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Project Summary for a Construction Permit Application from Archer Daniels Midland Company for a Glycols Plant at its Decatur complex

Site Identification No.: 115015AAE
Application No.: 06060071
Date Received: June 29, 2006

Schedule
Public Comment Period Begins: March 9, 2007
Public Comment Period Closes: April 8, 2007

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I. INTRODUCTION

Archer Daniels Midland Company (ADM) has requested a construction permit to develop a Glycols production plant at its Decatur complex. ADM currently operates a number of plants at its Decatur complex including a corn wet mill, an ethanol plant, corn sweetener plants, several oilseed processing plants, a number of bioproducts plants and related support facilities.

The Illinois EPA has reviewed ADM's application and made a preliminary determination that ADM's application for the proposed project meets applicable requirements. Accordingly, the Illinois EPA has prepared a draft of the air pollution control construction permit that it would propose to issue for this project. The permit is intended to identify the additional control requirements that apply to the proposed plant and to set necessary limitations on those emissions. However, before issuing this permit, the Illinois EPA is holding a public comment period to receive comments on the proposed issuance of this permit and the terms and conditions of the draft permit.

II. PROJECT DESCRIPTION

The proposed Glycols plant would produce glycol products, i.e., USP (United States Pharmacopeia) grade glycerin, propylene glycol, and ethylene glycol. The raw materials for the plant would be raw glycerol, which is a byproduct from biodiesel production, and sorbitol, which is manufactured elsewhere at ADM's Decatur complex. The main byproducts from this plant would be simple alcohols (i.e., a mixture of ethanol, methanol, and water) and various butanediol compounds.

The proposed plant would be constructed out of the former Vitamin C plant at the complex. The plant would reuse much of the existing tankage and some other equipment from the Vitamin C plant, coupled with construction and installation of new equipment as needed for manufacture of glycol products. The sources of emissions at the proposed plant would include process and tank vents and equipment in VOM service, new natural gas-fired combustion units, and several small particulate matter emission units. The principal process areas in the plant, i.e., 1) Raw Glycerol Processing, 2) Reactors (Hydrogenolysis), 3) Crude Glycols Product Purification, 4) Hydrogen Production, and 5) Support Operations, are further described below:

The steam supply for this plant would come from the existing coal-fired boilers at the cogeneration plant at the complex. The majority of the emissions that would accompany this project result from increased use of the existing cogeneration plant. This existing equipment has undergone PSD review and permitting based on operation at its maximum rated capacity.

A. Raw Glycerol Processing/Purification

Raw glycerol ($C_3H_8O_3$) or glycerin would be one of the principal raw material for the plant. While ADM expects to use byproduct glycerol from biodiesel production, glycerol from other sources could also be used. Raw glycerol would be received by truck and rail cars. The purified glycerin could also be sold as a final product, without further processing into glycol products, as the

purified glycerin would be processed to meet the specification for USP-grade glycerin.

The byproduct glycerol from biodiesel production contains water, small amounts of methanol and other trace impurities, so that this material must be purified before being converted into glycol products. The raw glycerol would be purified by vacuum distillation with steam sparging. The glycerin from the distillation column would be further treated to remove trace impurities in a bleaching column using activated carbon. The activated carbon would be handled on-site in the existing carbon regeneration furnaces at the Decatur complex. The bleached glycerin would be held in quality control tanks for testing, before being designated as USP glycerin or used for glycol products. Due to the extremely low vapor pressure of the purified glycerin (less than 0.0000000001 psia @ 100 °F), virtually no VOM emissions would occur from the storage and handing of purified glycerin.

Light-ends from the top of the raw glycerol distillation column would be ducted to an integral vapor scrubber. The substandard material recovered from this stream would be periodically reprocessed in the column to recover its glycerin content. Non-condensable gases (NCG) from the column may contain some VOM and organic HAP.

The heavy material from the bottom of the distillation column would be processed under vacuum in a separate thin-film evaporator to also recover its glycerin content. Vapor from this evaporator passes through a condenser to recover the glycerin, which is returned to the distillation column for purification. Light-ends from the condenser also return to the distillation system and the non-condensable fraction of this stream is vented with other non-condensables from the column. Heavy residue from the evaporator would accumulate in a vacuum lock vessel and be periodically removed from the unit.

B. Reactors (Hydrogenolysis)

Purified glycerin will be one of the primary feedstocks for making glycols products. A second possible raw material is sorbitol ($C_6H_{14}O_6$) produced elsewhere within the Decatur complex. In the reactors, the purified glycerin or sorbitol would be mixed with water and an inorganic base, heated, and then reacted with hydrogen under pressurer. The primary reaction products are ethylene glycol ($C_2H_6O_2$) and propylene glycol ($C_3H_8O_2$). Depending on the raw material, smaller amounts simple alcohols (methanol and ethanol) and butanediol compounds ($C_4H_{10}O_2$) would be produced as byproducts.

From the reactors, the crude product stream is cooled and then sent to a series of flash tanks were excess hydrogen is removed, first at high pressure and then at low pressure. The crude product would then be processed to remove salts and residual catalyst from the mixture.

