PCT | 607-106 | 0 | ROTO | C | 0.80 |
| 24-Aug-98 | PCT | 607-106 | 0 | ROTO | C | 0.52 |
| 13-Aug-98 | PCT | 607-107 | 0 | ROTO | C | 0.98 |
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| 21-Aug-98 | PCT | 607-110 | 0 | ROTO | C | 0.41 |
| 22-Aug-98 | PCT | 607-111 | 0 | ROTO | C | 0.27 |
| 24-Aug-98 | PCT | 607-112 | 0 | ROTO | C | 0.28 |
| 25-Aug-98 | PCT | 607-113 | 0 | ROTO | C | 0.11 |
| 27-Aug-98 | PCT | 607-114 | 0 | ROTO | C | 0.46 |
| 28-Aug-98 | PCT | 607-115 | 0 | ROTO | C | 0.41 |
| 31-Aug-98 | PCT | 607-116 | 0 | ROTO | C | 0.7 |
| 3-Sep-98 | PCT | 607-117 | 0 | ROTO | C | 0.16 |
| 3-Sep-98 | PCT | 607-117 | 0 | ROTO | C | 0.10 |
| 4-Sep-98 | PCT | 607-118 | 0 | ROTO | C | 0.38 |
| 9-Sep-98 | PCT | 607-119 | 0 | ROTO | C | 0.37 |

| DUMP DATE | TERM | UNIT | % SLATE | OTHER FORM | PRECIP | % MOIST UNL'D |
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| 8-Sep-98 | PCT | 607-120 | 0 | ROTO | C | 0.30 |
| 9-Sep-98 | PCT | 607-120 | 0 | ROTO | C | 0.42 |
| 10-Sep-98 | PCT | 607-121 | 0 | ROTO | O | 0.91 |
| 11-Sep-98 | PCT | 607-122 | 0 | ROTO | C | 0.4 |
| 11-Sep-98 | PCT | 607-122 | 0 | ROTO | D | 1.95 |
| 12-Sep-98 | PCT | 607-122 | 0 | ROTO | C | 0.71 |
| 13-Sep-98 | PCT | 607-123 | 0 | ROTO | C | 1.08 |
| 15-Sep-98 | PCT | 607-124 | 0 | ROTO | C | 0.41 |
| 17-Sep-98 | PCT | 607-125 | 0 | ROTO | C | 0.41 |
| 18-Sep-98 | PCT | 607-125 | 0 | ROTO | O | 1.26 |
| 18-Sep-98 | PCT | 607-126 | 0 | ROTO | D | 0.34 |
| 21-Sep-98 | PCT | 607-127 | 0 | ROTO | C | 0.42 |
| 23-Sep-98 | VW | 607-128 | 0 | ROTO | C | 0.34 |
| 26-Sep-98 | VW | 607-128 | 0 | ROTO | C | 0.43 |
| 26-Sep-98 | PCT | 607-129 | 0 | ROTO | O | 0.3 |
| 27-Sep-98 | PCT | 607-130 | 0 | ROTO | C | 0.14 |
| 27-Sep-98 | PCT | 607-131 | 0 | ROTO | C | 0.32 |
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| 14-Oct-98 | VW | 607-131 | 0 | ROTO | C | 0.92 |
| 30-Sep-98 | PCT | 607-132 | 0 | ROTO | C | 0.28 |
| 2-Oct-98 | PCT | 607-133 | 0 | ROTO | R | 0.91 |
| 4-Oct-98 | PCT | 607-134 | 0 | ROTO | O | 0.70 |
| 5-Oct-98 | VW | 607-135 | 0 | ROTO | O | 0.46 |
| 7-Oct-98 | VW | 607-135 | 0 | ROTO | O | 0.46 |
| 14-Oct-98 | VW | 607-135 | 0 | ROTO | C | 0.48 |
| 7-Oct-98 | PCT | 607-136 | 0 | ROTO | C | 0.3 |
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| 11-Oct-98 | PCT | 607-138 | 0 | ROTO | R | 0.34 |
| 14-Oct-98 | PCT | 607-139 | 0 | ROTO | O | 0.85 |
| 16-Oct-98 | PCT | 607-140 | 0 | ROTO | C | 0.37 |
| 16-Oct-98 | PCT | 607-140 | 0 | ROTO | O | 0.5 |
| 16-Oct-98 | PCT | 607-141 | 0 | ROTO | O | 0.62 |
| 17-Oct-98 | PCT | 607-141 | 0 | ROTO | R | 1.14 |
| 22-Oct-98 | VW | 607-142 | 0 | ROTO | C | 0.27 |
| 23-Oct-98 | VW | 607-142 | 0 | ROTO | C | 0.38 |
| 24-Oct-98 | VW | 607-142 | 0 | ROTO | C | 0.51 |
| 25-Oct-98 | PCT | 607-143 | 0 | ROTO | C | 0.38 |
| 23-Oct-98 | PCT | 607-144 | 0 | ROTO | C | 0.26 |
| 23-Oct-98 | PCT | 607-144 | 0 | ROTO | C | 0.31 |
| 24-Oct-98 | PCT | 607-145 | 0 | ROTO | C | 0.3 |
| 31-Oct-98 | PCT | 607-145/146 | 0 | ROTO | R | 0.52 |

Summary of Moisture Data Received from Shell Canada Limited

| Observation Number | Measured Moisture Content (%) | Moisture Content Sorted From Highest to Lowest Observation (%) | Observation Number | Measured Moisture Content (%) | Moisture Content Sorted From Highest to Lowest Observation (%) |
|---|---|---|---|---|---|
| 1 | 1.73 | 2.18 | 87 | 1.22 | 0.50 |
| 2 | 1.68 | 2.14 | 88 | 0.49 | 0.50 |
| 3 | 1.66 | 1.95 | 89 | 0.70 | 0.50 |
| 4 | 0.85 | 1.85 | 90 | 0.50 | 0.50 |
| 5 | 2.14 | 1.73 | 91 | 0.42 | 0.49 |
| 6 | 0.80 | 1.70 | 92 | 0.78 | 0.49 |
| 7 | 1.85 | 1.68 | 93 | 0.52 | 0.49 |
| 8 | 1.64 | 1.66 | 94 | 0.35 | 0.48 |
| 9 | 1.31 | 1.64 | 95 | 0.49 | 0.48 |
| 10 | 1.32 | 1.44 | 96 | 0.31 | 0.48 |
| 11 | 1.70 | 1.32 | 97 | 0.23 | 0.47 |
| 12 | 1.03 | 1.31 | 98 | 0.29 | 0.47 |
| 13 | 0.70 | 1.26 | 99 | 0.23 | 0.47 |
| 14 | 0.77 | 1.22 | 100 | 0.33 | 0.46 |
| 15 | 0.78 | 1.22 | 101 | 0.67 | 0.46 |
| 16 | 0.55 | 1.14 | 102 | 0.34 | 0.46 |
| 17 | 0.89 | 1.11 | 103 | 0.33 | 0.46 |
| 18 | 0.68 | 1.07 | 104 | 0.48 | 0.46 |
| 19 | 0.74 | 1.06 | 105 | 0.29 | 0.44 |
| 20 | 0.69 | 1.05 | 106 | 0.14 | 0.43 |
| 21 | 0.68 | 1.03 | 107 | 0.62 | 0.43 |
| 22 | 0.72 | 1.02 | 108 | 0.35 | 0.42 |
| 23 | 1.05 | 1.01 | 109 | 0.41 | 0.42 |
| 24 | 0.77 | 0.96 | 110 | 0.52 | 0.42 |
| 25 | 0.59 | 0.96 | 111 | 0.46 | 0.42 |
| 26 | 0.95 | 0.95 | 112 | 0.80 | 0.42 |
| 27 | 0.47 | 0.92 | 113 | 0.52 | 0.41 |
| 28 | 1.07 | 0.92 | 114 | 0.96 | 0.41 |
| 29 | 0.79 | 0.92 | 115 | 0.25 | 0.41 |
| 30 | 0.28 | 0.91 | 116 | 0.38 | 0.41 |
| 31 | 0.36 | 0.91 | 117 | 0.43 | 0.41 |
| 32 | 0.70 | 0.90 | 118 | 0.42 | 0.40 |
| 33 | 0.71 | 0.89 | 119 | 0.41 | 0.39 |
| 34 | 0.65 | 0.85 | 120 | 0.27 | 0.39 |
| 35 | 0.71 | 0.85 | 121 | 0.28 | 0.38 |
| 36 | 1.02 | 0.82 | 122 | 0.11 | 0.38 |
| 37 | 0.75 | 0.80 | 123 | 0.48 | 0.38 |
| 38 | 0.92 | 0.80 | 124 | 0.41 | 0.38 |
| 39 | 0.74 | 0.79 | 125 | 0.70 | 0.38 |
| 40 | 0.37 | 0.79 | 126 | 0.16 | 0.37 |
| 41 | 0.33 | 0.78 | 127 | 0.16 | 0.37 |
| 42 | 0.53 | 0.78 | 128 | 0.38 | 0.37 |
| 43 | 0.56 | 0.78 | 129 | 0.37 | 0.37 |
| 44 | 0.21 | 0.77 | 130 | 0.30 | 0.37 |
| 45 | 0.48 | 0.77 | 131 | 0.42 | 0.36 |
| 46 | 0.52 | 0.77 | 132 | 0.91 | 0.36 |
| 47 | 0.39 | 0.75 | 133 | 0.40 | 0.35 |
| 48 | 0.71 | 0.74 | 134 | 1.95 | 0.35 |
| 49 | 0.79 | 0.74 | 135 | 0.71 | 0.35 |
| 50 | 0.35 | 0.74 | 136 | 1.06 | 0.35 |
| 51 | 0.53 | 0.72 | 137 | 0.41 | 0.35 |
| 52 | 0.56 | 0.71 | 138 | 0.41 | 0.34 |
| 53 | 0.38 | 0.71 | 139 | 1.26 | 0.34 |
| 54 | 0.46 | 0.71 | 140 | 0.34 | 0.34 |
| 55 | 0.65 | 0.71 | 141 | 0.42 | 0.34 |
| 56 | 1.11 | 0.70 | 142 | 0.34 | 0.33 |
| 57 | 0.68 | 0.70 | 143 | 0.43 | 0.33 |
| 58 | 0.19 | 0.70 | 144 | 0.30 | 0.33 |
| 59 | 0.78 | 0.70 | 145 | 0.14 | 0.32 |
| 60 | 0.77 | 0.70 | 146 | 0.32 | 0.31 |
| 61 | 0.56 | 0.69 | 147 | 0.38 | 0.31 |
| 62 | 0.74 | 0.68 | 148 | 0.92 | 0.30 |
| 63 | 0.35 | 0.68 | 149 | 0.28 | 0.30 |
| 64 | 0.55 | 0.68 | 150 | 0.91 | 0.30 |
| 65 | 0.35 | 0.67 | 151 | 0.70 | 0.30 |
| 66 | 0.47 | 0.67 | 152 | 0.46 | 0.29 |
| 67 | 0.42 | 0.66 | 153 | 0.46 | 0.29 |
| 68 | 0.66 | 0.65 | 154 | 0.48 | 0.29 |
| 69 | 0.39 | 0.65 | 155 | 0.30 | 0.29 |
| 70 | 0.67 | 0.64 | 156 | 0.44 | 0.28 |
| 71 | 0.82 | 0.62 | 157 | 0.37 | 0.28 |
| 72 | 0.90 | 0.62 | 158 | 0.37 | 0.28 |
| 73 | 2.18 | 0.59 | 159 | 0.34 | 0.27 |
| 74 | 1.44 | 0.56 | 160 | 0.85 | 0.27 |
| 75 | 0.96 | 0.56 | 161 | 0.37 | 0.26 |
| 76 | 0.29 | 0.56 | 162 | 0.50 | 0.25 |
| 77 | 0.47 | 0.55 | 163 | 0.62 | 0.23 |
| 78 | 0.64 | 0.55 | 164 | 1.14 | 0.23 |
| 79 | 0.50 | 0.53 | 165 | 0.27 | 0.21 |
| 80 | 0.29 | 0.53 | 166 | 0.36 | 0.19 |
| 81 | 0.49 | 0.52 | 167 | 0.51 | 0.16 |
| 62 | 1.22 | 0.52 | 168 | 0.36 | 0.16 |
| 83 | 1.01 | 0.52 | 169 | 0.28 | 0.14 |
| 84 | 0.05 | 0.52 | 170 | 0.31 | 0.14 |
| 85 | 0.92 | 0.52 | 171 | 0.30 | 0.11 |
| 86 | 0.50 | 0.51 | 172 | 0.52 | 0.05 |

