Iowa Department of Natural Resources
Environmental Services Division
Air Quality Bureau

Prevention of Significant Deterioration (PSD) Permit Review
Technical Support Document for Issuance of a PSD Permit for
Project Number 12-219, Plant Number 56-10-001

Iowa Fertilizer Company
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Wever, IA 52658

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Purpose of this Document

This document has been prepared to fulfill the public participation requirements of 567 Iowa Administrative Code (IAC) 22.2(2), 567 IAC 33.17.

Introduction to the Project

Background on Orascom Construction Industries (OCI):
OCI is one of Egypt's largest corporations with projects and investments across Europe, the Americas, Asia, the Middle East, and North Africa. It is based in London, England and is the largest publicly traded company in Egypt. In addition to its fertilizer and construction groups, OCI has investments in manufacturers of fabricated steel products, glass curtain walling, paints, concrete pipes, and two (2) facilities management companies.

The OCI fertilizer group is a leading international producer and construction contractor based in Cairo, Egypt. It is an owner and operator of nitrogen fertilizer plants in Algeria, Egypt, the Netherlands, and the United States with an international platform spanning Europe, North & South America, Southeast Asia, and Africa.

The OCI fertilizer operations will reach 7.0 million metric tons [7,716,179.18 tons (US) or short tons] by the end of 2012 which would make OCI among the top global nitrogen-based fertilizer producers. Its operations are also capable of producing a combined total of 1.0 million metric tons [1,102,311.31 tons (US) or short tons] of melamine and methanol.

OCI produces the following nitrogen-based fertilizers:

- Anhydrous ammonia
- Granular urea
- Calcium ammonium nitrate (CAN)
- Urea ammonium nitrate (UAN)

In addition, OCI is the largest global producer of melamine.[1]

Project Number 12-219 Description:
Iowa Fertilizer Company (IFC) is owned by OCI and is proposing to the build largest nitrogen fertilizer plant in the US. The primary raw material is natural gas which is delivered by pipeline. The proposed facility will manufacture anhydrous ammonia, urea ammonium nitrate (UAN), granular urea, and diesel exhaust fluid (DEF). By-products of the process will be liquid urea and nitric acid. All of the final products will be transported from the facility by either truck or rail. Preliminary production estimates for each final product is listed in Table 5.

There are seven (7) production areas within the plant. In addition there is support equipment such as auxiliary boilers, emergency generators, and cooling towers. An overall process diagram is shown in Figure 1.

[1] Information from the OCI website (http://www.orascomci.com).

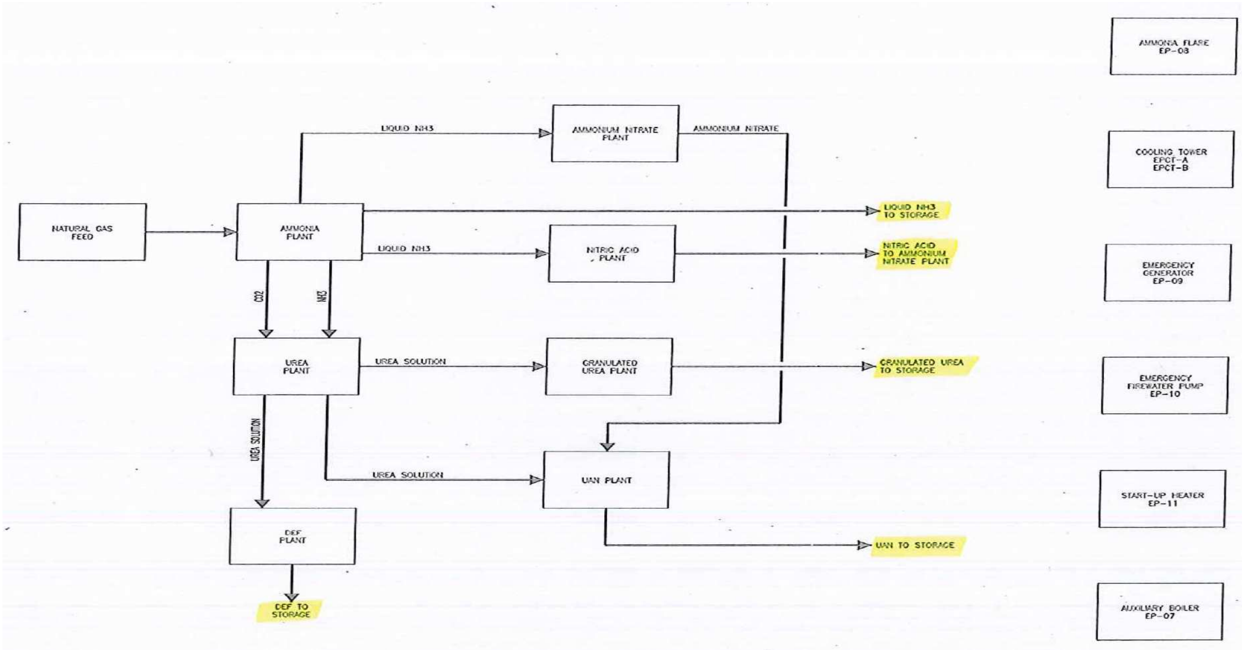

Figure 1 – Overall IFC Process Flow Diagram

Following is a description of each of the main production plants along with a list of the emission point(s) for each of these areas:

- Ammonia Production:

  Compressed natural gas is fed to the ammonia plant. The sulfur present must be removed from the feedstock because it deactivates catalysts used in later steps of the process. The gas is preheated in the convection section of the primary reformer and then desulfurized in two (2) steps.

  1) The heated gas passes through a hydrotreater which contains a cobalt (Co) and molybdenum oxide catalyst. The catalyst ensures hydrogentation of any organic sulfur compounds (RSH) into hydrogen sulfide (H_2S). This reaction is below:

  $$H_2 + RSH \longrightarrow RH + H_2S_{\text{(gas)}}$$

  2) The gaseous hydrogen sulfide is removed in two (2) desulferizer vessels. Both of the vessels contain a bed of zinc oxide (ZnO). This reaction is represented as:

  $$H_2S + ZnO \longrightarrow ZnS + H_2O$$

  Sulfur compounds will not be emitted from the desulfurizer vessels as the zinc oxide beds will not be regenerated. Instead they will be replaced once they reach their useful life. According to IFC the lifetime can range from two (2) to four (4) years.

The sulfur free methane (CH_4) feedstock is then reacted with steam to produce hydrogen (H_2) and carbon monoxide (CO):

$$CH_4 + H_2O \longrightarrow CO + 3H_2$$

Per the application, the primary reformer will be designed to obtain the maximum thermal efficiency by recovering heat from the flue gas in the convection section. The recovered heat will be used for:

- Mixed-feed (gas-steam) preheating
- Process air preheating
- Steam superheating
- Feed gas preheating
- Boiler feed water preheating

The partially reformed gas is then reacted with air in the secondary reformer. Traditionally, the air flow rate is set to provide the amount of nitrogen required for the ammonia synthesis reaction. However, the design of the IFC plant calls for about 50% excess air. The oxygen (O_2) in the air burns some of the process gas to provide heat for the reforming reaction. Heat recovery downstream of the reforming section will be achieved in a natural-circulation waste heat boiler followed by a steam super heater.

The carbon monoxide (CO) in the reformed gas feed is reacted with steam to produce carbon dioxide (CO_2) and additional hydrogen (H_2) as part of a shift reaction:

$$CO + H_2O \longrightarrow CO_2 + H_2$$

The reaction rate is favored by high temperature, but the equilibrium conversion is favored by low temperature. Therefore, two (2) stages of shift conversion are provided. They are referred to as high temperature shift (HTS) and low temperature shift (LTS). In the HTS, a relatively cheap and more durable iron catalyst is used and produces the bulk of the reaction. In the LTS, a more expensive and poisoning-sensitive copper-zinc catalyst produces a high final conversion.

The LTS effluent is cooled before further processing. The condensed water contains small quantities of a variety of chemical species. The condensate will be stripped with steam in a high pressure process condensate stripper. The overhead vapor from the stripper is used as a process steam in the reforming section. This will allow the heat from the stripping steam to be recovered. The stripped condensate will be routed to a condensate polisher and then used as high pressure boiler feed water.

The carbon dioxide (CO_2) contained in the shifted process gas can be removed either by absorption in aqueous ethanolamine solutions or by adsorption in pressure swing adsorbers (PSA) using proprietary solid adsorption media.

The IFC plant will reduce the CO_2 to 500 parts per million by volume (ppm_v) by washing the shifted process gas in a two (2) stage activated amine based system that uses an aqueous solution of methyl-diethanol amine (MDEA) with an activator to enhance absorption.

The CO_2 is absorbed in an absorber tower at process pressure and relatively low temperature. The MDEA is regenerated in a stripper tower at low pressure and higher temperature. The heat for the regeneration is low level heat recovered from the LTS effluent. A storage tank is provided to hold the inventory of MDEA during a shutdown of the process system. A portion of the recovered CO_2 is used for urea production with some CO_2 emitted to the atmosphere.

After the CO_2 removal, residual CO_2 and CO from the synthesis gas are converted back to methane through the use of catalytic methanation:

$$CO + 3H_2 \longrightarrow CH_4 + H_2O$$

$$CO_2 + 4H_2 \longrightarrow CH_4 + 2H_2O$$

Synthesis gas from the methanator system passes through one (1) of two (2) molecular sieve dryers which remove the water and trace amounts of CO_2.

IFC will use a cryogenic purification process which condenses out excess nitrogen (N_2) from the synthesis gas which will leave a gas with a hydrogen-to-nitrogen ratio of 3-to-1. The condensed nitrogen (N_2) takes with it all of the methane (CH_4) and most of the argon (Ar) and other impurities in the gas. This results in a very pure makeup gas to the synthesis loop.

The makeup synthesis gas is compressed to a pressure of about 15,500 kilopascals (kPa) in a centrifugal compressor driven by a high-pressure steam turbine. The gas is passed through the ammonia synthesis converter where it reacts with a magnetite (Fe_3O_4) catalyst to form anhydrous ammonia. This step is known as the *"ammonia synthesis loop"* or as the *"Haber-Bosch Process"* and it is an exothermic reaction:

$$N_2 + 3H_2 \longrightarrow 2NH_3$$

When a new batch of synthesis catalyst is introduced it needs a chemical reduction and needs to be preheated to a specific temperature to allow for a self sustaining reaction. A fired startup heater is provided for these purposes.

The converter effluent is cooled through the following steps in order:

1) High pressure steam generator,
2) Heat exchange with the converter feed,
3) Water cooling, and
4) Cooling in a chiller.

Most of the ammonia (NH_3) vapor in the converter effluent condenses and is separated from the recycle gas in an ammonia separator. Liquid from the ammonia separator is sent to the ammonia refrigeration system. Cold liquid ammonia product for storage is drawn from the chiller while warm liquid ammonia product for urea plant operations is drawn from a receiver in the refrigeration system.

The list of emission units along with corresponding emission points and permit numbers for the ammonia production plant are found in Table 1.

Table 1 – Ammonia Plant Equipment and Permits

Emission Unit	Control Equipment	Permit Number
Primary Reformer (EU 01, EP 01)	LNB & SCR (CE 01)	12-A-380-P
CO_2 Regenerator (EU 02, EP 02)	None	12-A-381-P
MDEA Storage Tank (EU MDEA-TK, EP MDEA-TK)	Nitrogen Gas Blanket (CE MDEA-TK)	12-A-400-P

The ammonia plant process flow diagram can be found below in Figure 2.

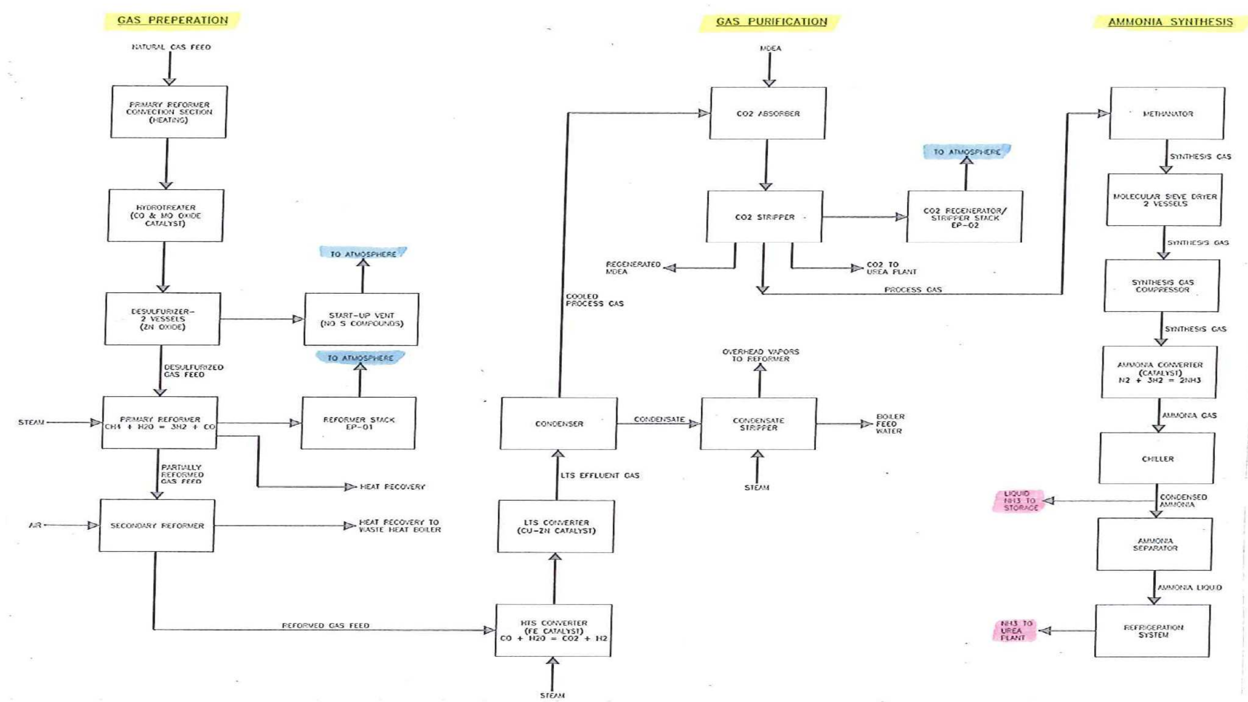

Figure 2 – Ammonia Plant Process Flow Diagram

- Nitric Acid Production:

Liquid ammonia is sent to the ammonia vaporizer where a water/oil mixture is separated, drained, and flashed in an ammonia blow-down separator. The resulting gaseous ammonia from the evaporators is superheated and mixed with primary air prior to oxidation in the burner.

The ammonia mixture is introduced into the ammonia burner where it crosses a perforated sheet-plate that distributes the gas uniformly over a platinum/rhodium alloy catalyst gauze.

Gas distribution, velocity, contact time, and oxidation temperature on the platinum gauzes are optimized to achieve high ammonia conversion efficiency and to minimize the catalyst losses. The combustion efficiency in the ammonia burner is about 96.6%. At the outlet of the burner the nitrous gas mixture flows through heat exchangers to transfer energy to the tail gas and produce high pressure steam.

The nitrous gas is first cooled through a superheater where a significant amount of heat is transferred to produce steam in a waste heat boiler. At the outlet of the waste gas heat boiler the nitrous gas flows directly to the tail gas heater.

The oxidation of nitrogen monoxide (NO) into nitrogen dioxide (NO_2) is an exothermic reaction and is favored as the temperature is lowered. The nitrous gas is cooled further in a cooler condenser against cooling water. Weak nitric acid is condensed at a concentration of about 41.8% (by weight). The nitric acid is formed by the reaction of NO_2 with condensed water.

The weak acid from the nitrous gas is separated at the outlet of the condenser and is recycled by pump to an absorber and then fed on a tray with matching weak acid solution of the same concentration.

The separated nitrous gas is mixed with secondary air and the combined stream is sent to a nitrogen oxide (NO_x) compressor. From the compressor outlet high pressure NO_x gas is heated due to the oxidation of NO to NO_2.

High pressure nitrous gas cooling and strong nitric acid condensation both occur in a high pressure cooler condenser. The gas is cooled and the nitric acid is condensed. The nitric acid is once again formed by reaction of NO_2 with condensed water.

The acid is separated from the nitrous gas and is recycled to the absorber and is fed on the tray with the matching nitric acid solution concentration. Production of nitric acid takes place on the absorber trays by absorption and reaction of NO_x, NO_2, and nitrogen tetraoxide (N_2O_4) with water fed at the upper tray of the absorber. The acid is sent through a product acid cooler and then sent to a storage tank.

The list of emission units along with corresponding emission points and permit numbers for the nitric acid plant are found in Table 2.

Table 2 – Nitric Acid Plant Equipment and Permits

Emission Unit	Control Equipment	Permit Number
Nitric Acid Plant (EU 05, EP 05)	De-NO_x & De-N_2O System (CE 05)	12-A-384-P
Nitric Acid Storage Tank (EU 06, EP 06)	Acid/Water Vent Lock (CE 06)	12-A-385-P

The nitric acid plant process flow diagram is below in Figure 3.

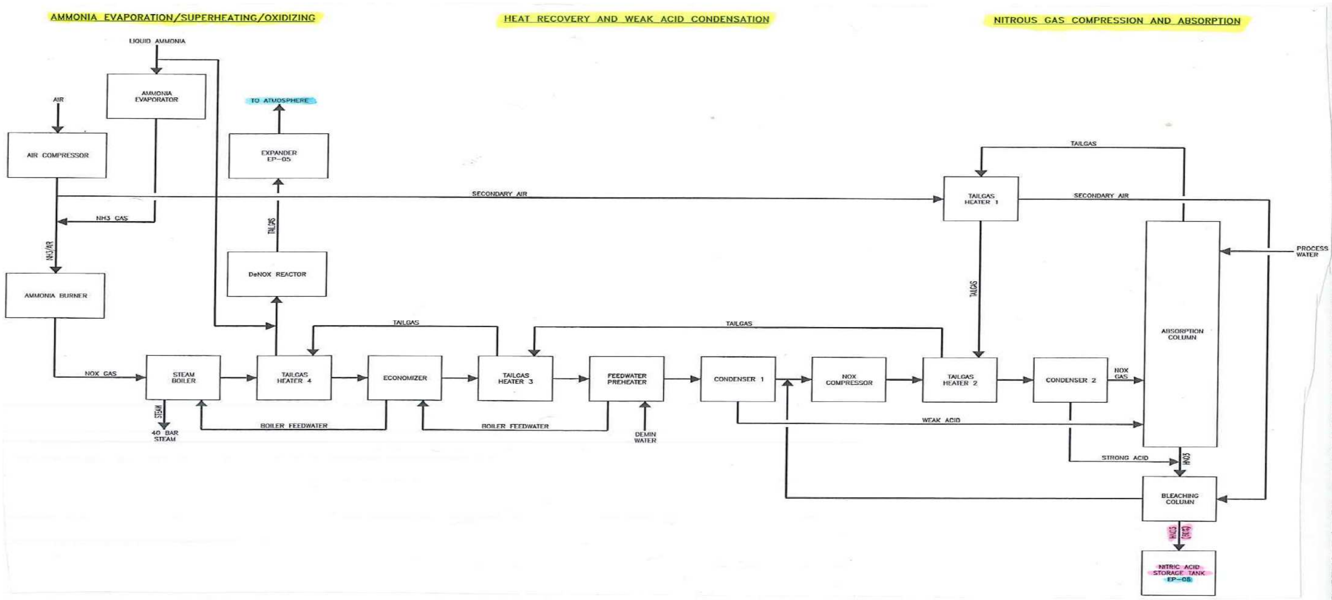

Figure 3 – Nitric Acid Plant Process Flow Diagram

- UAN Production:

  An integrated UAN facility is made up of urea [$CO(NH_2)_2$] and ammonium nitrate (NH_4NO_3) manufacturing. Ammonia (NH_3) and carbon dioxide (CO_2) from the ammonia plant are fed to a urea synthesis section where the urea is created through the formation of ammonium carbamate [$(NH_4)_2CO_3$].

