05710008-058-AC

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JUL 02 2007
BUREAU OF AIR REGULATION

Dept. of Environmental Protection
JUN 27 2007
Southwest District

PERMIT APPLICATION FOR EXPANSION OF ANIMAL FEED INGREDIENT PLANT
MOSAIC FERTILIZER, LLC
RIVERVIEW, FLORIDA

Prepared For:
Mosaic Fertilizer, LLC
8813 U.S. Highway 41 South
Riverview, Florida 33569

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

June 2007

07387576

DISTRIBUTION:
4 Copies – FDEP
2 Copies – Mosaic Fertilizer, LLC
1 Copy – Golder Associates Inc.

APPLICATION FOR AIR PERMIT – LONG FORM

Department of Environmental Protection

Division of Air Resource Management

Dept. of Environmental Protection

JUN 27 2007

Southwest District

APPLICATION FOR AIR PERMIT - LONG FORM

I. APPLICATION INFORMATION

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Air Construction Permit – Use this form to apply for an air construction permit at a facility operating under a federally enforceable state air operation permit (FESOP) or Title V air permit. Also use this form to apply for an air construction permit:

- For a proposed project subject to prevention of significant deterioration (PSD) review, nonattainment area (NAA) new source review, or maximum achievable control technology (MACT) review; or
- Where the applicant proposes to assume a restriction on the potential emissions of one or more pollutants to escape a federal program requirement such as PSD review, NAA new source review, Title V, or MACT; or
- Where the applicant proposes to establish, revise, or renew a plantwide applicability limit (PAL).

Air Operation Permit – Use this form to apply for:

- an initial federally enforceable state air operation permit (FESOP); or
- an initial/revised/renewal Title V air operation permit.

Air Construction Permit & Title V Air Operation Permit (Concurrent Processing Option) – Use this form to apply for both an air construction permit and a revised or renewal Title V air operation permit incorporating the proposed project.

To ensure accuracy, please see form instructions.

Identification of Facility

1. Facility Owner/Company Name: **Mosaic Fertilizer, LLC**	
2. Site Name: **Riverview Plant**	
3. Facility Identification Number: **0570008**	
4. Facility Location...: Street Address or Other Locator: **8813 U.S. Highway 41 South** City: **Riverview** County: **Hillsborough** Zip Code: **33569**	
5. Relocatable Facility? ☐ Yes ☒ No	6. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: **Jeff Stewart, Environmental Superintendent**
2. Application Contact Mailing Address... Organization/Firm: **Mosaic Fertilizer, LLC** Street Address: **8813 U.S. Highway 41 South** City: **Riverview** State: **FL** Zip Code: **33569**
3. Application Contact Telephone Numbers... Telephone: **(813) 671-6369** ext. Fax: **(813) 671-6149**
4. Application Contact Email Address: **jeff.stewart@mosaicco.com**

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	3. PSD Number (if applicable):
2. Project Number(s):	4. Siting Number (if applicable):

APPLICATION INFORMATION

Purpose of Application

This application for air permit is submitted to obtain: (Check one)

Air Construction Permit

☒ Air construction permit.

☐ Air construction permit to establish, revise, or renew a plantwide applicability limit (PAL).

☐ Air construction permit to establish, revise, or renew a plantwide applicability limit (PAL), and separate air construction permit to authorize construction or modification of one or more emissions units covered by the PAL.

Air Operation Permit

☐ Initial Title V air operation permit.

☐ Title V air operation permit revision.

☐ Title V air operation permit renewal.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is required.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is not required.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit (Concurrent Processing)

☐ Air construction permit and Title V permit revision, incorporating the proposed project.

☐ Air construction permit and Title V permit renewal, incorporating the proposed project.

Note: By checking one of the above two boxes, you, the applicant, are requesting concurrent processing pursuant to Rule 62-213.405, F.A.C. In such case, you must also check the following box:

☐ I hereby request that the department waive the processing time requirements of the air construction permit to accommodate the processing time frames of the Title V air operation permit.

Application Comment

This air construction application is for the purpose of modifying the Animal Feed Ingredient (AFI) Plant in order to achieve production rates closer to the currently permitted hourly and annual production rates as set in Permit No. 0570008-036-AC/ PSD-FL-315. The proposed changes include installing an evaporator to promote defluorination of the phosphoric acid in two batch tanks and a new defluorinated acid storage tank; refurbishment of an existing 850-ton silo for limestone storage; and installation of a new 25,000-ton storage warehouse for AFI product. The AFI product will be transported over the existing material handling system for loadout to ships.

APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
078-081, 103	Animal Feed Ingredient (AFI) Plant	AC1C	N/A
051-053, 061	Material Handling System	AC1E	N/A

Application Processing Fee

Check one: ☐ Attached - Amount: $__________________ ☒ Not Applicable

APPLICATION INFORMATION

Owner/Authorized Representative Statement

Complete if applying for an air construction permit or an initial FESOP.

1. Owner/Authorized Representative Name : **Jeff Stewart, Environmental Superintendent**
2. Owner/Authorized Representative Mailing Address... Organization/Firm: **Mosaic Fertilizer, LLC** Street Address: **8813 U.S. Highway 41 South** City: **Riverview** State: **FL** Zip Code: **33569**
3. Owner/Authorized Representative Telephone Numbers... Telephone: **(813) 671-6369** ext. Fax: **(813) 671-6149**
4. Owner/Authorized Representative Email Address: **jeff.stewart@mosaicco.com**
5. Owner/Authorized Representative Statement: *I, the undersigned, am the owner or authorized representative of the facility addressed in this air permit application. 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 and all other requirements identified in this application to which the facility is subject. 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 the facility or any permitted emissions unit.* Jeff Stewart (signature) 6/26/07 Signature Date

APPLICATION INFORMATION

Application Responsible Official Certification

Complete if applying for an initial/revised/renewal Title V permit or concurrent processing of an air construction permit and a revised/renewal Title V permit. If there are multiple responsible officials, the "application responsible official" need not be the "primary responsible official."

1.	Application Responsible Official Name:
2.	Application Responsible Official Qualification (Check one or more of the following options, as applicable): ☐ For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C. ☐ For a partnership or sole proprietorship, a general partner or the proprietor, respectively. ☐ For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official. ☐ The designated representative at an Acid Rain source.
3.	Application Responsible Official Mailing Address... Organization/Firm: Street Address: City: State: Zip Code:
4.	Application Responsible Official Telephone Numbers... Telephone: ( ) - ext. Fax: ( ) -
5.	Application Responsible Official Email Address:
6.	Application Responsible Official Certification: *I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. 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 and all other applicable requirements identified in this application to which the Title V source is subject. 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 the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application.* Signature Date

APPLICATION INFORMATION

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**
3.	Professional Engineer Telephone Numbers... Telephone: **(352) 336-5600** ext. **545** Fax: **(352) 336-6603**
4.	Professional Engineer Email Address: **dbuff@golder.com**
5.	Professional Engineer Statement: *I, the undersigned, hereby certify, except as particularly noted herein*, that:* *(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and* *(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.* *(3) If the purpose of this application is to obtain a Title V 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 plan and schedule is submitted with this application.* *(4) If the purpose of this application is to obtain an air construction permit (check here ☒, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, 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.* *(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal 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) 6/25/07 Signature Date (seal)

* Attach any exception to certification statement.
** **Board of Professional Engineers Certificate of Authorization #00001670**

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: 0	4. Facility Status Code: A	5. Facility Major Group SIC Code: 28	6. Facility SIC(s): 2874
7. Facility Comment :			

Facility Contact

1. Facility Contact Name: Jeff Stewart, Environmental Superintendent
2. Facility Contact Mailing Address... Organization/Firm: Mosaic Fertilizer, LLC Street Address: 8813 U.S. Highway 41 South City: Riverview State: FL Zip Code: 33569
3. Facility Contact Telephone Numbers: Telephone: (813) 671-6369 ext. Fax: (813) 671-6149
4. Facility Contact Email Address: jeff.stewart@mosaicco.com

Facility Primary Responsible Official
Complete if an "application responsible official" is identified in Section I. that is not the facility "primary responsible official."

1. Facility Primary Responsible Official Name:
2. Facility Primary Responsible Official Mailing Address... Organization/Firm: Street Address: City: State: Zip Code:
3. Facility Primary Responsible Official Telephone Numbers... Telephone: ( ) - ext. Fax: ( ) -
4. Facility Primary Responsible Official Email Address:

FACILITY INFORMATION

Facility Regulatory Classifications

Check all that would apply *following* completion of all projects and implementation of all other changes proposed in this application for air permit. Refer to instructions to distinguish between a "major source" and a "synthetic minor source."

1. ☐ Small Business Stationary Source	☐ Unknown
2. ☐ Synthetic Non-Title V Source	
3. ☒ Title V Source	
4. ☒ Major Source of Air Pollutants, Other than Hazardous Air Pollutants (HAPs)	
5. ☐ Synthetic Minor Source of Air Pollutants, Other than HAPs	
6. ☒ Major Source of Hazardous Air Pollutants (HAPs)	
7. ☐ Synthetic Minor Source of HAPs	
8. ☒ One or More Emissions Units Subject to NSPS (40 CFR Part 60)	
9. ☐ One or More Emissions Units Subject to Emission Guidelines (40 CFR Part 60)	
10. ☒ One or More Emissions Units Subject to NESHAP (40 CFR Part 61 or Part 63)	
11. ☐ Title V Source Solely by EPA Designation (40 CFR 70.3(a)(5))	
12. Facility Regulatory Classifications Comment:	

FACILITY INFORMATION

List of Pollutants Emitted by Facility

1. Pollutant Emitted	2. Pollutant Classification	3. Emissions Cap [Y or N]?
Particulate Matter Total – PM	**A**	**N**
Particulate Matter – PM_{10}	**A**	**N**
Fluorides Total – FL	**A**	**N**
Sulfur Dioxide – SO_2	**A**	**N**
Nitrogen Oxides – NO_X	**A**	**N**
Hydrogen Fluoride – H107	**A**	**N**
Sulfuric Acid Mist – SAM	**A**	**N**
Total Hazardous Air Pollutants – HAPs	**A**	**N**

B. EMISSIONS CAPS

Facility-Wide or Multi-Unit Emissions Caps

1. Pollutant Subject to Emissions Cap	2. Facility Wide Cap [Y or N]? (all units)	3. Emissions Unit ID No.s Under Cap (if not all units)	4. Hourly Cap (lb/hr)	5. Annual Cap (ton/yr)	6. Basis for Emissions Cap

7. Facility-Wide or Multi-Unit Emissions Cap Comment:

C. FACILITY ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Facility Plot Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: **MFRIV-FI-C1** ☐ Previously Submitted, Date: ____
2. Process Flow Diagram(s): (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: **MFRIV-FI-C2** ☐ Previously Submitted, Date: ____
3. Precautions to Prevent Emissions of Unconfined Particulate Matter: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: **MFRIV-FI-C3** ☐ Previously Submitted, Date: ____

Additional Requirements for Air Construction Permit Applications

1. Area Map Showing Facility Location: ☐ Attached, Document ID:____ ☒ Not Applicable (existing permitted facility)
2. Description of Proposed Construction, Modification, or Plantwide Applicability Limit (PAL): ☒ Attached, Document ID: **See Attachment A**
3. Rule Applicability Analysis: ☒ Attached, Document ID: **See Attachment A**
4. List of Exempt Emissions Units (Rule 62-210.300(3), F.A.C.): ☐ Attached, Document ID:____ ☒ Not Applicable (no exempt units at facility)
5. Fugitive Emissions Identification: ☒ Attached, Document ID:**See Attachment A** ☐ Not Applicable
6. Air Quality Analysis (Rule 62-212.400(7), F.A.C.): ☐ Attached, Document ID:____ ☒ Not Applicable
7. Source Impact Analysis (Rule 62-212.400(5), F.A.C.): ☐ Attached, Document ID:____ ☒ Not Applicable
8. Air Quality Impact since 1977 (Rule 62-212.400(4)(e), F.A.C.): ☐ Attached, Document ID:____ ☒ Not Applicable
9. Additional Impact Analyses (Rules 62-212.400(8) and 62-212.500(4)(e), F.A.C.): ☐ Attached, Document ID:____ ☒ Not Applicable
10. Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.): ☐ Attached, Document ID:____ ☒ Not Applicable

FACILITY INFORMATION

Additional Requirements for FESOP Applications

1. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.): ☐ Attached, Document ID:____ ☐ Not Applicable (no exempt units at facility)	

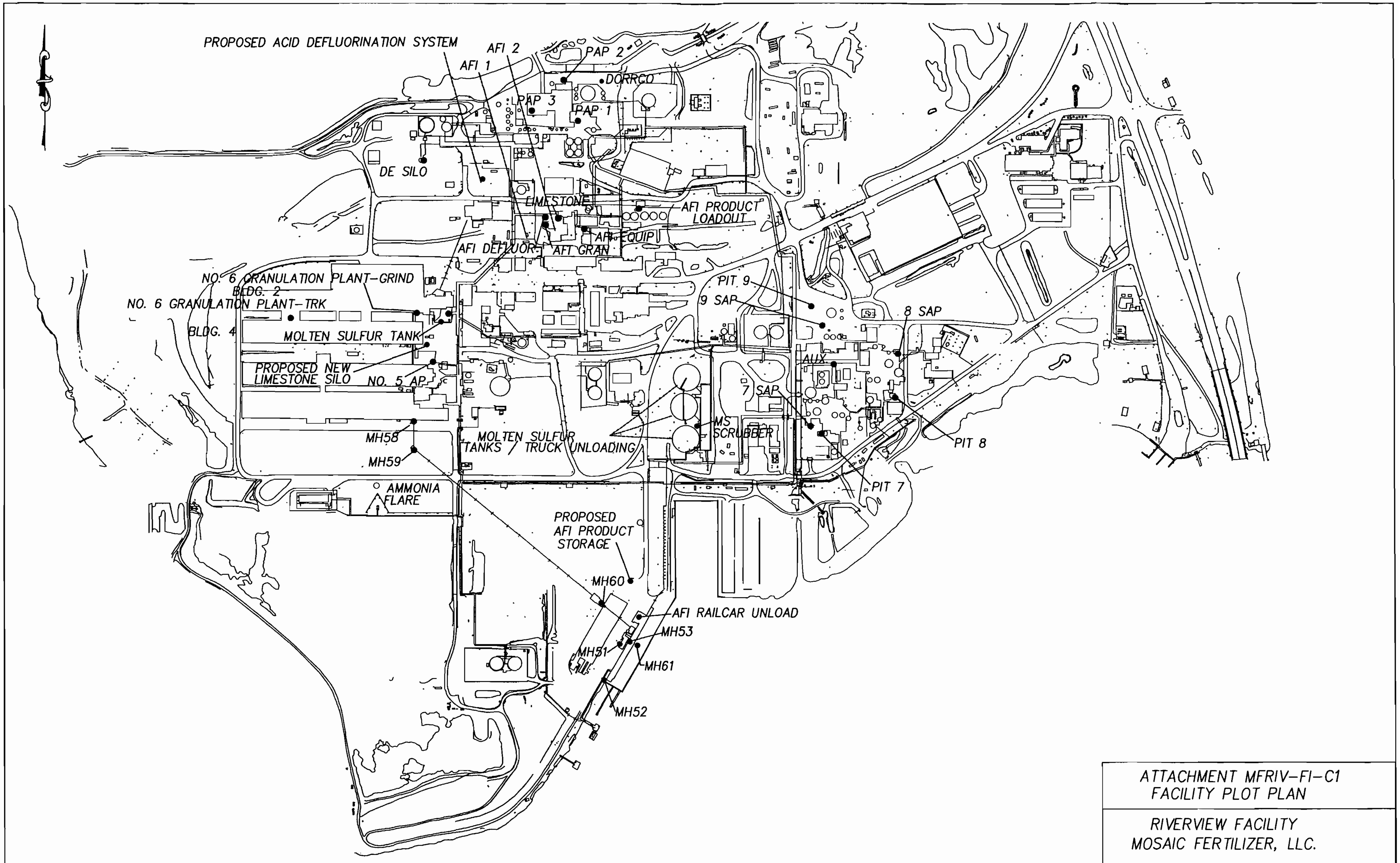
Additional Requirements for Title V Air Operation Permit Applications

1. List of Insignificant Activities (Required for initial/renewal applications only): ☐ Attached, Document ID:____ ☐ Not Applicable (revision application)	
2. Identification of Applicable Requirements (Required for initial/renewal applications, and for revision applications if this information would be changed as a result of the revision being sought): ☐ Attached, Document ID:____ ☐ Not Applicable (revision application with no change in applicable requirements)	
3. Compliance Report and Plan (Required for all initial/revision/renewal applications): ☐ Attached, Document ID:____ Note: A compliance plan must be submitted for each emissions unit that is not in compliance with all applicable requirements at the time of application and/or at any time during application processing. The department must be notified of any changes in compliance status during application processing.	
4. List of Equipment/Activities Regulated under Title VI (If applicable, required for initial/renewal applications only): ☐ Attached, Document ID:____ ☐ Equipment/Activities On site but Not Required to be Individually Listed ☐ Not Applicable	
5. Verification of Risk Management Plan Submission to EPA (If applicable, required for initial/renewal applications only) : ☐ Attached, Document ID:____ ☐ Not Applicable	
6. Requested Changes to Current Title V Air Operation Permit: ☐ Attached, Document ID:____ ☐ Not Applicable	

Additional Requirements Comment

ATTACHMENT MFRIV-FI-C1

FACILITY PLOT PLAN

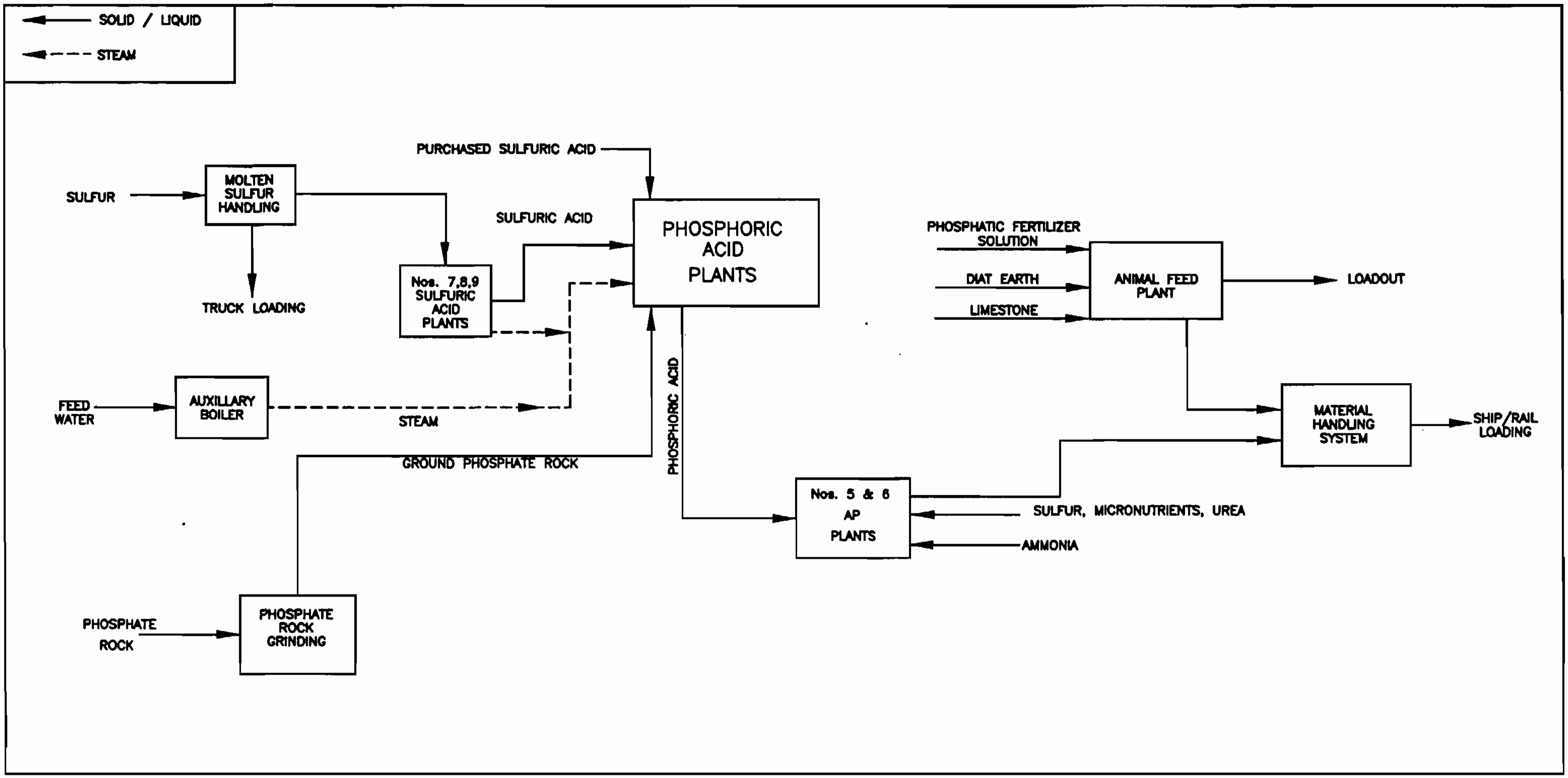


ATTACHMENT MFRIV-FI-C1
FACILITY PLOT PLAN

RIVERVIEW FACILITY
MOSAIC FERTILIZER, LLC.

ATTACHMENT MFRIV-FI-C2

PROCESS FLOW DIAGRAM



Attachment MFRIV-FI-C2
Facility Flow Diagram

Mosaic Fertilizer, LLC., Riverview

EMISSION UNIT:	FACILITY WIDE
PROCESS AREA:	
FILENAME:	07387576/App-AFI/MFRIV-FI-C2
LATEST REVISION:	04/11/07 PDC

ATTACHMENT MFRIV-FI-C3

PRECAUTIONS TO PREVENT EMISSIONS OF UNCONFINED PARTICULATE MATTER

ATTACHMENT MFRIV-FI-C3

PRECAUTIONS TO PREVENT EMISSIONS OF UNCONFINED PARTICULATE MATTER

Various activities at Mosaic Fertilizer have the potential to generate fugitive particulate matter emissions. Precautions employed to minimize such emissions are as follows:

1. Confine sand blasting when practical.
2. Fertilizer product conveyor belts are covered.
3. Use street cleaning equipment to remove dirt from paved areas.
4. Use dust suppression agents on fertilizer products.
5. Posted speed limits on plant roads.
6. Fertilizer products are stored inside buildings.
7. Material transfer points are enclosed.
8. Keep covers on openings in process equipment except during service.

III. EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Application - For Title V air operation permitting only, emissions units are classified as regulated, unregulated, or insignificant. If this is an application for Title V air operation permit, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each regulated and unregulated emissions unit addressed in this application for air permit. Some of the subsections comprising the Emissions Unit Information Section of the form are optional for unregulated emissions units. Each such subsection is appropriately marked. Insignificant emissions units are required to be listed at Section II, Subsection C.

Air Construction Permit or FESOP Application - For air construction permitting or federally enforceable state air operation permitting, emissions units are classified as either subject to air permitting or exempt from air permitting. The concept of an "unregulated emissions unit" does not apply. If this is an application for air construction permit or FESOP, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air permitting are required to be listed at Section II, Subsection C.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit Application – Where this application is used to apply for both an air construction permit and a revised/renewal Title V air operation permit, each emissions unit is classified as either subject to air permitting or exempt from air permitting for air construction permitting purposes and as regulated, unregulated, or insignificant for Title V air operation permitting purposes. **The air construction permitting classification must be used to complete the Emissions Unit Information Section of this application for air permit.** A separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air construction permitting and insignificant emissions units are required to be listed at Section II, Subsection C.

If submitting the application form in hard copy, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application must be indicated in the space provided at the top of each page.

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

   ☐ 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.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

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

   ☒ 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.

2. Description of Emissions Unit Addressed in this Section:

   Animal Feed Ingredient (AFI) Plant

3. Emissions Unit Identification Number: **078, 079, 080, 081 & 103**

4. Emissions Unit Status Code:	5. Commence Construction Date:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
A			**28**	☐ Yes ☒ No

9. Package Unit:
   Manufacturer: Model Number:

10. Generator Nameplate Rating: MW

11. Emissions Unit Comment:

   Consists of AFI Plant No. 1 and AFI Plant No. 2, Diatomaceous Earth (DE) Silo, Limestone Silos (2), AFI Loadout System, and AFI Product Storage Building.

Emissions Unit Control Equipment

1. Control Equipment/Method(s) Description: **Baghouses (5)** **Packed-Bed Cross-Flow Scrubber** **Venturi Scrubbers (4)**
2. Control Device or Method Code(s): **018, 117, 058**

B. EMISSIONS UNIT CAPACITY INFORMATION

(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate:	
2. Maximum Production Rate: **2,280 TPD AFI Product**	
3. Maximum Heat Input Rate: **186** million Btu/hr	
4. Maximum Incineration Rate: pounds/hr tons/day	
5. Requested Maximum Operating Schedule: **24** hours/day **52** weeks/year	 **7** days/week **8,760** hours/year
6. Operating Capacity/Schedule Comment: **Maximum production rate is the combined total for both AFI Plants. AFI Plant No. 1 (EU 078) has a maximum production rate of 1,080 TPD AFI product, and AFI Plant No. 2 (EU 103) has a maximum production rate of 1,200 TPD AFI product [Permit No. 0570008-036-AC/PSD-FL-315].** **Maximum heat input rate is the combined total for both AFI Plants, where AFI Plant No. 1 (EU 078) and AFI Plant No. 2 (EU 103) each have a maximum heat input rate of 93 MMBtu/hr (93,000 scf/hr and 1,000 Btu/scf) annual average [Permit No. 0570008-036-AC/PSD-FL-315].**	

C. EMISSION POINT (STACK/VENT) INFORMATION
(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: **AFI1, Limestone, AFI Product Loadout, DE Silo, AFI2, New Limestone Silo, AFI Product Storage**	2. Emission Point Type Code: **3**

3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking:

078 – AFI Plant No. 1 Common Stack
079 – D.E. Silo
080 – Limestone Silo
081 – AFI Loadout System
103 – AFI Plant No. 2 Stack
New Limestone Silo
New AFI Product Storage Building

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

5. Discharge Type Code: **V**	6. Stack Height: **136** feet	7. Exit Diameter: **6** feet
8. Exit Temperature: **147** °F	9. Actual Volumetric Flow Rate: **130,300** acfm	10. Water Vapor: %

11. Maximum Dry Standard Flow Rate: dscfm	12. Nonstack Emission Point Height: feet
13. Emission Point UTM Coordinates... Zone: East (km): North (km):	14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS) Longitude (DD/MM/SS)

15. Emission Point Comment:

Parameters are for the common stack for AFI Plant No. 1.
See Attachment MFRIV-EU1-C15 for parameters for other sources. Parameters updated from recent stack tests. Flow rate adjusted to reflect production rate.

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment 1 of 3

1. Segment Description (Process/Fuel Type): **In-process Fuel Use; Natural Gas: General**		
2. Source Classification Code (SCC): **3-90-006-89**	3. SCC Units: **Million Cubic Feet Burned**	
4. Maximum Hourly Rate: **0.186**	5. Maximum Annual Rate: **1,629**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: **1,000**
10. Segment Comment: **Represents annual average heat input rate of 93 MMBtu/hr (93,000 scf/hr) for the rotary dryer in the granulation area for each AFI Plant.** **[Permit No. 0570008-036-AC/PSD-FL-315]**		

Segment Description and Rate: Segment 2 of 3

1. Segment Description (Process/Fuel Type): **In-Process Fuel Use; Distillate Oil: General**		
2. Source Classification Code (SCC): **3-90-005-98**	3. SCC Units: **1,000 Gallons Burned**	
4. Maximum Hourly Rate: **1.324**	5. Maximum Annual Rate: **529.6**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur: **0.5**	8. Maximum % Ash:	9. Million Btu per SCC Unit: **140**
10. Segment Comment: **Represents annual average fuel usage of 662 gal/hr for the rotary dryer in the granulation area for each AFI Plant. Fuel oil burning is limited to 400 hr/yr operation in each dryer (264,800 gal/yr). [Permit No. 0570008-036-AC/PSD-FL-315]**		

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment 3 of 3

1. Segment Description (Process/Fuel Type): **Mineral Products; Phosphate Rock**		
2. Source Classification Code (SCC): **3-05-019-99**	3. SCC Units: **Tons Processed**	
4. Maximum Hourly Rate: **95**	5. Maximum Annual Rate: **832,200**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment: **Represents total combined granular AFI product combined from both AFI Plants (2,280 TPD; 1,080 TPD from AFI Plant No. 1 and 1,200 TPD from AFI Plant No. 2). [Permit No. 0570008-036-AC/PSD-FL-315]**		

Segment Description and Rate: Segment _____ of _____

1. Segment Description (Process/Fuel Type):		
2. Source Classification Code (SCC):	3. SCC Units:	
4. Maximum Hourly Rate:	5. Maximum Annual Rate:	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment:		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
SO_2			EL
PM	018	058	EL
PM_{10}	018	058	EL
FL	117		EL
NO_X			NS
CO			NS

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **SO_2**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **94.0** lb/hour **19.3** tons/year	4. Synthetically Limited? ☒ Yes ☐ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **142(S) lb/1,000 gal fuel oil** Reference: **AP-42**	7. Emissions Method Code: **0**
8.a. Baseline Actual Emissions (if required): **0.104** tons/year	8.b. Baseline 24-month Period: From: **1/05** To: **12/06**
9.a. Projected Actual Emissions (if required): **0.236** tons/year	9.b. Projected Monitoring Period: ☐ 5 years ☒ 10 years
10. Calculation of Emissions: **See Attachment A, Table 4-3 for calculation.**	
11. Potential Fugitive and Actual Emissions Comment: **Emissions are from a combination of Fuel Oil and Natural Gas burning. Percent sulfur in Fuel Oil is 0.5. Oil burning is limited to 400 hr/yr by Permit No. 0570008-036-AC/PSD-FL-315. Natural gas is burned for the remaining 8,360 hr/yr.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.5% Sulfur Fuel**	4. Equivalent Allowable Emissions: **94.0** lb/hour **19.3** tons/year
5. Method of Compliance: **Fuel Analysis**	
6. Allowable Emissions Comment (Description of Operating Method): **Permit No. 0570008-036-AC/PSD-FL-315.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **NO_x**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **72.82** lb/hour **92.3** tons/year	4. Synthetically Limited? ☒ Yes ☐ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **55 lb/1,000 gal fuel oil** Reference: **AP-42**	7. Emissions Method Code: **0**
8.a. Baseline Actual Emissions (if required): **17.27** tons/year	8.b. Baseline 24-month Period: From: **1/05** To: **12/06**
9.a. Projected Actual Emissions (if required): **39.32** tons/year	9.b. Projected Monitoring Period: ☐ 5 years ☒ 10 years
10. Calculation of Emissions: **See Attachment A, Table 4-3 for calculation.**	
11. Potential Fugitive and Actual Emissions Comment: **Emissions are from a combination of Fuel Oil and Natural Gas burning. Percent sulfur in Fuel Oil is 0.5. Oil burning is limited to 400 hr/yr by Permit No. 0570008-036-AC/PSD-FL-315. Natural gas is burned for the remaining 8,360 hr/yr.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **CO**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **15.62** lb/hour **68.4** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **84 lb/10^6 ft^3 natural gas** Reference: **AP-42**	7. Emissions Method Code: **0**
8.a. Baseline Actual Emissions (if required): **14.51** tons/year	8.b. Baseline 24-month Period: From: **1/05** To: **12/06**
9.a. Projected Actual Emissions (if required): **33.02** tons/year	9.b. Projected Monitoring Period: ☐ 5 years ☒ 10 years
10. Calculation of Emissions: **See Attachment A, Table 4-3 for calculation.**	
11. Potential Fugitive and Actual Emissions Comment:	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **PM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **33.58** lb/hour **131.0** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **33.58 lb/hr & 131.0 TPY** Reference: **Permit No. 0570008-043-AC/PSD-FL-315D and Attachment A**	7. Emissions Method Code: **0**
8.a. Baseline Actual Emissions (if required): **33.35** tons/year	8.b. Baseline 24-month Period: From: **1/04** To: **12/05**
9.a. Projected Actual Emissions (if required): **82.94** tons/year **Point Sources=79.49 TPY** **Fugitive Sources=3.45 TPY**	9.b. Projected Monitoring Period: ☐ 5 years ☒ 10 years
10. Calculation of Emissions: **See Attachment A, Table 4-3 for calculation.** **Point Sources=29.12 lb/hr; 127.56 TPY** **Fugitive Sources=4.46 lb/hr; 3.45 TPY**	
11. Potential Fugitive and Actual Emissions Comment: **Fugitive emissions from truck traffic and AFI product loadout and storage are included in these calculations.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **29.12 lb/hr & 127.56 TPY**	4. Equivalent Allowable Emissions: **29.12** lb/hour **127.56** tons/year
5. Method of Compliance: **EPA Method 5**	
6. Allowable Emissions Comment (Description of Operating Method): **Reflects point sources only.** **Based on Permit No. 0570008-043-AC/PSD-FL-315D and Attachment A.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **PM_{10}**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **30.85** lb/hour **128.6** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **30.85 lb/hr & 128.6 TPY** Reference: **Permit No. 0570008-043-AC/PSD-FL-315D and Attachment A**	7. Emissions Method Code: **0**
8.a. Baseline Actual Emissions (if required): **33.35** tons/year	8.b. Baseline 24-month Period: From: **1/04** To: **12/05**
9.a. Projected Actual Emissions (if required): **80.54** tons/year **Point Sources=79.49 TPY** **Fugitive Sources=1.05 TPY**	9.b. Projected Monitoring Period: ☐ 5 years ☒ 10 years

10. Calculation of Emissions:

See Attachment A, Table 4-3 for calculation.
Point Sources=29.12 lb/hr; 127.56 TPY
Fugitive Sources=1.73 lb/hr; 1.06 TPY

11. Potential Fugitive and Actual Emissions Comment:

Fugitive emissions from truck traffic and AFI product loadout and storage are included in these calculations.

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **30.85 lb/hr & 128.6 TPY**	4. Equivalent Allowable Emissions: **30.85** lb/hour **128.6** tons/year
5. Method of Compliance: **EPA Method 5**	
6. Allowable Emissions Comment (Description of Operating Method): **Reflects point sources only.** **Based on Permit No. 0570008-043-AC/PSD-FL-315D and Attachment A.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **FL**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **2.11** lb/hour **9.24** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **2.11 lb/hr & 9.24 TPY** Reference: **Permit No. 0570008-036-AC/PSD-FL-315**	7. Emissions Method Code: **0**
8.a. Baseline Actual Emissions (if required): **2.14** tons/year	8.b. Baseline 24-month Period: From: **1/00** To: **12/01**
9.a. Projected Actual Emissions (if required): **7.56** tons/year	9.b. Projected Monitoring Period: ☐ 5 years ☒ 10 years
10. Calculation of Emissions: **See Attachment A, Table 4-3 for calculation.**	
11. Potential Fugitive and Actual Emissions Comment: **Fluoride emissions from the Defluorination System vent through the AFI Plant No. 1 Common Stack.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **2.11 lb/hr & 9.24 TPY**	4. Equivalent Allowable Emissions: **2.11** lb/hour **9.24** tons/year
5. Method of Compliance: **EPA Method 13A or 13B.**	
6. Allowable Emissions Comment (Description of Operating Method): **Based on Permit No. 0570008-036-AC/PSD-FL-315.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

G. VISIBLE EMISSIONS INFORMATION

Complete if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation 1 of 2

1. Visible Emissions Subtype: **VE15**	2. Basis for Allowable Opacity: ☐ Rule ☒ Other
3. Allowable Opacity: Normal Conditions: **15** % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: **EPA Method 9.**	
5. Visible Emissions Comment: **Applies to AFI Plant No. 1 (EU 078) and AFI Plant No. 2 (EU 103). Based on Permit No. 0570008-036-AC/PSD-FL-315 and Rule 62-212.400, F.A.C.**	

Visible Emissions Limitation: Visible Emissions Limitation 2 of 2

1. Visible Emissions Subtype: **VE05**	2. Basis for Allowable Opacity: ☐ Rule ☐ Other
3. Allowable Opacity: Normal Conditions: **5** % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: **EPA Method 9.**	
5. Visible Emissions Comment: **Applies to DE Silo (EU 079), Limestone Silo (EU 080), AFI Product Loadout System (EU 081), New Limestone Silo, and New AFI Product Storage building. Based on Permit No. 0570008-045-AV and Rule 62-212.400, F.A.C.**	

H. CONTINUOUS MONITOR INFORMATION

Complete if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	☐ Rule ☐ Other
4. Monitor Information... Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	☐ Rule ☐ Other
4. Monitor Information... Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: **Attachment A** ☐ Previously Submitted, Date _____
2. Fuel Analysis or Specification (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: **MFRIV-EU1-I2** ☐ Previously Submitted, Date _____
3. Detailed Description of Control Equipment (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: **MFRIV-EU1-I3** ☐ Previously Submitted, Date _____
4. Procedures for Startup and Shutdown (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____ ☒ Not Applicable (construction application)
5. Operation and Maintenance Plan (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____ ☒ Not Applicable
6. Compliance Demonstration Reports/Records ☐ Attached, Document ID: _____ Test Date(s)/Pollutant(s) Tested: _____ ☐ Previously Submitted, Date: _____ Test Date(s)/Pollutant(s) Tested: _____ ☐ To be Submitted, Date (if known): _____ Test Date(s)/Pollutant(s) Tested: _____ ☒ Not Applicable Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.
7. Other Information Required by Rule or Statute ☒ Attached, Document ID: **See Attachment A** ☐ Not Applicable

Additional Requirements for Air Construction Permit Applications

1. Control Technology Review and Analysis (Rules 62-212.400(10) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e)) ☐ Attached, Document ID: ____ ☒ Not Applicable
2. Good Engineering Practice Stack Height Analysis (Rule 62-212.400(4)(d), F.A.C., and Rule 62-212.500(4)(f), F.A.C.) ☐ Attached, Document ID: ____ ☒ Not Applicable
3. Description of Stack Sampling Facilities (Required for proposed new stack sampling facilities only) ☐ Attached, Document ID: ____ ☒ Not Applicable

Additional Requirements for Title V Air Operation Permit Applications

1. Identification of Applicable Requirements ☐ Attached, Document ID: ____ ☐ Not Applicable
2. Compliance Assurance Monitoring ☐ Attached, Document ID: ____ ☐ Not Applicable
3. Alternative Methods of Operation ☐ Attached, Document ID: ____ ☐ Not Applicable
4. Alternative Modes of Operation (Emissions Trading) ☐ Attached, Document ID: ____ ☐ Not Applicable
5. Acid Rain Part Application ☐ Certificate of Representation (EPA Form No. 7610-1) ☐ Copy Attached, Document ID: ____ ☐ Acid Rain Part (Form No. 62-210.900(1)(a)) ☐ Attached, Document ID: ____ ☐ Previously Submitted, Date: ____ ☐ Repowering Extension Plan (Form No. 62-210.900(1)(a)1.) ☐ Attached, Document ID: ____ ☐ Previously Submitted, Date: ____ ☐ New Unit Exemption (Form No. 62-210.900(1)(a)2.) ☐ Attached, Document ID: ____ ☐ Previously Submitted, Date: ____ ☐ Retired Unit Exemption (Form No. 62-210.900(1)(a)3.) ☐ Attached, Document ID: ____ ☐ Previously Submitted, Date: ____ ☐ Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.) ☐ Attached, Document ID: ____ ☐ Previously Submitted, Date: ____ ☐ Phase II NOx Averaging Plan (Form No. 62-210.900(1)(a)5.) ☐ Attached, Document ID: ____ ☐ Previously Submitted, Date: ____ ☐ Not Applicable

Additional Requirements Comment

ATTACHMENT MFRIV-EU1-C15

STACK PARAMETERS

ATTACHMENT MFRIV-EU1-C15

STACK PARAMETERS FOR THE AFI PLANT, MOSAIC RIVERVIEW

Source	Stack/Vent Release Height (ft)	Stack/Vent Diameter (ft)	Flow Rate (acfm)	Flow Rate (scfm)	Flow Rate (dscfm)	Gas Exit Temperature (°F)	Water Vapor Content (%)	Velocity (ft/sec)
AFI Plant No. 1	136	6.0	130,000	113,100	96,500	147	16	76.6
DE Hopper Dust Collector Vent	64	1.5	600	576	518	90	10	5.7
Limestone Silo Dust Collector	85	1.5	800	768	691	90	10	7.5
AFI Loadout System Dust Collector	15	1.0 x 3.5	15,000	14,400	12,960	90	10	55.6
AFI Plant No. 2	136	6.0	130,000	113,100	96,500	147	16	76.6
New Limestone Silo Dust Collector	87	1.2	4,282	--	3,700	90	10	63.1
New AFI Product Storage Building Dust Collector	TBD	TBD	3,472	--	3,000	90	10	TBD

Note:

acfm = actual cubic feet per minute.
AFI = animal feed ingredient.
DE = diatomaceous earth.
dscfm = dry standard cubic feet per minute.
scfm = standard cubic feet per minute.
TBD = to be determined.

ATTACHMENT MFRIV-EU1-I2

FUEL ANALYSIS OR SPECIFICATION

ATTACHMENT MFRIV-EU1-I2
AFI PLANT FUEL ANALYSIS

Fuel	Density	Moisture (%)	Weight % Sulfur	Weight % Nitrogen	Weight % Ash	Heat Capacity
Natural Gas	0.048 lb/scf	<0.01	<0.001	0.62	-----	1,000 Btu/scf
No. 2 Fuel Oil	6.83 lb/gal	<0.01	0.5	0.006	<0.01	140,000 Btu/gal

ATTACHMENT MFRIV-EU1-I3

DETAILED DESCRIPTION OF CONTROL EQUIPMENT

ATTACHMENT MFRIV-EU1-I3
SUMMARY OF POLLUTION CONTROL EQUIPMENT, AFI PLANT, MOSAIC RIVERVIEW

Source	Control Type	Manufacturer/Model	Design Capacity	Control Efficiency (%)
AFI PLANT NO. 1 COMMON STACK:				
Acid Defluorination and Storage System	Venturi Scrubber & Packed-Bed Cross-Flow Scrubber	BCI/Bithell CF4x4-3	14,000 acfm	99.95 (F)
Reactor/Granulator/Dryer/ Materials Handling	Venturi Scrubber	Modified Fisher-Klosterman	150,000 acfm	99.9 (PM)
DE HOPPER	Baghouse	MAC 39-AVRC-21	518 scfm	99.9 (PM)
LIMESTONE SILO NO. 1	Baghouse	MAC 39-AVRC-21	691 dscfm	99.9 (PM)
AFI PRODUCT LOADOUT	Baghouse	MAC 144-MCF-255	12,960 dscfm	99.9 (PM)
AFI PLANT NO. 2:				
Dryer	Venturi-Cyclonic Scrubber	DR Technology Inc. Custom Built	70,000 acfm	99.9 (PM)
Reactor/Granulator	Venturi-Cyclonic Scrubber	DR Technology Inc. Custom Built	55,000 acfm	99.9 (PM)
NEW LIMESTONE SILO NO. 2	Baghouse	Flex-Kleen 84CT38	3,700 dscfm	99.9 (PM)
NEW AFI PRODUCT STORAGE BUILDING	Baghouse	DCL BV49-84	3,000 dscfm	99.9 (PM)

Note:
acfm = actual cubic feet per minute.
AFI = animal feed ingredient.
DE = diatomaceous earth.
dscfm = dry standard cubic feet per minute.

III. EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Application - For Title V air operation permitting only, emissions units are classified as regulated, unregulated, or insignificant. If this is an application for Title V air operation permit, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each regulated and unregulated emissions unit addressed in this application for air permit. Some of the subsections comprising the Emissions Unit Information Section of the form are optional for unregulated emissions units. Each such subsection is appropriately marked. Insignificant emissions units are required to be listed at Section II, Subsection C.

Air Construction Permit or FESOP Application - For air construction permitting or federally enforceable state air operation permitting, emissions units are classified as either subject to air permitting or exempt from air permitting. The concept of an "unregulated emissions unit" does not apply. If this is an application for air construction permit or FESOP, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air permitting are required to be listed at Section II, Subsection C.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit Application – Where this application is used to apply for both an air construction permit and a revised/renewal Title V air operation permit, each emissions unit is classified as either subject to air permitting or exempt from air permitting for air construction permitting purposes and as regulated, unregulated, or insignificant for Title V air operation permitting purposes. **The air construction permitting classification must be used to complete the Emissions Unit Information Section of this application for air permit.** A separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air construction permitting and insignificant emissions units are required to be listed at Section II, Subsection C.

If submitting the application form in hard copy, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application must be indicated in the space provided at the top of each page.

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

   ☐ 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.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

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

   ☒ 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.

2. Description of Emissions Unit Addressed in this Section:

   Material Handling System

3. Emissions Unit Identification Number: **051, 052, 053 & 061**

4. Emissions Unit Status Code:	5. Commence Construction Date:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
A			**28**	☐ Yes ☒ No

9. Package Unit:
   Manufacturer: Model Number:

10. Generator Nameplate Rating: MW

11. Emissions Unit Comment:

    These emissions units are the only units in the material handling system that will be used in the loadout of Animal Feed Product to ships.

Emissions Unit Control Equipment

1. Control Equipment/Method(s) Description: **Baghouses (3)** **Miscellaneous Devices – Choke Feeder** **Dust Suppression by Chemical Stabilizer**
2. Control Device or Method Code(s): **018, 062, 099**

B. EMISSIONS UNIT CAPACITY INFORMATION

(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate: **1,000 TPH**	
2. Maximum Production Rate:	
3. Maximum Heat Input Rate:	million Btu/hr
4. Maximum Incineration Rate:	pounds/hr tons/day
5. Requested Maximum Operating Schedule:	**24** hours/day **7** days/week **52** weeks/year **8,000** hours/year
6. Operating Capacity/Schedule Comment: **The maximum material transfer rate of 1,000 TPH is a daily average. The maximum ship loading rate is 1,000 TPH as a daily average.**	

C. EMISSION POINT (STACK/VENT) INFORMATION
(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: **MH***	2. Emission Point Type Code: **3**
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking: **051 – West Baghouse** **052 – South Baghouse** **053 – Vessel Loading System – Tower Baghouse Exhaust** **061 – East Vessel Loading Facility – Shiphold/Chokefeeder**	
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:	

5. Discharge Type Code: **V**	6. Stack Height: **30** feet	7. Exit Diameter: **3.5** feet
8. Exit Temperature: **80** °F	9. Actual Volumetric Flow Rate: **33,000** acfm	10. Water Vapor: **5**%

11. Maximum Dry Standard Flow Rate: **30,700** dscfm	12. Nonstack Emission Point Height: feet
13. Emission Point UTM Coordinates... Zone: East (km): North (km):	14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS) Longitude (DD/MM/SS)
15. Emission Point Comment: **Stack parameters represent the West Baghouse (EU 051). All other parameters are presented in Attachment MFRIV-EU2-C15.**	

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment 1 of 1

1. Segment Description (Process/Fuel Type): **Mineral Products; Bulk Materials; Fertilizer – Ammoniated Phosphates/Animal Feed/Phosphate Rock**		
2. Source Classification Code (SCC): **3-05-105-97**	3. SCC Units: **Tons Processed**	
4. Maximum Hourly Rate: **1,000**	5. Maximum Annual Rate: **8,000,000**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment: **Maximum hourly rate based on Permit No. 0570008-045-AV**		

Segment Description and Rate: Segment _____ of _____

1. Segment Description (Process/Fuel Type):		
2. Source Classification Code (SCC):	3. SCC Units:	
4. Maximum Hourly Rate:	5. Maximum Annual Rate:	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment:		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
PM	018	062, 099	EL
PM_{10}	018	062, 099	EL

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **PM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **5.52** lb/hour **22.1** tons/year	4. Synthetically Limited? ☒ Yes ☐ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: Reference: **Permit No. 0570008-045-AV and Attachment A**	7. Emissions Method Code: **0**
8.a. Baseline Actual Emissions (if required): **8.1** tons/year	8.b. Baseline 24-month Period: From: **1/04** To: **12/05**
9.a. Projected Actual Emissions (if required): **13.12** tons/year	9.b. Projected Monitoring Period: ☐ 5 years ☒ 10 years
10. Calculation of Emissions: **See Attachment A, Table 4-3 for calculation.**	
11. Potential Fugitive and Actual Emissions Comment:	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 4

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.02 gr/dscf**	4. Equivalent Allowable Emissions: **1.16** lb/hour **4.6** tons/year
5. Method of Compliance: **Annual VE test using EPA Method 9 in lieu of stack test.**	
6. Allowable Emissions Comment (Description of Operating Method): **Permit limit from Permit No. 0570008-045-AV. Applies to EU 051.**	

Allowable Emissions Allowable Emissions 2 of 4

1. Basis for Allowable Emissions Code: **RULE**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.03 gr/dscf**	4. Equivalent Allowable Emissions: **1.16** lb/hour **4.6** tons/year
5. Method of Compliance: **Annual VE test using EPA Method 9 in lieu of stack test.**	
6. Allowable Emissions Comment (Description of Operating Method): **Permit limit from Permit No. 0570008-045-AV. Applies to EU 052.**	

Allowable Emissions Allowable Emissions 3 of 4

1. Basis for Allowable Emissions Code: **RULE**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.03 gr/dscf**	4. Equivalent Allowable Emissions: **3.10** lb/hour **12.4** tons/year
5. Method of Compliance: **Annual VE test using EPA Method 9 in lieu of stack test.**	
6. Allowable Emissions Comment (Description of Operating Method): **Permit limit from Permit No. 0570008-045-AV. Applies to EU 053.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 4 of 4

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.10 lb/hr and 0.40 TPY**	4. Equivalent Allowable Emissions: **0.10** lb/hour **0.40** tons/year
5. Method of Compliance: **Annual VE test using EPA Method 9.**	
6. Allowable Emissions Comment (Description of Operating Method): **Permit limit from Permit No. 0570008-045-AV. Applies to EU 061.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **PM_{10}**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **5.52** lb/hour **22.1** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: Reference: **Permit No. 0570008-045-AV and Attachment A**	7. Emissions Method Code: **0**
8.a. Baseline Actual Emissions (if required): **8.1** tons/year	8.b. Baseline 24-month Period: From: **1/04** To: **12/05**
9.a. Projected Actual Emissions (if required): **13.12** tons/year	9.b. Projected Monitoring Period: ☐ 5 years ☒ 10 years
10. Calculation of Emissions: **See Attachment A, Table 4-3 for calculation.**	
11. Potential Fugitive and Actual Emissions Comment:	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

G. VISIBLE EMISSIONS INFORMATION

Complete if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation 1 of 2

1. Visible Emissions Subtype: **VE05**	2. Basis for Allowable Opacity: ☒ Rule ☒ Other
3. 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: **For all emissions sources except ship loading. Rule 62-296.711(2)(a).**	

Visible Emissions Limitation: Visible Emissions Limitation 2 of 2

1. Visible Emissions Subtype: **VE10**	2. Basis for Allowable Opacity: ☒ Rule ☐ Other
3. 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: **Applies to ship loading operation. Rule 62-296.711(2)(a).**	

H. CONTINUOUS MONITOR INFORMATION

Complete if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor ____ of ____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement: ☐ Rule ☐ Other	
4. Monitor Information... Manufacturer: Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

Continuous Monitoring System: Continuous Monitor ____ of ____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement: ☐ Rule ☐ Other	
4. Monitor Information... Manufacturer: Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☒ Attached, Document ID: **Attachment A** ☐ Previously Submitted, Date _____

2. Fuel Analysis or Specification (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____

3. Detailed Description of Control Equipment (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☒ Attached, Document ID: **MFRIV-EU2-I3** ☐ Previously Submitted, Date _____

4. Procedures for Startup and Shutdown (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____
   ☒ Not Applicable (construction application)

5. Operation and Maintenance Plan (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____
   ☒ Not Applicable

6. Compliance Demonstration Reports/Records
   ☐ Attached, Document ID: _____
   Test Date(s)/Pollutant(s) Tested: _____

   ☐ Previously Submitted, Date: _____
   Test Date(s)/Pollutant(s) Tested: _____

   ☐ To be Submitted, Date (if known): _____
   Test Date(s)/Pollutant(s) Tested: _____

   ☒ Not Applicable

   Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.

7. Other Information Required by Rule or Statute
   ☒ Attached, Document ID: **See Attachment A** ☐ Not Applicable

Additional Requirements for Air Construction Permit Applications

1. Control Technology Review and Analysis (Rules 62-212.400(10) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e)) ☐ Attached, Document ID: _____ ☒ Not Applicable	
2. Good Engineering Practice Stack Height Analysis (Rule 62-212.400(4)(d), F.A.C., and Rule 62-212.500(4)(f), F.A.C.) ☐ Attached, Document ID: _____ ☒ Not Applicable	
3. Description of Stack Sampling Facilities (Required for proposed new stack sampling facilities only) ☐ Attached, Document ID: _____ ☒ Not Applicable	

Additional Requirements for Title V Air Operation Permit Applications

1. Identification of Applicable Requirements ☐ Attached, Document ID: _____ ☐ Not Applicable	
2. Compliance Assurance Monitoring ☐ Attached, Document ID: _____ ☐ Not Applicable	
3. Alternative Methods of Operation ☐ Attached, Document ID: _____ ☐ Not Applicable	
4. Alternative Modes of Operation (Emissions Trading) ☐ Attached, Document ID: _____ ☐ Not Applicable	
5. Acid Rain Part Application ☐ Certificate of Representation (EPA Form No. 7610-1) ☐ Copy Attached, Document ID: _____ ☐ Acid Rain Part (Form No. 62-210.900(1)(a)) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____ ☐ Repowering Extension Plan (Form No. 62-210.900(1)(a)1.) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____ ☐ New Unit Exemption (Form No. 62-210.900(1)(a)2.) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____ ☐ Retired Unit Exemption (Form No. 62-210.900(1)(a)3.) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____ ☐ Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____ ☐ Phase II NOx Averaging Plan (Form No. 62-210.900(1)(a)5.) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____ ☐ Not Applicable	

Additional Requirements Comment

ATTACHMENT MFRIV-EU2-C15

STACK PARAMETERS

ATTACHMENT MFRIV-EU2-C15

STACK PARAMETERS FOR THE MATERIAL HANDLING SYSTEM, MOSAIC RIVERVIEW

Source	EU ID	Stack/Vent Release Height (ft)	Stack/Vent Diameter (ft)	Flow Rate (acfm)	Flow Rate (dscfm)	Gas Exit Temperature (°F)	Water Vapor Content (%)	Velocity (ft/sec)
West Baghouse	051	30	3.5	33,000	30,700	80	5	57.17
South Baghouse	052	50	1.5	4,500	4,200	80	5	42.44
Tower Baghouse	053	30	2.5	12,000	11,200	80	5	40.74
Chokefeeder	061	30	--	--	12,960	80	5	0.00

Note:

acfm = actual cubic feet per minute.
dscfm = dry standard cubic feet per minute.

ATTACHMENT MFRIV-EU2-I3

DETAILED DESCRIPTION OF CONTROL EQUIPMENT

ATTACHMENT MFRIV-EU2-I3
SUMMARY OF POLLUTION CONTROL EQUIPMENT, MATERIAL HANDLING, MOSAIC RIVERVIEW

Source	EU ID	Control Type	Manufacturer/Model	Design Capacity	Control Efficiency (%)
WEST BAGHOUSE	051	Baghouse	Flex-Kleen 100-WM-510 TR10	33,000 acfm	99.5 (PM)
SOUTH BAGHOUSE	052	Baghouse	Flex-Kleen 100-WRT-64 TR10	4,500 acfm	99.5 (PM)
TOWER BAGHOUSE	053	Baghouse	Flex-Kleen 100-WRT-192 TR10	12,000 acfm	99.5 (PM)
EAST VESSEL LOADING FACILITY	061	Chokefeeder	MAC 144-MCF-255	12,960 dscfm	--

Note:
acfm = actual cubic feet per minute.
dscfm = dry standard cubic feet per minute.

ATTACHMENT A

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LIST OF ACRONYMS AND ABBREVIATIONS

AOR	annual operating report
CFR	Code of Federal Regulations
CO	carbon monoxide
dscfm	dry standard cubic foot per minute
EPA	U.S. Environmental Protection Agency
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
gr/dscf	grains per dry standard cubic foot
hr/yr	hours per year
lb/hr	pound per hour
lb/MMBtu	pound per million British thermal units
lb/ton	pound per ton
MMBtu/hr	million British thermal units per hour
Mosaic	Mosaic Fertilizer, LLC
NO_x	nitrogen oxides
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter equal to or less than 10 micrometers
PSD	prevention of significant deterioration
SAM	sulfuric acid mist
SO_2	sulfur dioxide
SO_3	sulfur trioxide
TPD	tons per day
TPH	tons per hour
TPY	tons per year
VOC	volatile organic compound

1.0 INTRODUCTION

Mosaic Fertilizer, LLC (Mosaic) operates a phosphate fertilizer manufacturing facility located in Riverview, Hillsborough County, Florida. Mosaic is proposing to modify the existing Animal Feed Ingredient (AFI) Plant at Riverview to achieve production rates closer to the currently-permitted hourly and annual production limits for the plant. The current production limits are 1,080 tons per day (TPD) of AFI product for AFI Plant No. 1, and 1,200 TPD AFI product for AFI Plant No. 2. These daily limits equate to 394,200 tons per year (TPY) of AFI product for AFI Plant No. 1 and 438,000 TPY AFI product for AFI Plant No. 2. Historically, the two plants combined have produced a maximum of 253,000 TPY of AFI product.

Mosaic currently operates the AFI plant with four acid batch tanks, two granulation systems, a diatomaceous earth (DE) silo, a limestone silo, and an AFI product loadout system. Phosphoric acid is used as a raw material in the process. The phosphoric acid typically contains fluorine compounds in excess of that allowed for the production of AFI, so a significant amount of fluorine must be removed before the phosphoric acid is introduced into the AFI granulation plants. The four acid batch tanks are currently used to defluorinate the phosphoric acid.

The changes required to implement this project include:

- Installation of a new forced circulation acid evaporator.
- Installation of two new 200,000-gallon (approximate) defluorination batch tanks.
- Installation of a new 500,000-gallon (approximate) defluorinated acid storage tank.
- Convert an existing 850-ton silo that is no longer in service for limestone storage and delivery. The silo will provide limestone to AFI Plant No. 2.
- Installation of a new 25,000-ton warehouse with associated conveyors and elevators for AFI product storage and delivery.

Based on the comparison of past actual (baseline actual) annual emissions to future actual annual emissions from all affected sources associated with the AFI Plant expansion, no emissions increases will trigger new source review (NSR) under the Federal and State prevention of significant deterioration (PSD) regulations.

A more detailed project description is provided in Section 2.0 of this attachment. PSD review requirements are discussed in Section 3.0 and air emissions estimates and the PSD applicability of the project are presented in Section 4.0.

2.0 PROJECT DESCRIPTION

Mosaic is proposing to add two new acid batch tanks with eductors, a phosphoric acid evaporator, a defluorinated acid storage tank, and a product storage building; and to refurbish an existing silo to achieve AFI production rates closer to the currently permitted hourly and annual production for the AFI plant. The AFI Plant contains emissions units 078, 079, 080, 081, and 103. Mosaic is also proposing to use the existing material handling system to deliver the AFI product to ships. The emissions units in the material handling system that will be affected by the AFI loadout system are emissions units 051, 052, 053, and 061.

The AFI Plant is currently operating under Air Construction Permit Nos. 0570008-036-AC/PSD-FL-315 and 0570008-043-AC/PSD-FL-315D. Permit No. 0570008-036-AC/PSD-FL-315 was issued on November 11, 2001, and amended on December 27, 2005, and November 28, 2006. Permit No. 0570008-043-AC/PSD-FL-315D was issued November 12, 2003, and amended February 4, 2004. The material handling system is currently operating under Title V Operating Permit No. 0570008-045-AV, issued May 31, 2006. The Mosaic Riverview facility is located at 8813 U.S. Highway 41 South in Riverview in Hillsborough County. A plot plan of the facility, showing stack locations, is presented in Attachment MFRIV-FI-C1 of the air permit application form. The following sections describe the existing AFI system and the proposed project in more detail. An overall facility flow diagram is presented in Attachment MFRIV-FI-C2 of the application form.

2.1 Existing Operations

The AFI Plant operates by first defluorinating phosphoric acid by reacting it with a silica source (diatomaceous earth) in batch tanks. The phosphoric acid entering the AFI Plant contains a fluorine content that is typically too high for the AFI product and must undergo a defluorination process to lower the fluorine concentration. This is accomplished through a batch process in the four existing batch tanks. Total fluoride emissions from the defluorination area batch tanks are passed first through a venturi scrubber, and then through a packed-bed cross-flow scrubber. The exhaust gases exit to the atmosphere through the AFI Plant No. 1 common stack.

The defluorinated acid is then reacted with a calcium source (limestone) in mixers located in the two granulation areas. The granulation areas (one for AFI Plant No. 1 and one for AFI Plant No. 2) each consist of a mixer, a pug mill, a dryer, screens, mills, and a classifier. The AFI product is then sent to the storage and loadout area. A flow diagram of the existing AFI Plant is shown in Figure 2-1 (proposed new facilities indicated in red).

Particulate matter (PM) emissions and PM emissions with an aerodynamic diameter of 10 microns or less (PM_{10}) from the AFI Plant No. 1 granulation area are controlled by a venturi scrubber, with exhaust gases vented to the AFI Plant No. 1 common stack. PM/PM_{10} emissions from the AFI Plant No. 2 granulation area are controlled by two venturi scrubbers (one for the dryer and one for the equipment vents); with exhaust gases vented to the AFI Plant No. 2 common stack.

The dryers in the AFI Plant Nos. 1 and 2 each have a maximum heat input of 93 million British thermal units per hour (MMBtu/hr). The plants are permitted to fire natural gas, with distillate oil (0.5 percent maximum sulfur content) as a backup fuel. Distillate oil firing is limited to 400 hours per year (hr/yr) for each plant.

DE is delivered to the facility via truck or railcar, and is pneumatically conveyed to the DE silo. The DE silo has a baghouse for PM control. The DE is then conveyed to the acid defluorination area.

Limestone is delivered to the facility via truck, and pneumatically conveyed to the existing limestone silo. The existing limestone silo is able to feed limestone to either AFI Plant Nos. 1 or 2 granulation systems. The conveying air from the limestone silo discharges through a baghouse located on the top of the storage silo.

The existing AFI loadout system consists of several storage silos and a truck and railcar loadout system. AFI product from the granulation systems is sent to the AFI loadout system for storage and subsequent loadout. AFI product loaded out to railcars can be shipped directly to customers or transferred to be unloaded via a bottom dump hopper to barges. This unloading system is part of the existing permitted dock conveying system at the facility.

AFI Plant No. 1 (EU 078) is currently permitted to produce 1,080 TPD of AFI product, while AFI Plant No. 2 (EU 103) is permitted for 1,200 TPD of AFI product. These daily limits equate to 394,200 TPY of AFI product for AFI Plant No. 1, and 438,000 TPY AFI product for AFI Plant No. 2.

PM emissions from the AFI Plant are controlled by means of three baghouses and four venturi scrubbers. Fluoride emissions are controlled by a packed-bed cross-flow scrubber. Maximum PM/PM_{10} emissions from each AFI Plant granulation system are limited to 13 pounds per hour (lb/hr) and 56.94 TPY. Total fluoride emissions from the AFI Plant are limited to 2.11 lb/hr and 9.25 TPY.

The current material handling system consists of the West Bag Filer (EU 051), South Baghouse (EU 052), Vessel Loading System – Tower Baghouse (EU 053), Building No. 6 Belt to Conveyor No. 7 Transfer Point (EU 058), Conveyor No. 7 to Conveyor No. 8 Transfer Point with Baghouse (EU 059), Conveyor No. 8 to Conveyor No. 9 Transfer Point with Baghouse (EU 060), and East Vessel Loading Facility – Shiphold/Chokefeeder (EU 061). The material handling system transfers materials processed and produced in the facility from storage buildings or railcars to marine vessels and from the storage buildings to railcars. PM emissions from the material handling system are controlled by means of six baghouses, a chokefeeder, and dust suppressant.

The material handling system currently has a maximum permitted material transfer rate of 1,000 TPH as a daily average. The maximum ship-loading rate is also 1,000 TPH as a daily average. The material handling system has operational and PM emissions limits as shown below:

Emissions Unit	Hours of Operation (hr/yr)	PM Emissions Limit		
		(grains/dscf)	(lb/hr)	(TPY)
West Baghouse (EU 051)	8,000	0.02	1.16	4.6
South Baghouse (EU 052)	8,000	0.03	1.16	4.6
Tower Baghouse (EU 053)	8,000	0.03	3.10	12.4
Building #6 Baghouse (EU 058)	4,000	0.02	0.62	1.2
Belt #7 to #8 Baghouse (EU 059)	6,000	0.02	0.62	1.9
Belt #8 to #9 Baghouse (EU 060)	6,000	0.02	1.19	3.6
Chokefeeder (EU 061)	8,000	N/A	0.10	0.42

2.2 Proposed Modifications

Mosaic is proposing to add two acid batch tanks acid, a defluorinated acid storage tank, an acid evaporator, a product storage building, and to refurbish an existing silo to achieve production rates closer to the currently permitted hourly and annual production for the AFI Plant. The changes required to implement this project include:

- Installation of two new 200,000-gallon (approximate) acid defluorination batch tanks;
- Installation of a new forced-circulation defluorinated acid evaporator to promote the defluorination of the acid;
- Installation of a new 500,000-gallon (approximate) defluorinated acid storage tank;
- Conversion of an existing 850-ton storage silo that is no longer in service, for limestone storage and delivery. The silo will provide limestone to AFI Plant No. 2; and
- Installation of a new 25,000-ton warehouse with associated conveyors and elevators for AFI product storage and delivery.

As described above, changes will be made to the acid defluorination system, limestone system, and the AFI product storage. No changes will be made to the two existing granulation systems, other than the tie-in of the new limestone silo with the AFI Plant No. 2 granulation system. No changes will be made to the existing DE storage system.

A flow diagram of the modified AFI Plant is presented in Figure 2-1, with the red items indicating the proposed new systems. A flow diagram of the proposed new acid defluorination area is shown in Figure 2-2. Phosphoric acid will enter the two new batch tanks for defluorination. The new evaporator will receive acid from the tanks, provide defluorination by heating the acid, then return the defluorinated acid to the batch tanks. Once the satisfactory level of defluorination is reached, the defluorinated acid will be transferred to the new defluorinated acid storage tank. Acid from this tank will then feed the AFI granulation plants.

The batch tanks will each utilize an eductor to remove fluorides from the off-gases from the tanks. The eductors use pond water to remove fluoride. The cleaned gases are then sent back to the batch tanks. The new defluorinated acid tank will not be vented to any control device, since the fluoride content of this acid is very low.

The existing defluorination system and batch tanks may continue to be used in the future, with no physical changes from their present operation, except that they will be tied into the new 500,000 gallon (approximate) defluorinated acid storage tank. They will continue to be vented to the AFI defluorination system venturi scrubber and packed-bed scrubber.

Limestone will continue to be delivered to the facility via truck, and pneumatically conveyed to either the existing limestone silo (AFI Plant No. 1), or the existing 850-ton storage silo that will be converted to limestone storage (AFI Plant No. 2). The existing limestone silo is able to feed limestone to either AFI Plant Nos. 1 or 2 granulation systems. The newly converted limestone silo will only feed limestone to the AFI Plant No. 2 granulation system. The conveying air from limestone silo No. 2 will discharge through a new baghouse, which will be located on the top of the storage silo.

AFI product will continue to be loaded out through the existing AFI Loadout system. No physical changes will be made to this system. However, the maximum permitted operating hours will be increased from 3,500 hr/yr to 8,760 hr/yr.

The AFI product will optionally be stored in a new 25,000-ton warehouse located at the dock within the Riverview facility. A flow diagram of this system is shown in Figure 2-3. The existing railcar dump hopper used for transferring AFI product to ship will be utilized. From the unloading hopper, the AFI product will be conveyed to an elevator, then to the new product storage warehouse. The elevator and conveyor transfer points used in the system will be controlled by a new baghouse.

All of the transfer points associated with the storage and loadout of the AFI product involve conveyors with partially- to completely-enclosed transfer points. These transfer points will potentially cause fugitive PM/PM_{10} emissions. There are six transfer points associated with the transport of the AFI product from the AFI plant to the new AFI storage warehouse. There are 11 transfer points associated with the loadout of the AFI product from the new AFI storage warehouse to ships. The AFI storage and loadout system will tie into the existing material handling system at the railcar unloading station. The West Baghouse (EU 051), South Baghouse (EU 052), Vessel Loading System – Tower Baghouse (EU 053), and East Vessel Loading Facility – Chokefeeder (EU 061) are the emissions units in the material handling system that are affected by the AFI product loadout.

2.3 Air Pollution Control Equipment

PM/PM_{10} and fluoride emissions from the AFI Plant are currently controlled by three baghouses, four venturi scrubbers, and a packed-bed cross flow scrubber. Two venturi scrubbers control the PM/PM_{10} emissions from AFI Plant No. 1 (EU 078) and a venturi scrubber and packed-bed cross-flow scrubber control fluoride emissions. Three separate baghouses control the PM/PM_{10} emissions from the DE silo (EU 079), the existing limestone silo (EU 080), and the AFI product loadout system (EU 081). Two venturi scrubbers control the PM/PM_{10} emissions from AFI Plant No. 2 (EU 103). These control devices will continue to be used to control PM/PM_{10} and fluoride emissions.

Mosaic is proposing to install two eductors and two additional baghouses to control PM/PM_{10} and fluoride emissions from the AFI Plant. The eductors, which are considered to be process equipment, will utilize pond water. The water discharge from the eductors will be returned to the process water pond at Riverview. The baghouse, which will be installed on top of an existing inactive 850-ton silo, will be reconditioned along with the silo to serve as additional limestone storage for AFI Plant No. 2. A new baghouse will control the PM/PM_{10} emissions from a new 25,000-ton AFI product storage warehouse.

Descriptions of the air pollution control equipment are provided in Attachments MFRIV-EU1-I3 and MFRIV-EU2-I3 of the permit application form.

FIGURE 2-1
AFI PLANT PROCESS FLOW DIAGRAM

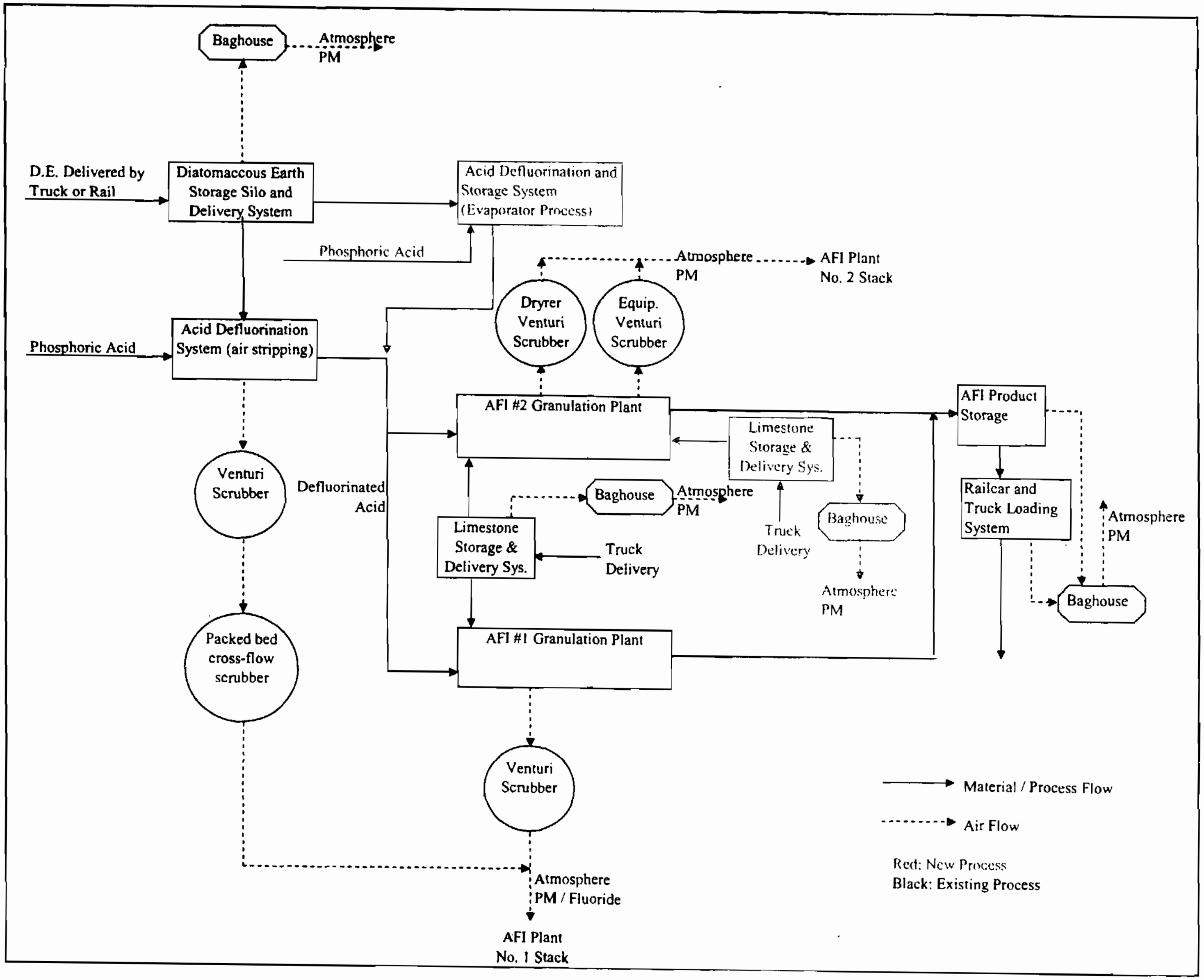


FIGURE 2-2
PROPOSED ACID DEFLUORINATION AND STORAGE SYSTEM (EVAPORATOR PROCESS) PROCESS FLOW DIAGRAM

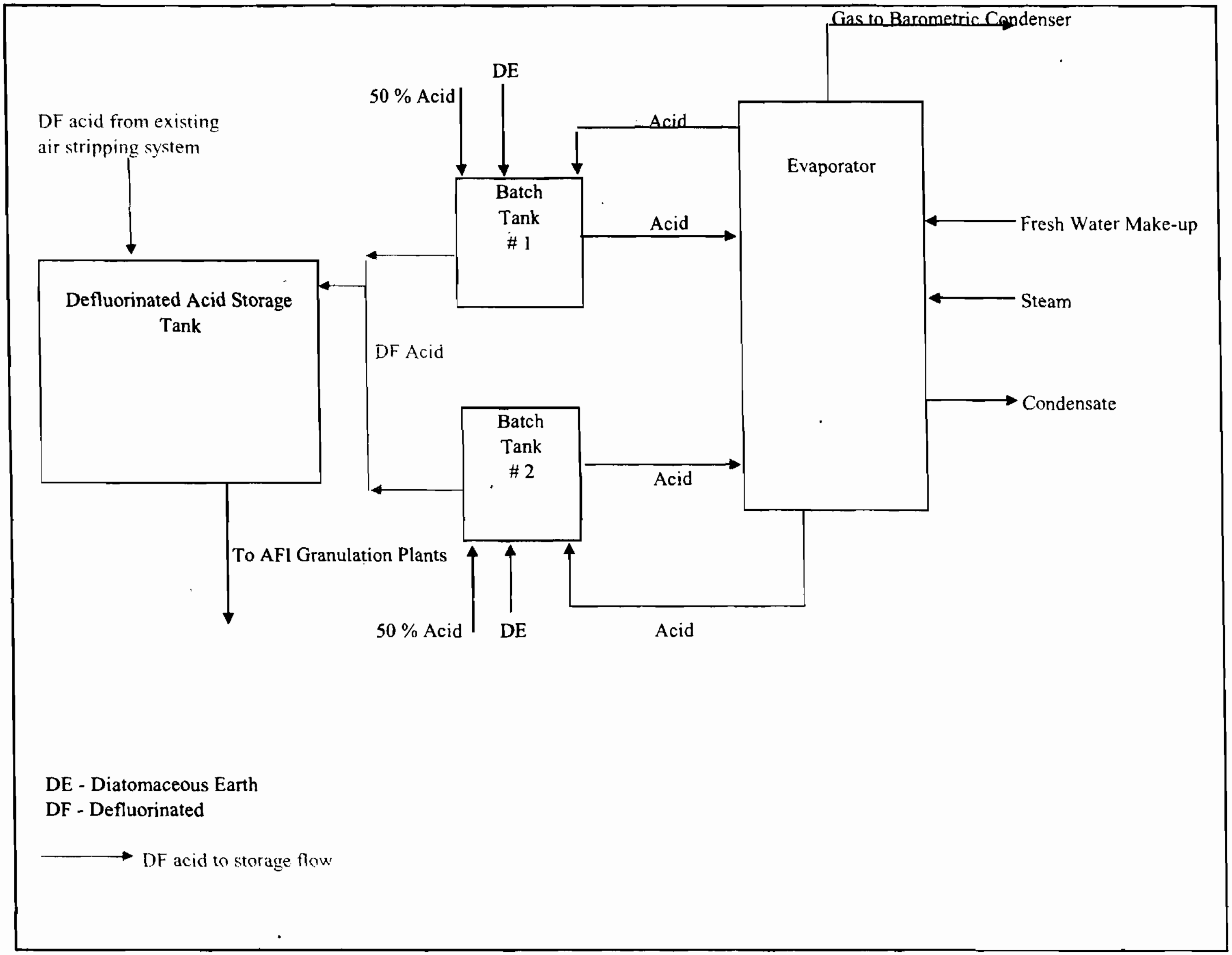
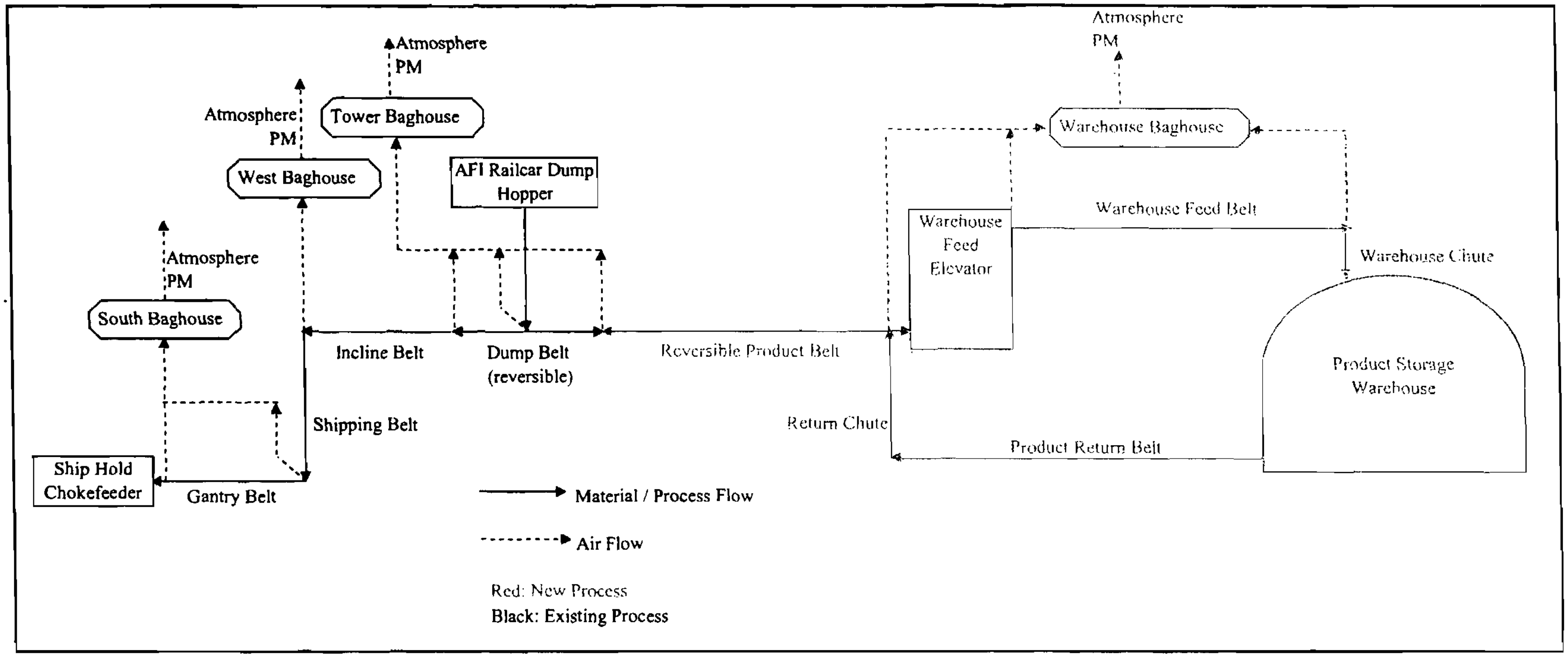


FIGURE 2-3
PROPOSED AFI PRODUCT STORAGE & LOADOUT PROCESS FLOW DIAGRAM



3.0 PSD REVIEW REQUIREMENTS

PSD review is used to determine whether significant air quality deterioration will result from a new or modified facility. Federal PSD requirements are contained in Title 40 of the Code of Federal Regulations (CFR), Section 52.21 (Prevention of Significant Deterioration of Air Quality). The State of Florida Department of Environmental Protection (FDEP) has adopted PSD regulations that are equivalent to the federal PSD regulations (Rule 62-212.400, F.A.C.). Major facilities and major modifications are required to undergo the following analyses related to PSD for each pollutant for which the emissions increase is significant:

- Control technology review,
- Source impact analysis,
- Air quality analysis (monitoring), and
- Additional impact analyses.

For an existing major stationary source for which a modification is proposed, the modification is subject to PSD review if the net increase in emissions due to the modification is greater than the PSD significant emissions rates (i.e., a "major modification"). The PSD significant emissions rates are listed in Table 3-1.

The determination of whether a significant net increase in emissions will occur is based on comparison of "baseline actual emissions" to "projected actual emissions" for all emissions units affected by the proposed project. "Baseline actual emissions" and "projected actual emissions" are defined in Rule 62-210.200(34) and (215), Florida Administrative Code (F.A.C.). "Baseline actual emissions," for an existing emissions unit other than an electric utility steam generating unit, is the average rate, in TPY, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period, selected by the owner/operator, within the 10-year period immediately preceding the date a complete permit application is received by the FDEP.

The average rate includes fugitive emissions to the extent quantifiable, and emissions associated with startups and shutdowns. The average rate must also be adjusted downward to exclude any non-compliant emissions that occurred while the emissions units were operating above an emissions limitation that was legally enforceable during the consecutive 24-month period.

For projects involving multiple emissions units, only one consecutive 24-month period can be used for all the emissions units being changed. However, a different 24-month period can be used for each PSD pollutant.

"Projected actual emissions" is the maximum annual rate, in TPY, at which an existing emissions unit is projected to emit a regulated air pollutant in any one of the 5 years following the date the unit resumes regular operation after the project, or in any one of the 10 years following that date, if the project involves increasing the emissions unit's potential to emit that regulated air pollutant, and full utilization of the unit would result in a significant emissions increase or a significant net emissions increase at the facility.

In determining the projected actual emissions, the FDEP shall consider all relevant information, including historical operating data, the company's own representations, the company's expected business activity, the company's filings with the state or federal regulatory authorities, and compliance plans or orders. Fugitive emissions, to the extent quantifiable, and emissions associated with startups and shutdowns, shall be considered. The projected actual emissions shall exclude that portion of the unit's emissions following the project that an existing unit could have accommodated during the consecutive 24-month period used to establish the baseline actual emissions, and that are also unrelated to the particular project, including any increased utilization due to demand growth.

If the proposed modification results in a significant emissions increase for any PSD pollutant, then all contemporaneous increases or decreases in emissions of that pollutant that have occurred at the facility in the last 5 years, must also be considered.

The Mosaic Riverview facility is an existing major stationary facility because potential emissions of at least one PSD-regulated pollutant exceed 100 TPY [for example, potential sulfur dioxide (SO_2) emissions currently exceed 100 TPY]. Therefore, PSD review is required for any pollutant for which the net increase in emissions due to a modification is greater than the PSD significant emissions rates (see Table 3-1). If the modification meets these criterion, it is deemed a "major modification".

TABLE 3-1
NATIONAL AND STATE AAQS, ALLOWABLE PSD INCREMENTS, AND SIGNIFICANT IMPACT LEVELS (µg/m³)

		AAQS			PSD Increments		Significant Impact Levels[d]	
Pollutant	**Averaging Time**	**National Primary Standard**	**National Secondary Standard**	**State of Florida**	**Class I**	**Class II**	**Class I (proposed)**	**Class II**
Particulate Matter[a] (PM_{10})	Annual Arithmetic Mean	50	50	50	4	17	0.2	1
	24-Hour Maximum[b]	150[b]	150[b]	150[b]	8	30	0.3	5
Sulfur Dioxide	Annual Arithmetic Mean	80	N/A	60	2	20	0.1	1
	24-Hour Maximum[e]	365[b]	N/A	260[b]	5	91	0.2	5
	3-Hour Maximum[b]	NA	1,300[b]	1,300[b]	25	512	1	25
Carbon Monoxide	8-Hour Maximum[b]	10,000[b]	10,000[b]	10,000[b]	N/A	N/A	N/A	500
	1-Hour Maximum[b]	40,000[b]	40,000[b]	40,000[b]	N/A	N/A	N/A	2,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25	0.1	1
Ozone[a]	1-Hour Maximum	235[c]	235[c]	235[c]	N/A	N/A	N/A	N/A
	8-Hour Maximum	157	157	N/A	N/A	N/A	N/A	N/A
							N/A	
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	1.5	N/A	N/A	N/A	N/A

Note: NA = Not applicable, *i.e.*, no standard exists.
PM_{10} = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.

[a]On July 18, 1997, EPA promulgated revised AAQS for particulate matter and ozone. For particulate matter, $PM_{2.5}$ standards were introduced with a 24-hour standard of 65 µg/m³ (3-year average of 98th percentile) and an annual standard of 15 µg/m³ (3-year average at community monitors). The ozone standard was modified to be 0.08 ppm (157 µg/m³) for an 8-hour average; achieved when 3-year average of 99th percentile is 0.08 ppm or less. FDEP has not yet adopted either of these standards.

[b]Short-term maximum concentrations are not to be exceeded more than once per year except for the PM_{10} AAQS (these do not apply to significant impact levels). The PM_{10} 24-hour AAQS is attained when the expected number of days per year with a 24-hour concentration above 150 µg/m³ is equal to or less than 1. For modeling purposes, compliance is based on the sixth-highest 24-hour average value over a 5-year period.

[c]Achieved when the expected number of days per year with concentrations above the standard is fewer than 1.

[d]Maximum concentrations.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978; 40 CFR 50; 40 CFR 52.21; Rule 62-204, F.A.C.