The emission points from this operation include the vents from the high and low-pressure hydrogen flash tanks, and the vent from the salt/catalyst removal system feed tank. Hydrogen released in

the high-pressure flash vent (99.5% hydrogen by weight) would be recompressed and fed back to the reactor when possible. If this stream cannot be returned to the reactor, it is vented to the atmosphere. The hydrogen released from the low pressure flash vent cannot be reused in the reactors due to pressure considerations. A flare would be used to control VOM and organic HAP emissions from this stream unless it can be utilized as supplemental fuel at the plant.

D. Glycol Product Purification

The mixture of products, byproducts and unreacted feedstock from the reactors must be separated and purified to create the individual glycols products. This occurs in a series of distillation columns, with the sequence of steps depending on the feedstock, to produce separate streams of product propylene glycol and ethylene glycol, and mixed alcohol and butanediol byproducts.

In general, each of the distillation columns has a non-condensable gas vent stream. For columns in which appreciable quantities of VOM are present in this stream, the non-condensable gas stream will be controlled by scrubber. Otherwise, the non-condensable gases will be vented to the atmosphere. Each distillation system has a process feed tank, which in most cases is also the product tank for the upstream distillation step. For each final product there are also multiple quality control and storage tanks.

D. Hydrogen Production

The hydrogen (H_2) used in the reactors would be produced at the plant in a reformer unit. In the reformer, natural gas would be reacted with steam, at elevated temperatures in the presence of a catalyst, to produce hydrogen. The primary fuel fired in the reformer furnace to heat the natural gas-steam process stream would also being natural gas. The reformer, which would have a design heat input capacity of 80 million Btu/hr, would also generate steam from heat recovered from hot process streams. The emissions of the reformer would be the products of combustion that occur from firing natural gas.

Because the reforming process is not perfect and pure hydrogen is needed in the hydrogenolysis reactors, the product gas from the reformer must be processed to separate the hydrogen from other constituents in the product gas, mainly CO_2 and H_2O, with some CO. The product gas is first cooled to remove water and then processed in one of several parallel molecular sieve units. These units selectively adsorb CO_2, CO and other unwanted compounds from the reformer product gas to yield a purified stream of hydrogen for the hydrogenolysis reactors. The CO_2, CO and other material collected by each molecular sieve, which is combustible, is periodically desorbed and sent to the furnace of the reformer where it is used as supplemental fuel.

E. Other Support Equipment and Operations

Certain additional new equipment will be installed and some existing equipment will be reused to support operation of the

Glycols plant. This equipment includes wastewater tanks, general purpose process tanks, non-organic reagent storage tanks (e.g., sodium hydroxide solutions), two non-contact cooling tower cells, three small natural gas-fired oil heaters and an emergency diesel engine generator.

With both feedstocks (glycerin and sorbitol), the distillation columns also produce wastewater containing some organic compounds, which will be processed in the existing wastewater treatment plant at the complex.

III. PROJECT EMISSIONS

The potential annual emissions of this project are summarized below. Actual emissions will be less than the potential emissions to the extent that the facility would operate at less than its maximum capacity and control equipment normally operates to achieve emission rates that are lower than the applicable standards and limitations.

Annual Emissions of the Project (Tons/Year)

	PM[a]	PM10[b]	VOM	SO_2	NO_x	CO
Glycols Plant	6.6	4.5	84.6	0.5	39.8	24.7
Existing Facilities[c]	24.6	24.6	2.5	565	291	75.3
Total	31.2	29.1	87.1	565.5	330.8	100.0

Notes:
a. Particulate matter including condensable particulate as measured by USEPA Method 202.
b. Particulate matter less than 10 microns including condensable particulate as measured by USEPA Method 202.
c. Increase in emissions with this project at existing facilities.

IV. APPLICABLE EMISSION STANDARDS

The application shows that the proposed project will readily comply with applicable state and federal emission standards, including the emission standards and regulations of the State of Illinois (35 Il. Adm. Code: Subtitle B) and applicable federal emission standards adopted by the United States EPA (40 CFR Part 60 and 40 CFR Part 63). (See Attachments 1-A and 1-B of the draft permit for more detailed information of rule applicability.)

V. PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

The proposed project is considered a major project under the federal rules for Prevention of Significant Deterioration (PSD), 40 CFR 52.21, for emissions of particulate matter (PM/PM10), volatile organic material (VOM), sulfur dioxide (SO_2), nitrogen oxides (NOx), and carbon monoxide (CO). The Illinois EPA has been delegated authority by the United States EPA to administer the federal PSD program in Illinois. These rules are relevant for these pollutants because ADM's Decatur complex is located in a region whose air quality is classified as attainment for particulate matter, ozone, sulfur dioxide, nitrogen dioxide, and carbon monoxide.

Because the existing Decatur complex is already a major source of emissions, the criterion for whether the proposed project is considered major is whether the permitted emissions of the project for one or more

pollutants regulated by PSD would qualify as significant, as defined by the PSD rules. The project meets this criterion for PM, VOM, SO_2, NOx, and CO with permitted annual emissions that are greater than 15, 40, 40, 40 and 100 tons, respectively. The project is therefore subject to the certain substantive requirements of the PSD rules for these pollutants. The potential annual emission increases of lead, fluorides, sulfuric acid mist, hydrogen sulfide, total reduced sulfur, and reduced sulfur compounds associated with the project are less than 0.6, 3, 7, 10, 10, and 10 tons, respectively. Therefore, this project is not subject to PSD review for these pollutants.