**Statistics:**

| | |
|---|---|
| Number of Observation | 86 |
| Median Observation (%) | 0.50 |
| Average Moisture Content (%) | 0.77 |
| Minimum Mositure Content (%) | 0.05 |
| Maximum Moisture Content (%) | 2.18 |

# APPENDIX C
# AP-42 QUALITY FACTOR DOCUMENTATION

D:DataBase. ISU, 3/2/95

**SUBJECT:** Using the AP-42 Data Base for Making Exclusionary Rule Applicability Determinations

**FROM:** Eric Noble

**TO:** Distribution

One of the more perplexing issues affecting exclusionary rule development concerns the data base to be used in determining whether a source being considered for coverage by a exclusionary rule is really a minor source. Unfortunately, test data availability is very limited for most source categories. Major sources can be required to conduct emission tests, but this is not a feasible option for most minor sources. Of necessity, therefore, the emission factors (EF) in AP-42 have evolved into the data base of choice for many source categories. This reliance on AP-42 only becomes a problem if the AP-42 EF are used without making allowances for the fact that they were not designed to estimate potential emissions from individual sources, and are not well suited to this task.

Note: This discussion of the problems inherent in using AP-42 EF for applicability determinations is limited to its effect on the development of exclusionary rules. Its impact, however, is really much wider, since AP-42 is used extensively in making major/minor source determinations for new source review and operating permits as well.

There are two basic problems inherent in the use of AP-42 emission factors (EF) for making applicability determinations. One is the paucity of emissions data on which some EF are based. The other problem is that the EF are not well suited to the task of determining the potential emissions of individual sources. Both of these deficiencies are mentioned, albeit fleetingly, in the introduction to AP-42, which states that:

"Because emission factors are averages obtained from data of wide range and varying degrees of accuracy, emissions calculated from such factors for a given facility are likely to be different from that facility's actual emissions."; and

"Factors are more appropriately used to estimate collectively the emissions of a number of sources, such as is done in emission inventory work."

As will be discussed later in this document, the AP-42 EF can reasonably be used to estimate potential emissions from individual sources, provided appropriate adjustments are made to compensate for their inadequacies in this role. One recommended adjustment is to lower the upper applicability threshold (the maximum amount of pollutant a source can emit and still be subject to an exclusionary rule) to adjust for the variance between the potential emissions of an individual source and its EF.[1] Another desirable adjustment would be to apply confidence or adjustment factors to the EF, where appropriate, to compensate for weak data bases.

Data Base Adequacy:

The credibility of the supporting data must be considered when determining how much reliance to place on the AP-42 EF. These data bases range from excellent to essentially nonexistent, so confidence factors must be applied to some EF to compensate for the need to use EF supported by less than adequate data bases. (Sometimes the entire data base may consist of only a single unvalidated test, or an informed estimate.) Most of the data elements in AP-42 are ranked to reflect the confidence level in the data. These rankings range from A (the most reliable) to E (the least). An admittedly coarse attempt has been made to correlate these rankings with appropriate confidence factors. The results are listed below for your consideration:

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[1] Emission factors reflect the average emissions of a group of sources. This is appropriate for emission inventories, which require an estimate of average emissions for a source category. Within any source category, however, sources usually vary widely in size, operation, and emissions. Thus, an estimate of average emissions is a poor indicator of the potential emissions from an individual source.

| AP-42 Rank | Confidence Factor |
|---|---|
| A | 1.0 |
| B | 1.2 |
| C | 1.5 |
| D | 1.8 |
| E | 2.1 |

The basis for these recommendations is the assumption that, for source categories with the most inadequate data base, emissions from individual sources will not be more than 210 percent higher than the EF. The ones in between were arbitrarily selected to bridge the gap between the best and the worst.

Data Variability:

As indicated earlier, the EF are emission averages.[3] This is appropriate for inventory estimates, for which the EF were designed, but it is not acceptable for estimating the potential emissions of an individual source -- unless the upper applicability threshold of the exclusionary rule is lowered to compensate. The amount the threshold must be lowered will depend on the range of emissions expected for the source category. For those sources with EF which are supported by good data bases, the appropriate limit will be evident from the EF data base or other available information. In most cases, however, the most appropriate course of action may be to arbitrarily set the threshold at 50 percent of the major source threshold (assume the potential emissions are twice the average). For many source categories, limiting access to the rule to sources emitting no more than 50 percent of the major source threshold adequately compensates for the need to use AP-42 or equivalent data bases and provides some assurance that most major sources will be excluded. For others, an even lower threshold may be needed to

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[3] Since the emissions from individual sources within a source category can (and do) vary widely, the effect of the averaging will be to underestimate potential emissions about 50 percent of the time, regardless of the accuracy of the data base.

compensate for unusually wide emission rate variability.

Conclusions:

Neither reducing the applicability threshold nor applying confidence factors to the EF will entirely eliminate the possibility that a major source will become subject to a exclusionary rule. Used together, however, they should provide reasonable assurance that most major sources will not be eligible for coverage by a exclusionary rule.

# Emission Factor Uses and Misuses

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## ABSTRACT

Various requirements of the Clean Air Act Amendments and basic air quality management concepts have multiplied the number of instances where States and industry use emission factors to estimate emissions. This includes emission inventories needed to implement Title I and State Implementation Plans (SIP's), Environmental Impact Statements, Superfund analysis, and more recently, Title V or other permits, State toxic emission control programs, and others. The use of emission factors in Title V and other State permit (including fees) programs and emission trading programs have been increasing and have raised many questions regarding the appropriateness and technical sufficiency of using emission factors for estimating emissions from individual sources. Many States have had permit programs for many years, so the question is not new. Prior to the 1990 Amendments, however, such programs were not Federally mandated, and consequently the U.S. Environmental Protection Agency (EPA) was not as heavily involved. Repercussions of the Act's revisions are resulting in many changes in the structure of how air pollution programs are established and how they are managed. Fees are being collected based on emissions, for example, which in turn, are often based on non-site-specific emission factors. Since it is not often economically feasible, or practical, to measure emissions or to otherwise absolutely quantify emissions in a source-specific fashion, many concerns arise. This discussion is intended articulate some of the issues regarding such needs, legitimate uses, and potential misuses of emission factors, and to provide arguments for and against such applications.

## Background and Historic Use of Emission Factors

Emission factors have been in broad use since the inception of the concept of air quality management. Basically, emission factors relate an emission level to an activity level for some emission generating operation or process. Emission estimation has been an integral part, often referred to as a basic cornerstone, of air quality management programs. The concept of air quality management relies upon reasonably accurate estimation of emissions for a jurisdictional area, the analysis of these data for determination of the relative causes of ambient air quality problems, and the development of more refined input to models which simulate mathematically what is happening in the ambient air.

The earliest federal programs to place a major focus on the use of emission factors were in the early to mid-1960's. The concept of air quality management was more firmly incorporated into the Clean Air Act of 1970 with the requirements that states must adopt State Implementation Plans (SIPs). and use inventory and modeling results to develop and demonstrate the means to attain

[illegible]

compliance with the National Ambient Air Quality Standards (NAAQS). Other needs for emission factors and inventories have evolved over the years since. These needs range from Environmental Impact Statements, through emission trading, permit programs, and others. Today, there is a long list of programs, legislation and activities which ultimately rely on the estimation of emissions and source assessments and analyses. Programs which once were used only for basic planning, and whose outputs were recognized as approximate, but adequate, estimates are now being refined, extended and extrapolated, and quantities of estimated air pollution are being translated into real, and precise, dollars and cents.

The ability to accurately and precisely estimate emissions is difficult to establish. The errors involved do not readily fit into conventional means of statistical analysis due to the number of variables and the typical shortage of data that are needed to describe all possible source conditions and operating parameters. Likely errors and uncertainties range from a few percent to an order of magnitude, or even more. In the development of emission factors, an effort is usually made to determine emissions from the typical or average source. Some screening and data selection may be possible to accomplish this end, either by excluding data from what seems to be an atypical source, or by the development of subcategories to try to isolate the major causes of variances and source characteristics which may affect emissions. At best, there will still be variations between sources of similar type, process, size, design, and operating practices, and even within a given source (Reference 1). The assumption is made that such variations averaged over a selection of actual sources and over time will be representative of the averages for typical sources in the population. Therefore, when an emission factor is applied to a broad population of similar sources, variations will tend to cancel out and area-wide composite emissions for the source category will tend to be reasonably accurate. Keep in mind, however, that errors in emission factors alone result in a probability of over-estimating emissions from 50 percent of the sources and underestimating the remainder (by some unknown and undefined margin).

Problems begin when we begin to depend upon the absolute value of the estimates for a particular source or facility as the basis for decisions and legal actions concerning that individual source. This occurs most obviously through the use of emission factors (and inventories) for calculation of emission fees, permit source size cutoff decisions, emission trading/marketing and other similar applications. Such applications are intensified, and mandated, under various programs and requirements resulting from the Clean Air Act Amendments of 1990.