4.0 AIR EMISSIONS

4.1 Baseline Actual Emissions

The past actual (baseline actual) annual average emissions for the AFI Plant are presented in Table 4-1. The basis of the emissions estimates are presented in Appendix A. Based on recently-adopted Florida PSD reform rules, the baseline actual emissions are based on a consecutive 24-month period out of the last 10 years. Actual emissions for each of these 10 years (1997 to 2006) were determined based on operating data, available stack test data, and emissions factors. For each pollutant, the consecutive 2-year period with the highest average TPY emissions was selected as the baseline actual emissions for the AFI Plant. The 2-year averages used for each pollutant are as follows:

Sulfur Dioxide	2005 to 2006
Nitrogen Oxides	2005 to 2006
Carbon Monoxide	2005 to 2006
Particulate Matter	2004 to 2005
Particulate Matter (PM10)	2004 to 2005
Volatile Organic Compounds	2005 to 2006
Sulfuric Acid Mist	2005 to 2006
Lead	2005 to 2006
Mercury	2005 to 2006
Fluorides	2000 to 2001

The baseline actual emissions for the AFI Plant shown in Table 4-1 may differ from the annual emissions shown in the Annual Operating Reports (AORs) submitted to the FDEP, as described below. The emissions factors reported in the AOR for each pollutant, as well as the AFI Plant operating data, are presented in Appendix A, Table A-1. The revised emissions factors used for determining the baseline actual emissions are shown in Appendix A, Table A-2. These emissions factors were based on the latest emissions factors obtained from AP-42 and from stack testing on the AFI Plant.

The resulting baseline actual emissions for each pollutant, based on the revised emissions factors, are presented in Appendix A, Table A-3, for each year. The resulting 2-year average emissions for each 2-year period during the last 10 years are presented in Appendix A, Table A-4. The highest 2-year average for each pollutant represents the baseline actual emissions, shown in Table 4-1.

Sulfur Dioxide

The SO_2 emissions factor used in the past AOR reporting was 0.6 pounds per million cubic feet (lb/10^6 ft^3) of natural gas burned (see Appendix A, Table A-1). SO_2 emissions from the AFI Plant have not been measured. The most current AP-42 factor for natural gas combustion is 0.6 lb/10^6 ft^3. Since there are no actual SO_2 test data available for the AFI Plant, this emissions factor was used for all years to estimate baseline actual emissions (see Appendix A, Table A-2). Using the annual natural gas usage (from the AOR data), the annual emissions for each year were determined (refer to Appendix A, Table A-3). Emissions for the 2-year period of 2005 to 2006 were selected for the baseline actual SO_2 emissions (Tables A-4 and 4-1).

Nitrogen Oxides

The NO_x emissions factor used in the past AOR reporting was 100 lb/10^6 ft^3 of natural gas burned (see Appendix A, Table A-1). NO_x emissions from the AFI Plant have not been measured. The most current AP-42 factor for small (<100 MMBtu/hr) boilers is 100 lb/10^6 ft^3 natural gas burned. Since there are no actual NO_x test data available for the AFI Plant, this emissions factor was used for all years to estimate baseline actual emissions (see Appendix A, Table A-2). Using the annual natural gas usage (from the AOR data), the annual emissions for each year were determined (refer to Appendix A, Table A-3). Emissions for the 2-year period of 2005 and 2006 were selected for the baseline actual NO_x emissions (Tables A-4 and 4-1).

Carbon Monoxide

The carbon monoxide (CO) emissions factor used in the past AOR reporting was 84 lb/10^6 ft^3 of natural gas burned (see Appendix A, Table A-1). CO emissions from the AFI Plant have not been measured. The most current AP-42 factor for small (<100 MMBtu/hr) is 84 lb/10^6 ft^3 natural gas burned. Since there are no actual CO test data available for the AFI Plant, this emissions factor was used for all years to estimate baseline actual emissions (see Appendix A, Table A-2). Using the annual natural gas usage (from the AOR data), the annual emissions for each year were determined (refer to Appendix A, Table A-3). Emissions for the 2-year period of 2005 and 2006 were selected for the baseline actual CO emissions (Tables A-4 and 4-1).

Particulate Matter/PM_{10}

The PM emissions factor used in past AOR reporting was based on the annual stack test results in lb/hr or pounds per ton (lb/ton) for the AFI Plant, and AP-42 factors or maximum permitted emissions limits for the material handling system (Appendix A, Table A-1). This factor, coupled with the annual operating hours or annual process/production rate, was used to calculate annual PM emissions.

The PM/PM_{10} emissions limit for the AFI Plant is currently 28.72 lb/hr and 125.78 TPY as a combined emissions limit. AFI Plant Nos. 1 and 2 granulation systems have PM/PM_{10} emissions limits of 13 lb/hr and 58 TPY each. The DE silo, limestone silo, and loadout system have PM/PM_{10} emissions limits of 0.053 lb/hr and 0.23 TPY, 0.32 lb/hr and 1.40 TPY, and 2.06 lb/hr and 9.01 TPY, respectively. The PM/PM_{10} emissions limit for the material handling system is currently 1.16 lb/hr and 4.6 TPY for the West Baghouse, 1.16 and 4.6 TPY for the South Baghouse, 3.10 lb/hr and 12.4 TPY for the Tower Baghouse, and 0.10 lb/hr and 0.42 TPY for the Chokefeeder.

Baseline actual PM/PM_{10} emissions for AFI Plant Nos. 1 and 2 granulation systems were calculated based on annual PM compliance test data conducted over the 10-year period (see Appendix A, Table A-5). The compliance test averages, in lb/ton product, were determined for each year. Rule 62-210.370(2)(d)1.a., F.A.C. requires, when using annual stack test results to calculate baseline actual emissions, a minimum 5-year period encompassing the 2-year period for which emissions estimates are being made, if adequate data are available.

To comply with this requirement, to determine actual emissions for the years 1997, 2000, and the previous 4 years (1996 to 2000) were used. The AFI Plant did not operate until 1996. Using the average PM emissions in lb/ton product, the 5-year average PM emissions in lb/ton product were determined (see Appendix A, Table A-5). Using the production rate for the AFI Plant Nos. 1 and 2 (from the AOR data), the annual emissions for 1997 were then determined (refer to Appendix A). This process was repeated for all years from 1997 to 2006.

No stack tests were available for emissions from the DE silo, limestone silo, or material handling system; so the maximum permitted emissions rates in lb/hr multiplied by the annual operating hours for each year were used to determine the baseline emissions rates from these emissions units. Emissions for the 2-year period of 2004 to 2005 were selected for the baseline actual PM emissions (see Table 4-1 and Appendix A).

PM_{10} emissions reported in the AOR have generally been based on 100 percent of PM emissions. This factor was applied to the PM emissions factor for each year to obtain PM_{10} emissions. Emissions for the 2-year period of 2004 and 2005 were selected for the baseline actual PM_{10} emissions (see Table 4-1 and Appendix A).

Volatile Organic Compounds

The volatile organic compound (VOC) emissions factor used in the past AOR reporting was 5.5 $lb/10^6$ ft^3 of natural gas burned (see Appendix A, Table A-1). VOC emissions from the AFI Plant have not been measured. The most current AP-42 factor for natural gas combustion is 5.5 $lb/10^6$ ft^3. Since there are no actual VOC test data available for the AFI Plant, this emissions factor was used for all years to estimate baseline actual emissions (see Appendix A, Table A-2). Using the annual natural gas usage (from the AOR data), the annual emissions for each year were determined (refer to Appendix A, Table A-3). Emissions for the 2-year period of 2005 and 2006 were selected for the baseline actual VOC emissions (Tables A-4 and 4-1).

Sulfuric Acid Mist

The sulfuric acid mist (SAM) emissions factor used in the past AOR reporting was based on a 5 percent conversion of SO_2 emissions to SO_3, and then multiplied by the ratio of the molecular weights of sulfuric acid (H_2SO_4) and sulfate (SO_3) (98/80), resulting in an emissions factor of about 0.037 $lb/10^6$ ft^3 of natural gas burned (see Appendix A, Table A-1). SAM emissions from the AFI Plant have not been measured. Since there are no actual SAM test data available for the AFI Plant, this emissions factor was used for all years to estimate baseline actual emissions (see Appendix A, Table A-2). Using the annual natural gas usage (from the AOR data), the annual emissions for each year were determined (refer to Appendix A, Table A-3). Emissions for the 2-year period of 2005 and 2006 were selected for the baseline actual SAM emissions (Tables A-4 and 4-1).

Lead

Lead (Pb) emissions have not been reported in the AORs for the AFI Plant. Therefore, Pb emissions were calculated based on an AP-42 emissions factor of 0.0005 lb/10^6 ft^3 natural gas burned (see Appendix C). Using the annual natural gas usage rate for the AFI Plant (from the AOR data), the annual emissions for each year were determined (refer to Appendix A, Table A-3). Emissions for the 2-year period of 2005 and 2006 were selected for the baseline actual Pb emissions (see Table 4-1 and Appendix A, Table A-4).

Mercury

Mercury (Hg) emissions have not been reported in the AORs for the AFI Plant. Therefore, Hg emissions were calculated based on an AP-42 emissions factor of 0.00026 lb/10^6 ft^3 natural gas burned (see Appendix B). Using the annual natural gas usage rate for the AFI Plant (from the AOR data), the annual emissions for each year were determined (refer to Appendix A, Table A-3). Emissions for the 2-year period of 2005 to 2006 were selected for the baseline actual Hg emissions (see Table 4-1 and Appendix A, Table A-4).

Fluorides

The fluoride emissions factor used in past AOR reporting was based on the annual stack test result in lb/hr or lb/ton (Appendix A, Table A-1). This factor, coupled with the annual operating hours or annual production rate, was used to calculate annual fluoride emissions.

The fluoride emissions limit for the AFI Plant No. 1 defluorination system is 2.11 lb/hr and 9.25 TPY. Baseline actual fluoride emissions for AFI Plant No. 1 were calculated based on annual fluoride compliance test data conducted over the 10-year period (see Appendix A, Table A-5). The compliance test averages, in lb/ton product, were determined for each year. Rule 62-210.370(2)(d)1.a., F.A.C. requires that, when using annual stack test results to calculate baseline actual emissions, a minimum 5-year period that encompasses the 2-year period for which emissions estimates are being made, if adequate data are available.

To comply with this requirement, to determine actual emissions for 1997, the year 2000 and the previous 4 years (1996 to 2000) were used. Using the average fluoride emissions in lb/ton product, the 5-year average fluoride emissions in lb/ton product was determined (see Appendix A). Using the production rate for the AFI Plant Nos. 1 and 2 (from the AOR data), the annual emissions for 1997 were then determined (refer to Appendix A). This process was repeated for all years from 1997 to 2006. Emissions for the 2-year period of 2000 to 2001 were selected for the baseline actual fluoride emissions (see Table 4-1).

4.1.1 Projected Actual Emissions

AFI Plant Defluorination/Granulation Systems

"Projected actual emissions" for the AFI Plant were developed using the maximum operating factors determined for the baseline actual emissions. Projected annual production rates were developed based on a maximum combined production of 473,000 TPY of AFI product. According to current permitted production rates of 1,080 TPD (394,200 TPY) and 1,200 TPD (438,000 TPY) for AFI Plant Nos. 1 and 2 granulation systems, respectively, either AFI Plant granulation system could produce most of the 473,000 TPY of AFI product. Actual operation, however, will have both AFI plant granulation systems operating and producing closer to equal amounts of AFI product.

Operating factors for natural gas usage were also determined for the AFI Plant to establish natural gas usage as a function of AFI production. The operating factor of 10^6 ft^3/ton of AFI product was determined by dividing the annual natural gas usage rates by the annual production rates (Appendix A, Table A-6). These operating factors provide a way to scale up the natural gas usage rates from the current AFI product production rates up to the desired rate of 473,000 TPY. Operating factors were also determined for the material transfer system to establish a function of material transferred per hour of operation.

Emissions factors for PM and PM_{10} were the same as those used for the baseline actual emissions. Emissions factors for AFI Plant No. 1 were based on the maximum 5-year average stack tests. Stack tests have only been performed on AFI Plant No. 2 for the past 5 years, and so the average of these stacks tests were used as the emission factor for AFI Plant No. 2. AFI Plant No. 1 had a higher emissions factor than AFI Plant No. 2, and so production is maximized through AFI Plant No. 1 in order to establish a worst case emissions scenario. The maximum estimated production from AFI Plant No. 1 is 214,000 TPY of AFI product. The remaining 259,000 TPY of AFI product will be produced by AFI Plant No. 2.

Emissions factors were the same for SO_2, NO_x, CO, VOC, SAM, Pb, Hg, and fluorides as used for the baseline actual emissions. Projected actual emissions for these pollutants emitted from natural gas burning by the AFI Plants were determined using the operating factor of 10^6 ft^3/ton product. The highest annual factors were used for the projected actual emissions (0.00165 10^6 ft^3/ton product in 2006 for AFI Plant No. 1; 0.00168 10^6 ft^3/ton product in 2006 for AFI Plant No. 2) to establish a worst case scenario. AFI Plant No. 2 had the highest emissions factor; however, the maximum production rates for AFI Plant Nos. 1 and 2 were determined by using the PM emission factors, as stated above.

Emissions factors for fluorides were the same as those used for the baseline actual emissions, with the maximum 5-year average emissions factor being used. The acid defluorination system vents exclusively through the AFI Plant No. 1 stack; however, defluorinated acid is used in both AFI Plant Nos. 1 and 2 granulation systems to produce AFI product. To estimate the worst-case emissions scenario, the projected total production rate of 473,000 TPY of AFI product was used to determine the fluoride emissions rate from the AFI Plant.

Projected actual annual emissions for the AFI Plant are shown in Table 4-2.

Material Handling and Storage

Emissions factors for PM and PM_{10} from the material handling and storage sources were the same as those used for the baseline actual emissions. The emissions factors were based on the maximum permitted emissions rates as set in Permit Nos. 0570008-045-AV/PSD-FL-315D and 0570008-045-AV in lb/hr. The projected actual emissions for the DE Silo, Limestone Silo No. 1, and Animal Feed Loadout System were determined based on continuous (8,760 hr/yr) operation. The hours of operation for each affected emissions unit in the material handling system were based on the sum of the 2-year average operating hours from the 2004 to 2005 operating years and the operating hours calculated from the operating factors based on the projected production of 473,000 TPY going through the material handling system (4,441 hr/yr for the West Baghouse; 4,860 hr/yr for the South Baghouse, 4,824 hr/yr for the Tower Baghouse; and 4,860 hr/yr for the Chokefeeder).

Since the emissions from the Limestone Silo No. 2 and AFI product storage are new sources of air emissions, the projected actual emissions from these sources are the same as the future potential emissions. The future potential emissions are described below.

4.1.2 Future Potential Emissions

AFI Plant Defluorination/Granulation Systems

The future potential annual emissions for the AFI Plant are presented in Table 4-3. The table shows the calculations for both the annual and short-term averaging periods. Annual emissions are calculated based on unlimited use of all sources in the AFI Plant (i.e. 8,760 hr/yr).

The emissions factors used to calculate the future potential emissions are the same as those used to calculate the projected actual emissions, except for PM/PM_{10} and fluorides, which have allowable emissions established by permit.

Potential emissions of PM/PM_{10} for the AFI Plant granulation systems are calculated from the current allowable PM limit of 13 lb/hr for AFI Plant No. 1 and 2, 0.053 lb/hr for the DE silo, 0.32 lb/hr for the limestone silo, and 2.06 lb/hr for the AFI loadout system, which were established in Permit No. 0570008-043-AC/PSD-FL-315D.

Fluoride potential emissions for the AFI Plant are calculated from the current allowable fluoride limit of 2.11 lb/hr from the defluorination system, which vents through the AFI Plant No. 1 stack. This limit was established in Permit No. 0570008-036-AC/PSD-FL-315.

Material Handling and Storage

Emissions factors for PM and PM_{10} for the proposed Limestone Silo No. 2 and AFI Product Storage Building were based on the permitted grain loading for the DE silo, Limestone Silo No. 1, and AFI Loadout System of 0.012 grain per dry standard cubic foot (gr/dscf) as established in Permit No. 0570008-043-AC/PSD-FL-315D. The air flow rate used to determine the projected actual emissions for the proposed Limestone Silo No. 2 was determined from past flow rates through the refurbished silo (formerly GTSP storage silo) of 3,700 dry standard cubic feet per minute (dscfm). The air flow rate used to determine the projected actual emissions rate for the proposed AFI product storage building was 3,000 dscfm.

A new AFI product storage and delivery system will be installed to support the AFI Plant, which will result in additional fugitive PM/PM_{10} emissions. A summary of the maximum hourly and annual fugitive PM/PM_{10} potential emissions rate calculations for the new AFI product storage and delivery system is presented in Table 4-4. Appropriate emissions factors were calculated using the equation presented in AP-42, Section 13.2. This equation is commonly referred to as the "material drop equation" and is applicable to such operations as conveyor transfer points, loading into trucks or railcars, loading into storage piles, and similar drop operations.

The drop equation is a function of the moisture content of the material and the wind speed. The average moisture content of the AFI product processed through storage and delivery system (1.5 percent) was used in the drop equation. All equipment associated with the new handling and storage system for AFI product will be located inside the proposed storage building. To account for the effect of the building enclosures and conveyor transfer point enclosures, in minimizing the effect of the wind on the generation of PM/PM_{10} emissions, a wind speed of 1.3 miles per hour, the lowest wind speed for which the drop equation can be applied with an "A" quality rating, was used in the drop equation.

AFI product will be transported to the new AFI warehouse for storage, and then transported back along the conveying system to be delivered to ships. The total PM/PM_{10} fugitive emissions account for this activity. As presented in Table 4-4, maximum hourly fugitive PM and PM_{10} emissions rates were estimated to be 0.282 and 0.133 lb/hr, respectively. Annual fugitive PM and PM_{10} emissions rates were estimated to be 0.123 and 0.058 TPY, respectively.

An increase in truck traffic is also expected from this project to support the increased production of AFI product. The increase in truck traffic will come primarily from increased limestone deliveries. Approximate truck weights are 31,000 lbs. (empty truck) and 81,000 lbs. (truck filled with ground limestone), with a limestone capacity of 50,000 lbs. (25 tons). The maximum increase in number of trucks transporting the limestone into the facility each day will be 20, for a total of 30 trucks per day delivering limestone to the facility. The maximum increase in number of truck deliveries per year is 2,500 trucks, for an annual total of 6,560 trucks. This increase in truck traffic is based on a maximum increase of limestone usage of 170 TPD or 62,050 TPY.

The AP-42 equation was used to estimate fugitive dust emissions for trucks on paved roads (Section 13.2.1, December 2003). This emissions factor is used with the roundtrip distance (1.2 miles) the trucks will be traveling, the maximum increase in the amount of trucks per day (10) and per year (2,500), and the average weight of the truck fleet (28 tons) to determine PM and PM_{10} annual and hourly emissions. Using the equation and the truck traffic mileage, the increase in potential emissions for PM are 1.38 lb/hr and 2.07 TPY, and potential maximum emissions for PM_{10} are 0.27 lb/hr and 0.40 TPY. The calculation of the fugitive PM and PM_{10} emissions from truck traffic is presented in Table 4-5.

4.2 Effects on Other Emissions Units

No other emissions units at the Mosaic Riverview facility will be affected by AFI Plant expansion. No additional phosphoric acid will be produced, as the phosphoric acid that was being used in the MAP/DAP plants will be diverted to the AFI Plant, thus requiring no increase in sulfuric acid production from the sulfuric acid plants.

4.3 PSD Review

Pollutant Applicability

The Mosaic Riverview facility is considered to be an existing major stationary facility because potential emissions of at least one PSD-regulated pollutant exceed 100 TPY (for example, potential SO_2 emissions currently exceed 100 TPY). Therefore, PSD review is required for any pollutant for which the net increase in emissions due to the modification is greater than the PSD significant emissions rates.

The net increase in emissions due to the proposed modification at the Mosaic Riverview facility is summarized in Table 4-6. For the AFI Plant, the baseline actual emissions and projected actual emissions are based on information from Tables 4-1 and 4-2. The future potential emissions from the new limestone storage and delivery system and the new AFI Product storage warehouse, shown in Table 4-3, are also included.

As shown in Table 4-6, the increase in emissions due to the project exceeds the significance levels for PM, PM_{10}, and fluorides only. For these pollutants, the PSD regulations require that all contemporaneous emissions increases and decreases be included in a netting analysis to determine PSD applicability. These emissions changes are included in the bottom portion of Table 4-6. Also presented is the total net increase in emissions, considering the contemporaneous emissions changes. The contemporaneous decreases were determined in a manner similar to the baseline actual emissions, where the highest emissions over a 24-month period were calculated based on AOR data, stack testing, and published emissions factors. The derivation of the contemporaneous decreases is contained in Appendix B, Tables B-1 through B-5.

As shown in Table 4-6, no net increase in emissions exceeds the PSD significant emissions rate after the contemporaneous changes are accounted for. Therefore, PSD review does not apply for these pollutants.

TABLE 4-1
BASELINE ACTUAL EMISSIONS
ANIMAL FEED INGREDIENT FACILITY, MOSAIC RIVERVIEW

Source Description		Highest 2-Year Average Calculation (TPY) Year 1	Year 2	2-Year Average
Sulfur Dioxide - SO_2		**2005**	**2006**	**'05-'06**
Animal Feed Plant No. 1 (EU 078)		0.045	0.050	0.047
Animal Feed Plant No. 2 (EU 103)		0.046	0.066	0.056
	Total:	**0.091**	**0.116**	**0.104**
Nitrogen Oxides - NO_X		**2005**	**2006**	**'05-'06**
Animal Feed Plant No. 1 (EU 078)		7.48	8.30	7.89
Animal Feed Plant No. 2 (EU 103)		7.72	11.05	9.38
	Total:	**15.20**	**19.35**	**17.27**
Carbon Monoxide - CO		**2005**	**2006**	**'05-'06**
Animal Feed Plant No. 1 (EU 078)		6.29	6.97	6.63
Animal Feed Plant No. 2 (EU 103)		6.48	9.28	7.88
	Total:	**12.77**	**16.25**	**14.51**
Particulate Matter Total - PM		**2004**	**2005**	**'04-'05**
West Bag Filter (EU 051)		1.29	1.16	1.23
South Baghouse (EU 052)		1.62	2.03	1.83
Vessel Loading System (EU 053)		4.34	5.43	4.88
East Vessel Loading Facility (EU 061)		0.14	0.18	0.16
Animal Feed Plant No. 1 (EU 078)		14.37	11.53	12.95
Diatomaceous Earth Silo (EU 079)		0.23	0.23	0.23
Limestone Silo (EU 080)		1.40	1.40	1.40
Animal Feed Loadout System (EU 081)		2.66	2.13	2.39
Animal Feed Plant No. 2 (EU 103)		17.07	15.69	16.38
	Total:	**43.12**	**39.78**	**41.45**
Particulate Matter - PM_{10}		**2004**	**2005**	**'04-'05**
West Bag Filter (EU 051)		1.29	1.16	1.23
South Baghouse (EU 052)		1.62	2.03	1.83
Vessel Loading System (EU 053)		4.34	5.43	4.88
East Vessel Loading Facility (EU 061)		0.14	0.18	0.16
Animal Feed Plant No. 1 (EU 078)		14.37	11.53	12.95
Diatomaceous Earth Silo (EU 079)		0.23	0.23	0.23
Limestone Silo (EU 080)		1.40	1.40	1.40
Animal Feed Loadout System (EU 081)		2.66	2.13	2.39
Animal Feed Plant No. 2 (EU 103)		17.07	15.69	16.38
	Total:	**43.12**	**39.78**	**41.45**
Volatile Organic Compounds - VOC		**2005**	**2006**	**'05-'06**
Animal Feed Plant No. 1 (EU 078)		0.412	0.457	0.434
Animal Feed Plant No. 2 (EU 103)		0.424	0.608	0.516
	Total:	**0.836**	**1.064**	**0.950**
Sulfuric Acid Mist - SAM		**2005**	**2006**	**'05-'06**
Animal Feed Plant No. 1 (EU 078)		0.0028	0.0031	0.0029
Animal Feed Plant No. 2 (EU 103)		0.0028	0.0041	0.0034
	Total:	**0.0056**	**0.0071**	**0.0063**
Lead - Pb		**2005**	**2006**	**'05-'06**
Animal Feed Plant No. 1 (EU 078)		3.74E-05	4.15E-05	3.95E-05
Animal Feed Plant No. 2 (EU 103)		3.86E-05	5.53E-05	4.69E-05
	Total:	**7.60E-05**	**9.68E-05**	**8.64E-05**
Mercury - Hg		**2005**	**2006**	**'05-'06**
Animal Feed Plant No. 1 (EU 078)		1.95E-05	2.16E-05	2.05E-05
Animal Feed Plant No. 2 (EU 103)		2.01E-05	2.87E-05	2.44E-05
	Total:	**3.95E-05**	**5.03E-05**	**4.49E-05**
Fluorides - F		**2000**	**2001**	**'00-'01**
Animal Feed Plant No. 1 (EU 078)		1.96	2.32	2.14
	Total:	**1.96**	**2.32**	**2.14**

[a] TPY = Tons per year.

TABLE 4-2
PROJECTED ACTUAL EMISSIONS
ANIMAL FEED INGREDIENT FACILITY, MOSAIC RIVERVIEW

Pollutant	Emission Factor	Ref.	Activity Factor [a]		Annual Emissions (TPY)
Sulfur Dioxide - SO_2					
Animal Feed Plant No. 1 (EU 078)	0.6 lb/10^6 ft^3	1	0.00165 10^6 ft^3/ton product 214,000 ton product/yr		0.106
Animal Feed Plant No. 2 (EU 103)	0.6 lb/10^6 ft^3	1	0.00168 10^6 ft^3/ton product 259,000 ton product/yr		0.130
				Total:	**0.236**
Nitrogen Oxides - NO_x					
Animal Feed Plant No. 1 (EU 078)	100 lb/10^6 ft^3	2	0.00165 10^6 ft^3/ton product 214,000 ton product/yr		17.62
Animal Feed Plant No. 2 (EU 103)	100 lb/10^6 ft^3	2	0.00168 10^6 ft^3/ton product 259,000 ton product/yr		21.69
				Total:	**39.32**
Carbon Monoxide - CO					
Animal Feed Plant No. 1 (EU 078)	84 lb/10^6 ft^3	2	0.00165 10^6 ft^3/ton product 214,000 ton product/yr		14.80
Animal Feed Plant No. 2 (EU 103)	84 lb/10^6 ft^3	2	0.00168 10^6 ft^3/ton product 259,000 ton product/yr		18.22
				Total:	**33.02**
Particulate Matter Total - PM					
West Bag Filter (EU 051)	1.16 lb/hr	3	4,441 hr/yr		2.58
South Baghouse (EU 052)	1.16 lb/hr	3	4,860 hr/yr		2.82
Vessel Loading System (EU 053)	3.10 lb/hr	3	4,824 hr/yr		7.48
East Vessel Loading Facility (EU 061)	0.10 lb/hr	3	4,860 hr/yr		0.24
Animal Feed Plant No. 1 (EU 078)	0.3136 lb/ton product	4	214,000 ton product/yr		33.55
Diatomaceous Earth Silo (EU 079)	0.053 lb/hr	5	8,760 hr/yr		0.23
Limestone Silo No. 1 (EU 080)	0.32 lb/hr	5	8,760 hr/yr		1.40
Animal Feed Loadout System (EU 081)	2.06 lb/hr	5	8,760 hr/yr		9.02
Animal Feed Plant No. 2 (EU 103)	0.2492 lb/ton product	6	259,000 ton product/yr		32.27
New Limestone Silo No. 2	0.012 grain/dscf	7	3,700 dscf/min 8,760 hr/yr		1.67
New AFI Product Storage Warehouse	0.012 grain/dscf	7	3000 dscf/min 8760 hr/yr		1.35
				Total:	**92.61**
Particulate Matter - PM_{10}					
West Bag Filter (EU 051)	1.16 lb/hr	3	4,441 hr/yr		2.58
South Baghouse (EU 052)	1.16 lb/hr	3	4,860 hr/yr		2.82
Vessel Loading System (EU 053)	3.10 lb/hr	3	4,824 hr/yr		7.48
East Vessel Loading Facility (EU 061)	0.10 lb/hr	3	4,860 hr/yr		0.24
Animal Feed Plant No. 1 (EU 078)	0.3136 lb/ton product	4	214,000 ton product/yr		33.55
Diatomaceous Earth Silo (EU 079)	0.053 lb/hr	5	8,760 hr/yr		0.23
Limestone Silo No. 1 (EU 080)	0.32 lb/hr	5	8,760 hr/yr		1.40
Animal Feed Loadout System (EU 081)	2.06 lb/hr	5	8,760 hr/yr		9.02
Animal Feed Plant No. 2 (EU 103)	0.2492 lb/ton product	6	259,000 ton product/yr		32.27
New Limestone Silo No. 2	0.012 grain/dscf	7	3,700 dscf/min 8,760 hr/yr		1.67
New AFI Product Storage Warehouse	0.012 grain/dscf	7	3,000 dscf/min 8,760 hr/yr		1.35
				Total:	**92.61**
Volatile Organic Compounds - VOC					
Animal Feed Plant No. 1 (EU 078)	5.5 lb/10^6 ft^3	1	0.00165 10^6 ft^3/ton product 214,000 ton product/yr		0.97
Animal Feed Plant No. 2 (EU 103)	5.5 lb/10^6 ft^3	1	0.00168 10^6 ft^3/ton product 259,000 ton product/yr		1.19
				Total:	**2.16**
Sulfuric Acid Mist - SAM					
--Animal Feed Plant No. 1 (EU 078)	0.037 lb/10^6 ft^3	8	0.00165 10^6 ft^3/ton product 214,000 ton product/yr		0.0065
--Animal Feed Plant No. 2 (EU 103)	0.037 lb/10^6 ft^3	8	0.00168 10^6 ft^3/ton product 259,000 ton product/yr		0.0080
				Total:	**0.0144**
Lead - Pb					
Animal Feed Plant No. 1 (EU 078)	0.0005 lb/10^6 ft^3	9	0.00165 10^6 ft^3/ton product 214,000 ton product/yr		8.81E-05
Animal Feed Plant No. 2 (EU 103)	0.0005 lb/10^6 ft^3	9	0.00168 10^6 ft^3/ton product 259,000 ton product/yr		1.08E-04
				Total:	**1.97E-04**
Mercury - Hg					
Animal Feed Plant No. 1 (EU 078)	0.00026 lb/10^6 ft^3	9	0.00165 10^6 ft^3/ton product 214,000 ton product/yr		4.58E-05
Animal Feed Plant No. 2 (EU 103)	0.00026 lb/10^6 ft^3	9	0.00168 10^6 ft^3/ton product 259,000 ton product/yr		5.64E-05
				Total:	**1.02E-04**
Fluorides - F					
Animal Feed Plant No. 1 (EU 078)	0.0320 lb/ton product	4	473,000 ton product/yr		7.56
				Total:	**7.56**

[a] Activity factors for AFI production based on actual maximum annual fuel usages, and maximum average stack tests. See Tables A-5 and A-6. AFI Plant No. 1 has the highest emission factor for PM/PM_{10}, therefore the highest emissions occur when production is maximized at AFI Plant No. 1. Maximum estimated production at AFI Plant No. 1 is 25 TPH of AFI Product, or 219,000 TPY. The total desired production from the AFI Plant Nos. 1 and 2 is 478,000 TPY, therefore the remaining 259,000 TPY production is associated with AFI Plant No. 2. Hours of operation of the material handling system (EU 051, 052, 053, and 061) are based on the maximum annual operating hours from the past 10 years plus the increase in operating hours resulting from handling the additional 478,000 TPY of AFI Product.

References:
1 Based on AP-42, Table 1.4-2 for Natural Gas combustion.
2 Based on AP-42, Table 1.4-1 for Natural Gas combustion in small (<100 MMBtu/hr) boilers.
3 Based on Permit No. 0570008-045-AV, Condition H.4.
4 Based on maximum 5-year average stack test (see Appendix A).
5 Based on Permit No. 0570008-043-AC/PSD-FL-315D.
6 Based on average stack tests performed 05/08/2003, 07/11/2006, and 10/24/2006.
7 Based on permitted grain loading for DE Silo, Limestone Silo, and Loadout System (Permit Nos. 0570008-036-AC/PSD-FL-315 & 0570008-043-AC/PSD-FL-315D).
8 Based on 5% conversion of SO_2 to SO_3 multiplied by the ratio of the molecular weights of H_2SO_4 and SO_3 (98/80).
9 Based on AP-42, Table 1.4-4 for Natural Gas combustion.

TABLE 4-3
FUTURE POTENTIAL EMISSIONS
ANIMAL FEED INGREDIENT FACILITY, MOSAIC RIVERVIEW

Pollutant	Emission Factor	Ref.	Short-Term[a] Activity Factor	Short-Term[a] Emissions[c] (lb/hr)	Annual Average[b] Activity Factor	Annual Average[b] Emissions (TPY)
Sulfur Dioxide - SO_2						
Animal Feed Plant No. 1 (EU 078)	71 lb/1,000 gal	1	662 gal/hr	47.00	400 hr/yr	9.40
	0.6 lb/10^6 ft^3	2	0.093 10^6 ft^3/hr	0.056	8,360 hr/yr	0.23
Animal Feed Plant No. 2 (EU 103)	71 lb/1,000 gal	1	662 gal/hr	47.00	400 hr/yr	9.40
	0.6 lb/10^6 ft^3	2	0.093 10^6 ft^3/hr	0.056	8,360 hr/yr	0.23
			Total:	***94.00***	*Total:*	***19.27***
Nitrogen Oxides - NO_x						
Animal Feed Plant No. 1 (EU 078)	55 lb/1,000 gal	1	662 gal/hr	36.41	400 hr/yr	7.28
	100 lb/10^6 ft^3	3	0.093 10^6 ft^3/hr	9.30	8,360 hr/yr	38.87
Animal Feed Plant No. 2 (EU 103)	55 lb/1,000 gal	1	662 gal/hr	36.41	400 hr/yr	7.28
	100 lb/10^6 ft^3	3	0.093 10^6 ft^3/hr	9.30	8,360 hr/yr	38.87
			Total:	***72.82***	*Total:*	***92.31***
Carbon Monoxide - CO						
Animal Feed Plant No. 1 (EU 078)	5 lb/1,000 gal	1	662 gal/hr	3.31	0 hr/yr	0.00
	84 lb/10^6 ft^3	3	0.093 10^6 ft^3/hr	7.81	8,760 hr/yr	34.22
Animal Feed Plant No. 2 (EU 103)	5 lb/1,000 gal	1	662 gal/hr	3.31	0 hr/yr	0.00
	84 lb/10^6 ft^3	3	0.093 10^6 ft^3/hr	7.81	8,760 hr/yr	34.22
			Total:	***15.62***	*Total:*	***68.43***
Particulate Matter Total - PM						
West Bag Filter (EU 051)	1.16 lb/hr	4	1 hr	1.16	8,000 hr/yr	4.64
South Baghouse (EU 052)	1.16 lb/hr	4	1 hr	1.16	8,000 hr/yr	4.64
Vessel Loading System (EU 053)	3.10 lb/hr	4	1 hr	3.10	8,000 hr/yr	12.40
East Vessel Loading Facility (EU 061)	0.10 lb/hr	4	1 hr	0.10	8,000 hr/yr	0.40
Animal Feed Plant No. 1 (EU 078)	13 lb/hr	5	1 hr	13.00	8,760 hr/yr	56.94
Diatomaceous Earth Silo (EU 079)	0.053 lb/hr	5	1 hr	0.05	8,760 hr/yr	0.23
Limestone Silo (EU 080)	0.32 lb/hr	5	1 hr	0.32	8,760 hr/yr	1.40
Animal Feed Loadout System (EU 081)	2.06 lb/hr	5	1 hr	2.06	8,760 hr/yr	9.02
Animal Feed Plant No. 2 (EU 103)	13 lb/hr	5	1 hr	13.00	8,760 hr/yr	56.94
New Limestone Silo	0.012 grain/dscf	6	3,700 dscf/min	0.38	8,760 hr/yr	1.67
New AFI Product Building	0.012 grain/dscf	6	3,000 dscf/min	0.31	8,760 hr/yr	1.35
Fugitive Emissions	-- (See Tables 4-4 and 4-5 for calculation) --			4.46		3.45
			Total:	***39.10***	*Total:*	***153.09***
Particulate Matter - PM_{10}						
West Bag Filter (EU 051)	1.16 lb/hr	4	1 hr	1.16	8,000 hr/yr	4.64
South Baghouse (EU 052)	1.16 lb/hr	4	1 hr	1.16	8,000 hr/yr	4.64
Vessel Loading System (EU 053)	3.10 lb/hr	4	1 hr	3.10	8,000 hr/yr	12.40
East Vessel Loading Facility (EU 061)	0.10 lb/hr	4	1 hr	0.10	8,000 hr/yr	0.40
Animal Feed Plant No. 1 (EU 078)	13 lb/hr	5	1 hr	13.00	8,760 hr/yr	56.94
Diatomaceous Earth Silo (EU 079)	0.053 lb/hr	5	1 hr	0.05	8,760 hr/yr	0.23
Limestone Silo (EU 080)	0.32 lb/hr	5	1 hr	0.32	8,760 hr/yr	1.40
Animal Feed Loadout System (EU 081)	2.06 lb/hr	5	1 hr	2.06	8,760 hr/yr	9.02
Animal Feed Plant No. 2 (EU 103)	13 lb/hr	5	1 hr	13.00	8,760 hr/yr	56.94
New Limestone Silo	0.012 grain/dscf	6	3,700 dscf/min	0.38	8,760 hr/yr	1.67
New AFI Product Building	0.012 grain/dscf	6	3,000 dscf/min	0.31	8,760 hr/yr	1.35
Fugitive Emissions	-- (See Tables 4-4 and 4-5 for calculation) --			1.73		1.06
			Total:	***36.37***	*Total:*	***150.69***
Volatile Organic Compounds - VOC						
Animal Feed Plant No. 1 (EU 078)	1.13 lb/1,000 gal	7	662 gal/hr	0.75	400 hr/yr	0.15
	5.5 lb/10^6 ft^3	2	0.093 10^6 ft^3/hr	0.51	8,360 hr/yr	2.14
Animal Feed Plant No. 2 (EU 103)	1.13 lb/1,000 gal	7	662 gal/hr	0.75	400 hr/yr	0.15
	5.5 lb/10^6 ft^3	2	0.093 10^6 ft^3/hr	0.51	8,360 hr/yr	2.14
			Total:	***1.50***	*Total:*	***4.58***
Sulfuric Acid Mist - SAM						
Animal Feed Plant No. 1 (EU 078)	6.13% of SO_2 Factor	8	-- --	2.88	400 hr/yr	0.58
	6.13% of SO_2 Factor	8	-- --	0.003	8,360 hr/yr	0.01
Animal Feed Plant No. 2 (EU 103)	6.13% of SO_2 Factor	8	-- --	2.88	400 hr/yr	0.58
	6.13% of SO_2 Factor	8	-- --	0.003	8,360 hr/yr	0.01
			Total:	***5.76***	*Total:*	***1.18***
Lead - Pb						
Animal Feed Plant No. 1 (EU 078)	0.00151 lb/1,000 gal	9	662 gal/hr	1.00E-03	400 hr/yr	2.00E-04
	0.0005 lb/10^6 ft^3	10	0.093 10^6 ft^3/hr	4.65E-05	8,360 hr/yr	1.94E-04
Animal Feed Plant No. 2 (EU 103)	0.00151 lb/1,000 gal	9	662 gal/hr	1.00E-03	400 hr/yr	2.00E-04
	0.0005 lb/10^6 ft^3	10	0.093 10^6 ft^3/hr	4.65E-05	8,360 hr/yr	1.94E-04
			Total:	***2.00E-03***	*Total:*	***7.89E-04***
Mercury - Hg						
Animal Feed Plant No. 1 (EU 078)	0.000113 lb/1,000 gal	9	662 gal/hr	7.48E-05	400 hr/yr	1.50E-05
	0.00026 lb/10^6 ft^3	10	0.093 10^6 ft^3/hr	2.42E-05	8,360 hr/yr	1.01E-04
Animal Feed Plant No. 2 (EU 103)	0.000113 lb/1,000 gal	9	662 gal/hr	7.48E-05	400 hr/yr	1.50E-05
	0.00026 lb/10^6 ft^3	10	0.093 10^6 ft^3/hr	2.42E-05	8,360 hr/yr	1.01E-04
			Total:	***1.50E-04***	*Total:*	***2.32E-04***
Fluorides - F						
Animal Feed Plant No. 1 (EU 078)	2.11 lb/hr	5	1 hr	2.11	8,760 hr/yr	9.24
			Total:	***2.11***	*Total:*	***9.24***

[a] Short term activity factors based on permit limits established in Permit No. 0570008-036-AC/PSD-FL-315. Fuel firing scenarios are based on which fuel produces the highest hourly emissions.

[b] Annual average activity factors based on Permit No. 0570008-045-AV.

[c] Totals refelct worst-case fuel being burned.

References:

1 Based on AP-42, Table 1.3-1 for fuel oil combustion. 142*(S) lb/1,000 gal, where S = 0.5%.

2 Based on AP-42, Table 1.4-2 for Natural Gas combustion.

3 Based on AP-42, Table 1.4-1 for Natural Gas combustion in small (<100 MMBtu/hr) boilers.

4 Based on Permit No. 0570008-045-AV, Condition H.4.

5 Based on Permit No. 0570008-043-AC/PSD-FL-315D.

6 Based on permitted grain loading for DE Silo, Limestone Silo, and Loadout System (Permit Nos. 0570008-036-AC/PSD-FL-315 & 0570008-043-AC/PSD-FL-315D).

7 Based on AP-42, Table 1.3-3 for Non-Methane Total Organic Compound emissions during No. 6 Fuel Oil combustion in commercial boilers.