The substantive requirement of the PSD rules for a major project for a pollutant are: 1) A case-by-case determination of Best Available Control Technology (BACT), 2) An ambient air quality impact analysis to confirm that the project would not cause or contribute to a violation of the National Ambient Air Quality Standard(s) (NAAQS) or applicable PSD increment(s); and 3) An assessment of the impacts on soils, vegetation and visibility.

A. BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

ADM submitted a "top-down" BACT demonstration in its application reflecting its judgment as to the emission control technologies and associated emission limits that should be considered BACT under the PSD rules for various units at the Glycols plant. This demonstration addressed the new and modified units in the Glycols plant that emit those pollutants for which the project is a major modification (i.e., PM, VOM, SO_2, NOx and CO). The BACT requirement of the PSD rules does not apply to the cogeneration plant and other existing units that are not being physically modified.

The Illinois EPA has reviewed the material submitted by ADM and made its independent determination of BACT. In addition to the material submitted by ADM, the Illinois EPA's determination of BACT relies upon its general knowledge of the types of emission units at the proposed plant and specific information about existing plants with similar operations that are located in Illinois. As explained below, the Illinois EPA concurred with ADM's selection of control technologies as it reflected technologies that are effectively used on similar emission units to control emissions. However, the Illinois EPA's determination of BACT for the proposed plant, as set forth in the draft permit, would establish performance requirements for the control technology on certain units that are more stringent than those proposed by ADM in its application.

<u>Distillation and Reactor Systems</u> (VOM Emissions)

The proposed plant will have a number of distillation columns to purify both reactants and products. Each of these units produces a non-condensable gas (NCG) stream that must be vented from the unit. Along with the non-condensable gases (mostly air), these streams typically contain some "light-end" VOMs with relatively low boiling points, including ethanol and methanol. The hydrogenolysis reactor system also has two non-condensable gas vents (the high pressure hydrogen flash vent and the low-pressure hydrogen flash vent) that contain light-end VOMs. Due to the

operating pressures, most of the VOM are present in the low-pressure flash vent.

For the NCG vent streams, the two basic options for control technology are oxidation (combustion) and scrubbing. Both of these technologies are capable of reducing VOM emissions by 98%. As BACT, ADM is proposing to route the following process vents to a water scrubber. Water scrubbing is a very effective control options for these units because the VOM compounds in these streams are readily soluble in water.

Unit Description	Unit ID
Crude Glycols Distillation System	DS001S
Alcohol/Water Distillation System	DS002S
PG/EG Distillation System #2	DS008S

ADM is proposing to employ thermal oxidation to control VOM emissions from the low-pressure flash vent. This vent stream may either be routed to one of the gas-fired combustion units at the plant or to a stand-alone flare. In either case, a minimum 98% control efficiency for VOM is required.

Due to the low emissions rate of the remaining process vent streams (about 2.5 tons per year of uncontrolled emissions from all vents combined), the control costs are projected to be excessive. This conclusion is based on the calculated Total Resource Effectiveness (TRE) values for these streams which are all in excess of 30 as shown below. The TRE index is a USEPA-developed method of evaluating control cost effectiveness for VOM-containing process streams under the federal New Source Performance Standards (NSPS).[1] High TRE index values, such as those for this group of process vents, indicate excessive control costs. For example, vent streams with a TRE value above 8 are exempt from control requirements under the relevant NSPS (i.e., 40 CFR 60, Subparts NNN or RRR).

Unit Description	Unit ID	TRE*
Glycerin Deodorizer	DO001N	487
Crude Glycerin Distillation System	DS001N	487
Water/Glycols Distillation System	DS003S	263
PG-EG/Glycerin Distillation System	DS004S	135
PG/EG Distillation System #1 Vent	DS005S	97
BDO/Glycerin Distillation System	DS006S	153
Glycerin/Sorbitol Distillation System	DS007S	35
BDO/PG Distillation System	DS009S	259
EG/BDO Distillation System	DS010S	48
BDO/EG Distillation System	DS011S	53
Glycerin Thin Film Evaporator	EV001N	487
High-Pressure H2 Flash Vent	HF001S	112

* As determined using the procedures found at 40 CFR 60, Subpart NNN, or in the case of the Hydrogen Flash Vent, 40 CFR 60, Subpart RRR.

[1] The TRE index is used to determine the applicability of certain New Source Performance Standards (NSPS) control requirements to these vent streams. Vent streams with a TRE index value in excess of 8 are exempt from control requirements under the relevant NSPS (i.e., 40 CFR 60, Subparts NNN or RRR).

There is also a safety issue that affects the advisability of routing certain of these vent streams to the scrubber system. The scrubber system will be located in the "solvent" area of the plant, as is appropriate as it is used for emission units in the area of the plant where significant VOM emissions would occur. However, all but one of the units listed above are located in the "non-solvent" area of the plant. These two areas of the plant are distinct and are structurally separated from each other by specifically designed walls. The "solvent" area was constructed in a manner that allows the safe handling of VOM containing streams. In addition to the structural design, the electrical system such as motors, process control equipment, lighting, etc. were chosen and installed to satisfy the requirements of the applicable building and fire codes that apply in areas in which solvent materials are or may be present. The "non-solvent" area was not designed and constructed in the same manner and the presence of VOM containing materials in this area would present serious safety concerns.