  Complete conversion to urea does not occur. This means the synthesized urea solution contains urea, water, unconverted ammonia, and CO_2. These unconverted compounds are recycled at synthesis pressure by stripping with CO_2. This causes a significant portion of the unconverted compounds to evaporate from the solution. The evaporated NH_3 and CO_2 from the stripper are combined with fresh NH_3, condensed, and recycled to the synthesis reactor where they are partly converted to urea and water.

  In the dissociation section the stripped urea solution, which now contains minimal NH_3 and CO_2, is expanded and stored. A diagram of the urea plant can be found in Figure 4.

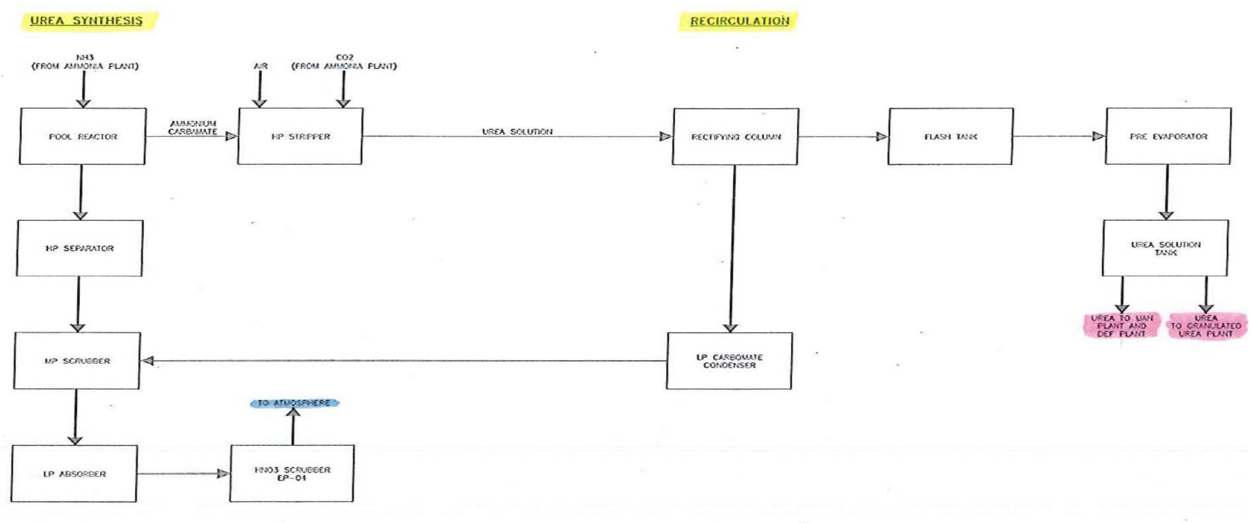

Figure 4 – Urea Plant Process Flow Diagram

The overhead vapors from the synthesis reactor are mixed with off-gases from the dissociation section and then sent to the neutralization section. The ammonia containing gases are neutralized by means of nitric acid from the nitric acid plant to form ammonium nitrate.

Some ammonium nitrate in the form of droplets is released to the atmosphere during this process. The ammonia present in the urea solution from the urea storage tank and in the off gases from the storage tank is also neutralized to form ammonium nitrate. A diagram of the ammonium nitrate plant can be found in Figure 5.

The ammonium nitrate solution resulting from this process is mixed with the urea solution from the dissociation section to form the UAN solution. The UAN product will be delivered as a liquid to the UAN product storage system.

A diagram of the UAN production plant is found in Figure 6. In addition, a list of all emission units, their respective emission points, and construction permits can be found in Table 3.

Table 3 – Permits for Equipment Associated with UAN Production

Emission Unit	Control Equipment	Permit Number
UAN Mixing Tank (EU 03, EP 03)	Acid Scrubber (CE 03)	12-A-382-P
Urea Synthesis (EU 04, EP 04)	Acid Scrubber (CE 04)	12-A-383-P

Both of the acid scrubbers listed above are for ammonia control.

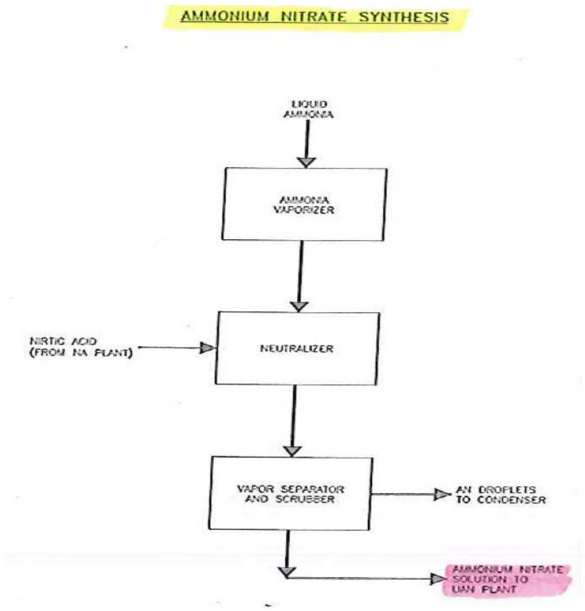

Figure 5 – Ammonium Nitrate Plant Process Flow Diagram

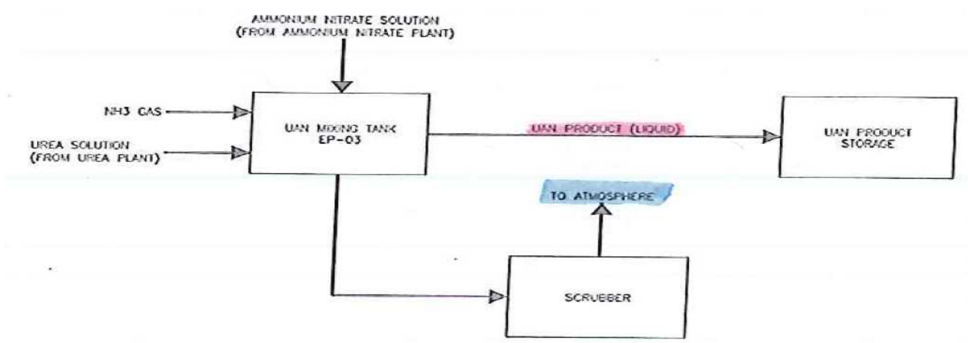

Figure 6 – UAN Plant Process Flow Diagram

- DEF Production:

  DEF is a 32% (by weight) urea solution that is used to reduce NO_x in the off gas of diesel engines in cars. Since the ammonia in the urea solution causes an odor issue for diesel fuel refilling at filling stations at filling stations, the DEF process uses stripping and dilution to lower the ammonia content in the solution from 0.6% (by weight) to 0.02% (by weight) or 200 ppm.

  The 72% (by weight) urea solution is pumped from the urea storage tank into a stripping column. Low pressure steam is injected to strip off the ammonia which lowers the ammonia content from 0.6% (by weight) to 0.045% (by weight). After the stripper, the 72% urea solution is diluted with water to lower the urea concentration to 32.5%. The ammonia concentration also decreases as a result of the dilution from 0.045% to 0.02%.

  After dilution and proper mixing, the DEF flow will pass a cooler that lowers the temperature to less than 40 degrees Celsius (^oC). After the cooler the DEF solution is either pumped into storage as a liquid or into a truck for offsite transport.

A process flow diagram for the DEF process can be found in Figure 7. There are no emission points associated directly to the DEF process.

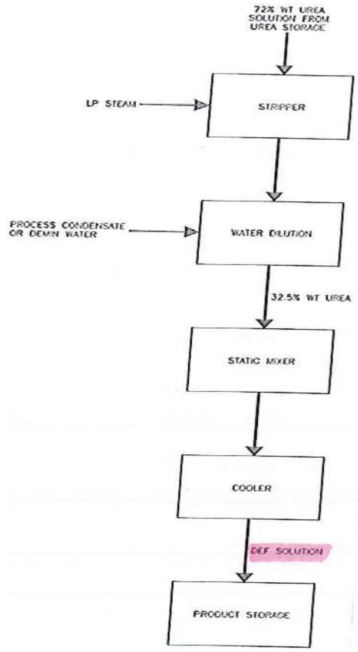

Figure 7 – DEF Plant Process Flow Diagram

- Granular Urea Production:

A urea solution (typically 97%) is delivered from the urea plant and dispensed to the injection heads and finely atomized upwards into a bed of moving particles. Urea formaldehyde pre-condensate is added as an anti-caking agent. This allows free product flow, low dust content, and high stability for storage and shipment.

Fluidization air is delivered under the perforated plate and flows through the product layer to create a fluid bed and is exhausted at the top of the granulator. The granular urea flows out of the granulator at a controlled rate to a fluid bed cooler. Once cool, the granules are lifted by a bucket elevator to a screening section.

The fines fraction is recycled directly to the granulator whereas the coarse material is first crushed and then sent to the granulator as seeding particles. The on-size product is sent to the warehouse after final cooling.

Reduction of ammonia emissions from the air from the granulator is done through the use of an acidic scrubbing section. This ammonia is converted to ammonium nitrate which can be used as fertilizer or used in the UAN plant as feed material.

A process flow diagram of the urea plant can be seen in Figure 8. The equipment, emission points, and permits associated with granulated urea production can be found in Table 4.

Table 4 – Permits for Equipment Associated with Granulated Urea Production

Emission Unit	Control Equipment	Permit Number
Urea Granulator (EU 12, EP 12)	Wet Scrubber (CE 12)	12-A-391-P

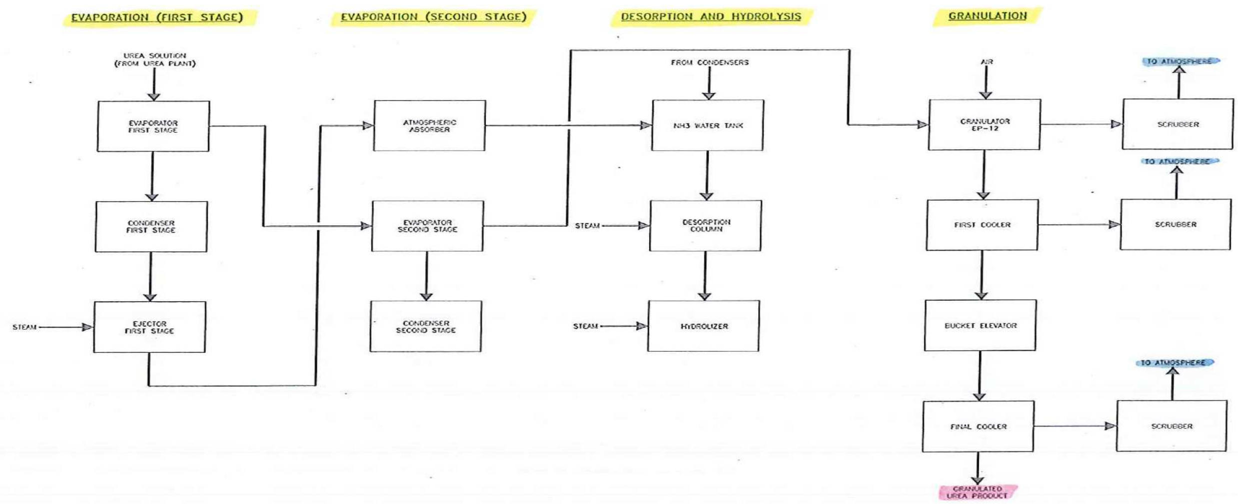

Figure 8 – Granulated Urea Plant Process Flow Diagram

Table 5 – IFC Production Estimates

Product Description	Production Rate (MTPD)	Production Rate (STPD)
Ammonia	2,400	2,645
Nitric Acid	1,905	2,100
Liquid Urea	2,500	2,756
UAN	5,400	5,952
DEF	900	992
Granular Urea	1,500	1,653

Notes for Table 5:
- MTPD = metric tons per day. One (1) metric ton = 2,204.6 pounds (lbs).
- STPD = short tons per day = tons (US). One (1) short ton = 2,000 lbs.
- The ammonia production rate allows for 10% increase over design parameters as some of this ammonia will be used in the production of UAN.
- Liquid urea is needed for both UAN and DEF production.
- Nitric acid is needed for UAN production.

According to the application, thirty-four million British thermal units (34 MMBTU) of natural gas is needed per metric ton of ammonia produced. The plant will use 29,784 million standard cubic feet of natural gas per year. Two thirds of that natural gas is used as feedstock to make the above materials. One third is combusted as fuel gas in the primary reformer according to the application.

- Support Equipment:

In order for the facility to operate properly there will be other equipment located at the plant. This equipment is not associated with any specific production area, but helps in the overall plant operation. This equipment includes auxiliary boilers, emergency generators, and cooling towers. This equipment, emission point numbers and permit numbers are listed in Table 6.

Table 6 – Other Construction Permits at IFC

Emission Unit	Control Equipment	Permit Number
Auxiliary Boiler (EU 07, EP 07)	LNB (CE 07A) & FGR (CE 07B)	12-A-386-P
Ammonia Flare (EU 08, EP 08)	None	12-A-387-P
Emergency Generator (EU 09, EP 09)	None	12-A-388-P
Fire Pump (EU 10, EP 10)	None	12-A-389-P
Startup Heater (EU 11, EP 11)	None	12-A-390-P
Cooling Tower A (EU CTA, EP CTA)	Drift Eliminator (CE CTA)	12-A-392-P
Cooling Tower B (EU CTB, EP CTB)	Drift Eliminator (CE CTB)	12-A-393-P
Granulated Urea Warehouse Transfer (EU P1, EP P1)	Bin Vent Filter (CE P1)	12-A-394-P
Granulated Urea Warehouse Transfer (EU P2, EP P2)	Bin Vent Filter (CE P2)	12-A-395-P
Granulated Urea Truck Loading (EU P3, EP P3)	Bin Vent Filter (CE P3)	12-A-396-P
Granulated Urea Truck Loading (EU P4, EP P4)	Bin Vent Filter (CE P4)	12-A-397-P
Granulated Urea Train Loading (EU P5, EP P5)	Bin Vent Filter (CE P5)	12-A-398-P
Granulated Urea Train Loading (EU P6, EP P6)	Bin Vent Filter (CE P6)	12-A-399-P
Liquid Product Haul Road (EU LHR, EP LHR)	Paved Road, Water Flushing, and Sweeping (CE LHR)	12-A-401-P
Solid Product Haul Road (EU SHR, EP SHR)	Paved Road, Water Flushing, and Sweeping (CE SHR)	12-A-421-P

A copy of the preliminary plant layout in Figure 9.

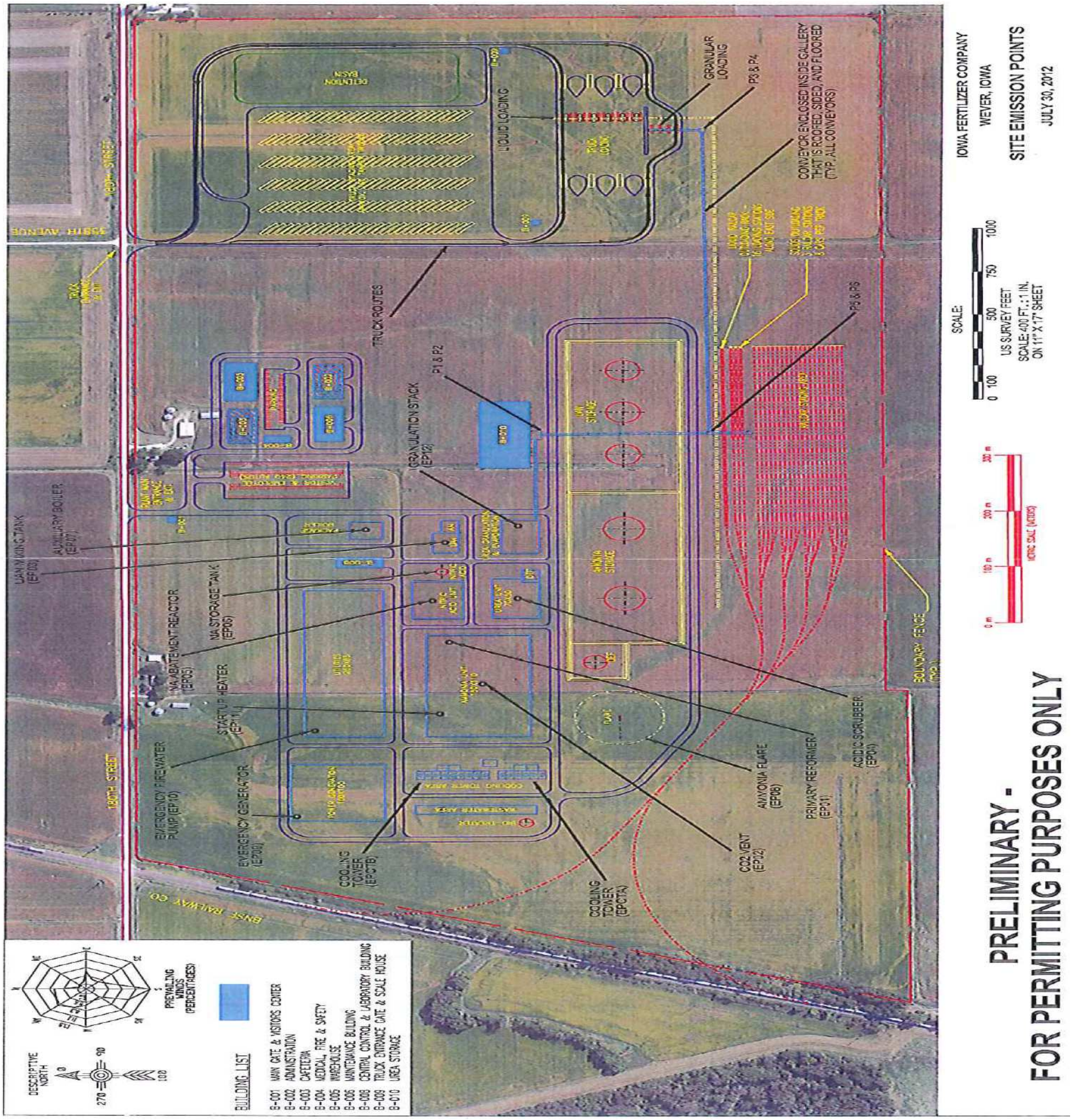

Figure 9 – Preliminary Plant Layout

The plant is proposed to be constructed in Wever, Iowa. Wever is an unincorporated community in northeastern Lee County. It is along US Route 61 northeast of Fort Madison which is the county seat of Lee County. See Figure 10 for a map of the area.