8 Based on 5% conversion of SO_2 to SO_3 multiplied by the ratio of the molecular weights of H_2SO_4 and SO_3 (98/80).

9 Based on AP-42, Table 1.3-11 for No. 6 Fuel Oil combustion.

10 Based on AP-42, Table 1.4-4 for Natural Gas combustion.

TABLE 4-4
POTENTIAL CONTROLLED AND FUGITIVE PARTICULATE MATTER EMISSION RATES FOR AFI PRODUCT STORAGE AND DELIVERY SYSTEM
ANIMAL FEED INGREDIENT FACILITY, MOSAIC RIVERVIEW

Process Description	Source Description	Number of Transfer Points	Maximum Fertilizer Throughput[a] (TPH)	Maximum Fertilizer Throughput[a] (TPY)	Moisture Content[b] (%)	Wind Speed[c] (mph)	Calculated PM Emission Factor[d] (lb/ton)	Calculated PM_{10} Emission Factor (lb/ton)	Uncontrolled PM Emission Rate (lb/hr)	Uncontrolled PM Emission Rate (TPY)	Uncontrolled PM_{10} Emission Rate (lb/hr)	Uncontrolled PM_{10} Emission Rate (TPY)	Control Equipment / Measure	Control Efficiency (%)[e]	Maximum Total PM Fugitive Emission Rate (lb/hr)	Maximum Total PM Fugitive Emission Rate (TPY)	Maximum PM_{10} Fugitive Emission Rate (lb/hr)	Maximum PM_{10} Fugitive Emission Rate (TPY)
Product Delivery by Railcar	Drop from railcar to dump conveyor belt	1	100	473,000	1.5	1.3	0.00061	0.00029	0.061	0.145	0.029	0.069		0	0.0615	0.1454	0.0291	0.0688
Product Transfer to Storage Warehouse	Drop from dump conveyor belt to reversible product conveyor belt	1	100	473,000	1.5	1.3	0.00061	0.00029	0.061	0.145	0.029	0.069		0	0.0615	0.1454	0.0291	0.0688
	Drop from reversible product conveyor belt to warehouse feed elevator	1	100	473,000	1.5	1.3	0.00061	0.00029	0.061	0.145	0.029	0.069		0	0.0615	0.1454	0.0291	0.0688
	Drop from warehouse feed elevator to warehouse feed conveyor belt	1	100	473,000	1.5	1.3	0.00061	0.00029	0.061	0.145	0.029	0.069		0	0.0615	0.1454	0.0291	0.0688
	Drop from warehouse feed conveyor belt to product chute	1	100	473,000	1.5	1.3	0.00061	0.00029	0.061	0.145	0.029	0.069		0	0.0615	0.1454	0.0291	0.0688
	Drop from product chute into storage warehouse	1	100	473,000	1.5	1.3	0.00061	0.00029	0.061	0.145	0.029	0.069	Building Enclosure	100	0.0000	0.0000	0.0000	0.0000
Product Transfer from Storage Warehouse to Railcar Dump Hopper	Pickup of product	1	1,000	473,000	1.5	1.3	0.00061	0.00029	0.615	0.145	0.291	0.069	Building Enclosure	100	0.0000	0.0000	0.0000	0.0000
	Drop to product return conveyor belt	1	1,000	473,000	1.5	1.3	0.00061	0.00029	0.615	0.145	0.291	0.069		0	0.6148	0.1454	0.2908	0.0688
	Drop from product return conveyor belt to product return chute	1	1,000	473,000	1.5	1.3	0.00061	0.00029	0.615	0.145	0.291	0.069		0	0.6148	0.1454	0.2908	0.0688
	Drop from product return chute to reversible product conveyor belt	1	1,000	473,000	1.5	1.3	0.00061	0.00029	0.615	0.145	0.291	0.069		0	0.6148	0.1454	0.2908	0.0688
	Drop from reversible product conveyor belt to dump conveyor belt	1	1,000	473,000	1.5	1.3	0.00061	0.00029	0.615	0.145	0.291	0.069		0	0.6148	0.1454	0.2908	0.0688
Product Transfer from Railcar Dump Conveyor Belt to Loadout Hopper	Drop from dump conveyor belt to incline conveyor belt	1	1,000	473,000	1.5	1.3	0.00061	0.00029	0.615	0.145	0.291	0.069	Enclosure Coating Oil	90 90	0.0061	0.0015	0.0029	0.0007
	Drop from incline conveyor belt to shipping conveyor belt	1	1,000	473,000	1.5	1.3	0.00061	0.00029	0.615	0.145	0.291	0.069	Coating Oil	90	0.0615	0.0145	0.0291	0.0069
	Drop from shipping conveyor belt to gantry conveyor belt	1	1,000	473,000	1.5	1.3	0.00061	0.00029	0.615	0.145	0.291	0.069	Coating Oil	90	0.0615	0.0145	0.0291	0.0069
	Loader internal transfer points	2	1,000	473,000	1.5	1.3	0.00061	0.00029	1.230	0.291	0.582	0.138	Coating Oil	90	0.1230	0.0291	0.0582	0.0138
Choke Feeder - Product Loadout to Ships	Drop from loader to ship holds	1	1,000	473,000	1.5	1.3	0.00061	0.00029	0.615	0.145	0.291	0.069	Coating Oil	90	0.0615	0.0145	0.0291	0.0069
														PM/PM_{10} Fugitive Emission Rate From AFI Product Storage and Delivery System:	**3.080**	**1.383**	**1.457**	**0.654**

Footnotes:

[a] Throughput for the transfer of AFI product into the warehouse based on maximum desired annual production (see Table 4-2). Throughput for the loadout of product to railcars, ships, and barges is based on the current permit limit of 1,000 tons per hour on a daily average (Permit No. 0570008-040-AV).

[b] The average AFI product moisture content.

[c] All transfer points are partially to completely enclosed. As such, the wind speed is assumed to be 1.3 mph or the minimum wind speed recommended for use in the AP-42 drop emission factor equation.

[d] 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]
= 0.74 for total suspended particulate and 0.35 for particles smaller than 10 microns
U = mean wind speed [mph]
M = moisture content [%]

[e] Control device capture efficiency and building capture efficiency based on engineering judgement.

TABLE 4-5
POTENTIAL FUGITIVE PARTICULATE MATTER EMISSION RATES FROM INCREASE IN TRUCK TRAFFIC
ANIMAL FEED INGREDIENT FACILITY, MOSAIC RIVERVIEW

	Roundtrip Distance (miles)	Annual Distance[a]	Average Weight (tons)	PM Emission Factor (lb/VMT)	Maximum PM Emissions	PM_{10} Emission Factor (lb/VMT)	Maximum PM_{10} Emissions
Maximum Long-term Emissions	1.2	3,000	28	1.381	2.07 TPY	0.270	0.40 TPY
Maximum Short-term Emissions	1.2	24	28	1.381	1.38 lb/hr	0.270	0.27 lb/hr

[a] Based on 20 additional trucks/day and 2,500 trucks per year.

Calculated using the following equation presented in Section 13.2.1 of AP-42, Compilation of Air Pollutant Emission Factors, January 1995.

$$E = k\,(sL/2)^{0.65}\,(W/3)^{1.5}$$

where,
E = particulate emission rate [lb/VMT]
VMT = vehicle miles traveled (round trip distance x number of vehicles)
k = base emission factor for particulate size range
= 0.082 lb/VMT for PM
= 0.016 lb/VMT for PM_{10}
sL = road surface silt loading
= 0.89 g/m^2, based on testing conducted at CF Industries Plant City phosphate plant.
W = average weight of the vehicles traveling the road [tons]

TABLE 4-6
PSD CONTEMPORANEOUS AND PROJECT EMISSIONS NETTING ANALYSIS
ANIMAL FEED INGREDIENT FACILITY, MOSAIC RIVERVIEW

Source Description	Pollutant Emission Rate (TPY)										
	SO_2	NO_X	CO	PM	PM_{10}	VOC	TRS	SAM	Lead	Mercury	Fluoride
Projected Actual Emissions											
AFI Plant [a]	0.236	39.32	33.02	92.61	92.61	2.16	0.0	0.0144	1.97E-04	1.02E-04	7.56
Fugitive Emissions [b]	0.0	0.0	0.0	3.45	1.06	0.0	0.0	0.0	0.0	0.0	0.0
Total- Projected Actual	**0.236**	**39.32**	**33.02**	**96.07**	**93.67**	**2.16**	**0.0**	**0.0144**	**1.97E-04**	**1.02E-04**	**7.56**
Baseline Actual Emissions											
AFI Plant [c]	0.104	17.27	14.51	41.45	41.45	0.95	0.0	0.0063	8.64E-05	4.49E-05	2.14
Total - Baseline Actual	**0.104**	**17.27**	**14.51**	**41.45**	**41.45**	**0.95**	**0.0**	**0.0063**	**8.64E-05**	**4.49E-05**	**2.14**
Increase Due to Project	**0.132**	**22.04**	**18.51**	**54.62**	**52.22**	**1.21**	**0.0**	**0.0081**	**1.10E-04**	**5.73E-05**	**5.42**
PSD SIGNIFICANT EMISSION RATE	40	40	100	25	15	40	10	7	0.6	0.1	3
Netting Triggered?	No	No	No	Yes	Yes	No	No	No	No	No	Yes
CONTEMPORANEOUS EMISSION CHANGES											
MAP PLANT SHUT DOWN (emissions decreases) [d]	0.0 [f]	0.0 [f]	0.0 [f]	-27.70	-27.70	0.0 [f]	0.0 [f]	0.0 [f]	0.0 [f]	0.0 [f]	-6.12
GTSP PLANT SHUT DOWN (emissions decreases) [d]	0.0 [f]	0.0 [f]	0.0 [f]	-10.33	-10.00	0.0 [f]	0.0 [f]	0.0 [f]	0.0 [f]	0.0 [f]	-13.36
AP STORAGE & LOADING (emissions increases) [e]	0.0 [f]	0.0 [f]	0.0 [f]	0.84	0.40	0.0 [f]	0.0 [f]	0.0 [f]	0.0 [f]	0.0 [f]	0.0
Total Contemporaneous Emission Changes	***0.0*** [f]	***0.0*** [f]	***0.0*** [f]	***-37.19***	***-37.31***	***0.0*** [f]	***0.0*** [f]	***0.0*** [f]	***0.0*** [f]	***0.0*** [f]	***-19.48***
TOTAL NET CHANGE	**0.132**	**22.04**	**18.51**	**17.42**	**14.91**	**1.21**	**0.0**	**0.0081**	**1.10E-04**	**5.73E-05**	**-14.06**
PSD SIGNIFICANT EMISSION RATE	40	40	100	25	15	40	10	7	0.6	0.1	3
PSD REVIEW TRIGGERED?	No	No	No	No	No	No	No	No	No	No	No

[a] See projected actual emissions, Table 4-2.
[b] See fugitive emission calculations, Tables 4-4 and 4-5.
[c] See baseline actual emissions, Table 4-1.
[d] See contemporaneous emissions calculations, Tables B-1 through B-5.
[e] Emissions based on calculations from application submitted for Permit No. 0570008-052-AC.
[f] Project does not result in emission increase above PSD significant rate. Therefore, netting is not triggered for these pollutants.

APPENDIX A

BASELINE ACTUAL EMISSIONS CALCULATIONS FOR THE AFI PLANT

TABLE A-1
BASELINE ACTUAL ANNUAL (1997-2006) EMISSION FACTORS FROM ANNUAL OPERATING REPORTS
ANIMAL FEED INGREDIENT FACILITY AND MATERIAL HANDLING, MOSAIC RIVERVIEW

Source Description	EU ID	Annual Operation (hr/yr)	Annual Process/Fuel	Factor Units	Pollutant Emission Factors							
					SO_2	NO_X	CO	PM	PM_{10}	VOC	SAM	Fluorides
1997 Actual Emission Factors												
--West Bag Filter	*051*	3,900	1,875,192 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]
--South Baghouse	*052*	4,051	1,875,192 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	4,051	1,875,192 tons material processed	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	4,051	1,875,192 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	5,892	86,400 tons product produced	lb/hr	- [A]	- [A]	- [A]	6.0 [B]	6.0 [B]	- [A]	- [A]	0.24 [B]
			265 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	5,255	1,070 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.09 [B]	0.09 [B]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	771	36,300 tons lime produced	lb/hr	- [A]	- [A]	- [A]	0.120 [B]	0.120 [B]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	871	86,400 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.22 [B]	2.22 [B]	- [A]	- [A]	- [A]
1998 Actual Emission Factors												
--West Bag Filter	*051*	3,536	1,857,564 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]
--South Baghouse	*052*	3,754	1,857,564 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	3,754	1,857,564 tons material processed	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	3,754	1,822,641 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	7,198	116,948 tons product produced	lb/hr	- [A]	- [A]	- [A]	0.27 [B]	5.85 [B]	- [A]	- [A]	5.850 [B]
			102.36 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	8,760	1,169 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.09 [B]	0.09 [B]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	54,256 tons lime produced	lb/hr	- [A]	- [A]	- [A]	0.12 [B]	0.12 [B]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	1,077	116,948 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.96 [B]	2.96 [B]	- [A]	- [A]	- [A]
1999 Actual Emission Factors												
--West Bag Filter	*051*	3,282	1,858,785 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0007 [O]	0.0007 [O]	- [A]	- [A]	- [A]
--South Baghouse	*052*	3,282	1,624,767 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0007 [O]	0.0007 [O]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	3,045	1,624,767 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0007 [G]	0.0007 [O]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	3,045	1,624,767 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0003 [O]	0.0003 [G]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	6,572	124,036 tons product produced	lb/ton product	- [A]	- [A]	- [A]	0.27 [H]	0.27 [H]	- [A]	- [A]	0.061 [B]
			108.12 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	8,760	1,305 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.03 [I]	0.03 [I]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	56,908 tons lime produced	lb/ton lime	- [A]	- [A]	- [A]	0.002 [J]	0.002 [J]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	1,240	124,036 tons product processed	lb/ton product	- [A]	- [A]	- [A]	0.01 [J]	0.01 [J]	- [A]	- [A]	- [A]
2000 Actual Emission Factors												
--West Bag Filter	*051*	3,100	1,794,214 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0007 [G]	0.0007 [G]	- [A]	- [A]	- [A]
--South Baghouse	*052*	2,932	1,652,514 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0007 [G]	0.0007 [G]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	2,932	1,794,214 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0007 [G]	0.0007 [O]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	2,932	1,652,514 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0005 [G]	0.0003 [G]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	7,174	131,634 tons product produced	lb/ton product	- [A]	- [A]	- [A]	0.23 [H]	0.23 [H]	- [A]	- [A]	0.007 [H]
			120.35 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	8,784	1,530 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.03 [I]	0.03 [I]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,784	58,495 tons lime produced	lb/ton lime	- [A]	- [A]	- [A]	0.002 [J]	0.002 [J]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	1,363	136,300 tons product processed	lb/ton product	- [A]	- [A]	- [A]	0.01 [J]	0.01 [J]	- [A]	- [A]	- [A]
2001 Actual Emission Factors												
--West Bag Filter	*051*	3,251	1,576,363 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0007 [G]	0.0007 [G]	- [A]	- [A]	- [A]
--South Baghouse	*052*	3,146	1,839,492 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0007 [G]	0.0007 [O]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	3,146	1,839,492 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0007 [G]	0.0007 [G]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	3,146	1,839,492 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.0005 [G]	0.0003 [G]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	7,444	168,839 tons product produced	lb/ton product	- [A]	- [A]	- [A]	0.23 [H]	0.23 [H]	- [A]	- [A]	0.003 [H]
			137.5 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	8,760	1,661 tons material processed	lb/ton material	- [A]	- [A]	- [A]	0.03 [I]	0.03 [I]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	73,306 tons lime produced	lb/ton lime	- [A]	- [A]	- [A]	0.002 [J]	0.002 [J]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	745	168,839 tons product processed	lb/ton product	- [A]	- [A]	- [A]	0.01 [J]	0.01 [J]	- [A]	- [A]	- [A]
2002 Actual Emission Factors												
--West Bag Filter	*051*	3,232	1,675,288 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [K]	1.16 [K]	- [A]	- [A]	- [A]
--South Baghouse	*052*	2,889	1,476,648 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [K]	1.16 [K]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	2,889	1,476,648 tons material processed	lb/hr	- [A]	- [A]	- [A]	3.1 [K]	3.1 [K]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	2,889	1,476,648 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.1 [K]	0.1 [K]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	7,591	159,711 tons product produced	lb/ton product	- [A]	- [A]	- [A]	0.203 [H]	0.203 [H]	- [A]	- [A]	0.005 [H]
			125.96 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	8,760	2,022 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.09 [K]	0.09 [K]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	72,784 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.12 [K]	0.12 [K]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	1,070	159,711 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.22 [K]	2.22 [K]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	*103*	112	7,900 tons product produced	lb/ton product	- [A]	- [A]	- [A]	0.203 [H]	0.203 [H]	- [A]	- [A]	- [A]
			69.20 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
2003 Actual Emission Factors												
--West Bag Filter	*051*	2,816	1,734,669 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [K]	1.16 [K]	- [A]	- [A]	- [A]
--South Baghouse	*052*	3,117	1,734,669 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [K]	1.16 [K]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	3,117	1,734,669 tons material processed	lb/hr	- [A]	- [A]	- [A]	3.1 [K]	3.1 [K]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	3,117	1,734,669 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.1 [K]	0.1 [K]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	6,700	115,604 tons product produced	lb/ton product	- [A]	- [A]	- [A]	0.123 [H]	0.123 [H]	- [A]	- [A]	0.011 [H]
			82.86 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	8,760	3,089 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.09 [K]	0.09 [K]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	97,819 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.09 [K]	0.09 [K]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	1,052	115,604 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.22 [K]	2.22 [K]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	*103*	6,249	106,997 tons product produced	lb/ton product	- [A]	- [A]	- [A]	0.204 [H]	0.204 [H]	- [A]	- [A]	- [A]
			5.98 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
2004 Actual Emission Factors												
--West Bag Filter	*051*	2,223	1,603,974 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [K]	1.16 [K]	- [A]	- [A]	- [A]
--South Baghouse	*052*	2,800	1,603,974 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [K]	1.16 [K]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	2,800	1,603,974 tons material processed	lb/hr	- [A]	- [A]	- [A]	3.1 [K]	3.1 [K]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	2,800	1,603,974 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.1 [K]	0.1 [K]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	6,256	115,806 tons product produced	lb/hr	- [A]	- [A]	- [A]	4.5 [H]	4.5 [H]	- [A]	- [A]	0.024 [H]
			155.8 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	8,760	3,496 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.09 [K]	0.09 [K]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	107,637 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.09 [K]	0.09 [K]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	2,578	255,178 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.22 [K]	2.22 [K]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	*103*	7,415	137,016 tons product produced	lb/hr	- [A]	- [A]	- [A]	5 [H]	5 [H]	- [A]	- [A]	- [A]
			152.1 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
2005 Actual Emission Factors												
--West Bag Filter	*051*	2,005	1,752,231 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [K]	1.16 [K]	- [A]	- [A]	- [A]
--South Baghouse	*052*	3,501	1,752,231 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [K]	1.16 [K]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	3,501	1,752,231 tons material processed	lb/hr	- [A]	- [A]	- [A]	3.1 [K]	3.1 [K]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	3,501	1,752,231 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.1 [K]	0.1 [K]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	6,004	97,877 tons product produced	lb/hr	- [A]	- [A]	- [A]	7.2 [H]	7.2 [H]	- [A]	- [A]	0.049 [H]
			149.68 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	8,760	4,199 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.09 [K]	0.09 [K]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	95,459 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.12 [K]	0.12 [K]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	2,067	217,234 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.22 [K]	2.22 [K]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	*103*	7,808	125,949 tons product produced	lb/ton product	- [A]	- [A]	- [A]	- [L]	- [L]	- [A]	- [A]	- [A]
			154.31 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]

TABLE A-1
BASELINE ACTUAL ANNUAL (1997-2006) EMISSION FACTORS FROM ANNUAL OPERATING REPORTS
ANIMAL FEED INGREDIENT FACILITY AND MATERIAL HANDLING, MOSAIC RIVERVIEW

Source Description	EU ID	Annual Operation (hr/yr)	Annual Process/Fuel	Factor Units	Pollutant Emission Factors							
					SO_2	NO_X	CO	PM	PM_{10}	VOC	SAM	Fluorides
2006 Actual Emission Factors												
--West Bag Filter	*051*	1,976	1,721,158 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [M]	1.16 [M]	- [A]	- [A]	- [A]
--South Baghouse	*052*	3,496	1,451,938 tons material processed	lb/hr	- [A]	- [A]	- [A]	1.16 [M]	1.16 [M]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	3,496	1,670,110 tons material processed	lb/hr	- [A]	- [A]	- [A]	3.1 [M]	3.1 [M]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	3,496	1,670,110 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.1 [M]	0.1 [M]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	5,676	100,789 tons product produced	lb/hr	- [A]	- [A]	- [A]	2.97 [H]	2.97 [H]	- [A]	- [A]	0.012 [H]
			166 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]
--Diatomaceous Earth Silo	*079*	8,760	3,409 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.09 [N]	0.09 [N]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	91,312 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.12 [N]	0.12 [N]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	1,885	220,858 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.22 [N]	2.22 [N]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	*103*	8,112	131,935 tons product produced	lb/ton product	- [A]	- [A]	- [A]	- [L]	- [L]	- [A]	- [A]	- [A]
			221 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [D]	84 [D]	- [E]	- [E]	5.5 [C]	0.037 [F]	- [D]

[A] No emissions reported in the AORs.
[B] Based on emissions as reported in AOR.
[C] Based on AP-42, Table 1.4-2 for Natural Gas combustion.
[D] Based on AP-42, Table 1.4-1 for Natural Gas combustion in small (<100 MMBtu/hr) boilers.
[E] PM and PM_{10} emissions accounted for through stack testing.
[F] Based on 5% conversion of SO_2 to SO_3 multiplied by the ratio of the molecular weights of H_2SO_4 and SO_3 (98/80).
[G] Based on AP-42 Section 13.2.4.
[H] Based on stack testing (see Attachment A-38).
[I] Based on AP-42 Section 6.2.
[J] Based on AP-42 Table 11.17-4.
[K] Maximum permitted emission rate.
[L] Emission factors based on stack tests for EU078.
[M] Based on Permit No. 0570008-045-AV, Condition H.4.
[N] Based on Permit No. 0570008-045-AV, Condition N.4.

TABLE A-2
REVISED EMISSION FACTORS USED TO DETERMINE BASELINE ACTUAL ANNUAL EMISSIONS (1997-2006)
ANIMAL FEED INGREDIENT FACILITY AND MATERIAL HANDLING, MOSAIC RIVERVIEW

Source Sescription	EU ID	Annual Operation (hr/yr)	Annual Process/Fuel	Factor Units	Pollutant Emission Factors SO_2	NO_x	CO	PM	PM_{10}	VOC	SAM	Lead	Mercury	Fluorides
1997 Actual Emission Factors														
--West Bag Filter	051	3,900	1,875,192 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	052	4,051	1,875,192 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	053	4,051	1,875,192 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	061	4,051	1,875,192 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	078	5,892	86,400 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3136 [C]	0.3136 [C]	- [A]	- [A]	- [A]	- [A]	0.0320 [C]
			265 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	079	5,255	1,070 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	080	771	36,300 tons lime produced	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	081	871	86,400 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
1998 Actual Emission Factors														
--West Bag Filter	051	3,536	1,857,564 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	052	3,754	1,857,564 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	053	3,754	1,857,564 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	061	3,754	1,822,641 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	078	7,198	116,948 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3136 [C]	0.3136 [C]	- [A]	- [A]	- [A]	- [A]	0.0320 [C]
			102.36 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	079	8,760	1,169 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	080	8,760	54,256 tons lime produced	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	081	1,077	116,948 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
1999 Actual Emission Factors														
--West Bag Filter	051	3,282	1,858,785 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	052	3,282	1,624,767 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	053	3,045	1,624,767 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	061	3,045	1,624,767 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	078	6,572	124,036 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3136 [C]	0.3136 [C]	- [A]	- [A]	- [A]	- [A]	0.0320 [C]
			108.12 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	079	8,760	1,305 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	080	8,760	56,908 tons lime produced	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	081	1,240	124,036 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
2000 Actual Emission Factors														
--West Bag Filter	051	3,100	1,794,214 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	052	2,932	1,652,514 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	053	2,932	1,794,214 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	061	2,932	1,652,514 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	078	7,174	131,634 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3136 [C]	0.3136 [C]	- [A]	- [A]	- [A]	- [A]	0.0320 [C]
			120.35 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	079	8,784	1,530 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	080	8,784	58,495 tons lime produced	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	081	1,363	136,300 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
2001 Actual Emission Factors														
--West Bag Filter	051	3,251	1,576,363 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	052	3,146	1,839,492 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	053	3,146	1,839,492 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	061	3,146	1,839,492 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	078	7,444	168,839 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3073 [C]	0.3073 [C]	- [A]	- [A]	- [A]	- [A]	0.0298 [C]
			137.5 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	079	8,760	1,661 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	080	8,760	73,306 tons lime produced	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	081	745	168,839 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
2002 Actual Emission Factors														
--West Bag Filter	051	3,232	1,675,288 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	052	2,889	1,476,648 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	053	2,889	1,476,648 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	061	2,889	1,476,648 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	078	7,591	159,711 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.2558 [C]	0.2558 [C]	- [A]	- [A]	- [A]	- [A]	0.0275 [C]
			125.96 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	079	8,760	2,022 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	080	8,760	72,784 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	081	1,070	159,711 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	103	112	7,900 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3549 [C]	0.3549 [C]	- [A]	- [A]	- [A]	- [A]	- [A]
			69.2 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
2003 Actual Emission Factors														
--West Bag Filter	051	2,816	1,734,669 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	052	3,117	1,734,669 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	053	3,117	1,734,669 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	061	3,117	1,734,669 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	078	6,700	115,604 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.1965 [C]	0.1965 [C]	- [A]	- [A]	- [A]	- [A]	0.0174 [C]
			82.86 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	079	8,760	3,089 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	080	8,760	97,819 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	081	1,052	115,604 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	103	6,249	106,997 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3549 [C]	0.3549 [C]	- [A]	- [A]	- [A]	- [A]	- [A]
			5.98 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
2004 Actual Emission Factors														
--West Bag Filter	051	2,223	1,603,974 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	052	2,800	1,603,974 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	053	2,800	1,603,974 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	061	2,800	1,603,974 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	078	6,256	115,806 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.2058 [C]	0.2058 [C]	- [A]	- [A]	- [A]	- [A]	0.0100 [C]
			155.8 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	079	8,760	3,496 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	080	8,760	107,637 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	081	2,578	255,178 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	103	7,415	137,016 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3549 [C]	0.3549 [C]	- [A]	- [A]	- [A]	- [A]	- [H]
			152.1 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]

TABLE A-2
REVISED EMISSION FACTORS USED TO DETERMINE BASELINE ACTUAL ANNUAL EMISSIONS (1997-2006)
ANIMAL FEED INGREDIENT FACILITY AND MATERIAL HANDLING, MOSAIC RIVERVIEW

Source Sescription	EU ID	Annual Operation (hr/yr)	Annual Process/Fuel	Factor Units	Pollutant Emission Factors									
					SO_2	NO_x	CO	PM	PM_{10}	VOC	SAM	Lead	Mercury	Fluorides
2005 Actual Emission Factors														
--West Bag Filter	*051*	2,005	1,752,231 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	*052*	3,501	1,752,231 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	3,501	1,752,231 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	3,501	1,752,231 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	6,004	97,877 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.2482 [C]	0.2482 [C]	- [A]	- [A]	- [A]	- [A]	0.0184 [C]
			149.68 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	*079*	8,760	4,199 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	95,459 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	2,067	217,234 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	*103*	7,808	125,949 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3549 [C]	0.3549 [C]	- [A]	- [A]	- [A]	- [A]	- [H]
			154.31 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
2006 Actual Emission Factors														
--West Bag Filter	*051*	1,976	1,721,158 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--South Baghouse	*052*	3,496	1,451,938 tons material transferred	lb/hr	- [A]	- [A]	- [A]	1.16 [B]	1.16 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Vessel Loading System	*053*	3,496	1,670,110 tons material transferred	lb/hr	- [A]	- [A]	- [A]	3.10 [B]	3.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--East Vessel Loading Facility	*061*	3,496	1,670,110 tons material transferred	lb/hr	- [A]	- [A]	- [A]	0.10 [B]	0.10 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 1	*078*	5,676	100,789 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.2356 [C]	0.2356 [C]	- [A]	- [A]	- [A]	- [A]	0.0201 [C]
			166 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]
--Diatomaceous Earth Silo	*079*	8,760	3,409 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.053 [D]	0.053 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Limestone Silo	*080*	8,760	91,312 tons material processed	lb/hr	- [A]	- [A]	- [A]	0.32 [D]	0.32 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Loadout System	*081*	1,885	220,858 tons product processed	lb/hr	- [A]	- [A]	- [A]	2.06 [D]	2.06 [D]	- [A]	- [A]	- [A]	- [A]	- [A]
--Animal Feed Plant No. 2	*103*	8,112	131,935 tons product produced	lb/ton material	- [A]	- [A]	- [A]	0.3549 [C]	0.3549 [C]	- [A]	- [A]	- [A]	- [A]	- [H]
			221 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [E]	100 [F]	84 [F]	- [G]	- [G]	5.5 [E]	0.037 [J]	5.0E-04 [E]	2.6E-04 [I]	- [F]

[A] No emission factors exist for this pollutant emitted by this process/fuel.
[B] Based on Permit No. 0570008-045-AV, Condition H.4.
[C] Based on 5-year average stack testing (see Table A-36).
[D] Based on Permit No. 0570008-043-AC/PSD-FL-315D.
[E] Based on AP-42, Table 1.4-2 for Natural Gas combustion.
[F] Based on AP-42, Table 1.4-1 for Natural Gas combustion in small (<100 MMBtu/hr) boilers.
[G] Overall PM and PM_{10} emissions captured for natural gas burning during the stack tests performed (see Table A-36).
[H] All Fluorine emissions from Animal Feed Plants come from Animal Feed Plant No. 1 (EU 078).
[I] Based on AP-42, Table 1.4-4 for Natural Gas combustion.
[J] Based on 5% conversion of SO_2 to SO_3 multiplied by the ratio of the molecular weights of H_2SO_4 and SO_3 (98/80).

TABLE A-3
BASELINE ACTUAL EMISSIONS
ANIMAL FEED INGREDIENT FACILITY AND MATERIAL HANDLING, MOSAIC RIVERVIEW

Source Description	EU ID	Pollutant Emission Rate (TPY) ᵃ									
		SO_2	NO_x	CO	PM	PM_{10}	VOC	SAM	Lead	Mercury	Fluorides
1997 Actual Emissions											
--West Bag Filter	051	-	-	-	2.26	2.26	-	-	-	-	-
--South Baghouse	052	-	-	-	2.35	2.35	-	-	-	-	-
--Vessel Loading System	053	-	-	-	6.28	6.28	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.20	0.20	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.080	13.250	11.130	13.547	13.547	0.729	0.0049	6.63E-05	3.45E-05	1.381
--Diatomaceous Earth Silo	*079*	-	-	-	0.139	0.139	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	0.123	0.123	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	0.897	0.897	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	-	-	-	-	-	-	-	-	-	-
--Total		***0.080***	***13.250***	***11.130***	***25.800***	***25.800***	***0.729***	***0.0049***	***6.63E-05***	***3.45E-05***	***1.381***
1998 Actual Emissions											
--West Bag Filter	051	-	-	-	2.05	2.05	-	-	-	-	-
--South Baghouse	052	-	-	-	2.18	2.18	-	-	-	-	-
--Vessel Loading System	053	-	-	-	5.82	5.82	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.19	0.19	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.031	5.118	4.299	18.337	18.337	0.281	0.0019	2.56E-05	1.33E-05	1.869
--Diatomaceous Earth Silo	*079*	-	-	-	0.232	0.232	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.402	1.402	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.109	1.109	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	-	-	-	-	-	-	-	-	-	-
--Total		***0.031***	***5.118***	***4.299***	***31.314***	***31.314***	***0.281***	***0.0019***	***2.56E-05***	***1.33E-05***	***1.869***
1999 Actual Emissions											
--West Bag Filter	051	-	-	-	1.90	1.90	-	-	-	-	-
--South Baghouse	052	-	-	-	1.90	1.90	-	-	-	-	-
--Vessel Loading System	053	-	-	-	4.72	4.72	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.15	0.15	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.032	5.406	4.541	19.448	19.448	0.297	0.0020	2.70E-05	1.41E-05	1.982
--Diatomaceous Earth Silo	*079*	-	-	-	0.232	0.232	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.402	1.402	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.277	1.277	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	-	-	-	-	-	-	-	-	-	-
--Total		***0.032***	***5.406***	***4.541***	***31.038***	***31.038***	***0.297***	***0.0020***	***2.70E-05***	***1.41E-05***	***1.982***
2000 Actual Emissions											
--West Bag Filter	051	-	-	-	1.80	1.80	-	-	-	-	-
--South Baghouse	052	-	-	-	1.70	1.70	-	-	-	-	-
--Vessel Loading System	053	-	-	-	4.54	4.54	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.15	0.15	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.036	6.018	5.055	20.226	20.226	0.331	0.0022	3.01E-05	1.56E-05	1.963
--Diatomaceous Earth Silo	*079*	-	-	-	0.233	0.233	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.405	1.405	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.404	1.404	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	-	-	-	-	-	-	-	-	-	-
--Total		***0.036***	***6.018***	***5.055***	***31.458***	***31.458***	***0.331***	***0.0022***	***3.01E-05***	***1.56E-05***	***1.963***
2001 Actual Emissions											
--West Bag Filter	051	-	-	-	1.89	1.89	-	-	-	-	-
--South Baghouse	052	-	-	-	1.82	1.82	-	-	-	-	-
--Vessel Loading System	053	-	-	-	4.88	4.88	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.16	0.16	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.041	6.875	5.775	21.592	21.592	0.378	0.0025	3.44E-05	1.79E-05	2.321
--Diatomaceous Earth Silo	*079*	-	-	-	0.232	0.232	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.402	1.402	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	0.767	0.767	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	-	-	-	-	-	-	-	-	-	-
--Total		***0.041***	***6.875***	***5.775***	***32.737***	***32.737***	***0.378***	***0.0025***	***3.44E-05***	***1.79E-05***	***2.321***
2002 Actual Emissions											
--West Bag Filter	051	-	-	-	1.87	1.87	-	-	-	-	-
--South Baghouse	052	-	-	-	1.68	1.68	-	-	-	-	-
--Vessel Loading System	053	-	-	-	4.48	4.48	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.14	0.14	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.038	6.298	5.290	15.692	15.692	0.346	0.0023	3.15E-05	1.64E-05	1.388
--Diatomaceous Earth Silo	*079*	-	-	-	0.232	0.232	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.402	1.402	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.102	1.102	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.021	3.460	2.906	0.984	0.984	0.190	0.0013	1.73E-05	9.00E-06	-
--Total		***0.059***	***9.758***	***8.197***	***27.584***	***27.584***	***0.537***	***0.0036***	***4.88E-05***	***2.54E-05***	***1.388***
2003 Actual Emissions											
--West Bag Filter	051	-	-	-	1.63	1.63	-	-	-	-	-
--South Baghouse	052	-	-	-	1.81	1.81	-	-	-	-	-
--Vessel Loading System	053	-	-	-	4.83	4.83	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.16	0.16	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.025	4.143	3.480	11.897	11.897	0.228	0.0015	2.07E-05	1.08E-05	0.575
--Diatomaceous Earth Silo	*079*	-	-	-	0.232	0.232	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.402	1.402	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.084	1.084	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.002	0.299	0.251	13.331	13.331	0.016	0.0001	1.50E-06	7.77E-07	-
--Total		***0.027***	***4.442***	***3.731***	***36.373***	***36.373***	***0.244***	***0.0016***	***2.22E-05***	***1.15E-05***	***0.575***
2004 Actual Emissions											
--West Bag Filter	051	-	-	-	1.29	1.29	-	-	-	-	-
--South Baghouse	052	-	-	-	1.62	1.62	-	-	-	-	-
--Vessel Loading System	053	-	-	-	4.34	4.34	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.14	0.14	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.047	7.790	6.544	14.369	14.369	0.428	0.0029	3.90E-05	2.03E-05	1.064
--Diatomaceous Earth Silo	*079*	-	-	-	0.232	0.232	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.402	1.402	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	2.655	2.655	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.046	7.605	6.388	17.071	17.071	0.418	0.0028	3.80E-05	1.98E-05	-
--Total		***0.092***	***15.395***	***12.932***	***43.122***	***43.122***	***0.847***	***0.0057***	***7.70E-05***	***4.00E-05***	***1.064***
2005 Actual Emissions											
--West Bag Filter	051	-	-	-	1.16	1.16	-	-	-	-	-
--South Baghouse	052	-	-	-	2.03	2.03	-	-	-	-	-
--Vessel Loading System	053	-	-	-	5.43	5.43	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.18	0.18	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.045	7.484	6.287	11.530	11.530	0.412	0.0028	3.74E-05	1.95E-05	0.985
--Diatomaceous Earth Silo	*079*	-	-	-	0.232	0.232	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.402	1.402	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	2.129	2.129	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.046	7.716	6.481	15.692	15.692	0.424	0.0028	3.86E-05	2.01E-05	-
--Total		***0.091***	***15.200***	***12.768***	***39.780***	***39.780***	***0.836***	***0.0056***	***7.60E-05***	***3.95E-05***	***0.985***
2006 Actual Emissions											
--West Bag Filter	051	-	-	-	1.15	1.15	-	-	-	-	-
--South Baghouse	052	-	-	-	2.03	2.03	-	-	-	-	-
--Vessel Loading System	053	-	-	-	5.42	5.42	-	-	-	-	-
--East Vessel Loading Facility	061	-	-	-	0.17	0.17	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.050	8.300	6.972	13.037	13.037	0.457	0.0031	4.15E-05	2.16E-05	1.264
--Diatomaceous Earth Silo	*079*	-	-	-	0.232	0.232	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.402	1.402	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.942	1.942	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.066	11.050	9.282	16.438	16.438	0.608	0.0041	5.53E-05	2.87E-05	-
--Total		***0.116***	***19.350***	***16.254***	***41.817***	***41.817***	***1.064***	***0.0071***	***9.68E-05***	***5.03E-05***	***1.264***

TPY = Tons per year.

Notes:
ᵃ See Table A-2 for emission factors and operating data.

TABLE A-4
SUMMARY OF BASELINE 2-YEAR AVERAGE ACTUAL EMISSIONS
ANIMAL FEED INGREDIENT FACILITY AND MATERIAL HANDLING, MOSAIC RIVERVIEW

Source	EU	Pollutant Emission Rate (TPY) [a]									
Description	ID	SO_2	NO_x	CO	PM	PM_{10}	VOC	SAM	Lead	Mercury	Fluorides
1997 - 1998 Average Emissions											
--West Bag Filter	*051*	-	-	-	2.16	2.16	-	-	-	-	-
--South Baghouse	*052*	-	-	-	2.26	2.26	-	-	-	-	-
--Vessel Loading System	*053*	-	-	-	6.05	6.05	-	-	-	-	-
--East Vessel Loading Facility	*061*	-	-	-	0.20	0.20	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.055	9.18	7.71	15.94	15.94	0.505	0.0034	4.59E-05	2.39E-05	1.63
--Diatomaceous Earth Silo	*079*	-	-	-	0.19	0.19	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	0.76	0.76	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.00	1.00	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	-	-	-	-	-	-	-	-	-	-
--Total		***0.055***	***9.184***	***7.715***	***28.557***	***28.557***	***0.505***	***0.0034***	***4.59E-05***	***2.39E-05***	***1.63***
1998 - 1999 Average Emissions											
--West Bag Filter	*051*	-	-	-	1.98	1.98	-	-	-	-	-
--South Baghouse	*052*	-	-	-	2.04	2.04	-	-	-	-	-
--Vessel Loading System	*053*	-	-	-	5.27	5.27	-	-	-	-	-
--East Vessel Loading Facility	*061*	-	-	-	0.17	0.17	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.032	5.26	4.42	18.89	18.89	0.289	0.0019	2.63E-05	1.37E-05	1.93
--Diatomaceous Earth Silo	*079*	-	-	-	0.23	0.23	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.40	1.40	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.19	1.19	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	-	-	-	-	-	-	-	-	-	-
--Total		**0.032**	**5.26**	**4.42**	**31.18**	**31.18**	**0.289**	**0.0019**	**2.63E-05**	**1.37E-05**	**1.93**
1999 - 2000 Average Emissions											
--West Bag Filter	*051*	-	-	-	1.85	1.85	-	-	-	-	-
--South Baghouse	*052*	-	-	-	1.80	1.80	-	-	-	-	-
--Vessel Loading System	*053*	-	-	-	4.63	4.63	-	-	-	-	-
--East Vessel Loading Facility	*061*	-	-	-	0.15	0.15	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.034	5.71	4.80	19.84	19.84	0.314	0.0021	2.86E-05	1.49E-05	1.97
--Diatomaceous Earth Silo	*079*	-	-	-	0.23	0.23	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.40	1.40	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.34	1.34	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	-	-	-	-	-	-	-	-	-	-
--Total		**0.034**	**5.71**	**4.80**	**31.25**	**31.25**	**0.314**	**0.0021**	**2.86E-05**	**1.49E-05**	**1.97**
2000 - 2001 Average Emissions											
--West Bag Filter	*051*	-	-	-	1.84	1.84	-	-	-	-	-
--South Baghouse	*052*	-	-	-	1.76	1.76	-	-	-	-	-
--Vessel Loading System	*053*	-	-	-	4.71	4.71	-	-	-	-	-
--East Vessel Loading Facility	*061*	-	-	-	0.15	0.15	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.039	6.45	5.41	20.91	20.91	0.355	0.0024	3.22E-05	1.68E-05	2.14
--Diatomaceous Earth Silo	*079*	-	-	-	0.23	0.23	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.40	1.40	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.09	1.09	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	-	-	-	-	-	-	-	-	-	-
--Total		**0.039**	**6.45**	**5.41**	**32.10**	**32.10**	**0.355**	**0.0024**	**3.22E-05**	**1.68E-05**	**2.14**
2001 - 2002 Average Emissions											
--West Bag Filter	*051*	-	-	-	1.88	1.88	-	-	-	-	-
--South Baghouse	*052*	-	-	-	1.75	1.75	-	-	-	-	-
--Vessel Loading System	*053*	-	-	-	4.68	4.68	-	-	-	-	-
--East Vessel Loading Facility	*061*	-	-	-	0.15	0.15	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.040	6.59	5.53	18.64	18.64	0.362	0.0024	3.29E-05	1.71E-05	1.85
--Diatomaceous Earth Silo	*079*	-	-	-	0.23	0.23	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.40	1.40	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	0.93	0.93	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.010	1.73	1.45	0.49	0.49	0.095	0.0006	8.65E-06	4.50E-06	-
--Total		**0.050**	**8.32**	**6.99**	**30.16**	**30.16**	**0.457**	**0.0031**	**4.16E-05**	**2.16E-05**	**1.85**
2002 - 2003 Average Emissions											
--West Bag Filter	*051*	-	-	-	1.75	1.75	-	-	-	-	-
--South Baghouse	*052*	-	-	-	1.74	1.74	-	-	-	-	-
--Vessel Loading System	*053*	-	-	-	4.65	4.65	-	-	-	-	-
--East Vessel Loading Facility	*061*	-	-	-	0.15	0.15	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.031	5.22	4.39	13.79	13.79	0.287	0.0019	2.61E-05	1.36E-05	0.98
--Diatomaceous Earth Silo	*079*	-	-	-	0.23	0.23	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.40	1.40	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.09	1.09	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.011	1.88	1.58	7.16	7.16	0.103	0.0007	9.40E-06	4.89E-06	-
--Total		**0.043**	**7.10**	**5.96**	**31.98**	**31.98**	**0.391**	**0.0026**	**3.55E-05**	**1.85E-05**	**0.98**
2003 - 2004 Average Emissions											
--West Bag Filter	*051*	-	-	-	1.46	1.46	-	-	-	-	-
--South Baghouse	*052*	-	-	-	1.72	1.72	-	-	-	-	-
--Vessel Loading System	*053*	-	-	-	4.59	4.59	-	-	-	-	-
--East Vessel Loading Facility	*061*	-	-	-	0.15	0.15	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.036	5.97	5.01	13.13	13.13	0.328	0.0022	2.98E-05	1.55E-05	0.82
--Diatomaceous Earth Silo	*079*	-	-	-	0.23	0.23	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.40	1.40	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	1.87	1.87	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.024	3.95	3.32	15.20	15.20	0.217	0.0015	1.98E-05	1.03E-05	-
--Total		**0.060**	**9.92**	**8.33**	**39.75**	**39.75**	**0.546**	**0.0036**	**4.96E-05**	**2.58E-05**	**0.82**
2004 - 2005 Average Emissions											
--West Bag Filter	*051*	-	-	-	1.23	1.23	-	-	-	-	-
--South Baghouse	*052*	-	-	-	1.83	1.83	-	-	-	-	-
--Vessel Loading System	*053*	-	-	-	4.88	4.88	-	-	-	-	-
--East Vessel Loading Facility	*061*	-	-	-	0.16	0.16	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.046	7.64	6.42	12.95	12.95	0.420	0.0028	3.82E-05	1.99E-05	1.02
--Diatomaceous Earth Silo	*079*	-	-	-	0.23	0.23	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.40	1.40	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	2.39	2.39	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.046	7.66	6.43	16.38	16.38	0.421	0.0028	3.83E-05	1.99E-05	-
--Total		**0.092**	**15.30**	**12.85**	**41.45**	**41.45**	**0.841**	**0.0056**	**7.65E-05**	**3.98E-05**	**1.02**
2005 - 2006 Average Emissions											
--West Bag Filter	*051*	-	-	-	1.15	1.15	-	-	-	-	-
--South Baghouse	*052*	-	-	-	2.03	2.03	-	-	-	-	-
--Vessel Loading System	*053*	-	-	-	5.42	5.42	-	-	-	-	-
--East Vessel Loading Facility	*061*	-	-	-	0.17	0.17	-	-	-	-	-
--Animal Feed Plant No. 1	*078*	0.047	7.89	6.63	12.28	12.28	0.434	0.0029	3.95E-05	2.05E-05	1.12
--Diatomaceous Earth Silo	*079*	-	-	-	0.23	0.23	-	-	-	-	-
--Limestone Silo	*080*	-	-	-	1.40	1.40	-	-	-	-	-
--Animal Feed Loadout System	*081*	-	-	-	2.04	2.04	-	-	-	-	-
--Animal Feed Plant No. 2	*103*	0.056	9.38	7.88	16.06	16.06	0.516	0.0034	4.69E-05	2.44E-05	-
--Total		**0.104**	**17.27**	**14.51**	**40.80**	**40.80**	**0.950**	**0.0063**	**8.64E-05**	**4.49E-05**	**1.12**
Average Actual Emissions of Highest 2-Year Period											
		'05-'06	**'05-'06**	**'05-'06**	**'04-'05**	**'04-'05**	**'05-'06**	**'05-'06**	**'05-'06**	**'05-'06**	**'00-'01**
--Total		**0.104**	**17.27**	**14.51**	**41.45**	**41.45**	**0.950**	**0.0063**	**8.64E-05**	**4.49E-05**	**2.14**

TPY = Tons per year.