For the reasons outlined above, the BACT limit for the controlled process vents is 98% control of the incoming VOM or an outlet VOM concentration of 20 ppmv. Due to the low emissions and high cost of add-on control for the remaining process vents, add-on control is not required and emissions are minimized by the inherent nature of the process.

Process Tanks and Storage Tanks (VOM Emissions)

The proposed plant will have a number of process and storage tanks. Control technologies identified as potentially applicable for these tanks are:

- Fixed roof tanks equipped with conservation (pressure/vacuum) vents;
- Floating roof tanks;
- Fixed roof tanks equipped with vapor collection and/or control equipment.

Each of these options is considered to be technically feasible. The most effective option for controlling VOM emissions from these tanks is collecting the vent streams and routing them to a control device. The next most effective option is the use of floating roof tanks. The least effective control option is the use of a conservation vent.

The tanks at the plant can be divided into two classes, based on the vapor pressure of the materials handled in the tank. One class of tank handles liquids containing organic materials and/or aqueous solutions with low true vapor pressures (i.e., materials with total organic material partial vapor pressures of less than 0.25 psia at process/storage temperatures) so that the potential emissions of the tank is small. As a group, the maximum uncontrolled VOM emissions from these tanks at the plant would be less than 5 tons per year, in total, from over 40 tanks. The other class of tank handles organic liquids and solutions with vapor pressures above 0.25 psia at process/storage temperatures. These tanks have the potential to emit substantially larger

quantities of VOM. As a group, the combined VOM emissions from these 18 tanks would be approximately 140 tons per year if they were not controlled.

ADM evaluated the impacts of controlling emissions of the various tanks using each of the identified control options. Due to the low VOM emission rates, control costs for retrofit of floating roofs and for collection and control of tank emissions were determined to be excessive for those tanks storing low vapor pressure materials. This situation was also true for two of the tanks storing materials with vapor pressures above 0.25 psia (i.e., Tank TK010N and TK035N). Emissions of these tanks must be minimized by use of conservation vents.

Control of emissions from the remaining tanks was determined to be both cost effective and appropriate. Based on ADM's impacts analyses, the specific BACT control technology identified for each of the tanks that does not handle low vapor pressure material is listed below. The BACT limit for the scrubber controlled tank vents is 98% control of the incoming VOM, or achievement of an outlet VOM concentration of 20 ppmv. This allows the tanks to be controlled by the same scrubber system that will control VOM emissions from the distillation vents. Tank TK034N will be controlled by a condenser which will be designed to achieve 98% control of VOM emissions or a reduction in the partial pressure of VOM in the exhaust to 0.1 psia or less, equivalent to a "low vapor pressure" material.

Tank Description	Tank ID	BACT Control
Byproduct Tank	EU-TK010N	Conservation Vent
Glycerin/PG-EG Still Feed	EU-TK034N	Condenser
PG/EG Still Feed Tank	EU-TK035N	Conservation Vent
Process Work Around Tank #4	EU-TK005S	Scrubber
Alcohol/Water Still Feed	EU-TK006S	"
Glycol/Water Still Feed	EU-TK007S	"
Overflow Tank	EU-TK008S	"
PG/EG Still Feed Tank (Sorbitol Process)	EU-TK009S	"
EG/BDO Distillation Feed Tank	EU-TK011S	"
BDO/PG Distillation Feed Tank #1	EU-TK012S	"
BDO/PG Distillation Feed Tank #2	EU-TK013S	"
Glycerin/Sorbitol Distillation Feed Tank	EU-TK023S	"
Alcohol Storage Tank	EU-TK024S	"
Blast Reactor Feed Tank	EU-TK025S	"
Alcohol QC Tank #1	EU-TK034S	"
Alcohol QC Tank #2	EU-TK035S	"
Sorbitol Recycle Tank	EU-RX023S	"
Glycerin Recycle Tank	EU-RX026S	"

Components in VOM Service (VOM Emissions)

Certain "equipment" in the Glycols plant will be in VOM service. Leaks from this equipment will result in the emissions of small amounts of VOM. Emissions from equipment leaks may be subject to several regulatory requirements including 40 CFR 60, Subpart VV and in a few cases, 40 CFR 63, Subpart H. Other "equipment" in the Glycols plant (e.g., process water piping) will not be in VOM service. Emissions of VOM from this other equipment are minimal.

Based on a review of the RBLC and other technical sources of information, ADM concluded the only technically feasible control option for these sources of VOM/HAP emissions is a leak detection and repair (LDAR) program. After considering information submitted by ADM, the Illinois IEPA confirmed that BACT for emissions from leaks by components in VOM service in the affected plant is implementation of a Leak Detection and Repair (LDAR) Program that meets the requirements of the USEPA's Consolidated Air Rule, 40 CFR 65, Subpart F.