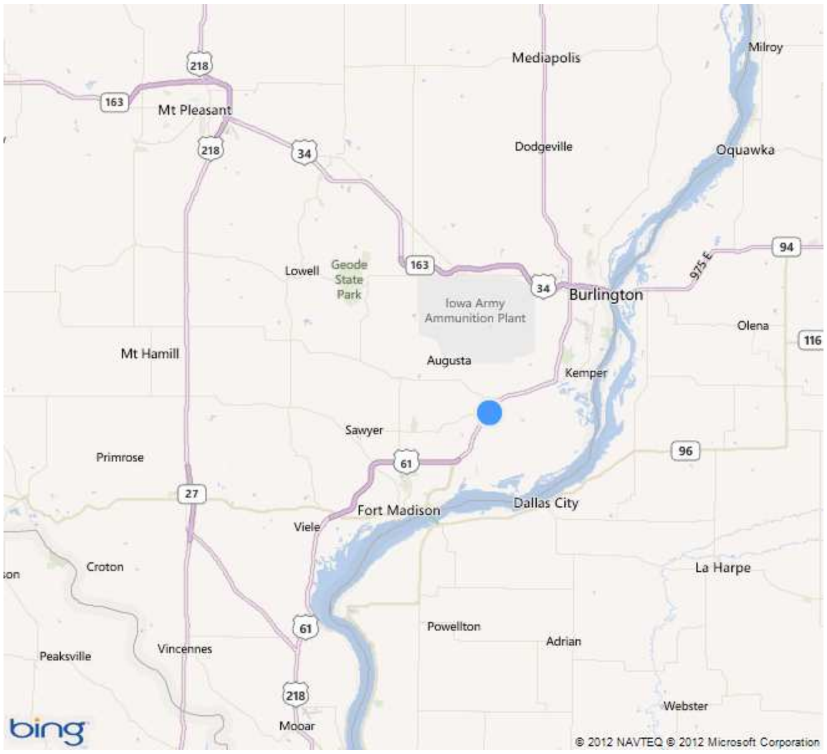

Figure 10 – Map of Wever Area[2]

Contact information for both IFC and the Department concerning this project can be found below in Table 7.

Table 7 – Contact Information

Responsible Party	Company Contact	Air Quality Contact
Kevin Struve Planning Director Orascom Construction Industries 4 Cork Street 5th Fl London, W1S 3LG Ph: +44 (0) 20 7439 4801 kstruve@orascomci.co.uk	Kevin Struve Planning Director Orascom Construction Industries 4 Cork Street 5th Fl London, W1S 3LG Ph: +44 (0) 20 7439 4801 kstruve@orascomci.co.uk	Christopher A. Roling, PE Senior Environmental Engineer 7900 Hickman Rd, Suite 1 Windsor Heights, IA 50324 Ph: (515) 242-6002 Fax: (515) 242-5094 chris.roling@dnr.iowa.gov

[2] Map obtained from Bing Maps.

A list of important dates in regards to this application and the public comment period are found in Table 8.

Table 8 – Important Dates

Application Received Date:	May 25, 2012
Completed Application:	August 3, 2012
Beginning of Public Comment Period:	September 19, 2012
Public Hearing Date:	October 17, 2012
Ending of Public Comment Period:	October 19, 2012

It should be noted that the original application was received on May 25, 2012 but it was not considered a complete application until August 3, 2012 since the location of the plant changed from Middleton, Iowa to Wever, Iowa. The August 3, 2012 date is when the Department received the updated signed Form FI with the Wever location.

Analysis of the Application

A. *PSD*: The source is classified as a "major stationary source" for PSD purposes. Therefore, the PSD process must be followed for all pollutants for which emissions will be increased equal to or greater than the PSD significance levels. Particulate matter (PM, PM_{10}, and $PM_{2.5}$), NO_x, CO, VOC, and carbon dioxide equivalents (CO_{2e}) all have a net significant emissions increase for this project. A more detailed discussion on the emissions and PSD applicability can be found later in this document.

No source subject to PSD review may be constructed without a PSD permit. To obtain a PSD permit the applicant must:

1) Conduct a BACT analysis, on a case-by-case basis, in which energy, environmental and economic impacts are considered in determining the maximum degree of reduction of emissions that are achievable for the proposed unit.
2) Perform an analysis of the ambient air quality prior to the major modification (i.e. preconstruction monitoring).
3) Demonstrate that the modified emissions from the proposed project and associated growth due to the project will not exceed the NAAQS or applicable PSD increments.
4) Perform additional analysis on the effects of the modified emissions on soils, vegetation, and visibility.
5) Address the air quality impacts of associated growth in the area of the source since the minor source baseline date and of major sources in the area since the major source baseline date.
6) Demonstrate that the modification will not adversely impact a Class I area.

In addition, the public must be notified of the proposed project, the degree of the increment consumption, and be given the opportunity for submitting written comments. Finally, the Department will hold a public hearing for persons to comment on the project in person.

B. *New Source Performance Standards (NSPS)*: The following NSPS subparts are applicable to the emission units in this project (See Appendix A for a copy of the regulations):

1. Subpart A (40 CFR §60.1 – 40 CFR §60.19; *General Provisions*): This subpart affects any facility that is subject to any NSPS subpart.
2. Subpart Db (40 CFR §60.40b – 40 CFR §60.49b; *Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units*): This subpart affects those units that produce steam, are greater than 100 MMBTU/hr heat input (29 MW), and are constructed after June 19, 1984. The Auxiliary Boiler (EU 07) and Startup Heater (EU 11) are all subject to this subpart.
3. Subpart Ga (40 CFR §60.70a – 40 CFR §60.77a; *Standards of Performance for Nitric Acid Plants for Which Construction, Reconstruction, or Modification Commenced After October 14, 2011*): This subpart affects nitric acid plants that are new, reconstructed, or modified. The Nitric Acid Plant (EU 05) is subject to this subpart.
4. Subpart IIII (40 CFR §60.4200 – 40 CFR §60.4219; *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*): This subpart affects new generators. The Emergency Generator (EU 09) and Fire Pump (EU 10) are subject to this subpart.

C. *National Emission Standards for Hazardous Air Pollutants (NESHAP):* In the original application IFC had expected its hazardous air pollutant (HAP) emissions would be more than 10 tons/yr of an individual HAP and 25 tons/yr for total HAP emissions as methanol emissions were estimated at over 150 tons/yr.

However, after reviewing stack test data from another fertilizer plant in Iowa and taking into account the process that will be used IFC determined its methanol emissions would be less than 10 tons/yr. This means total HAP emissions would be less than 25 tons/yr. Therefore, IFC is considered an area source for HAP emissions. The HAP calculations can be found in Appendix B.

The following NESHAP subparts are applicable to the emission units in this project (See Appendix C for a copy of the regulations):

1. Subpart A (40 CFR §60.1 - 40 CFR §60.15; *General Provisions*): This subpart affects any facility that is subject to any NSPS subpart.

In addition, please note the following NESHAP standards have been promulgated by EPA and may affect emission units in this project, but the Department has not yet adopted the standard:

2. Subpart ZZZZ (40 CFR §63.6580 – 40 CFR §63.6675; *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*): This subpart applies to new and existing major sources with stationary reciprocating internal combustion engines (RICE). The Emergency Generator (EU 09) and the Fire Pump (EU 10) are of this source category.

3. Subpart JJJJJ (40 CFR §63.11193 – 40 CFR §63.11226; *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters*): This subpart affects industrial, commercial, and institutional boilers and process heaters located at major sources of hazardous air pollutant (HAP) emissions. The Primary Reformer (EU 01), Auxiliary Boiler (EU 07), and Startup Heater (EU 11) are of this source category.

D. *Iowa Administrative Code (IAC):* The following sections of the IAC are applicable to this project:

1. 567 IAC 21.5: *Evidence used in establishing that a violation has or is occurring.*
2. 567 IAC 22.1(1): *Permit required.* Requirement for new or modified equipment to obtain a construction permit.
3. 567 IAC 23.1(2)"ccc": *Industrial-commercial-institutional steam generating units.* State reference to NSPS Subpart Db.
4. 567 IAC 23.1(4)"cz": *Emission standards for stationary reciprocating internal combustion engines.* State reference to NESHAP Subpart ZZZZ.
5. 567 IAC 23.3(2)"a": *General emission rate for particulate matter.* State standard of 0.1 gr/dscf for PM.
6. 567 IAC 23.3(2)"d": *Visible emissions.* 40% state standard.
7. 567 IAC 23.3(3)"b": *Sulfur dioxide from use of liquid fuels.* 2.5 lb/MMBTU standard for units that combust liquid fuels.
8. 567 IAC 23.3(3)"e": *Other processes emitting sulfur dioxide.* 500 ppm standard for other processes emitting SO_2 (example: units that combust natural gas).
9. 567 IAC Chapter 33: *Special regulations and construction permit requirements for major stationary sources – Prevention of Significant Deterioration (PSD) of air quality.* State adoption of the PSD regulations.

Introduction to New Source Review (NSR) and Prevention of Significant Deterioration (PSD)

Regulatory Background:

On August 7, 1977 Congress substantially amended the Clean Air Act (CAA or the Act). These amendments added detailed PSD and nonattainment area (NAA) programs. On June 19, 1978 the United States Environmental Protection Agency (USEPA or EPA) revised the PSD regulations to comply with the 1977 amendments. The June 1978 regulations were challenged in court and as a result of the judicial review on August 7, 1980 EPA extensively revised both the PSD (for attainment areas) and NAA (for nonattainment areas) regulations. Five sets of regulations resulted from those revisions. These regulations, subsequent modifications, EPA guidance documents, interpretations, and policies represent the current NSR regulatory requirements.

The first set of regulations, 40 CFR §51.166, specifies the minimum requirements that a PSD air quality permit program under Part C of the Act must contain in order to obtain approval by EPA as a revision to a State Implementation Plan (SIP). The second set, 40 CFR §52.21, delineates the federal PSD permit program which currently applies as part of the SIP for States that have not submitted a PSD program meeting the requirements of 40 CFR §51.166. Roughly two thirds of the States are implementing their own PSD programs which have been approved by EPA under 40 CFR §51.166. Iowa is implementing its own PSD program [see 567 Iowa Administrative Code (IAC) Chapter 33]. 40 CFR §52.21 applies in the remaining States. The remainder of the five (5) regulations applies to the NAA program.

PSD Concepts:

The PSD permitting program is for new and modified major sources of air pollution that emit a pollutant subject to regulation under the CAA. PSD applies to all pollutants that do not exceed the National Ambient Air Quality Standards (NAAQS) in an area. The NAAQS establish the maximum pollution concentration levels to protect public health and welfare from harmful levels of pollutants. Pollutants covered by the NAAQS are nitrogen oxides (NO_x), volatile organic compounds (VOC) which are precursors to ground-level ozone, sulfur dioxide (SO_2), fine particulate (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), and lead (Pb). These pollutants are called criteria pollutants.

PSD also applies to other pollutants that do not have a NAAQS. These non-criteria pollutants are listed in the regulations and include fluorides, sulfuric acid mist, total reduced sulfur, certain contaminants from municipal solid waste plants, and greenhouse gases (GHGs).

On June 3, 2010 the US EPA issued the Greenhouse Gas Tailoring Rule. Through the Tailoring Rule, EPA is phasing in the greenhouse gas (GHG) permitting requirements in two steps outlined below, followed by assessment and rulemaking to phase in appropriate, additional requirements for controlling GHG emissions from stationary sources. The Greenhouse Gas Tailoring Rule was adopted by the State of Iowa and became effective on December 22, 2010.

- Step 1 (January 2, 2011 – June 30, 2011)
  Effective January 2, 2011, only sources currently subject to the PSD permitting program (i.e., sources that are newly-constructed or modified in a way that significantly increases emissions of a pollutant other than GHGs) would be subject to permitting requirements for their GHG emissions under PSD. For these projects, only GHG increases of 75,000 TPY or more of total GHG (based on potential to emit (PTE) and using a specific formula to calculate “TPY CO_2 equivalent emissions (CO_{2e})”) would be subject to PSD for their GHG emissions.

  During this time, no sources would be subject to the PSD permitting requirements due solely to GHG emissions.

- Step 2 (July 1, 2011 to June 30, 2013)
  In this phase, PSD permitting requirements will, for the first time, cover new construction projects with a GHG PTE of at least 100,000 TPY (CO2e), even if they do not exceed the permitting thresholds for any other pollutant. Modifications at existing facilities that increase their GHG PTE by at least 75,000 TPY (CO2e) will be subject to permitting requirements, even if they do not significantly increase emissions of any other pollutant.

On July 1, 2011 EPA promulgated a rulemaking that will exempt GHG emissions from biomass for three years while EPA further deliberates on how to treat such emissions in GHG permitting. This includes facilities that emit CO_2 from burning forest or agricultural products for energy, wastewater treatment, waste management (landfills), and fermentation processes for ethanol production. This does not include CO_2 emissions from these facilities for processes that are not derived from biomass, such as combustion of natural gas or coal.

PSD does **not** prevent sources of air pollution from increasing emissions. Instead, the PSD regulations are designed to achieve the following:

1) to ensure that economic growth will occur in harmony with the preservation of existing clean air resources
2) to protect the public health and welfare from any adverse effects which might occur even though air pollution concentrations are below the National Ambient Air Quality Standards (NAAQS)
3) to preserve, protect, and enhance the air quality in areas of special natural recreational, scenic, or historic value, such as national parks and wilderness areas
4) to provide the opportunity for public comment on proposed applications

The PSD program applies to a new stationary source that will have a “major” and “significant” amount of any air pollutant subject to regulation under the CAA. It also applies to an existing major stationary source that plans to modify its operations in such a way that would lead to an increase of air pollution that would be “major” or “significant”.

All PSD thresholds are based upon "potential-to-emit (PTE)." For PSD applicability purposes only, this is the maximum design capacity of a stationary source to emit a pollutant under its physical and operational design after the application of air pollution control equipment and after considering all "federally enforceable" limitations restricting the potential-to-emit of the source.

Therefore, a "major stationary source" is defined in Section 169 of the CAA as:

> *“Any one of 28 types of sources with the potential-to-emit 100 tons per year or more of any pollutant regulated in the CAA or any other type of source with the potential to emit regulated pollutants in amounts equal to or greater than 250 tons per year.”*

Per 567 IAC 33.3(1), a regulated pollutant is defined as:

1. *Any pollutant for which a national ambient air quality standard has been promulgated and any constituents or precursors for such pollutants identified by the Administrator (e.g., volatile organic compounds and NO_x are precursors for ozone);*
2. *Any pollutant that is subject to any standard promulgated under Section 111 of the Act;*
3. *Any Class I or Class II substance subject to a standard promulgated under or established by Title VI of the Act; or*

4. *Any pollutant that otherwise is subject to regulation under the Act; except that any or all hazardous air pollutants either listed in Section 112 of the Act or added to the list pursuant to Section 112(b)(2) of the Act, which have not been delisted pursuant to Section 112(b)(3) of the Act, are not regulated NSR pollutants unless the listed hazardous air pollutant is also regulated as a constituent or precursor of a general pollutant listed under Section 108 of the Act.*

The term "significant" refers to the thresholds assigned to each criteria pollutant and certain non-criteria pollutants. For example, the significant threshold is 40 tpy for NO_x and 15 tpy for PM_{10}.

Before a new major stationary source constructs or an existing major stationary source makes a significant modification, the source is required to obtain a PSD permit. A PSD permit is a legal document that limits the amount of air pollution that may be released by the source. The permit will also specify things such as the construction that is allowed, all emission limits (both state and federal), compliance testing requirements, operating monitoring, recordkeeping, and the type of pollution controls.

In order to obtain a PSD permit the source must meet the following requirements of the PSD program:

- *Best Available Control Technology (BACT)*

  BACT is defined as an emission limit (including a visible emissions standard) based on the maximum degree of reduction for each regulated NSR pollutant which would be emitted from any proposed major stationary source or major modification. BACT is determined on a case-by-case analysis that takes into account energy, environmental, and economic impacts. BACT can be add-on control equipment or it can be modification to the production processes/methods.

- *Air Quality Impact Analysis*

  The main purpose of the air quality analysis is to demonstrate that new air pollution from the proposed major stationary source or major modification in conjunction with other applicable emissions increases and decreases from existing sources will not cause or contribute to a violation of any applicable NAAQS or PSD increment.

  PSD increment is the amount of pollution an area is allowed to increase. PSD increments prevent the air quality in clean areas from deteriorating to the level set by the NAAQS. PSD regions are defined as Class I through Class III. Area classifications affect the maximum allowable increase in the PSD ambient air increments with Class I areas allowed the least increase and Class III areas allowed the most.

  - Class I areas are international parks, national wilderness areas and national memorial parks greater than 5,000 acres in size and national parks which exceed 6,000 acres in size.
  - Class II areas include all areas not designated as Class I or Class III.
  - Class III areas are planning areas set aside for industrial growth.

All of the State of Iowa is classified as a Class II area. All planning areas were initially designated either Class I or Class II. States must request and receive approval from the Environmental Protection Agency (EPA) for Class III areas. No Class III areas have been approved in the United States and therefore none exist at this time.

Generally, the air quality analysis will involve:

(1) An assessment of existing air quality, which may include ambient monitoring data and air quality dispersion modeling results, and
(2) Prediction, using dispersion modeling, of the ambient concentrations that will result from the applicant's proposed project and future growth associated with the project.

- *Additional Impact Analysis*

  The additional impacts analysis assesses the impacts of air, ground, and water pollution on soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the source or modification under review and from associated growth. Associated growth is industrial, commercial, and residential growth that will occur in the area due to the new source or modification.

- *Public Participation*

  Public participation is citizens being involved in the permitting process. Any person may comment on the permit(s) or request a public hearing if one has not been scheduled during the public comment period.

PSD Applicability

There is no existing facility at the Wever site so this project is for a Greenfield plant. The two (2) digit Standard Industrial Classification Code (SIC) for nitrogenous fertilizer manufacturing is 28. Although there is no definition under the PSD rules for a *"chemical process plant"* there are catalysts being used and chemical reactions occurring in order to make ammonia, urea, and nitric acid. Therefore, the new IFC plant is considered a *"chemical process plant"* under the PSD regulations.

A source that is one of the 28 listed source categories is classified as a *"major stationary source"* for PSD purposes if it has potential emissions greater than 100 tons per year of any one of the pollutants regulated by the CAA. In addition, fugitive emissions, to the extent quantifiable, are considered in any subsequent PSD analysis.

As can be seen in Table 9, the potential emissions of CO and greenhouse gases (GHG) which are listed as CO_{2e} are over 100 tons per year (tons/yr). The emissions of CO_{2e} are also over the 100,000 ton/yr threshold. Therefore, this facility is considered to be a *"major stationary source"* for the purposes of PSD. In addition, fugitive emissions, to the extent quantifiable, are required to be considered in any PSD analysis since the facility is one of the 28 listed source categories.