Notes:
[a] See Table A-2 for emission factors.

TABLE A-5
STACK TESTS AND EMISSIONS DATA
ANIMAL FEED INGREDIENT FACILITY, MOSAIC RIVERVIEW

Test Date	Fluorides Emission Rate	Fluorides Converted Rate[a] (lb/ton)	Fluorides Averaging Period	Fluorides Avg. Rate (lb/ton)	PM Emission Rate	PM Converted Rate[a] (lb/ton)	PM Averaging Period	PM Avg. Rate (lb/ton)	PM_{10} Emission Rate	PM_{10} Converted Rate[a] (lb/ton)	PM_{10} Averaging Period	PM_{10} Avg. Rate (lb/ton)
Animal Feed No. 1 (EU 078)												
1993	-- Emission Unit did not exist											
1994	-- Emission Unit did not exist											
1995	-- Emission Unit did not operate											
1996	0.15 lb/hr	0.014			2.82 lb/hr	0.255			2.82 lb/hr	0.255		
1997	0.24 lb/hr	0.017	1996-2000	0.0320	6 lb/hr	0.409	1996-2000	0.3136	6 lb/hr	0.409	1996-2000	0.3136
1998	0.27 lb/hr	0.062	1996-2000	0.0320	5.85 lb/hr	0.360	1996-2000	0.3136	5.85 lb/hr	0.360	1996-2000	0.3136
1999	1.15 lb/hr	0.061	1996-2000	0.0320			1996-2000	0.3136			1996-2000	0.3136
8/24/2000	0.007 lb/ton product	0.007	1997-2001	0.0298	0.23 lb/ton product	0.230	1997-2001	0.3073	0.23 lb/ton product	0.230	1997-2001	0.3073
3/22/2001	0.003 lb/ton product	0.003	1998-2002	0.0275	0.23 lb/ton product	0.230	1998-2002	0.2558	0.23 lb/ton product	0.230	1998-2002	0.2558
2/2/2002	0.005 lb/ton product	0.005	1999-2003	0.0174	0.203 lb/ton product	0.203	1999-2003	0.1965	0.203 lb/ton product	0.203	1999-2003	0.1965
5/7/2003	0.011 lb/ton product	0.011	2000-2004	0.0100	0.123 lb/ton product	0.123	2000-2004	0.2058	0.123 lb/ton product	0.123	2000-2004	0.2058
5/13/2004	0.44 lb/hr	0.024	2001-2005	0.0184	4.5 lb/hr	0.243	2001-2005	0.2482	4.5 lb/hr	0.243	2001-2005	0.2482
7/29/2005	0.80 lb/hr	0.049	2002-2006	0.0201	7.2 lb/hr	0.442	2002-2006	0.2356	7.2 lb/hr	0.442	2002-2006	0.2356
6/23/2006	0.21 lb/hr	0.012	2003-2007	0.0251	2.97 lb/hr	0.167	2003-2007	0.2587	2.97 lb/hr	0.167	2003-2007	0.2587
5/15/2007	0.74 lb/hr	0.030			7.89 lb/hr	0.318			7.89 lb/hr	0.318		
Animal Feed Plant No. 2 (EU 103)												
5/8/2003					0.204 lb/ton product	0.204	2003-2007	0.2492	0.204 lb/ton product	0.204	2003-2007	0.2492
5/20/2004					5.0 lb/hr	0.194			5.0 lb/hr	0.194		
8/4/2005					4.5 lb/hr	0.190			4.5 lb/hr	0.190		
7/11/2006					2.1 lb/hr	0.082			2.1 lb/hr	0.082		
10/24/2006					11.9 lb/hr	0.732			11.9 lb/hr	0.732		
5/31/2007					3.1 lb/hr	0.093			3.1 lb/hr	0.093		

[a] To convert from lb/hr to lb/ton multiply by operating hours and divide by throughput from Table A-1.

TABLE A-6
BASELINE ACTUAL OPERATING CONDITIONS
ANIMAL FEED INGREDIENT FACILITY, MOSAIC RIVERVIEW

						2-Year Average			
Year	Plant Operation (hours)	Material/Product (tons/yr)	Natural Gas (10^6 ft^3/yr)	Calculated Factor (10^6 ft^3/ton product)	2-Year Period	Plant Operation (hours)	Material/Product (tons/yr)	Natural Gas (10^6 ft^3)	Calculated Factor (10^6 ft^3/ton product)
Animal Feed Plant No. 1 (EU 078)									
1996 [a]	5,688	62,873	250.0	0.00398	--	--	--	--	--
1997 [a]	5,892	86,400	265.0	0.00307	1996 - 1997	5,790	74,637	257.5	0.00352
1998	7,198	116,948	102.4	0.00088	1997 - 1998	6,545	101,674	183.7	0.00197
1999	6,572	124,036	108.1	0.00087	1998 - 1999	6,885	120,492	105.2	0.00087
2000	7,174	131,634	120.4	0.00091	1999 - 2000	6,873	127,835	114.2	0.00089
2001	7,444	168,839	137.5	0.00081	2000 - 2001	7,309	150,237	128.9	0.00086
2002	7,591	159,711	126.0	0.00079	2001 - 2002	7,518	164,275	131.7	0.00080
2003	6,700	115,604	82.9	0.00072	2002 - 2003	7,146	137,658	104.4	0.00075
2004	6,256	115,806	155.8	0.00135	2003 - 2004	6,478	115,705	119.3	0.00103
2005	6,004	97,877	149.7	0.00153	2004 - 2005	6,130	106,842	152.7	0.00144
2006	5,676	100,789	166.0	0.00165	2005 - 2006	5,840	99,333	157.8	0.00159
Maximum:	7,591	168,839	166.0	0.00165		**Maximum 2-Year Average Conditions**			
Average:	6,735	125,694	127.6	0.00106		**'01-'02**	**'01-'02**	**'05-'06**	**'05-'06**
Minimum:	5,676	97,877	82.9	0.00072		7,518	164,275	157.8	0.00159
Diatomaceous Earth Silo (EU 079)									
1996 [a]	212	140	--	--	--	--	--	--	--
1997	5,255	1,070	--	--	1996 - 1997	2,734	605	--	--
1998	8,760	1,169	--	--	1997 - 1998	7,008	1,120	--	--
1999	8,760	1,305	--	--	1998 - 1999	8,760	1,237	--	--
2000	8,760	1,530	--	--	1999 - 2000	8,760	1,418	--	--
2001	8,760	1,661	--	--	2000 - 2001	8,760	1,596	--	--
2002	8,760	2,022	--	--	2001 - 2002	8,760	1,842	--	--
2003	8,760	3,089	--	--	2002 - 2003	8,760	2,556	--	--
2004	8,760	3,496	--	--	2003 - 2004	8,760	3,293	--	--
2005	8,760	4,199	--	--	2004 - 2005	8,760	3,848	--	--
2006	8,760	3,409	--	--	2005 - 2006	8,760	3,804	--	--
Maximum:	8,760	4,199	--	--		**Maximum 2-Year Average Conditions**			
Average:	8,410	2,295	--	--		**'98-'06**	**'04-'05**	**--**	**--**
Minimum:	5,255	1,070	--	--		8,760	3,848	0.0	0.0
Limestone Silo (EU 080)									
1996 [a]	1,111	37,000	--	--	--	--	--	--	--
1997 [a]	771	36,300	--	--	1996 - 1997	941	36,650	--	--
1998	8,760	54,256	--	--	1997 - 1998	4,766	45,278	--	--
1999	8,760	56,908	--	--	1998 - 1999	8,760	55,582	--	--
2000	8,760	58,495	--	--	1999 - 2000	8,760	57,702	--	--
2001	8,760	73,306	--	--	2000 - 2001	8,760	65,901	--	--
2002	8,760	72,784	--	--	2001 - 2002	8,760	73,045	--	--
2003	8,760	97,819	--	--	2002 - 2003	8,760	85,302	--	--
2004	8,760	107,637	--	--	2003 - 2004	8,760	102,728	--	--
2005	8,760	95,459	--	--	2004 - 2005	8,760	101,548	--	--
2006	8,760	91,312	--	--	2005 - 2006	8,760	93,386	--	--
Maximum:	8,760	107,637	--	--		**Maximum 2-Year Average Conditions**			
Average:	8,760	78,664	--	--		**'98-'06**	**'03-'04**	**--**	**--**
Minimum:	8,760	54,256	--	--		8,760	102,728	0.0	0.0
Animal Feed Loadout System (EU 081)									
1996	812	81,200	--	--	--	--	--	--	--
1997	871	86,400	--	--	1996 - 1997	842	83,800	--	--
1998	1,077	116,948	--	--	1997 - 1998	974	101,674	--	--
1999	1,240	124,036	--	--	1998 - 1999	1,159	120,492	--	--
2000	1,363	136,300	--	--	1999 - 2000	1,302	130,168	--	--
2001	745	168,839	--	--	2000 - 2001	1,054	152,570	--	--
2002	1,070	159,711	--	--	2001 - 2002	908	164,275	--	--
2003	1,052	115,604	--	--	2002 - 2003	1,061	137,658	--	--
2004	2,578	255,178	--	--	2003 - 2004	1,815	185,391	--	--
2005	2,067	217,234	--	--	2004 - 2005	2,323	236,206	--	--
2006	1,885	220,858	--	--	2005 - 2006	1,976	219,046	--	--
Maximum:	2,578	255,178	--	--		**Maximum 2-Year Average Conditions**			
Average:	1,395	152,937	--	--		**'04-'05**	**'04-'05**	**--**	**--**
Minimum:	745	81,200	--	--		2,323	236,206	0.0	0.0
Animal Feed Plant No. 2 (EU 103)									
1996	--	--	--	--	--	--	--	--	--
1997	--	--	--	--	1996 - 1997	--	--	--	--
1998	--	--	--	--	1997 - 1998	--	--	--	--
1999	--	--	--	--	1998 - 1999	--	--	--	--
2000	--	--	--	--	1999 - 2000	--	--	--	--
2001	--	--	--	--	2000 - 2001	--	--	--	--
2002 [a]	112	7,900	69.2	0.00876	2001 - 2002	112	7,900	69.2	0.00876
2003 [a]	6,249	106,997	6.0	0.00006	2002 - 2003	3,181	57,449	37.6	0.00441
2004	7,415	137,016	152.1	0.00111	2003 - 2004	6,832	122,007	79.0	0.00058
2005	7,808	125,949	154.3	0.00123	2004 - 2005	7,612	131,483	153.2	0.00117
2006	8,112	131,935	221.0	0.00168	2005 - 2006	7,960	128,942	187.7	0.00145
Maximum:	8,112	137,016	221.0	0.00168		**Maximum 2-Year Average Conditions**			
Average:	7,778	131,633	175.8	0.00134		**'05-'06**	**'04-'05**	**'05-'06**	**'05-'06**
Minimum:	7,415	125,949	152.1	0.00111		7,960	131,483	187.7	0.00145
Animal Feed Plant No. 1 (EU 078) + Animal Feed Plant No. 2 (EU 103)									
1996 [a]	5,688	62,873	250.0	0.00398	--	--	--	--	--
1997 [a]	5,892	86,400	265.0	0.00307	1996 - 1997	5,790	74,637	257.5	0.00352
1998	7,198	116,948	102.4	0.00088	1997 - 1998	6,545	101,674	183.7	0.00197
1999	6,572	124,036	108.1	0.00087	1998 - 1999	6,885	120,492	105.2	0.00087
2000	7,174	131,634	120.4	0.00091	1999 - 2000	6,873	127,835	114.2	0.00089
2001	7,444	168,839	137.5	0.00081	2000 - 2001	7,309	150,237	128.9	0.00086
2002	7,703	167,611	195.2	0.00116	2001 - 2002	7,574	168,225	166.3	0.00099
2003	12,949	222,601	88.8	0.00040	2002 - 2003	10,326	195,106	142.0	0.00078
2004	13,671	252,822	307.9	0.00122	2003 - 2004	13,310	237,712	198.4	0.00081
2005	13,812	223,826	304.0	0.00136	2004 - 2005	13,742	238,324	305.9	0.00129
2006	13,788	232,724	387.0	0.00166	2005 - 2006	13,800	228,275	345.5	0.00151
Maximum:	13,812	252,822	387.0	0.00166		**Maximum 2-Year Average Conditions**			
Average:	10,035	182,338	194.6	0.00103		**'05-'06**	**'04-'05**	**'05-'06**	**'05-'06**
Minimum:	6,572	116,948	88.8	0.00040		13,800	238,324	345.5	0.00151

[a] Production rates and/or fuel usage rates not indicative of normal plant operations, therefore were excluded from analysis.

TABLE A-7
BASELINE ACTUAL OPERATING CONDITIONS
MATERIAL HANDLING, MOSAIC RIVERVIEW

					2-Year Average		
Year	Plant Operation (hours)	Material (tons/yr)	Calculated Factor (tons material/hr)	2-Year Period	Plant Operation (hours)	Material (tons/yr)	Calculated Factor (tons material/hr)
West Bag Filter (EU 051)							
1997	3,900	1,875,192	480.8	--	--	--	--
1998	3,536	1,857,564	525.3	1997 - 1998	3,718	1,866,378	503.1
1999	3,282	1,858,785	566.4	1998 - 1999	3,409	1,858,175	545.8
2000	3,100	1,794,214	578.8	1999 - 2000	3,191	1,826,500	572.6
2001	3,251	1,576,363	484.9	2000 - 2001	3,176	1,685,289	531.8
2002	3,232	1,675,288	518.3	2001 - 2002	3,242	1,625,826	501.6
2003	2,816	1,734,669	616.0	2002 - 2003	3,024	1,704,979	567.2
2004	2,223	1,603,974	721.5	2003 - 2004	2,520	1,669,322	668.8
2005	2,005	1,752,231	873.9	2004 - 2005	2,114	1,678,103	797.7
2006	1,976	1,721,158	871.0	2005 - 2006	1,991	1,736,695	872.5
Maximum:	3,900	1,875,192	873.9		**Maximum 2-Year Average Conditions**		
Average:	2,932	1,744,944	623.7		**'97-'98**	**'97-'98**	**'05-'06**
Minimum:	1,976	1,576,363	480.8		**3,718**	**1,866,378**	**872.5**
South Baghouse (EU 052)							
1997	4,051	1,875,192	462.9	--	--	--	--
1998	3,754	1,857,564	494.8	1997 - 1998	3,903	1,866,378	478.9
1999	3,282	1,624,767	495.1	1998 - 1999	3,518	1,741,166	494.9
2000	2,932	1,652,514	563.6	1999 - 2000	3,107	1,638,641	529.3
2001	3,146	1,839,492	584.7	2000 - 2001	3,039	1,746,003	574.2
2002	2,889	1,476,648	511.1	2001 - 2002	3,018	1,658,070	547.9
2003	3,117	1,734,669	556.5	2002 - 2003	3,003	1,605,659	533.8
2004	2,800	1,603,974	572.8	2003 - 2004	2,959	1,669,322	564.7
2005	3,501	1,752,231	500.5	2004 - 2005	3,151	1,678,103	536.7
2006	3,496	1,451,938	415.3	2005 - 2006	3,499	1,602,085	457.9
Maximum:	4,051	1,875,192	584.7		**Maximum 2-Year Average Conditions**		
Average:	3,297	1,686,899	515.7		**'97-'98**	**'97-'98**	**'00-'01**
Minimum:	2,800	1,451,938	415.3		**3,903**	**1,866,378**	**574.2**
Vessel Loading System (EU 053)							
1997	4,051	1,875,192	462.9	--	--	--	--
1998	3,754	1,857,564	494.8	1997 - 1998	3,903	1,866,378	478.9
1999	3,045	1,624,767	533.6	1998 - 1999	3,400	1,741,166	514.2
2000	2,932	1,794,214	611.9	1999 - 2000	2,989	1,709,491	572.8
2001	3,146	1,839,492	584.7	2000 - 2001	3,039	1,816,853	598.3
2002	2,889	1,476,648	511.1	2001 - 2002	3,018	1,658,070	547.9
2003	3,117	1,734,669	556.5	2002 - 2003	3,003	1,605,659	533.8
2004	2,800	1,603,974	572.8	2003 - 2004	2,959	1,669,322	564.7
2005	3,501	1,752,231	500.5	2004 - 2005	3,151	1,678,103	536.7
2006	3,496	1,670,110	477.7	2005 - 2006	3,499	1,711,171	489.1
Maximum:	4,051	1,875,192	611.9		**Maximum 2-Year Average Conditions**		
Average:	3,273	1,722,886	530.7		**'97-'98**	**'97-'98**	**'00-'01**
Minimum:	2,800	1,476,648	462.9		**3,903**	**1,866,378**	**598.3**
East Vessel Loading Facility (EU 061)							
1997	4,051	1,875,192	462.9	--	--	--	--
1998	3,754	1,822,641	485.5	1997 - 1998	3,903	1,848,917	474.2
1999	3,045	1,624,767	533.6	1998 - 1999	3,400	1,723,704	509.6
2000	2,932	1,652,514	563.6	1999 - 2000	2,989	1,638,641	548.6
2001	3,146	1,839,492	584.7	2000 - 2001	3,039	1,746,003	574.2
2002	2,889	1,476,648	511.1	2001 - 2002	3,018	1,658,070	547.9
2003	3,117	1,734,669	556.5	2002 - 2003	3,003	1,605,659	533.8
2004	2,800	1,603,974	572.8	2003 - 2004	2,959	1,669,322	564.7
2005	3,501	1,752,231	500.5	2004 - 2005	3,151	1,678,103	536.7
2006	3,496	1,670,110	477.7	2005 - 2006	3,499	1,711,171	489.1
Maximum:	4,051	1,875,192	584.7		**Maximum 2-Year Average Conditions**		
Average:	3,273	1,705,224	524.9		**'97-'98**	**'97-'98**	**'00-'01**
Minimum:	2,800	1,476,648	462.9		**3,903**	**1,848,917**	**574.2**

APPENDIX B

CONTEMPORANEOUS BASELINE ACTUAL EMISSIONS CALCULATIONS

TABLE B-1
BASELINE ACTUAL ANNUAL (1997-2006) EMISSION FACTORS FROM ANNUAL OPERATING REPORTS
CONTEMPORANEOUS EMISSIONS SOURCES, MOSAIC RIVERVIEW

Source Description	EU ID	Annual Operation (hr/yr)	Annual Process/Fuel	Factor Units	Pollutant Emission Factors									
					SO_2	NO_x	CO	PM	PM_{10}	VOC	SAM	Lead	Mercury	Fluorides
1997 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	8,294	121,025 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	0.61 [B]	0.61 [B]	- [A]	- [A]	- [A]	- [A]	0.09 [B]
			10.4 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 4 MAP Plant	*023*	8,289	122,259 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	0.61 [B]	0.61 [B]	- [A]	- [A]	- [A]	- [A]	0.09 [B]
			10.9 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	6,877	194,158 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	3.3 [G]	3.3 [G]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	194,158 tons phosphate rock processed	lb/hr	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	451,891 tons fertilizer produced	lb/hr	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	4.65 [H]
--No. 4 GTSP Storage Bldg	*071*	8,760	451,891 tons fertilizer produced	lb/hr	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	3.77 [H]
--GTSP Truck Loading Station	*072*	33	1,500 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	0.53 [H]	0.53 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	5,950	194,158 tons phosphate rock processed	lb/hr	- [A]	- [A]	- [A]	1.4 [H]	1.4 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
			77 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--Raymond Mill No. 9	*101*	5,625	194,158 tons phosphate rock processed	lb/hr	- [A]	- [A]	- [A]	0.7 [H]	0.7 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
			73 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
1998 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	8,193	117,855 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	1.1 [B]	1.1 [B]	- [A]	- [A]	- [A]	- [A]	0.10 [B]
			2.05 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 4 MAP Plant	*023*	8,193	119,550 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	1.1 [B]	1.1 [B]	- [A]	- [A]	- [A]	- [A]	0.10 [B]
			2.24 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	6,407	183,859 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	3.04 [G]	3.04 [G]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	183,859 tons phosphate rock processed	lb/hr	- [A]	- [A]	- [A]	0.41 [H]	0.41 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	216,073 tons fertilizer produced	lb/hr	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	5.03 [H]
--No. 4 GTSP Storage Bldg	*071*	8,760	216,073 tons fertilizer produced	lb/hr	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	4.77 [H]
--GTSP Truck Loading Station	*072*	119	5,711 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	0.53 [H]	0.53 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	7,161	93,768 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			91.27 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--Raymond Mill No. 9	*101*	6,812	90,091 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			86.82 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
1999 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	8,046	107,581 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	1.69 [B]	1.69 [B]	- [A]	- [A]	- [A]	- [A]	0.48 [B]
			1.14 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 4 MAP Plant	*023*	8,281	121,437 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	1.69 [B]	1.69 [B]	- [A]	- [A]	- [A]	- [A]	0.48 [B]
			0.99 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--South Cooler	*024*	8,760	458,035 tons fertilizer granulated	lb/ton fertilizer	- [A]	- [A]	- [A]	0.008 [B]	0.008 [B]	- [A]	- [A]	- [A]	- [A]	0.0024 [B]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	6,486	188,332 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	188,332 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	214,859 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	0.18 [H]
--No. 4 GTSP Storage Bldg	*071*	8,760	214,859 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	0.16 [H]
--GTSP Truck Loading Station	*072*	77	3,220 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.004 [G]	0.002 [G]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	7,872	96,564 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			102.3 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--Raymond Mill No. 9	*101*	7,481	91,768 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			97.3 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
2000 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	7,986	111,714 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	2.0 [B]	2.0 [B]	- [A]	- [A]	- [A]	- [A]	0.74 [B]
			1.12 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 4 MAP Plant	*023*	8,082	117,235 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	2.0 [B]	2.0 [B]	- [A]	- [A]	- [A]	- [A]	0.74 [B]
			0.88 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--South Cooler	*024*	8,784	457,898 tons fertilizer granulated	lb/ton fertilizer	- [A]	- [A]	- [A]	0.010 [B]	0.010 [B]	- [A]	- [A]	- [A]	- [A]	0.0038 [B]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	6,802	191,448 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,784	191,448 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,784	226,526 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	0.09 [H]
--No. 4 GTSP Storage Bldg	*071*	8,784	226,526 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	0.09 [H]
--GTSP Truck Loading Station	*072*	174	5,986 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.004 [G]	0.002 [G]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	6,899	69,640 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			87.9 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--Raymond Mill No. 9	*101*	7,127	71,942 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			90.8 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 7 Rock Drying/Grinding Mill	*106*	4,940	49,866 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [J]	0.05 [J]	- [A]	- [A]	- [A]	- [A]	- [A]
			63 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
2001 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	7,983	161,856 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	3.7 [B]	3.7 [B]	- [A]	- [A]	- [A]	- [A]	0.50 [B]
			1.06 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 4 MAP Plant	*023*	7,738	161,856 tons P_2O_5 produced	lb/hr	- [A]	- [A]	- [A]	3.7 [B]	3.7 [B]	- [A]	- [A]	- [A]	- [A]	0.50 [B]
			0.80 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--South Cooler	*024*	8,760	323,711 tons fertilizer granulated	lb/ton fertilizer	- [A]	- [A]	- [A]	0.040 [G]	0.040 [G]	- [A]	- [A]	- [A]	- [A]	0.0054 [G]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	7,066	185,689 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	185,689 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	220,870 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	0.18 [H]
--No. 4 GTSP Storage Bldg	*071*	8,760	220,870 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	0.12 [H]
--GTSP Truck Loading Station	*072*	89	12,722 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.004 [G]	0.002 [G]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	7,579	66,869 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			98.5 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--Raymond Mill No. 9	*101*	6,675	56,073 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			90.8 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 7 Rock Drying/Grinding Mill	*106*	7,263	63,234 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [J]	0.05 [I]	- [A]	- [A]	- [A]	- [A]	- [A]
			94.40 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
2002 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	7,906	206,247 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.021 [B]	0.021 [B]	- [A]	- [A]	- [A]	- [A]	0.0031 [B]
			1.31 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 4 MAP Plant	*023*	7,628	206,247 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.021 [B]	0.021 [B]	- [A]	- [A]	- [A]	- [A]	0.0031 [B]
			1.95 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--South Cooler	*024*	8,760	412,493 tons fertilizer granulated	lb/ton fertilizer	- [A]	- [A]	- [A]	0.021 [G]	0.021 [G]	- [A]	- [A]	- [A]	- [A]	0.0031 [G]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	7,608	177,444 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	177,444 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	16,440 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	1.93 [H]

--No. 4 GTSP Storage Bldg	*071*	8,760	19,300	tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	- [A]	1.93 [H]
--GTSP Truck Loading Station	*072*	644	64,401	tons material processed	lb/hr	- [A]	- [A]	- [A]	0.53 [K]	0.53 [K]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	8,247	61,320	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			107.20	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--Raymond Mill No. 9	*101*	7,935	59,590	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			103.20	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 7 Rock Drying/Grinding Mill	*106*	7,740	56,534	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [J]	0.05 [J]	- [A]	- [A]	- [A]	- [A]	- [A]
			100.60	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
2003 Actual Emission Factors															
MAP PLANT															
--No. 3 MAP Plant	*022*	8,487	106,520	tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.014 [B]	0.014 [B]	- [A]	- [A]	- [A]	- [A]	0.0043 [B]
			5.73	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 4 MAP Plant	*023*	8,464	116,717	tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.014 [B]	0.014 [B]	- [A]	- [A]	- [A]	- [A]	0.0043 [B]
			1.13	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	94 [D]	40 [D]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--South Cooler	*024*	8,760	223,237	tons fertilizer granulated	lb/ton fertilizer	- [A]	- [A]	- [A]	0.014 [G]	0.014 [G]	- [A]	- [A]	- [A]	- [A]	0.0043 [G]
GTSP PLANT															
--GTSP/Ground Rock Storage	*008*	8,116	156,599	tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	156,599	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	15,677	tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.2 [G]	0.2 [G]	- [A]	- [A]	- [A]	- [A]	0.04 [G]
--No. 4 GTSP Storage Bldg	*071*	8,760	14,176	tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.2 [G]	0.2 [G]	- [A]	- [A]	- [A]	- [A]	0.04 [G]
--GTSP Truck Loading Station	*072*	102	7,664	tons material processed	lb/hr	- [A]	- [A]	- [A]	0.53 [K]	0.53 [K]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	8,760	52,200	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			111.64	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--Raymond Mill No. 9	*101*	8,760	52,200	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			111.64	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 7 Rock Drying/Grinding Mill	*106*	8,760	52,200	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [J]	0.05 [J]	- [A]	- [A]	- [A]	- [A]	- [A]
			111.64	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
2004 Actual Emission Factors															
MAP PLANT															
--No. 3 MAP Plant	*022*	0	0	-- DID NOT OPERATE --											
--No. 4 MAP Plant	*023*	0	0	-- DID NOT OPERATE --											
--South Cooler	*024*	0	0	-- DID NOT OPERATE --											
GTSP PLANT															
--GTSP/Ground Rock Storage	*008*	1,325	26,395	tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	1,325	26,395	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	2,184	1,166	tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.2 [G]	0.2 [G]	- [A]	- [A]	- [A]	- [A]	0.04 [G]
--No. 4 GTSP Storage Bldg	*071*	1,440	633	tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.2 [G]	0.2 [G]	- [A]	- [A]	- [A]	- [A]	0.04 [G]
--GTSP Truck Loading Station	*072*	10	212	tons material processed	lb/hr	- [A]	- [A]	- [A]	0.53 [K]	0.53 [K]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	847	9,498	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			0.63	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--Raymond Mill No. 9	*101*	819	12,047	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [B]	0.05 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			0.8	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
--No. 7 Rock Drying/Grinding Mill	*106*	245	1,532	tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [J]	0.05 [J]	- [A]	- [A]	- [A]	- [A]	- [A]
			0.1	10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.6 [C]	100 [I]	84 [I]	7.6 [C]	7.6 [C]	5.5 [C]	0.04 [E]	5.0E-04 [C]	2.6E-04 [F]	- [A]
2005 Actual Emission Factors															
MAP PLANT															
--No. 3 MAP Plant	*022*	0	0	-- DID NOT OPERATE --											
--No. 4 MAP Plant	*023*	0	0	-- DID NOT OPERATE --											
--South Cooler	*024*	0	0	-- DID NOT OPERATE --											
GTSP PLANT															
--GTSP/Ground Rock Storage	*008*	0	0	-- DID NOT OPERATE --											
--Dry/Wet Phosphate Railcar	*034*	0	0	-- DID NOT OPERATE --											
--No. 2 GTSP Storage Bldg	*070*	0	0	-- DID NOT OPERATE --											
--No. 4 GTSP Storage Bldg	*071*	0	0	-- DID NOT OPERATE --											
--GTSP Truck Loading Station	*072*	0	0	-- DID NOT OPERATE --											
--Raymond Mill No. 5	*100*	0	0	-- DID NOT OPERATE --											
--Raymond Mill No. 9	*101*	0	0	-- DID NOT OPERATE --											
--No. 7 Rock Drying/Grinding Mill	*106*	0	0	-- DID NOT OPERATE --											
2006 Actual Emission Factors															
MAP PLANT															
--No. 3 MAP Plant	*022*	0	0	-- DID NOT OPERATE --											
--No. 4 MAP Plant	*023*	0	0	-- DID NOT OPERATE --											
--South Cooler	*024*	0	0	-- DID NOT OPERATE --											
GTSP PLANT															
--GTSP/Ground Rock Storage	*008*	0	0	-- DID NOT OPERATE --											
--Dry/Wet Phosphate Railcar	*034*	0	0	-- DID NOT OPERATE --											
--No. 2 GTSP Storage Bldg	*070*	0	0	-- DID NOT OPERATE --											
--No. 4 GTSP Storage Bldg	*071*	0	0	-- DID NOT OPERATE --											
--GTSP Truck Loading Station	*072*	0	0	-- DID NOT OPERATE --											
--Raymond Mill No. 5	*100*	0	0	-- DID NOT OPERATE --											
--Raymond Mill No. 9	*101*	0	0	-- DID NOT OPERATE --											
--No. 7 Rock Drying/Grinding Mill	*106*	0	0	-- DID NOT OPERATE --											

[A] No emissions factors reported for this pollutant in this process.
[B] Based on stack testing as reported in the AORs.
[C] Based on AP-42, Table 1.4-2 for Natural Gas combustion.
[D] Based on AP-42, Table 1.4-1 for Natural Gas combustion in Residual Furnaces (<0.3 MMBtu/hr).
[E] Based on 5% conversion of SO_2 to SO_3 multiplied by the ratio of the molecular weights of H_2SO_4 and SO_3 (98/80).
[F] Based on AP-42, Table 1.4-4 for Natural Gas combustion.
[G] Based on AP-42 Table 8.5.2-1.
[H] Based on emissions as reported in AOR.
[I] Based on AP-42, Table 1.4-1 for Natural Gas combustion in small (<100 MMBtu/hr) boilers.
[J] Based on stack tests from Raymond Mill No. 5 & No. 9
[K] Maximum permitted emission rate.

TABLE B-2
REVISED EMISSION FACTORS USED TO DETERMINE BASELINE ACTUAL ANNUAL EMISSIONS (1997-2006)
CONTEMPORANEOUS EMISSIONS SOURCES, MOSAIC RIVERVIEW

Source Description	EU ID	Annual Operation (hr/yr)	Annual Process/Fuel	Factor Units	Pollutant Emission Factors									
					SO_2	NO_x	CO	PM	PM_{10}	VOC	SAM	Lead	Mercury	Fluorides
1997 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	8,294	121,025 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.139 [B]	0.139 [B]	- [A]	- [A]	- [A]	- [A]	0.023 [B]
			10.4 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--No. 4 MAP Plant	*023*	8,289	122,259 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.139 [B]	0.139 [B]	- [A]	- [A]	- [A]	- [A]	0.023 [B]
			10.9 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	6,877	194,158 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	194,158 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	451,891 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--No. 4 GTSP Storage Bldg	*071*	8,760	451,891 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--GTSP Truck Loading Station	*072*	33	1,500 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.00775 [I]	0.00367 [J]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	5,950	194,158 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.046 [B]	0.046 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			77 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--Raymond Mill No. 9	*101*	5,625	194,158 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.035 [B]	0.035 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			73 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
1998 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	8,193	117,855 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.079 [B]	0.079 [B]	- [A]	- [A]	- [A]	- [A]	0.012 [B]
			2.05 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--No. 4 MAP Plant	*023*	8,193	119,550 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.079 [B]	0.079 [B]	- [A]	- [A]	- [A]	- [A]	0.012 [B]
			2.24 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	6,407	183,859 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	183,859 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	216,073 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--No. 4 GTSP Storage Bldg	*071*	8,760	216,073 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--GTSP Truck Loading Station	*072*	119	5,711 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.00775 [I]	0.00367 [I]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	7,161	93,768 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.046 [B]	0.046 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			91.27 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--Raymond Mill No. 9	*101*	6,812	90,091 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.035 [B]	0.035 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			86.82 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
1999 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	8,046	107,581 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.085 [B]	0.085 [B]	- [A]	- [A]	- [A]	- [A]	0.016 [B]
			1.14 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--No. 4 MAP Plant	*023*	8,281	121,437 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.083 [B]	0.083 [B]	- [A]	- [A]	- [A]	- [A]	0.015 [B]
			0.99 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--South Cooler	*024*	8,760	458,035 tons fertilizer granulated	lb/ton fertilizer	- [A]	- [A]	- [A]	0.041 [B]	0.041 [B]	- [A]	- [A]	- [A]	- [A]	0.009 [B]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	6,486	188,332 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	188,332 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	214,859 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--No. 4 GTSP Storage Bldg	*071*	8,760	214,859 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--GTSP Truck Loading Station	*072*	77	3,220 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.00775 [I]	0.00367 [I]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	7,872	96,564 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.046 [B]	0.046 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			102.34 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--Raymond Mill No. 9	*101*	7,481	91,768 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.035 [B]	0.035 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			97.25 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
2000 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	7,986	111,714 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.096 [B]	0.096 [I]	- [A]	- [A]	- [A]	- [A]	0.022 [B]
			1.12 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--No. 4 MAP Plant	*023*	8,082	117,235 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.093 [B]	0.093 [B]	- [A]	- [A]	- [A]	- [A]	0.021 [B]
			0.88 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--South Cooler	*024*	8,784	457,898 tons fertilizer granulated	lb/ton fertilizer	- [A]	- [A]	- [A]	0.041 [B]	0.041 [B]	- [A]	- [A]	- [A]	- [A]	0.009 [B]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	6,802	191,448 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,784	191,448 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,784	226,526 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--No. 4 GTSP Storage Bldg	*071*	8,784	226,526 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--GTSP Truck Loading Station	*072*	174	5,986 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.00775 [I]	0.00367 [I]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	6,899	69,640 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.046 [B]	0.046 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			87.9 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--Raymond Mill No. 9	*101*	7,127	71,942 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.035 [B]	0.035 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			90.8 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--No. 7 Rock Drying/Grinding Mill	*106*	4,940	49,866 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [K]	0.05 [K]	- [A]	- [A]	- [A]	- [A]	- [A]
			63 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	7.600 [C]	7.600 [C]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
2001 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	7,983	161,856 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.114 [B]	0.114 [B]	- [A]	- [A]	- [A]	- [A]	0.025 [B]
			1.06 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--No. 4 MAP Plant	*023*	7,738	161,856 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.109 [B]	0.109 [B]	- [A]	- [A]	- [A]	- [A]	0.024 [B]
			0.8 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--South Cooler	*024*	8,760	323,711 tons fertilizer granulated	lb/ton fertilizer	- [A]	- [A]	- [A]	0.041 [B]	0.041 [B]	- [A]	- [A]	- [A]	- [A]	0.009 [B]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	7,066	185,689 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	185,689 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
--No. 2 GTSP Storage Bldg	*070*	8,760	220,870 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--No. 4 GTSP Storage Bldg	*071*	8,760	220,870 tons fertilizer produced	lb/ton fertilizer	- [A]	- [A]	- [A]	0.00183 [I]	0.00087 [I]	- [A]	- [A]	- [A]	- [A]	0.04 [H]
--GTSP Truck Loading Station	*072*	89	12,722 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.00775 [I]	0.00367 [I]	- [A]	- [A]	- [A]	- [A]	- [A]
--Raymond Mill No. 5	*100*	7,579	66,869 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.046 [B]	0.046 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			98.5 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--Raymond Mill No. 9	*101*	6,675	56,073 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.035 [B]	0.035 [B]	- [A]	- [A]	- [A]	- [A]	- [A]
			90.8 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--No. 7 Rock Drying/Grinding Mill	*106*	7,263	63,234 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.05 [K]	0.05 [K]	- [A]	- [A]	- [A]	- [A]	- [A]
			94.4 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	100.00 [J]	84.00 [J]	7.600 [C]	7.600 [C]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
2002 Actual Emission Factors														
MAP PLANT														
--No. 3 MAP Plant	*022*	7,906	206,247 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.110 [B]	0.110 [B]	- [A]	- [A]	- [A]	- [A]	0.025 [B]
			1.31 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--No. 4 MAP Plant	*023*	7,628	206,247 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.105 [B]	0.105 [B]	- [A]	- [A]	- [A]	- [A]	0.024 [B]
			1.95 10^6 ft^3 Natural Gas	lb/10^6 ft^3	0.60 [C]	94.00 [D]	40.00 [D]	- [E]	- [E]	5.50 [C]	0.037 [F]	5.0E-04 [C]	2.6E-04 [G]	- [A]
--South Cooler	*024*	8,760	412,493 tons fertilizer granulated	lb/ton fertilizer	- [A]	- [A]	- [A]	0.041 [B]	0.041 [B]	- [A]	- [A]	- [A]	- [A]	0.009 [D]
GTSP PLANT														
--GTSP/Ground Rock Storage	*008*	7,608	177,444 tons P_2O_5 produced	lb/ton P_2O_5	- [A]	- [A]	- [A]	0.04 [H]	0.04 [H]	- [A]	- [A]	- [A]	- [A]	- [A]
--Dry/Wet Phosphate Railcar	*034*	8,760	177,444 tons phosphate rock processed	lb/ton rock	- [A]	- [A]	- [A]	0.0009 [B]	0.0009 [B]	- [A]	- [A]	- [A]	- [A]	- [A]