Loadout Operations (VOM Emissions)

The output of the plant will be loaded into trucks and rail cars. Emissions occur from loadout operations due to organic compound contained in the air displaced from the transport tank as the tank is loaded. Because of the low vapor pressure of the output of the plant, the level of organic compounds in the displaced air is low, with the total VOM emissions from material loadout operations determined to be approximately 1.0 tons per year.

Control technologies for loadout emissions can be divided into two general categories: design and/or work practice standards and add-on controls. The technically feasible control options in these categories include:

- Submerged filling of transport vehicles;
- Collection and control of displaced vapors using a condenser, flare, adsorption system, or incinerator.

The more effective option for controlling VOM emissions from these operations is collecting the vent streams and routing them to a control device. The less effective option is the use of submerged product loading.

ADM evaluated the impacts of these options for application to loadout operations at the plant. Due to the low emissions from product loadout (i.e., approximately 1 ton per year), the cost of collecting and controlling the emissions from the loadout operations is estimated to be nearly $52,000 per ton. Control of VOM emissions at this cost is excessive. Based on the information submitted by ADM and its own experience, the Illinois EPA concluded that the loadout of material with a VOM vapor pressure, at the temperature of the material as loaded, that is equal to or greater than 0.1 psia from the plant must be conducted with submerged loading. This directly addresses the loadout of mixed alcohol byproduct from the plant, which accounts for most of the VOM emissions from material loadout.

Hydrogen Reformer and Oil Heaters (Combustion Emissions)

Combustion of fuel will occur in the reformer and in three small natural gas fired heaters, which will heat a heat transfer oil needed for certain process units within the plant. These combustion units are subject to BACT for emissions of PM/PM10, NOx, SO_2, CO, and VOM, as addressed below

Particulate Matter - Combustion of natural gas results in the lowest PM/PM10 emissions of any commercial fuel. When fired with good combustion practices, the standard USEPA emission factor for total PM10 emissions from natural gas combustion is 0.0076 lb/million Btu. Previous BACT determinations show that good combustion practices are the only PM/PM10 control technology option identified for gas-fired reformers. The associated PM/PM10 emission rates range from 0.005 to 0.020 lb/million Btu.

Other control options that are theoretically applicable for control of PM emissions from the gas-fired combustion units are fabric filters and electrostatic precipitators, as routinely used on solid-fuel fired units. However, these controls are commonly applied to units that burn solid fuels that contain significant levels of ash and not to units that only fire gas. Fabric filters and electrostatic precipitators are not considered technically feasible for the control of the PM/PM10 emissions from the gas-fired combustion units at the plant. These technologies would not be expected to provide any significant emissions reductions from these units because of the already low emission rate and the small particle size of the emissions.

Based on the information reviewed by Illinois EPA, the only technically feasible PM control option for the proposed gas-fired combustion units is the use of good combustion practices. Illinois EPA has determined that the reformer's BACT emissions limit is 0.4 lb/hr which is equivalent to an emission rate of 0.005 lb/million Btu. For each heater, the proposed limit is 0.1 lb/hr, which is also equivalent to an emission rate 0.005 lb/million Btu. These values are consistent with the lowest limits identified in the RBLC.

Nitrogen Oxides - Nitrogen oxides are formed during combustion by two major mechanisms; thermal formation ("thermal NOx"), and fuel formation ("fuel NOx"). Thermal NOx results from the high temperature oxidation of nitrogen (N_2) and oxygen (O_2). The N_2 is supplied from air, which is approximately 79 percent N_2 by volume. As its name implies, thermal NOx formation is primarily dependent on combustion temperature. Thermal NOx formation increases exponentially with temperature, and becomes significant at temperatures above about 2,200 °F. Fuel NOx results from the direct oxidation of organic nitrogen compounds in the fuel. Because natural gas contains virtually no nitrogen, the NOx emissions from the combustion of natural gas in the reformer and heaters are primarily thermal NOx.

The RBLC database was reviewed to identify technologies used to control NOx emissions from gas-fired reformers, process heaters, and boilers. For reformers, the NOx control technologies identified include low-NOx burners (LNB) with and without selective catalytic reduction (SCR). NOx emission limits for these heaters range from 0.0061 to 0.036 lb/million Btu. For gas-fired heaters and boilers, only low-NOx burner technology has been used.

In addition to low NOx burners with and without SCR, the following post-combustion NOx control technologies are commercially available for certain gas-fired combustion units:

- SCONOx™;
- Non-Selective Catalytic Reduction (NSCR); and
- Selective Non-Catalytic Reduction (SNCR).

ADM found that the technically feasible NOx controls identified for further evaluation as part of the reformer NOx BACT analysis are SCR, SNCR, and low NOx burners. SCONOx is considered infeasible because SCONOx has not been demonstrated on reformer furnaces or small heaters like the ones to be installed at the proposed plant.

For the gas-fired oil heaters, only low-NOx burners and SCR are considered technically feasible. Small gas-fired package boilers and heaters, such as the ones planned for this project are compact and have insufficient residence time at the correct temperature to allow effective use of SNCR technology. Thus, the application of SNCR to these units would require design and fabrication of unique units, rather than "off the shelf" purchase of available model of units. Accordingly, use of SNCR would entail development of this control technology for an application for which it has not yet been commercially demonstrated, rather than use of a control technology that may readily be transferred to an emission unit. Additionally, advanced LNB technology can achieve lower NOx emissions when firing gas than can be achieved with SNCR technology alone, but at much lower costs. As such, SNCR is not considered a technically feasible control option for proposed oil heaters, and is therefore not considered further by the Illinois EPA.

