

MEMORANDUM

TO: Paul Foster, P.E.

FROM: Ravi Rangan, P.E.
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SUBJECT: **Delaware City Refinery Upgrade and Optimization Project:**
Applications for the Construction of an Upgrade and Optimization Project for the Crude Unit, Fluid Coking Unit, Liquefied Petroleum Gas Propylene Dryer and Splitter, Sour Water Stripper and Diglycolamine Scrubbing System at The Premcor Refining Group, Inc. Delaware City Refinery.
Permit: APC-81/0828-CONSTRUCTION(Amendment 2)PSD-NSR
Permit: APC-81/0829-CONSTRUCTION(Amendment 8)PSD-NSR

DATE: July 15, 2008

Background:

The Premcor Refining Group Inc. (Premcor) owns and operates the Delaware City Refinery (DCR) located at 4550 Wrangle Hill Road in Delaware City, Delaware. Premcor submitted a permit application titled the DCR Upgrade and Optimization Project (UOP) on November 30, 2007¹. The DCR UOP includes the following projects and activities:

- Crude Unit Optimization
- Fluid Coking Unit (FCU) Optimization
- LPG propylene Dryer and Splitter Installation
- Sour Water Stripping System Upgrade
- Diglycolamine (DGA) Scrubbing System Upgrade

AQM reviewed a draft application for the Bin 1 Project and provided written comments to Premcor in a letter dated February 1, 2007. Premcor addressed these comments in subsequent submittals on May 3, 2007 and August 8, 2007 and submitted a final application on November 30, 2007 superseding all previous applications. Because additional deficiencies were identified by AQM, Premcor submitted additional clarifications on January 14, 2008 and an updated netting analysis on April 22, 2008. Because there are several ongoing major and complex permitting activities concerning

¹ The DCR UOP is also referred to as the "Bin 1 Project." Because Premcor's application and correspondence with the Department use both terms interchangeably, AQM has adopted the same nomenclature.

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the DCR, a meeting between Premcor and the Department's upper management was held on November 26, 2007 to chart a mutually acceptable timeline for completion of these permitting activities. The Air Quality Management (AQM) Section which also participated in this meeting identified a time frame of 9 months from receipt of a complete permit application to issue draft Prevention of Significant Deterioration (PSD) permits under Delaware's New Source Review (NSR) Program for the Bin 1 project. AQM issued a notification of deficiency on December 20, 2007. Premcor submitted additional information on January 14, 2008 and on February 1, 2008 clarifying the deficiencies. The Bin 1 project application was considered to be complete as of February 11, 2008; the application was public noticed on February 17, 2008 thereby setting a target issuance date of November 11, 2008 for the draft PSD permits. While the Bin 1 project includes all of the components identified above, one aspect of the crude unit optimization includes the installation of a Selective Catalytic Reduction (SCR) System for controlling nitrogen oxide (NO_x) emissions of the crude unit atmospheric tower heater (21-H-701) and from the crude unit vacuum tower heater (21-H-2). This aspect of the Bin 1 Project does not seek to modify the existing process heaters. However, the installation of the SCR system will result in reductions of NO_x emissions from 21-H-701 and 21-H-2, a portion of which will be used to meet the NO_x reductions needed to comply with the provisions of the Heaters and Boilers Consent Decree of 2001². AQM completed its review of the SCR project and issued construction permits on May 14, 2008³. Therefore, this memorandum is confined to AQM's technical and regulatory review of the remaining Bin 1 components⁴. This memorandum is structured as follows:

- Section 1: Bin 1 Project Scope and Description
- Section 2: Project Analysis
- Section 3: Modeling Analysis
- Section 4: Public Participation Requirements
- Attachment A: DRAFT Permit: APC-81/0828-C(A2)PSD-NSR
- Attachment B: DRAFT Permit: APC-81/0829-C(A8)PSD-NSR
- Attachment C: Registration APC-2008/0169-R for the Sour Water Stripper
- Attachment D: Registration APC-2008/0170-R for the DGA Upgrades

² Third Addendum to Civil Action H-01-0978 (for the Heaters and Boilers Marquee Issue) dated February 7, 2005 between the United States of America, Plaintiff and the States of Delaware, Louisiana and the Northwest Air Pollution Authority of the State of Washington, Plaintiff-Intervenors versus Motiva Enterprises LLC, Equilon Enterprises, LLC and Deer Park refining Limited Partnership, Defendants entered in the United States District Court for the Southern District of Texas.

³ Permit: APC-95/0570-CONSTRUCTION(Amendment 3)(NSPS) for the crude unit atmospheric tower heater and Permit: APC-81/0784-CONSTRUCTION(Amendment 2) for the crude unit vacuum tower heater.

⁴ While this memorandum does not include a discussion of the SCR system, the relevant netting transactions are repeated here under the Section titled "Technical and Regulatory Analysis" in order to present a comprehensive evaluation of project-related emissions changes.

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Glossary of Terms:

| | |
|---------------------|--|
| ASCF: | Actual Standard Cubic Feet |
| AQM: | DNREC's Air Quality Management |
| AQRV: | Air Quality Related Values |
| BACT: | Best Available Control Technology |
| BPD: | Barrels Per Day |
| CAA: | Clean Air Act |
| CAM: | Compliance Assurance Monitoring |
| CCR: | Continuous Catalyst Regenerator Reformer |
| CD: | Civil Action H-01-0978 dated March 21, 2001 Lodged in the US District Court for the Southern District of Texas |
| CEMS: | Continuous Emissions Monitoring System |
| COB: | Carbon Monoxide Boiler |
| DCR: | Delaware City Refinery |
| DGA: | Diglycolamine |
| DSCF: | Dry Standard Cubic Feet |
| EF: | Emission Factor |
| FCCU: | Fluid Catalytic Cracking Unit |
| FCU: | Fluid Coking Unit |
| FLM: | Federal Land Manager |
| GPM: | Gallons per Minute |
| HDU: | Hydrodesulfurizer units |
| HSS: | Heat Stable Salts |
| LAER: | Lowest Achievable Emission Rate |
| LPG: | Liquefied Petroleum Gas |
| MBPD: | 1,000 Barrels per Day |
| Mlb/hr: | 1,000 Pounds Per Hour |
| mmDSCF: | 1,000,000 Dry Standard Cubic Feet |
| NA: | Non-attainment, not applicable, not available |
| NAAQS: | National Ambient Air Quality Standards |
| NA NSR: | Non-Attainment New Source Review |
| NSPS: | New Source Performance Standards |
| NSR: | New Source Review |
| PCUP: | Pollution Control Upgrade Project |
| PM ₁₀ : | Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 10 Micrometers |
| PM _{2.5} : | Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 2.5 Micrometers |
| PSD: | Prevention of Significant Deterioration, Particle Size Distribution |

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PSIG: Pounds per Square Inch Gauge
RACT: Reasonably Available Control Technology
RFG: Refinery Fuel Gas
RSC: Reduced Sulfur Compounds
SCR: Selective Catalytic Reduction
SER: Significant Emissions Rate
SNCR: Selective Non-Catalytic Reduction
SIL: Significant Impact Levels
SIP: State Implementation Plan
SMR: Steam-Methane Reformer
SRP: Sulfur Recovery Plant
SWS: Sour Water Stripper
TPY: Tons per Year, as determined on a rolling twelve month basis
TSP: Total Suspended Particulate
ULSD: Ultra-low Sulfur Diesel
UOP: Upgrade and Optimization Project
WGS: Wet Gas Scrubber

Also, the State of Delaware Regulations and the State of Delaware “**Regulations Governing the Control of Air Pollution**” are collectively termed “*Regulations*” in this document.

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Section 1: Project Scope & Description

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This section of the memorandum describes the UOP as it relates to the Bin 1 project, excluding the installation of a common SCR system for the 2 crude unit heaters. In general, the expression “optimized refinery operations” means operating the refinery in a manner that maximizes the operation of each unit operation within its physical and operational constraints. To accomplish optimized operation, the DCR currently purchases refinery intermediate feedstocks to operate the refinery. The Bin 1 project will allow for potential reductions in the amount of purchased intermediate feedstocks needed to maintain operation of various refinery unit operations at their optimal levels. The following unit operations are directly affected by the Bin 1 project.

Crude Unit:

The crude unit is the first fractionating unit operation at the refinery used for distilling crude oil into its various fractions. Within the crude unit oil is fractionated into and separated into groups of hydrocarbon compounds of differing boiling point ranges. The principal components of the crude unit include the following:

- Desalters: Crude oil from storage tanks is preheated in heat exchangers and fed to the desalters where it is water washed to scrub out impurities which in turn are removed electrostatically. Desalted is then further preheated on its way to the gasoline column 21-C-1. Desalter effluent water is routed to the SWS
- Gasoline column to crude atmospheric heater: From 21-C-1 crude oil flows through a pre-heater train and then through both new and relocated heat exchangers. Preheated crude enters the atmospheric heater (21-H-701) where a new heat exchanger will preheat combustion air to 21-H-701. This air preheating will be performed by conductive/convective heat transfer and no new combustion equipment will be involved. Flue gas from 21-H-701 passes through the new SCR system and is vented through a common stack for 21-H-701 and 2-H-2, (the vacuum tower heater). Heated crude oil from 21-H-701 enters the atmospheric distillation column (21-C-2).
- Atmospheric column to vacuum heater: Bottoms from 21-C-2 enters the vacuum heater, 21-H-2. A new heat exchanger will preheat combustion air to the heater using conductive/convective heat transfer. Flue from 21-H-2 combines with the flue from 21-H-701 and passes through the SCR for NO_x reduction and is then vented through a common stack.
- Vacuum heater to vacuum tower: Crude now flows to the vacuum tower. Modifications to the vacuum tower include replacement of trays and nozzles, installation of a new packed bed section in the top of the column, wash bed upgrades and upsize of overflash gravity flow piping.

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- Heat transfer and pumparound system: The crude unit heat transfer system and pumparound system will be modified to improve heat recovery throughout the unit.

Fluid Coking Unit:

The FCU is an integral part of refinery operations that allows the refinery to process low cost, high sulfur crude oil to produce high value products such as gasoline, thereby increasing profitability. Vacuum residuum from the vacuum distillation tower of the Crude Unit is the main feedstock to the FCU. This feed enters the scrubber section of the FCU where it is blended with cooled recycle oil. Recycle oil is blended oil at the bottom of the scrubber that has been used to scrub out coke particulate matter. About 66 % of this combined recycled scrubber oil is fed to the reactor through three inlet distribution rings having a total of 42 feed injection nozzles⁵. The feed thus comes into contact with hot coke in the reactor (about 980EF) and breaks up into smaller chains of hydrocarbons by the process of thermal cracking. The coke bed is kept in a fluidized state by injection of fluidizing steam at 175 psig and 750EF through 37 steam nozzles. Cold coke at about 950EF is drawn from the bottom of the reactor and returned to the burner where combustion air is supplied to burn the coke partially and generate the heat necessary to sustain the endothermic cracking reaction in the reactor. The hot coke is withdrawn through an overflow well and is fed to the reactor to continue the cracking operation. Excess product coke is withdrawn through a quench elutriator prior to its being conveyed by conveyor belts to a storage area on site north of the DCR Power Plant. About 1.5 tons per minute of product coke leaves the elutriator at 425EF. Scrubber overhead at a rate of 350 tons per hour is fed to the bottom of the main Fractionator (22-C-1). Light gas oil is condensed and refluxed with additional gas oil and fed to either the Hydrocracker or the FCCU as feed. Tower bottoms are refluxed to the top of the scrubber and overheads flow to a flash drum and accumulator which allows the separation of gas, fractionator overhead liquid and water. About 200 tons per hour of wet gas is produced. Coker gasoline is extracted from the accumulator and split into fractionator reflux and excess going to the flash drum. The latter is heated and flashed with the vapors being condensed and sent to the absorber/stripper column where the liquid is extracted and pumped to storage for use as feed to the FCCU. The burner unit contains about 350 tons of coke. The circulation of this coke through the reactor and back to the burner is controlled by two slide valves that achieve precise control. The stoichiometry for the combustion process in the burner unit is as follows:



⁵ Additional feed injection nozzles will be installed as part of the Bin 1 Project.3,170

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During periods of start up, an air heater (Unit 22-H-1) rated at 107 mmBtu/hour is used to supply the heat necessary to initiate the combustion stoichiometry given above. This unit fires only refinery fuel gas and is supplied by a forced draft fan.