Since this project is for a Greenfield site the current actual emissions (i.e. baseline emissions) are 0 tons/yr. Since this project results in at least one (1) pollutant with more than a 100 ton/yr increase all pollutants over their respective PSD significant increase threshold are also required to go through a PSD analysis. Table 9 shows the potential emissions for the project after BACT has been applied. This shows that even after BACT is applied PM, PM_{10}, $PM_{2.5}$, NO_x, CO, VOC, and CO_{2e} are still all over their respective PSD significant increase levels. Calculations can be found in Appendix D.

Table 9 – Net Emission Increases for Project Number 12-219[3]

Pollutant	Potential Emissions after BACT (tpy)	PSD Significant Increase Level (tpy)
PM	84.6	25
PM_{10}	84.6	15
$PM_{2.5}$	82.4	10
SO_2	3.3	40
NO_x	95.7	40
CO	111	100
VOC	59.7	40
Pb	0.00	0.6
CO_{2e}[4]	1,909,012	75,000
H_2SO_4	0.00	10
TRS	0.00	10
F	0.00	3

Best Available Control Technology (BACT)

BACT is defined as:

> "an emissions limitation, including a visible emissions standard, based on the maximum degree of reduction for each regulated NSR pollutant which would be emitted from any proposed major stationary source or major modification which the reviewing authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combination techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 567—subrules 23.1(2) through 23.1(5) (standards for new stationary sources, federal standards for hazardous air pollutants, and federal emissions guidelines), or federal regulations as set forth in 40 CFR Parts 60, 61 and 63 but not yet adopted by the state. If the department determines that technological or economic

[3] While there are Pb, H_2SO_4, TRS, and F emissions from this project, the emissions are so small that they were rounded to 0.00. For example the Pb emissions are 0.003 tons/yr.
[4] CO_{2e} = carbon dioxide equivalent = (mass of GHG) x (individual GWP).

limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard or combination thereof may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation and shall provide for compliance by means which achieve equivalent results." [567 IAC 33.3(1)]

Each BACT analysis is conducted on a case-by-case basis. The economic analysis is conducted using costs that are valid for that area in which the source is located. No technology may be approved which is less stringent that the NSPS found in 40 CFR Part 60 [See also 567 IAC 23.1(2)] or any of the NESHAPS found in 40 CFR Part 61 [See also 567 IAC 23.1(3)] and 40 CFR Part 63 [See also 567 IAC 23.1(4)].

To fulfill PSD requirements, the applicant has performed a BACT analysis for the new & modified equipment for each pollutant emitted above the PSD "significance level." Appendix E has a description of each type of control equipment reviewed for this project. Following is a summary of the BACT determinations for each emission unit or type of emission unit:

- **Primary Reformer (EP 01):**
  In some aspects the primary reformer is similar to a water-tube boiler. Natural gas is used as a feed and reacts with steam to produce hydrogen and carbon oxides. The natural gas feed is preheated and distributed to tubes that are suspended in a radiant section. The heat for the endothermic reaction within the tubes is provided by combustion of fuel gas. The reformer burners will be located between the rows of catalyst tubes and operate with downward firing that heats the tubes from both sides. The loading on the tubes also results from this downward firing.

  PM:
  Natural gas produces very low particulate emissions compared to other fuels. The main reason is that there is little to no ash in the fuel as it is mostly methane and other gaseous hydrocarbons. Since there is little ash in natural gas, add-on control technologies are not practical as they would provide little if any additional reduction in emissions.

  Therefore, the only remaining BACT control technology is natural gas combustion with good operating/combustion practices which is the same technology proposed by the applicant.

  The applicant proposed to set the BACT emission rate at the same level as EPA's AP-42 emission factor for natural gas combustion which is 0.0076 lb/MMBTU (heat input) with an overall rating of "D". Appendix F-1 is the introduction for AP-42 and explains the development of emission factors and the rating system.

  The AP-42 emission factors for natural gas combustion were released in 1998 and have not been updated. Since these factors are older the Department researched past stack testing on natural gas combustion. There were two (2) stack tests for the 429.4 MMBTU/hr Auxiliary Boiler at MidAmerican's Walter Scott Jr. Generating Station in 2007. The Department analyzed the data by using a 95% confidence interval which resulted in an emission factor of 0.0024 lb/MMBTU (heat input). A copy of the data and the Department's review is in Appendix F-2. Since this data is more recent and was also on an emission unit that went through a BACT review the Department set the BACT emission limit for PM based on the MidAmerican Auxiliary Boiler stack tests.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0024 lb/MMBTU [average of three (3) stack tests] 11.9 tons/yr [rolling twelve (12) month total]

PM_{10}:

The fuel/feedstock for the reformer is natural gas. Natural gas produces very low particulate emissions compared to other fuels. The main reason is that there is little to no ash in the fuel as it is mostly methane and other gaseous hydrocarbons. Since there is little ash in natural gas, add-on control technologies are not practical as they would provide little if any additional reduction in emissions.

Therefore, the only remaining BACT control technology is natural gas combustion with good operating/combustion practices which is the same technology proposed by the applicant.

Based on past experience PM = PM_{10} which means the Department has set the PM_{10} BACT limits the same as the PM BACT limits.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0024 lb/MMBTU [average of three (3) stack tests] 11.9 tons/yr [rolling twelve (12) month total]

$PM_{2.5}$:

The fuel/feedstock for the reformer is natural gas. Natural gas produces very low particulate emissions compared to other fuels. The main reason is that there is little to no ash in the fuel as it is mostly methane and other gaseous hydrocarbons. Since there is little ash in natural gas, add-on control technologies are not practical as they would provide little if any additional reduction in emissions.

Therefore, the only remaining BACT control technology is natural gas combustion with good operating/combustion practices which is the same technology proposed by the applicant.

The Department has little data on the fraction of $PM_{2.5}$ emissions from natural gas emissions and AP-42 does not have any information either. Therefore, the Department has assumed $PM_{2.5}$ = PM_{10} = PM for natural gas combustion.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0024 lb/MMBTU [average of three (3) stack tests] 11.9 tons/yr [rolling twelve (12) month total]

Opacity:
Typically opacity is caused by particulate emissions so the same BACT technology for particulate is used as the BACT technology for opacity. Based on a BACT limit of 0.0024 lb/MMBTU the estimated emission rate is 2.71 lb/hr which at a flowrate 214,800 scfm is a grain loading of 0.00147 gr/dscf. Based on past experience a grain loading less than 0.01 gr/dscf results in an opacity of 0%. Therefore, the Department has proposed a BACT emission rate of *"No Visible Emissions"* or *"No VE"* as the facility would not need a certified reader for a *"No VE"* standard.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	No Visible Emissions (No VE)

NO_x:
There are three (3) types of NO_x formation from combustion:

1) Prompt NO_x
This type is formed from molecular nitrogen in the air combining with fuel in fuel-rich conditions which exist, to some extent, in all combustion. This nitrogen then oxidizes along with the fuel and becomes NO_x during combustion.

2) Thermal NO_x
This type is formed through the thermal dissociation and reaction of combustion air nitrogen and oxygen. The concentration of "thermal NO_x" is controlled by the nitrogen and oxygen molar concentrations and the temperature of combustion. Combustion at temperatures well below 1,300 ^oC (2,370 ^oF) forms much smaller concentrations of thermal NO_x.

3) Fuel NO_x
This type forms due to fuels that contain nitrogen (i.e. coal, natural gas, etc.) and is a result of oxidation of the already-ionized nitrogen contained in the fuel. Natural gas has a low fuel nitrogen content and therefore, this formation is expected to be insignificant.

The applicant has proposed to install the top control option which is selective catalytic reduction (SCR). Since the applicant has chosen the top control there was no need to do an economic analysis of the technology or review the other control technologies.

The applicant proposed to set the BACT emission rate at 10 ppm_{vd} based on the average of three (3) one (1) hour stack test runs. The Department did not have any test data from a reformer with similar controls. So the Department has defaulted to a review of EPA's RACT/BACT/LAER Clearinghouse. A review of the Clearinghouse showed the following limits that were 10 ppm_{vd} or less:

- Chevron Products (Los Angeles, CA): 5 ppm_{vd}
- CENCO Refinery (South Coast, CA): 5 ppm_{vd}
- Air Products (Los Angeles, CA): 5 ppm_{vd}
- Tosco Refinery (Los Angeles, CA): 7 ppm_{vd}
- Air Products (TX): 9 ppm_{vd}
- Air Liquide (Rodeo, CA): 10 ppm

The first four (4) limits are all believed to be LAER limits since those areas in California are nonattainment. The 9 ppm_{vd} limit from Texas is believed to be a BACT limit and SCR is the control listed. No date is given in the Clearinghouse for this permit.

The applicant did not provide any justification beyond a *"manufacturer's guarantee"* for the proposed 10 ppm_{vd} BACT limit. Since the unit in Texas has similar control and is of a similar size there is no reason to set a limit higher than the permitted BACT limit of 9 ppm_{v}. In addition, the Department has set the limit based on a thirty (30) day rolling average instead of the average of three (3) one (1) hour stack test runs. The thirty (30) rolling average allows more variability in the hourly and daily emission rates.

BACT:	Selective Catalytic Reduction (SCR)
Emission Limits:	9 ppm_{v} [thirty (30) day rolling average]
	56.0 tons/yr [rolling twelve (12) month total]

<u>*VOC:*</u>
VOC and CO emissions depend on the efficiency of fuel combustion. Decreased combustion efficiency results in increased VOC and CO emissions.

Thermal oxidation was not considered technically feasible since typically it requires a VOC concentration between 1,500 and 3,000 ppm. In addition, high combustion temperatures between 1,000 ^{o}F and 1,200 ^{o}F are needed. The VOC concentration within the reformer stack is expected to be approximately 0.001 ppm.

Catalytic oxidation was not considered technically feasible since typical exhaust flowrates are between 700 and 50,000 scfm. The flowrate of the primary reformer is approximately 215,000 scfm which is well outside the range of the required flowrate.

Oxidation catalysts were not considered feasible since the minimum temperature of 600 ^{o}F is required for proper operation. The temperature where the oxidation catalyst would be placed is between 275 ^{o}F and 325 ^{o}F. It would be possible to reheat the gas stream, but that would take more natural gas and create additional emissions to try and control less than 10 tons of VOC emissions.

Therefore, the only remaining BACT control technology is natural gas combustion with good operating/combustion practices which is the same technology proposed by the applicant.

The applicant proposed to set the BACT emission rate at the same level as EPA's AP-42 emission factor for natural gas combustion which is 0.0055 lb/MMBTU (heat input) with a rating of "C".

Similar to particulate matter, the Department reviewed the stack testing done on MidAmerican's Auxiliary Boiler. The resulting emission factor was 0.0014 lb/MMBTU. A copy of the data and the Department's review is in Appendix F-2. Since this data is more recent and was also on an emission unit that went through a BACT review the Department set the BACT emission limit for VOC based on the MidAmerican Auxiliary Boiler stack tests.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0014 lb/MMBTU [average of three (3) stack tests] 6.95 tons/yr [rolling twelve (12) month total]

CO:

VOC and CO emissions depend on the efficiency of fuel combustion. Decreased combustion efficiency results in increased VOC and CO emissions.

Thermal oxidation was not considered technically feasible since typically it requires a CO concentration greater than 125,000 ppm or high levels of excess oxygen (8%). In addition, high combustion temperatures between 1,000 ^{o}F and 1,200 ^{o}F are needed. The CO concentration within the reformer stack is expected to be approximately 0.02 ppm.

Catalytic oxidation was not considered technically feasible since typical exhaust flowrates are between 700 and 50,000 scfm. The flowrate of the primary reformer is approximately 215,000 scfm which is well outside the range of the required flowrate.

Oxidation catalysts were not considered feasible since the minimum temperature of 600 ^{o}F is required for proper operation. The temperature where the oxidation catalyst would be placed is between 275 ^{o}F and 325 ^{o}F. It would be possible to reheat the gas stream, but that would take more natural gas and create additional emissions to try and control less than 100 tons of CO emissions.

Therefore, the only remaining BACT control technology is natural gas combustion with good operating/combustion practices which is the same technology proposed by the applicant.

The applicant proposed to set the BACT emission rate at the same level as EPA's AP-42 emission factor for natural gas combustion which is 0.084 lb/MMBTU (heat input) with a rating of "B".

Since there is an inverse relationship between NO_x and CO the Department reviewed the Texas primary reformer determination as that determination was the basis for the Department's NO_x BACT limit. The Texas permit set a CO BACT limit of 0.016 lb/MMBTU.

The Department also reviewed MidAmerican's Auxiliary Boiler stack test for CO and based on a review of that data an emission factor of 0.0194 lb/MMBTU was developed. Since this data is actual data the Department has chosen to use it as the BACT emission limit instead of the Texas limit of 0.016 lb/MMBTU.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0194 lb/MMBTU [average of three (3) stack tests] 96.3 tons/yr [rolling twelve (12) month total]

CO_{2e}:
For this unit, the CO_{2e} emissions are due to carbon dioxide (CO_2), methane (CH_4) and nitrous oxides (N_2O) emissions. Global warming potentials (GWP) of methane and nitrous oxide emissions are normalized to the warming potential of carbon dioxide (i.e., CO_{2e}) by multiplying the methane emissions by 21 and the nitrous oxide emissions by 310. Despite the higher warming potentials of CH_4 and N_2O compared to CO_2, it is expected that CO_2 will account for the majority of the global warming potential from this unit.

Appendix E discusses potential CO_2 capture technologies. According to the application, several pilot scale projects have been successfully executed on reformers in the fertilizer industry to capture the CO_2. However, there are no commercial full scale operations as of this date.

Carbon capture has high capital and operating costs. Studies indicate that capital costs of capturing a metric ton of CO_2 are approximately $39/ton. The operating expenses which include the cost of steam, cooling water, and electric power equal approximately $29/ton. In the case of IFC the initial capital expense would be $25 million with the annual operating expenses being $18 million.

Capturing the CO_2 is only the first step as once it is captured the CO_2 must be sequestered. There may be potential carbon sequestration sites in Iowa, but the technologies to use them are mostly still in the pilot scale phase of development. The closest known existing site for sequestration is approximately fifty (50) miles from the IFC site. Estimates on the cost of constructing a pipeline to transport captured CO_2 range from $1 - $3 million per mile.

This means the capital cost is $75 - $175 million for capture equipment and pipeline construction. Add in the annual operating expenses of $18 million and there would still be costs for gas compression, additional injection and monitoring wells necessary to handle the volume of CO_2 produced, pipeline right-of-way, etc.

The following facts are sufficient to eliminate this option without requiring a more detailed site-specific technological or economic analysis:

- the qualitative cost estimate of capture and sequestration is quite high,
- the technological effectiveness for the capture equipment has not been demonstrated in practice yet on a full scale operation,
- there are no commercially available operations, and
- there is uncertainty as to whether locations capable of storing the large amounts of CO_2 that would be produced per year exist within a closer radius of the plant.

This means the only control options available are the use of natural gas which is lowest GHG emitting fossil fuel. Natural gas is also required as a feedstock for the ammonia plant. In addition to the use of natural gas IFC will incorporate good combustion practices and good operating practices. Finally, IFC will develop a *Work Practices Manual* to ensure that all energy design elements are continuously maintained and implemented at the plant.

BACT:	Natural Gas Combustion, Good Combustion Practices, and Good Operating Practices
Emission Limits:	117 lb CO_2/MMBTU [thirty (30) day rolling average] 0.0023 lb CH_4/MMBTU [average of three (3) stack test runs] 0.00063 lb N_2O/MMBTU [average of three (3) stack test runs] 596,905 tons of CO_{2e}/yr [twelve (12) month rolling total]

- **CO_2 Regenerator (EP 02):**
  CO_2 removal from the process gas in the ammonia plant results in emissions of CO and VOC from the regenerator stack. CO_2 is absorbed at a relatively low temperature (50 – 70 ^oF) in an absorber tower using MDEA. The recovered CO_2 gas which contains small amounts of CO and VOC is used for downstream urea and UAN production. Excess gas from the CO_2 absorber is used as secondary fuel in the primary reformer.

<u>VOC:</u>
The only identifiable control technologies for VOC for this process are:

1) Use of good operating practices to maximize absorption of CO_2 from the process gas and using the resultant CO_2 stream for downstream urea production; and
2) Using overhead process gas as a secondary fuel in the primary reformer where CO and VOC can be combusted.

Both of these control techniques will be employed in the IFC ammonia manufacturing process.

The applicant proposed a BACT emission rate of 115 lb/hr which is based on the AP-42 emission factor of 1.04 lb/ton of ammonia produced. This emission factor was published in 1993 and has an “E” rating.

The Department reviewed a VOC stack test report from a CO_2 Regenerator at Terra Nitrogen. The test was conducted in 1996. The 95% confidence interval on the three (3) test runs resulted in an emission factor of 0.106 lb/ton of ammonia. A copy of the test summary and the Department’s analysis can be found in Appendix F-3.

BACT:	Good Operating Practices
Emission Limits:	0.106 lb/ton of ammonia produced [average of three (3) stack tests] 51.2 tons/yr [twelve (12) month rolling total]

CO:
The only identifiable control technologies for CO for this process are the same as those identified for VOC above.

The applicant proposed a BACT emission rate of 220 lb/hr which is based on the AP-42 emission factor of 2.0 lb/ton of ammonia produced. This emission factor was published in 1993 and has an "E" rating.

The Department reviewed a CO stack test report from a CO_2 Regenerator at Terra Nitrogen. The test was conducted in 1996. The 95% confidence interval on the three (3) test runs resulted in an emission factor of 0.020 lb/ton of ammonia. A copy of the test summary and the Department's analysis can be found in Appendix F-3.

BACT: Natural Gas Combustion & Good Combustion Practices
Emission Limits: 0.020 lb/ton of ammonia produced [average of three (3) stack tests]
9.65 tons/yr [twelve (12) month rolling total]

CO_{2e}:
The regenerator is a non-combustion emission unit. The only GHG emissions are CO_2. Even though the CO_2 could potentially be captured the issue is still sequestering the emissions as described above for the reformer.

Since CO_2 is used in the urea and UAN plants BACT is maximizing the recovery and use of CO_2 within those plants. As stated above, IFC will develop a *Work Practices Manual* to ensure that all energy design elements are continuously maintained and implemented at the plant.

BACT: Good Operating Practices
Emission Limits: 1.39 tons of CO_2/ton of ammonia produced [thirty (30) day rolling average]
1,211,847 tons of CO_{2e}/yr [twelve (12) month rolling total]

- **UAN Mixing Tank (EP 03):**
The mixing tank receives liquid urea, ammonium nitrate solution, and water for final UAN production. The solution contains CO_2 and trace amounts of this CO_2 (less than 0.2% by weight) are emitted to the atmosphere through a tank scrubber. The purpose of the scrubber is to minimize ammonia emissions to the atmosphere.

CO_{2e}:
Since it was not considered feasible to capture and sequester emissions from the reformer (over 500,000 tons of CO_2) or the CO_2 regenerator (over 1,000,000 tons of CO_2) it would not be feasible to capture and sequester less than 5 tons/yr of CO_2.