NSCR is infeasible because it requires a reducing atmosphere (i.e., H_2, CO, CH_4 or some other reductant must be present) combined with the proper temperature range for the SNCR catalyst to function. Although the reformer and heater burners may have a localized reducing atmosphere in the flame zone of the burners, the burner design is such that this situation does not exist beyond the burnout zone of the fuel (i.e., overall, these units will operate fuel-lean, not fuel-rich). No suitable temperature window or residence time exists in units to allow an NSCR catalysts to be installed at locations where they would be effective.

For the reformer, the NOx BACT hierarchy for the feasible control options is shown below:

Control Option	Control Efficiency (%)	NOx Emission Rate (lb/MMBtu)
LNB + SCR	80	0.008
LNB + SNCR	20	0.032
LNB	Baseline	0.040

ADM provided an evaluation of control option impacts based on estimates of installed costs of each option derived from vendor estimates and standard factors for installation and operation of this equipment. SCR in combination with a low NOx burner is considered economically infeasible for the proposed reformer because the incremental increase in annual costs of over $1 million and because a cost-effectiveness of nearly $250,000 per ton of additional NOx emissions reduced is excessive. SNCR in combination with a low NOx burner is also considered economically infeasible for this unit because the incremental increase in annual costs of over $340,000 and because the control cost effectiveness of $280,000 per ton of additional NOx emissions reduced is excessive. Based on the above analysis, ADM concluded that the use of a low NOx burner on the reformer furnace with an emission limit of 0.04 lb/million Btu is BACT.

For the hot oil heaters, the hierarchy for the feasible control technology for NOx is shown below:

Control Option	Control Efficiency (%)	NOx Emission Rate (lb/million Btu)
AULNB + SCR	96	0.003
Advanced ULNB (AULNB)	71	0.02
Ultra-Low NOx Burner (ULNB)	57	0.03
Low-NOx Burner (LNB)	Baseline	0.07

ADM provided an evaluation of these control option impacts based on estimates of installed costs of each option derived from vendor estimates and standard factors for installation and operation of this equipment. The cost impact of SCR in combination with an advanced ultra-low NOx burner (AULNB) is considered excessive because of incremental increase in annual costs of over $516,000 relative to the baseline low-NOx burner cost and because a cost-effectiveness value of nearly $88,000 per ton of NOx controlled. The use of an AULNB is also considered inappropriate because of the increase in annual costs of over $80,000 and a cost-effectiveness of $18,000 per ton of NOx controlled. Finally, the use of a ULNB can be eliminated because of the increase in annual costs of over $42,000 and a cost-effectiveness of nearly $12,000 per ton of NOx controlled.

Based on the above cost-effectiveness analysis, ADM concluded that the use of low NOx burners on the gas fired heaters with an emission limit of 0.07 lb/million Btu is BACT. However, in order to show less than significant impacts for NOx in the air quality impact analysis for this project. ADM has proposed to install burners that will meet a lower emission rate, 0.04 lb/million Btu. Accordingly the Illinois EPA has set BACT at this lower rate, based on the capability of the low NOx burners selected by ADM. This level of performance is also considered to be more consistent with the level of NOx emissions that is

achievable on these heaters with use of ultra low-NOx burner technology, given the constraints inherent in their relatively small size.

CO and VOM - CO and VOM are emitted from combustion units as a result of incomplete combustion. The control technologies used to control CO and VOM emissions from gas-fired reformers, process heaters, and boilers were first identified using the RBLC database. The results of this review show that good combustion practice is the only control technology that has been applied for the control of CO and VOM emissions from such equipment. Gas combustion, when combined with good combustion practices, results in low CO and VOM emissions. Typical CO and VOM emission rates for gas combustion are 0.084 and 0.0055 lb/million Btu respectively.

The lowest CO emission rate for reformer furnaces found in the RBLC is 0.01 lb/million Btu. For VOM, recent BACT determinations are based on rates ranging from 0.003 to 0.004 lb/million Btu. For gas-fired boilers, emission rates found in the RBLC range from 0.036 to 0.165 lb/million Btu for CO and 0.004 to 0.032 lb/million Btu for VOM.

A variety of control technologies are used to reduce CO and VOM emissions from various types of process units. While these technologies may be suitable for controlling CO and VOM emissions from non-combustion units such as paint booths, process dryers, and refinery units, they have not been used to control emissions from combustion units. In this regard, catalytic oxidation is at times applied to certain fuel burning engines, especially when CO emissions are elevated due to measures taken to reduce NOx emissions. However, catalytic oxidation is not routinely applied to boiler- and heater-type fuel combustion units. While the use of an oxidation catalyst is theoretically possible, it has not been demonstrated on reformers, process heaters, or small package boilers. The use of this control technology would require a specialized design for both the reformer and the boilers. Additionally, it would involve significant engineering and technology transfer risks (and costs) for little, if any, further reduction in emissions.