Sources of uncertainty can be a function of process and control device characteristics that vary between facilities and at the same facility over time. Examples include use of different process equipment; process size or process rate differences that affect per unit emitting potential; process temperature differences; variations in raw materials and fuels; differences in air pollution control device operating characteristics such as scrubber pressure drop, ESP specific collection area, carbon adsorber regeneration frequency; and facility housekeeping, operation and maintenance practices. Many uncertainties associated with these sources cannot readily be reduced by improved emission factor development methodologies, nor the degree of uncertainty well estimated. Uncertainty associated with sources can conceptually be reduced by identifying these sources and improving the emission factor development process, but this is difficult and expensive.

### Alternative Means of Estimating Emissions

The introduction to the U. S. Environmental Protection Agency's Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, (Reference 2), qualifies the validity of using emission factors contained therein, and in the several companion documents and data bases, to applications such as area wide inventories, and discourages their use for individual source estimation and decisions. It also encourages the use of representative (temporal and production rates, especially) and unbiased (stack) test data from the specific source as often being a more reliable and appropriate alternative. Because it is often very expensive to test each individual emission source, and since there are frequently no better or more complete sources of emission factors, (AP-42 is constantly being updated to include most reasonable data available), the emission factors in AP-42 frequently become the primary default. For many sources, the resulting errors are of little significance, in that no regulatory or fee "trigger" is engaged by this action, or if such happens, the consequences of the fee are much lower than the testing involved.

Some sources and trade associations have developed alternative emission factors that could be more accurate, or could have biases, but these factors suffer from the same sort of basic uncertainties as those in AP-42. Regulatory Agencies are often reluctant to use factors which are not generally accepted and "blessed" by EPA. An exception perhaps, could be in cases where the factors are developed from tests of a specific set of process and control equipment and the resulting factors are only applied to that same set of equipment within a narrow range of the same operating parameters. Data from such tests are solicited by EPA for use as additional input to the development of improved emission factors for AP-42, if reasonable assurance can be established that they are relatively unbiased and that proper quality assurance practices have been adhered to. A Draft Public Participation Plan recognizes this need and responds to Section 130 of the 1990 Amendments (Reference 3).

The most reliable estimates of actual emissions from a source are from cases where continuous emission monitors (CEM's) are used for the pollutants of concern and for the time period of interest. Although these instruments may have inherent errors and uncertainties, they are relatively small compared to estimates resulting from emission factors or even short term stack tests. A major problem is that they are expensive to purchase and to maintain (requiring investments often in the several hundred thousand dollar range), and are not available for many pollutants of interest, and thus, it is often not reasonable and realistic to require sources to have and operate such equipment. Continuous monitors capable of quantifying the full range of criteria and toxic/hazardous pollutants reliably and economically are far from reality.

The traditional means to quantify emissions from a source is by multi-run, multi-condition stack testing. Stack testing is also expensive. This is one of the reasons that the concept of emission factors developed in the first place. A very simple test of one run, for one stack, for one (simple) pollutant may cost a minimum of $3,000-10,000, and often much more. Most facilities have multiple stacks or emission sources and have multiple pollutants, many of which require complex test and analytical methods. Multiple runs (usually 3 or more) need to be completed on each emission point and quality assurance/quality control measures need to be carried out to insure that the results are reliable and representative. Not the least of these needs is to capture the emissions that would be "typical" over an extended period of time and not just under optimum short term conditions that might only exist at the time of a compliance test. It would not be unusual for a small, reasonably uncomplicated facility, to require $50,000 or $100,000 to quantify the emissions of all pollutants reliably; and to test larger and more complex facilities may typically require $250,000 to several $ million.

Title V of the Clean Air Act requires each State to have an air pollutant source operating permit program which conforms to specific guidelines. One of the constraints imposed is that emission levels, either potential, allowable, or actual, must be established for purposes of defining emission fees to be collected from facilities to pay the administrative costs of the permit program.

[illegible]

The baseline minimum fee has been defined in the Act as $25.00/ton of emissions, plus adjustments for inflation. Although "Allowable" emissions are being used by some states to determine this fee, Actual emissions are being used by other states for fee determinations.

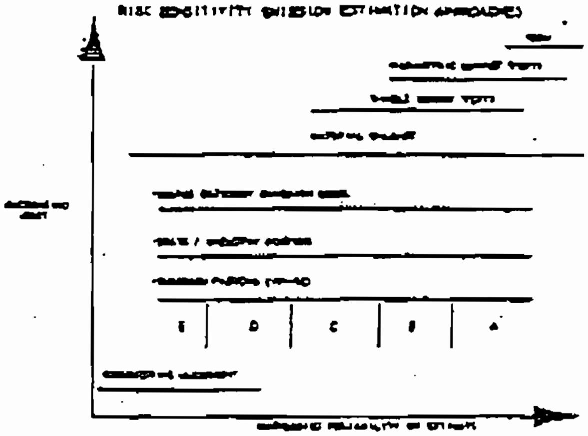
One of the key issues and causes for concern for using emission factors to establish emission quantities in permits and fees is that of the impact of revisions to the factor. In an academic and idealistic sense, improvements in data and consequent emission estimates are well supported goals. However, when ten fold increases or decreases in emission fees may result from the improvement of an emission factor, the underlying trust and belief in the system are eroded. Emission facility owners in particular will not likely find it acceptable and fair if suddenly their annual permit fee doubles or even becomes larger by a factor of ten. They are likely to take great issue with such action. The permitting agency, will at the same time come into some "windfall" funds that they had not expected. On the other hand, if the factors decrease, the owners will not likely complain, but still be disillusioned in the integrity of the process. In this case, the involved agency could end up with significant shortages in budget and might have to take steps to raise fees for all sources in their jurisdiction, accordingly. The likelihood of such "catastrophic" revisions to emission factors is not major, but may become real over time. Experience has shown that emission factors may change significantly with the availability and use of additional test data. This has particularly been the case in industries which have historically had little or no test data base upon which to establish factors. These industries have often been ignored, or highly uncertain emission factors have been adopted, based on engineering analysis and speculation.

## Data Quality and Hierarchy of Emission Factors

As discussed earlier, and as illustrated in Figure 1, it would be ideal to have continuous emission monitors or multiple stack tests on all emission sources, for all pollutants, so that all releases would be well quantified, within a small and acceptable range of uncertainty. This is, of course, not practical with current technology. If none of the more reliable methods of emission estimation continuum on Figure 1 are available, the person needing to estimate emissions will tend to rely upon emission factors. Within the emission factor envelope, there are also many choices, and these choices have significantly different cost implications and trade offs. These methods and tools include AP-42 as mentioned earlier, but also several other sources and formats of the same or similar alternative information.

Within AP-42, ratings are assigned from A through E (Reference 4) to give a qualitative assessment of the uncertainty of the emission estimates resulting from their use. The factor ratings are arrived at after a process of first rating the test data available and then following a factor rating scheme which is somewhat arbitrary, but reflects the gradations in quality of the data. Regardless of the rating, the user generally will use the factor anyway, because it is "the best available," even if it might be little more than a standardized guess. If the factor does not suit the user's purpose, that user may be motivated to either collect more real data or to undertake a more creative effort to arrive at convincing estimates.

FIGURE 1



### Uncertainties and Errors From Definition of Pollutant

Several factors related to definition of pollutants represent disconnects between scientific reality and common practices which often creep in to the emission factor and emission estimation process. For example, test methods adequate for one purpose may not provide a technically correct result when defining a pollutant to be used in the air quality management process. The discussions below touch on some of the more basic issues and show the inaccuracies that creep into the emission estimation process due to such mismatches of convention and terminology.

#### Organic Compounds

.Organic compounds have been historically described both loosely and precisely as "hydrocarbons" which technically means only compounds with hydrogen and carbon atoms; "Volatile Organic Compounds" (VOC's), with many technical and regulatory definitions which relate to vapor pressure, exclusion of specific compounds for photochemical reactivity, and others; "Total Organic Compounds" (TOC), which includes all organic carbon compounds, such as aldehydes, heavier organic aerosols, etc.; Reactive Organic Compounds (ROG's) limited only to photochemically reactive organic compounds, and other definitions. The measurement techniques often used to quantify these emissions may not measure on the same basis as desired, however. For example, a flame ionization detector may measure carbon atoms ("as methane", or other calibration gas), but not correctly measure those atoms associated with aldehydes, ketone, chlorinated compounds and the like, nor provide the molecular weight of the mixture for purposes-of converting to the actual mass emitted. Depending on the mixture this sort of error may be limited or it may be significant. Other organic compounds may be heavier and exist primarily as aerosols (and may be photochemically reactive) but also be measured as particulate in the ambient air. Though there may be double counting from some perspectives, it is necessary to have such compounds quantified in each realm in order to make proper scientific and engineering judgements of reality, even these may run amuck of regulatory conventions.

### Particulate Matter

Particulate matter has many inherent nomenclature and measurement problems related to properly estimating the emissions needed for a particular application. Condensibles, for example, may be included in some measurements and not in others; there may be measurement problems with some reactions occuring within the sampling train. Particle size, the method for determining that particle size, and other variables impact upon the reality of what is represented by a particular emission factor. There is also an imprecise relationship between the ambient "Total Suspended Particulate" (TSP) term and the source related "Total Particulate" term. Other similar disparities exist that must be recognized and dealt with in every day decisions and realities.

### Other Pollutants

Though not as pronounced and obvious as for the example pollutants above, there are similar difficulties with other pollutants. Often test methods will provide output only for one subset of pollutants of interest and a separate method will provide them, but introduce other errors or mismatches between what you want and what you get. There is a more extensive discussion of conventions and nomenclature in the revised Introduction to AP-42 (Reference 4).

### Improvements Underway and Interim Recommendations

Emission factors, by their very existence, as an attempt to provide a simplistic model of often extremely complex activities, are prone to many errors and uncertainties. Though we must often use them for purposes for which they are technically inappropriate, they frequently provide the only way to make needed emission estimates and proceed with mandated and desired environmentally enhancing programs. Much remains to be done, but we must keep in mind that even at best, the uncertainties will not disappear and we will continue to need further improvements the more that we are called upon to provide factors to estimate emissions for permits or emission fees, or even to quantify emissions to a precision that will facilitate emissions being traded on the open market in terms of very precise dollars and cents. The program simply does not have the budget to test the sources needed to significantly reduce the uncertainties for all possible sources, but continues to make strides toward improvement.

What is the recommendation in the interim while EPA forms a more nearly perfect data base? It depends considerably on the use of the data. If the use of the estimate is such that it makes little difference in area wide emission control strategies, if the emission fee is not significantly affected, or other such qualifiers, then there is little hinderance to use of a less than reliable factor to estimate emissions. Use of such factors provides an order of magnitude assessment and "place holder" should further work be done or other new intelligence become available. You might say the qualifiers for recommending use of an emission factor for a particular application is risk based. If the risk is high, a factor may not be adequate and testing of the source should be pursued at the earliest opportunity. If the risk is low, then the consequences may be of less significant impact than the costs of improvement of the data base or means of estimating emissions. One can then propose a qualitative hierarchy which fits this model and is in agreement with Figure 1. Any factors used, however, should be carefully and fully documented. Other alternatives are discussed below:

### Continuous Emission Monitoring Data (CEM)

If CEM data are available, and are not otherwise disqualified due to errors or equipment problems, etc., then these data should be used wherever possible to estimate emissions.