BACT: Good Operating Practices
Emission Limits: 1.1 lb CO_2/hr
[average of three (3) stack test runs]
4.92 tons of CO_{2e}/yr
[twelve (12) month rolling total]

- **Urea Synthesis (EP 04):**
The acid scrubber in the Urea Plant vents a small amount of CO_2 emissions contained in off gases from an atmospheric absorber and desorption column. The purpose of the scrubber is to minimize ammonia emissions to the atmosphere. Purified process condensate produced by the desorption process is recirculated to urea granulation as make up water for the granulation scrubbing system or to the utilities section of the plant where it can be used as boiler feed water or cooling tower water makeup.

CO_{2e}:
Since it was not considered feasible to capture and sequester emissions from the reformer (over 500,000 tons of CO_2) or the CO_2 regenerator (over 1,000,000 tons of CO_2) it would not be feasible to capture and sequester less than 725 tons/yr of CO_2.

BACT: Good Operating Practices
Emission Limits: 165.4 lb CO_2/hr
[average of three (3) stack test runs]

- **Nitric Acid Plant (EP 05):**
IFC will use a weak nitric acid production process. This method utilizes oxidation, condensation, and absorption to produce nitric acid at concentrations between 30 and 70% nitric acid. Each of the three (3) steps of this high temperature catalytic ammonia oxidation process relates to a specified chemical reaction. In the 1st step, ammonia and heated air is distributed by a perforated sheet plate over platinum and rhodium alloy catalyst gauze to produce nitrous gas. Following this exothermic stage, heat is recovered and used for steam generation in a waste heat boiler which supplies steam for a turbine driven compressor.

In the 2nd process step, nitric oxide is oxidized to form nitrogen dioxide. Finally, the nitrogen dioxide is processed with water to form nitric acid. The process gas or tail gas is compressed and sent through heat exchangers. The nitric acid process produces emissions of NO_2 and nitrous oxide (N_2O). EPA recently promulgated a new NSPS for nitric acid plant which limits NO_2 emissions to 0.50 lb/ton of nitric acid produced.

NO_x:
The top control technology for NO_x reduction is tertiary catalytic reduction which occurs downstream of the absorber. Since IFC has chosen the top control technique no economic analysis is required and no review of the other technologies is required.

The specific control technology chosen by IFC is EnviNO$_x$® by Uhde. Specifically the system that will be installed is the Type 2 variant. As is described in Appendices G this technology is a single vessel that has two (2) beds. The 1st bed controls NO_x emissions and the 2nd bed controls N_2O emissions.

The applicant has proposed a NO_x emission limit of 35 ppm_v (0.5 lb NO_2/ton of nitric acid). As is mentioned above the 0.5 lb NO_2/ton of nitric acid is the new NSPS standard. EPA established this rate by reviewing data from the highest controlled nitric acid plants in the US. The best controlled were those with SCR. EPA adjusted the data to account for partial operating days and then used the highest data out of the three (3) sites that had SCR for control. The background information for the setting of the standard can be found in Appendix G-1 which is from the NSPS docket.

This technique for setting an emission limit is not equivalent to BACT. The Department has reviewed information from Uhde's website concerning EnviNO$_x$®. This information can be found in Appendix G-2 with the specific website addresses at the bottom of the various pages. In addition to the Uhde website there is data concerning EnviNO$_x$® on the United Nations Framework Convention on Climate Change website (www.unfccc.org/cdm).

Based on this data NO_x emissions are consistently near 0 ppm with a N_2O reduction of over 98%. Therefore, it was the opinion of the Department the proposed 35 ppm_v limit cannot be considered BACT. Reviewing the various graphs in the data shows 5 ppm_v is an achievable limit for NO_x. Therefore, this limit was set as BACT on a thirty (30) day rolling average, but the limit does not include periods of startup, shutdown, or malfunction (SSM).

In order to account for periods of SSM emissions the ton/yr emission limit was set at 30.0 tons/yr which is based on 6 ppm_v.

BACT:	De-NO_x System
Emission Limits:	5 ppm_v [thirty (30) day rolling average]
	30.0 tons/yr [rolling twelve (12) month total]

CO_{2e}:
Unlike previous discussions on GHG emissions there are no CO_2 emissions from this process. The main emission is N_2O which is created in the nitric acid plant. The EnviNO$_x$® system injects natural gas (i.e. methane) into the 2nd bed for N_2O control. Therefore, unreacted methane (CH_4) is emitted out of EP 05. Methane emissions are preferable to N_2O emissions since the global warming potential (GWP) of CH_4 is 21 while the GWP of N_2O is 310.

As stated above the EnviNO$_x$® system controls both NO_x and N_2O. The applicant proposed a BACT emission limit of 30 ppm_v. Based on information in the application and its supplemental information the amount of uncontrolled N_2O emissions going to the EnviNO$_x$® system will vary from 500 ppm to 1,200 ppm.

According to an August 29, 2012 email, the normal lifetime of the platinum/rhodium gauzes is six (6) months. This is based on IFC experience at other nitric acid plants they operate. Normally the N_2O concentration starts around 500 ppm when the gauzes are fresh and gradually/steadily increases during the life span of the gauzes to 1,200 ppm.

This means that to meet the proposed 30 ppm limit the control equipment would only have to be 96% efficient at the beginning of the gauze lifetime. At the end of the gauze lifetime the control equipment needs to be 97.5% efficient.

As stated earlier the data from the Uhde website shows the control equipment was consistently able to meet 98% control of N_2O. Therefore, to address the changing inlet N_2O concentration the Department has set the BACT emission limit as 30 ppm_v **and** 98% reduction. Two (2) stack tests are being required with the 1st test at the beginning of the gauze lifetime and the 2nd test being at the end of the gauze lifetime. Both tests will have inlet and outlet testing required for N_2O.

BACT:	De-NO_x System and De-N_2O System
Emission Limits:	N_2O: 30 ppm_v & 98% reduction [average of three (3) stack test runs]
	CH_4: 40 ppm_v [average of three (3) stack test runs]
	CO_{2e}: 29,543 tons/yr [rolling twelve (12) month total]

- **Nitric Acid Storage Tank (EP 06):**
In addition to the NO_x emissions from the tail gas of the nitric acid plant there is a small amount of NO_x emissions from the breathing and working losses associated with the nitric acid storage tank. The storage tank holds one (1) day of nitric acid production in intermediate storage. NO_x emissions are minimized through the use of an integrated 50 mm acid lock and 50 mm water lock. Typically the acid flow into the tank is zero (0) since most of the nitric acid produced is used downstream for UAN production.

NO_x:
While it may be possible to install add on controls no technology would be economically feasible since this tank has limited operation and the expected emissions are less than 1 ton/yr. Therefore, the Acid/Water Vent Lock is considered BACT.

BACT:	Acid/Water Vent Lock
Emission Limits:	0.72 tons/yr [rolling twelve (12) month total]

- **Auxiliary Boiler (EP 07):**
The Auxiliary Boiler combusts natural gas to produce steam. The unit being installed is a package boiler that includes Low-NO_x Burners (LNB) and Flue Gas Recirculation (FGR). The unit is expected to operate at 20% load for 8,660 hours per year and 100% load for the other 100 hours per year. Therefore, IFC has requested a permit limit on natural gas usage of 865.44 million cubic feet per year.

PM:
Since this unit combusts only natural gas the BACT analysis for particulate matter is the same as that for the primary reformer.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0024 lb/MMBTU [average of three (3) stack tests]
	1.06 tons/yr [rolling twelve (12) month total]

PM_{10}:
Since this unit combusts only natural gas the BACT analysis for particulate matter is the same as that for the primary reformer.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0024 lb/MMBTU [average of three (3) stack tests] 1.06 tons/yr [rolling twelve (12) month total]

$PM_{2.5}$:
Since this unit combusts only natural gas the BACT analysis for particulate matter is the same as that for the primary reformer.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0024 lb/MMBTU [average of three (3) stack tests] 1.06 tons/yr [rolling twelve (12) month total]

Opacity:
Since this unit combusts only natural gas the BACT analysis for opacity is the same as that for the primary reformer.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	No Visible Emissions (No VE)

NO_x:
NO_x emissions are formed in the same manner in the boiler as they are in the primary reformer. According to the BACT analysis submitted by the company the package boiler with LNB & FGR can achieve a NO_x emission rate as low as 0.0125 lb/MMBTU. Combined with the annual natural gas usage limit the potential NO_x emissions are 5.52 tons/yr.

According to the BACT analysis submitted by the applicant SCR can achieve an emission rate of 0.011 lb/MMBTU which combined with the natural gas limit on the unit results in an annual emission rate of 4.86 tons/yr.

SCR does result in more control, but the added cost of an SCR system would not be cost effective as the amount of additional control is less than 1 ton/yr due to the restricted use of the auxiliary boiler. Had this unit been unrestricted at full capacity SCR would likely have been cost effective since there would have been more NO_x emissions available to be controlled by SCR.

The applicant proposed an emission rate of 0.032 lb/MMBTU which is at the high end of the capability of the package boiler with LNB and FGR. The Department has chosen the low end (i.e. 0.0125 lb/MMBTU) as the application states a package boiler with LNB and FGR is capable of achieving this rate.

It should be noted that the Department did not do a thorough analysis of the economic analysis submitted by the applicant, but some of the rates used would not have been acceptable without more justification. One such rate was the hourly labor rate of $75/hr.

BACT:	LNB & FGR
Emission Limits:	0.0125 lb/MMBTU [thirty (30) day rolling average] 5.52 tons/yr [rolling twelve (12) month total]

<u>VOC:</u>

Since this unit combusts only natural gas the BACT analysis for VOC is the same as that for the primary reformer.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0014 lb/MMBTU [average of three (3) stack tests] 0.62 tons/yr [rolling twelve (12) month total]

<u>CO:</u>

As stated earlier there is an inverse relationship between NO_x and CO. From past experience the use of FGR can lead to an increase in CO emissions from a combustion unit. Therefore, the stack test from MidAmerican's Auxiliary Boiler could not be used.

Wells Enterprises was required to install LNB and FGR on several of their boilers. While these units are quite a bit smaller than this auxiliary boiler it is still considered better data since the tests were recent compared to the AP-42 emission factors which are over ten (10) years old.

Unfortunately not all of the tests at Wells Enterprises gave the results in lb/MMBTU for CO. The test that did resulted in a 95% confidence emission factor of 0.0013 lb/MMBTU. This is the rate proposed as BACT in the draft permit for the auxiliary boiler.

It should be noted that IFC incorrectly assumed $4,110/ton of CO removal was cost prohibitive for an oxidation catalyst. The Department considers $4,110/ton of pollutant removal to be cost effective. However, the $4,110/ton of CO removal is in error since it is based on the removal of 19.9 tons/yr. The test data from a similar source with the natural gas usage limit gives an uncontrolled annual emission rate of only 0.57 tons/yr so 19.9 tons/yr cannot be removed.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0013 lb/MMBTU [average of three (3) stack tests] 0.57 tons/yr [rolling twelve (12) month total]

<u>CO_{2e}:</u>

Since it was not considered feasible to capture and sequester emissions from the reformer (over 500,000 tons of CO_2) or the CO_2 regenerator (over 1,000,000 tons of CO_2) it would not be feasible to capture and sequester approximately 52,000 tons/yr of CO_2.

BACT:	Natural Gas Combustion, Good Combustion Practices, and Good Operating Practices
Emission Limits:	117 lb CO_2/MMBTU [thirty (30) day rolling average] 0.0023 lb CH_4/MMBTU [average of three (3) stack test runs] 0.00063 lb N_2O/MMBTU [average of three (3) stack test runs] 51,748 tons of CO_{2e}/yr [twelve (12) month rolling total]

- **Ammonia Flare (EP 08):**
  The purpose of the ammonia flare is to process intermittent ammonia releases from process upsets. There are four (4) natural gas pilot burners associated with the flare. Since this is for intermittent operation it is difficult to set actual emission limits. Therefore, BACT for all pollutants for this emission unit is work practice standards which include the following:
  - Properly designed flare such as smokeless design
  - Flare minimization
  - Good combustion practices

BACT for the project:	Proper design, Flare Minimization, and Good Combustion Practices
Emission Rates:	Work Practices

- **Emergency Generator (EP 09) and Fire Pump (EP 10):**
  Over the last several years new federal standards were established for new nonroad diesel engines. These standards were phased in over time for specific horsepower ratings representing major emission reductions for new nonroad diesel engines.

  The federal standards do not specify specific control technologies to be used, but instead set numerical emission limits in terms of grams per brake-horsepower hour. Therefore, many different technologies could be used to meet the emission standards.

  Since the engines in this project are limited use engines with annual restrictions on hourly usage the ton per year emissions allowed for each pollutant from each engine is very small. Accordingly, BACT for each pollutant was established as the same emission rate as the NSPS/NESHAP standard.

  PM:
  Available particulate controls for internal combustion engines include engine design and combustion optimization, low sulfur diesel fuel specification, diesel oxidation catalysts (DOC) and diesel particulate filters (DPF) or catalyzed diesel particulate filters (CDPF). Each of these control options are considered technically feasible and can be used separately or in combination to achieve an emission reduction.

Emergency Generator:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 0.20 g/kW-hr (average of 3 stack test runs)
0.22 tons/yr (rolling-12-month total)

Fire Pump:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 0.20 g/kW-hr (average of 3 stack test runs)
0.03 tons/yr (rolling-12-month total)

PM_{10}:
Available particulate controls for internal combustion engines include engine design and combustion optimization, low sulfur diesel fuel specification, diesel oxidation catalysts (DOC) and diesel particulate filters (DPF) or catalyzed diesel particulate filters (CDPF). Each of these control options are considered technically feasible and can be used separately or in combination to achieve an emission reduction.

Based on past experience PM = PM_{10} which means the Department has set the PM_{10} BACT limits the same as the PM BACT limits.

Emergency Generator:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 0.20 g/kW-hr (average of 3 stack test runs)
0.22 tons/yr (rolling-12-month total)

Fire Pump:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 0.20 g/kW-hr (average of 3 stack test runs)
0.03 tons/yr (rolling-12-month total)

$PM_{2.5}$:
Available particulate controls for internal combustion engines include engine design and combustion optimization, low sulfur diesel fuel specification, diesel oxidation catalysts (DOC) and diesel particulate filters (DPF) or catalyzed diesel particulate filters (CDPF). Each of these control options are considered technically feasible and can be used separately or in combination to achieve an emission reduction.

The Department has little data on the fraction of $PM_{2.5}$ emissions from diesel engines emissions and AP-42 does not have any information either. Since most of the emissions will be condensable emissions the Department has assumed $PM_{2.5}$ = PM_{10} = PM for these engines.

Emergency Generator:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 0.20 g/kW-hr (average of 3 stack test runs)
0.22 tons/yr (rolling-12-month total)

Fire Pump:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 0.20 g/kW-hr (average of 3 stack test runs)
0.03 tons/yr (rolling-12-month total)

Opacity:
The following emission rate was considered BACT for the emergency generator and the fire pump:

BACT: Control to Meet NSPS Subpart IIII
Emission Limits: 5% (6-minute avg.)
20% applies during periods of startup, shutdown, and malfunction

NO_x:
Available NO_x controls for internal combustion engines include fuel injection rate shaping and multiple fuel injections, charge air cooling, injection timing retard, exhaust gas recirculation, and lean-NO_x catalyst technology. These technologies are considered feasible and can be used separately or in combination to achieve an emission reduction.

The NSPS Subpart IIII standards for NO_x specifies an emission limit of NO_x plus Non-Methane Hydrocarbons (NMHC). Based on background documentation in the rule development, the Department separated the limits for NO_x and VOC.

Emergency Generator:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 6.0 g/kW-hr (average of 3 stack test runs)
6.61 tons/yr (rolling-12-month total)

Fire Pump:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 3.75 g/kW-hr (average of 3 stack test runs)
0.49 tons/yr (rolling-12-month total)

VOC:
Available VOC controls for internal combustion engines include engine design and combustion optimization and oxidation catalysts. Each of these control options are considered technically feasible and can be used separately or in combination to achieve an emission reduction.

As stated above with NO_x, the Department separated the limits for NO_x and VOC.

Emergency Generator:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 0.4 g/kW-hr (average of 3 stack test runs)
0.44 tons/yr (rolling-12-month total)

Fire Pump:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 0.25 g/kW-hr (average of 3 stack test runs)
0.03 tons/yr (rolling-12-month total)

CO:
Available CO controls for internal combustion engines include engine design and combustion optimization, combustion modification, and catalytic oxidation. Each of these control options are considered technically feasible and can be used separately or in combination to achieve an emission reduction.

Emergency Generator:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 3.5 g/kW-hr (average of 3 stack test runs)
3.86 tons/yr (rolling-12-month total)

Fire Pump:
Control Technology: Control to Meet NSPS Subpart IIII
BACT emission limit: 3.5 g/kW-hr (average of 3 stack test runs)
0.45 tons/yr (rolling-12-month total)

CO_{2e}:
Since it was not considered feasible to capture and sequester emissions from the reformer (over 500,000 tons of CO_2) or the CO_2 regenerator (over 1,000,000 tons of CO_2) it would not be feasible to capture and sequester less than 1,000 tons/yr of CO_2 form the generator or less than 100 tons/yr of CO_2 from the fire pump.

Emergency Generator:
BACT: Natural Gas Combustion, Good Combustion Practices, and Good Operating Practices
Emission Limits: 1.55 grams of CO_2/kW-hr
[average of three (3) stack test runs]
1.22 x 10^{-4} grams of CH_4/kW-hr
[average of three (3) stack test runs]
788.5 tons of CO_{2e}/yr
[twelve (12) month rolling total]

Fire Pump:
BACT: Natural Gas Combustion, Good Combustion Practices, and Good Operating Practices
Emission Limits: 1.55 grams of CO_2/kW-hr
[average of three (3) stack test runs]
1.22 x 10^{-4} grams of CH_4/kW-hr
[average of three (3) stack test runs]
91 tons of CO_{2e}/yr
[twelve (12) month rolling total]

- **Startup Heater (EP 11):**
  The startup heater combusts natural gas to produce steam. It is used to stabilize the ammonia synthesis loop make up gas from the front end before bringing the synthesis loop online. The startup heater will also operate when the synthesis loop trips out.

  IFC estimates this unit will operate for a maximum of forty-eight (48) hours during cold startup situations and a maximum of two (2) startups per year. It is likely that a minimum of two (2) years could go by without a startup situation occurring. Therefore, IFC has proposed a natural gas limit of 10.572 million cubic feet per year which results in very low potential emissions and any add on control equipment will be economically infeasible even if technically feasible.

PM:
Since this unit combusts only natural gas the BACT analysis for particulate matter is the same as that for the primary reformer & auxiliary boiler.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0024 lb/MMBTU [average of three (3) stack tests] 0.01 tons/yr [rolling twelve (12) month total]

PM_{10}:
Since this unit combusts only natural gas the BACT analysis for particulate matter is the same as that for the primary reformer.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0024 lb/MMBTU [average of three (3) stack tests] 0.01 tons/yr [rolling twelve (12) month total]

$PM_{2.5}$:
Since this unit combusts only natural gas the BACT analysis for particulate matter is the same as that for the primary reformer.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0024 lb/MMBTU [average of three (3) stack tests] 0.01 tons/yr [rolling twelve (12) month total]

Opacity:
Since this unit combusts only natural gas the BACT analysis for opacity is the same as that for the primary reformer.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	No Visible Emissions (No VE)

NO_x:
IFC proposed no controls for the startup heater with an emission rate of 0.19 lb/MMBTU which is based on the post-NSPS AP-42 emission factor for large natural gas fired boilers (greater than 100 MMBTU/hr).