TABLE B-3
BASELINE ACTUAL EMISSIONS
CONTEMPORANEOUS EMISSIONS SOURCES, MOSAIC RIVERVIEW

Source Description	EU ID	Pollutant Emission Rate (TPY) [a]									
		SO_2	NO_x	CO	PM	PM_{10}	VOC	SAM	Lead	Mercury	Fluorides
--MAP PLANT SHUT DOWN											
1997 Actual Emissions											
--No. 3 MAP Plant	*022*	0.003	0.49	0.21	8.41	8.41	0.03	0.0002	2.60E-06	1.35E-06	1.37
--No. 4 MAP Plant	*023*	0.003	0.51	0.22	8.52	8.52	0.03	0.0002	2.73E-06	1.42E-06	1.39
--Total		**0.006**	**1.00**	**0.43**	**16.93**	**16.93**	**0.06**	**0.0004**	**5.33E-06**	**2.77E-06**	**2.76**
1998 Actual Emissions											
--No. 3 MAP Plant	*022*	0.001	0.10	0.04	4.65	4.65	0.01	0.0000	5.13E-07	2.67E-07	0.68
--No. 4 MAP Plant	*023*	0.001	0.11	0.04	4.72	4.72	0.01	0.0000	5.60E-07	2.91E-07	0.69
--Total		**0.001**	**0.20**	**0.09**	**9.37**	**9.37**	**0.01**	**0.0001**	**1.07E-06**	**5.58E-07**	**1.37**
1999 Actual Emissions											
--No. 3 MAP Plant	*022*	0.000	0.05	0.02	4.58	4.58	0.00	0.0000	2.85E-07	1.48E-07	0.87
--No. 4 MAP Plant	*023*	0.000	0.05	0.02	5.04	5.04	0.00	0.0000	2.48E-07	1.29E-07	0.94
--South Cooler	*024*	-	-	-	9.43	9.43	-	-	-	-	2.03
--Total		**0.001**	**0.10**	**0.04**	**19.05**	**19.05**	**0.01**	**0.0000**	**5.33E-07**	**2.77E-07**	**3.83**
2000 Actual Emissions											
--No. 3 MAP Plant	*022*	0.000	0.05	0.02	5.38	5.38	0.00	0.0000	2.80E-07	1.46E-07	1.21
--No. 4 MAP Plant	*023*	0.000	0.04	0.02	5.47	5.47	0.00	0.0000	2.20E-07	1.14E-07	1.22
--South Cooler	*024*	-	-	-	9.42	9.42	-	-	-	-	2.03
--Total		**0.001**	**0.09**	**0.04**	**20.28**	**20.28**	**0.01**	**0.0000**	**5.00E-07**	**2.60E-07**	**4.46**
2001 Actual Emissions											
--No. 3 MAP Plant	*022*	0.000	0.05	0.02	9.22	9.22	0.00	0.0000	2.65E-07	1.38E-07	2.05
--No. 4 MAP Plant	*023*	0.000	0.04	0.02	8.84	8.84	0.00	0.0000	2.00E-07	1.04E-07	1.95
--South Cooler	*024*	-	-	-	6.66	6.66	-	-	-	-	1.43
--Total		**0.001**	**0.09**	**0.04**	**24.73**	**24.73**	**0.01**	**0.0000**	**4.65E-07**	**2.42E-07**	**5.44**
2002 Actual Emissions											
--No. 3 MAP Plant	*022*	0.000	0.06	0.03	11.33	11.33	0.00	0.0000	3.28E-07	1.70E-07	2.55
--No. 4 MAP Plant	*023*	0.001	0.09	0.04	10.86	10.86	0.01	0.0000	4.88E-07	2.54E-07	2.43
--South Cooler	*024*	-	-	-	8.49	8.49	-	-	-	-	1.83
--Total		**0.001**	**0.15**	**0.07**	**30.68**	**30.68**	**0.01**	**0.0001**	**8.15E-07**	**4.24E-07**	**6.80**
2003 Actual Emissions											
--No. 3 MAP Plant	*022*	0.002	0.27	0.11	5.19	5.19	0.02	0.0001	1.43E-06	7.45E-07	1.29
--No. 4 MAP Plant	*023*	0.000	0.05	0.02	5.43	5.43	0.00	0.0000	2.83E-07	1.47E-07	1.34
--South Cooler	*024*	-	-	-	4.59	4.59	-	-	-	-	0.99
--Total		**0.002**	**0.32**	**0.14**	**15.21**	**15.21**	**0.02**	**0.0001**	**1.72E-06**	**8.92E-07**	**3.62**
2004 Actual Emissions											
--Total		-	-	-	-	-	-	-	-	-	-
2005 Actual Emissions											
--Total		-	-	-	-	-	-	-	-	-	-
2006 Actual Emissions											
--Total		-	-	-	-	-	-	-	-	-	-
--GTSP PLANT SHUT DOWN											
1997 Actual Emissions											
--GTSP/Ground Rock	*008*	-	-	-	3.88	3.88	-	-	-	-	-
--Dry/Wet Phosphate	034	-	-	-	0.09	0.09	-	-	-	-	-
--No. 2 GTSP Storag	070	-	-	-	0.41	0.20	-	-	-	-	9.04
--No. 4 GTSP Storag	071	-	-	-	0.41	0.20	-	-	-	-	9.04
--GTSP Truck Loadin	072	-	-	-	0.01	0.00	-	-	-	-	-
--Raymond Mill No. :	100	0.023	3.85	3.23	4.51	4.51	0.21	0.0014	1.93E-05	1.00E-05	-
--Raymond Mill No. 5	101	0.022	3.65	3.07	3.41	3.41	0.20	0.0013	1.83E-05	9.49E-06	-
--Total		**0.045**	**7.50**	**6.30**	**12.72**	**12.29**	**0.41**	**0.0028**	**3.75E-05**	**1.95E-05**	**18.08**
1998 Actual Emissions											
--GTSP/Ground Rock	*008*	-	-	-	3.68	3.68	-	-	-	-	-
--Dry/Wet Phosphate	034	-	-	-	0.08	0.08	-	-	-	-	-
--No. 2 GTSP Storag	070	-	-	-	0.20	0.09	-	-	-	-	4.32
--No. 4 GTSP Storag	071	-	-	-	0.20	0.09	-	-	-	-	4.32
--GTSP Truck Loadin	072	-	-	-	0.02	0.01	-	-	-	-	-
--Raymond Mill No. :	100	0.027	4.56	3.83	2.18	2.18	0.25	0.0017	2.28E-05	1.19E-05	-
--Raymond Mill No. 5	101	0.026	4.34	3.65	1.58	1.58	0.24	0.0016	2.17E-05	1.13E-05	-
--Total		**0.053**	**8.90**	**7.48**	**7.94**	**7.72**	**0.49**	**0.0033**	**4.45E-05**	**2.32E-05**	**8.64**
1999 Actual Emissions											
--GTSP/Ground Rock	*008*	-	-	-	3.77	3.77	-	-	-	-	-
--Dry/Wet Phosphate	034	-	-	-	0.08	0.08	-	-	-	-	-
--No. 2 GTSP Storag	070	-	-	-	0.20	0.09	-	-	-	-	4.30
--No. 4 GTSP Storag	071	-	-	-	0.20	0.09	-	-	-	-	4.30
--GTSP Truck Loadin	072	-	-	-	0.01	0.01	-	-	-	-	-

TABLE B-4
SUMMARY OF BASELINE 2-YEAR AVERAGE ACTUAL EMISSIONS
CONTEMPORANEOUS EMISSIONS SOURCES, MOSAIC RIVERVIEW

Source Description	EU ID	Pollutant Emission Rate (TPY) [a]									
		SO_2	NO_x	CO	PM	PM_{10}	VOC	SAM	Lead	Mercury	Fluorides
–MAP PLANT SHUT DOWN											
1997 - 1998 Average Emissions											
--No. 3 MAP Plant	*022*	0.002	0.29	0.12	6.53	6.53	0.02	0.0001	1.56E-06	8.09E-07	1.03
--No. 4 MAP Plant	*023*	0.002	0.31	0.13	6.62	6.62	0.02	0.0001	1.64E-06	8.54E-07	1.04
--South Cooler	*024*	-	-	-	-	-	-	-	-	-	-
–Total		***0.004***	***0.60***	***0.26***	***13.15***	***13.15***	***0.04***	**0.0002**	***3.20E-06***	***1.66E-06***	***2.07***
1998 - 1999 Average Emissions											
--No. 3 MAP Plant	*022*	0.000	0.07	0.03	4.61	4.61	0.00	0.0000	3.99E-07	2.07E-07	0.77
--No. 4 MAP Plant	*023*	0.000	0.08	0.03	4.88	4.88	0.00	0.0000	4.04E-07	2.10E-07	0.81
--South Cooler	*024*	-	-	-	4.71	4.71	-	-	-	-	1.01
–Total		***0.001***	***0.15***	***0.06***	***14.21***	***14.21***	***0.01***	**0.0001**	***8.03E-07***	***4.17E-07***	***2.60***
1999 - 2000 Average Emissions											
--No. 3 MAP Plant	*022*	0.000	0.05	0.02	4.98	4.98	0.00	0.0000	2.83E-07	1.47E-07	1.04
--No. 4 MAP Plant	*023*	0.000	0.04	0.02	5.26	5.26	0.00	0.0000	2.34E-07	1.22E-07	1.08
--South Cooler	*024*	-	-	-	9.43	9.43	-	-	-	-	2.03
–Total		***0.001***	***0.10***	***0.04***	***19.66***	***19.66***	***0.01***	**0.0000**	***5.16E-07***	***2.68E-07***	***4.14***
2000 - 2001 Average Emissions											
--No. 3 MAP Plant	*022*	0.000	0.05	0.02	7.30	7.30	0.00	0.0000	2.73E-07	1.42E-07	1.63
--No. 4 MAP Plant	*023*	0.000	0.04	0.02	7.16	7.16	0.00	0.0000	2.10E-07	1.09E-07	1.58
--South Cooler	*024*	-	-	-	8.04	8.04	-	-	-	-	1.73
–Total		***0.001***	***0.09***	***0.04***	***22.50***	***22.50***	***0.01***	**0.0000**	***4.83E-07***	***2.51E-07***	***4.95***
2001 - 2002 Average Emissions											
--No. 3 MAP Plant	*022*	0.000	0.06	0.02	10.28	10.28	0.00	0.0000	2.96E-07	1.54E-07	2.30
--No. 4 MAP Plant	*023*	0.000	0.06	0.03	9.85	9.85	0.00	0.0000	3.44E-07	1.79E-07	2.19
--South Cooler	*024*	-	-	-	7.58	7.58	-	-	-	-	1.63
–Total		***0.001***	***0.12***	***0.05***	***27.70***	***27.70***	***0.01***	**0.0000**	***6.40E-07***	***3.33E-07***	***6.12***
2002 - 2003 Average Emissions											
--No. 3 MAP Plant	*022*	0.001	0.17	0.07	8.26	8.26	0.01	0.0001	8.80E-07	4.58E-07	1.92
--No. 4 MAP Plant	*023*	0.000	0.07	0.03	8.14	8.14	0.00	0.0000	3.85E-07	2.00E-07	1.88
--South Cooler	*024*	-	-	-	6.54	6.54	-	-	-	-	1.41
–Total		***0.002***	***0.24***	***0.10***	***22.94***	***22.94***	***0.01***	**0.0001**	***1.27E-06***	***6.58E-07***	***5.21***
2003 - 2004 Average Emissions											
--No. 3 MAP Plant	*022*	0.001	0.13	0.06	2.59	2.59	0.01	0.0001	7.16E-07	3.72E-07	0.64
--No. 4 MAP Plant	*023*	0.000	0.03	0.01	2.71	2.71	0.00	0.0000	1.41E-07	7.35E-08	0.67
--South Cooler	*024*	-	-	-	2.30	2.30	-	-	-	-	0.49
–Total		***0.001***	***0.16***	***0.07***	***7.60***	***7.60***	***0.01***	**0.0001**	***8.58E-07***	***4.46E-07***	***1.81***
2004 - 2005 Average Emissions											
--No. 3 MAP Plant	*022*	-	-	-	-	-	-	-	-	-	-
--No. 4 MAP Plant	*023*	-	-	-	-	-	-	-	-	-	-
--South Cooler	*024*	-	-	-	-	-	-	-	-	-	-
–Total		-	-	-	-	-	-	-	-	-	-
2005 - 2006 Average Emissions											
--No. 3 MAP Plant	*022*	-	-	-	-	-	-	-	-	-	-
--No. 4 MAP Plant	*023*	-	-	-	-	-	-	-	-	-	-
--South Cooler	*024*	-	-	-	-	-	-	-	-	-	-
–Total		-	-	-	-	-	-	-	-	-	-
Highest 2-Year Period		**'97-'98**	**'97-'98**	**'97-'98**	**'01-'02**	**'01-'02**	**'97-'98**	**'97-'98**	**'97-'98**	**'97-'98**	**'01-'02**
–Total		***0.004***	***0.60***	***0.26***	***27.70***	***27.70***	***0.04***	**0.0002**	***3.20E-06***	***1.66E-06***	***6.12***
–GTSP PLANT SHUT DOWN											
1997 - 1998 Average Emissions											
--GTSP/Ground Rock	*008*	-	-	-	3.78	3.78	-	-	-	-	-
--Dry/Wet Phosphate	*034*	-	-	-	0.09	0.09	-	-	-	-	-
--No. 2 GTSP Storage	*070*	-	-	-	0.31	0.15	-	-	-	-	6.68
--No. 4 GTSP Storage	*071*	-	-	-	0.31	0.15	-	-	-	-	6.68
--GTSP Truck Loadin	*072*	-	-	-	0.01	0.01	-	-	-	-	-
--Raymond Mill No. 5	*100*	0.025	4.21	3.53	3.34	3.34	0.23	0.0015	2.10E-05	1.09E-05	-
--Raymond Mill No. 9	*101*	0.024	4.00	3.36	2.50	2.50	0.22	0.0015	2.00E-05	1.04E-05	-
--No. 7 Rock Drying/	*106*	-	-	-	-	-	-	-	-	-	-
–Total		***0.049***	***8.20***	***6.89***	***10.33***	***10.00***	***0.45***	***0.0030***	***4.10E-05***	***2.13E-05***	***13.36***
1998 - 1999 Average Emissions											
--GTSP/Ground Rock	*008*	-	-	-	3.72	3.72	-	-	-	-	-
--Dry/Wet Phosphate	*034*	-	-	-	0.08	0.08	-	-	-	-	-
--No. 2 GTSP Storage	*070*	-	-	-	0.20	0.09	-	-	-	-	4.31
--No. 4 GTSP Storage	*071*	-	-	-	0.20	0.09	-	-	-	-	4.31
--GTSP Truck Loadin	*072*	-	-	-	0.02	0.01	-	-	-	-	-
--Raymond Mill No. 5	*100*	0.029	4.84	4.07	2.21	2.21	0.27	0.0018	2.42E-05	1.26E-05	-
--Raymond Mill No. 9	*101*	0.028	4.60	3.87	1.60	1.60	0.25	0.0017	2.30E-05	1.20E-05	-
--No. 7 Rock Drying/	*106*	-	-	-	-	-	-	-	-	-	-
–Total		***0.057***	***9.44***	***7.93***	***8.03***	***7.81***	***0.52***	***0.0035***	***4.72E-05***	***2.45E-05***	***8.62***

1999 - 2000 Average Emissions											
--GTSP/Ground Rock	*008*	-	-	-	3.80	3.80	-	-	-	-	-
--Dry/Wet Phosphate	*034*	-	-	-	0.09	0.09	-	-	-	-	-
--No. 2 GTSP Storage	*070*	-	-	-	0.20	0.10	-	-	-	-	4.41
--No. 4 GTSP Storage	*071*	-	-	-	0.20	0.10	-	-	-	-	4.41
--GTSP Truck Loadin	*072*	-	-	-	0.02	0.01	-	-	-	-	-
--Raymond Mill No. 5	*100*	0.029	4.76	4.00	1.93	1.93	0.26	0.0017	2.38E-05	1.24E-05	-
--Raymond Mill No. 9	*101*	0.028	4.70	3.95	1.44	1.44	0.26	0.0017	2.35E-05	1.22E-05	-
--No. 7 Rock Drying/	*106*	0.009	1.58	1.32	0.74	0.74	0.09	0.0006	7.88E-06	4.10E-06	-
--Total		***0.066***	***11.03***	***9.27***	***8.42***	***8.20***	***0.61***	***0.0041***	***5.52E-05***	***2.87E-05***	***8.83***
2000 - 2001 Average Emissions											
--GTSP/Ground Rock	*008*	-	-	-	3.77	3.77	-	-	-	-	-
--Dry/Wet Phosphate	*034*	-	-	-	0.08	0.08	-	-	-	-	-
--No. 2 GTSP Storage	*070*	-	-	-	0.20	0.10	-	-	-	-	4.47
--No. 4 GTSP Storage	*071*	-	-	-	0.20	0.10	-	-	-	-	4.47
--GTSP Truck Loadin	*072*	-	-	-	0.04	0.02	-	-	-	-	-
--Raymond Mill No. 5	*100*	0.028	4.66	3.91	1.59	1.59	0.26	0.0017	2.33E-05	1.21E-05	-
--Raymond Mill No. 9	*101*	0.027	4.54	3.81	1.12	1.12	0.25	0.0017	2.27E-05	1.18E-05	-
--No. 7 Rock Drying/	*106*	0.024	3.94	3.31	1.71	1.71	0.22	0.0014	1.97E-05	1.02E-05	-
--Total		***0.079***	***13.14***	***11.03***	***8.72***	***8.49***	***0.72***	***0.0048***	***6.57E-05***	***3.42E-05***	***8.95***
2001 - 2002 Average Emissions											
--GTSP/Ground Rock	*008*	-	-	-	3.63	3.63	-	-	-	-	-
--Dry/Wet Phosphate	*034*	-	-	-	0.08	0.08	-	-	-	-	-
--No. 2 GTSP Storage	*070*	-	-	-	0.11	0.05	-	-	-	-	2.37
--No. 4 GTSP Storage	*071*	-	-	-	0.11	0.05	-	-	-	-	2.40
--GTSP Truck Loadin	*072*	-	-	-	0.15	0.07	-	-	-	-	-
--Raymond Mill No. 5	*100*	0.031	5.14	4.32	1.49	1.49	0.28	0.0019	2.57E-05	1.34E-05	-
--Raymond Mill No. 9	*101*	0.029	4.85	4.07	1.02	1.02	0.27	0.0018	2.43E-05	1.26E-05	-
--No. 7 Rock Drying/	*106*	0.029	4.88	4.10	1.87	1.87	0.27	0.0018	2.44E-05	1.27E-05	-
--Total		***0.089***	***14.87***	***12.49***	***8.45***	***8.26***	***0.82***	***0.0055***	***7.43E-05***	***3.87E-05***	***4.77***
2002 - 2003 Average Emissions											
--GTSP/Ground Rock	*008*	-	-	-	3.34	3.34	-	-	-	-	-
--Dry/Wet Phosphate	*034*	-	-	-	0.08	0.08	-	-	-	-	-
--No. 2 GTSP Storage	*070*	-	-	-	0.01	0.01	-	-	-	-	0.32
--No. 4 GTSP Storage	*071*	-	-	-	0.02	0.01	-	-	-	-	0.33
--GTSP Truck Loadin	*072*	-	-	-	0.14	0.07	-	-	-	-	-
--Raymond Mill No. 5	*100*	0.033	5.47	4.60	1.32	1.32	0.30	0.0020	2.74E-05	1.42E-05	-
--Raymond Mill No. 9	*101*	0.032	5.37	4.51	0.98	0.98	0.30	0.0020	2.69E-05	1.40E-05	-
--No. 7 Rock Drying/	*106*	0.032	5.31	4.46	1.76	1.76	0.29	0.0019	2.65E-05	1.38E-05	-
--Total		***0.097***	***16.15***	***13.56***	***7.65***	***7.56***	***0.89***	***0.0059***	***8.07E-05***	***4.20E-05***	***0.66***
2003 - 2004 Average Emissions											
--GTSP/Ground Rock	*008*	-	-	-	1.83	1.83	-	-	-	-	-
--Dry/Wet Phosphate	*034*	-	-	-	0.04	0.04	-	-	-	-	-
--No. 2 GTSP Storage	*070*	-	-	-	0.01	0.00	-	-	-	-	0.17
--No. 4 GTSP Storage	*071*	-	-	-	0.01	0.00	-	-	-	-	0.15
--GTSP Truck Loadin	*072*	-	-	-	0.02	0.01	-	-	-	-	-
--Raymond Mill No. 5	*100*	0.017	2.81	2.36	0.72	0.72	0.15	0.0010	1.40E-05	7.30E-06	-
--Raymond Mill No. 9	*101*	0.017	2.81	2.36	0.56	0.56	0.15	0.0010	1.41E-05	7.31E-06	-
--No. 7 Rock Drying/	*106*	0.017	2.79	2.35	0.88	0.88	0.15	0.0010	1.40E-05	7.26E-06	-
--Total		***0.050***	***8.41***	***7.07***	***4.06***	***4.05***	***0.46***	***0.0031***	***4.21E-05***	***2.19E-05***	***0.32***
2004 - 2005 Average Emissions											
--GTSP/Ground Rock	*008*	-	-	-	0.26	0.26	-	-	-	-	-
--Dry/Wet Phosphate	*034*	-	-	-	0.01	0.01	-	-	-	-	-
--No. 2 GTSP Storage	*070*	-	-	-	0.00	0.00	-	-	-	-	0.01
--No. 4 GTSP Storage	*071*	-	-	-	0.00	0.00	-	-	-	-	0.01
--GTSP Truck Loadin	*072*	-	-	-	0.00	0.00	-	-	-	-	-
--Raymond Mill No. 5	*100*	0.000	0.02	0.01	0.11	0.11	0.00	0.0000	7.88E-08	4.10E-08	-
--Raymond Mill No. 9	*101*	0.000	0.02	0.02	0.11	0.11	0.00	0.0000	1.00E-07	5.20E-08	-
--No. 7 Rock Drying/	*106*	0.000	0.00	0.00	0.02	0.02	0.00	0.0000	1.25E-08	6.50E-09	-
--Total		***0.000***	***0.04***	***0.03***	***0.51***	***0.50***	***0.00***	***0.0000***	***1.91E-07***	***9.95E-08***	***0.02***
2005 - 2006 Average Emissions											
--GTSP/Ground Rock	*008*	-	-	-	-	-	-	-	-	-	-
--Dry/Wet Phosphate	*034*	-	-	-	-	-	-	-	-	-	-
--No. 2 GTSP Storage	*070*	-	-	-	-	-	-	-	-	-	-
--No. 4 GTSP Storage	*071*	-	-	-	-	-	-	-	-	-	-
--GTSP Truck Loadin	*072*	-	-	-	-	-	-	-	-	-	-
--Raymond Mill No. 5	*100*	-	-	-	-	-	-	-	-	-	-
--Raymond Mill No. 9	*101*	-	-	-	-	-	-	-	-	-	-
--No. 7 Rock Drying/	*106*	-	-	-	-	-	-	-	-	-	-
--Total		-	-	-	-	-	-	-	-	-	-
Highest 2-Year Period		**'02-'03**	**'02-'03**	**'02-'03**	**'97-'98**	**'97-'98**	**'02-'03**	**'02-'03**	**'02-'03**	**'02-'03**	**'97-'98**
--Total		***0.097***	***16.15***	***13.56***	***10.33***	***10.00***	***0.89***	***0.0059***	***8.07E-05***	***4.20E-05***	***13.36***

TPY = Tons per year.

Notes:

[a] See Table A-2 for emission factors and operating data.

TABLE B-5
STACK TESTS AND EMISSIONS DATA
CONTEMPORANEOUS EMISSIONS SOURCES, MOSAIC RIVERVIEW

Test Date	Fluorides				PM				PM_{10}			
	Emission Rate	Converted Rate[a] (lb/ton)	Averaging Period	Avg. Rate (lb/ton)	Emission Rate	Converted Rate[a] (lb/ton)	Averaging Period	Avg. Rate (lb/ton)	Emission Rate	Converted Rate[a] (lb/ton)	Averaging Period	Avg. Rate (lb/ton)
No. 3 MAP Plant (EU 022)												
1993	0.83 lb/hr	0.0626			14 lb/hr	0.377			14 lb/hr	0.377		
1994	0.2 lb/hr	0.0133			1.43 lb/hr	0.095			1.4 lb/hr	0.095		
1995	0.35 lb/hr	0.0247			1.23 lb/hr	0.087			1.23 lb/hr	0.087		
1996	0.1 lb/hr	0.0068			1.4 lb/hr	0.095			1.4 lb/hr	0.095		
1997	0.09 lb/hr	0.0062	1993-1997	0.023	0.605 lb/hr	0.041	1993-1997	0.139	0.605 lb/hr	0.041	1993-1997	0.139
1998	0.1 lb/hr	0.0070	1994-1998	0.012	1.1 lb/hr	0.076	1994-1998	0.079	1.1 lb/hr	0.076	1994-1998	0.079
4/20/1999	0.48 lb/hr	0.0359	1995-1999	0.016	1.69 lb/hr	0.126	1995-1999	0.085	1.69 lb/hr	0.126	1995-1999	0.085
2000	0.74 lb/hr	0.0529	1996-2000	0.022	2 lb/hr	0.143	1996-2000	0.096	2 lb/hr	0.143	1996-2000	0.096
5/10/2001	0.5 lb/hr	0.0247	1997-2001	0.025	3.7 lb/hr	0.182	1997-2001	0.114	3.7 lb/hr	0.182	1997-2001	0.114
6/6/2002	0.0031 lb/ton P_2O_5	0.0031	1998-2002	0.025	0.021 lb/ton P_2O_5	0.021	1998-2002	0.110	0.021 lb/ton P_2O_5	0.021	1998-2002	0.110
6/17/2003	0.0043 lb/ton P_2O_5	0.0043	1999-2003	0.024	0.014 lb/ton P_2O_5	0.014	1999-2003	0.097	0.014 lb/ton P_2O_5	0.014	1999-2003	0.097
2004	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--
6/27/1905	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--
6/28/1905	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--
No. 4 MAP Plant (EU 023)												
1993	0.83 lb/hr	0.0627			14 lb/hr	0.377			14 lb/hr	0.377		
1994	0.2 lb/hr	0.0133			1.43 lb/hr	0.095			1.43 lb/hr	0.095		
1995	0.35 lb/hr	0.0245			1.23 lb/hr	0.086			1.23 lb/hr	0.086		
1996	0.1 lb/hr	0.0069			1.4 lb/hr	0.097			1.4 lb/hr	0.097		
1997	0.09 lb/hr	0.0061	1993-1997	0.023	0.605 lb/hr	0.041	1993-1997	0.139	0.61 lb/hr	0.041	1993-1997	0.139
1998	0.1 lb/hr	0.0069	1994-1998	0.012	1.1 lb/hr	0.075	1994-1998	0.079	1.1 lb/hr	0.075	1994-1998	0.079
4/20/1999	0.48 lb/hr	0.0327	1995-1999	0.015	1.69 lb/hr	0.115	1995-1999	0.083	1.69 lb/hr	0.115	1995-1999	0.083
2000	0.74 lb/hr	0.0510	1996-2000	0.021	2 lb/hr	0.138	1996-2000	0.093	2 lb/hr	0.138	1996-2000	0.093
5/10/2001	0.5 lb/hr	0.0239	1997-2001	0.024	3.7 lb/hr	0.177	1997-2001	0.109	3.7 lb/hr	0.177	1997-2001	0.109
6/6/2002	0.0031 lb/ton P_2O_5	0.0031	1998-2002	0.024	0.021 lb/ton P_2O_5	0.021	1998-2002	0.105	0.021 lb/ton P_2O_5	0.021	1998-2002	0.105
6/19/2003	0.0043 lb/ton P_2O_5	0.0043	1999-2003	0.023	0.014 lb/ton P_2O_5	0.014	1999-2003	0.093	0.014 lb/ton P_2O_5	0.014	1999-2003	0.093
6/26/1905	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--
6/27/1905	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--
6/28/1905	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--
South Cooler (EU 024)												
1993	-- Emissions accounted for in EU 022 & 023											
1994	-- Emissions accounted for in EU 022 & 023											
1995	-- Emissions accounted for in EU 022 & 023											
1996	-- Emissions accounted for in EU 022 & 023											
1997	-- Emissions accounted for in EU 022 & 023											
1998	-- Emissions accounted for in EU 022 & 023											
4/20/1999	0.48 lb/hr	0.0092	1999-2003	0.009	1.69 lb/hr	0.032	1999-2003	0.041	1.69 lb/hr	0.032	1999-2003	0.041
5/18/2000	0.74 lb/hr	0.0142	1999-2003	0.009	2 lb/hr	0.038	1999-2003	0.041	2 lb/hr	0.038	1999-2003	0.041
5/10/2001	0.5 lb/hr	0.0135	1999-2003	0.009	3.7 lb/hr	0.100	1999-2003	0.041	3.7 lb/hr	0.100	1999-2003	0.041
6/6/2002	0.0031 lb/ton fert	0.0031	1999-2003	0.009	0.021 lb/ton fert	0.021	1999-2003	0.041	0.021 lb/ton fert	0.021	1999-2003	0.041
6/19/2003	0.0043 lb/ton fert	0.0043	1999-2003	0.009	0.014 lb/ton fert	0.014	1999-2003	0.041	0.014 lb/ton fert	0.014	1999-2003	0.041
6/26/1905	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--
6/27/1905	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--
6/28/1905	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--	-- SHUT DOWN --	--	--	--

[a] To convert from lb/hr to lb/ton multiply by operating hours and divide by throughput from Table A-1. Maximum emission rate set to 10 lb/hr for PM and 0.041 lb/hr for FL combined from EUs 022, 023, & 024.

APPENDIX C

SUPPORTING DOCUMENTATION FOR EMISSIONS CALCULATION

1.3 Fuel Oil Combustion

1.3.1 General[1-3]

Two major categories of fuel oil are burned by combustion sources: distillate oils and residual oils. These oils are further distinguished by grade numbers, with Nos. 1 and 2 being distillate oils; Nos. 5 and 6 being residual oils; and No. 4 being either distillate oil or a mixture of distillate and residual oils. No. 6 fuel oil is sometimes referred to as Bunker C. Distillate oils are more volatile and less viscous than residual oils. They have negligible nitrogen and ash contents and usually contain less than 0.3 percent sulfur (by weight). Distillate oils are used mainly in domestic and small commercial applications, and include kerosene and diesel fuels. Being more viscous and less volatile than distillate oils, the heavier residual oils (Nos. 5 and 6) may need to be heated for ease of handling and to facilitate proper atomization. Because residual oils are produced from the residue remaining after the lighter fractions (gasoline, kerosene, and distillate oils) have been removed from the crude oil, they contain significant quantities of ash, nitrogen, and sulfur. Residual oils are used mainly in utility, industrial, and large commercial applications.

1.3.2 Firing Practices[4]

The major boiler configurations for fuel oil-fired combustors are watertube, firetube, cast iron, and tubeless design. Boilers are classified according to design and orientation of heat transfer surfaces, burner configuration, and size. These factors can all strongly influence emissions as well as the potential for controlling emissions.

Watertube boilers are used in a variety of applications ranging from supplying large amounts of process steam to providing space heat for industrial facilities. In a watertube boiler, combustion heat is transferred to water flowing through tubes which line the furnace walls and boiler passes. The tube surfaces in the furnace (which houses the burner flame) absorb heat primarily by radiation from the flames. The tube surfaces in the boiler passes (adjacent to the primary furnace) absorb heat primarily by convective heat transfer.

Firetube boilers are used primarily for heating systems, industrial process steam generators, and portable power boilers. In firetube boilers, the hot combustion gases flow through the tubes while the water being heated circulates outside of the tubes. At high pressures and when subjected to large variations in steam demand, firetube units are more susceptible to structural failure than watertube boilers. This is because the high-pressure steam in firetube units is contained by the boiler walls rather than by multiple small-diameter watertubes, which are inherently stronger. As a consequence, firetube boilers are typically small and are used primarily where boiler loads are relatively constant. Nearly all firetube boilers are sold as packaged units because of their relatively small size.

A cast iron boiler is one in which combustion gases rise through a vertical heat exchanger and out through an exhaust duct. Water in the heat exchanger tubes is heated as it moves upward through the tubes. Cast iron boilers produce low pressure steam or hot water, and generally burn oil or natural gas. They are used primarily in the residential and commercial sectors.

Another type of heat transfer configuration used on smaller boilers is the tubeless design. This design incorporates nested pressure vessels with water in between the shells. Combustion gases are fired into the inner pressure vessel and are then sometimes recirculated outside the second vessel.

1.3.3 Emissions[5]

Emissions from fuel oil combustion depend on the grade and composition of the fuel, the type and size of the boiler, the firing and loading practices used, and the level of equipment maintenance. Because the combustion characteristics of distillate and residual oils are different, their combustion can produce significantly different emissions. In general, the baseline emissions of criteria and noncriteria pollutants are those from uncontrolled combustion sources. Uncontrolled sources are those without add-on air pollution control (APC) equipment or other combustion modifications designed for emission control. Baseline emissions for sulfur dioxide (SO_2) and particulate matter (PM) can also be obtained from measurements taken upstream of APC equipment.

1.3.3.1 Particulate Matter Emissions[6-15] -

Particulate emissions may be categorized as either filterable or condensable. Filterable emissions are generally considered to be the particules that are trapped by the glass fiber filter in the front half of a Reference Method 5 or Method 17 sampling van. Vapors and particles less than 0.3 microns pass through the filter. Condensable particulate matter is material that is emitted in the vapor state which later condenses to form homogeneous and/or heterogeneous aerosol particles. The condensable particulate emitted from boilers fueled on coal or oil is primarily inorganic in nature.

Filterable particulate matter emissions depend predominantly on the grade of fuel fired. Combustion of lighter distillate oils results in significantly lower PM formation than does combustion of heavier residual oils. Among residual oils, firing of No. 4 or No. 5 oil usually produces less PM than does the firing of heavier No. 6 oil.

In general, filterable PM emissions depend on the completeness of combustion as well as on the oil ash content. The PM emitted by distillate oil-fired boilers primarily comprises carbonaceous particles resulting from incomplete combustion of oil and is not correlated to the ash or sulfur content of the oil. However, PM emissions from residual oil burning are related to the oil sulfur content. This is because low-sulfur No. 6 oil, either from naturally low-sulfur crude oil or desulfurized by one of several processes, exhibits substantially lower viscosity and reduced asphaltene, ash, and sulfur contents, which results in better atomization and more complete combustion.

Boiler load can also affect filterable particulate emissions in units firing No. 6 oil. At low load (50 percent of maximum rating) conditions, particulate emissions from utility boilers may be lowered by 30 to 40 percent and by as much as 60 percent from small industrial and commercial units. However, no significant particulate emission reductions have been noted at low loads from boilers firing any of the lighter grades. At very low load conditions (approximately 30 percent of maximum rating), proper combustion conditions may be difficult to maintain and particulate emissions may increase significantly.

1.3.3.2 Sulfur Oxides Emissions[1-2,6-9,16] -

Sulfur oxides (SO_x) emissions are generated during oil combustion from the oxidation of sulfur contained in the fuel. The emissions of SO_x from conventional combustion systems are predominantly in the form of SO_2. Uncontrolled SO_x emissions are almost entirely dependent on the sulfur content of the fuel and are not affected by boiler size, burner design, or grade of fuel being fired. On average, more than 95 percent of the fuel sulfur is converted to SO_2, about 1 to 5 percent is further oxidized to sulfur trioxide (SO_3), and 1 to 3 percent is emitted as sulfate particulate. SO_3 readily reacts with water vapor (both in the atmosphere and in flue gases) to form a sulfuric acid mist.

1.3.3.3 Nitrogen Oxides Emissions[1-2,6-10,15,17-27] -

Oxides of nitrogen (NO_x) formed in combustion processes are due either to thermal fixation of atmospheric nitrogen in the combustion air ("thermal NO_x"), or to the conversion of chemically bound nitrogen in the fuel ("fuel NO_x"). The term NO_x refers to the composite of nitric oxide (NO) and nitrogen dioxide (NO_2). Test data have shown that for most external fossil fuel combustion systems, over 95 percent of the emitted NO_x is in the form of nitric oxide (NO). Nitrous oxide (N_2O) is not included in NO_x but has recently received increased interest because of atmospheric effects.

Experimental measurements of thermal NO_x formation have shown that NO_x concentration is exponentially dependent on temperature, and proportional to N_2 concentration in the flame, the square root of O_2 concentration in the flame, and the residence time. Thus, the formation of thermal NO_x is affected by four factors: (1) peak temperature, (2) fuel nitrogen concentration, (3) oxygen concentration, and (4) time of exposure at peak temperature. The emission trends due to changes in these factors are generally consistent for all types of boilers: an increase in flame temperature, oxygen availability, and/or residence time at high temperatures leads to an increase in NO_x production.

Fuel nitrogen conversion is the more important NO_x-forming mechanism in residual oil boilers. It can account for 50 percent of the total NO_x emissions from residual oil firing. The percent conversion of fuel nitrogen to NO_x varies greatly, however; typically from 20 to 90 percent of nitrogen in oil is converted to NO_x. Except in certain large units having unusually high peak flame temperatures, or in units firing a low nitrogen content residual oil, fuel NO_x generally accounts for over 50 percent of the total NO_x generated. Thermal fixation, on the other hand, is the dominant NO_x-forming mechanism in units firing distillate oils, primarily because of the negligible nitrogen content in these lighter oils. Because distillate oil-fired boilers are usually smaller and have lower heat release rates, the quantity of thermal NO_x formed in them is less than that of larger units which typically burn residual oil.[28]

A number of variables influence how much NO_x is formed by these two mechanisms. One important variable is firing configuration. NO_x emissions from tangentially (corner) fired boilers are, on the average, less than those of horizontally opposed units. Also important are the firing practices employed during boiler operation. Low excess air (LEA) firing, flue gas recirculation (FGR), staged combustion (SC), reduced air preheat (RAP), low NO_x burners (LNBs), burning oil/water emulsions (OWE), or some combination thereof may result in NO_x reductions of 5 to 60 percent. Load reduction (LR) can likewise decrease NO_x production. Nitrogen oxide emissions may be reduced from 0.5 to 1 percent for each percentage reduction in load from full load operation. It should be noted that most of these variables, with the exception of excess air, only influence the NO_x emissions of large oil-fired boilers. Low excess air-firing is possible in many small boilers, but the resulting NO_x reductions are less significant.

1.3.3.4 Carbon Monoxide Emissions[29-32] -

The rate of carbon monoxide (CO) emissions from combustion sources depends on the oxidation efficiency of the fuel. By controlling the combustion process carefully, CO emissions can be minimized. Thus if a unit is operated improperly or not well maintained, the resulting concentrations of CO (as well as organic compounds) may increase by several orders of magnitude. Smaller boilers, heaters, and furnaces tend to emit more of these pollutants than larger combustors. This is because smaller units usually have a higher ratio of heat transfer surface area to flame volume than larger combustors have; this leads to reduced flame temperature and combustion intensity and, therefore, lower combustion efficiency.

The presence of CO in the exhaust gases of combustion systems results principally from incomplete fuel combustion. Several conditions can lead to incomplete combustion, including insufficient oxygen (O_2) availability; poor fuel/air mixing; cold-wall flame quenching; reduced combustion temperature; decreased combustion gas residence time; and load reduction (i. e., reduced combustion intensity). Since various combustion modifications for NO_x reduction can produce one or more of the above conditions, the possibility of increased CO emissions is a concern for environmental, energy efficiency, and operational reasons.

1.3.3.5 Organic Compound Emissions[29-39] -

Small amounts of organic compounds are emitted from combustion. As with CO emissions, the rate at which organic compounds are emitted depends, to some extent, on the combustion efficiency of the boiler. Therefore, any combustion modification which reduces the combustion efficiency will most likely increase the concentrations of organic compounds in the flue gases.

Total organic compounds (TOCs) include VOCs, semi-volatile organic compounds, and condensable organic compounds. Emissions of VOCs are primarily characterized by the criteria pollutant class of unburned vapor phase hydrocarbons. Unburned hydrocarbon emissions can include essentially all vapor phase organic compounds emitted from a combustion source. These are primarily emissions of aliphatic, oxygenated, and low molecular weight aromatic compounds which exist in the vapor phase at flue gas temperatures. These emissions include all alkanes, alkenes, aldehydes, carboxylic acids, and substituted benzenes (e. g., benzene, toluene, xylene, and ethyl benzene).

The remaining organic emissions are composed largely of compounds emitted from combustion sources in a condensed phase. These compounds can almost exclusively be classed into a group known as polycyclic organic matter (POM), and a subset of compounds called polynuclear aromatic hydrocarbons (PAH or PNA). There are also PAH-nitrogen analogs. Information available in the literature on POM compounds generally pertains to these PAH groups.

Formaldehyde is formed and emitted during combustion of hydrocarbon-based fuels including coal and oil. Formaldehyde is present in the vapor phase of the flue gas. Formaldehyde is subject to oxidation and decomposition at the high temperatures encountered during combustion. Thus, larger units with efficient combustion (resulting from closely regulated air-fuel ratios, uniformly high combustion chamber temperatures, and relatively long gas retention times) have lower formaldehyde emission rates than do smaller, less efficient combustion units.

1.3.3.6 Trace Element Emissions[29-32,40-44] -

Trace elements are also emitted from the combustion of oil. For this update of AP-42, trace metals included in the list of 189 hazardous air pollutants under Title III of the 1990 Clean Air Act Amendments are considered. The quantity of trace elements entering the combustion device depends solely on the fuel composition. The quantity of trace metals emitted from the source depends on combustion temperature, fuel feed mechanism, and the composition of the fuel. The temperature determines the degree of volatilization of specific compounds contained in the fuel. The fuel feed mechanism affects the separation of emissions into bottom ash and fly ash. In general, the quantity of any given metal emitted depends on the physical and chemical properties of the element itself; concentration of the metal in the fuel; the combustion conditions; and the type of particulate control device used, and its collection efficiency as a function of particle size.

Some trace metals concentrate in certain waste particle streams from a combustor (bottom ash, collector ash, flue gas particulate), while others do not. Various classification schemes to describe this partitioning have been developed. The classification scheme used by Baig, et al.[44] is as follows:

- Class 1: Elements which are approximately equally distributed between fly ash and bottom ash, or show little or no small particle enrichment.

- Class 2: Elements which are enriched in fly ash relative to bottom ash, or show increasing enrichment with decreasing particle size.

- Class 3: Elements which are emitted in the gas phase.

By understanding trace metal partitioning and concentration in fine particulate, it is possible to postulate the effects of combustion controls on incremental trace metal emissions. For example, several NO_x controls for boilers reduce peak flame temperatures (e. g., SC, FGR, RAP, OWE, and LR). If combustion temperatures are reduced, fewer Class 2 metals will initially volatilize, and fewer will be available for subsequent condensation and enrichment on fine PM. Therefore, for combustors with particulate controls, lower volatile metal emissions should result due to improved particulate removal. Flue gas emissions of Class 1 metals (the non-segregating trace metals) should remain relatively unchanged.

Lower local O_2 concentrations is also expected to affect segregating metal emissions from boilers with particle controls. Lower O_2 availability decreases the possibility of volatile metal oxidation to less volatile oxides. Under these conditions, Class 2 metals should remain in the vapor phase as they enter the cooler sections of the boiler. More redistribution to small particles should occur and emissions should increase. Again, Class 1 metal emissions should remain unchanged.

1.3.3.7 Greenhouse Gases[45-50]

Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions are all produced during fuel oil combustion. Nearly all of the fuel carbon (99 percent) in fuel oil is converted to CO_2 during the combustion process. This conversion is relatively independent of firing configuration. Although the formation of CO acts to reduce CO_2 emissions, the amount of CO produced is insignificant compared to the amount of CO_2 produced. The majority of the fuel carbon not converted to CO_2 is due to incomplete combustion in the fuel stream.

Formation of N_2O during the combustion process is governed by a complex series of reactions and its formation is dependent upon many factors. Formation of N_2O is minimized when combustion temperatures are kept high (above 1475°F) and excess air is kept to a minimum (less than 1 percent). Additional sampling and research is needed to fully characterize N_2O emissions and to understand the N_2O formation mechanism. Emissions can vary widely from unit to unit, or even from the same unit at different operating conditions. Average emission factors based on reported test data have been developed for conventional oil combustion systems.

Methane emissions vary with the type of fuel and firing configuration, but are highest during periods of incomplete combustion or low-temperature combustion, such as the start-up or shut-down cycle for oil-fired boilers. Typically, conditions that favor formation of N_2O also favor emissions of CH_4.

1.3.4 Controls

Control techniques for criteria pollutants from fuel oil combustion may be classified into three broad categories: fuel substitution/alteration, combustion modification, and postcombustion control. Emissions of noncriteria pollutants such as particulate phase metals have been controlled through the use of post combustion controls designed for criteria pollutants. Fuel substitution reduces SO_2 or NO_x and involves burning a fuel with a lower sulfur or nitrogen content, respectively. Particulate matter will generally be reduced when a lighter grade of fuel oil is burned.[6,8,11] Fuel alteration of heavy oils includes mixing water and heavy oil using emulsifying agents for better atomization and lower combustion temperatures. Under some conditions, emissions of NO_x, CO, and PM may be reduced significantly. Combustion modification includes any physical or operational change in the furnace or boiler and is applied primarily for NO_x control purposes, although for small units, some reduction in PM emissions may be available through improved combustion practice. Postcombustion control is a device after the combustion of the fuel and is applied to control emissions of PM, SO_2, and NO_x.

1.3.4.1 Particulate Matter Controls[51] -

Control of PM emissions from residential and commercial units is accomplished by improving burner servicing and improving oil atomization and combustion aerodynamics. Optimization of combustion aerodynamics using a flame retention device, swirl, and/or recirculation is considered effective toward achieving the triple goals of low PM emissions, low NO_x emissions, and high thermal efficiency.

Large industrial and utility boilers are generally well-designed and well-maintained so that soot and condensable organic compound emissions are minimized. Particulate matter emissions are more a result of emitted fly ash with a carbon component in such units. Therefore, postcombustion controls (mechanical collectors, ESP, fabric filters, etc.) or fuel substitution/alteration may be used to reduce PM emissions from these sources.

Mechanical collectors, a prevalent type of control device, are primarily useful in controlling particulates generated during soot blowing, during upset conditions, or when a very dirty heavy oil is fired. For these situations, high-efficiency cyclonic collectors can achieve up to 85 percent control of particulate. Under normal firing conditions, or when a clean oil is combusted, cyclonic collectors are not nearly so effective because of the high percentage of small particles (less than 3 micrometers in diameter) emitted.

Electrostatic precipitators (ESPs) are commonly used in oil-fired power plants. Older precipitators, usually small, typically remove 40 to 60 percent of the emitted PM. Because of the low ash content of the oil, greater collection efficiency may not be required. Currently, new or rebuilt ESPs can achieve collection efficiencies of up to 90 percent.