Material Balances

If the process involved is one which is amenable to material balance, such as solvent usage, then this is generally a very high quality alternative for estimating emissions. If however, it is one where a material balance would require taking small differences in large numbers or situations where it is not reasonable to quantify all waste and material streams; then this is a poor choice to estimate emissions.

Stack Test Data

If properly quality assured stack test data exist for a particular piece of equipment operating under the "normal" loads, conditions, raw materials, etc., then these data should be used above generalized emission factors. If these tests are for other similar sources using the same type of equipment, under similar conditions, then it will usually be reasonable to use these data to estimate emissions in conjunction with AP-42 emission factors and underlying test data. If these conditions are not met or there are other reasons to suspect or disqualify the test data, then the AP-42 emission factors are likely more reliable and preferred.

AP-42

These are normally EPA's most highly researched and documented factors for emission inventory purposes and are recommended for use when CEM data, proper stack test data or good material balance data are not available. Here, AP-42 also includes updates residing on FaxCHIEF or the CHIEF electronic bulletin board (which update AP-42, but may not have yet been updated in the printed version).

FIRE

The data contained in this computer data base are reflective of AP-42 and other sources. The rated data (A-E) in FIRE should generally agree with the latest version of AP-42 for both criteria and hazardous (and other) air pollutants, though FIRE will often have a longer list of factors. FIRE also contains other "U" rated data which are useful also, but may have higher risk or uncertainties. Such U-rated data are generally preferred above other non-reviewed and researched data.

SPECIATE

SPECIATE data are useful for speciation of existing inventories for photochemical and receptor modeling purposes, but many toxic compounds are not included or properly quantified for use for estimating quantitative emissions. References used in developing SPECIATE have been reviewed in the development of FIRE and AP-42, and data of sufficient quality have been included in emission factors therein. Thus, there will normally be little value gained, except in the most gross sense, in using the data in SPECIATE for base emission estimation.

State/Industry/Trade Association Factors

As alluded to earlier, these data may be of quality equal to or exceeding those in AP-42/*FIRE*. However, any such factors should demonstrate the benefit of review of the AP-42 data base and provide arguments for inclusion or exclusion of AP-42 data points in their development. If the emission factor is for a specific site, it should still have some relevance and relation to the realities of the data bases included in the background of AP-42.

### Other EPA Factors and Gap Filling Results

Generally, all other EPA factors and gap filling products will have been included in the review of AP-42 and are thus not relevant if an AP-42 emission factor exists. If there is a traceable reference trail and an individual engineering analysis indicates that there is reasonableness, then such factors are reasonable to use. The user is on his own to make an argument to the officials in question, as to whether the new data must take precedence. Again, any arguments and rebuttals should reflect the review and inclusion or exclusion of data for the source category which may exist in the AP-42 data bases and documentation.

Obviously there are many pitfalls in the use of emission factors. There are many situations where use of alternative means to estimate emissions are preferable, albeit more expensive. If used correctly and in the proper context with proper respect for uncertainties and shortfalls, emission factors are adequate for many purposes. Used in the wrong situations, and with the wrong expectations, they may result in many problems. The key is to be alert to the potential pitfalls, respect the caveats and chose the proper action for the situation. If testing is done or new emission factors are developed, the Emission Inventory and Factor Group requests that they be provided the data and associated assumptions, background, calculations, etc to document the situation so that the information may be used in future improvements to emission factors.

### A Fitting Conclusion

Let me end with a tongue in cheek quotation from an old philosopher well versed in emission factor technologies. [Please consider this quote as an overstatement and for its intended humor element and not as a serious challenge to the value of emission factors.] This person defined an emission factor as follows:

> "An emission factor is a number which passes as an accurate approximation of emissions and is developed with prolific fortitude from extremely incomprehensible information and calculated with microscopic precision using extremely vague assumptions which are based on debatable figures acquired from inconclusive tests and ou ite incomplete experiments carried out with instruments of problematic accuracy bypersons of doubtful reliability and rather dubious mentality." (adapted)

However, an equally well versed authority has made the following observation:

> "In the beginning, God created the heavens and the earth. Then, man was created and given dominion over the plants, animals and minerals on the earth. The ten commandments were soon promulgated to regulate man's actions. Shortly thereafter, emission factors were developed to characterize the impact of man's actions on the atmospheric environment. These emission factors were cannonized in AP-42 and it was good. The Emission Factors and Inventory Group of the U.S. Environmental Protection Agency is now empowered to maintain and update AP-42, and it is still good." (Reference 5).

Where you stand on emission factors and inventories often depends upon where you sit. In any case, it is important to keep the realities and uncertainties of estimation of emissions in mind when faced with the situation of making the best and most reasonable estimates, and that the reason for making the estimates be considered heavily in the decision process.

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# APPENDIX D

# DOCUMENTATION OF THE CONTROL EFFICIENCY OF WATER SPRAYING

# WORKBOOK ON ESTIMATION OF EMISSIONS AND DISPERSION MODELING FOR FUGITIVE PARTICULATE SOURCES

Document P-A857
September 1981

Prepared for

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ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.
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### 3.2.17 Coal Transfer Points

As far as can be determined, no emission factor measurements have been made specifically for transfer points. EPA (1981) recommends UEF equations (discussed in previous sections) based on load-in operations. These equations should be used by substituting Y = 4.6 m , as these transfer operations are continuous by nature (see Table 3.2.17-1). Colorado (1981) recommends a UEF of 0.01 kg/tonne; however, this is based on an "engineering estimate" for which no justification has been presented and should not be used except in dealings with the Colorado agency. A UEF of 0.06 kg/tonne (PEDCo 1976a, 1976b; Battelle 1970) has been used fairly widely. However, this UEF is not based on measured data, either. It is stated to be for all transfer points; thus, it is impossible with this UEF to divide emissions among the various transfer points. It is thus not recommended for use.

Control techniques for transfer points include spraying and enclosures with and without control devices (see Table 3.2.17-2).

### 3.2.18 Coal Conveyors

As far as can be determined, only one reference has measured emissions from any conveying operation (Blackwood and Peters 1976). This UEF, which was developed for traprock using only downwind monitors, probably overestimates TSP emissions.

Other UEFs that have been used fairly often are those provided by Colorado (1981) and EPA's Region VIII (EPA (VIII) 1979) (see Table 3.2.18-1). However, Colorado (1981) gives no reference for its source and states that it is a "worst-case" estimate. The UEF provided by EPA (VIII) 1979 is for all transfer points and conveyors. Both of these UEFs are thus too crude for use in areas outside Colorado or Region VIII except as "screening" tools. Some conveyors between a coal mine or preparation plant to the power plant can be several miles long. However, none of the UEFs in Table 3.2.18-1 have conveyor emissions dependent on the length, nor do they depend on the height of the conveyor or wind speed. Hence, none of these UEFs has a

TABLE 3.2.17-2

TRANSFER POINTS:

EFFICIENCIES OF CONTROL TECHNIQUES AND METHODS

| Technique | Control Efficiency | Comments | Reference |
|---|---|---|---|
| Enclosure | 90%<br>70-99%* |  | Szabo 1978<br>EPA 1978a |
| Enclosure with control device | 99(+)% | See Appendix A for calculating controlled emissions. | EPA 1978a |
| Spraying | 70-95% |  | EPA 1978a |
| Telescopic chutes | 75% |  | EPA 1978a |

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*Lower value uses "weathertight" system; higher value utilizes dust collection system.

# APPENDIX E

# MOLTEN SULFUR HANDLING AND STORAGE EMISSION FACTORS AND VENTILATION RATE DOCUMENTATION

# EMISSION FACTORS FOR SULFUR PARTICLES, TRS, $SO_2$ AND VOC IN MOLTEN SULFUR STORAGE AND HANDLING SYSTEMS

Sulfur particle emissions have been measured by Koogler & Associates (November 1988) from molten sulfur storage tanks in the phosphate chemical fertilizer industry. The measured sulfur particle concentrations in the gases vented from the storage tanks have ranged from 0.3-0.5 grains/ft$^3$. The higher concentrations were measured when the tanks were being filled with molten sulfur, and the lower concentrations when the tanks were idle. The average natural ventilation rates on multi-vent tanks were measured at about 18 cfm/vent.

Measurements of sulfur particle emissions at the Pennzoil terminals in Tampa, Florida, in October 1986 by Enviroplan were measured at 0.45 grains/ft$^3$ (NOTE: Data was corrected by Koogler and comments were transmitted to FDER, December 30, 1986). However, later tests conducted by Enviroplan (1987) at Sulfur Storage Company, Inc. in Tampa, Florida, measured sulfur particle concentrations at 0.12 grain/ft$^3$. It is believed that the Pennzoil tests and the Koogler tests during tank filling could contain condensed organics. Enviroplan (1987) indicated the total particulate concentrations including condensible hydrocarbons could be 2.5 times the sulfur particulate concentration.

Therefore, a reasonable estimate of sulfur particle concentration under all conditions is:

$$(0.3 + 0.12)/2 = 0.2 \text{ grains/ft}^3$$

Air vented from molten sulfur storage tanks and pits is also expected to contain small quantities of total reduced sulfur compounds, including $H_2S$ (TRS), sulfur dioxide and volatile organic compounds (VOCs). The volatile organic compounds result from small quantities of petroleum products contained in Frasch sulfur (approximately 0.25%) and the vaporization of these compounds at the storage temperature of molten sulfur. The reduced sulfur compounds result from the reduction of elemental sulfur in the presence of carbon supplied by the petroleum products and the $SO_2$ results from the oxidation of elemental sulfur.

A limited number of measurements have been made on molten sulfur storage tanks at Frasch sulfur terminals in the Tampa area to determine TRS, $SO_2$, and VOC concentrations in the headspace of the tanks over molten sulfur. These measurements have been made on molten sulfur storage tanks with capacities in the range of 10,000 tons which are air purged at rates between 10 and 63 cfm to prevent the accumulation of $H_2S$. Because of the size of the tanks, the fact that they are air purged and the fact that sulfur delivered to the Port of Tampa most probably has a higher fraction of VOCs (due to the fact that there has been less time for the volatile fraction of the petroleum products to vaporize), measurements made in Tampa will overestimate TRS, $SO_2$ and VOC emissions from phosphate chemical fertilizer facilities which later receive the sulfur. However, as no other data is available, the Tampa data will be used to estimate TRS (including $H_2S$), $SO_2$ and VOC emissions factors for molten sulfur storage tanks and molten sulfur pits. It should be recognized that the application of these emission factors will overstate the actual emissions by some unknown amount.