As has been discussed earlier in this document the AP-42 emission factors are over ten (10) years old and existing units have been capable of meeting lower rates. The Department reviewed the NO_x test data from MidAmerican's Auxiliary Boiler which resulted in a NO_x emission rate of 0.119 lb/ton which is proposed as BACT. A copy of the test summaries and the Department's analysis can be found in Appendix F-2.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.119 lb/MMBTU [thirty (30) day rolling average] 0.63 tons/yr [rolling twelve (12) month total]

VOC:
Since this unit combusts only natural gas the BACT analysis for VOC is the same as that for the primary reformer and auxiliary boiler.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0014 lb/MMBTU [average of three (3) stack tests] 0.01 tons/yr [rolling twelve (12) month total]

CO:
Since this unit combusts only natural gas the BACT analysis for VOC is the same as that for the primary reformer.

BACT:	Natural Gas Combustion & Good Combustion Practices
Emission Limits:	0.0194 lb/MMBTU [average of three (3) stack tests] 0.10 tons/yr [rolling twelve (12) month total]

CO_{2e}:
Since it was not considered feasible to capture and sequester emissions from the reformer (over 500,000 tons of CO_2) or the CO_2 regenerator (over 1,000,000 tons of CO_2) it would not be feasible to capture and sequester less than 650 tons/yr of CO_2.

BACT:	Natural Gas Combustion, Good Combustion Practices, and Good Operating Practices
Emission Limits:	117 lb CO_2/MMBTU [thirty (30) day rolling average] 0.0023 lb CH_4/MMBTU [average of three (3) stack test runs] 0.00063 lb N_2O/MMBTU [average of three (3) stack test runs] 638 tons of CO_{2e}/yr [twelve (12) month rolling total]

- **Urea Granulator (EP 12):**
  A concentrated urea solution is fed to the granulator, dispensed through injection heads, and finely atomized upwards into a bed of moving particles to form urea solids. A formaldehyde based anti-caking agent will be added to the urea solution prior to the granulator to reduce the brittleness of the solids, ensure free solids flow, increase solids storage & shipment stability, and reduce particulate emissions.

  The solids are cooled prior to either transfer to the product warehouse or recycle through the granulator as seed particles. Cooling the solids to a sufficiently low temperature will also assist in the free flow of the solids. Air emitted from the granulator and coolers will contain particulate emissions.

PM:
Granulated urea is very hygroscopic which means it readily takes up and retains water. It is also sensitive to temperature such that if its temperature limit is exceeded the material will lose its dry solid form and become very sticky. Due to these characteristics a wet scrubber is the best control option since the urea will be attracted to the water. In addition, a baghouse is not a good option since it is possible for the urea to become sticky and gum up/clog the baghouse bags and walls.

IFC proposed a wet scrubber which is the top option for this type of process. Their proposed limit was 0.17 kg/metric ton of urea. This proposal was based on a manufacturer's guarantee. According to the application (Form CE) the manufacturer of the control equipment is Uhde.

In an August 15, 2012 email the Department asked for the basis of the proposed 0.17 lb/metric ton limit. Attached to that email were several documents including information from the Uhde website. According to this information Uhde states:

> *"The air from the granulator and the fluid bed coolers contains some urea dust which is easy to catch in standard scrubbing equipment. Efficiencies of more than 99.5% are easily obtained using industrially proven scrubbers, with dust outlet concentrations of less than 0.1 kg per ton of urea produced being achieved."*

A copy of this information is included in Appendix H of this document. Based on this information the Department has set the BACT emission rate as 0.1 kg/metric ton of ammonia produced.

BACT:	Wet scrubber
Emission Limits:	0.10 kg/mt of ammonia produced [average of three (3) stack tests] 60.4 tons/yr [rolling twelve (12) month total]

PM_{10}:
Since this unit has a wet scrubber and urea is hygroscopic the Department has assumed that PM = PM_{10} which means the Department has set the PM_{10} BACT limits the same as the PM BACT limits.

BACT:	Wet scrubber
Emission Limits:	0.10 kg/mt of ammonia produced [average of three (3) stack tests] 60.4 tons/yr [rolling twelve (12) month total]

$PM_{2.5}$:
Based on the information found on the internet $PM_{2.5}$ is assumed to be 25% of the urea particulates.

BACT:	Wet scrubber
Emission Limits:	0.025 kg/mt of ammonia produced [average of three (3) stack tests] 15.1 tons/yr [rolling twelve (12) month total]

Opacity:
Since opacity would be directly related to the particulate emissions in this case, the Department has based the BACT limit on the particulate grain loading of the emission point. The 0.10 kg/mt limit results in an emission rate of 13.8 lb/hr at full capacity. With the 192,700 scfm flowrate this results in a grain loading of 0.0084 gr/dscf. Based on past experience visible emissions are not observed with particulate grain loadings less than 0.01 gr/dscf.

BACT:	Wet scrubber
Emission Limits:	No Visible Emissions (No VE)

- **Cooling Tower A (EP CTA) and Cooling Tower B (EP CTB):**
  Cooling towers are a source of particulate emissions due to the drift of cooling water from the tower containing dissolved solids. Materials are usually added to the water to prevent the growth of biological matter; however any VOC, HAP, or Chromium based materials are prohibited from being used in these towers. Emissions from the cooling tower are PM, PM_{10}, and opacity.

PM:
The top-down BACT analysis was followed and it was determined that high efficiency drift eliminators are considered to be the appropriate BACT technology.

BACT:	High Efficiency Drift Eliminator
Emission Limits:	0.0005% control efficiency in gallons of drift per gallon of cooling water flow

PM_{10}:
The top-down BACT analysis was followed and it was determined that high efficiency drift eliminators are considered to be the appropriate BACT technology.

BACT:	High Efficiency Drift Eliminator
Emission Limits:	0.0005% control efficiency in gallons of drift per gallon of cooling water flow

$PM_{2.5}$:
The top-down BACT analysis was followed and it was determined that high efficiency drift eliminators are considered to be the appropriate BACT technology. It is likely that not all of the emissions from the cooling tower are $PM_{2.5}$. However, there is no method to conduct a test to verify this assumption. Therefore, it is assumed that $PM_{2.5}$ = PM = $PM_{2.5}$

BACT:	High Efficiency Drift Eliminator
Emission Limits:	0.0005% control efficiency in gallons of drift per gallon of cooling water flow

Opacity:
Since opacity would be directly related to the particulate emissions in this case the high efficiency drift eliminator is considered to be the appropriate BACT technology. Based on the Department's past experience with these types of emission units and the low grain loading being emitted from the cooling tower no visible emissions are expected.

BACT:	High Efficiency Drift Eliminator
Emission Limits:	No Visible Emissions (No VE)

- **Granulated Urea Handling (EPs P1, P2, P3, P4, P5, and P6):**
Once the granules are cooled they are transferred to the product warehouse where they will be intermittently handled and set to either rail or truck loadout stations. By the time the urea granules are cooled, transported, and stored under the proper low temperature and low humidity conditions, the hygroscopic nature of the urea granules plays less of a factor in the overall effectiveness of particulate control technologies. This means fabric filters are considered technically feasible and the top control option.

PM:
IFC has proposed fabric filters in the form of bin vent filters for all six (6) urea handling emission points. They proposed an emission limit of 0.005 gr/dscf for each emission point.

A well maintained and operated fabric filter can achieve an emission rate of 0.005 gr/dscf. The Department has seen stack test results with emission rates lower than this grain loading, but it varies dependent upon the type of material being handled. Since the Department did not find test results from other solid urea handling equipment it has accepted the proposed 0.005 gr/dscf limit.

Granulated Urea Warehouse Transfer (EPs P1 and P2):
Control Technology: Bin Vent Filter
BACT emission limit: 0.005 gr/dscf (average of 3 stack test runs)
1.23 tons/yr (rolling-12-month total)

Granulated Urea Truck Loading (EPs P3 and P4):
Control Technology: Bin Vent Filter
BACT emission limit: 0.005 gr/dscf (average of 3 stack test runs)
0.44 tons/yr (rolling-12-month total)

Granulated Urea Train Loading (EPs P5 and P6):
Control Technology: Bin Vent Filter
BACT emission limit: 0.005 gr/dscf (average of 3 stack test runs)
0.75 tons/yr (rolling-12-month total)

PM_{10}:
Based on past experience PM_{10} emissions are typically equivalent to PM emissions from fabric filters. Therefore, the Department has set the PM_{10} BACT limits the same as the PM BACT limits.

Granulated Urea Warehouse Transfer (EPs P1 and P2):
Control Technology: Bin Vent Filter
BACT emission limit: 0.005 gr/dscf (average of 3 stack test runs)
1.23 tons/yr (rolling-12-month total)

Granulated Urea Truck Loading (EPs P3 and P4):
Control Technology: Bin Vent Filter
BACT emission limit: 0.005 gr/dscf (average of 3 stack test runs)
0.44 tons/yr (rolling-12-month total)

Granulated Urea Train Loading (EPs P5 and P6):
Control Technology: Bin Vent Filter
BACT emission limit: 0.005 gr/dscf (average of 3 stack test runs)
0.75 tons/yr (rolling-12-month total)

$PM_{2.5}$:
As stated above $PM_{2.5}$ is assumed to be 25% of the urea particulates. Therefore, the BACT emission limits are assumed to be 25% of those set for PM and PM_{10}.

Granulated Urea Warehouse Transfer (EPs P1 and P2):
Control Technology: Bin Vent Filter
BACT emission limit: 0.00125 gr/dscf
(average of 3 stack test runs)
0.31 tons/yr (rolling-12-month total)

Granulated Urea Truck Loading (EPs P3 and P4):
Control Technology: Bin Vent Filter
BACT emission limit: 0.00125 gr/dscf
(average of 3 stack test runs)
0.11 tons/yr (rolling-12-month total)

Granulated Urea Train Loading (EPs P5 and P6):

Control Technology: Bin Vent Filter
BACT emission limit: 0.00125 gr/dscf
(average of 3 stack test runs)
0.19 tons/yr (rolling-12-month total)

Opacity:
Since opacity would be directly related to the particulate emissions in this case, the Department has based the BACT limit on the particulate grain loading of the emission point. Based on past experience visible emissions are not observed with particulate grain loadings less than 0.01 gr/dscf.

BACT: Bin Vent Filter
Emission Limits: No Visible Emissions (No VE)

- **MDEA Storage Tank (EP MDEA-TK):**
Methyl-diethanol amine (MDEA) is the solvent used in the CO_2 removal (regeneration) process. The inventory of this solvent is stored in a tank during a shutdown of the process system. The MDEA will be stored in a fixed roof tank that uses a nitrogen blanket to keep the tank pressure at or a little above atmospheric to prevent air infiltration. The tank will typically be idle with a minimal inventory under slight pressure from the nitrogen blanket. The vapor pressure of MDEA is approximately 0.0006 psia at 104^{o}F.

VOC:
Since the tank will be typically idle and MDEA has a very low vapor pressure the nitrogen blanket is considered BACT.

Control Technology: Nitrogen Blanket
BACT emission limit: 0.1 tons/yr (rolling-12-month total)

- **Liquid Product Haul Road (EP LHR) and Solid Product Haul Road (EP SPR):**
Both liquid products and solid products are loaded onto trucks for shipping. The movement of the trucks across the paved roads at the plant will produce fugitive particulate emissions.

Particulate Matter (PM, PM_{10}, and $PM_{2.5}$):
No BACT emission rate was established in the permits. A work practice standard was established instead. The work practice requires that the facility pave all haul roads and complete daily water flushing followed by vacuum sweeping at least once per day. As an option, the facility may use a high efficiency vacuum sweeper than can meet an overall control efficiency of 80%.

Control Technology: Paved Road with Daily Water Flushing
Followed by Vacuum Sweeping
BACT emission limit: Work Practices

Opacity:
All of the visible emissions from the haul roads would be the result of particulate matter emissions. Since the BACT control technology is a daily water flushing followed by vacuum sweeping this is also BACT for opacity.

BACT opacity was determined to be no visible emissions across the lot line.

Control Technology:	Paved Road with Daily Water Flushing Followed by Vacuum Sweeping
BACT emission limit:	No visible emissions across the lot line

PSD Ambient Air Quality Analysis

Applicants for a PSD permit are required to conduct an air quality analysis of the ambient impacts associated with the construction and operation of the proposed new source or modification. The main purpose of the air quality analysis is to demonstrate that the new emissions emitted from a proposed project in conjunction with other applicable emissions from existing sources (including secondary emissions from growth associated with the new project) will not cause or contribute to a violation of any applicable NAAQS or PSD increment. This review is required for both criteria and non-criteria pollutants.

A separate air quality analysis is required for each regulated pollutant that will be emitted in a net significant amount. Each air quality analysis is unique due to the variety of sources and meteorological and topographical conditions that may be involved. Nevertheless, the air quality analysis must be accomplished in a manner consistent with the requirements in 567 IAC 33.3(11) through 567 IAC 33.3(16) which adopted 40 CFR §51.21(k) through 40 CFR §51.21(o) by reference. Generally, the analysis involves

- An assessment of existing air quality, which may include ambient monitoring data and air quality dispersion modeling results.
- Predictions, using air dispersion modeling, of ambient concentrations that will result from the applicant's proposed project and future growth associated with the project.

There are two (2) distinct phases for the ambient air assessment:

1) *Preliminary analysis:* This analysis models only the significant increase in potential emissions of a pollutant from the proposed project. The results of this preliminary analysis determine whether the applicant must perform a full impact analysis involving the estimation of background pollutant concentrations resulting from existing sources and growth associated with the proposed project. Specifically it:

    - Determines whether the applicant can forgo further air quality analysis for a particular pollutant;
    - May allow the applicant to be exempted from the ambient monitoring data requirements; and
    - Is used to define the impact area within which a full impact analysis must be carried out.

Historically, the Department has not required a full impact analysis for a particular pollutant when the emissions of that pollutant from a proposed project would not increase ambient concentrations by more than the prescribed significant ambient impact levels.

2) *Full impact analysis:* This analysis is required for any pollutant for which the proposed project's estimated ambient pollutant concentrations exceed prescribed significant ambient impact levels. This analysis expands the preliminary analysis in that it considers emissions from the proposed project, existing sources, and residential, commercial, and industrial growth associated with the new project.

PSD Ambient Air Monitoring (Pre- and Post-Construction)

567 IAC 33.3(13) adopted 40 CFR §52.21(m) by reference. 40 CFR §52.21(m) requires preconstruction ambient air monitoring for any pollutant in which the applicant proposes to emit in significant amounts. If, however, either the predicted ambient impact caused by the emissions increase or the existing ambient air concentrations are less than the prescribed significant monitoring value [See 40 CFR §52.21(i)(5)], the permitting agency has discretionary authority to exempt an applicant from this data requirement.

Table 10 – Monitoring Significance Levels[5]

Pollutant	Averaging Period	Maximum Modeled Concentration (μg/m^3)	Monitoring de minimis Level (μg/m^3)
PM_{10}	24-hr	50.22	10
	Annual	8.52	---
$PM_{2.5}$	24-hr	24.87	4
	Annual	2.38	---
NO_x	1-hr	93.66	---
	Annual	3.16	14
CO	1-hr	315.36	---
	8-hr	189.80	575

As can be seen from Table 10 above, the significant monitoring concentrations (SMC) for PM_{10} and $PM_{2.5}$ were predicted to be exceeded. IFC proposed to use existing monitoring data from Lake Sugema to fulfill the preconstruction monitoring requirement for PM_{10} and data from Keokuk to fulfill the requirement for $PM_{2.5}$.

Ambient air monitoring staff from the Department has confirmed that the data from the existing PM_{10} and $PM_{2.5}$ monitoring network suffices to meet the preconstruction monitoring requirements for this project.

The original application submitted by IFC predicted both NO_x and VOC emissions greater than 100 tons/yr which would mean preconstruction monitoring is required for ozone. Therefore, IFC proposed the use of existing data from Lake Sugema to fulfill this requirement. The ambient air monitoring staff from the Department approved the use of the data. It should be noted that based on BACT limits in the permits both the NO_x and VOC

[5] No *de minimus* air quality level is provided for ozone. However, any net emissions increase of 100 tons per year or more of volatile organic compounds or nitrogen oxides subject to PSD would be required to perform an ambient impact analysis, including the gathering of ambient air quality data.

potential emissions from this project will be less than 100 tons/yr (See Table 9 from earlier in this document).

Finally, preconstruction monitoring for NO_x and CO is not required since the modeled concentrations were below the SMC for both of these pollutants. All of the modeling results are discussed in the August 23, 2012 dispersion modeling memo from Brad Ashton to Chris Roling. A copy of this document can be found in Appendix I of this document.

NAAQS:

The NAAQS are maximum concentration “ceilings” measured in terms of the total concentration of a pollutant in the atmosphere. They are health and welfare based standards established by EPA. For a new project, compliance with any NAAQS is based upon the total estimated air quality. This is the sum of the ambient estimates resulting from existing sources of air pollution (modeled source impacts plus measured background concentrations) and the modeled ambient impact caused by the proposed project and its associated growth.

As stated earlier, a separate air quality analysis is required for each regulated pollutant if the applicant proposes to emit the pollutant in a significant amount from a new major stationary source, or proposes to cause a significant net emissions increase from a major modification. A new or modified source is determined to contribute to a violation of the NAAQS if it is expected to increase the ambient concentration by the PSD "significant amount" at the location of a violation of an ambient standard. Any contribution to a violation is considered "significant" according to PSD if it exceeds the values listed in Table 11.

Table 11 – PSD Significant Impact Concentrations

Pollutant	Annual	24-hr	8-hr	3-hr	1-hr
PM_{10}	1 ug/m^3	5 ug/m^3	--	--	--
$PM_{2.5}$	0.3 µg/m^3	1.2 µg/m^3	--	--	--
NO_x	1 ug/m^3	--	--	--	7.5
SO_2	1 ug/m^3	5 ug/m^3	--	25 ug/m^3	7.8
CO	--	--	500 ug/m^3	--	2,000 ug/m^3
Ozone	--	--	See Note 1	--	--

NOTES: 1) There is no significant ambient impact concentration established. Instead, any net emissions increase of 100 tons per year of VOC subject to PSD would be required to perform an ambient impact analysis.
2) The 1-hr concentrations for NO_x and SO_2 are interim limits.
3) There is no significant impact level for Pb.

Comparing the maximum modeled concentrations in Table 11 to the PSD Significant Impact Concentrations (SIC) listed above in Table 10 indicated that full impact analyses were required for PM_{10}, $PM_{2.5}$, and NO_x. In addition, it showed the full impact analysis was not required for CO. Since the 1-hour standard for ozone has been rescinded the there currently is no acceptable method to evaluate the 8-hour ozone standard, no ambient air evaluation of ozone is required at this time.

The modeled increase in emissions due to the construction of a new or modified source plus the existing background concentration of a pollutant is not allowed to exceed the NAAQS for that pollutant. Table 12 shows the NAAQS and the worst case modeled impacts (including background).