In fabric filtration, a number of filtering elements (bags) along with a bag cleaning system are contained in a main shell structure incorporating dust hoppers. The particulate removal efficiency of the fabric filter system is dependent on a variety of particle and operational characteristics including particle size distribution, particle cohesion characteristics, and particle electrical resistivity. Operational parameters that affect collection efficiency include air-to-cloth ratio, operating pressure loss, cleaning sequence, interval between cleaning, and cleaning intensity. The structure of the fabric filter, filter composition, and bag properties also affect collection efficiency. Collection efficiencies of baghouses may be more than 99 percent.

Scrubbing systems have also been installed on oil-fired boilers to control both sulfur oxides and particulate. These systems can achieve SO_2 removal efficiencies of 90 to 95 percent and particulate control efficiencies of 50 to 60 percent.

Fuel alteration of heavy oil by mixing with water and an emulsifying agent has reduced PM emissions significantly in controlled tests.

1.3.4.2 SO_2 Controls[52-53] -

Commercialized postcombustion flue gas desulfurization (FGD) processes use an alkaline reagent to absorb SO_2 in the flue gas and produce a sodium or a calcium sulfate compound. These solid sulfate compounds are then removed in downstream equipment. Flue gas desulfurization technologies are categorized as wet, semi-dry, or dry depending on the state of the reagent as it leaves the absorber vessel. These processes are either regenerable (such that the reagent material can be treated and reused) or nonregenerable (in which case all waste streams are de-watered and discarded).

Wet regenerable FGD processes are attractive because they have the potential for better than 95 percent sulfur removal efficiency, have minimal waste water discharges, and produce a saleable sulfur product. Some of the current nonregenerable calcium-based processes can, however, produce a saleable gypsum product.

To date, wet systems are the most commonly applied. Wet systems generally use alkali slurries as the SO_x absorbent medium and can be designed to remove greater than 90 percent of the incoming SO_x. Lime/limestone scrubbers, sodium scrubbers, and dual alkali scrubbing are among the commercially proven wet FGD systems. Effectiveness of these devices depends not only on control device design but also on operating variables.

1.3.4.3 NO_x Controls[41,54-55] -

In boilers fired on crude oil or residual oil, the control of fuel NO_x is very important in achieving the desired degree of NO_x reduction since fuel NO_x typically accounts for 60 to 80 percent of the total NO_x formed. Fuel nitrogen conversion to NO_x is highly dependent on the fuel-to-air ratio in the combustion zone and, in contrast to thermal NO_x formation, is relatively insensitive to small changes in combustion zone temperature. In general, increased mixing of fuel and air increases nitrogen conversion which, in turn, increases fuel NO_x. Thus, to reduce fuel NO_x formation, the most common combustion modification technique is to suppress combustion air levels below the theoretical amount required for complete combustion. The lack of oxygen creates reducing conditions that, given sufficient time at high temperatures, cause volatile fuel nitrogen to convert to N_2 rather than NO.

Several techniques are used to reduce NO_x emissions from fuel oil combustion. Fuel substitution consists of burning lower nitrogen fuels. Fuel alteration includes burning emulsified heavy oil and water mixtures. In addition to these, the primary techniques can be classified into one of two fundamentally different methods — combustion controls and postcombustion controls. Combustion controls reduce NO_x by suppressing NO_x formation during the combustion process while postcombustion controls reduce NO_x emissions after their formation. Combustion controls are the most widely used method of controlling NO_x formation in all types of boilers and include low excess air, burners out of service, biased-burner firing, flue gas recirculation, overfire air, and low-NO_x burners. Postcombustion control methods include selective noncatalytic reduction (SNCR) and selective catalytic reduction (SCR). These controls can be used separately, or combined to achieve greater NO_x reduction.

Operating at low excess air involves reducing the amount of combustion air to the lowest possible level while maintaining efficient and environmentally compliant boiler operation. NO_x formation is inhibited because less oxygen is available in the combustion zone. Burners out of service involves withholding fuel flow to all or part of the top row of burners so that only air is allowed to pass through. This method simulates air staging, or overfire air conditions, and limits NO_x formation by lowering the oxygen level in the burner area. Biased-burner firing involves firing the lower rows of burners more fuel-rich than the upper row of burners. This method provides a form of air staging and limits NO_x formation by limiting the amount of oxygen in the firing zone. These methods may change the normal operation of the boiler and the effectiveness is boiler-specific. Implementation of these techniques may also reduce operational flexibility; however, they may reduce NO_x by 10 to 20 percent from uncontrolled levels.

Flue gas recirculation involves extracting a portion of the flue gas from the economizer section or air heater outlet and readmitting it to the furnace through the furnace hopper, the burner windbox, or both. This method reduces the concentration of oxygen in the combustion zone and may reduce NO_x by as much as 40 to 50 percent in some boilers.

Overfire air is a technique in which a percentage of the total combustion air is diverted from the burners and injected through ports above the top burner level. Overfire air limits NO_x by (1) suppressing thermal NO_x by partially delaying and extending the combustion process resulting in less intense combustion and cooler flame temperatures; (2) a reduced flame temperature that limits thermal NO_x formation, and/or (3) a reduced residence time at peak temperature which also limits thermal NO_x formation.

Low NO_x burners are applicable to tangential and wall-fired boilers of various sizes. They have been used as a retrofit NO_x control for existing boilers and can achieve approximately 35 to 55 percent reduction from uncontrolled levels. They are also used in new boilers to meet NSPS limits. Low NO_x burners can be combined with overfire air to achieve even greater NO_x reduction (40 to 60 percent reduction from uncontrolled levels).

SNCR is a postcombustion technique that involves injecting ammonia or urea into specific temperature zones in the upper furnace or convective pass. The ammonia or urea reacts with NO_x in the flue gas to produce nitrogen and water. The effectiveness of SNCR depends on the temperature where reagents are injected; mixing of the reagent in the flue gas; residence time of the reagent within the required temperature window; ratio of reagent to NO_x; and the sulfur content of the fuel that may create sulfur compound that deposit in downstream equipment. There is not as much commercial experience to base effectiveness on a wide range of boiler types; however, in limited applications, NO_x reductions of 25 to 40 percent have been achieved.

SCR is another postcombustion technique that involves injecting ammonia into the flue gas in the presence of a catalyst to reduce NO_x to nitrogen and water. The SCR reactor can be located at various positions in the process including before an air heater and particulate control device, or downstream of the air heater, particulate control device, and flue gas desulfurization systems. The performance of SCR is influenced by flue gas temperature, fuel sulfur content, ammonia to NO_x ratio, inlet NO_x concentration, space velocity, and catalyst condition. NO_x emission reductions of 75 to 85 percent have been achieved through the use of SCR on oil-fired boilers operating in the U.S.

Fuel alteration for NO_x reduction includes use of oil/water emulsion fuels. In controlled tests, a mixture of 9 percent water in No. 6 oil with a petroleum based emulsifying agent reduced NO_x emissions by 36 percent on a Btu basis or 41 percent on a volume basis, compared with the same fuel in unaltered form. The reduction appears to be due primarily to improved atomization with a corresponding reduction of excess combustion air, with lower flame temperature contributing slightly to the reduction.[84]

Tables 1.3-1 and 1.3-3 present emission factors for uncontrolled criteria pollutants from fuel oil combustion. Tables in this section present emission factors on a volume basis ($lb/10^3gal$). To convert to an energy basis (lb/MMBtu), divide by a heating value of 150 $MMBtu/10^3gal$ for Nos. 4, 5, 6, and residual fuel oil, and 140 $MMBtu/10^3gal$ for No. 2 and distillate fuel oil. Table 1.3-2 presents emission factors for condensible particulate matter. Tables 1.3-4, 1.3-5, 1.3-6, and 1.3-7 present cumulative size distribution data and size-specific emission factors for particulate emissions from uncontrolled and controlled fuel oil combustion. Figures 1.3-1, 1.3-2, 1.3-3, and 1.3-4 present size-specific emission factors for particulate emissions from uncontrolled and controlled fuel oil combustion. Emission factors for N_2O, POM, and formaldehyde are presented in Table 1.3-8. Emission factors for speciated organic compounds are presented in Table 1.3-9. Emission factors for trace elements in distillate oil are given in Table 1.3-10. Emission factors for trace metals residual oil are given in Table 1.3-11. Default emission factors for CO_2 are presented in Table 1.3-12. A summary of various SO_2 and NO_x controls for fuel-oil-fired boilers is presented in Table 1.3-13 and 1.3-14, respectively. Emission factors for CO, NO_x, and PM from burning No. 6 oil/water emulsion fuel are presented in Table 1.3-15.

1.3.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section. These and other documents can be found on the CHIEF web site (http://www.epa.gov/ttn/chief/).

Supplement A, February 1996

- The formulas presented in the footnotes for filterable PM were moved into the table.
- For SO_2 and SO_3 emission factors, text was added to the table footnotes to clarify that "S" is a weight percent and not a fraction. A similar clarification was made to the CO and NO_x footnotes. SCC A2104004/A2104011 was provided for residential furnaces.
- For industrial boilers firing No. 6 and No. 5 oil, the methane emission factor was changed from 1 to 1.0 to show two significant figures.
- For SO_2 and SO_3 factors, text was added to the table footnotes to clarify that "S" is a weight percent and not a fraction.
- The N_2O, POM, and formaldehyde factors were corrected.
- Table 1.3-10 was incorrectly labeled 1.1-10. This was corrected.

Supplement B, October 1996

- Text was added concerning firing practices.
- Factors for N_2O, POM, and formaldehyde were added.
- New data for filterable PM were used to create a new PM factor for residential oil-fired furnaces.
- Many new factors were added for toxic organics, toxic metals from distillate oil, and toxic metals from residual oil.
- A table was added for new CO_2 emission factors.

Supplement E, September 1998

- Table 1.3-1, the sub-heading for "Industrial Boilers" was added to the first column.
- Table 1.3-3, the emission factor for uncontrolled PM less than 0.625 micron was corrected to 1.7A, the emission factor for scrubber controlled PM less than 10 micron was corrected to 0.50A, and the relationships for each content in various fuel oils was corrected in footnote C.
- Table 1.3-4 and 1.3-6, the relationship for ash content in various fuel oils was corrected in the footnote C of each table.

- Table 1.3-9, the emission factors for trace metals in distillate oil were updated with newer data where available.

- 1.3-10, the title of the table was changed to clarify these factors apply to uncontrolled fuel oil boilers.

- Text and emission factors were added pertaining to No. 6 oil/water emulsion fuel.

- Table 1.3-1 was revised to include new NO_x emission factors.

- Emission factors for condensable particulate matter were added (Table 1.3-2).

Table 1.3-1. CRITERIA POLLUTANT EMISSION FACTORS FOR FUEL OIL COMBUSTION[a]

Firing Configuration (SCC)[a]	SO_2[b]		SO_3[c]		NO_x[d]		CO[e]		Filterable PM[f]	
	Emission Factor ($lb/10^3$ gal)	EMISSION FACTOR RATING	Emission Factor ($lb/10^3$ gal)	EMISSION FACTOR RATING	Emission Factor ($lb/10^3$ gal)	EMISSION FACTOR RATING	Emission Factor ($lb/10^3$ gal)	EMISSION FACTOR RATING	Emission Factor ($lb/10^3$ gal)	EMISSION FACTOR RATING
Boilers > 100 Million Btu/hr										
No. 6 oil fired, normal firing (1-01-004-01), (1-02-004-01), (1-03-004-01)	157S	A	5.7S	C	47	A	5	A	9.19(S)+3.22	A
No. 6 oil fired, normal firing, low NO_x burner (1-01-004-01), (1-02-004-01)	157S	A	5.7S	C	40	B	5	A	9.19(S)+3.22	A
No. 6 oil fired, tangential firing, (1-01-004-04)	157S	A	5.7S	C	32	A	5	A	9.19(S)+3.22	A
No. 6 oil fired, tangential firing, low NO_x burner (1-01-004-04)	157S	A	5.7S	C	26	E	5	A	9.19(S)+3.22	A
No. 5 oil fired, normal firing (1-01-004-05), (1-02-004-04)	157S	A	5.7S	C	47	B	5	A	10	B
No. 5 oil fired, tangential firing (1-01-004-06)	157S	A	5.7S	C	32	B	5	A	10	B
No. 4 oil fired, normal firing (1-01-005-04), (1-02-005-04)	150S	A	5.7S	C	47	B	5	A	7	B
No. 4 oil fired, tangential firing (1-01-005-05)	150S	A	5.7S	C	32	B	5	A	7	B
No. 2 oil fired (1-01-005-01), (1-02-005-01), (1-03-005-01)	157S	A	5.7S	C	24	D	5	A	2	A
No.2 oil fired, LNB/FGR, (1-01-005-01), (1-02-005-01), (1-03-005-01)	157S	A	5.7S	A	10	D	5	A	2	A

Table 1.3-1. (cont.)

Firing Configuration (SCC)[a]	SO_2[b]		SO_3[c]		NO_x[d]		CO[e]		Filterable PM[f]	
	Emission Factor (lb/10^3 gal)	EMISSION FACTOR RATING	Emission Factor (lb/10^3 gal)	EMISSION FACTOR RATING	Emission Factor (lb/10^3 gal)	EMISSION FACTOR RATING	Emission Factor (lb/10^3 gal)	EMISSION FACTOR RATING	Emission Factor (lb/10^3 gal)	EMISSION FACTOR RATING
Boilers < 100 Million Btu/hr										
No. 6 oil fired (1-02-004-02/03) (1-03-004-02/03)	157S	A	2S	A	55	A	5	A	10	B
No. 5 oil fired (1-03-004-04)	157S	A	2S	A	55	A	5	A	9.19(S)+3.22	A
No. 4 oil fired (1-03-005-04)	150S	A	2S	A	20	A	5	A	7	B
Distillate oil fired (1-02-005-02/03) (1-03-005-02/03)	142S	A	2S	A	20	A	5	A	2	A
Residential furnace (A2104004/A2104011)	142S	A	2S	A	18	A	5	A	0.4[g]	B

[a] To convert from lb/10^3 gal to kg/10^3 L, multiply by 0.120. SCC = Source Classification Code.

[b] References 1-2,6-9,14,56-60. S indicates that the weight % of sulfur in the oil should be multiplied by the value given. For example, if the fuel is 1% sulfur, then S = 1.

[c] References 1-2,6-8,16,57-60. S indicates that the weight % of sulfur in the oil should be multiplied by the value given. For example, if the fuel is 1% sulfur, then S = 1.

[d] References 6-7,15,19,22,56-62. Expressed as NO_2. Test results indicate that at least 95% by weight of NO_x is NO for all boiler types except residential furnaces, where about 75% is NO. For utility vertical fired boilers use 105 lb/10^3 gal at full load and normal (>15%) excess air. Nitrogen oxides emissions from residual oil combustion in industrial and commercial boilers are related to fuel nitrogen content, estimated by the following empirical relationship: lb NO_2/10^3 gal = 20.54 + 104.39(N), where N is the weight % of nitrogen in the oil. For example, if the fuel is 1% nitrogen, then N = 1.

[e] References 6-8,14,17-19,56-61. CO emissions may increase by factors of 10 to 100 if the unit is improperly operated or not well maintained.

[f] References 6-8,10,13-15,56-60,62-63. Filterable PM is that particulate collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train. Particulate emission factors for residual oil combustion are, on average, a function of fuel oil sulfur content where S is the weight % of sulfur in oil. For example, if fuel oil is 1% sulfur, then S = 1.

[g] Based on data from new burner designs. Pre-1970's burner designs may emit filterable PM as high as 3.0 lb/10^3 gal.

Table 1.3-2. CONDENSABLE PARTICULATE MATTER EMISSION FACTORS FOR OIL COMBUSTION[a]

Firing Configuration[b] (SCC)	Controls	CPM - TOT[c,d]		CPM - IOR[c,d]		CPM - ORG[c,d]	
		Emission Factor (lb/10^3 gal)	EMISSION FACTOR RATING	Emission Factor (lb/10^3 gal)	EMISSION FACTOR RATING	Emission Factor (lb/10^3 gal)	EMISSION FACTOR RATING
No. 2 oil fired (1-01-005-01, 1-02-005-01, 1-03-005-01)	All controls, or uncontrolled	1.3[d,e]	D	65% of CPM-TOT emission factor[c]	D	35% of CPM-TOT emission factor[c]	D
No. 6 oil fired (1-01-004-01/04, 1-02-004-01, 1-03-004-01)	All controls, or uncontrolled	1.5[f]	D	85% of CPM-TOT emission factor[d]	E	15% of CPM-TOT emission factor[d]	E

[a] All condensable PM is assumed to be less than 1.0 micron in diameter.
[b] No data are available for numbers 3, 4, and 5 oil. For number 3 oil, use the factors provided for number 2 oil. For numbers 4 and 5 oil, use the factors provided for number 6 oil.
[c] CPM-TOT = total condensable particulate matter.
CPM-IOR = inorganic condensable particulate matter.
CPM-ORG = organic condensable particulate matter.
[d] To convert to lb/MMBtu of No. 2 oil, divide by 140 MMBtu/10^3 gal. To convert to lb/MMBtu of No. 6 oil, divide by 150 MMBtu/10^3 gal.
[e] References: 76-78.
[f] References: 79-82.

Table 1.3-3. EMISSION FACTORS FOR TOTAL ORGANIC COMPOUNDS (TOC), METHANE, AND NONMETHANE TOC (NMTOC) FROM UNCONTROLLED FUEL OIL COMBUSTION[a]

EMISSION FACTOR RATING: A

Firing Configuration (SCC)	TOC[b] Emission Factor (lb/10^3 gal)	Methane[b] Emission Factor (lb/10^3 gal)	NMTOC[b] Emission Factor (lb/10^3 gal)
Utility boilers			
No. 6 oil fired, normal firing (1-01-004-01)	1.04	0.28	0.76
No. 6 oil fired, tangential firing (1-01-004-04)	1.04	0.28	0.76
No. 5 oil fired, normal firing (1-01-004-05)	1.04	0.28	0.76
No. 5 oil fired, tangential firing (1-01-004-06)	1.04	0.28	0.76
No. 4 oil fired, normal firing (1-01-005-04)	1.04	0.28	0.76
No. 4 oil fired, tangential firing (1-01-005-05)	1.04	0.28	0.76
Industrial boilers			
No. 6 oil fired (1-02-004-01/02/03)	1.28	1.00	0.28
No. 5 oil fired (1-02-004-04)	1.28	1.00	0.28
Distillate oil fired (1-02-005-01/02/03)	0.252	0.052	0.2
No. 4 oil fired (1-02-005-04)	0.252	0.052	0.2
Commercial/institutional/residential combustors			
No. 6 oil fired (1-03-004-01/02/03)	1.605	0.475	1.13
No. 5 oil fired (1-03-004-04)	1.605	0.475	1.13
Distillate oil fired (1-03-005-01/02/03)	0.556	0.216	0.34
No. 4 oil fired (1-03-005-04)	0.556	0.216	0.34
Residential furnace (A2104004/A2104011)	2.493	1.78	0.713

[a] To convert from lb/10^3 gal to kg/10^3 L, multiply by 0.12. SCC = Source Classification Code.
[b] References 29-32. Volatile organic compound emissions can increase by several orders of magnitude if the boiler is improperly operated or is not well maintained.

Table 1.3-4. CUMULATIVE PARTICLE SIZE DISTRIBUTION AND SIZE-SPECIFIC EMISSION FACTORS FOR UTILITY BOILERS FIRING RESIDUAL OIL[a]

Particle Size[b] (μm)	Cumulative Mass % ≤ Stated Size			Cumulative Emission Factor lb/10^3 gal)					
		Controlled		Uncontrolled[c]		ESP Controlled[d]		Scrubber Controlled[e]	
	Uncon-trolled	ESP	Scrubber	Emission Factor	EMISSION FACTOR RATING	Emission Factor	EMISSION FACTOR RATING	Emission Factor	EMISSION FACTOR RATING
15	80	75	100	6.7A	C	0.05A	E	0.50A	D
10	71	63	100	5.9A	C	0.042A	E	0.50A	D
6	58	52	100	4.8A	C	0.035A	E	0.50A	D
2.5	52	41	97	4.3A	C	0.028A	E	0.48A	D
1.25	43	31	91	3.6A	C	0.021A	E	0.46A	D
1.00	39	28	84	3.3A	C	0.018A	E	0.42A	D
0.625	20	20	64	1.7A	C	0.007A	E	0.32A	D
TOTAL	100	100	100	8.3A	C	0.067A	E	0.50A	D

[a] Reference 26. Source Classification Codes 1-01-004-01/04/05/06 and 1-01-005-04/05. To convert from lb/10^3 gal to kg/m^3, multiply by 0.120. ESP = electrostatic precipitator.

[b] Expressed as aerodynamic equivalent diameter.

[c] Particulate emission factors for residual oil combustion without emission controls are, on average, a function of fuel oil grade and sulfur content where S is the weight % of sulfur in the oil. For example, if the fuel is 1.00% sulfur, then S = 1.
No. 6 oil: A = 1.12(S) + 0.37
No. 5 oil: A = 1.2
No. 4 oil: A = 0.84

[d] Estimated control efficiency for ESP is 99.2%.

[e] Estimated control efficiency for scrubber is 94%

Table 1.3-5. CUMULATIVE PARTICLE SIZE DISTRIBUTION AND SIZE-SPECIFIC EMISSION FACTORS FOR INDUSTRIAL BOILERS FIRING RESIDUAL OIL[a]

Particle Size[b] (μm)	Cumulative Mass % ≤ Stated Size		Cumulative Emission Factor[c] (lb/10^3 gal)			
			Uncontrolled		Multiple Cyclone Controlled[d]	
	Uncontrolled	Multiple Cyclone Controlled	Emission Factor	EMISSION FACTOR RATING	Emission Factor	EMISSION FACTOR RATING
15	91	100	7.59A	D	1.67A	E
10	86	95	7.17A	D	1.58A	E
6	77	72	6.42A	D	1.17A	E
2.5	56	22	4.67A	D	0.33A	E
1.25	39	21	3.25A	D	0.33A	E
1.00	36	21	3.00A	D	0.33A	E
0.625	30	—[e]	2.50A	D	—[e]	NA
TOTAL	100	100	8.34A	D	1.67A	E

[a] Reference 26. Source Classification Codes 1-02-004-01/02/03/04 and 1-02-005-04. To convert lb/10^3 gal to kg/10^3 L, multiply by 0.120. NA = not applicable.

[b] Expressed as aerodynamic equivalent diameter.

[c] Particulate emission factors for residual oil combustion without emission controls are, on average, a function of fuel oil grade and sulfur content where S is the weight % of sulfur in the oil. For example, if the fuel is 1.0% sulfur, then S = 1.
No. 6 oil: A = 1.12(S) + 0.37
No. 5 oil: A = 1.2
No. 4 oil: A = 0.84

[d] Estimated control efficiency for multiple cyclone is 80%.

[e] Insufficient data.

Table 1.3-6. CUMULATIVE PARTICLE SIZE DISTRIBUTION AND SIZE-SPECIFIC EMISSION FACTORS FOR UNCONTROLLED INDUSTRIAL BOILERS FIRING DISTILLATE OIL[a]

EMISSION FACTOR RATING: E

Particle Size[b] (μm)	Cumulative Mass % ≤ Stated Size	Cumulative Emission Factor (lb/10^3 gal)
15	68	1.33
10	50	1.00
6	30	0.58
2.5	12	0.25
1.25	9	0.17
1.00	8	0.17
0.625	2	0.04
TOTAL	100	2.00

[a] Reference 26. Source Classification Codes 1-02-005-01/02/03. To convert from lb/10^3 gal to kg/10^3 L, multiply by 0.12.
[b] Expressed as aerodynamic equivalent diameter.

Table 1.3-7. CUMULATIVE PARTICLE SIZE DISTRIBUTION AND SIZE-SPECIFIC EMISSION FACTORS UNCONTROLLED COMMERCIAL BOILERS BURNING RESIDUAL OR DISTILLATE OIL[a]

EMISSION FACTOR RATING: D

Particle Size[b] (μm)	Cumulative Mass % ≤ Stated Size		Cumulative Emission Factor[c] (lb/10^3 gal)	
	Residual Oil	Distillate Oil	Residual Oil	Distillate Oil
15	78	60	6.50A	1.17
10	62	55	5.17A	1.08
6	44	49	3.67A	1.00
2.5	23	42	1.92A	0.83
1.25	16	38	1.33A	0.75
1.00	14	37	1.17A	0.75
0.625	13	35	1.08A	0.67
TOTAL	100	100	8.34A	2.00

[a] Reference 26. Source Classification Codes: 1-03-004-01/02/03/04 and 1-03-005-01/02/03/04. To convert from lb/10^3 gal to kg/10^3 L, multiply by 0.12.
[b] Expressed as aerodynamic equivalent diameter.
[c] Particulate emission factors for residual oil combustion without emission controls are, on average, a function of fuel oil grade and sulfur content where S is the weight % of sulfur in the fuel. For example, if the fuel is 1.0% sulfur, then S = 1.
No. 6 oil: A = 1.12(S) + 0.37 No. 4 oil: A = 0.84
No. 5 oil: A = 1.2 No. 2 oil: A = 0.24

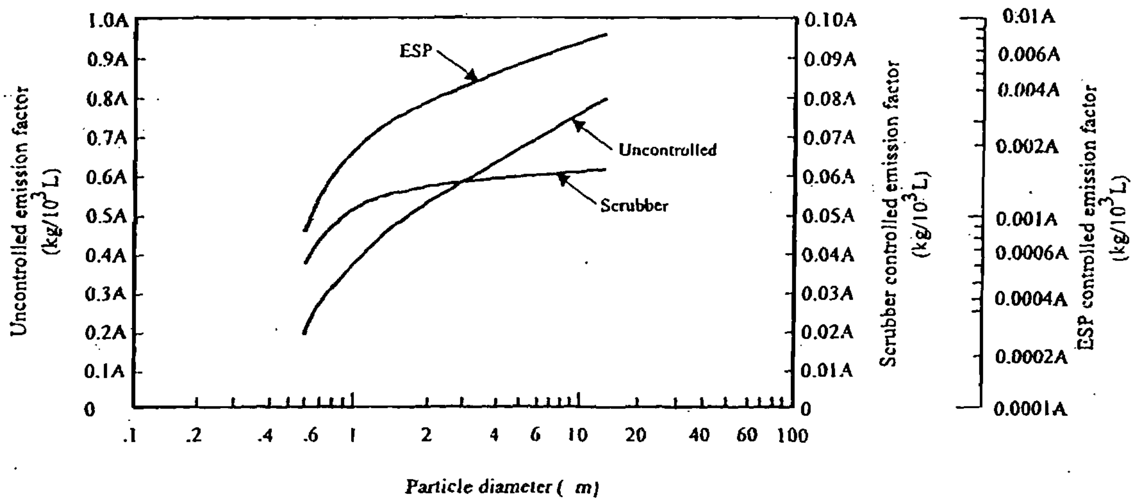


Figure 1.3-1. Cumulative size-specific emission factors for utility boilers firing residual oil.

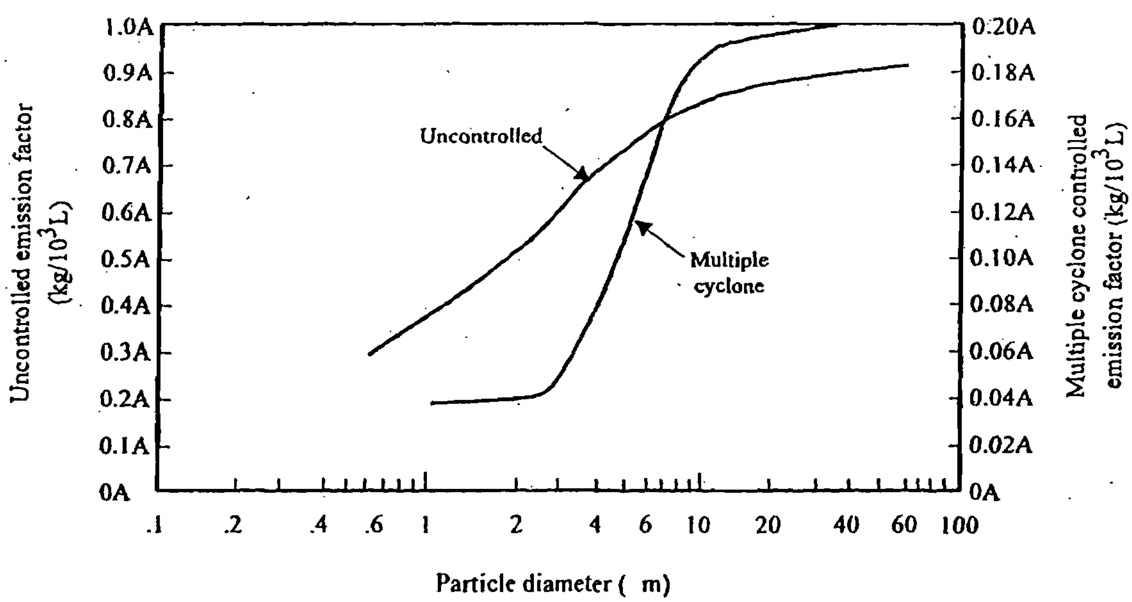


Figure 1.3-2. Cumulative size-specific emission factors for industrial boilers firing residual oil.

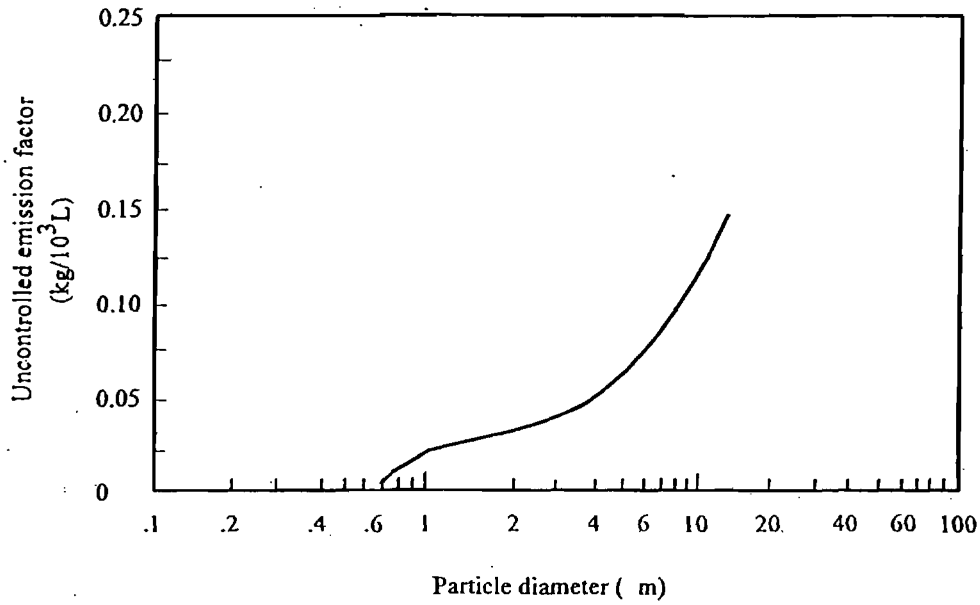


Figure 1.3-3. Cumulative size-specific emission factors for uncontrolled industrial boilers firing distillate oil.

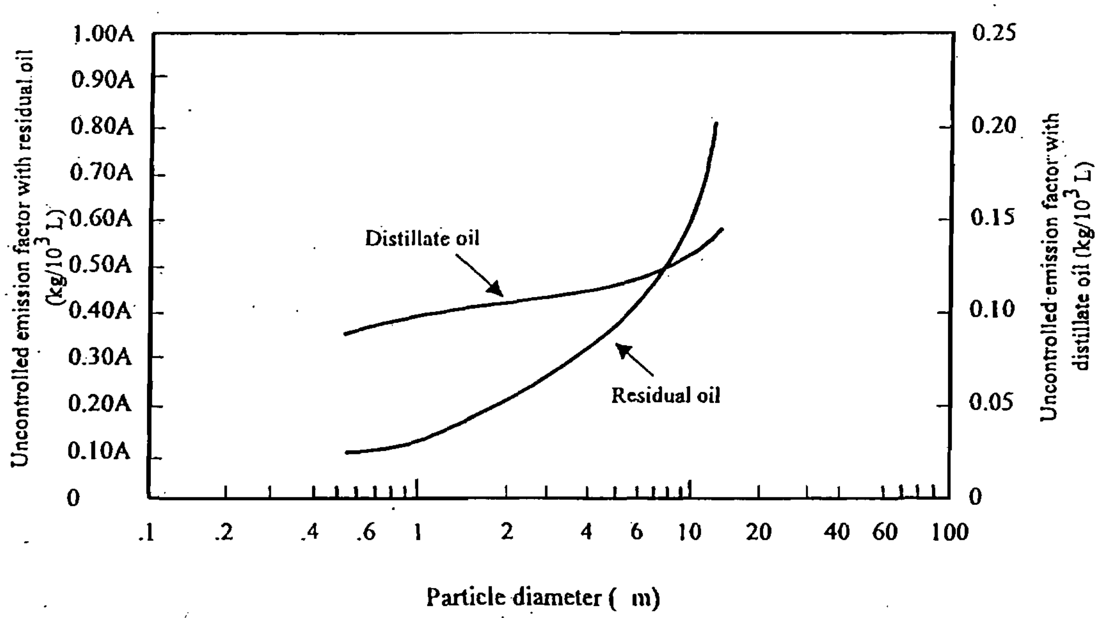


Figure 1.3-4. Cumulative size-specific emission factors for uncontrolled commercial boilers burning residual and distillate oil.

Table 1.3-8. EMISSION FACTORS FOR NITROUS OXIDE (N_2O), POLYCYCLIC ORGANIC MATTER (POM), AND FORMALDEHYDE (HCOH) FROM FUEL OIL COMBUSTION[a]

EMISSION FACTOR RATING: E

Firing Configuration (SCC)	Emission Factor (lb/10^3 gal)		
	N_2O[b]	POM[c]	HCOH[c]
Utility/industrial/commercial boilers			
No. 6 oil fired (1-01-004-01, 1-02-004-01, 1-03-004-01)	0.11	0.0011 - 0.0013[d]	0.024 - 0.061
Distillate oil fired (1-01-005-01, 1-02-005-01, 1-03-005-01)	0.11	0.0033[e]	0.035 - 0.061
Residential furnaces (A2104004/A2104011)	0.05	ND	ND

[a] To convert from lb/10^3 gal to kg/10^3 L, multiply by 0.12. SCC = Source Classification Code. ND = no data.
[b] References 45-46. EMISSION FACTOR RATING = B.
[c] References 29-32.
[d] Particulate and gaseous POM.
[e] Particulate POM only.

Table 1.3-9. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM FUEL OIL COMBUSTION[a]

Organic Compound	Average Emission Factor[b] (lb/10^3 Gal)	EMISSION FACTOR RATING
Benzene	2.14E-04	C
Ethylbenzene	6.36E-05[c]	E
Formaldehyde[d]	3.30E-02	C
Naphthalene	1.13E-03	C
1,1,1-Trichloroethane	2.36E-04[c]	E
Toluene	6.20E-03	D
o-Xylene	1.09E-04[c]	E
Acenaphthene	2.11E-05	C
Acenaphthylene	2.53E-07	D
Anthracene	1.22E-06	C
Benz(a)anthracene	4.01E-06	C
Benzo(b,k)fluoranthene	1.48E-06	C
Benzo(g,h,i)perylene	2.26E-06	C
Chrysene	2.38E-06	C
Dibenzo(a,h) anthracene	1.67E-06	D
Fluoranthene	4.84E-06	C
Fluorene	4.47E-06	C
Indo(1,2,3-cd)pyrene	2.14E-06	C
Phenanthrene	1.05E-05	C
Pyrene	4.25E-06	C
OCDD	3.10E-09[c]	E

[a] Data are for residual oil fired boilers, Source Classification Codes (SCCs) 1-01-004-01/04.

[b] References 64-72. To convert from lb/10^3 gal to kg/10^3 L, multiply by 0.12.

[c] Based on data from one source test (Reference 67).

[d] The formaldehyde number presented here is based only on data from utilities using No. 6 oil. The number presented in Table 1.3-7 is based on utility, commercial, and industrial boilers.

Table 1.3-10. EMISSION FACTORS FOR TRACE ELEMENTS FROM DISTILLATE FUEL OIL COMBUSTION SOURCES[a]

EMISSION FACTOR RATING: E

Firing Configuration (SCC)	Emission Factor (lb/10^{12} Btu)										
	As	Be	Cd	Cr	Cu	Pb	Hg	Mn	Ni	Se	Zn
Distillate oil fired (1-01-005-01, 1-02-005-01, 1-03-005-01)	4	3	3	3	6	9	3	6	3	15	4

[a] Data are for distillate oil fired boilers, SCC codes 1-01-005-01, 1-02-005-01, and 1-03-005-01. References 29-32, 40-44 and 83. To convert from lb/10^{12} Btu to pg/J, multiply by 0.43.

Table 1.3-11. EMISSION FACTORS FOR METALS FROM UNCONTROLLED NO. 6 FUEL OIL COMBUSTION[a]

Metal	Average Emission Factor[b, d] (lb/10^3 Gal)	EMISSION FACTOR RATING
Antimony	5.25E-03[c]	E
Arsenic	1.32E-03	C
Barium	2.57E-03	D
Beryllium	2.78E-05	C
Cadmium	3.98E-04	C
Chloride	3.47E-01	D
Chromium	8.45E-04	C
Chromium VI	2.48E-04	C
Cobalt	6.02E-03	D
Copper	1.76E-03	C
Fluoride	3.73E-02	D
Lead	1.51E-03	C
Manganese	3.00E-03	C
Mercury	1.13E-04	C
Molybdenum	7.87E-04	D
Nickel	8.45E-02	C
Phosphorous	9.46E-03	D
Selenium	6.83E-04	C
Vanadium	3.18E-02	D
Zinc	2.91E-02	D

[a] Data are for residual oil fired boilers, Source Classification Codes (SCCs) 1-01-004-01/04.

[b] References 64-72. 18 of 19 sources were uncontrolled and 1 source was controlled with low efficiency ESP. To convert from lb/10^3 gal to kg/10^3 L, multiply by 0.12.

[c] References 29-32,40-44.

[d] For oil/water mixture, reduce factors in proportion to water content of the fuel (due to dilution). To adjust the listed values for water content, multiply the listed value by 1-decimal fraction of water (ex: For fuel with 9 percent water by volume, multiply by 1-0.9=.91).

Table 1.3-12. DEFAULT CO_2 EMISSION FACTORS FOR LIQUID FUELS[a]

EMISSION FACTOR RATING: B

Fuel Type	%C[b]	Density[c] (lb/gal)	Emission Factor (lb/10^3 gal)
No. 1 (kerosene)	86.25	6.88	21,500
No. 2	87.25	7.05	22,300
Low Sulfur No. 6	87.26	7.88	25,000
High Sulfur No. 6	85.14	7.88	24,400

[a] Based on 99% conversion of fuel carbon content to CO_2. To convert from lb/gal to gram/cm^3, multiply by 0.12. To convert from lb/10^3 gal to kg/m^3, multiply by 0.12.

[b] Based on an average of fuel carbon contents given in references 73-74.

[c] References 73, 75.

Table 1.3-13. POSTCOMBUSTION SO_2 CONTROLS FOR FUEL OIL COMBUSTION SOURCES

Control Technology	Process	Typical Control Efficiencies	Remarks
Wet scrubber	Lime/limestone	80-95+%	Applicable to high-sulfur fuels, Wet sludge product
	Sodium carbonate	80-98%	5-430 MMBtu/hr typical application range, High reagent costs
	Magnesium oxide/hydroxide	80-95+%	Can be regenerated
	Dual alkali	90-96%	Uses lime to regenerate sodium-based scrubbing liquor
Spray drying	Calcium hydroxide slurry, vaporizes in spray vessel	70-90%	Applicable to low-and medium-sulfur fuels, Produces dry product
Furnace injection	Dry calcium carbonate/hydrate injection in upper furnace cavity	25-50%	Commercialized in Europe, Several U.S. demonstration projects underway
Duct injection	Dry sorbent injection into duct, sometimes combined with water spray	25-50+%	Several R&D and demonstration projects underway, Not yet Commercially available in the U.S.

Table 1.3-14. NO_x CONTROL OPTIONS FOR OIL-FIRED BOILERS[a]

Control Technique	Description Of Technique	NO_x Reduction Potential (%)		Range Of Application	Commercial Availability/ R&D Status	Comments
		Residual Oil	Distillate Oil			
Low Excess Air (LEA)	Reduction of combustion air	0 to 28	0 to 24	Generally excess O_2 can be reduced to 2.5% representing a 3% drop from baseline	Available for boilers with sufficient operational flexibility.	Added benefits included increase in boiler efficiency. Limited by increase in CO, HC, and smoke emissions.
Staged Combustion (SC)	Fuel-rich firing burners with secondary combustion air ports	20 to 50	17 to 44	70-90% burner stoichiometries can be used with proper installation of secondary air ports	Technique is applicable on packaged and field-erected units. However, not commercially available for all design types.	Best implemented on new units. Retrofit is probably not feasible for most units, especially packaged ones.
Burners Out of Service (BOOS)	One or more burners on air only. Remainder of burners firing fuel-rich	10 to 30	ND	Most effective on boilers with 4 or more burners in a square pattern.	Available.	Requires careful selection of BOOS pattern and control of air flow. May result in boiler de-rating unless fuel delivery system is modified.
Flue Gas Recirculation (FGR)	Recirculation of portion of flue gas to burners	15 to 30	58 to 73	Up to 25-30% of flue gas recycled. Can be implemented on most design types.	Available. Best suited for new units.	Requires extensive modifications to the burner and windbox. Possible flame instability at high FGR rates.
Flue Gas Recirculation Plus Staged Combustion	Combined techniques of FGR and staged combustion.	25 to 53	73 to 77	Maximum FGR rates set at 25% for distillate oil and 20% for residual oil.	Available for boilers with sufficient operational flexibility.	May not be feasible on all existing boiler types. Best implemented on new units.

Table 1.3-14 (cont.).

Control Technique	Description Of Technique	NO_x Reduction Potential (%)		Range Of Application	Commercial Availability/ R&D Status	Comments
		Residual Oil	Distillate Oil			
Load Reduction (LR)	Reduction of air and fuel flow to all burners in service	33% decrease to 25% increase in No_x	31% decrease to 17% increase in NO_x	Applicable to all boiler types and sizes. Load can be reduced to 25% of maximum.	Available in retrofit applications.	Technique not effective when it necessitates an increase in excess O_2 levels. LR possibly implemented in new designs as reduced combustion intensity (i. e., enlarged furnace plan area).
Low NO_x Burners (LNB)	New burner designs with controlled air/fuel mixing and increased heat dissipation	20 to 50	20 to 50	New burners described generally applicable to all boilers.	Commercially available.	Specific emissions data from industrial boilers equipped with LNB are lacking.
Reduced Air Preheat (RAP)	Bypass of combustion air preheater	5 to 16	ND	Combustion air temperature can be reduced to ambient conditions.	Available.	Application of this technique on new boilers requires installation of alternate heat recovery system (e. g., an economizer).
Selective Noncatalytic Reduction (SNCR)	Injection of NH_3 or urea as a reducing agent in the flue gas	40 to 70	40 to 70	Applicable for large packaged and field-erected watertube boilers. May not be feasible for fire-tube boilers.	Commercially offered but not widely demonstrated on large boilers.	Elaborate reagent injection, monitoring, and control system required. Possible load restrictions on boilers and air preheater fouling when burning high sulfur oil. Must have sufficient residence time at correct temperature.
Conventional Selective Catalytic Reduction (SCR)	Injections of NH_3 in the presence of a catalyst (usually upstream of air heater).	Up to 90% (estimated)	Up to 90% (estimated)	Typically large boiler designs	Commercially offered but not widely demonstrated.	Applicable to most boiler designs as a retrofit technology or for new boilers.

Table 1.3-14 (cont.).