In order to keep the coke fluffed, an auxiliary refinery fuel gas fired steam superheater called the Selas Steam Superheater (Unit 22-H-2) is provided. This unit is fired continuously and provides 175 psig steam that is injected at strategic points with the aid of special steam injection nozzles. Unit 22-H-2 is rated at 17.8 mmBtu/hour and uses 12 mmSCF/month of refinery fuel gas.

Burner flue gas exits through 18 two-stage cyclones and flows to one of three water seals before entering the CO boiler and the downstream WGS train. The COB houses an ammonia based SNCR system. The SNCR process involves injection of 19.5 % solution of ammonia into the COB combustion gases. When the desired temperature and residence time is maintained the reagent will selectively react with the nitric oxide to reduce it to molecular nitrogen.

The amine-based regenerative WGS includes a water pre-scrubber, an amine-based regenerative scrubber and a caustic. There are 2 main elements in the WGS – the scrubber and regeneration systems. The scrubber element consists of a Belco prescrubber followed by a Cansolv absorber section. The purpose of the Belco prescrubber is to saturate the flue gas with water and to remove particulate matter and sulfur trioxide before the gas enters the absorber section. The Belco prescrubber section consists of a quench section followed by Agglofilter modules and Cyclolab droplet separators. A low pH is maintained in the prescrubber section to maximize the SO₂ absorption in the absorber section. The quench and Agglofilter modules remove particulate matter and SO₃ while the Cyclolabs remove any large entrained droplets carried over from the prescrubber. Blowdown from the prescrubber flows to a purge treatment unit where it is neutralized with caustic and clarified prior to being routed to the refinery's effluent treatment plant. The main SO₂ absorption section of the Belco/Cansolv WGS uses an amine-based scrubber solution in a packed bed absorber tower to remove SO₂ from the exhaust stream. The main absorption loop is followed by a polishing scrubber, which is a final packed stage that is separate from the amine-based absorption step and will be used to ensure that the CD driven levels of control are achieved (i.e., 25 ppmvd @ 0 % O₂ on a 365 day rolling average basis and 50 ppmvd @ 0 % O₂ on a 7 day rolling average basis). A packed tower serves as the absorber where the gas is contacted with an amine which absorbs the SO₂. Cleaned gas exits the absorber through a stack mounted on the absorber tower. Rich amine is filtered and heated through an effluent-influent heat exchanger before being fed to the regenerator tower. In the regenerator, the rich amine is steam stripped yielding a high purity SO₂ stream that will be routed to the refinery's SRA. The regenerated lean amine is pumped back to the absorber. Because HSS are formed over time, a small slip stream of lean amine is routed to an electro-dialysis unit to extract the HSS from the lean amine.

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The Bin 1 Project includes the following modifications to support the UOP:

- Modifications to enhance the FCU blower and oxygen system;
- Install 3 additional feed injection nozzles;
- Increase the size of the transfer line restrictor orifices;
- Install new burner cyclone hangers;
- Upgrade the reactor effluent scrubber internals;
- Modify an existing line to manage pumping resid feed from the piers to the FCU charge tanks;
- Install an additional (3rd) pump to transfer vacuum resid from the crude unit to the FCU to improve overall reliability;
- Modify heat exchanger piping to increase cooling capacity;
- Replace the existing hot coke line slide valve by a new 51 inch slide valve;
- Modify cold coke riser;
- Increase the capacity of the main refinery gas plant located at the FCCU by 12 to 14 MMSCFD from the present capacity of 70 MMSCFD by upgrading the wet gas compressor. The modification to the FCCU wet gas compressor will allow all refinery low line gases to be processed through the refinery gas plant, thereby unloading the wet gas compressor at the FCU gas plant which can then accommodate additional gases generated by the FCU UOP. The application indicates the choice to upgrade the FCCU gas plant rather than the FCU gas plant was based on anticipating greater efficiency gains at the FCCU wet gas compressor than the FCU wet gas compressor.

As a result of these modifications, there will be two significant changes to FCU operations. First, the FCU's coke burn rate will increase from the present level of 47 Mlb/hour to 60.9 Mlb/hour; and second, the FCU will be able to realize its design throughput of 57,199 BPD. Therefore, the regulatory review of the Bin 1 Project has to be evaluated in the context of these increases.

LPG Propylene Dryer and Splitter:

The DCR's propane-propylene splitter and associated skid have been idle since November 2003 when the previous owner decided to stop the production of refinery grade propylene. The Bin 1 Project seeks to restore the production of refinery grade propylene at the DCR. Operationally, there are a few potential options to recommission the use of the propane-propylene production skid. The planned approach involves changing the existing propylene skid regenerative sulfur guard reactors consumable

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potassium hydroxide treaters. The solid potassium hydroxide will remove both water and sulfur compounds from production propylene. LPG will continue to be dried with the regenerative propylene dryers, as has been done since 2004, when the original LPG dryer skid was taken out of service. This will allow the DCR to resume production of refinery grade propylene without having to replace the old LPG dryer.

Redundant Sour Water Stripper:

A new redundant 500 gpm SWS will be constructed as part of the Bin 1 Project. Wash water will be injected upstream of the hydrocracker reactor effluent air coolers to prevent salt deposition. Hydrogen sulfide and ammonia liberated during the hydrocracking process combine to form ammonium bisulfide salts, which deposit around the effluent air coolers. Such salt deposits cause unwanted pressure drop, under deposit corrosion and risk of loss of containment if not controlled by appropriate wash water rates.

Additionally, the Bin 1 Project is expected to increase sour water production in the refinery. The new SWS will assist in handling this additional load.

Upgrade of the Diglycolamine Scrubbing System:

The refinery's DGA system will be upgraded as part of the Bin 1 project to provide increased reliability by making improvements that will result in improved amine solution quality. The proposed modifications to the DGS scrubbing system include the following:

- Install a coalescer vessel downstream of the existing rich DGA flashdrum (24-D-302) which will aid in the removal of entrained oil from the process;
- Install new full flow rich DGA filtration equipment, a new slip stream rich DGA filtration vessel with particulate filter, and a new water wash tower upstream of the sponge oil tower (24-C-8);
- Install piping upgrades;
- Revamp existing DGA sump (24-D-11) system;
- Install new pumpout system from DGA equipment to the revamped sump;
- Install a nitrogen blanketing system on the lean DGA storage tank (33-TC-1);
- Install a back-flush connection on the cooling water piping exchangers (24-E-24);
- Revamp antifoam system to a permanent installation;
- Modifications to piping in order to bypass exchangers (24-E-26);
- Increase the rating for heat exchangers (24-E-25) by increasing the steam pressure from 40 psig to 175 psig thereby improving the regeneration operation; and

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- Addition of a trim cooler to the lean/rich amine circuit to lower the rich air cooler DGA temperature and minimize corrosion in the rich amine stream.

The principal unit operations directly affected by the Bin 1 project are the crude unit and the FCU. Additionally, because the Bin 1 project potentially affects other downstream units, such as other process units, process heaters and storage and loading facilities, it is necessary to examine these potential impacts.

Discussion of Operating Units Affected by the Bin 1 Project:

The FCU, the FCCU and trains 2 through 4 of the HDU receive part or all of their feeds from the crude unit. The following discussion examines each of these affected unit operations:

- The changes to the FCU have been described above. The emissions impacts are evaluated in more detail under the discussion “Regulatory and Technical Analysis”.
- The FCCU is presently constrained by the capacity of the air blower. No modifications of the air blower are planned at this time. Additionally, the FCCU is presently permitted to operate at its design feed rate of 82 MBPD. Under current operating scenarios, the DCR purchases intermediate feedstock as needed to keep the FCCU operation optimized. Therefore, without modifications to the FCCU itself, it is not possible to increase the throughput beyond currently permitted operations.
- The HDU trains 2 through 4 are constrained by their hydrogen requirements. Hydrogen to the HDUs is supplied by the SMR hydrogen plant and the CCR reformer. Neither of these 2 unit operations are being modified.

The alkylation, polymerization, HDUs and the CCR reformer receive part or all of their feeds from the FCU. The following discussion examines each of these affected unit operations:

- The alkylation and polymerization units have no emission points with the exception of fugitive emissions. Since these units will not be modified by additional equipment, the Bin 1 project will not result in a change in emissions.
- As described above, the HDUs continue to be constrained by the availability of hydrogen.
- The DCR is presently operating the CCR at its full capacity by purchasing intermediate feedstocks. Therefore, absent a modification to the CCR itself, its capacity will remain unaffected by the FCU UOP.

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- The firing duty of affected ancillary process heaters will remain unaffected for the same reason.

Other affected unit operations of the Bin 1 project include the SRP, cooling tower, intermediate and product storage facilities, product loading operations and the power plant boilers.

- The Bin 1 project will increase the loading to the SRP by approximately 8 %. This increase in acid gas loading is attributable to the additional loading from the SWS and DGA regeneration system. While, the project related emissions impacts are evaluated in more detail under the discussion “Regulatory and Technical Analysis”, the incremental increase is well within the existing capacity of the SRP. Consequently there are no proposed changes to the existing SRP.
- The Bin 1 project is expected to increase the cooling water requirements by 2,500 gpm. This additional flow is within the existing cooling water capabilities of the DCR. The emissions impacts of the increased cooling water flow are evaluated in more detail under the discussion “Regulatory and Technical Analysis”.
- The proposed optimizations of the Crude Unit and FCU will not result in an increase of flow of produced intermediates and products within the refinery. Emissions from working and breathing losses associated with the storage of produced intermediates and products will not be impacted because outside intermediates previously purchased and used for refinery operation will be decreased by an amount equivalent to any increases realized by the Crude Unit and FCU optimizations. Thus, the operation of the refinery at the proposed Crude and FCU throughput would not impact the emissions from intermediate and product storage.
- Product loading will also remain unchanged for the same reason.
- The DCR Power Plant Boilers No. 1, 2, 3, and 4 are used to produce the majority of the steam at the DCR. Other steam sources include the FCCU, FCU, and gasification units. Steam is required to support the proposed unit modifications for the DCR Upgrade and Optimization Project. This includes incremental steam increases for the proposed LPG propylene dryer and splitter and 500 gpm SWS installations. The incremental steam needs for the entire DCR Upgrade and Optimization Project will be met by the refinery’s existing steam generation operations and anticipated increases in gasifier capacity utilization. Thus, the DCR Upgrade and Optimization Project will not require any additional steam to be produced by the DCR and there will be no increase in emissions from DCR Power Plant Boilers as a result of the proposed project.

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Section 2: Project Analysis

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Applicable Requirements & Regulatory Review:

Table 1 provides a list of applicable requirements.

Table 1: Applicable Requirements

| REGULATION | DESCRIPTION | REGULATORY LIMIT / REQUIREMENT | COMPLIANCE METHODOLOGY |
|------------|--|--|--|
| 1102 | Permits | Except as exempted in Section 2.2, no person shall initiate construction, install, alter or initiate operation of any equipment or facility or air contaminant control device which will emit or prevent the emission of an air contaminant prior to receiving approval of his application from the Department: 2.1.3. For equipment, a facility or an air contaminant control device that is not subject to Section 2.1.1 or 2.1.2, the person shall submit to the Department an application for a permit pursuant to Section 11 of this regulation. | Permit application has been submitted as part of the Bin 1 Project |
| 5 | Particulate Emissions From Industrial Process Operations | PM emissions not to exceed those specified in Section 5.2 and Table 4 of this regulation. | Annual stack testing to demonstrate compliance with more stringent permit limits based on the PTE of the FCU equipped with a WGS system as a control device |
| 9 | SO ₂ Emissions From Industrial Operations | SO ₂ emissions to be controlled to a limit that meets the ambient air quality requirements. | Existing controls limit stack emission to 25 ppmvd @ 0% O ₂ on a 365-day rolling average and 50 ppmvd @ 0% O ₂ on a 7-day rolling average. |
| 14 | Visible Emissions | 20% percent opacity not to be exceeded for an aggregate of more than 3 minutes in any 1 hour or more than 15 minutes in any 24 hour period. | Maintain operating parameters in accordance with approved alternate monitoring plan. |

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| 17 | Source Monitoring, Record keeping and Reporting | 2.1 Upon written request of the Department, an owner or operator of an air contaminant source shall, at his expense, install, maintain, and use emission monitoring devices, keep records, and make periodic reports to the Department on the nature and amount of emissions from such source. The Department shall make such data available to the public as reported and as correlated with any applicable emission standards or limitations. | CEMS for NO _x , SO ₂ , O ₂ , CO ₂ , CO and flow. |
| 20 and 40 CFR Part 60 | NSPS | H ₂ S content in RFG not to exceed 162 ppm on a 3 hour average basis | CEMS |
| 1125 | Requirements for Pre-construction Review | Section 2 applies to NA NSR pollutants and Section 3 to PSD NSR pollutants | See discussion under “Regulatory and Technical Analysis” |
| 39 | NO _x Budget Trading Program | Ozone season (May 1 through September 30) NO _x allocation of 97 tons. This permitting action does not affect the allocation. | CEMS |
| 1142 | Specific Controls | 0.04 lb NO _x /mmBtu on a 24 hour rolling average basis | CEMS |
| 40 CFR Part 64 | CAM Rule | CAM is an applicable requirement. However, the deadline for submission of a CAM plan will be the renewal date of the Title V permit ⁶ . | N/A |

⁶ The initial TV permit for the crude unit heaters and FCU was issued in May 2008. Its first renewal will therefore be due in 2013.