Table 12 – NAAQS Analysis

Pollutant	Averaging Period	NAAQS (µ/m^3)	Modeled Impact (µ/m^3)
$PM_{2.5}$	24-hr	35	11,554.44
	Annual	15	1,507.60
PM_{10}	24-hr	150	9,516.77
	Annual	50	1,107.45
NO_x	1-hr	188	1,160,932.59
	Annual	100	60.98

As is noted in the dispersion modeling memo (See Appendix I), the IFC project has an insignificant contribution to the exceedances shown above. Since IFC has an insignificant contribution this project can be permitted.

PSD Increment:

The PSD increment is the maximum allowable increase in ambient concentrations that is allowed to occur above a baseline concentration for a given pollutant. The baseline concentration is defined for each pollutant and its related averaging period(s). In general, the baseline concentration is the ambient concentration existing at the time the first complete PSD permit application affecting the area is submitted.

Therefore, the submittal date of the first complete PSD application for a given pollutant in an area is the *"baseline date"* for that pollutant. On or before this date most emissions are considered to be part of the baseline concentration and emission changes which occur after that date affect the amount of available increment. However, to fully understand how and when increment is consumed or expanded one must understand three (3) different dates related to baseline:

- *Major source baseline date:* This is the date after which actual emissions associated with construction at a major stationary source affect the available increment. Other changes in actual emissions occurring at any source after the major source baseline date do not affect the increment, but instead contribute to the baseline concentration until after the minor source baseline date is established.

- *Trigger date:* This is the date after which the minor source baseline date may be established. Both the major source baseline date and the trigger date are fixed dates as shown in Table 13:

Table 13 – Major Source Baseline and Trigger Dates for PM, SO_2, and NO_x

Pollutant	Major Source Baseline Date	Trigger Date
PM & SO_2	January 6, 1975	August 7, 1977
NO_x	February 8, 1988	February 8, 1988
$PM_{2.5}$	October 20, 2010	October 20, 2011

- *Minor source baseline date:* This is the earliest date after the trigger date on which a complete PSD application is received by the permit agency. If the application that established the minor source baseline date is ultimately denied or is voluntarily withdrawn by the applicant the minor source baseline date remains in effect because the date marks the point in time after which actual emissions changes from all sources affect the available increment. This is often referred to as the “baseline date”. The minor source baseline date for a particular pollutant is triggered by a PSD applicant only if the proposed increase in emissions of that pollutant is significant. So the minor source baseline date for different pollutants could be different in the same area.

The area where the minor source baseline date is established by a PSD permit application is known as the baseline area. It is limited to intrastate areas and may include one or more areas designated as attainment or unclassified under Section 107 of the CAA.

The baseline area is to include all portions of the attainment or unclassifiable area in which the PSD applicant would propose to locate and any attainment or unclassifiable area in which the proposed emissions would have a significant impact. In this case significant impact is defined as at least a 1 $\mu g/m^3$ annual increase in the average annual concentration of the applicable pollutant.

The amount of PSD increment consumed in an area is determined from the emission increases and decreases that have occurred from sources since the applicable baseline date. It should be noted that increment consumption calculations reflect only the ambient pollutant concentration change attributable to increment affecting emissions.

Emission increases that consume a portion of the applicable increment are usually all those not accounted for in the baseline concentration and specifically include:

- actual emissions increases occurring after the major source baseline date which are associated with physical changes or changes in the method of operation at a major stationary source and
- actual emissions increases at any stationary source, area source, or mobile source occurring after the minor source baseline date.

The amount of available increment may be expanded in two ways. The main way is through the reduction of actual emissions from any source after the minor source baseline date. Any such emissions reduction would increase the amount of available increment to the extent that the ambient concentrations would be reduced.

Increment expansion can also result from the reduction of actual emissions after the major source baseline date, but before the minor source baseline date if the reduction results from a physical change or a change in the method of operation at a major stationary source. The reduction will only add to the increment if the reduction is made enforceable through a permit or State Implementation Plan (SIP) provision.

Significant deterioration is considered to have occurred when the amount of new air pollution would exceed the applicable PSD increment. It should be noted that even if not all of the increment is consumed in an area the air quality cannot deteriorate to the point where it exceeds the applicable NAAQS.

Finally, only those pollutants that exceed the PSD significant impact levels are reviewed for increment consumption. Table 14 summarizes the PSD allowable increment consumption (for a PSD Class II region) for the pollutants of concern:

Table 14 – Allowable Increment Consumption

Pollutant	PSD Maximum Allowable Increment (μg/m^3)[6]		
	3-hr	24-hr	Annual
$PM_{2.5}$	---	9	4
PM_{10}	---	30	17
NO_x	---	---	25

Based on the results of this analysis, this project triggers the minor source baseline dates for the Lee County baseline area ($PM_{2.5}$) and the "Remainder of Lee County" baseline area (PM_{10}). The minor source baseline date for these areas is August 3, 2012. The minor source baseline date for the impacted area was already triggered for NO_x and there is currently no PSD increment for CO.

Table 15 – Maximum Impact From Increment Consuming Sources

Pollutant	Averaging Period	Project Contribution (μ/m^3)
$PM_{2.5}$	24-hr	8.54
	Annual	0.87
PM_{10}	24-hr	18.91
	Annual	2.06
NO_x	Annual	56.09

Comparing Tables 14 and 15 shows no predicted exceedances of the increment for $PM_{2.5}$ or PM_{10}. Although the comparison shows a predicted exceedance of the NO_x increment, this project can still be permitted since IFC was shown to have predicted concentrations that were less than the significant impact level at every predicted exceedance of the increment.

[6] The short-term increments (i.e. 3-hr & 24-hr) are allowed to be exceeded once per year [compared to the H2H modeled concentration for each of the five (5) years modeled]. See 40 CFR 51.166(c) and 52.21(c), as well as the $PM_{2.5}$ rule published on October 20, 2010 (75 FR 64864), section V.E.7.a.

Class I Area Impact Analysis

Class I areas are places of special national or regional value from a natural, scenic, recreational, or historic perspective. The PSD regulations provide special protection for these areas. There are three (3) types of Class I areas:

- *Mandatory Federal Class I areas:* These are specified as Class I by the CAA on August 7, 1977 and include:
  - International parks,
  - National wilderness areas including certain national wildlife refuges, national monuments, and national seashores which exceed 5,000 acres in size, and
  - National parks which exceed 6,000 acres in size

  These Class I areas cannot be reclassified to Class II or Class III. They are managed by the Forest Service, National Park Service, or the Fish and Wildlife Service.

- *Federal Class I areas:* These are Federal lands in which a State has redesignated as a Class I area. They are managed by the Forest Service, National Park Service, or the Fish and Wildlife Service.

- *Non-Federal Class I areas:* These are State or Indian lands reclassified as Class I.

PSD projects that propose to locate within 100 kilometers (km) of a Class I area and PSD projects that propose to locate at a distance greater than 100 km that have an impact on a Class I area are required to conduct a Class I area impact analysis. There is currently no Class I area located within 100 km of Iowa's borders (see map in Appendix J). The closest Class I areas to the proposed project are the Mingo National Wildlife Refuge in Missouri (~ 550 km away), Rainbow Lake Wilderness Area in Wisconsin (~790 km away), and the Hercules-Glades Wilderness Area in Missouri (~500 km away).

No Class I impact analysis was conducted since this project is more than 100 km from a Class I area and will not have an impact on a Class I area.

Additional Impact Analysis

All PSD permit applicants are required to prepare an additional impact analysis for each pollutant subject to regulation under the CAA which will be emitted by the proposed project. This analysis assesses the impacts on air, ground, and water pollution to soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the project and its associated growth.

Other impact analysis requirements can also be imposed on the applicant under local, State, or Federal laws which are outside of the PSD permitting process. For example, two (2) Federal laws which may apply on occasion are the Endangered Species Act and the National Historic Preservation Act. Even though not required as part of the PSD permit, such legislation may require additional analysis if any federally listed rare or endangered species or any sites that are included (or are eligible to be included) in the National Register of Historic Sites are identified in the source's impact area.

The depth of the additional impact analysis will generally depend on the existing air quality, the quantity of emissions, and the sensitivity of the local soils, vegetation, and visibility in the source's impact area. It is important that the analysis fully document all sources of information, assumptions made, and any agreements reached with any government agencies (i.e. EPA, State, US Forest Service, etc.).

The additional impact analysis usually has four parts:

- *Growth:* The purpose of the growth analysis is to predict how much new growth is likely to occur to support the new project and then estimate the emissions that will result from that growth. This analysis includes:

    - A projection of associated industrial, commercial, and residential growth that will occur in the area due to the project, and
    - An estimate of the air emissions generated by the above associated industrial, commercial, and residential growth.

  First the applicant needs to assess the amount of residential growth that the proposed project will bring to the area. This will depend on the size of the available work force, the number of new employees, and the availability of housing in the area.

  Associated commercial and industrial growth consists of new businesses providing goods and services to the new employees and to the proposed project. Other growth is all growth that is not covered by the preceding, including construction related activities and mobile sources (permanent and temporary).

  Next the applicant is required to develop an estimate of the air pollution which would likely result from this associated growth.

- *Ambient air quality impact analysis:* This analysis projects the air quality which will exist in the area of the proposed project during construction and after the project begins operation.

  The applicant combines the air pollutant emissions estimates for the associated growth with the estimates of emissions from the proposed project. Next, the projected emissions from other sources in the area which have been permitted, but are not yet in operation are included in the modeling analysis.

  The applicant then models the combined emissions estimate and adds the modeling analysis results to the background air quality to arrive at an estimate of the total ground level concentration of pollutants which can be anticipated as a result of the construction and operation of the proposed project.

- *Soils & vegetation impacts:*

  The analysis of soils & vegetation air pollution impacts are based on an inventory of the soils & vegetation types found in the impact area. This inventory includes all vegetation with any commercial or recreational value. The inventory may be available from conservation groups, State agencies, and universities.

In most cases, ambient concentrations of criteria pollutants below the secondary NAAQS will not result in harmful effects to soils & vegetation. However, there are sensitive vegetation species such as soybeans and alfalfa which may be harmed by long term exposure to low ambient air concentrations of regulated pollutants for which there are no NAAQS.

- *Visibility impairment:* This analysis is different than the Class I visibility analysis requirement. In this analysis the applicant is to review the impacts that occur within the impact area of the proposed project. EPA's suggested components of a good visibility analysis are:

  - A determination of the visual quality in the area,
  - An initial screening of emission sources to assess the possibility of visibility impairment, and
  - If warranted, a more in-depth analysis involving computer models.

  EPA's "Workbook for Plume Visual Impact Screening and Analysis (Revised)", October 1992 (EPA-450/4-88-015) is used to conduct a visibility impairments analysis. The workbook outlines a screening procedure designed to expedite the analysis of emissions impacts on the visual quality of an area. Although it is designed for Class I area impacts, the procedures are also generally applicable to other areas.

<u>Growth:</u>

As stated earlier in the application the proposed facility will be located near Wever, Iowa which is an unincorporated community in northeastern Lee County. The closest population center is Ft. Madison, IA which is located about ten (10) miles to the south. Ft. Madison has a population of 11,051. Burlington, IA is located about thirteen (13) miles to the north and has a population of 25,663.

- *Work Force:*
  The applicant reviewed workforce statistics provided by Lee County Economic Development Group, Inc. and the Lee County Laborshed Analysis. According to that information, the majority of the 2,000 construction related jobs will be filled by workers commuting to the site.

  The laborshed data suggests workers willing to accept employment in this area are willing to commute an average of twenty-five (25) miles one way for meaningful employment. This area would include the population centers of not only Ft. Madison and Burlington, but also Mt. Pleasant and Keokuk. There are over 180,000 skilled, educated, highly qualified workers available in this area according to the laborshed data.

  It is expected that some permanent positions will be filled with non-local employees that will relocate to the vicinity of the plant. The majority of the permanent jobs will be filled with workers within the Lee County Laborshed area.

- *Housing:*
  Information from local realtors and internet searches shows the predominant housing in the area consists of single family homes in a range of prices. In addition, there are a number of single family, multi family, and lots available to absorb a quick expansion in the area. However, the impact on housing is expected to be minimal based on the availability of workers from the nearby population centers that can commute.

- *Industry:*
  New industrial projects can lead to new support jobs in an area. Service related industries may see an increase during the plant construction to provide services to the employees working at the plant. These service related industries may be scaled back to continue to provide services to the permanent employees. The impact to the immediate area is expected to be minimal since there are two (2) population centers located within fifteen (15) miles of the project site.

  The impact of additional industrial development is expected to be minimal and limited to those operations complimentary to the fertilizer production. Such operations may include transportation and distribution facilities.

<u>Soils & Vegetation:</u>

- *Types of Soils:*

  IFC used the Department's Interactive Mapping webpage to evaluate a one (1) mile radius around the proposed site. The majority of the area surrounding the site is used for agriculture, recreation, and residential purposes. Burk's Lost Creek Run Wildlife Management Area is located within 100 feet of the southeastern corner fo the proposed project boundary. Highway 61, local roads, and the Burlington Northern Santa Fe Railroad are also located in the area.

  According to the Iowa Geologic Survey (IGS), the uppermost bedrock formations in the area are of the Upper Devonian and lower to upper Famennian age. Included in this rock unit are the following primary lithologies:

  - Grassy Creek Shale,
  - Saverton Shale,
  - "Mapple Mill" Shale,
  - English River Formation, and
  - Louisiana Limestone.

Secondary lithologies are:

- o Olive-brown and medium to dark brown,
- o Part laminated shale and part fossiliferous,
- o Cherty, and
- o Argillaceous dolomite.

Minor inclusions found within the bedrock are:

- Interstratified dolomite,
- Part fossilferous limestone,
- Ooidal ironstone, and
- Red-brown shale.

The maximum thickness of bedrock in the outcrop belt is approximately 135 – 310 feet. Quartz geodes, chalecedony, silicification, siltsone, and phophatic limestone are minor lithologies within these formations.

IFC used data from the United States Department of Agriculture Natural Resource Conservation Service (NRCS) soil survey mapping for soils within a thirty-one (31) miles radius of the site. According to this information, the Iowa soils in the area are derived from parent materials of alluvium, loess, and glacial till.

The soils in western Illinois are comprised primarily of alfisols which form under forest vegetation, mollisols which form under prairie vegetation, and entisols which are young soils that likely are alluvial or disturbed and are in the process of soil development. The soils within the small portion of Northeast Missouri that extends into the project area are composed of clay/mud, shale, and limestone. See Appendix K-1 for soil maps of Iowa, Illinois, and Missouri.

The predominant soil types within the proposed site consist of Lawler loam and Dockery silt loam. Lawler loam is present primarily in stream terraces in flat areas and is somewhat poorly drained. The depth to water table in areas where this soil type is present is typically twelve (12) to forty-two (42) inches below the ground surface.

Dockery silt loam is common in flood plains and is occasionally flooded. The depth to the water table also ranges from twelve (12) to forty-two (42) inches below the ground surface.

Both Lawler loam and Dockery silt loam are listed on the state hydric soils list as well as ten (10) other soil types found within the proposed site boundaries. The two (2) remaining well-drained soils comprise only a small portion of the proposed site. A copy of the complete soils inventory and map for the project site can be found in Appendix K-2.

- *Types of Vegetation:*

  Vegetation in the area immediately around the proposed site is typical of vegetation throughout Southeast Iowa. The dominant tree species include:

  - Cottonwood (*Populus deltoids*),
  - Sugar maple (*Acer saccharum*),
  - Box elder (*Acer negundo*), and
  - Green ash (*Fraxinus pennsylvanica*).

  Other tree species scattered throughout the area include black willow (*Salix nigra*), sandbar willow (*Salix exigua*), and red cedar (*Juniperus virginiana*). In addition, numerous sapling/shrub and herb species are present in the area. Some of the species that have been observed on the proposed site or nearby include:

  - Queen Anne's lace (*Daucus carota*),
  - Reed canary grass (*Phalaris arundinacea*),
  - Narrow leaf cattail (*Typha angustifolia*),
  - Horsetail (*Equisetum sp.*),
  - Common mullein *(Verbascum Thapsus*),
  - Bedstraw (*Rhus glabra*),
  - Shepherd's purse (*Capsella bursa-pastoris*),
  - Dandelion (*Taraxacum officinale*),
  - Common plantain (*Plantago major*),
  - Red clover (*Trifolium pretense*),
  - Bushy wallflower (*Erysimum repandum*),
  - Field pennycress (*Thlaspi arvense*)
  - Kentucky bluegrass (*Poa pratensis*),
  - Indian grass (*Sorghastrum nutans*),
  - Aster (*Aster sp.*),
  - Redroot pigweed (*Amaranthus retroflexus*), and
  - Brome grass (*Bromus inermis*).

  Also in the area are numerous ornamental trees, shrubs, and flowers at residential and business properties surrounding the proposed site.

  Since this project is located in the middle of the country the land cover within a thirty-one (31) mile radius of the site is mostly agricultural land, prairie remnants, emergent and forested wetlands, as well as deciduous forests. The species found in this area include but are not limited to:

  - Silver maple (*Acer saccharinum*),
  - Sugar maple (*Acer Saccharum*),
  - Shag-bark hickory (*Carya ovate*),
  - Cinnamon fern (*Osmunda cinnamonea*),
  - Royal fern (*Osmunda regalis*),
  - Slippery elm (*Ulmus rubra*),
  - Summer grape (*Vitis aestivalis*),
  - Angelica (*Angelica atropurpurea*),

- Woodland phlox (*Phlox divaricata*),
- Cut leaf coneflower (*Rudbeckia laciniata*),
- Sweetflag (*Acorus calamus*),
- Inland rush (*Juncus interior*),
- Woodrush (*Luzula acuminate*),
- Tiger lily (*Lilium lancifolium*),
- Horned pondweed (*Zannichellia palustris*), and
- Three awned grass (*Aristida oligantha*).

- *Threatened and Endangered Species:*

  According to the United States Fish and Wildlife Service (USFWS) website and the Department's databases there are two (2) federally listed species and seventy-seven (77) state listed species that are found to exist within Lee County that are considered threatened, endangered, or of special concern. This does not mean these species are located within the proposed project boundaries or within the immediate area surrounding the project. A complete listing of the species that are threatened, endangered, or of special concern can be found in Appendix K-3. According to the application, based on field observations of the proposed site, IFC construction activities will not adversely affect any federally or state listed species as no potential habitat will be impacted.

- *Impact of Pollutants:*

  - CO:

    Carbon monoxide does not poison vegetation since it is rapidly oxidized to carbon dioxide which is used for photosynthesis. However, extremely high concentrations can reduce the photosynthetic rate. According to EPA's "*A Screening Procedure for the Impacts of Air Pollution Sources on Plant, Soils, and Animals*" (copy attached in Appendix K-4), a CO concentration of 1,800,000 $\mu g/m^3$ (1 week averaging period) could potentially reduce the photosynthetic rate for the most sensitive vegetation.

    As is listed in Table 10, the predicted maximum CO impact is 315.36 $\mu g/m^3$ (1-hr average) which is significantly lower than the screening level. Therefore, no adverse impacts to vegetation are expected from CO emissions due to this project.

  - GHG:

    IFC conducted internet research for documents and information outlining the effects of GHG emissions on soils and vegetation. According to the research reviewed by IFC, increased levels of CO_2 would be beneficial for plant growth in temperate and humid regions as plants can produce more food for growth due to an increased efficiency of photosynthesis.