Control Technique	Description Of Technique	NO_x Reduction Potential (%)		Range Of Application	Commercial Availability/ R&D Status	Comments
		Residual Oil	Distillate Oil			
Air Heater (SCR)	Catalyst-coated baskets in the air heater.	40-65 (estimated)	40-65 (estimated)	Boilers with rotating-basket air heaters	Available but not widely demonstrated	Design must address pressure drop and maintain heat transfer.
Duct SCR	A smaller version of conventional SCR is placed in existing ductwork	30 (estimated)	30 (estimated)	Typically large boiler designs	Available but not widely demonstrated.	Location of SCR in duct is temperature dependent.
Activated Carbon SCR	Activated carbon catalyst, installed downstream of air heater.	ND	ND	Typically large boiler designs	Available but not widely demonstrated.	High pressure drop.
Oil/Water Emulsified Fuel[a,b]	Oil/water fuel with emulsifying agent	41	ND	Firetube boilers	Available but not widely demonstrated	Thermal efficiency reduced due to water content

[a] ND = no data.

[b] Test conducted by EPA using commercially premixed fuel and water (9 percent water) containing a petroleum based emulsifying agent. Test boiler was a 2400 lb/hr, 15 psig Scotch Marine firetube type, fired at 2 x 10^6 Btu/hr.

Table 1.3-15. EMISSION FACTORS FOR NO. 6 OIL/WATER EMULSION IN INDUSTRIAL/COMMERCIAL/INSTITUTIONAL BOILERS[a]

Pollutant	Emission Factor ($lb/10^3$ gal)	Factor Rating	Comments
CO	1.90	C	33% Reduction from plain oil
NO_x	38.0	C	41% Reduction
PM	14.9	C	45% Reduction

[a] Test conducted by EPA using commercially premixed fuel and water (9 percent water) containing a petroleum based emulsifying agent. Test boiler was a 2400 lb/hr, 15 psig Scotch Marine firetube type, fired at 2×10^6 Btu/hr.

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1.4 Natural Gas Combustion

1.4.1 General[1-2]

Natural gas is one of the major combustion fuels used throughout the country. It is mainly used to generate industrial and utility electric power, produce industrial process steam and heat, and heat residential and commercial space. Natural gas consists of a high percentage of methane (generally above 85 percent) and varying amounts of ethane, propane, butane, and inerts (typically nitrogen, carbon dioxide, and helium). The average gross heating value of natural gas is approximately 1,020 British thermal units per standard cubic foot (Btu/scf), usually varying from 950 to 1,050 Btu/scf.

1.4.2 Firing Practices[3-5]

There are three major types of boilers used for natural gas combustion in commercial, industrial, and utility applications: watertube, firetube, and cast iron. Watertube boilers are designed to pass water through the inside of heat transfer tubes while the outside of the tubes is heated by direct contact with the hot combustion gases and through radiant heat transfer. The watertube design is the most common in utility and large industrial boilers. Watertube boilers are used for a variety of applications, ranging from providing large amounts of process steam, to providing hot water or steam for space heating, to generating high-temperature, high-pressure steam for producing electricity. Furthermore, watertube boilers can be distinguished either as field erected units or packaged units.

Field erected boilers are boilers that are constructed on site and comprise the larger sized watertube boilers. Generally, boilers with heat input levels greater than 100 MMBtu/hr, are field erected. Field erected units usually have multiple burners and, given the customized nature of their construction, also have greater operational flexibility and NO_x control options. Field erected units can also be further categorized as wall-fired or tangential-fired. Wall-fired units are characterized by multiple individual burners located on a single wall or on opposing walls of the furnace while tangential units have several rows of air and fuel nozzles located in each of the four corners of the boiler.

Package units are constructed off-site and shipped to the location where they are needed. While the heat input levels of packaged units may range up to 250 MMBtu/hr, the physical size of these units are constrained by shipping considerations and generally have heat input levels less than 100 MMBtu/hr. Packaged units are always wall-fired units with one or more individual burners. Given the size limitations imposed on packaged boilers, they have limited operational flexibility and cannot feasibly incorporate some NO_x control options.

Firetube boilers are designed such that the hot combustion gases flow through tubes, which heat the water circulating outside of the tubes. These boilers are used primarily for space heating systems, industrial process steam, and portable power boilers. Firetube boilers are almost exclusively packaged units. The two major types of firetube units are Scotch Marine boilers and the older firebox boilers. In cast iron boilers, as in firetube boilers, the hot gases are contained inside the tubes and the water being heated circulates outside the tubes. However, the units are constructed of cast iron rather than steel. Virtually all cast iron boilers are constructed as package boilers. These boilers are used to produce either low-pressure steam or hot water, and are most commonly used in small commercial applications.

Natural gas is also combusted in residential boilers and furnaces. Residential boilers and furnaces generally resemble firetube boilers with flue gas traveling through several channels or tubes with water or air circulated outside the channels or tubes.

1.4.3 Emissions[3-4]

The emissions from natural gas-fired boilers and furnaces include nitrogen oxides (NO_x), carbon monoxide (CO), and carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), volatile organic compounds (VOCs), trace amounts of sulfur dioxide (SO_2), and particulate matter (PM).

Nitrogen Oxides -

Nitrogen oxides formation occurs by three fundamentally different mechanisms. The principal mechanism of NO_x formation in natural gas combustion is thermal NO_x. The thermal NO_x mechanism occurs through the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most NO_x formed through the thermal NO_x mechanism occurs in the high temperature flame zone near the burners. The formation of thermal NO_x is affected by three furnace-zone factors: (1) oxygen concentration, (2) peak temperature, and (3) time of exposure at peak temperature. As these three factors increase, NO_x emission levels increase. The emission trends due to changes in these factors are fairly consistent for all types of natural gas-fired boilers and furnaces. Emission levels vary considerably with the type and size of combustor and with operating conditions (e.g., combustion air temperature, volumetric heat release rate, load, and excess oxygen level).

The second mechanism of NO_x formation, called prompt NO_x, occurs through early reactions of nitrogen molecules in the combustion air and hydrocarbon radicals from the fuel. Prompt NO_x reactions occur within the flame and are usually negligible when compared to the amount of NO_x formed through the thermal NO_x mechanism. However, prompt NO_x levels may become significant with ultra-low-NO_x burners.

The third mechanism of NO_x formation, called fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Due to the characteristically low fuel nitrogen content of natural gas, NO_x formation through the fuel NO_x mechanism is insignificant.

Carbon Monoxide -

The rate of CO emissions from boilers depends on the efficiency of natural gas combustion. Improperly tuned boilers and boilers operating at off-design levels decrease combustion efficiency resulting in increased CO emissions. In some cases, the addition of NO_x control systems such as low NO_x burners and flue gas recirculation (FGR) may also reduce combustion efficiency, resulting in higher CO emissions relative to uncontrolled boilers.

Volatile Organic Compounds -

The rate of VOC emissions from boilers and furnaces also depends on combustion efficiency. VOC emissions are minimized by combustion practices that promote high combustion temperatures, long residence times at those temperatures, and turbulent mixing of fuel and combustion air. Trace amounts of VOC species in the natural gas fuel (e.g., formaldehyde and benzene) may also contribute to VOC emissions if they are not completely combusted in the boiler.

Sulfur Oxides -

Emissions of SO_2 from natural gas-fired boilers are low because pipeline quality natural gas typically has sulfur levels of 2,000 grains per million cubic feet. However, sulfur-containing odorants are added to natural gas for detecting leaks, leading to small amounts of SO_2 emissions. Boilers combusting unprocessed natural gas may have higher SO_2 emissions due to higher levels of sulfur in the natural gas. For these units, a sulfur mass balance should be used to determine SO_2 emissions.

Particulate Matter -

Because natural gas is a gaseous fuel, filterable PM emissions are typically low. Particulate matter from natural gas combustion has been estimated to be less than 1 micrometer in size and has filterable and condensable fractions. Particulate matter in natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted. Increased PM emissions may result from poor air/fuel mixing or maintenance problems.

Greenhouse Gases -[6-9]

CO_2, CH_4, and N_2O emissions are all produced during natural gas combustion. In properly tuned boilers, nearly all of the fuel carbon (99.9 percent) in natural gas is converted to CO_2 during the combustion process. This conversion is relatively independent of boiler or combustor type. Fuel carbon not converted to CO_2 results in CH_4, CO, and/or VOC emissions and is due to incomplete combustion. Even in boilers operating with poor combustion efficiency, the amount of CH_4, CO, and VOC produced is insignificant compared to CO_2 levels.

Formation of N_2O during the combustion process is affected by two furnace-zone factors. N_2O emissions are minimized when combustion temperatures are kept high (above 1475°F) and excess oxygen is kept to a minimum (less than 1 percent).

Methane emissions are highest during low-temperature combustion or incomplete combustion, such as the start-up or shut-down cycle for boilers. Typically, conditions that favor formation of N_2O also favor emissions of methane.

1.4.4 Controls[4,10]

NO_x Controls -

Currently, the two most prevalent combustion control techniques used to reduce NO_x emissions from natural gas-fired boilers are flue gas recirculation (FGR) and low NO_x burners. In an FGR system, a portion of the flue gas is recycled from the stack to the burner windbox. Upon entering the windbox, the recirculated gas is mixed with combustion air prior to being fed to the burner. The recycled flue gas consists of combustion products which act as inerts during combustion of the fuel/air mixture. The FGR system reduces NO_x emissions by two mechanisms. Primarily, the recirculated gas acts as a dilutent to reduce combustion temperatures, thus suppressing the thermal NO_x mechanism. To a lesser extent, FGR also reduces NO_x formation by lowering the oxygen concentration in the primary flame zone. The amount of recirculated flue gas is a key operating parameter influencing NO_x emission rates for these systems. An FGR system is normally used in combination with specially designed low NO_x burners capable of sustaining a stable flame with the increased inert gas flow resulting from the use of FGR. When low NO_x burners and FGR are used in combination, these techniques are capable of reducing NO_x emissions by 60 to 90 percent.

Low NO_x burners reduce NO_x by accomplishing the combustion process in stages. Staging partially delays the combustion process, resulting in a cooler flame which suppresses thermal NO_x formation. The two most common types of low NO_x burners being applied to natural gas-fired boilers are staged air burners and staged fuel burners. NO_x emission reductions of 40 to 85 percent (relative to uncontrolled emission levels) have been observed with low NO_x burners.

Other combustion control techniques used to reduce NO_x emissions include staged combustion and gas reburning. In staged combustion (e.g., burners-out-of-service and overfire air), the degree of staging is a key operating parameter influencing NO_x emission rates. Gas reburning is similar to the use of overfire in the use of combustion staging. However, gas reburning injects additional amounts of natural gas in the upper furnace, just before the overfire air ports, to provide increased reduction of NO_x to NO_2.

Two postcombustion technologies that may be applied to natural gas-fired boilers to reduce NO_x emissions are selective noncatalytic reduction (SNCR) and selective catalytic reduction (SCR). The SNCR system injects ammonia (NH_3) or urea into combustion flue gases (in a specific temperature zone) to reduce NO_x emission. The Alternative Control Techniques (ACT) document for NO_x emissions from utility boilers, maximum SNCR performance was estimated to range from 25 to 40 percent for natural gas-fired boilers.[12] Performance data available from several natural gas fired utility boilers with SNCR show a 24 percent reduction in NO_x for applications on wall-fired boilers and a 13 percent reduction in NO_x for applications on tangential-fired boilers.[11] In many situations, a boiler may have an SNCR system installed to trim NO_x emissions to meet permitted levels. In these cases, the SNCR system may not be operated to achieve maximum NO_x reduction. The SCR system involves injecting NH_3 into the flue gas in the presence of a catalyst to reduce NO_x emissions. No data were available on SCR performance on natural gas fired boilers at the time of this publication. However, the ACT Document for utility boilers estimates NO_x reduction efficiencies for SCR control ranging from 80 to 90 percent.[12]

Emission factors for natural gas combustion in boilers and furnaces are presented in Tables 1.4-1, 1.4-2, 1.4-3, and 1.4-4.[11] Tables in this section present emission factors on a volume basis (lb/10^6 scf). To convert to an energy basis (lb/MMBtu), divide by a heating value of 1,020 MMBtu/10^6 scf. For the purposes of developing emission factors, natural gas combustors have been organized into three general categories: large wall-fired boilers with greater than 100 MMBtu/hr of heat input, boilers and residential furnaces with less than 100 MMBtu/hr of heat input, and tangential-fired boilers. Boilers within these categories share the same general design and operating characteristics and hence have similar emission characteristics when combusting natural gas.

Emission factors are rated from A to E to provide the user with an indication of how "good" the factor is, with "A" being excellent and "E" being poor. The criteria that are used to determine a rating for an emission factor can be found in the Emission Factor Documentation for AP-42 Section 1.4 and in the introduction to the AP-42 document.

1.4.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section are summarized below. For further detail, consult the Emission Factor Documentation for this section. These and other documents can be found on the Emission Factor and Inventory Group (EFIG) home page (http://www.epa.gov/ttn/chief).

Supplement D, March 1998

- Text was revised concerning Firing Practices, Emissions, and Controls.

- All emission factors were updated based on 482 data points taken from 151 source tests. Many new emission factors have been added for speciated organic compounds, including hazardous air pollutants.

July 1998 - minor changes

- Footnote D was added to table 1.4-3 to explain why the sum of individual HAP may exceed VOC or TOC, the web address was updated, and the references were reordered.

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION[a]

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO_x[b]		CO	
	Emission Factor (lb/10^6 scf)	Emission Factor Rating	Emission Factor (lb/10^6 scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS)[c]	280	A	84	B
Uncontrolled (Post-NSPS)[c]	190	A	84	B
Controlled - Low NO_x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO_x burners	50	D	84	B
Controlled - Low NO_x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from lb/10^6 scf to kg/10^6 m^3, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from 1b/10^6 scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] Expressed as NO_2. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO_x emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO_x emission factor.

[c] NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_X burner)	0.64	E
PM (Total)[c]	7.6	D
PM (Condensable)[c]	5.7	D
PM (Filterable)[c]	1.9	B
SO_2[d]	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. CO_2[$lb/10^6$ scf] = (3.67) (CON) (C)(D), where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, $4.2x10^4$ $lb/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM_{10}, $PM_{2.5}$ or PM_1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to SO_2. Assumes sulfur content is natural gas of 2,000 grains/10^6 scf. The SO_2 emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO_2 emission factor by the ratio of the site-specific sulfur content (grains/10^6 scf) to 2,000 grains/10^6 scf.

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
91-57-6	2-Methylnaphthalene[b, c]	2.4E-05	D
56-49-5	3-Methylchloranthrene[b, c]	<1.8E-06	E
	7,12-Dimethylbenz(a)anthracene[b,c]	<1.6E-05	E
83-32-9	Acenaphthene[b,c]	<1.8E-06	E
203-96-8	Acenaphthylene[b,c]	<1.8E-06	E
120-12-7	Anthracene[b,c]	<2.4E-06	E
56-55-3	Benz(a)anthracene[b,c]	<1.8E-06	E
71-43-2	Benzene[b]	2.1E-03	B
50-32-8	Benzo(a)pyrene[b,c]	<1.2E-06	E
205-99-2	Benzo(b)fluoranthene[b,c]	<1.8E-06	E
191-24-2	Benzo(g,h,i)perylene[b,c]	<1.2E-06	E
205-82-3	Benzo(k)fluoranthene[b,c]	<1.8E-06	E
106-97-8	Butane	2.1E+00	E
218-01-9	Chrysene[b,c]	<1.8E-06	E
53-70-3	Dibenzo(a,h)anthracene[b,c]	<1.2E-06	E
25321-22-6	Dichlorobenzene[b]	1.2E-03	E
74-84-0	Ethane	3.1E+00	E
206-44-0	Fluoranthene[b,c]	3.0E-06	E
86-73-7	Fluorene[b,c]	2.8E-06	E
50-00-0	Formaldehyde[b]	7.5E-02	B
110-54-3	Hexane[b]	1.8E+00	E
193-39-5	Indeno(1,2,3-cd)pyrene[b,c]	<1.8E-06	E
91-20-3	Naphthalene[b]	6.1E-04	E
109-66-0	Pentane	2.6E+00	E
85-01-8	Phenanathrene[b,c]	1.7E-05	D

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION (Continued)

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
74-98-6	Propane	1.6E+00	E
129-00-0	Pyrene[b, c]	5.0E-06	E
108-88-3	Toluene[b]	3.4E-03	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. Emission Factors preceeded with a less-than symbol are based on method detection limits.

[b] Hazardous Air Pollutant (HAP) as defined by Section 112(b) of the Clean Air Act.

[c] HAP because it is Polycyclic Organic Matter (POM). POM is a HAP as defined by Section 112(b) of the Clean Air Act.

[d] The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant.

TABLE 1.4-4. EMISSION FACTORS FOR METALS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
7440-38-2	Arsenic[b]	2.0E-04	E
7440-39-3	Barium	4.4E-03	D
7440-41-7	Beryllium[b]	<1.2E-05	E
7440-43-9	Cadmium[b]	1.1E-03	D
7440-47-3	Chromium[b]	1.4E-03	D
7440-48-4	Cobalt[b]	8.4E-05	D
7440-50-8	Copper	8.5E-04	C
7439-96-5	Manganese[b]	3.8E-04	D
7439-97-6	Mercury[b]	2.6E-04	D
7439-98-7	Molybdenum	1.1E-03	D
7440-02-0	Nickel[b]	2.1E-03	C
7782-49-2	Selenium[b]	<2.4E-05	E
7440-62-2	Vanadium	2.3E-03	D
7440-66-6	Zinc	2.9E-02	E

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. Emission factors preceeded by a less-than symbol are based on method detection limits. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to lb/MMBtu, divide by 1,020.

[b] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

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13.2.1 Paved Roads

13.2.1.1 General

Particulate emissions occur whenever vehicles travel over a paved surface such as a road or parking lot. Particulate emissions from paved roads are due to direct emissions from vehicles in the form of exhaust, brake wear and tire wear emissions and resuspension of loose material on the road surface. In general terms, resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface (i.e., the surface loading). In turn, that surface loading is continuously replenished by other sources. At industrial sites, surface loading is replenished by spillage of material and trackout from unpaved roads and staging areas. Figure 13.2.1-1 illustrates several transfer processes occurring on public streets.

Various field studies have found that public streets and highways, as well as roadways at industrial facilities, can be major sources of the atmospheric particulate matter within an area.[1-9] Of particular interest in many parts of the United States are the increased levels of emissions from public paved roads when the equilibrium between deposition and removal processes is upset. This situation can occur for various reasons, including application of granular materials for snow and ice control, mud/dirt carryout from construction activities in the area, and deposition from wind and/or water erosion of surrounding unstabilized areas. In the absence of continuous addition of fresh material (through localized trackout or application of antiskid material), paved road surface loading should reach an equilibrium value in which the amount of material resuspended matches the amount replenished. The equilibrium surface loading value depends upon numerous factors. It is believed that the most important factors are: mean speed of vehicles traveling the road; the average daily traffic (ADT); the number of lanes and ADT per lane; the fraction of heavy vehicles (buses and trucks); and the presence/absence of curbs, storm sewers and parking lanes.[10]

The particulate emission factors presented in the previous version of this section of AP-42, dated October 2002, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material. EPA included these sources in the emission factor equation for paved roads since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the paved road emission factor equation only estimates particulate emissions from resuspended road surface material [28]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOBILE6.2 [27]. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOBILE6.2 to estimate particulate emissions from vehicle traffic on paved roads. It also incorporates the decrease in exhaust emissions that has occurred since the paved road emission factor equation was developed. The previous version of the paved road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.1.2 Emissions And Correction Parameters

Dust emissions from paved roads have been found to vary with what is termed the "silt loading" present on the road surface as well as the average weight of vehicles traveling the road. The term silt loading (sL) refers to the mass of silt-size material (equal to or less than 75 micrometers [μm] in physical diameter) per unit area of the travel surface. The total road surface dust loading consists of loose material that can be collected by broom sweeping and vacuuming of the traveled portion of the paved road. The silt fraction is determined by measuring the proportion of the loose dry surface dust that passes through a 200-mesh screen, using the ASTM-C-136 method. Silt loading is the product of the silt fraction and the total loading, and is abbreviated "sL". Additional details on the sampling and analysis of such material are provided in AP-42 Appendices C.1 and C.2.

The surface sL provides a reasonable means of characterizing seasonal variability in a paved road emission inventory. In many areas of the country, road surface loadings [11-21] are heaviest during the late winter and early spring months when the residual loading from snow/ice controls is greatest. As noted earlier, once replenishment of fresh material is eliminated, the road surface loading can be expected to reach an equilibrium value, which is substantially lower than the late winter/early spring values.

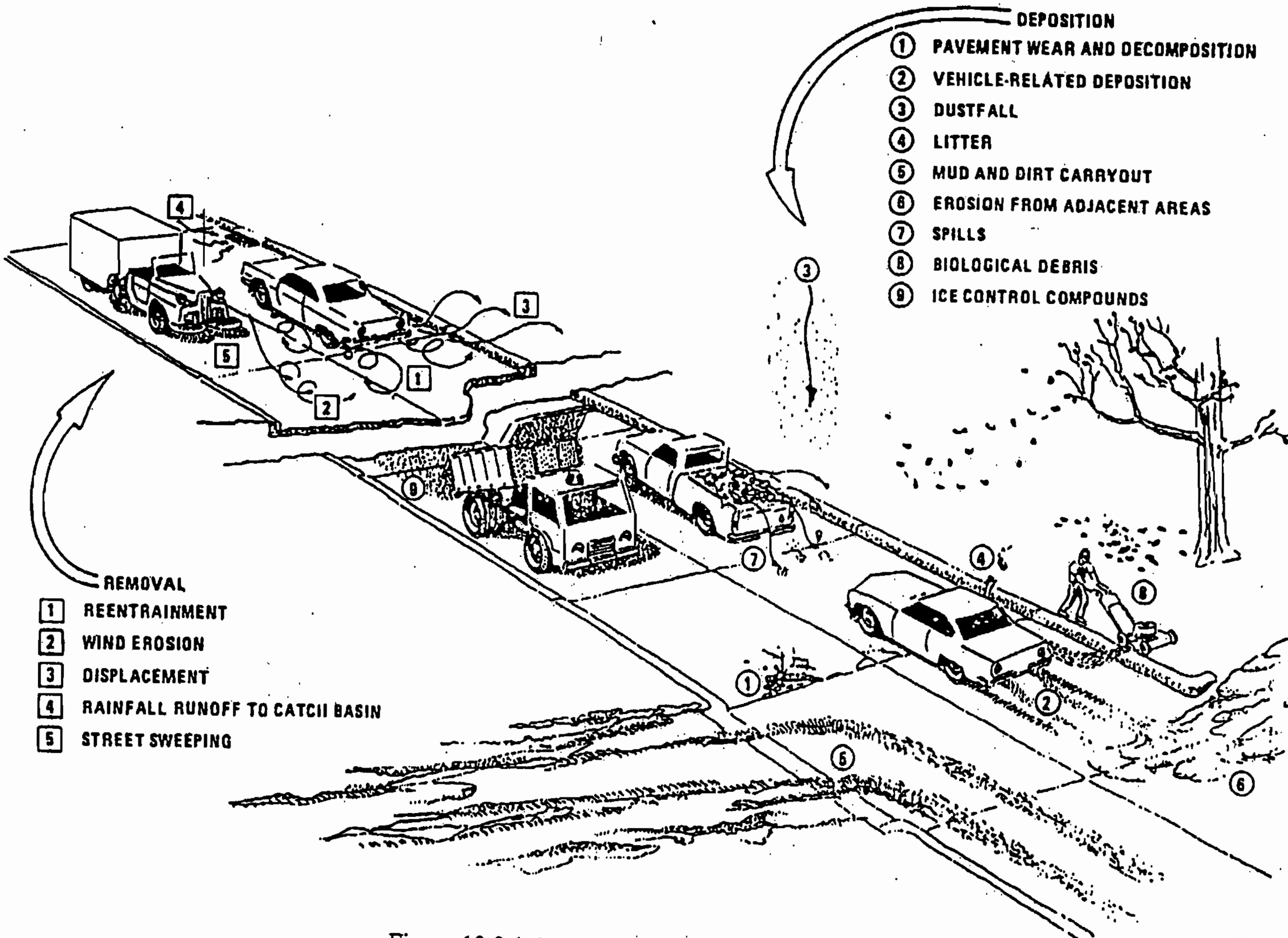

Figure 13.2.1-1. Deposition and removal processes.

13.2.1.3 Predictive Emission Factor Equations [10]

The quantity of particulate emissions from resuspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression:

$$E = k\left(\frac{sL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - C \qquad (1)$$

where: E = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see below),
sL = road surface silt loading (grams per square meter) (g/m^2),
W = average weight (tons) of the vehicles traveling the road, and
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

It is important to note that Equation 1 calls for the average weight of all vehicles traveling the road. For example, if 99 percent of traffic on the road are 2 ton cars/trucks while the remaining 1 percent consists of 20 ton trucks, then the mean weight "W" is 2.2 tons. More specifically, Equation 1 is *not* intended to be used to calculate a separate emission factor for each vehicle weight class. Instead, only one emission factor should be calculated to represent the "fleet" average weight of all vehicles traveling the road.

The particle size multiplier (k) above varies with aerodynamic size range as shown in Table 13.2.1-1. To determine particulate emissions for a specific particle size range, use the appropriate value of k shown in Table 13.2.1-1.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (C) was obtained from EPA's MOBILE6.2 model [28]. The emission factor also varies with aerodynamic size range as shown in Table 13.2.1-2.

Table 13.2-1.1. PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Size range[a]	Particle Size Multiplier k[b]		
	g/VKT	g/VMT	lb/VMT
PM-2.5[c]	0.66	1.1	0.0024
PM-10	4.6	7.3	0.016
PM-15	5.5	9.0	0.020
PM-30[d]	24	38	0.082

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.

[c] The revised k-factors were based on the ratio of $PM_{2.5}$:PM_{10} in Table 1 of Reference 22 and are found in Table 2 of Reference 22. However, this ratio may not be used directly to estimate $PM_{2.5}$ from PM_{10} emissions. Equation (1) must be be computed separately for each size fraction because the relationship between $PM_{2.5}$ and PM_{10} emissions is not a simple ratio (i.e., the constant "C" in Equation (1) is not multiplied by the k-factor).

[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Table 13.2.1-2. EMISSION FACTOR FOR 1980'S VEHICLE FLEET EXHAUST, BRAKE WEAR AND TIRE WEAR

Particle Size Range[a]	*C*, Emission Factor for Exhaust, Brake Wear and Tire Wear[b]		
	g/VMT	g/VKT	lb/VMT
$PM_{2.5}$	0.1617	0.1005	0.00036
PM_{10}	0.2119	0.1317	0.00047
PM_{15}	0.2119	0.1317	0.00047
PM_{30}[c]	0.2119	0.1317	0.00047

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.
[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT).
[c] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Equation 1 is based on a regression analysis of numerous emission tests, including 65 tests for PM-10.[10] Sources tested include public paved roads, as well as controlled and uncontrolled industrial paved roads. All sources tested were of freely flowing vehicles traveling at constant speed on relatively level roads. No tests of "stop-and-go" traffic or vehicles under load were available for inclusion in the data base. The equations retain the quality rating of A (B for PM-2.5), if applied within the range of source conditions that were tested in developing the equation as follows:

Silt loading:	0.03 - 400 g/m^2 0.04 - 570 grains/square foot (ft^2)
Mean vehicle weight:	1.8 - 38 megagrams (Mg) 2.0 - 42 tons
Mean vehicle speed:	16 - 88 kilometers per hour (kph) 10 - 55 miles per hour (mph)

Note: There may be situations where low silt loading and/or low average weight will yield calculated negative emissions from equation 1. If this occurs, the emissions calculated from equation 1 should be set to zero.

Users are cautioned that application of equation 1 outside of the range of variables and operating conditions specified above, e.g., application to roadways or road networks with speeds below 10 mph and with stop-and-go traffic, will result in emission estimates with a higher level of uncertainty. In these situations, users are encouraged to consider alternative methods that are equally or more plausible in light of local emissions data and/or ambient concentration or compositional data.

To retain the quality rating for the emission factor equation when it is applied to a specific paved road, it is necessary that reliable correction parameter values for the specific road in question be determined. With the exception of limited access roadways, which are difficult to sample, the collection and use of site-specific silt loading (sL) data for public paved road emission inventories are strongly recommended. The field and laboratory procedures for determining surface material silt content and surface dust loading are summarized in Appendices C.1 and C.2. In the event that site-specific values cannot be obtained, an appropriate value for a paved public road may be selected from the values in Table 13.2.1-3, but the quality rating of the equation should be reduced by 2 levels. Also, recall that Equation 1 refers to emissions due to freely flowing (not stop-and-go) traffic at constant speed on level roads.

Equation 1 may be extrapolated to average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual (or other long-term) average emissions are inversely proportional to the frequency of measurable (> 0.254 mm [0.01 inch]) precipitation by application of a precipitation correction term. The precipitation correction term can be applied on a daily or an hourly basis [26].

For the daily basis, Equation 1 becomes:

$$E_{ext} = \left[k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5} - C \right] \left(1 - \frac{P}{4N} \right) \qquad (2)$$

where k, sL, W, *and* C are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as k,
P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Note that the assumption leading to Equation 2 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2. However, Equation 2 above incorporates an additional factor of "4" in the denominator to account for the fact that paved roads dry more quickly than unpaved roads and that the precipitation may not occur over the complete 24-hour day.

For the hourly basis, equation 1 becomes:

$$E_{ext} = \left[k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5} - C \right] \left(1 - \frac{1.2P}{N} \right) \qquad (3)$$

where k, sL, and W, and C are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as k,
P = number of hours with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of hours in the averaging period (e.g., 8760 for annual, 2124 for season 720 for monthly).

Note: In the hourly moisture correction term (1-1.2P/N) for equation 3, the 1.2 multiplier is applied to account for the residual mitigative effect of moisture. For most applications, this equation will produce satisfactory results. However, if the time interval for which the equation is applied is short, e.g., for one hour or one day, the application of this multiplier makes it possible for the moisture correction term to become negative. This will result in calculated negative emissions which is not realistic. Users should expand the time interval to include sufficient "dry" hours such that negative emissions are not calculated. For the special case where this equation is used to calculate emissions on an hour by hour basis, such as would be done in some emissions modeling situations, the moisture correction term should be modified so that the moisture correction "credit" is applied to the first hours following cessation of precipitation. In this special case, it is suggested that this 20% "credit" be applied on a basis of one hour credit for each hour of precipitation up to a maximum of 12 hours.

Note that the assumption leading to Equation 3 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2.

Figure 13.2.1-2 presents the geographical distribution of "wet" days on an annual basis for the United States. Maps showing this information on a monthly basis are available in the *Climatic Atlas of the United States*[23]. Alternative sources include other Department of Commerce publications (such as local climatological data summaries). The National Climatic Data Center (NCDC) offers several products that provide hourly precipitation data. In particular, NCDC offers *Solar and Meteorological Surface Observation Network 1961-1990* (SAMSON) CD-ROM, which contains 30 years worth of hourly meteorological data for first-order National Weather Service locations. Whatever meteorological data are used, the source of that data and the averaging period should be clearly specified.

It is emphasized that the simple assumption underlying Equations 2 and 3 has not been verified in any rigorous manner. For that reason, the quality ratings for Equations 2 and 3 should be downgraded one letter from the rating that would be applied to Equation 1.

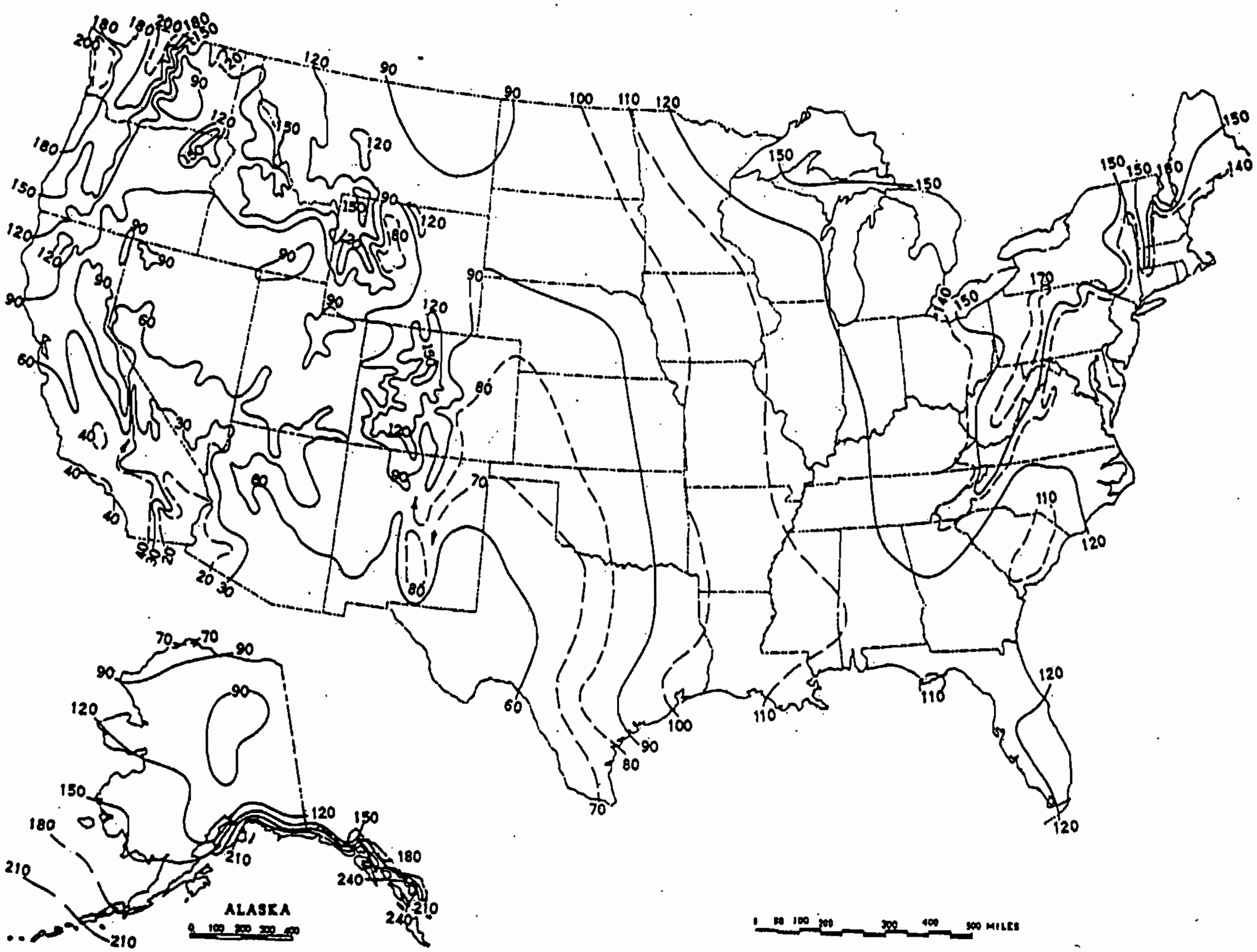

Figure 13.2.1-2. Mean number of days with 0.01 inch or more of precipitation in the United States.

Table 13.2.1-3 presents recommended default silt loadings for normal baseline conditions and for wintertime baseline conditions in areas that experience frozen precipitation with periodic application of antiskid material[24]. The winter baseline is represented as a multiple of the non-winter baseline, depending on the ADT value for the road in question. As shown, a multiplier of 4 is applied for low volume roads (< 500 ADT) to obtain a wintertime baseline silt loading of 4 X 0.6 = 2.4 g/m^2.

Table 13.2.1-3. Ubiquitous Silt Loading Default Values with Hot Spot Contributions from Anti-Skid Abrasives (g/m^2)

ADT Category	< 500	500-5,000	5,000-10,000	> 10,000
Ubiquitous Baseline g/m^2	0.6	0.2	0.06	0.03 0.015 limited access
Ubiquitous Winter Baseline Multiplier during months with frozen precipitation	X4	X3	X2	X1
Initial peak additive contribution from application of antiskid abrasive (g/m^2)	2	2	2	2
Days to return to baseline conditions (assume linear decay)	7	3	1	0.5

It is suggested that an additional (but temporary) silt loading contribution of 2 g/m^2 occurs with each application of antiskid abrasive for snow/ice control. This was determined based on a typical application rate of 500 lb per lane mile and an initial silt content of 1 % silt content. Ordinary rock salt and other chemical deicers add little to the silt loading, because most of the chemical dissolves during the snow/ice melting process.

To adjust the baseline silt loadings for mud/dirt trackout, the number of trackout points is required. It is recommended that in calculating PM-10 emissions, six additional miles of road be added for each active trackout point from an active construction site, to the paved road mileage of the specified category within the county. In calculating PM-2.5 emissions, it is recommended that three additional miles of road be added for each trackout point from an active construction site.

It is suggested the number of trackout points for activities other than road and building construction areas be related to land use. For example, in rural farming areas, each mile of paved road would have a specified number of trackout points at intersections with unpaved roads. This value could be estimated from the unpaved road density (mi/sq. mi.).

The use of a default value from Table 13.2.1-3 should be expected to yield only an order-of-magnitude estimate of the emission factor. Public paved road silt loadings are dependent upon: traffic characteristics (speed, ADT, and fraction of heavy vehicles); road characteristics (curbs, number of lanes, parking lanes); local land use (agriculture, new residential construction) and regional/seasonal factors (snow/ice controls, wind blown dust). As a result, the collection and use of site-specific silt loading data is highly recommended. In the event that default silt loading values are used, the quality ratings for the equation should be downgraded 2 levels.

Limited access roadways pose severe logistical difficulties in terms of surface sampling, and few silt loading data are available for such roads. Nevertheless, the available data do not suggest great variation in silt loading for limited access roadways from one part of the country to another. For annual conditions, a default value of 0.015 g/m^2 is recommended for limited access roadways.[9,22] Even fewer of the available data correspond to worst-case situations, and elevated loadings are observed to be quickly depleted because of high traffic speeds and high ADT rates. A default value of 0.2 g/m^2 is recommended for short periods of time following application of snow/ice controls to limited access roads.[22]

The limited data on silt loading values for industrial roads have shown as much variability as public roads. Because of the variations of traffic conditions and the use of preventive mitigative controls, the data probably do not reflect the full extent of the potential variation in silt loading on industrial roads. However, the collection of site specific silt loading data from industrial roads is easier and safer than for public roads. Therefore, the collection and use of site-specific silt loading data is preferred and is highly recommended. In the event that site-specific values cannot be obtained, an appropriate value for an industrial road may be selected from the mean values given in Table 13.2.1-4, but the quality rating of the equation should be reduced by 2 levels.

Table 13.2.1-4 (Metric And English Units). TYPICAL SILT CONTENT AND LOADING VALUES FOR PAVED ROADS AT INDUSTRIAL FACILITIES[a]

Industry	No. Of Sites	No. Of Samples	Silt Content (%)		No. Of Travel Lanes	Total Loading x 10^{-3}			Silt Loading (g/m^2)	
			Range	Mean		Range	Mean	Units[b]	Range	Mean
Copper smelting	1	3	15.4-21.7	19.0	2	12.9-19.5 45.8-69.2	15.9 55.4	kg/km lb/mi	188-400	292
Iron and steel production	9	48	1.1-35.7	12.5	2	0.006-4.77 0.020-16.9	0.495 1.75	kg/km lb/mi	0.09-79	9.7
Asphalt batching	1	3	2.6-4.6	3.3	1	12.1-18.0 43.0-64.0	14.9 52.8	kg/km lb/mi	76-193	120
Concrete batching	1	3	5.2-6.0	5.5	2	1.4-1.8 5.0-6.4	1.7 5.9	kg/km lb/mi	11-12	12
Sand and gravel processing	1	3	6.4-7.9	7.1	1	2.8-5.5 9.9-19.4	3.8 13.3	kg/km lb/mi	53-95	70
Municipal solid waste landfill	2	7	—	—	2	—	—	—	1.1-32.0	7.4
Quarry	1	6	—	—	2	—	—	—	2.4-14	8.2

[a] References 1-2,5-6,11-13. Values represent samples collected from *industrial* roads. Public road silt loading values are presented in Table-13.2.1-2. Dashes indicate information not available.

[b] Multiply entries by 1000 to obtain stated units; kilograms per kilometer (kg/km) and pounds per mile (lb/mi).

13.2.1.4 Controls[6,25]

Because of the importance of the silt loading, control techniques for paved roads attempt either to prevent material from being deposited onto the surface (preventive controls) or to remove from the travel lanes any material that has been deposited (mitigative controls). Covering of loads in trucks, and the paving of access areas to unpaved lots or construction sites, are examples of preventive measures. Examples of mitigative controls include vacuum sweeping, water flushing, and broom sweeping and flushing. Actual control efficiencies for any of these techniques can be highly variable. Locally measured silt loadings before and after the application of controls is the preferred method to evaluate controls. It is particularly important to note that street sweeping of gutters and curb areas may actually increase the silt loading on the traveled portion of the road. Redistribution of loose material onto the travel lanes will actually produce a short-term increase in the emissions.

In general, preventive controls are usually more cost effective than mitigative controls. The cost-effectiveness of mitigative controls falls off dramatically as the size of an area to be treated increases. The cost-effectiveness of mitigative measures is also unfavorable if only a short period of time is required for the road to return to equilibrium silt loading condition. That is to say, the number and length of public roads within most areas of interest preclude any widespread and routine use of mitigative controls. On the other hand, because of the more limited scope of roads at an industrial site, mitigative measures may be used quite successfully (especially in situations where truck spillage occurs). Note, however, that public agencies could make effective use of mitigative controls to remove sand/salt from roads after the winter ends.

Because available controls will affect the silt loading, controlled emission factors may be obtained by substituting controlled silt loading values into the equation. (Emission factors from controlled industrial roads were used in the development of the equation.) The collection of surface loading samples from treated, as well as baseline (untreated), roads provides a means to track effectiveness of the controls over time.

13.2.1.5 Changes since Fifth Edition

The following changes were made since the publication of the Fifth Edition of AP-42:

1) The particle size multiplier was reduced by approximately 55% as a result of emission testing specifically to evaluate the PM-2.5 component of the emissions.

2) Default silt loading values were included in Table 13.2.1-2 replacing the Tables and Figures containing silt loading statistical information.

3) Editorial changes within the text were made indicating the possible causes of variations in the silt loading between roads within and among different locations. The uncertainty of using the default silt loading value was discussed.

4) Section 13.2.1.1 was revised to clarify the role of dust loading in resuspension. Additional minor text changes were made.

5) Equations 2 and 3, Figure 13.2.1-2, and text were added to incorporate natural mitigation into annual or other long-term average emission factors.

6) The emission factor equation was adjusted to remove the component of particulate emissions from exhaust, brake wear, and tire wear. The parameter *C* in the new equation varies with aerodynamic size range of the particulate matter. Table 13.2.1-2 was added to present the new coefficients.

7) The default silt loading values in Table 13.2.1-3 were revised to incorporate the results from a recent analysis of silt loading data.

8) The PM-2.5 particle size multiplier was reduced by 40% as the result of wind tunnel studies of a variety of dust emitting surface materials.

9) References were rearranged and renumbered.

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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 [μm] 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.

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

Industry	No. Of Facilities	Material	Silt Content (%) No. Of Samples	Silt Content (%) Range	Silt Content (%) Mean	Moisture Content (%) No. Of Samples	Moisture Content (%) Range	Moisture Content (%) 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.

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.

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]

$$E = k(0.0016) \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \text{ (kg/megagram [Mg])} \qquad (1)$$

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

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	0.053[a]

[a] Multiplier for < 2.5 µm taken from Reference 14.

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]

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