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Regulatory & Technical Analysis:

As described in the “Background” of this memorandum, the SCR portion of the Bin 1 project was carved out of the application and permits were issued on May 14, 2008. In order to present a comprehensive analysis of the project related emissions changes the SCR portion of the project related changes is shown in Table 2 below:

Table 2: Crude Unit UOP – SCR Project

| Unit | Pollutant (TPY) | | | | | | |
|--------------|-----------------|-----------------|-----|------|---------------------|--------------------------------|--------|
| | NO _x | SO ₂ | VOC | CO | PM/PM ₁₀ | H ₂ SO ₄ | Pb |
| 21-H-701 B/L | 77.7 | 20.3 | 0.2 | 1.0 | 12.4/12.4 | 0.2 | 0.0003 |
| 21-H-2 B/L | 106.8 | 4.8 | 2.2 | 0.9 | 2.3/2.3 | 0 | 0.0004 |
| PTE 21-H-701 | 39.9 | 52.7 | 6.0 | 59.9 | 39.9/39.9 | 1.6 | 0.001 |
| PTE 21-H-2 | 21.0 | 27.7 | 3.2 | 31.5 | 21.0/21.0 | 0.8 | 0.0005 |
| Net change | -123.6 | 55.3 | 6.8 | 89.5 | 46.2/46.2 | 2.2 | 0.001 |

The net change in emissions shown in Table 2 will be incorporated later in the analysis for evaluating the Bin 1 project related emissions changes.

Emissions Analysis for the FCU on a Pollutant Specific Basis:

The baseline period selected for this analysis is a 24-month period from May 2004 through November 2006.⁷ Table 3 shows the past actual emissions from the FCU during the baseline period.

Table 3: Baseline Emissions from the FCU

| Unit | Pollutant (TPY) | | | | | | |
|------|-----------------|-----------------|-----|-------|---------------------|--------------------------------|-------|
| | NO _x | SO ₂ | VOC | CO | PM/PM ₁₀ | H ₂ SO ₄ | Pb |
| FCU | 674.5 | 174.0 | 7.3 | 690.3 | 206.3/582.9 | 252.3 | 0.065 |

⁷ AQM did not approve of a contiguous 24 month period because there were several months of atypical operations during this time frame.

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FCU PTE Calculations:

For SO₂ and H₂SO₄

Gas flow to scrubber: 43,042 lb-mole/hr

Coke burn rate: 60,900 lb/hr

Flue gas moisture: 19.3 mole %

Inlet gas O₂, wet: 2.63 mole %

Inlet gas flow dry: [43,042 lb-mole/hr][1- 19.3/100]
= 34,735 lb-mole/hr

Inlet gas O₂, dry: [2.63 mole %][1- 19.3/100] = 3.26 mole %

Inlet gas flow dry & 0% O₂: [34,735 lb-mole/hr][1 - 3.26/100/0.209]
= 29,318 lb-mole/hr

Inlet SO₂ @ 0% O₂: 4,303 ppmvd

Outlet SO₂ @ 0% O₂: 25 ppmvd
= [29,193 lb-mole/hr][25/1.0 E +06]
= 0.73 lb-mole/hr

SO₂ Corrected Outlet gas @ 0% O₂: [29,318 lb-mole/hr][1 - (4,303 - 25)/10 E+06]
= 29,193 lb-mole/hr

Inlet SO₃ @ 0 % O₂: [4,303 ppmvd SO₂][0.91 % conversion⁸]
= 39.16 ppmvd
= 1.15 lb-mole/hr

WGS outlet SO₃: [1.1.5 lb-mole/hr][1 - 0.4]⁹
= 0.69 lb-mole/hr

PTE SO₂: 0.73 lb-mole/hr][64 lb SO₂/lb-mole][4.38 ton-
hr/lb-year]
= **204.6 TPY**

⁸ Oxidation (conversion) factor based on 95 % CI of test data.

⁹ Belco guarantee for SO₃ removal is 40 %.

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As a result of the Bin 1 Project, the FCU coke burn rate will increase from the present rate of 47 Mlb/hr to 60.9 Mlb/hr because of the modifications to enhance performance of the FCU air blower and installation of an oxygen injection system. The above PTE of 204.6 TPY is based on the increased coke burn rate and the accompanying increased flow. At this increased flow of 5 %¹⁰, the SO₂ concentration corresponds to 22.28 ppmvd @ 0% O₂. Based on this concentration, the annual FCU SO₂ emissions are calculated as follows:

$$\begin{aligned} \text{Revised PTE SO}_2: & \quad [22.28 \text{ ppm}/25 \text{ ppm}][204.6 \text{ TPY}] \\ & \quad = \underline{\underline{182.3 \text{ TPY}}} \end{aligned}$$

H₂SO₄ emissions are a function of the SO₂ to SO₃ conversion.

$$\begin{aligned} \text{PTE H}_2\text{SO}_4: & \quad [0.69 \text{ lb-mole SO}_3/\text{hr}][1 \text{ lb-mole H}_2\text{SO}_4/\text{lb-mole} \\ & \quad \text{SO}_3][98 \text{ lb H}_2\text{SO}_4/\text{lb-mole H}_2\text{SO}_4][4.38 \text{ ton-hr/lb-} \\ & \quad \text{year}] \\ & \quad = \underline{\underline{295.7 \text{ TPY}}} \end{aligned}$$

For NO_x:

$$\begin{aligned} \text{WGS inlet NO}_x \text{ concentration:} & \quad 90 \text{ ppm}^{11} \\ \text{PTE NO}_x: & \quad [43,042 \text{ lb-mole/hr}][90 \text{ ppm NO}_x][1.0 \text{ E-06 parts} \\ & \quad \text{flue}][46 \text{ lb/lb-mole NO}_x][4.38 \text{ ton-hr/lb-year}] \\ & \quad = \underline{\underline{780.5 \text{ TPY}}} \end{aligned}$$

In order to not trigger NA NSR, Premcor's application indicates FCU NO_x emissions will be restricted to the existing permit limit of 689.8 TPY¹². Compliance will be based on CEMS.

For PM:

As with the PCUP application, Premcor's application presumed all PM emissions to be PM₁₀. Furthermore, since H₂SO₄ emissions are a subset of PM₁₀ emissions, the PTE for PM₁₀ was developed as the sum of TSP and H₂SO₄ emissions.

$$\begin{aligned} \text{PTE TSP:} & \quad 1 \text{ lb/1 Mlb coke burn}][60.9 \text{ Mlb coke burn/hour}] \\ & \quad [4.38 \text{ ton-hr/lb-year}] \\ & \quad = \underline{\underline{266.8 \text{ TPY}}} \end{aligned}$$

¹⁰ The PCUP permitting exercise in 2004 was based on a stack flow of 190,198 dscfm @ 0 % O₂. After the Bin 1 Project is implemented, stack flow will increase to 223,170 dscfm.

¹¹ Average NO_x concentrations based on 2006 CEMS data plus 1 standard deviation

¹² See NA-NSR discussion below.

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PTE PM₁₀: [266.8 + 295.7] TPY

= **562.4 TPY**

For CO:

Outlet gas CO: 200 ppmvd

CO EF: 0.03 lb/mmBtu¹³: 1.45 E-05 lb/dscf

PTE CO: [34,735 lb-mole/hr][385.3 SCF CO/lb-mole
CO][1.45 E-05 lb CO/SCF CO][4.38 ton-hr/lb-year]
= **852 TPY**¹⁴

Premcor has proposed accepting a lower limit of 694.4 TPY as an enforceable limitation in order to not trigger PSD for CO.

For VOC:

VOC EF: 0.14 lb/mmDSCF¹⁵

VOC PTE: [43,042 lb-mole/hr][0.14 lb/mmDSCF][385.3
DSCF/lb-mole][4.38 ton-hr/lb-year]
= **8.2 TPY**

For Pb:

Pb EF: 4.37 E-04 lb/Mlb of coke burn¹⁶

PTE Pb: [4.37 E-04 lb/Mlb][60.9 Mlb/hr][4.38 ton-hr/lb-
year]
= **1.17 E-01 TPY**

For RSC:

RSC: 3.68 E-05 lb/Mlb of coke burn¹⁷

PTE RSC: [3.68 E-05 lb/Mlb][60.9 Mlb/hr][4.38 ton-hr/lb-
year]
= **9.82 E-03 TPY**

¹³ CO EF = 200 ppm CO/1.0 E6][1 lb mole CO/385.3 SCF CO][28 lb CO/lb mole CO]

¹⁴ See PSD-NSR discussion below

¹⁵ From existing permit

¹⁶ Emissions of Trace Compounds from Cat Cracking Regenerators, Exxon R & E.

¹⁷ Emissions of Trace Compounds from Cat Cracking Regenerators, Exxon R & E.

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For NH₃:

NH₃ emissions are based on a slip of 10 ppmvd NH₃ @ 0 % O₂ from the SNCR system in the FCU COB and on a removal efficiency of 60 % in the WGS.

PTE NH₃: $[10\text{ppm}][10\text{ E-}06][17\text{ lb NH}_3/\text{lb-mole}][29,318\text{ lb-mole/hr}]/[1 - (3.26/100)/0.209][1 - 0.609][4.38\text{ ton-hr/lb-year}]$
= **10.2 TPY**

Table 4 shows the net emissions changes from the FCU and the contemporaneous emission changes

Table 4: Net Emissions Changes from the FCU

| Unit | Pollutant (TPY) | | | | | | |
|------------|-----------------|-----------------|-----|-------|----------------------|--------------------------------|-------|
| | NO _x | SO ₂ | VOC | CO | TSP/PM ₁₀ | H ₂ SO ₄ | Pb |
| FCU B/L | 674.5 | 174.0 | 7.3 | 690.3 | 206.3/582.9 | 252.3 | 0.065 |
| PTE FCU | 689.8 | 182.3 | 8.2 | 694.4 | 266.8/562.4 | 295.7 | 0.12 |
| Net change | 15.3 | 8.3 | 0.9 | 4.1 | 60.5/-20.5 | 43.4 | 0.052 |

LPG dryer and Splitter PTE Calculations:

The only emissions from the recommissioned installation of the LPG dryer and splitter are fugitive VOC emissions from equipment leaks. Potential fugitive emissions are estimated using EPA’s guidance correlations¹⁸. The Bin1 project related fugitive emissions are addressed below under the heading “Fugitive Emissions”.

Redundant SWS and DGA Scrubbing System:

The registration of the redundant SWS and DGA Scrubbing System are addressed in Section 6 of this memorandum.

Fugitive Emissions:

Project related fugitive emissions are a result of additional components that will be installed. These include pumps, control valves, check valves, relief valves, drains,

¹⁸ Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017.

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strainers, flanges and connectors. Table 5 provides the breakdown of fugitive emissions from equipment leaks.