Technology	Pollutant(s) Controlled	Used on Fuel Combustion Units?
Thermal Oxidation	CO & VOM	No
Catalytic Oxidation	CO & VOM	Yes/No
Afterburners	CO & VOM	No
Flares	CO & VOM	No
Condensation	VOM	No
Adsorption	VOM	No
Concentration & Oxidation	VOM	No
Biofiltration	VOM	No
UV Oxidation	VOM	No
Membrane Technology	VOM	No
Plasma Technology	VOM	No

Low VOM Materials	VOM	No
Hooding/Combustion	CO	No

Good combustion practices are the only technically feasible control option for CO and VOM emissions from this project's gas-fired units. For the reformer, based on review of CO emission rates currently established for similar units and on information provided by ADM, the CO BACT limit for is 0.8 pounds per hour. This limit is equal to a full-load CO emission rate of 0.01 lb/million Btu, which is consistent with most recent BACT CO emission limits found in RBLC. The VOM BACT limit for the reformer is 0.4 pounds per hour. This limit is equal to a full-load VOM emission rate of 0.005 lb/million Btu which is consistent with recent gas-fired combustion BACT VOM emission limits found in RBLC.

The CO BACT limit for each hot oil heater is 1.44 pounds per hour. This limit is equal to a full load CO emission rate of 0.072 lb/million Btu. This limit is consistent with most recent BACT CO emission limits found in RBLC, which range from 0.036 to 0.165 lb/million Btu. The VOM BACT limit for each heater is 0.1 pounds per hour. This limit is equal to a full-load VOM emission rate of 0.005 lb/million Btu and it is consistent with most recent BACT VOM emission limits found in RBLC.

Sulfur Dioxide - Emissions of SO_2 result from the oxidation of the sulfur in the fuel when the fuel is burned, which results in the majority of the fuel sulfur being emitted as SO_2. Commercial natural gas contains very low levels of sulfur compounds, resulting in a standard USEPA emission factor of 0.006 lb SO_2/million Btu.

Available control technologies for SO_2 emissions from units burning fuels containing significant amount of sulfur include wet and dry flue gas desulfurization. However, these systems would have little if any effect on SO_2 emissions from the proposed combustion units due to the already low SO_2 concentration in the flue gases from these units (i.e., less than 1 ppmv). These technologies are not applicable for the units at this plant. Given these circumstances, the Illinois EPA has concluded that BACT will be provided by the low-sulfur fuel gas selected for use in these combustion units.

Material Handling/Dust Collection Systems (Particulate Emissions)

The handling of the activated carbon for bleaching glycerin, which will be handled as a dry powder, will potentially emit particulate matter (PM). The other PM process emission unit at the plant will be the house dust collector system. This system is essentially a large industrial central vacuum system that will be used for general housekeeping purposes. The vent from this system will be a minor source of particulate emissions.

Particulate matter emissions generated from these types of units are typically controlled by filter-type control devices. Although there are other control technologies that could be used

for these types of units, such as electrostatic precipitators (wet and dry) and wet scrubbers, such technologies are only used when there are impediments to use of filters. These technologies have not been used for such applications because they offer no performance or cost advantages over the use of filters.

The most effective control technology for these emissions is the total enclosure of the unit or activity which is generating the particulate matter, coupled with a dust collection/ventilation system that uses a filter to remove particulates from the ventilation air/gas. However, in some cases this approach is not practical based on either economic or safety reasons and other available control strategies must be implemented.

Electrostatic precipitators and wet scrubbers are not considered technically feasible for controlling PM emissions from the solids handling sources at the plant because they are impractical for this type of application. Further, they offer no performance or cost advantages over the use of a fabric filter.

ADM is proposing to implement the most effective, technically feasible options for controlling PM/PM10 emissions from the solids handling activities at the Glycols plant. Accordingly, ADM has determined that BACT for these sources involves enclosure to prevent visible fugitive emissions and venting of collected emissions through a filter control device from which PM emissions, as would be measured by USEPA Method 5, do not exceed 0.005 gr/dscf.

Cooling Tower (Particulate Emissions)

As part of this project, an existing non-contact cooling tower will be expanded by the addition of two new cells. Cooling towers are a source of particulate matter emissions due to the loss or drift of droplets of cooling water containing dissolved solids from the tower.

Based on the review of BACT databases, the most effective PM control technology identified is use of high-efficiency drift eliminators. One additional control technology identified is the use of water treatment technology, in conjunction with a high efficiency mist eliminator. Water treatment can lower the dissolved solids in the drift, thereby lowering emissions of PM/PM10 from the tower.

Based on the feasible and available control technologies, the following ranking of control technologies was identified:

- Use of mist eliminators designed for 0.0005% drift plus water treatment for removal of 80% of the TDS in the makeup water;
- Use of mist eliminators designed for 0.0005% drift;
- Use of baseline mist eliminators (0.005% drift) plus water treatment for removal of 80% of the TDS in the makeup water; and

- Use of mist eliminators designed for 0.005% drift (baseline).

ADM provided an evaluation of the impacts of these control options based on estimates of installed costs of each technology option derived from vendor estimates and standard factors for installation and operation of this equipment. The control costs of the top-performing option (drift eliminators combined with water treatment) are excessive at nearly $15,000 per ton with incremental control costs of $150,000 per ton. The next best performing option involving the use of very high efficiency drift eliminators was determined to have acceptable impacts.