Measurements of TRS made in November 1983 by TRC and reported in the FDER "Sulfur Report" (February 1984) show the following:

| Tank Purge Rate (CFM) | TRS (as H2S) in Headspace Over Molten Sulfur (ppm, vol) |
|---|---|
| 43 | 280 |
| 63 | 403 |

Measurements made by Enviroplan, Inc. in 1987 in the headspace over molten sulfur in a tank purged at the rate of 10 cfm showed an average TRS concentration of 638 ppm (vol).

A "typical" concentration of TRS (as $H_2S$) in the headspace over molten sulfur can be estimated from these data:

$$[280 + 403 + 2(638)]/4 = 490 \text{ ppm (vol)}$$

$$= 3.5 \times 10^{-5} \text{ lb/ft}^3 \text{ at } 200^{\circ}\text{F}$$

Measurements of $SO_2$ made by TRC (1983) in the tank headspace over molten sulfur at purge rates of 43 and 63 cfm averaged 553 ppm (vol). This converts to an $SO_2$ concentration of $7.3 \times 10^{-5}$ lb/ft$^3$ at 200°F.

Measurements made by Enviroplan, Inc. (1987) in the tank headspace over molten sulfur at STI in Tampa showed VOC concentrations that averaged $5.2 \times 10^{-5}$ lb/ft$^3$.

Table 1 summarizes the above emission factors for molten sulfur storage and handling systems.

## TABLE 1
## SUMMARY OF EMISSION FACTORS FOR MOLTEN SULFUR STORAGE AND HANDLING SYSTEMS

| Air Pollutant | Emission Factor |
|---|---|
| Sulfur Particle | 0.2 grains/ft$^3$ |
| TRS (as $H_2S$) | $3.5 \times 10^{-5}$ lb/ft$^3$ |
| $SO_2$ | $7.3 \times 10^{-5}$ lb/ft$^3$ |
| VOC | $5.2 \times 10^{-5}$ lb/ft$^3$ |

# REFERENCES

1. "Preliminary Report on Emissions From Tank No. 4 at Sulfur Terminal Co.,Inc., Tampa, Florida." TRC Environmental Consultants, Inc., East Hartford, Connecticut, December 30, 1983.

2. "Sulfur Report." Bureau of Air Quality Management, Florida Department of Environmental Regulation, Tallahassee, Florida, February 1984.

3. "Sulfur Particulate Emission Measurement Project at the Pennzoil Terminals in Tampa, Florida." Enviroplan, Inc., West Orange, New Jersey, October 1986.

4. Comments in a letter dated December 30, 1986, by Dr. John Koogler, Koogler & Associates to Mr. Steve Smallwood, FDER, on Enviroplan's Pennzoil Sulfur Company emission measurement report.

5. "Technical Report Supporting Application to the Florida DER For An Alternate Sulfur Particulate Emissions Sampling Procedure." Enviroplan, Inc., West Orange, New Jersey, October 30, 1987.

6. "Particulate Matter Emission Measurements From Molten Sulfur Storage Tanks at Gardinier, Inc., Tampa, Florida." Koogler & Associates, Gainesville, Florida, November 7-8, 1988.

7. Discussions with Enviroplan, Inc. at a meeting in New Orleans, Louisiana, on July 6, 1989. Enviroplan supplied measurement data on TRS and VOC concentrations in the headspace over molten sulfur storage tanks at the Sulfur Terminals Company, Inc. in Tampa, Florida, for testing which was conducted during September 1987.

BEST AVAILABLE COPY

STATE OF FLORIDA

# DEPARTMENT OF ENVIRONMENTAL REGULATION

N TOWERS OFFICE BUILDING
0 BLAIR STONE ROAD
LLAHASSEE, FLORIDA 32301

BOB GRAHAM
GOVERNOR

VICTORIA J. TSCHINKEL
SECRETARY

## APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

RCE TYPE: SULFUR STORAGE & HANDLING SYSTEM [ ] New[1] [X] Existing[1]

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

PANY NAME: CARGILL FERTILIZER, INC. COUNTY: HILLSBOROUGH

dentify the specific emission point source(s) addressed in this application (i.e. Lime n No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) SEE ATTACHMENT "A"

OURCE LOCATION: Street 8813 U.S. HIGHWAY 41 SOUTH City RIVERVIEW

UTM: East (17) 363.0 KM North 3082.3 KM

Latitude 27 ° 51 ' 36 "N Longitude 82 ° 23 ' 29 "W

ICANT NAME AND TITLE: DAVID B. JELLERSON, ENVIRONMENTAL SUPERINTENDENT

ICANT ADDRESS: 8813 U.S. HIGHWAY 41 SOUTH, RIVERVIEW, FL 33569

### SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

APPLICANT

I am the undersigned owner or authorized representative* of CARGILL FERTILIZER, INC.

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

ach letter of authorization

Signed: David B. Jellerson

DAVID B. JELLERSON, ENVIRONMENTAL SUPERINTENDENT
Name and Title (Please Type)

Date: 10/8/93 Telephone No. 671-6207

ROFESSIONAL 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 een designed/examined by me and found to be in conformity with modern engineering rinciples applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgment, that

---

Florida Administrative Code Rule 17-2.100(57) and (104) the pollution control facilities, when properly maintained and operated, will dischar an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed David B. Jellerson

DAVID B. JELLERSON
Name (Please Type)

CARGILL FERTILIZER, INC.
Company Name (Please Type)

8813 U.S. HIGHWAY 41 SOUTH, RIVERVIEW, FL 33569
Mailing Address (Please Type)

Florida Registration No. 38676 Date: 10/8/93 Telephone No. (813) 671-6207

## SECTION II: GENERAL PROJECT INFORMATION

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

SEE ATTACHMENT "A"

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

Start of Construction OCTOBER 15, 1993 Completion of Construction OCTOBER 15, 1994

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.)

NONE REQUIRED

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

PERMIT NO. AC29-162375 - ISSUED: NOVEMBER 6, 1989 EXPIRED: APRIL 1, 1991

A029-201635 - ISSUED: MAY 1, 1991 EXPIRES: OCTOBER 15, 1996

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

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

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? N/A
   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. N/A
3. Does the State "Prevention of Significant Deterioriation" (PSD) requirement apply to this source? If yes, see Sections VI and VII. N/A
4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? N/A
5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? N/A

Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? NO

   a. If yes, for what pollutants? ______________________________
   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

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

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

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

| scription | Contaminants |  | Utilization Rate - lbs/hr | Relate to Flow Diagram |
|---|---|---|---|---|
|  | Type | % Wt |  |  |
|  |  |  |  |  |
|  | (SEE ATTACHMENT "A") |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

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

1. Total Process Input Rate (lbs/hr): N/A

2. Product Weight (lbs/hr): N/A

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

| Name of ontaminant | Emission[1] |  | Allowed[2] Emission Rate per Rule 17-2 | Allowable[3] Emission lbs/hr | Potential[4] Emission |  | Relate to Flow Diagram |
|---|---|---|---|---|---|---|---|
|  | Maximum lbs/hr | Actual T/yr |  |  | lbs/yr | T/yr |  |
|  | (SEE ATTACHMENT "A") |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

See Section V, Item 2.

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

Calculated from operating rate and applicable standard.

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

ATTACHMENT "A"

## SECTION V: SUPPLEMENTAL INFORMATION

1. Process input/production rates

Input Rate

Molten sulfur input rate to tank

= 1300 tonne/hr x 2200 lb/ton
= 2,860,000 lb/hr

Annual throughput @ 1.34 MM tonnes for the entire facility.

Assume annual throughput will be equally distributed between the three tanks.

= 1,340,000/3
= 446,667 tonne/yr

Time required to transfer sulfur to tank

= 446,667 tonne/yr x 1/1300 tonne/hr
= 344 hr/yr

Sulfur Withdrawl

Maximum sulfur withdrawl rate is approximately 300 tonne/hr. The sulfur is pumped to one of three covered sumps that serve the sulfuric acid plants or will go to the truck loading station as proposed in this permit application.

2/3. Controlled and Uncontrolled Emissions

Tank No. 1 has a 10,000 tonne capacity. Drawing sk-1 shows the configuration of the present tank. The roof vents, except for the single center vent, are sealed. Seal details are shown in drawing sk-4. Emissions from the tank will be essentially the same regardless of capacity.

Emission measurements made on a single vent molten sulfur storage tank (Penzoil) demonstrated that the ventilation rate of the tank (wind induced), while the tank is sitting idle (or while sulfur is being withdrawn) is approximately 30 dscfm. These measurements also indicated the sulfur particle concentration in the air vented from the tank is in the range of .46 grains/dscf.

Measurments made on the Cargill Fertilizer molten sulfur storage tanks in November 1988 (multiple vents on the tanks) showed a sulfur particle concentration in the vented gas of .51 grains/dscf when molten sulfur was being pumped into the tanks at a rate of 1000 tonnes per hour and .29 grains/dscf when the tanks were sitting idle.

For calculating emissions from the tank, the following conditions have been established:

Tank Filling

Ventilation Rate = 429 dscfm (ventilation due to inflow of 1300 tonnes/hr molten sulfur plus wind induced ventilation)

Sulfur Particle Concentration = 0.66 grains/dscf

$$\frac{1300 \text{ tonnes/hr}}{1000 \text{ tonnes/hr}} \times 0.51 \text{ gr/dscf} = 0.66 \frac{\text{gr.}}{\text{dscf}}$$

Time = 344 hr/yr

Tank Idle

Ventilation Rate = 30 dscfm (from Penzoil report)

Sulfur Particle Concentration = 0.29 grains/dscf

Time = 8760 - 344
= 8416 hr/yr

Emissions were estimated for the single vent only as rim vents are sealed as shown in drawing sk-4.

Tank Filling

Emissions = 429 cfm x 60 min/hr x .66 gr/cf
x 1/7000 gr/lb
= 2.43 lb/hr
x 344 hr/yr x 1/2000
= 0.42 tpy

3.72

Tank Idle

Emissions = 30 dscfm x 60 min/hr x 0.29 gr/cf
x 1/7000 gr/lb
= 0.075 lb/hr
x 8416 hr/yr x 1/2000
= 0.32 tpy

Total Emissions
Hourly = 0.075 to 2.43 lb/hr
Annual = 0.74 tpy

## SECTION V: SUPPLEMENTAL INFORMATION

1. Process input/production rates

Input Rate

Molten sulfur input rate to tank

= 1300 tonne/hr x 2200 lb/ton
= 2,860,000 lb/hr

Annual throughput @ 1.34 MM tonnes for the entire facility.

Assume annual throughput will be equally distributed between the three tanks.