Table 5: Bin 1 Project Related Fugitive Emissions¹⁹

| Unit | Component | Number | VOC (TPY) |
|-----------------------|--------------------|---------------|------------------|
| FCU Upgrade | Valves | 832 | 1.45 |
| PP Dryer and Splitter | Control valves | 2 | 0.003 |
| DGA Upgrade | Check valves | 1 | 0.002 |
| Redundant SWS | PRVs | 1 | 0.002 |
| | Drains | 12 | 0.025 |
| | Strainers | 1 | 0.002 |
| | Flanges/connectors | 2,345 | 3.67 |
| | Pump seals | 26 | 0.10 |
| Total | | 3,220 | 5.5 |

Project Related Increases to the SRP:

The SRP will see approximately 8 % increase in the acid gas loading. This incremental loading will result in incremental increase in fuel combustion. The incremental increase in SRP loading (8%) is then multiplied by this value on a pollutant specific basis to determine the potential incremental increase in emissions. The incremental increase is provided in Table 6.

¹⁹ The fugitive emissions from the Crude unit upgrade are not included here because they have been accounted for in the SCR project

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Table 6: Incremental Increase in SRP Emissions (TPY):

| Source | SRP Load Increase | Pollutant | Emissions (TPY) |
|--------|-------------------|--------------------------------|-----------------|
| SRP | 8 % | NO _x | 1.7 |
| | | SO ₂ | 13.8 |
| | | CO | 0.09 |
| | | VOC | 0.02 |
| | | PM/PM ₁₀ | 2.3/2.3 |
| | | H ₂ SO ₄ | 0.27 |

Based on the above analysis, the Bin 1 project related emissions changes are as shown in Table 7.

Table 7: Bin 1 Project Related Emissions Changes (TPY)

| Unit | NO _x ²⁰ | SO ₂ | VOC | CO | PM/PM ₁₀ | H ₂ SO ₄ | Pb |
|----------------------------|-------------------------------|-----------------|-------------------|-------------|---------------------|--------------------------------|--------------|
| Crude Unit & Crude Heaters | -58.8 | 55.3 | 7.1 ²¹ | 89.5 | 46.2/46.2 | 2.2 | 0.0011 |
| FCU | 15.3 | 8.3 | 0.9 | 4.1 | 60.5/-20.5 | 43.4 | 0.052 |
| Bin 1 Fugitive Emissions | - | - | 5.34 | - | - | - | - |
| SRP | 1.7 | 13.8 | 0.02 | 0.09 | 2.28/2.28 | 0.27 | - |
| Cooling Tower | - | - | 0.5 | - | 0.27/0.27 | - | - |
| Total | -41.8 | 77.4 | 13.8 | 93.6 | 109.2/28.3 | 45.8 | 0.053 |

²⁰ The actual NO_x reductions will be 106.6 TPY based on 123.6 TPY decreases from the crude unit and increases of 15.3 TPY from the FCU and 1.7 TPY from incremental increases in unmodified ancillary emission units.

²¹ Inclusive of fugitive emissions from new equipment being installed on the crude unit.

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NA NSR and PSD Review:

The DCR is located in New Castle County in the State of Delaware. New Castle County is classified as being in severe non-attainment of the 1-hour NAAQS for ozone. Because NO_x and VOCs are precursors to the formation of ground level ozone, the emissions of these pollutants have to be reviewed in the context of NA-NSR applicability. Furthermore, the entire State is classified as being in non-attainment of the NAAQS for PM_{2.5}. Because SO₂ is a precursor to the formation of fine particulate matter, the emissions of this pollutant also has to be reviewed in the context of NA-NSR applicability. The State of Delaware is in attainment of the NAAQS for all other pollutants. Therefore, emissions of all other pollutants (SO₂, NO_x, CO, PM₁₀, H₂SO₄ and Pb) have to be evaluated for PSD applicability.

There are two relevant issues that warrant discussion in this memorandum because they have a direct bearing on the NSR analysis. First, the selection of a representative baseline period is relevant because all increases and decreases are measured against the baseline, and second, the impact of the recent federal rule making that classifies PM_{2.5} as a non-attainment pollutant with an effective date of July 15, 2008 must be evaluated.

Discussion of Baseline:

Premcor's draft application had identified a baseline period of 24 months from October 2003 through September 2005. AQM did not find this period to be acceptable because it did not satisfy the requirements of Regulation No. 1125. In accordance with Section 1.9 of this Regulation, "actual emissions" is defined as follows:

"Actual emissions" means the actual rate of emissions of a pollutant from an emission unit, as determined in accordance with subparagraphs (1) through (3) below.

- 1. In general, actual emissions as of a particular date shall equal the average rate, in tons per year, at which the unit actually emitted the pollutant during a two -year period which precedes the particular date and which is representative of normal source operation. The Department shall allow the use of a different time period upon a determination that it is more representative of normal source operation. Actual emissions shall be calculated using the unit's actual operating hours, production rates, and types of materials processed, stored, or combusted during the selected time period.*

Based on this definition, the appropriate baseline period would appear to be January 2005 through December 2006. However, AQM believed the first 7 months of the proposed baseline period in the draft application (i.e. from October 2003 through April 2004) were not representative of Premcor's operations because the refinery was owned by Motiva at that time and Motiva's operating model is different from Premcor's. In response to this

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concern, Premcor revised the baseline to include the months of May and June 2004 (2 months), August and September 2004 (2 months), December 2004 through September 2005 (10 months) and February 2006 through November 2006 (10 months). This period was chosen because turnaround activities at the refinery of the FCU, FCCU, SHU and hydrocracker unit precluded consideration of a contiguous 24 month period. AQM found this proposal to be acceptable and has conducted its Bin 1 project related emissions comparison on the basis of the proposed baseline.

Discussion of PM_{2.5}:

The Bin 1 project application was developed using PM₁₀ as a surrogate for PM_{2.5} emissions. On May 16, 2008, EPA provided a notice in the Federal Register of the Implementation of the NSR Program for PM_{2.5}²². This program will have an effective date of July 15, 2008.

The major highlights of the new rule and how it impacts the DCR are as follows:

- PM_{2.5} is a non-attainment pollutant and the provisions of 40 CFR Part 51, Appendix "S" are applicable. This appendix sets forth EPA's Interpretative Ruling on the preconstruction review requirements for stationary sources of air pollution (not including indirect sources) under 40 CFR subpart I and section 129 of the Clean Air Act Amendments of 1977, Public Law 95-95, (note under 42 U.S.C. 7502). A major new source or major modification which would locate in any area designated under section 107(d) of the Act as attainment or unclassifiable for ozone that is located in an ozone transport region or which would locate in an area designated in 40 CFR part 81, subpart C, as nonattainment for a pollutant for which the source or modification would be major may be allowed to construct only if the stringent conditions set forth in this appendix are met. These conditions are designed to insure that the new source's emissions will be controlled to the greatest degree possible; that more than equivalent offsetting emission reductions (*emission offsets*) will be obtained from existing sources; and that there will be progress toward achievement of the NAAQS. For each area designated as exceeding a NAAQS (nonattainment area) under 40 CFR part 81, subpart C, or for any area designated under section 107(d) of the Act as attainment or unclassifiable for ozone that is located in an ozone transport region, this Interpretative Ruling will be superseded after June 30, 1979 (a) by preconstruction review provisions of the revised SIP, if the SIP meets the requirements of Part D, Title 1, of the Act; or (b) by a prohibition on construction under the applicable SIP and section 110(a)(2)(I) of the Act, if the SIP does not meet the requirements of Part D. The Ruling will remain in effect to the extent not

²² FR Vol. 73, No. 96, pages 28321 through 28350.

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superseded under the Act. This prohibition on major new source construction does not apply to a source whose permit to construct was applied for during a period when the SIP was in compliance with Part D, or before the deadline for having a revised SIP in effect that satisfies Part D. Because the State of Delaware has until 2011 to revise its SIP, the provisions of this appendix will be applicable for the present review rather than the provisions of Regulation No. 1125.

- SO₂ is a precursor to the formation of PM_{2.5} and is therefore, also a non-attainment pollutant.
- Major source thresholds are as follows: PSD: 100 TPY for listed categories and 250 TPY for all others; NA NSR: 100 TPY.
- Significant Emissions Rates are as follows: Direct PM_{2.5}: 10 TPY, SO₂: 40 TPY, NO_x: 40 TPY, VOC: 40 TPY or lower as determined by SIP and NH₃: to be determined by SIP.
- Until 2011, condensable emissions are not required to be included for applicability determinations, permits are not required to establish limits on condensable emissions and impact analyses and offsets do not need to consider condensable emissions. However, States have the authority to include condensable emissions.
- Control Technology: BACT and LAER apply to direct PM_{2.5}, SO₂, and other included precursors.
- PSD Air Quality Impact Analyses applies to PM_{2.5} for NAAQS and AQRVs.
- Nonattainment NSR Offsets applies for direct PM_{2.5} emissions and included precursors at a minimum 1:1 ratio and the preferred trading ratio for Interpollutant Offset Trading is as follows: 200 Tons NO_x = 1 Ton PM_{2.5} and 40 Tons of SO₂ = 1 Ton PM_{2.5}.

NA-NSR

NA-NSR is evaluated by making a comparison of past actual emissions to the future potential emissions. Additionally, because Regulation No. 1125 has a “dual source” definition as that term applies to major stationary sources, the evaluation of the emissions changes has to be performed at two levels²³. This means first the evaluation of the emissions changes has to be conducted for the emissions unit that is being constructed or modified, and second, the entire facility (i.e. all the pollutant emitting activities belonging

²³ Under the definition of “major stationary source” in Regulation No.1125, Section 2.2 (D), the term “installation” is defined to mean “an identifiable piece of process, combustion, or incineration equipment.” This definition of major source means that the Regulation No. 25, Section 2 applicability test must be performed at two levels (i.e., for each identifiable piece of equipment and for the source as a whole).

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to the same industrial grouping and which are located at one or more contiguous properties and are under common control) has to be evaluated to assess whether the Bin 1 project will result in a net significant emissions increase that is greater than the regulatory significance thresholds in Regulation No. 1125. Therefore the Bin 1 project related NO_x and VOCs emissions changes have been evaluated in this context. However, with regard to the Bin 1 project related PM_{2.5} emissions changes, the provisions in 40 CFR 51, Appendix “S” are applicable until 2011 instead of the provisions of Regulation No. 1125 as explained above. Therefore, the “dual source” definition is not applicable to the evaluation of the Bin 1 project related PM_{2.5} emissions changes.

The Bin 1 project related NA-NSR pollutant emissions changes have been conducted as follows:

- For NO_x, and VOCs as precursors for the formation of ozone pursuant to Section 2 of Regulation No. 1125;
- For PM_{2.5} pursuant to 40 CFR 51, Appendix “S”; and
- For SO₂ (as a precursor to the formation of PM_{2.5}) pursuant to 40 CFR 51, Appendix “S” and the Implementation of the NSR Program for PM_{2.5}²⁴.

Table 8 shows the NA-NSR emissions analysis inclusive of the contemporaneous emissions changes for the past 5 years.

Table 8: NA-NSR Emissions (TPY) Analysis

| Project Component | NO_x | VOCs | PM₁₀ |
|--|-----------------------|-------------|------------------------|
| DCR UOP | -41.8 | 13.8 | 28.3 |
| Creditable Reductions from FCCU LNB Installation ²⁵ | -51.6 | - | - |
| Contemporaneous Emissions Changes | 117.8 | 2.2 | - 937.3 |
| Net Emissions Changes | 24.4 | 16.0 | - 909.0 |
| NA-NSR Significance Threshold | 25 | 25 | 10 |
| NA-NSR Review Required | No | No | No |

²⁴ Federal Register: May 16, 2008 (Volume 73, Number 96)] [Rules and Regulations] Pages 28321-28350.

²⁵ Premcor is using 51.6 TPY reductions obtained from the FCCU NO_x project when LNBs were installed in 2007 for the FCCU COB, pursuant to paragraphs 11(a), 14 and 17 of the FCCU NO_x Agreement dated July 7, 2007. Additionally, pursuant to paragraph 16 of the FCCU NO_x Agreement, the NO_x reductions of 51.6 TPY shall be made federally enforceable and shall survive the termination of the Agreement.