    Depending on the region, if higher temperatures are observed it could accelerate the rate of decomposition of organic matter in soils and it may be necessary to use supplemental chemicals and/or fertilizer to replenish the soil. It is possible that at the same time plants are storing additional food due to increased CO_2 levels, the effect of the soil could be negated by the root growth caused by the increased efficiency of photosynthesis.

It is unknown at this time the balance between these two (2) scenarios. With increased temperatures, plant growth could increase linearly to an optimum threshold. At which point, plant growth could decline broadly on a linear level. Determinate plants, such as crops, could be affected adversely by higher temperatures due to the shortening of the reproductive phase, which could decrease yield percentages of the crops.

Overall the impacts of GHG emissions from this project are unknown to the local soils and vegetation as research is still being conducted on the impacts of GHG emissions.

- VOC:

Ozone (O_3) impacts plants by destroying chlorophyll and in particular chlorophyll b. Acute symptoms of ozone damage are necrosis, chlorosis, and water marks. Ozone causes noticeable leaf damage in many crop and tree species. Certain varieties of soybeans, clover, onions, spinach, muskmelon, and alfalfa are especially susceptible. Trees such as lilac, aspen, and ash are also sensitive to ozone.

Ozone is not directly emitted from the processes in this project. It is formed in a reaction between carbon dioxide (CO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC), and ultra violet (UV) light from the sun.

According to "*The Response of Native, Herbaceous Species to Ozone: Growth and Fluorescence Screening*[7]" a reduction in the growth rate was found in certain plants after being fumigated with 139.7 µg/m^3 of ozone for two (2) weeks. A copy of this article is also in Appendix K-5.

The increase in ozone formation due to the NO_x and VOC emissions from the project was estimated using the "*VOC/NO_x Point Source Screening Tables*" developed by Scheffe. A copy of this document is attached in Appendix K-6. The estimated impact from this project was less than 0.0115 ppm (22.54 µg/m^3) on an hourly basis.

Since VOC emissions can be made of several different compounds a review of the impact(s) of the individual species on soils and vegetation was done. The main VOC emissions from this project are

[7] "*The Response of Native, Herbaceous, Species to Ozone: Growth and Fluorescence Screening*," New Phytologist, Volume 120, Issue 1, 1992, pages 29 – 37.

hexane from combustion sources and methanol from the CO_2 Regenerator.

Internet research did not find any information regarding adverse effects on any plant species for hexane. In regards to methanol, several studies indicate that methanol can actually enhance the growth of many plants including agricultural crops.

The effects on soils would be minor as methanol is water soluble and would be transported out of the soil and into water sources quickly.

- NO_x:

All nitrous gases turn the edges of leaves brown or brownish black and cause blotches. Plant cells start to shrink and protoplasms detach from the cell wall. This process ultimately results in the damaged parts of the cell drying out. Poisoning by nitrous gases is mainly due to nitrogen dioxide (NO_2).

The sensitivity of the plant communities identified to NO_x is determined on the basis of the plant species sensitivity listing provided in EPA's *Air Quality Criteria for Oxides of Nitrogen*[8]. A copy of the referenced table can also be found in "*Air Quality Criteria for Oxides of Nitrogen - Vegetation Impacts*" on the Department's website at http://www.iowadnr.gov/portals/idnr/uploads/air/insidednr/dispmodel/nox_veg_impacts.pdf. A copy of this document is attached in Appendix K-7.

According to the Department's "*Air Quality Criteria for Oxides of Nitrogen - Vegetation Impacts*", a 1-hr NO_2 concentration of 7,520 µg/m^3 results in 5% foliar injury for the most susceptible plant species.

Finally, Figure 15 on page 84 in the US Fish and Wildlife Service document "*A Biologist's Manual for the Evaluation of Impacts of Coal-fired Power Plants on Fish, Wildlife, and their Habitats*" (copy of the document can be found in Appendix K-8) shows metabolic and growth effects occurring for NO_2 levels of 1,200 µg/m^3 (1-hr averaging period) and 500 µg/m^3 (24-hr averaging period).

Combining the above mentioned documents results in Table 16 for minimum concentrations resulting in foliar injury for sensitive species for NO_x.

[8] US EPA, "*Air Quality Criteria for Oxides of Nitrogen, Volume II of III*", EPA/600/8-91/049bF, August 1993.

Table 16 – Summary of NO_x Concentrations Resulting in Foliar Damage

Pollutant	Averaging Period	Min. Concentration Resulting in Foliar Injury for Sensitive Species (μg/m^3)
NO_x	1-hr	1,200
	4-hrs	3,760
	24-hrs	500
	1 month	564
	Annual	94

Based on the dispersion modeling done for this project and the use of the Department's Soils & Vegetation Screening Tool no adverse impacts due to NO_x emissions are expected on vegetation due to this project.

No direct impacts to soil from NO_x deposition are expected due to internet research. However, NO_x emissions in the ambient air can eventually combine with ambient moisture to form nitric acid (HNO_3). The nitric acid droplets in the ambient air can combine with rain and lower the pH of the rain to around 5.5 making it slightly acidic.

Acid rain deposition in soils can result in leaching of nutrients and minerals from the soil. The effect can be counteracted by the buffering capacity of certain soils. A well buffered soil has enough alkalinity contained in it that any deposited acid is neutralized before any leaching can occur. Based on EPA information the soil in the Midwest region of the country is well buffered. This well buffered soil also prevents acids from washing into streams and lakes.

- Particulate Matter (PM, PM_{10}, and $PM_{2.5}$):

The effects of particulate matter will vary greatly depending upon the particular mix of particles. Any particulate deposited on above ground plant parts can potentially exert physical or chemical effects. The effects of inert particulate are mainly physical where the effects of toxic particles are both chemical and physical.

Deposition of inert particulate on above ground plant organs sufficient to coat them with a layer of dust may result in changes in radiation received, a rise in leaf temperature, and the blockage of stomata. The main factor leading to plant injury is normally the chemical composition and more specifically the alkalinity of the applied dust.

Uptake of available metals in the ground can also result in metabolic effects in above ground tissues. Trace metals with a density greater than 6 g/cm^3 are referred to as "heavy metals" and are of particular interest because of their potential toxicity to both plants and animals. Some trace metals are essential for vegetative and animal health, but they are all toxic in large quantities.

No adverse impacts to vegetation around the IFC facility are anticipated from the particulate emissions due to this project since almost none of particulates are metals.

<u>Visibility:</u>

The visibility impacts were analyzed for three (3) sensitive Class II areas as identified by the Department. These areas are:

- The Burlington airport
- The Ft. Madison airport
- Geode State Park

The visibility impacts were evaluated by using the VISCREEN model (Version 1.01) and the VISCREEN tool (Version 1.0) spreadsheet. The VISCREEN tool was used to support Tier 2 screening to predict visibility impacts for the sensitive areas listed above.

The result of each of these areas is as follows:

- *Burlington Airport:*
  A Tier 2 VISCREEN analysis was performed using the worst case wind speed and stability class with a daily 1% cumulative frequency for a given time period as determined by the Department's VISCREEN tool output. The worst case stability class "E" and wind speed of 4.0 m/s determined for the Burlington Airport has a cumulative frequency above 1% during the hours 1 – 6 and 19 – 24. Using this information, the VISCREEN Tier 2 analysis showed there are no exceedances of the screening criteria inside the boundaries of the Burlington Airport.

- *Ft. Madison Airport:*
  A Tier 2 VISCREEN analysis was performed using the worst case wind speed and stability class with a daily 1% cumulative frequency for a given time period as determined using the Department's VISCREEN tool output. The worst case stability class "E" and wind speed of 3.0 m/s determined for the Ft. Madison Airport has a cumulative frequency above 1% during the hours of 19 – 24. Using this information, the VISCREEN Tier 2 analysis showed there are exceedances of the screening criteria inside the boundaries of the Ft. Madison Airport.

  The meteorological scenario where there is a daily cumulative frequency greater than 1% occurs during nighttime hours when visibility is not an issue. The next worse case stability class "E" and wind speed of 4.0 m/s determined for the Ft. Madison Airport was input into VISCREEN for a Tier 2 analysis and showed no exceedances of the screening criteria inside the boundaries of the Ft. Madison Airport.

- *Geode State Park:*
  A Tier 2 VISCREEN analysis was performed using the worst case wind speed and stability class with a daily 1% cumulative frequency for a given time period as determined by the Department's VISCREEN tool output. The worst case stability class "E" and wind speed of 3.0 m/s determined for the Burlington Airport has a cumulative frequency above 1% during the hours 19 – 24. Using this information, the VISCREEN Tier 2 analysis showed there are no exceedances of the screening criteria inside the boundaries of the Geode State Park.

Compliance Demonstration

In order to make an emission limit enforceable as a practical matter a compliance demonstration is necessary (See "*Limiting Potential to Emit in New Source Permitting*" which can be found in Appendix L). This compliance demonstration usually is for both initial compliance and continuous or periodic compliance.

Compliance can be demonstrated several ways. It can be done through emission stack testing, continuous emission monitoring systems (CEMS), or monitoring & recordkeeping. CEMS typically provide the best measure of emissions. In the case of this project the following mechanisms are being used to demonstrate compliance:

- **Primary Reformer (EP 01):**
  Multiple compliance methods are required for the reformer. An initial compliance test is required for each pollutant in the permit that has a BACT emission limit. Also, an initial compliance test is required for hexane in order to demonstrate the hexane emissions at the plant will be less than ten (10) tons/yr. In addition, since compliance with a thirty (30) day rolling average cannot be demonstrated through the use of three (3) stack test runs, CEMS are required for NO_x and CO_2. Finally, there is monitoring and recordkeeping of the pressure drop for the control equipment to show it is operating properly.

- **CO_2 Regenerator (EP 02):**
  An initial compliance test is required for each pollutant with a BACT emission limit (CO, VOC, and CO_2). In addition, a CEMS is required for CO_2 to demonstrate compliance against the thirty (30) day rolling average BACT limit and to measure total annual CO_2 emissions. . Also, an initial compliance test is required for methanol in order to demonstrate the methanol emissions at the plant will be less than ten (10) tons/yr.

- **UAN Mixing Tank (EP 03):**
  An initial compliance test is required for CO_2 to demonstrate compliance the hourly BACT emission limit.

- **Urea Synthesis (EP 04):**
  An initial compliance test is required for CO_2 to demonstrate compliance the hourly BACT emission limit.

- **Nitric Acid Plant (EP 05):**
  NSPS Subpart Ga requires a CEMS for NO_x so this same system will be used to demonstrate compliance with the BACT emission limits.

  In the case of N_2O and CH_4 there are two (2) compliance tests required. Per the application the inlet (i.e. uncontrolled) N_2O emissions vary depending on the age of the catalyst gauzes. The control efficiency and outlet concentrations could also vary. Therefore, inlet and outlet testing is required for N_2O at the beginning of the lifetime for the gauzes and at the end of the gauze lifetime. Stack testing of CH_4 will also be done at the same time to verify the amount of methane slip.

  Finally, there are requirements for pressure drop, minimum ammonia injection, and minimum methane injection to ensure the control equipment is being operated efficiently.

- **Nitric Acid Storage Tank (EP 06):**
  Since the tank is estimated to have less than one (1) ton of NO_x emissions no initial compliance testing is required. However, the facility is required to track annual NO_x emissions from the tank on a rolling twelve (12) month basis.

- **Auxiliary Boiler (EP 07):**
  Multiple compliance methods are required for the auxiliary boiler. An initial compliance test is required for each pollutant in the permit that has a BACT emission limit. Also, an initial compliance test is required for hexane in order to demonstrate the hexane emissions at the plant will be less than ten (10) tons/yr.

  NSPS Subpart Db requires NO_x and CO_2 CEMS so these pollutants will demonstrate continuous compliance through the use of these CEMS.

  Finally, there is recordkeeping to demonstrate the emission unit does not exceed the natural gas usage limt.

- **Ammonia Flare (EP 08):**
  There is no compliance testing required for the flare. Instead there are recordkeeping requirements to demonstrate the unit is operating correctly.

- **Emergency Generator (EP 09) and Fire Pump (EP 10):**
  No compliance testing is required as both of these units are limited to 500 hours of operation per year. The continuous compliance demonstration is recordkeeping to show the units do not exceed that limit. In addition, the sulfur content of the fuel used is required to be tracked. Finally, the company is required to purchase an engine certified to meet emission standards within the NSPS subpart.

- **Startup Heater (EP 11):**
  No compliance testing is required for any pollutants since this unit has very limited use. However, per NSPS Subpart Db a capacity test is required in order to show the unit is not subject to the NO_x emission standards. There are also recordkeeping requirements to show the unit does not exceed its natural gas usage limit.

- **Urea Granulator (EP 12):**
  Initial compliance testing is required for particulates (PM, PM_{10}, and $PM_{2.5}$) and opacity to demonstrate the BACT emission limits are being met.

- **Cooling Tower A (EP CTA) and Cooling Tower B (EP CTB):**
  Initial compliance testing on the opacity of each cooling tower is required. In addition, testing of the total dissolved solids (TDS) in the water used and recordkeeping is required. Finally, chromium (Cr), VOC, and HAP containing water treatment chemicals are prohibited from use in this unit.

- **Granulated Urea Handling (EPs P1, P2, P3, P4, P5, and P6):**

  - Granulated Urea Warehouse Transfer (EPs P1 and P2):
    An initial compliance test is required on either EP P1 or EP P2 since these emission points are the same and do not operate simultaneously. The testing is for PM, PM_{10}, $PM_{2.5}$, and opacity.

  - Granulated Urea Truck Loading (EPs P3 and P4):
    No testing is required on these emission points as their emissions would be similar to EPs P1 and P2 from a grain loading perspective. Therefore, the Department has elected to test either P1 or P2 since those emission points have a larger flowrate and likely higher emissions.

  - Granulated Urea Train Loading (EPs P5 and P6):
    No testing is required on these emission points as their emissions would be similar to EPs P1 and P2 from a grain loading perspective. Therefore, the Department has elected to test either P1 or P2 since those emission points have a larger flowrate and likely higher emissions.

- **MDEA Storage Tank (EP MDEA-TK):**
  Since the tank is estimated to have less than one (1) ton of VOC emissions no initial compliance testing is required. However, the facility is required to track annual VOC emissions from the tank on a rolling twelve (12) month basis.

- **Liquid Product Haul Road (EP LHR) and Solid Product Haul Road (EP SPR):**
  The facility is required to conduct testing of the silt loading on the haul roads. These test results will be used to calculate annual particulate emissions from the haul roads. In addition, the facility is required to conduct recordkeeping to demonstrate it is doing the daily water flushing and sweeping of the paved haul roads.

Confidentiality

IFC did not request confidentiality on any part of the project/application.

Requirements of PSD Public Notice

All PSD permits must be put on public notice. The Department will make the following documents available to the public:

- The draft PSD permit,
- The Department's Technical Support Document (i.e. Fact Sheet),
- The application,
- All materials submitted by the applicant, and
- All correspondence

These materials will be available at the following locations:

- Air Quality Bureau website (http://aqbweb.iowadnr.gov/airpermit/eecomment.jsp).
- Fort Madison Public Library (1920 Avenue E., Fort Madison, IA 52627)
- Burlington Public Library (210 Court Street, Burlington, IA 52601)
- Iowa Department of Natural Resources (Air Quality Bureau, 7900 Hickman Road, Suite #1, Windsor Heights, IA 50324)
- EPA Region VII (Currently the address is 901 N. 5th St., Kansas City, KS 66101. As of October 15, 2012 the address will be 11201 Renner Boulevard, Lenexa, KS 66219)

The DNR will publish a public notice in the Des Moines Register and the local The Hawk Eye. The notification will include notice of the PSD application, the determination, the degree of increment consumption that is expected from construction of the project, and the opportunity for comments (both oral and written).

A public comment meeting will be held for the purpose of receiving written and oral comments on the draft PSD air quality permits. This meeting will be held on October 17, 2012 from 6:45 PM to 8:45 PM at the Burlington Public Library (210 Court Street, Burlington, IA). If there is a lack of interest the public meeting will end at 7:30 PM.

All comments not received at a public hearing shall be submitted in writing and must be submitted before 4:30 PM on the last day of the public comment period which will run from September 19, 2012 to October 19, 2012. Written and signed comments shall be directed to:

Christopher A. Roling, PE
Environmental Engineer Senior
Air Quality Bureau
Iowa Department of Natural Resources
7900 Hickman Road
Suite #1
Windsor Heights, Iowa 50324

Or emailed to: chris.roling@dnr.iowa.gov

Any materials related to comments submitted by the public shall be included in full and not be incorporated by reference unless the material is already part of the administrative record or consists of State or Federal statutes and regulations, EPA documents of general applicability, or other available reference materials.

Upon a final decision on the project, all comments, Department responses, and the final documents will be available for public inspection at the Department address listed above and on the Air Quality Bureau website (http://aqbweb.iowadnr.gov/airpermit/eepsdpermit.jsp). In addition, all comments, Department responses, and the final documents will be available at EPA Region VII, Fort Madison Public Library, and the Burlington Public Library for thirty (30) days after the final decision.

Reopening of Public Comment Period

If information or comments submitted to the Department during the public comment period appear to raise substantial questions concerning the draft permits, then the Department may prepare revised draft permits, a revised or supplemental technical support document, and reopen or extend the public comment period. Any reopening or extension of the public comment period would be limited to those changes.

Department Determination

The Department determines that the applicant has met all of the requirements for issuance of a Prevention of Significant Deterioration (PSD) construction permit for the proposed project under 567 IAC 22.3 and is proposing to issue construction permit numbers 12-A-380-P through 12-A-402-P.

Supporting References to the Administrative Record Not Footnoted in or Attached to the Technical Support Document

The references below are additional documents used by the Department in its decision making process. They are the basis for the Iowa PSD program and may not be cited directly in either the permits or the technical support document.

1. The Clean Air Act as Amended through 1990.

2. US EPA Federal Register; http://www.epa.gov/fedrgstr/index.html.

3. New Source Performance Standards (NSPS); 40 CFR 60.

4. National Emission Standards for Hazardous Air Pollutants (NESHAP); 40 CFR 61 & 40 CFR 63.

5. Prevention of Significant Air Quality Deterioration (PSD) Regulations; 40 CFR 51.166, 40 CFR 52.21 & 567 IAC 33.

6. Iowa Code; Chapter 455B.

7. The Iowa Administrative Code; 567 IAC 20-34.

8. Compilation of Air Pollutant Emission Factors; 5th Edition and Revisions, AP-42; U.S. EPA.

9. New Source Review Workshop Manual; EPA-450/2-80-081, October 1990.

10. RACT/BACT/LAER Clearinghouse: A Compilation of Control Technology Determinations; http://cfpub1.epa.gov/rblc/htm/bl02.cfm.

11. OAQPS Control Cost Manual; Fourth Edition; USEPA, Office of Air Quality Planning and Standards; Research Triangle Park, NC; EPA 450/3-90-006; January 1990 and subsequent additions; http://www.epa.gov/ttn/catc/products.html.

12. 40 CFR Part 51, Appendix W.

13. Aermod Modeling System; http://www.epa.gov/scram001/dispersion_prefrec.htm#aermod.