= 1,340,000/3
= 446,667 tonne/yr

Time required to transfer sulfur to tank

= 446,667 tonne/yr x 1/1300 tonne/hr
= 344 hr/yr

Sulfur Withdrawl

Maximum sulfur withdrawl rate is approximately 300 tonne/hr. The sulfur is pumped to one of three covered sumps that serve the sulfuric acid plants or will go to the truck loading station as proposed in this permit application.

2/3. Controlled and Uncontrolled Emissions

Tank No. 2 has a 18,000 tonne capacity. Drawing SK-3 shows the configuration of the present tank. The roof vents, except for the single center vent, are sealed. Seal details are shown in drawing sk-4. The tank will be vented by a single 10-inch diameter gooseneck vent in the center of the tank roof (See drawing SK-3. Emissions from the tank will be essentially the same regardless of capacity.

Emission measurements made on a single vent molten sulfur storage tank (Penzoil) demonstrated that the ventilation rate of the tank (wind induced), while the tank is sitting idle (or while sulfur is being withdrawn) is approximately 30 dscfm. These measurements also indicated the sulfur particle concentration in the air vented from the tank is in the range of .46 grains/dscf.

Measurments made on the Cargill Fertilizer molten sulfur storage tanks in November 1988 (multiple vents on the tanks) showed a sulfur particle concentration in the vented gas of .51 grains/dscf when molten sulfur was being pumped into the tanks at a rate of 1000 tonnes per hour and .29 grains/dscf when the tanks were sitting idle.

For calculating emissions from the tank, the following conditions have been established:

Tank Filling

Ventilation Rate = 429 dscfm (ventilation due to inflow of 1300 tonnes/hr molten sulfur plus wind induced ventilation)

Sulfur Particle Concentration = 0.66 grains/dscf
Time = 344 hr/yr

Tank Idle

Ventilation Rate = 30 dscfm (from Penzoil report)

Sulfur Particle Concentration = 0.29 grains/dscf
Time = 8760 - 344
= 8416 hr/yr

Emissions were estimated for the single vent only as rim vents are sealed as shown in drawing sk-4.

Tank Filling

Emissions = 429 cfm x 60 min/hr x .66 gr/cf
x 1/7000 gr/lb
= 2.43 lb/hr
x 344 hr/yr x 1/2000
= 0.42 tpy

Tank Idle

Emissions = 30 dscfm x 60 min/hr x 0.29 gr/cf
x 1/7000 gr/lb
= 0.075 lb/hr
x 8416 hr/yr x 1/2000
= 0.32 tpy

Total Emissions
Hourly = 0.075 to 2.43 lb/hr
Annual = 0.74 tpy

## SECTION V: SUPPLEMENTAL INFORMATION

### 1. Process input/production rates

Input Rate

Molten sulfur input rate to tank

= 1300 tonne/hr x 2200 lb/ton
= 2,860,000 lb/hr

Annual throughput @ 1.34 MM tonnes for the entire facility.

Assume annual throughput will be equally distributed between the three tanks.

= 1,340,000/3
= 446,667 tonne/yr

Time required to transfer sulfur to tank

= 446,667 tonne/yr x 1/1300 tonne/hr
= 344 hr/yr

Sulfur Withdrawl

Maximum sulfur withdrawl rate is approximately 300 tonne/hr. The sulfur is pumped to one of three covered sumps that serve the sulfuric acid plants or will go to the truck loading station as proposed in this permit application.

### 2/3. Controlled and Uncontrolled Emissions

Tank No. 3 has a 18,000 tonne capacity. Drawing SK-3 shows the configuration of the present tank. The roof vents, except for the single center vent, are sealed. Seal details are shown in drawing sk-4. The tank will be vented by a single 10-inch diameter gooseneck vent in the center of the tank roof (See drawing SK-3. Emissions from the tank will be essentially the same regardless of capacity.

Emission measurements made on a single vent molten sulfur storage tank (Penzoil) demonstrated that the ventilation rate of the tank (wind induced), while the tank is sitting idle (or while sulfur is being withdrawn) is approximately 30 dscfm. These measurements also indicated the sulfur particle concentration in the air vented from the tank is in the range of .46 grains/dscf.

Measurments made on the Cargill Fertilizer molten sulfur storage tanks in November 1988 (multiple vents on the tanks) showed a sulfur particle concentration in the vented gas of .51 grains/dscf when molten sulfur was being pumped into the tanks at a rate of 1000 tonnes per hour and .29 grains/dscf when the tanks were sitting idle.

For calculating emissions from the tank, the following conditions have been established:

Tank Filling

Ventilation Rate = 429 dscfm (ventilation due to inflow of 1300 tonnes/hr molten sulfur plus wind induced ventilation)

Sulfur Particle Concentration = 0.66 grains/dscf

Time = 344 hr/yr

Tank Idle

Ventilation Rate = 30 dscfm (from Penzoil report)

Sulfur Particle Concentration = 0.29 grains/dscf

Time = 8760 - 344
= 8416 hr/yr

Emissions were estimated for the single vent only as rim vents are sealed as shown in drawing sk-4.

Tank Filling

Emissions = 429 cfm x 60 min/hr x .66 gr/cf
x 1/7000 gr/lb
= 2.43 lb/hr
x 344 hr/yr x 1/2000
= 0.42 tpy

Tank Idle

Emissions = 30 dscfm x 60 min/hr x 0.29 gr/cf
x 1/7000 gr/lb
= 0.075 lb/hr
x 8416 hr/yr x 1/2000
= 0.32 tpy

Total Emissions

Hourly = 0.075 to 2.43 lb/hr

Annual = 0.74 tpy

## SECTION V: SUPPLEMENTAL INFORMATION

### 1. Process Input/Production Rates

The sulfur pits receive molten sulfur from one of the three molten sulfur storage tanks and provide surge capacity between the storage tanks and the sulfuric acid plants. The maximum sulfur transfer rate to the pits is approximately 300 tonnes per hour depending upon the operating rates of the three sulfuric acid plants.

### 2/3. Controlled and Uncontrolled Emissions

Sulfur particle emissions from the three pits result from sulfur vapors that are displaced from the pits as sulfur is transferred to the pits and as a result of wind induced ventilation through the pit vents. Each pit is partitioned into two sections (attachment A) and each section has a single vent. As a result, each pit section is similar to a single vent molten sulfur storage tank. The ventilation rates of the pits have therefore been estimated on the same basis as molten sulfur storage tanks; with adjustments for sulfur transfer rates and vent diameters and heights.

The transfer of 300 tonnes per hour of sulfur into a pit will result in the displacement of approximately 100 dscfm of air (including wind induced ventilation). The wind induced ventilation rates of the pits have been estimated to be one-sixth the wind induced ventilation rates of the tanks (one-sixth of 30 dscfm or 5 dscfm). The factor of one-sixth was estimated considering differences in vent diameters (cross-sectional areas) - 3.5 to 6 inches vs. 10 inches for the tanks - and differences in vent heights - 6 to 8 feet vs. 25 to 30 feet for the tanks. Sulfur particle concentrations in the vented gas streams from the pits were assumed to be the same as from the tanks - 0.51 grains/dscf during sulfur transfer and 0.29 grains/dscf during wind induced ventilation.

Pit Filling

Controlled and Uncontrolled emissions are identical

Time = 446,667 tonnes per year at a transfer rate of 300 tonnes per hour

= 446,667 tpy/300 tph
= 1489 hr/yr

Emissions = 100 cfm x 60 min/hr x 0.51 gr/dscf
x 1/7000 gr/lb
= 0.44 lb/hr
x 1489 hr/yr x 1/2000 lb/ton
= 0.33 tpy

### Wind Induced

Time = 8760 - 1489
= 7271 hr/yr

Emissions = 5 cfm x 60 min/hr x 0.29 gr/dscf
x 1/7000 gr/lb
= 0.012 lb/hr
x 7271 hr/yr x 1/2000
= 0.04 tpy

### Total Emissions

Hourly = 0.012 to 0.44 lb/hr
Annual = 0.37 tpy

# APPENDIX F

# PARTICLE SIZE DISTRIBUTION DATA

## Table F-1. Calculation of Particle Size Distribution and PM Emission Rate for Scrubber Stack 1702 Using the Procedures Presented in Regulation 62-212.600, Sulfur Storage and Handling Facilities

| Lower Bound of Selected Particle Size Range (microns) | Upper Bound of Selected Particle Size Range (microns) | Mean Diameter[1] (microns) | Cumulative Weight Percent Greater Than Specified Diameter[2] (%) | Uncontrolled Weight Percent (%) | Uncontrolled Emission Rate (lb/hr) | Lower Bound Settling Velocity[3] (cm/s) | Mean Diameter Settling Velocity[3] (cm/s) | Upper Bound Settling Velocity[3] (cm/s) | Scrubber Control Efficiency[4] (%) | Controlled Emission Rate (lb/hr) | Controlled Weight Percent (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2.5 | 1.76 | 100.00 | 0.42 | 0.16 | -- | 0.019 | 0.038 | 92 | 0.013 | 2.85 |
| 2.5 | 5 | 3.50 | 99.58 | 15.64 | 6.02 | 0.038 | 0.074 | 0.15 | 96 | 0.24 | 52.38 |
| 5 | 10 | 6.79 | 83.94 | 15.98 | 6.15 | 0.15 | 0.28 | 0.60 | 98 | 0.12 | 26.77 |
| 10 | 20 | 13.34 | 67.96 | 10.56 | 4.07 | 0.60 | 1.07 | 2.41 | 99 | 0.041 | 8.85 |
| 20 | 30 | 20.86 | 57.39 | 11.46 | 4.41 | 2.41 | 2.62 | 5.41 | 99.5 | 0.022 | 4.80 |
| 30 | 50 | 33.87 | 45.93 | 10.03 | 3.86 | 5.41 | 6.90 | 15.0 | 99.75 | 0.010 | 2.10 |
| 50 | 75 | 51.77 | 35.90 | 7.50 | 2.89 | 15.0 | 16.1 | 33.8 | 99.9 | 0.0029 | 0.63 |
| 75 | 100 | 71.10 | 28.40 | 8.83 | 3.40 | 33.8 | 30.4 | 60.2 | 99.9 | 0.0034 | 0.74 |
| 100 | 150 | 103.29 | 19.57 | 9.57 | 3.68 | 60.2 | 64.2 | 135.4 | 99.9 | 0.0037 | 0.80 |
| 150 | 225 | 154.80 | 10.01 | 7.52 | 2.90 | 135.4 | 144.2 | 304.6 | 99.99 | 0.00029 | 0.063 |
| 225 | 300 | 212.77 | 2.49 | 2.49 | 0.96 | 304.6 | 272.4 | 541.4 | 99.99 | 0.00010 | 0.021 |
| **Total** | | | | **100.00** | **38.5** | | | | | **0.460** | **100.00** |

**Footnotes:**

[1] Calculated using the mass mean equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[2] Calculated using the particle size distribution equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[3] Calculated using the following equation presented on page 42 of "Aerosol Technology" by William C. Hines, 1982.

$$V_{ts} = pd^2g/18n$$

where, p = the density of the particle (gram/cm$^3$)
d = the particle diameter (cm)
g = acceleration of gravity (cm/s$^2$)
n = air viscosity (dyn s/cm$^2$)
and, $V_{ts}$ = the settling velocity (cm/s)

[4] Based on particle removal curve for a typical Tri-Mer Whirl/Wet Scrubber provided by H & B Industrial Equipment, Inc. via KEMWorks.