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The Bin 1 project on the whole will result in 41.8 TPY reductions in NO_x emissions. However, this figure is based on the Company accepting a federally enforceable limitation on the FCU PTE at the existing permit limit of 689.8 TPY. Baseline FCU NO_x emissions were 674.5 TPY resulting in a net increase of 15.3 TPY, which by itself does not exceed the significance threshold of 25 TPY. However, because the FCU coke burn will increase from 47.1 Mlb/hr to 60.9 Mlb/hr as a result of the Bin 1 project, the FCU's NO_x PTE will be 780 TPY²⁶. Therefore, absent a federally enforceable limitation on the FCU NO_x PTE, NA-NSR would have been triggered.

In accordance with the requirements of Section 1.8 of Regulation No. 1125:

Any stationary source that implements, for the purpose of gaining relief from Regulation 1125, Section 3, by any physical or operational limitation on the capacity of the source to emit a pollutant, including (but not limited to) air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design and the limitation or the effect it would have on emissions is enforceable, not withstanding any emission limit specified elsewhere in the State of Delaware Regulations Governing the Control of Air Pollution. If a source petitions the Department for relief from any resulting limitation described above, the source is subject to review under Regulation 1125, Sections 2 and 3 as though construction had not yet commenced on the source or modification.

Thus, we are recommending a condition be included in the permit to this effect.

The contemporaneous emissions changes for the past 5 years are shown in Table 9.

²⁶ See FCU NO_x PTE calculation.

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Table 9: DCR Contemporaneous Emissions Changes for NA Pollutants

| Project Name | Date | Net Emissions Changes (TPY) | | |
|---|------|-----------------------------|----------------------|------------------|
| | | VOC | NO _x | PM ₁₀ |
| Hydrocracker Corrosion Control Project | 2006 | 0.76 | 0.01 | 0.01 |
| FCCU LNB | 2006 | 0 | -250 | 0 |
| EtOH Blending Project | 2006 | 0.59 | 0 | NA |
| DuPont SAR and Steam Benefits | 2005 | -0.03 | -64.2 | -1.20 |
| Tier II Project | 2004 | 0.14 | 4.01 ²⁷ | 0.93 |
| Ether Plant Shut Down | 2004 | -1.04 | 0 | 0 |
| PCUP ²⁸ | 2006 | 0 | 100.1 ²⁹ | -895 |
| Boiler 2 NO _x Control Project | 2004 | 0 | -310.8 ³⁰ | -48.2 |
| SRA Fuel Gas Increase | 2003 | 0 | 24 | 4.3 |
| SRA Pit Vapor Recovery | 2003 | 0 | 3.4 | 0.6 |
| 29-H-9 Heater Retubing | 2002 | 0 | 4.2 | 0.1 |
| Net Emissions Changes Inclusive of CD | | 0.15 | -489.3 | -938.5 |
| Net Emissions Changes Exclusive CD | | 0.15 | -178.5 | -938.5 |
| CD Allowed Creditable NO _x Offsets for ULSD Projects | | | -67 ³¹ | |
| Total Net Emissions Change | | 0.15 | -556.3 | -938.5 |

²⁷ The 3rd addendum to Civil Action H-01-0978 modified Paragraph 29 of the CD to allocate 26 TPY NO_x emissions for use as future creditable offsets for Tier II Gasoline Projects. The DCR Tier II Project consumed 4.01 TPY of this allocation.

²⁸ The PCUP triggered NA-NSR for VOCs because it resulted in a net increase of 33.8 TPY VOCs. Of this 33.8 TPY increase the PCUP's contribution was 11.8 TPY. Therefore, Premcor provided 15.3 TPY at an offset ratio of 1.3:1 from the creditable VOC offsets that it has possessed since 1995 when Star Enterprises (a previous owner of the DCR) covered several tanks at the wastewater treatment plant and thereby obtained 180 TPY as creditable reductions. After the PCUP project was constructed, the DCR continued to retain 134.7 TPY as future creditable reductions. Therefore, for the Bin 1 Project emissions comparison, the contemporaneous VOC emissions were reset to zero effective 2004.

²⁹ The PCUP project emissions changes were revised from 174.1 TPY to 100.1 TPY based on the following: the FCU's permitted NO_x limit was 689.8 TPY versus 714.7 TPY (the limit sought in the PCUP application), the permitted FCCU NO_x limit was 24.9 TPY lower than requested, and the 2 package boilers were permitted at 24.9 TPY versus 49.1 TPY sought in the application.

³⁰ The NO_x reductions that resulted from upgrading Boiler 2 are not creditable because they are required by the CD.

³¹ The 3rd addendum to Civil Action H-01-0978 modified Paragraph 31 of the CD to allocate 67 TPY NO_x emissions for use as future creditable offsets for ULSD Projects

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In this analysis, AQM has used PM₁₀ as a surrogate for PM_{2.5} emissions. However, because the new NSR regulation as it applies to PM_{2.5} does not allow using PM₁₀ as a surrogate for PM_{2.5} emissions it is necessary to first determine the baseline PM_{2.5} emissions and then assess the post-modification PTE. There is no historic data for PM_{2.5} emissions. Therefore, AQM has developed a method based on past stack testing and engineering analysis to evaluate the associated PM_{2.5} emissions changes.

Review under NSR is triggered for PM_{2.5} if a significant emission rate increase as a result of a modification exceeds threshold of 10 TPY. Because there is no promulgated EPA test method for PM_{2.5}, we have used best available data and engineering judgment to determine whether NA-NSR has been triggered.

The DCR UOP application indicates a net increase of 60.5 TPY of TSP emissions from the FCU³². It is not known through promulgated sampling methods what fraction of the TSP is PM_{2.5}. So AQM reviewed test data from particulate testing performed on the FCU CO Boiler ESP exhaust (pre-scrubber) in April 1992. The testing consisted of sampling for TSP using EPA RM 5 and condensable particulate matter using EPA RM 202. Additionally, a PSD was performed on the suspended (RM 5) portion of the particulate matter collected using a Coulter Multisizer. The multisizer is based on the Coulter Principle whereby particles suspended in a weak electrolyte solution are drawn through a small aperture, separating two electrodes that have an electric current flowing between them. Particles passing through the aperture momentarily increase the impedance of the aperture creating a pulse. According to the principle, the pulse is directly related to the volume of the particle that produced it.

The generated distribution can either be based on volume or number of particles. DCR assumed the 1992 distribution was volume based. In addition, the DCR assumed the particles had unity density (1 g/cm³) therefore, actual particle size equals aerodynamic size. The 1992 distribution suggested the PM_{2.5} portion of the TSP was approximately 11.25%.

From the PCUP application, past actual TSP emissions (pre-scrubber) from the FCU were 276.7 TYP. Post scrubber TSP emissions were permitted at 206.3 TPY. Using the particle distribution from the 1992 test and assuming all particulate matter had unity density and the same PSD applies to post scrubber PM emissions, the following can be surmised:

| | |
|---|-----------|
| FCU PCUP Baseline TSP | 276.7 TPY |
| FCU Baseline TSP PM _{2.5} Fraction | 11.25 % |
| FCU Baseline TSP PM _{2.5} | 31.1 TPY |

³² See Table 7.

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FCU Post WGS TSP Emissions 206.3 TPY
FCU Post WGS TSP PM_{2.5} Fraction 11.25 %
FCU Post WGS TSP PM_{2.5} 23.2 TPY

Post WGS Reduction in PM_{2.5} 7.9 TPY

FCU UOP TSP Emissions 266.8 TPY
FCU UOP TSP PM_{2.5} Fraction 11.25 %
FCU UOP TSP PM_{2.5} Emissions 30.0 TPY

FCU UOP TSP PM_{2.5} vs. FCU Baseline TSP PM_{2.5} -1.1 TPY

As a result of the optimization project, a net decrease 1.1 TPY of PM_{2.5} will occur when a comparison is made to the baseline emissions level.

In addition to the filterable PM_{2.5}, increases or decreases in condensable particulate matter should be evaluated. The EPA considers all condensable PM to be considered PM_{2.5}. The main problem with the current promulgated condensable particulate matter methodology, EPA RM 202, is a significant positive bias results when the dissolution of SO₂ into the impinger water oxidizes to sulfates and is counted as condensable PM. This artifact formation is generally a function of sample duration and SO₂ concentration in the stack gas. The longer the sample duration and the greater the SO₂ concentration, the greater the bias. However, the positive bias can be limited if a nitrogen purge is conducted on the impinger contents immediately following sampling. EPA test data suggest the bias can be reduced by approximately 95% if the post nitrogen purge is conducted.

The April 1992 particulate test consisted of 1-hr sampling runs for condensables. The nitrogen purge was immediately conducted on the impinger contents of the 1992 samples, thereby limiting the potential positive bias caused by the dissolved SO₂. In January 2007, non-condensable and condensable (w/ post N₂ purge) particulate matter testing was conducted on the FCU wet gas scrubber. Table 10 summarizes the non-condensable and condensable results from both the April 1992 and January 2007 tests.

Table 10: Summary of April 1992 and January 2007 Test Results

| | April 1992 | January 2007 |
|-------------------------------------|---------------|-----------------|
| Total PM (lbs/hr) | 124.6 | 37.4 |
| Condensable PM (lbs/hr) | 70.0 | 2.8 |
| Non-Condensable PM (lbs/hr) | 54.6 | 34.5 |
| Condensable Fraction (%) | 56.2% | 7.5% |
| Non-Condensable Fraction (%) | 43.8% | 92.5% |

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The April 1992 and January 2007 particulate fractions can be applied to both the FCU PM₁₀ baseline period and the FCU PM₁₀ Optimization PTE, respectively. PM₁₀ was chosen because it is inclusive of H₂SO₄ emissions which also would be reflected in the condensable test results.

| | |
|--|-----------|
| FCU PCUP Baseline PM ₁₀ Emissions | 582.9 TPY |
| FCU PCUP Baseline PM _{2.5} Fraction (based on condensable PM fraction April 1992 test) | 56.2% |
| FCU PCUP Baseline PM _{2.5} Emissions | 327.6 TPY |
| FCU Optimization PM ₁₀ PTE Emissions | 562.4 TPY |
| FCU Optimization PM _{2.5} Fraction (based on condensable PM fraction from January 2007 test) | 7.5% |
| FCU Optimization PM _{2.5} PTE Emissions | 42.2 TPY |

FCU Pre vs Post Optimization PM_{2.5} Net Emissions -285.4 TPY

Furthermore, if the assumption is made that the net increase of 60.5 TPY of TSP reported in the application is all PM_{2.5}, then reductions from Pre vs Post Optimization project will be no less than 224.9 TPY.

Based on the above analysis, AQM is satisfied that the Bin 1 project will not result in a significant net emissions increase in PM_{2.5} emissions and, consequently, will not trigger NA-NSR review under 40 CFR Part 51, Appendix "S".

PSD

Premcor is a petroleum refinery and a major stationary source of air pollutants which emits, or has the potential to emit, greater than 100 TPY criteria pollutants subject regulation under the CAA. Therefore, the Bin 1 project related emissions increases are subject to review under Section 3 of Regulation No. 1125. The Bin 1 project related emissions changes for attainment pollutants are shown below in Table 11.

Table 11: Bin 1 Project Related Emissions Analysis

| Emissions | NO_x | SO₂ | CO | PM/PM₁₀ | H₂SO₄ | Pb |
|------------------------|-----------------------|-----------------------|-----------|---------------------------|------------------------------------|-----------|
| Bin 1 Project | -41.8 | 77.4 | 93.6 | 109.2/28.3 | 45.8 | 0.05 |
| PSD Significance Level | 40 | 40 | 100 | 25/15 | 7 | 0.6 |
| PSD Triggered | No | Yes | No | Yes/Yes | Yes | No |

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Section 3 of Regulation No. 1125 allows the use of a netting analysis to determine whether a “significant net emission increase” will occur. The netting analysis is conducted as follows:

1. First the emissions increases associated with the project are evaluated on a unit specific basis as shown in Table 10 above. Since the emissions changes associated with SO₂, PM/PM₁₀ and H₂SO₄ are greater than the respective PSD significance thresholds, further evaluation is necessary.
2. A contemporaneous period has to be defined³³. In this case, Premcor proposed a contemporaneous period beginning with the 2nd quarter of 2002 through the beginning of 2008. AQM found this period to be acceptable.
3. The facility wide emissions changes during the contemporaneous period are evaluated including the project related changes.
4. Determine which emissions changes are creditable and on a pollutant specific basis, identify the amount of each contemporaneous and creditable emissions change.
5. Obtain the algebraic sum of all contemporaneous and creditable increases and decreases with the project related emissions changes to determine whether a significant net emissions increase has occurred.