Based on this information, ADM determined that BACT for the affected cooling tower cells will be drift eliminators that are designed to reduce drift loss to no more than 0.0005 weight percent of the circulating water flow. Additionally, the total dissolved solids (TDS) content of the water circulated in the cooling tower shall not exceed 2500 ppm, annual average. The Illinois EPA has accepted ADM's determinations, as the ADM will be adding cells to the existing wet cooling tower at the plant.

Unloading/Loading Area (Particulate Emissions)

A new unloading/loading area will be constructed adjacent to the proposed plant to handle shipments of materials to and from the new Glycols plant. Truck traffic in this new area will be a potential source of fugitive PM emissions, for which BACT must be established. The preventative control measures for this area include partial enclosure and paving. The active dust control measure for the area is implementation of a fugitive dust control operating program, which would address cleanup of any spilled solid material and periodic treatment, flushing and/or sweeping of the area to remove accumulated dust or silt that could become airborne.

Based on the assessment of control options provided by ADM, as well as its own experience with control of fugitive dust, the Illinois EPA has proposed a BACT limit for this area expressed in terms of the opacity of the fugitive particulate emissions. Specifically opacity is of emissions is proposed to be limited to 10 percent, except during periods of high wind speeds. For this purpose, opacity and the presence of high wind speeds shall be determined in accordance with the relevant provisions of existing state rules, i.e., 35 IAC 212.109 and 35 IAC 212.314, respectively. This approach to BACT provides a standard that can be readily enforced for this area.

B. AIR QUALITY ANALYSIS

An ambient air quality analysis was conducted by a consulting firm, RTP Environmental Associates, Inc., on behalf of ADM to assess the impact of the emissions of the proposed project. Under the PSD rules, this analysis must determine whether the proposed project will cause or contribute to a violation of any applicable air quality standard.

The air quality analyses for PM, NOx, SO_2, and CO were performed using computerized dispersion modeling. The analyses conformed to the current guidance and requirements of the USEPA and the Illinois EPA. The analyses indicate that this project will not cause or contribute to a violation of the PM, NOx, SO_2, or CO air quality standards or PSD increments. For each of these pollutants, the modeled impacts were determined to be below the applicable significant impact levels, as summarized below.

Results of Significant Impact Modeling ($\mu g/m^3$)

Pollutant	Averaging Period	Maximum Concentration	Significant Impact Level	NAAQS
NOx	Annual	0.97	1	100
CO	1-hour	45.8	2000	40,000
	8-hour	25.5	500	10,000
PM10	Annual	0.82	1	50
	24-hour	4.69	5	150
SO_2	Annual	0.13	1	80
	24-hour	1.38	5	365
	3-hour	4.88	25	1300

The analysis for ozone was conducted using a screening method developed by USEPA for PSD permitting to address the historic one-hour ozone standard. The analysis confirms that the project will not cause a violation of the ozone air quality standard. For this purpose, information on current air quality for ozone in the region is available from an ambient monitoring station operated by the Illinois EPA in Decatur, Illinois. This analysis indicates a maximum increase in ozone concentration of 0.0129 ppm, one-hour average, as a result of this project. The resulting maximum ozone concentration is 0.102 ppm, compared to the historic one-hour ozone NAAQS of 0.120 ppm. This analysis is sufficient to conclude that air quality in the region that will continue to comply with both the historic one-hour ozone standard and the current eight-hour ozone standard.

C. IMPACTS ON SOIL, VEGETATION AND VISIBILITY

The application addresses the potential impact of the proposed project on soils, vegetation, and visibility. The assessment concludes that the project would not adversely impact soil, vegetation or visibility in the Decatur area. This is because the maximum air quality impacts predicted for PM, NOx, SO_2, and CO emissions from the project are below the PSD significant impact levels, so that existing air quality should not be measurably affected by this project.

VI. PERMIT CONDITIONS

The conditions of the permit set forth the air pollution control requirements that the project must meet. These requirements include the applicable emission standards that apply to the project. They also include the measures that must be used and the emission limits that must be met as BACT for emissions of PM, VOM, NOx, SO_2, and CO from the new facility.

The permit also establishes enforceable limitations on the amount of emissions for which the project is permitted. In addition to annual limitations on emissions, the permit includes short-term emission limitations and operational limitations, as needed to provide practical enforceability of the annual emission limitations. As previously noted, actual emissions associated with the project would be less than the permitted emissions to the extent that the facility operates at less than capacity and control equipment normally operates to achieve emission rates that are lower than the applicable standards and limitations.

The permit also establishes appropriate compliance procedures for the ongoing operation of the plant, including requirements for emission testing, required work practices, operational monitoring, recordkeeping, and reporting. These measures are imposed to assure that the operation and emissions of the plant are appropriately tracked to confirm compliance with the various limitations and requirements established for individual emission units.

VII. REQUEST FOR COMMENTS

It is the Illinois EPA's preliminary determination that the application for the proposed project meets applicable state and federal air pollution control requirements. The Illinois EPA is therefore proposing to issue a construction permit for the project.

Comments are requested on this proposed action by the Illinois EPA and the conditions of the draft permit.