## Table F-2. Calculation of Particle Size Distribution and PM Emission Rate for Scrubber Stack 1703 Using the Procedures Presented in Regulation 62-212.600, Sulfur Storage and Handling Facilities

| Lower Bound of Selected Particle Size Range (microns) | Upper Bound of Selected Particle Size Range (microns) | Mean Diameter[1] (microns) | Cumulative Weight Percent Greater Than Specified Diameter[2] (%) | Uncontrolled Weight Percent (%) | Uncontrolled Emission Rate (lb/hr) | Lower Bound Settling Velocity[3] (cm/s) | Mean Diameter Settling Velocity[3] (cm/s) | Upper Bound Settling Velocity[3] (cm/s) | Scrubber Control Efficiency[4] (%) | Controlled Emission Rate (lb/hr) | Controlled Weight Percent (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2.5 | 1.76 | 100.00 | 0.42 | 0.10 | -- | 0.019 | 0.038 | 92 | 0.008 | 2.85 |
| 2.5 | 5 | 3.50 | 99.58 | 15.64 | 3.66 | 0.038 | 0.074 | 0.15 | 96 | 0.15 | 52.38 |
| 5 | 10 | 6.79 | 83.94 | 15.98 | 3.74 | 0.15 | 0.28 | 0.60 | 98 | 0.07 | 26.77 |
| 10 | 20 | 13.34 | 67.96 | 10.56 | 2.47 | 0.60 | 1.07 | 2.41 | 99 | 0.025 | 8.85 |
| 20 | 30 | 20.86 | 57.39 | 11.46 | 2.68 | 2.41 | 2.62 | 5.41 | 99.5 | 0.013 | 4.80 |
| 30 | 50 | 33.87 | 45.93 | 10.03 | 2.35 | 5.41 | 6.90 | 15.0 | 99.75 | 0.006 | 2.10 |
| 50 | 75 | 51.77 | 35.90 | 7.50 | 1.75 | 15.0 | 16.1 | 33.8 | 99.9 | 0.0018 | 0.63 |
| 75 | 100 | 71.10 | 28.40 | 8.83 | 2.07 | 33.8 | 30.4 | 60.2 | 99.9 | 0.0021 | 0.74 |
| 100 | 150 | 103.29 | 19.57 | 9.57 | 2.24 | 60.2 | 64.2 | 135.4 | 99.9 | 0.0022 | 0.80 |
| 150 | 225 | 154.80 | 10.01 | 7.52 | 1.76 | 135.4 | 144.2 | 304.6 | 99.99 | 0.00018 | 0.063 |
| 225 | 300 | 212.77 | 2.49 | 2.49 | 0.58 | 304.6 | 272.4 | 541.4 | 99.99 | 0.000058 | 0.021 |
| **Total** | | | | **100.00** | **23.4** | | | | | **0.28** | **100.00** |

**Footnotes:**

[1] Calculated using the mass mean equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[2] Calculated using the particle size distribution equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[3] Calculated using the following equation presented on page 42 of "Aerosol Technology" by William C. Hines, 1982.

$$V_{ts} = pd^2g/18n$$

where, p = the density of the particle (gram/cm$^3$)
d = the particle diameter (cm)
g = acceleration of gravity (cm/s$^2$)
n = air viscosity (dyn s/cm$^2$)
and, $V_{ts}$ = the settling velocity (cm/s)

[4] Based on particle removal curve for a typical Tri-Mer Whirl/Wet Scrubber provided by H & B Industrial Equipment, Inc. via KEMWorks.

## Table F-3. Calculation of Particle Size Distribution and PM Emission Rate for the Sulfur Storage Building Stack Using the Procedures Presented in Regulation 62-212.600, Sulfur Storage and Handling Facilities

| Lower Bound of Selected Particle Size Range (microns) | Upper Bound of Selected Particle Size Range (microns) | Mean Diameter[1] (microns) | Cumulative Weight Percent Greater Than Specified Diameter[2] (%) | Uncontrolled Weignt Percent (%) | Uncontrolled Emission Rate (lb/hr) | Lower Bound Settling Velocity[3] (cm/s) | Mean Diameter Settling Velocity[3] (cm/s) | Upper Bound Settling Velocity[3] (cm/s) | Control Efficiency (%) | Controlled Emission Rate (lb/hr) | Controlled Weight Percent (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2.5 | 1.76 | 100.00 | 0.42 | 0.010 | -- | 0.019 | 0.038 | 0 | 0.010 | 0.42 |
| 2.5 | 5 | 3.50 | 99.58 | 15.64 | 0.37 | 0.038 | 0.074 | 0.15 | 0 | 0.37 | 15.64 |
| 5 | 10 | 6.79 | 83.94 | 15.98 | 0.38 | 0.15 | 0.28 | 0.60 | 0 | 0.38 | 15.98 |
| 10 | 20 | 13.34 | 67.96 | 10.56 | 0.25 | 0.60 | 1.07 | 2.41 | 0 | 0.25 | 10.56 |
| 20 | 30 | 20.86 | 57.39 | 11.46 | 0.27 | 2.41 | 2.62 | 5.41 | 0 | 0.27 | 11.46 |
| 30 | 50 | 33.87 | 45.93 | 10.03 | 0.24 | 5.41 | 6.90 | 15.0 | 0 | 0.24 | 10.03 |
| 50 | 75 | 51.77 | 35.90 | 7.50 | 0.18 | 15.0 | 16.1 | 33.8 | 0 | 0.18 | 7.50 |
| 75 | 100 | 71.10 | 28.40 | 8.83 | 0.21 | 33.8 | 30.4 | 60.2 | 0 | 0.21 | 8.83 |
| 100 | 150 | 103.29 | 19.57 | 9.57 | 0.22 | 60.2 | 64.2 | 135.4 | 0 | 0.22 | 9.57 |
| 150 | 225 | 154.80 | 10.01 | 7.52 | 0.18 | 135.4 | 144.2 | 304.6 | 0 | 0.18 | 7.52 |
| 225 | 300 | 212.77 | 2.49 | 2.49 | 0.058 | 304.6 | 272.4 | 541.4 | 0 | 0.058 | 2.49 |
| **Total** | | | | **100.00** | **2.35** | | | | | **2.35** | **100.00** |

**Footnotes:**

[1] Calculated using the mass mean equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[2] Calculated using the particle size distribution equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[3] Calculated using the following equation presented on page 42 of "Aerosol Technology" by William C. Hines, 1982.

$$V_{ts} = pd^2g/18n$$

where, p = the density of the particle (gram/cm$^3$)
d = the particle diameter (cm)
g = acceleration of gravity (cm/s$^2$)
n = air viscosity (dyn s/cm$^2$)
and, $V_{ts}$ = the settling velocity (cm/s)

## Table F-4. Calculation of Particle Size Distribution and PM Emission Rate for the Ship Unloader Stack Using the Procedures Presented in Regulation 62-212.600, Sulfur Storage and Handling Facilities

| Lower Bound of Selected Particle Size Range (microns) | Upper Bound of Selected Particle Size Range (microns) | Mean Diameter[1] (microns) | Cumulative Weight Percent Greater Than Specified Diameter[2] (%) | Uncontrolled Weignt Percent (%) | Uncontrolled Emission Rate[4] (lb/hr) | Lower Bound Settling Velocity[3] (cm/s) | Mean Diameter Settling Velocity[3] (cm/s) | Upper Bound Settling Velocity[3] (cm/s) | Control Efficiency (%) | Controlled Emission Rate (lb/hr) | Controlled Weight Percent (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2.5 | 1.76 | 100.00 | 0.42 | 0.08919 | -- | 0.019 | 0.038 | 90 | 0.008919 | 0.42 |
| 2.5 | 5 | 3.50 | 99.58 | 15.64 | 3.28343 | 0.038 | 0.074 | 0.15 | 90 | 0.32834 | 15.64 |
| 5 | 10 | 6.79 | 83.94 | 15.98 | 3.35627 | 0.15 | 0.28 | 0.60 | 90 | 0.33563 | 15.98 |
| 10 | 20 | 13.34 | 67.96 | 10.56 | 2.21836 | 0.60 | 1.07 | 2.41 | 90 | 0.22184 | 10.56 |
| 20 | 30 | 20.86 | 57.39 | 11.46 | 2.40645 | 2.41 | 2.62 | 5.41 | 90 | 0.24065 | 11.46 |
| 30 | 50 | 33.87 | 45.93 | 10.03 | 2.10656 | 5.41 | 6.90 | 15.0 | 90 | 0.21066 | 10.03 |
| 50 | 75 | 51.77 | 35.90 | 7.50 | 1.57491 | 15.0 | 16.1 | 33.8 | 90 | 0.15749 | 7.50 |
| 75 | 100 | 71.10 | 28.40 | 8.83 | 1.85409 | 33.8 | 30.4 | 60.2 | 90 | 0.18541 | 8.83 |
| 100 | 150 | 103.29 | 19.57 | 9.57 | 2.00887 | 60.2 | 64.2 | 135.4 | 90 | 0.20089 | 9.57 |
| 150 | 225 | 154.80 | 10.01 | 7.52 | 1.57910 | 135.4 | 144.2 | 304.6 | 90 | 0.15791 | 7.52 |
| 225 | 300 | 212.77 | 2.49 | 2.49 | 0.52275 | 304.6 | 272.4 | 541.4 | 90 | 0.052275 | 2.49 |
| **Total** | | | | **100.00** | **21.0000** | | | | | **2.10** | **100.00** |

Footnotes:

[1] Calculated using the mass mean equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities

[2] Calculated using the particle size distribution equation presented in Rule 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[3] Calculated using the following equation presented on page 42 of "Aerosol Technology" by William C. Hines, 1982.

$$V_{ts} = pd^2g/18n$$

where, p = the density of the particle (gram/cm$^3$)
d = the particle diameter (cm)
g = acceleration of gravity (cm/s$^2$)
n = air viscosity (dyn s/cm$^2$)
and, $V_{ts}$ = the settling velocity (cm/s)

[4] Calculated by multiplying the uncontrolled weight percent by the uncontrolled emission rate for particles with diameters of 0 to 30 microns ( 4.17 lb/hr) by 2.1 (prescribed emission factor in Rule 62-212.600 to convert from particles with diameters 0 to 30 microns to all particles emitted to the atmosphere).