Based on the above analysis, a PSD contemporaneous netting analysis was conducted for with SO₂, PM/PM₁₀ and H₂SO₄, which is shown in Table 12 below.

Table 12: Contemporaneous Netting Analysis for PSD Applicability

| Emissions | SO₂ | PM | PM₁₀ | H₂SO₄ |
|--------------------------|-----------------------|--------------|------------------------|------------------------------------|
| Bin 1 Project | 77.4 | 109.2 | 28.3 | 45.8 |
| Contemporaneous Changes | 148.5 | - 681.0 | - 937.3 | - 241.2 |
| Total | 225.9 | - 571.8 | - 909.0 | - 195.4 |
| PSD Significance level | 40 | 25 | 15 | 7 |
| PSD Review Status | Required | Not required | Not required | Not required |

³³ An increase or decrease in actual emissions is contemporaneous with the increase from the particular change only if it occurs between the date five years before construction on the particular change commences and the date that the increase from the particular change occurs.

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Table 13 shows the basis for the inputs used in developing the contemporaneous emissions changes for all attainment pollutants.

Table 13: Contemporaneous Emissions Changes - 2002 through 2008

| Project | Date | TSP | PM ₁₀ | CO | SO ₂ | H ₂ SO ₄ | Pb | NO _x |
|--|------|---------|------------------|-----------|-----------------|--------------------------------|----------|-----------------|
| Hydrocracker Corrosion Control Project | 2006 | 0.01 | 0.01 | 0.03 | 0.005 | 0.003 | 5.4 E-08 | 0.01 |
| FCCU LNB | 2006 | 0 | 0 | 0 | 0 | 0 | 0 | - 250 |
| EtOH Blending Project | 2006 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DuPont SAR and Steam Benefits | 2005 | - 1.20 | - 1.20 | - 3.20 | - 0.40 | 0 | 0 | - 64.2 |
| Tier II Project | 2004 | 0.93 | 0.93 | 4.05 | 3.24 | 0 | 0 | 4.01 |
| Ether Plant Shut Down | 2004 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PCUP ³⁴ | 2006 | - 664.4 | - 895.0 | 1,704.5 | - 32,312 | - 218.7 | 0.05 | 100.1 |
| Boiler 2 NO _x Control Project | 2004 | - 22.5 | - 48.2 | - 1,887.5 | - 1,590.5 | - 24.8 | - 0.10 | - 310.8 |
| SRA Fuel Gas Increase | 2003 | 4.3 | 4.3 | 6.0 | 4.0 | 0.1 | 0 | 24.0 |
| SRA Pit Vapor Recovery | 2003 | 0.6 | 0.6 | 0.9 | 137.7 | 2.2 | 0 | 3.4 |
| 29-H-9 Heater Retubing | 2002 | 0.1 | 0.1 | 1.0 | 3.6 | 0 | 0 | 4.2 |
| Net Changes Inclusive of CD Reductions | | - 682.2 | - 938.5 | - 174.2 | - 33,754.4 | - 241.2 | 0 | - 489.3 |
| Net Changes Exclusive of CD Reductions³⁵ | | - 682.2 | - 938.5 | - 174.2 | 148.1 | - 241.2 | 0 | - 178.5 |

³⁴ The PCUP triggered NA-NSR for VOCs because it resulted in a net increase of 33.8 TPY VOCs. Of this 33.8 TPY increase the PCUP's contribution was 11.8 TPY. Therefore, Premcor provided 15.3 TPY at an offset ratio of 1.3:1 from the creditable VOC offsets that it has possessed since 1995 when Star Enterprises (a previous owner of the DCR) covered several tanks at the wastewater treatment plant and thereby obtained 180 TPY as creditable reductions. After the PCUP project was constructed, the DCR continued to retain 134.7 TPY as future creditable reductions. Therefore, for the Bin 1 Project emissions comparison, the contemporaneous VOC emissions were reset to zero effective 2004.

³⁵ SO₂ and NO_x reductions from the PCUP and Boiler 2 NO_x Project are not creditable for use in PSD netting transactions or for use as offsets in NA-NSR.

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PM_{2.5} Discussion:

Total suspended particulate matter includes all non-condensable particulate matter regardless of the aerodynamic particle size. However, the particles of interest are those having nominal aerodynamic diameter equal to or less than 2.5 μm . The EPA defines aerodynamic diameter as the diameter of a spherical particle having unit density (1 g/cm^3) that has the same inertial properties in the gas stream as the particle of interest. In other words, all particles that *behave* aerodynamically (regardless of size, shape, or density) like a homogeneous sphere having a diameter equal to 2.5 μm with unit density are of interest.

As noted, the baseline testing for the PCUP application did not include PM_{2.5} speciation. In addition, the EPA does not currently have a promulgated test method specifically for PM_{2.5}. In an effort to quantify the PM_{2.5} emissions from the FCCU, the DCR conducted a particle size distribution test in both May and August of 2005 on the outlet of the FCCU regenerator using laser diffraction (LD) technology. In LD technology light from a laser is shone into a sample of particles which are suspended in a media (i.e. air). The particles scatter the light, smaller particles scattering the light at larger angles than bigger particles. The scattered light is measured by a series of detectors placed at different angles. The captured light on the detectors form the diffraction pattern for the sample. The diffraction pattern is directly related to the particle size through the Mie Theory (based on electromagnetic field equations).

The May and August 2005 tests provided a particle size *volumetric* distribution of the *physical/equivalent* (Stokes) diameter of the particles (assuming $d_{\text{particles}} = 1 \text{ g}/\text{cm}^3$). The test results do not provide a particle size distribution of the *aerodynamic equivalent* diameter of the particles ($d_{\text{particles}} \neq 1 \text{ g}/\text{cm}^3$). However, the PM_{2.5} mass fraction can be determined from the volumetric distribution using a few conservative engineering assumptions. In that respect, all assumptions and engineering estimates made that follow in the explanation of the calculations of the baseline PM_{2.5} emissions and PM_{2.5} reductions were done to provide a conservative underestimation of the PM_{2.5} emissions.

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Baseline PM_{2.5} Emission Calculations / PM_{2.5} Reductions

Table 14 summarizes the results of the particle distribution tests conducted in May and August 2005.

Table 14: PSD Analysis from past Stack Tests

| | May 3-4, 2005 | | | | | August 23-24, 2005 | | | |
|--------------------------|----------------------|------|------|------|---------|---------------------------|------|------|---------|
| | 1 | 2 | 3 | 4 | Average | 1 | 2 | 3 | Average |
| %PM_{2.5} | 67.1 | 69.2 | 71.2 | 68.4 | 69.1 | 67.0 | 66.7 | 69.6 | 67.7 |

The average PM_{2.5} fraction from the seven runs was 68.5%. As previously mentioned the distribution is a volumetric distribution of the particle size found in the sample. Laser diffraction systems are designed so that equal volumes of particles of different sizes yield equal scattering responses. Because there is a cubic relationship between the size of a particle and its volume, volume distributions are susceptible to the appearance of a few large particles. For example, it would take the volume of one thousand 1 μm particles to equal the volume of a single 10μm particle. Even though large particles significantly would sway the distribution, the particle sizing data from the May and August 2005 tests show a heavy distribution of particles in the less than 2.5 μm region, which suggests the majority of particulate matter from the FCCU can be characterized as PM_{2.5}.

If the PM_{2.5} fraction of 68.5% is applied to the PCUP baseline TSP emissions of 973 TPY, then the baseline PM_{2.5} emissions would be equivalent to 667 TPY.

Because the purpose of this exercise is to provide a conservative (understated) estimation of the PM_{2.5} emissions and offsets, calculation of the baseline values and offsets will go through a series of iterations with each subsequent iteration becoming more conservative in the result.

PM_{2.5} Analysis 1st Iteration:

| | | |
|---|--------------|------------|
| PCUP FCCU Baseline TSP | 972.9 | TPY |
| PM _{2.5} Fraction | 68.5 | % |
| PCUP FCCU Baseline PM _{2.5} | 666.4 | TPY |
| PCUP FCCU TSP Limit | 203 | TPY |
| PCUP FCCU PM _{2.5} | 139 | TPY |
| (PM _{2.5} fraction inlet/outlet of the scrubber identical) | | |
| PM_{2.5} Reduction | 527.4 | TPY |

It should be mentioned that laser diffraction measurements assume that the particles being measured are spherical. The size of irregularly shaped or non-spherical particles are expressed in terms of spherical equivalent diameters. The spherical equivalent diameter

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is deduced from a sphere that would have the same volume as the irregular shaped object. The inherent error in sizing non-spherical particles via laser diffraction can be explained as follows

The projected cross-sectional area of a non-spherical particle averaged over all the particle's possible orientations relative to the direction of the beam is larger than that of a sphere with an equal volume ([Jonasz, 1991](#)). This may lead to the assignment of a measured particle to a larger size fraction than it actually belongs to on the basis of its apparent radius; that is, a shift of the PSD toward its coarser fractions.

As the explanation suggests, the irregular shaped objects are typically classified as larger in size. The catalyst particles in the FCCU stream are typically non-spherical as a result of being broken or damaged in the process. Therefore, it may be discerned, the 68.5% PM_{2.5} fraction is conservative or underreported in its own right.

PM_{2.5} Analysis 2nd Iteration:

The supplied particle sizing data is based on equivalent/physical (Stokes) diameters assuming the particles are of unit density not aerodynamic equivalent diameters. The aerodynamic diameter differs from the Stokes diameter whenever the actual particle has a density different than 1 g/cm³. Therefore, the aerodynamic diameter is a function of the particle density. If the particle density is smaller than 1 g/cm³, then the aerodynamic size will be *smaller* than the equivalent diameter size reported by the laser diffraction. If the particle density is greater than 1 g/cm³, then the aerodynamic diameter would be *greater* than the diameter reported by the laser diffraction. The aerodynamic diameter can be related to the Stokes diameter using the following equation

$$D_{\text{aerodynamic}} = D_{\text{Stokes}} * \text{sqrt}(d_{\text{particle}})$$

$$d_{\text{particle}} = \text{particle density (g/cm}^3\text{)}$$

The manufacturer of the FCCU catalyst reports the fresh catalyst to have a density in the range of 1.2-2.1 g/cm³. The DCR reports the spent catalyst to have a density of 3.15 g/cm³. Because the particle density differs from unity, the particle diameters from the sizing data can not be considered aerodynamic diameters. The sizing data will have to be corrected for density to provide the aerodynamic equivalent diameter. Using the equation provided above, and keeping with the conservative approach, a particle having an aerodynamic diameter of 2.5 μm would be equivalent to a particle from the sizing data with a Stokes diameter of 1.41 μm and density of 3.15 g/cm³. The PM_{2.5} fractions can be revised as shown in Table 15.

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Table 15: Revised PSD Analysis

| | May 3-4, 2005 | | | | | August 23-24, 2005 | | | |
|--------------------|---------------|-------|-------|-------|---------|--------------------|-------|-------|---------|
| | 1 | 2 | 3 | 4 | Average | 1 | 2 | 3 | Average |
| %PM _{2.5} | 48.62 | 49.67 | 51.27 | 48.62 | 49.55% | 47.80 | 47.81 | 49.23 | 48.28% |

The average PM_{2.5} fraction from all seven runs is equal to 49.00%

Applying the revised PM_{2.5} fraction to the TSP emissions, the following is derived:

| | | |
|---|--------------|------------|
| PCUP FCCU Baseline TSP | 972.9 | TPY |
| PM _{2.5} Fraction | 49.00 | % |
| PCUP FCCU Baseline PM _{2.5} | 476.7 | TPY |
| PCUP FCCU TSP Limit | 203 | TPY |
| PCUP FCCU PM _{2.5} | 99.5 | TPY |
| (PM _{2.5} fraction inlet/outlet of the scrubber identical) | | |
| PM_{2.5} Reduction | 377.2 | TPY |

PM_{2.5} Analysis 3rd Iteration:

The first and second iterations assumed the same PM_{2.5} fraction on the outlet of the WGS as was determined from the sizing data. The third iteration makes the conservative assumption that all TSP from the outlet of the WGS is PM_{2.5}. Therefore, all the permitted PCUP FCCU TSP limit of 203 TPY is considered particulate matter with an aerodynamic diameter equal to 2.5 µm or less. The PM_{2.5} emission calculations are as follows:

| | | |
|--|--------------|------------|
| PCUP FCCU Baseline TSP | 972.9 | TPY |
| PM _{2.5} Fraction | 49.00 | % |
| PCUP FCCU Baseline PM _{2.5} | 476.7 | TPY |
| PCUP FCCU TSP Limit | 203 | TPY |
| PCUP FCCU PM _{2.5} | 203 | TPY |
| (all TSP at the outlet of WGS is PM _{2.5}) | | |
| PM_{2.5} Reduction | 264.7 | TPY |

The Bin 1 project permit application indicates SO₂ emissions from this project will represent a significant net emissions increase above the PSD threshold of 40 TPY. Based on Premcor's calculations, offsets for 225.9 TPY of SO₂ must be demonstrated. Because the SO₂ reductions from PCUP can not be applied as they were relied upon to meet the requirements of the CD, the refinery will be applying SO₂ offsets in the form of PM_{2.5} emissions (1 ton PM_{2.5} = 40 tons SO₂). Under this methodology Premcor will offset the 225.9 TPY increase in SO₂ emissions with a 5.65 ton/yr reduction in PM_{2.5} emissions.

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The 5.65 TPY reduction in PM_{2.5} emissions will be achieved using the reduction in particulate emissions as a result of the installation of the FCCU WGS. The past actual (pre scrubber installation) TSP emissions as stated in the PCUP application were 973 TPY. The FCCU WGS has reduced TSP emissions to 203 TPY, a 770 TPY decrease in *total* suspended particulate.

SO₂ offsets total 10,588 TPY as a result of obtaining 264.7 TPY reduction in PM_{2.5} at a 40:1, SO₂ to PM_{2.5}, ratio.

PSD Analysis for SO₂ Controls:

A PSD analysis includes all of the following components:

- Application of BACT: A BACT analysis is done on a case-by-case basis, and takes into account the energy, environmental and economic impacts in determining the maximum degree of reductions achievable for the proposed source or modification. In no event can the BACT determination result in an emission limitation which would not meet any applicable standard of performance under 40 CFR Parts 60 and 61.
- An ambient air quality analysis: Each PSD source or modification must perform an air quality analysis to demonstrate that its new pollutant emissions would not violate either the applicable NAAQS or the applicable PSD increment
- Analysis of impacts to soil, vegetation and visibility: The additional impact analysis is required to analyze whether the proposed emissions increases would impair visibility, or adversely affect soils or vegetation. In addition to the direct impact of source emissions on these resources, such analysis shall include the indirect impacts from general commercial, residential, industrial and other growth associated with the proposed source or modification
- Analysis of impacts on Class I areas: If the source could have an impact on a Class I area, the FLM or the federal official charged with direct responsibility for managing these lands must be notified of the proposed permit. These officials have an affirmative responsibility to protect the air quality-related values, including visibility, in Class I areas and for consulting with the reviewing authority to determine whether any proposed construction or modification will adversely affect such values. If the FLM determines that emissions from a proposed source or modification would impair air quality-related values, even though emission levels would not cause a violation of the allowable air quality increment, the FLM may recommend that the reviewing authority deny the permit.
- Public participation requirements: The basis of the proposed permit has to be made available for public review and comment.

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BACT Analysis:

Section 1.9 of Regulation No. 1125 defines BACT as “..an emission limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under the CAA which would be emitted from any proposed major stationary source or major modification which the Department, on a case-by-case basis, takes 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 combustion 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 Regulation Nos. 20 and 21. If the Department determines that technological or economic 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. For this purpose a “top-down” BACT analysis is conducted as described in EPA’s October, 1990, Draft New Source Review Workshop Manual. The five basic steps of a top-down BACT analysis are listed below:

- Step 1: Identify potential control technologies
- Step 2: Eliminate technically infeasible options
- Step 3: Rank remaining control technologies by control effectiveness
- Step 4: Evaluate the most effective controls and document results
- Step 5: Select BACT

The first step is to identify potentially “available” control options for each emission unit triggering PSD, for each pollutant under review. Available options should consist of a comprehensive list of those technologies with a potentially practical application to the emission unit in question. The list should include lowest achievable emission rate (LAER) technologies, innovative technologies, and controls applied to similar source categories. For this analysis, the following sources were relied upon:

- EPA’s New Source Review Website;
- RACT/BACT/LAER Clearinghouse (RBLC) Database;
- Various state air quality regulations and websites;
- Recent EPA Consent decrees within the refining industry;
- Control Technology Vendors;

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- Technical publications; and
- Guidance Documents.

After identifying potential technologies, the second step is to eliminate technically infeasible options from further consideration. To be considered feasible, a technology must be both available and applicable. It is important, in this step, that the technical basis for eliminating a technology from further consideration be clearly documented based on physical, chemical, engineering, and source-specific factors related to safe and successful use of the controls.

The third step is to rank the technologies not eliminated in Step 2 in order of descending control effectiveness for each pollutant of concern. If the highest ranked technology is proposed as BACT, it is not necessary to perform any further technical or economic evaluation. Potential adverse impacts, however, must still be identified and evaluated. The fourth step entails an evaluation of energy, environmental, and economic impacts for determining a final level of control. The evaluation begins with the most stringent control option and continues until a technology under consideration cannot be eliminated based on adverse energy, environmental, or economic impacts. The economic or cost-effectiveness" analysis is conducted in a manner consistent with EPA's *OAQPS Control Cost Manual* Fifth Edition (EPA 1996) and subsequent revisions.

The fifth and final step is to select as BACT from the most effective of the remaining technologies under consideration for each pollutant of concern. For this project, the only source being modified is the FCU. A comparative evaluation of the RBLC is shown in Table 16.

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Table 16: RBLC Technology Evaluation and Comparison

| Refinery | Unit | Control | Emission Limits (ppm) | | Basis |
|--------------------------|------|--------------------|-----------------------|-------|----------|
| | | | 365-Day | 7-Day | |
| Tesoro (ND) | FCCU | COB + WGS | 10 | 18 | CD |
| MAP (TX) | FCCU | COB + WGS | 20 | 50 | BACT-PSD |
| Conoco (MT) | FCCU | Catalyst additives | 25 | 50 | BACT-PSD |
| Exxon (CA) | FCCU | Low S feed | 25 | 50 | BACT-PSD |
| Chevron (CA) | FCCU | Low S Feed | 25 | 50 | BACT-PSD |
| Valero (TX City) | FCCU | COB + WGS | 25 | 50 | BACT-PSD |
| Valero (TX Three Rivers) | FCCU | COB + WGS | 25 | 50 | BACT-PSD |
| Valero (La) | FCCU | COB + WGS | 25 | 50 | BACT-PSD |

The DCR FCU was retrofitted with a WGS system comprised of a Belco pre-scrubber, a Cansolv absorber and caustic polisher in June 2006 at a cost of over \$ 200 million. The DCR FCU WGS system has present SO₂ permit limits of 25 ppmvd @ 0 % O₂ on a 365-day rolling average, 50 ppmvd @ 0 % O₂ on a 7-day rolling average and 174 TPY. Based on a comparative evaluation of similar control technologies, AQM finds the existing controls to meet BACT requirements.

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Section 3: Modeling Analysis

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Background:

The Bin 1 project will result in emissions increases of SO₂ and CO. Pollutants subject to PSD review are those regulated under the clean air act (40 CFR 52.21(b)(23)) and whose annual emissions as a result of the new or modified sources exceed the SER. Premcor in its May 3, 2007 submittal indicated that emissions increases for both the pollutants exceed their SERs, which triggered the PSD modeling analysis for both the pollutants. However, Premcor submitted revised estimates of SO₂ and CO emissions changes that result from the Bin 1 project and the revision indicates CO emissions increases are lower than the previous estimates and therefore do not trigger the PSD analysis. While the estimates for SO₂ emissions increases are lower than the previous estimates they nevertheless continue to trigger PSD applicability as described in Section 2 of this memorandum. Premcor has presented the May 3, 2007 modeling analysis as a conservative representation of the project impacts, and states that the actual project impacts will be less than reflected in the May 3, 2007 modeling analysis.

AQM has evaluated Premcor's PSD modeling analysis of the Bin 1 project. The purpose of the evaluation is to verify and affirm that the emissions increases resulting from the Bin 1 project, in conjunction with other applicable emissions from existing sources, do not cause or contribute to a violation of any applicable NAAQS or applicable PSD increments. The following explains the evaluation process adopted by the AQM and how the Bin 1 project complies with the applicable PSD and NAAQS requirements.

AQM's Evaluation:

As identified in the EPA New Source Review Workshop Manual, October, 1990 (Draft), an applicant for a PSD permit is 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 purpose of the analysis is to demonstrate that the emissions from a proposed major stationary source or major modification, in conjunction with other applicable emissions from existing sources, will not violate the NAAQS and PSD increments. The PSD Modeling Analysis and the NAAQS Compliance Analysis discuss the methodology to demonstrate compliance with the applicable PSD increments and NAAQS requirements.

PSD Modeling Analysis:

Both SO₂ and CO resulting from the Bin 1 project are PSD regulated pollutants. The SO₂ emissions increases associated with the Bin 1 project exceed the SER for SO₂ (40 tons/year), and therefore trigger the PSD modeling analysis. The CO emissions increases associated with the Bin 1 project, however, do not exceed the SER for CO (100 tons/year), and therefore, are not subject to the PSD modeling analysis.

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The PSD modeling analysis consists of two parts – preliminary impact air quality analysis and full impact air quality analysis. The preliminary impact air quality analysis is conducted to determine if a full impact air quality analysis is needed. A full impact analysis consists of separate analysis for the NAAQS and PSD increments and will consider emissions from the proposed source or source modifications, any existing onsite sources, offsite sources, and for the NAAQS analysis, background concentrations. The full impact analysis is conducted for Class II (NAAQS and PSD increment) and Class I (PSD increment and Air Quality Related Values (AQRV)) areas. The preliminary impact air quality analysis for this project has indicated that it complies with the applicable PSD increments and that a full impact analysis is not needed. The following describes the evaluation of preliminary impact air quality analysis.

Preliminary Impact Air Quality Analysis

The preliminary impact air quality analysis is conducted to determine if a full impact air quality analysis is needed. It consists of four parts.

i). Class II Area Preliminary Impact Analysis for Local Impacts:

Class II area preliminary impact analysis determines if the potential local impacts from the Bin 1 project comply with the PSD Significant Impact Levels (SILs) for Class II areas. It evaluates the significant increase in potential emissions of a pollutant from a proposed new source, or significant net emissions increase of a pollutant from a proposed modification. The modeled results of the preliminary analysis are compared to the PSD SILs to determine whether a full impact analysis is required or not. For existing facilities, the modeled emissions include contemporaneous emission increases and decreases from the modified sources. Emissions decreases are modeled as negative emissions. The SO₂ emissions increase resulting from proposed modifications including the contemporaneous emissions increases/decreases are 77.4 tons/year.

The highest modeled concentration of a pollutant for each averaging time is compared to the established SILs. If the highest modeled concentrations for any pollutant and averaging period evaluated are less than the applicable SIL, a full impact air quality analysis is not required for that pollutant and averaging period; however, these pollutants may still be subject to further review as part of the PSD additional impact analysis requirements. The annual, 24-hour and 3-hour SILs for SO₂ are listed in Table 17.

Premcor assessed the air quality impact of SO₂ emissions increases resulting from the Bin 1 project by making use of the latest version of EPA dispersion model AERMOD and National Weather Service (NWS) meteorological data. The AQM for its assessment made use of the same models and input parameters (Attachment E of the permit application) that Premcor used in its evaluation. Our modeling results are summarized in Table 17, and are similar to Premcor's results. As seen in this table, the maximum impacts are less than the SILs for all averaging periods, and therefore, a full impact analysis is not required. Figures 1, 2, and 3

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respectively show the maximum modeled 3-Hr, 24-Hr and annual average concentrations. The AQM ran the simulations for another set of operating conditions and obtained similar results that comply with the SILs for all averaging periods. As seen Table 17, predicted concentrations are also less than the monitoring de minimis levels; therefore preconstruction monitoring is not required.