**Table F-5. Calculation of Particle Size Distribution and PM Emission Rate for the Bucket Reclaimer Using the Procedures Presented in Regulation 62-212.600, Sulfur Storage and Handling Facilities**

| Lower Bound of Selected Particle Size Range (microns) | Upper Bound of Selected Particle Size Range (microns) | Mean Diameter[1] (microns) | Cumulative Weight Percent Greater Than Specified Diameter[2] (%) | Uncontrolled Weight Percent (%) | Uncontrolled Emission Rate[4] (lb/hr) | Lower Bound Settling Velocity[3] (cm/s) | Mean Diameter Settling Velocity[3] (cm/s) | Upper Bound Settling Velocity[3] (cm/s) | Control Efficiency (%) | Controlled Emission Rate (lb/hr) | Controlled Weight Percent (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2.5 | 1.76 | 100.00 | 0.42 | 0.0446 | -- | 0.019 | 0.038 | 90 | 0.004460 | 0.42 |
| 2.5 | 5 | 3.50 | 99.58 | 15.64 | 1.6417 | 0.038 | 0.074 | 0.15 | 90 | 0.16417 | 15.64 |
| 5 | 10 | 6.79 | 83.94 | 15.98 | 1.6781 | 0.15 | 0.28 | 0.60 | 90 | 0.16781 | 15.98 |
| 10 | 20 | 13.34 | 67.96 | 10.56 | 1.1092 | 0.60 | 1.07 | 2.41 | 90 | 0.11092 | 10.56 |
| 20 | 30 | 20.86 | 57.39 | 11.46 | 1.2032 | 2.41 | 2.62 | 5.41 | 90 | 0.12032 | 11.46 |
| 30 | 50 | 33.87 | 45.93 | 10.03 | 1.0533 | 5.41 | 6.90 | 15.0 | 90 | 0.10533 | 10.03 |
| 50 | 75 | 51.77 | 35.90 | 7.50 | 0.7875 | 15.0 | 16.1 | 33.8 | 90 | 0.07875 | 7.50 |
| 75 | 100 | 71.10 | 28.40 | 8.83 | 0.9270 | 33.8 | 30.4 | 60.2 | 90 | 0.09270 | 8.83 |
| 100 | 150 | 103.29 | 19.57 | 9.57 | 1.0044 | 60.2 | 64.2 | 135.4 | 90 | 0.10044 | 9.57 |
| 150 | 225 | 154.80 | 10.01 | 7.52 | 0.7896 | 135.4 | 144.2 | 304.6 | 90 | 0.07896 | 7.52 |
| 225 | 300 | 212.77 | 2.49 | 2.49 | 0.2614 | 304.6 | 272.4 | 541.4 | 90 | 0.026137 | 2.49 |
| **Total** | | | | **100.00** | **10.50** | | | | | **1.05** | **100.00** |

Footnotes:

[1] Calculated using the mass mean equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities

[2] Calculated using the particle size distribution equation presented in Rule 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[3] Calculated using the following equation presented on page 42 of "Aerosol Technology" by William C. Hines, 1982.

$$V_{ts} = pd^2g/18n$$

where, p = the density of the particle (gram/cm$^3$)
d = the particle diameter (cm)
g = acceleration of gravity (cm/s$^2$)
n = air viscosity (dyn s/cm$^2$)
and, $V_{ts}$ = the settling velocity (cm/s)

[4] Calculated by multiplying the uncontrolled weight percent by the uncontrolled emission rate for particles with diameters of 0 to 30 microns ( 4.17 lb/hr) by 2.1 (prescribed emission factor in Rule 62-212.600 to convert from particles with diameters 0 to 30 microns to all particles emitted to the atmosphere).

## Table F-6. Calculation of Particle Size Distribution and PM Emission Rate for the Drop from Railcar Unloader to Hopper 2703 Using the Procedures Presented in Regulation 62-212.600, Sulfur Storage and Handling Facilities

| Lower Bound of Selected Particle Size Range (microns) | Upper Bound of Selected Particle Size Range (microns) | Mean Diameter[1] (microns) | Cumulative Weight Percent Greater Than Specified Diameter[2] (%) | Uncontrolled Weight Percent (%) | Uncontrolled Emission Rate (lb/hr) | Lower Bound Settling Velocity[3] (cm/s) | Mean Diameter Settling Velocity[3] (cm/s) | Upper Bound Settling Velocity[3] (cm/s) | Control Efficiency (%) | Controlled Emission Rate (lb/hr) | Controlled Weight Percent (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2.5 | 1.76 | 100.00 | 0.42 | 0.013 | -- | 0.019 | 0.038 | 90 | 0.0013 | 0.42 |
| 2.5 | 5 | 3.50 | 99.58 | 15.64 | 0.496 | 0.038 | 0.074 | 0.15 | 90 | 0.0496 | 15.64 |
| 5 | 10 | 6.79 | 83.94 | 15.98 | 0.507 | 0.15 | 0.28 | 0.60 | 90 | 0.0507 | 15.98 |
| 10 | 20 | 13.34 | 67.96 | 10.56 | 0.335 | 0.60 | 1.07 | 2.41 | 90 | 0.0335 | 10.56 |
| 20 | 30 | 20.86 | 57.39 | 11.46 | 0.363 | 2.41 | 2.62 | 5.41 | 90 | 0.0363 | 11.46 |
| 30 | 50 | 33.87 | 45.93 | 10.03 | 0.318 | 5.41 | 6.90 | 15.0 | 90 | 0.0318 | 10.03 |
| 50 | 75 | 51.77 | 35.90 | 7.50 | 0.238 | 15.0 | 16.1 | 33.8 | 90 | 0.0238 | 7.50 |
| 75 | 100 | 71.10 | 28.40 | 8.83 | 0.280 | 33.8 | 30.4 | 60.2 | 90 | 0.0280 | 8.83 |
| 100 | 150 | 103.29 | 19.57 | 9.57 | 0.303 | 60.2 | 64.2 | 135.4 | 90 | 0.0303 | 9.57 |
| 150 | 225 | 154.80 | 10.01 | 7.52 | 0.238 | 135.4 | 144.2 | 304.6 | 90 | 0.0238 | 7.52 |
| 225 | 300 | 212.77 | 2.49 | 2.49 | 0.079 | 304.6 | 272.4 | 541.4 | 90 | 0.0079 | 2.49 |
| **Total** | | | | **100.00** | **3.17** | | | | | **0.317** | **100.00** |

**Footnotes:**

[1] Calculated using the mass mean equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities

[2] Calculated using the particle size distribution equation presented in Rule 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[3] Calculated using the following equation presented on page 42 of "Aerosol Technology" by William C. Hines, 1982.

where, p = the density of the particle (gram/cm$^3$)
d = the particle diameter (cm)
g = acceleration of gravity (cm/s$^2$)
n = air viscosity (dyn s/cm$^2$)
and, $V_{ts}$ = the settling velocity (cm/s)

[4] Calculated by multiplying the uncontrolled weight percent by the uncontrolled emission rate for particles with diameters of 0 to 30 microns ( 1.26 lb/hr) by 2.1 (prescribed emission factor in Rule 62-212.600 to convert from particles with diameters 0 to 30 microns to all particles emitted to the atmosphere).

**Table F-7. Calculation of Particle Size Distribution and PM Emission Rate for the Drop from Hopper 2703 to Conveyor 2110 Using the Procedures Presented in Regulation 62-212.600, Sulfur Storage and Handling Facilities**

| Lower Bound of Selected Particle Size Range (microns) | Upper Bound of Selected Particle Size Range (microns) | Mean Diameter[1] (microns) | Cumulative Weight Percent Greater Than Specified Diameter[2] (%) | Uncontrolled Weignt Percent (%) | Uncontrolled Emission Rate (lb/hr) | Lower Bound Settling Velocity[3] (cm/s) | Mean Diameter Settling Velocity[3] (cm/s) | Upper Bound Settling Velocity[3] (cm/s) | Control Efficiency (%) | Controlled Emission Rate (lb/hr) | Controlled Weight Percent (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2.5 | 1.76 | 100.00 | 0.42 | 0.013 | -- | 0.019 | 0.038 | 90 | 0.0013 | 0.42 |
| 2.5 | 5 | 3.50 | 99.58 | 15.64 | 0.496 | 0.038 | 0.074 | 0.15 | 90 | 0.0496 | 15.64 |
| 5 | 10 | 6.79 | 83.94 | 15.98 | 0.507 | 0.15 | 0.28 | 0.60 | 90 | 0.0507 | 15.98 |
| 10 | 20 | 13.34 | 67.96 | 10.56 | 0.335 | 0.60 | 1.07 | 2.41 | 90 | 0.0335 | 10.56 |
| 20 | 30 | 20.86 | 57.39 | 11.46 | 0.363 | 2.41 | 2.62 | 5.41 | 90 | 0.0363 | 11.46 |
| 30 | 50 | 33.87 | 45.93 | 10.03 | 0.318 | 5.41 | 6.90 | 15.0 | 90 | 0.0318 | 10.03 |
| 50 | 75 | 51.77 | 35.90 | 7.50 | 0.238 | 15.0 | 16.1 | 33.8 | 90 | 0.0238 | 7.50 |
| 75 | 100 | 71.10 | 28.40 | 8.83 | 0.280 | 33.8 | 30.4 | 60.2 | 90 | 0.0280 | 8.83 |
| 100 | 150 | 103.29 | 19.57 | 9.57 | 0.303 | 60.2 | 64.2 | 135.4 | 90 | 0.0303 | 9.57 |
| 150 | 225 | 154.80 | 10.01 | 7.52 | 0.238 | 135.4 | 144.2 | 304.6 | 90 | 0.0238 | 7.52 |
| 225 | 300 | 212.77 | 2.49 | 2.49 | 0.079 | 304.6 | 272.4 | 541.4 | 90 | 0.0079 | 2.49 |
| **Total** | | | | **100.00** | **3.17** | | | | | **0.317** | **100.00** |

**Footnotes:**

[1] Calculated using the mass mean equation presented in 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities

[2] Calculated using the particle size distribution equation presented in Rule 62-212.600(3)(C)4, Sulfur Storage and Handling Facilities.

[3] Calculated using the following equation presented on page 42 of "Aerosol Technology" by William C. Hines, 1982.

where, p = $V_{ts} = pd^2g/18n$
d = the particle diameter (cm)
g = acceleration of gravity (cm/s$^2$)
n = air viscosity (dyn s/cm$^2$)
and, $V_{ts}$ = the settling velocity (cm/s)

[4] Calculated by multiplying the uncontrolled weight percent by the uncontrolled emission rate for particles with diameters of 0 to 30 microns ( 1.26 lb/hr) by 2.1 (prescribed emission factor in Rule 62-212.600 to convert from particles with diameters 0 to 30 microns to all particles emitted to the atmosphere).