Table 17: Summary of AERMOD Modeling Results for SO₂ (µg/m³)

| Averaging Period | Significant Impact Level (SIL) | Year | | | | | |
|------------------|--------------------------------|---------|-------|-------|-------|-------|-------|
| | | Maximum | 1991 | 1992 | 1993 | 1994 | 1995 |
| 3-Hour | 25 | 8.460 | 8.361 | 8.460 | 8.413 | 7.926 | 8.372 |
| 24-Hour | 5 | 4.066 | 3.617 | 3.551 | 4.066 | 3.642 | 3.470 |
| Annual | 1 | 0.488 | 0.379 | 0.393 | 0.470 | 0.433 | 0.488 |

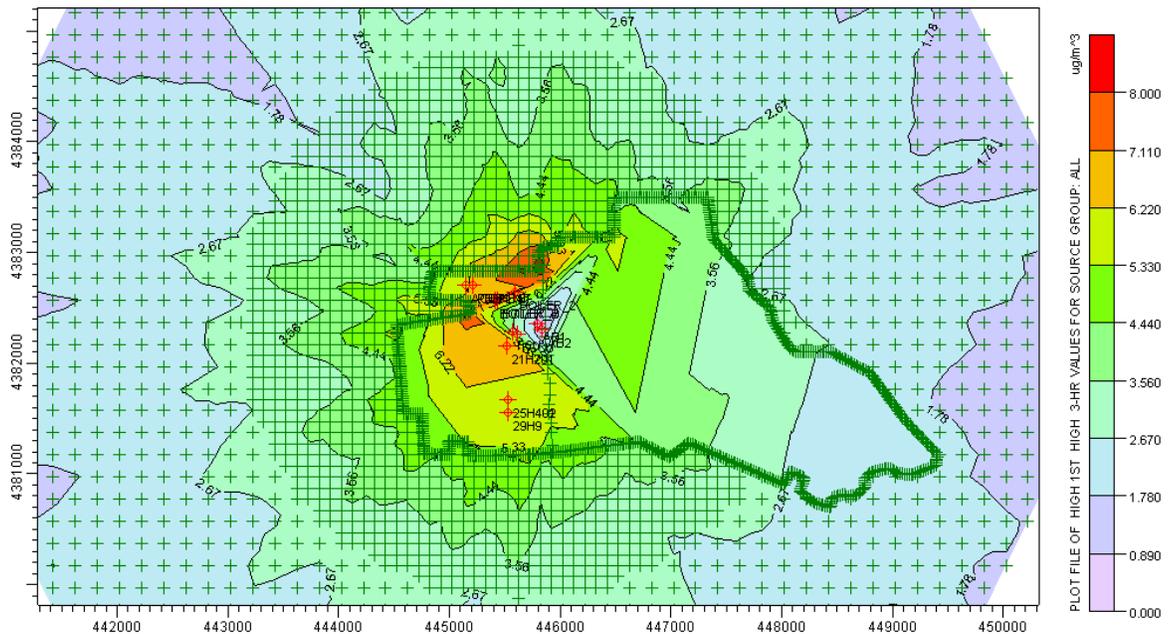


Figure 1: AERMOD modeled 3-Hour (Highest-1st-High) SO₂ contours in µg/m³ for 1992 meteorology

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ii). Class I Area Preliminary Impact Analysis:

Class I area preliminary impact analysis assesses the potential impacts of the emissions from the Bin 1 project on Federal Class I areas within 200 km radius of the Premcor facility. It consists of a SIL analysis, which determines if a more comprehensive analysis to include offsite source contributions and comparison of projected impacts to the Class I area PSD increment levels is needed. The Class I area SO₂ SILs are listed in Table 18.

Premcor assessed the impact of the emissions resulting from the Bin 1 project on two Class-I areas - Brigantine NWR, NJ and Shenandoah NP, VA. For assessing such impacts of emissions sources at distances greater than 50 km, CALPUFF is the suitable model as recommended by the Interagency Workgroup on Air Quality Modeling (IWAQM) and Federal Land Managers AQRV Guidance (FLAG) documents. Premcor conducted the CALPUFF modeling using two MM5-based meteorological datasets (2001 and 2002) prepared by Visibility Improvement State and Tribal Association of the Southeast (VISTAS) for the eastern US by placing receptors at different locations within the two Class-I areas. AQM, however, assessed the air quality impacts by conducting the CALPUFF (EPA approved Version 5.8) modeling for three VISTAS MM5-based datasets (200, 2002, and 2003), which were provided by Premcor. The Bin 1 project impacts on Brigantine and Shenandoah obtained by processing with CALPOST are summarized in Table 18. AQM modeled SO₂ concentrations for the impacts at the two Class I areas are very similar to Premcor's and are less than 3-Hr, 24-Hr and annual SILs, and therefore, do not require a comprehensive Class I area analysis.

Table 18: Summary of CALPUFF Modeling Results for SO₂ (µg/m³)

| Averaging Period | Significant Impact Level (SIL) | 2001 | | 2002 | | 2003 | |
|------------------|--------------------------------|----------------|---------------|----------------|---------------|----------------|---------------|
| | | Brigantine NWR | Shenandoah NP | Brigantine NWR | Shenandoah NP | Brigantine NWR | Shenandoah NP |
| 3-Hour | 1 | 0.15 | 0.04 | 0.12 | 0.03 | 0.13 | 0.04 |
| 24-Hour | 0.2 | 0.041 | 0.009 | 0.027 | 0.008 | 0.047 | 0.011 |
| Annual | 0.1 | 0.0030 | 0.0002 | 0.0023 | 0.0002 | 0.0025 | 0.0003 |

iii). Air Quality Related Values (AQRVs):

The emissions increases resulting from the Bin 1 project should not adversely impact the AQRVs (visibility, water, flora and fauna, odor, etc.) of Class I areas under consideration. The Federal Land Managers AQRV Guidance (FLAG) report identifies three types of AQRVs - visibility, deposition, and ozone, and the Federal Land Managers

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(FLM) typically require the evaluation of visibility and deposition impacts. The visibility degradation at the Class I areas should be less than the significance threshold of 5%, and the annual deposition of sulfur should be less than the significance threshold of 0.01 kg/ha/yr.

For CALPOST post processing for visibility, AQM chose the following options - maximum relative humidity (RH) of 98%, method 2 for light extinction calculations, FLAG (2000) f(RH) tabulation for particle growth. The AQM results on visibility degradation are listed in Table 18, and are different from Premcor's numbers; however, they are less than the significance threshold of 5% for all datasets.

Table 19: Summary of CALPUFF Modeling Results for Daily Visibility Degradation (%)

| Class I Area | Significance Threshold | 2001 | 2002 | 2003 |
|---------------------|-------------------------------|-------------|-------------|-------------|
| Brigantine | 5.0 | 2.43 | 0.35 | 3.57 |
| Shenandoah | 5.0 | 1.12 | 0.90 | 2.36 |

The sulfur deposition impacts as processed by POSTUTIL are summarized in Table 20. Summary of modeling results as listed in Tables 18, 19, and 20 indicate that the Bin 1 project does not result in significant impacts at Brigantine and Shenandoah.

Table 20: Summary of CALPUFF Modeling Results for Sulfur Deposition (kg/ha/yr)

| Class I Area | Deposition Analysis Threshold (DAT) | 2001 | 2002 | 2003 |
|---------------------|--|-------------|-------------|-------------|
| Brigantine | 0.01 | 0.0017 | 0.0014 | 0.0018 |
| Shenandoah | 0.01 | 0.0003 | 0.0005 | 0.0005 |

iv). Additional Impact Air Quality Analysis:

The additional impact air quality analysis assesses the impacts of air, ground and water pollution on soils, vegetation and visibility caused by any increase in emissions from the Bin 1 Project, and from associated growth.

Per Attachment E of the application -

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- the air pollution impacts from additional growth attributable to the Bin 1 project will not be significant,
- there will be no detrimental effects to soil, vegetation and wildlife would occur in the area surrounding the facility, and
- the Bin 1 project will have insignificant impact of sulfur deposition on Class I areas.

Full Impact Analysis

Preliminary impact analysis has shown that the air quality impacts due to the Bin 1 project on local as well as Class I areas are below the SILs, and therefore, a full impact analysis is not warranted.

NAAQS Compliance Analysis

The permit application did not demonstrate how it will comply with the NAAQS requirements. The AQM has conducted an analysis to determine if the emissions resulting from the Bin 1 project will meet the NAAQS. To assess the maximum ambient impacts the AQM ran AERMOD for all sources attributable to the Bin 1 project with their PTE (potential to emit) emissions. The same stack parameters and meteorological databases that are used in the preliminary analysis are also used for these runs.

The NAAQS and the ambient impacts from AERMOD modeling results for emissions sources attributable to the Bin 1 project are listed in Table 20. For the demonstration of compliance with the NAAQS, modeled highest-2nd-high (H2H) and highest-1st-high concentrations are used. As background concentrations are needed for the demonstration of NAAQS compliance, the AQM has taken a conservative approach and assumed the 2007 SO₂ monitored concentrations at Lums Pond to be the background values; these values are also listed in Table 20.

Table 21: SO₂ NAAQS, 2007 Background Concentrations and ambient impacts (µg/m³) of Project sources for their PTE emissions (TPY)

| Averaging Period | NAAQS | 2007 Background Concentrations | Year (TPY) | | | | | |
|---------------------|-------|--------------------------------|------------|--------|--------|--------|--------|--------|
| | | | Maximum | 1991 | 1992 | 1993 | 1994 | 1995 |
| 3-Hour (H2H) | 1300 | 54.970 | 73.501 | 72.743 | 68.965 | 70.827 | 71.922 | 73.501 |
| 24-Hour (H2H) | 365 | 26.176 | 39.963 | 35.082 | 38.912 | 37.262 | 38.954 | 39.963 |
| Annual (H1H) | 80 | 6.806 | 6.934 | 5.394 | 5.804 | 6.230 | 6.382 | 6.934 |

Compliance for SO₂ NAAQS is tested by comparing the total ambient impact with the SO₂ NAAQS. The results are summarized in Table 22, and clearly indicate that the maximum impacts attributable to the Bin 1 project comply with the SO₂ NAAQS.

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Table 22: SO₂ NAAQS, and ambient impacts (µg/m³) for Bin 1 Project sources with their PTE emissions (TPY)

| Averaging Period | NAAQS | | Maximum | Year (TPY) | | | | |
|------------------|---------|-----------|---------|------------|---------|---------|---------|---------|
| | Primary | Secondary | | 1991 | 1992 | 1993 | 1994 | 1995 |
| 3-Hour (H2H) | --- | 1300 | 128.471 | 127.713 | 123.935 | 125.797 | 126.892 | 128.471 |
| 24-Hour (H2H) | 365 | --- | 66.139 | 61.258 | 65.088 | 63.438 | 65.130 | 66.139 |
| Annual (H1H) | 80 | --- | 13.740 | 12.200 | 12.610 | 13.036 | 13.188 | 13.740 |

Conclusion

The AQM assessment agrees with Premcor's modeling analysis and conclusions for the DCR Upgrade and Optimization project. The emissions increases from the Bin 1 Project result in insignificant ambient impacts locally and in nearby Class I areas, and meets the PSD requirements for air quality impacts.

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Section 4: Public Participation

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Regulation No. 1125.3.14 details the Department's public participation requirements. AQM is required to notify the public that the preliminary determination for construction has been completed and there is a 30 day period to review the application submitted by the applicant and the draft construction permits. Per Section 3.14.2.3, public notification will be made in the Delaware State News on Wednesday, July 16, and the Wilmington News Journal on Thursday, July 17. The Company has indicated that timely permits will be required to be issued in order for the construction work to begin prior to the fall 2008 turnaround of the crude unit. Consequently, in order to expedite issuance of the permits, the Company has requested that a public hearing be scheduled at the end of the 30 day draft review period. The above referenced legal notices also include notifications of a scheduled public hearing to be held on August 18, 2008 at the Delaware City library so that interested persons may appear and submit written or oral comments on the Bin 1 project application and draft permits. Comments may also be submitted directly to the Department.

Per Section 3.14.2.4, the notice will also be sent to the applicant (Premcor), the City of Delaware City, and New Castle County. The notice will also be sent to the U.S. Fish and Wildlife Service and EPA Region III.

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pc: Dover Title V File
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