

NORTH CAROLINA  
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES  
DIVISION OF AIR QUALITY  
PERMITS SECTION

PREVENTION OF SIGNIFICANT DETERIORATION  
PRE-CONSTRUCTION REVIEW AND PRELIMINARY DETERMINATION

FOR

**DAK AMERICAS LLC – CAPE FEAR PLANT  
BRUNSWICK COUNTY  
LELAND, NORTH CAROLINA**

THIS REVIEW WAS PERFORMED BY THE  
DIVISION OF AIR QUALITY

In Accordance With NC DAQ Regulations For  
Prevention of Significant Deterioration of Air Quality  
15A NCAC 2D .0530 and 15A NCAC 2Q .0300

April 2009

## MAILING LIST

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OFFICIALS	Mr. Leslie Bell Director, Brunswick County Planning Dept. P.O. Box 249 Bolivia, North Carolina 28422 (910) 253-025	Public Notice
LIBRARY	Ms. Lisa Milligan Branch Manager Leland Library 487 Village Road Leland, North Carolina 28451 (910) 371-9442	Preliminary Determination & Application
SOURCE	Mr. Matthew Warrick Plant Manager DAK Americas LLC 3500 Daniels Road, NE Leland, North Carolina 28451	Preliminary Determination
EPA	Ms. Heather Abrams Air Permits Section U.S. EPA Region IV Sam Nunn Atlanta Federal Building 61 Forsyth Street Atlanta, Georgia 30303-3104 (404) 562-9185  Preliminary Determination and Public Notice via electronic mail to: <a href="mailto:abrams.heather@epamail.epa.gov">abrams.heather@epamail.epa.gov</a> with cc to: <a href="mailto:forney.kathleen@epa.gov">forney.kathleen@epa.gov</a> <a href="mailto:worley.gregg@epa.gov">worley.gregg@epa.gov</a>	Preliminary Determination & Application
EPA	Mr. Bob Blaszcak BACT/LAER Clearinghouse OAQPS, MD-13 RTP, North Carolina 27711	BACT Input Summary Sheet

WILMINGTON  
REGIONAL  
OFFICE  
DAQ

Mr. Wayne Cook  
Regional Supervisor  
127 Cardinal Drive Extension  
Wilmington, North Carolina 28405-3845  
(910) 796-7215  
FAX: (910) 350-2004

Preliminary Determination

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## **APPENDIX A – DRAFT PERMIT**

## **APPENDIX B – PUBLIC NOTICE**

## 1. FACT SHEET

### **Applicant:**

DAK Americas LLC  
3500 Daniels Road, NE  
Leland, North Carolina 28451  
Contact: Penny Mahoney, P.E.  
(910) 371-5232

### **Consultant:**

Trinity Consultants, Inc.  
2327 Englert Drive, Suite 201  
Durham, North Carolina 27713  
Contact: Aimee Andrews, P.E.  
(919) 544-7811

- DAK Americas LLC is proposing to modify the existing chemical intermediates area of the Cape Fear Plant by converting from a polymer grade terephthalic acid (PGTPA) process to a purified terephthalic acid (PTA) process. Production capacity at the Cape Fear Plant will increase from 550,000 metric tons of PGTPA per year to 1,430,000 metric tons of PTA per year.
- The Cape Fear Plant is located in Leland, Brunswick County, North Carolina. Brunswick County is designated as “attainment” or “unclassifiable” for all PSD-regulated pollutants.
- The Cape Fear Plant is an existing major stationary source under the PSD permitting program. The proposed modification will result in significant net emission increases of nitrogen oxides (NO<sub>x</sub>), and therefore must comply with major source modification requirements in accordance with the procedures in North Carolina Administrative Code Title 15A, Sub-Chapter 2D, Section .0530 (15A NCAC 2D .0530) prior to commencing construction.
- The proposed modification will result in a potential NO<sub>x</sub> emission increase of 120.5 tpy.
- BACT for NO<sub>x</sub> is the use of a low NO<sub>x</sub> burner with fuel gas recirculation on the new process heater (**ID No. ES15**) with a maximum allowable NO<sub>x</sub> emission rate of 0.07 pounds per million British thermal units.
- National Ambient Air Quality Standards (NAAQS) and PSD Class II increments will not be violated as a result of emissions from the proposed project.
- Emissions increases from the proposed modification will neither cause adverse impacts to soils and vegetation nor cause significant degradation of visibility.
- The anticipated economic growth associated with the proposed modification will not result in a significant increase in regional air pollutant levels.
- Air emissions resulting from the proposed project will not significantly impact air quality related values (including visibility) in a Class I area.

## 2. INTRODUCTION

### 2.1 Purpose of Application

In the PSD permit application received by the North Carolina Division of Air Quality (NC DAQ) on April 14, 2008, DAK Americas LLC (DAK) is proposing to modify the existing chemical intermediates area of the Cape Fear Plant, converting from a polymer grade terephthalic acid (PGTPA) process to a purified terephthalic acid (PTA) process. The proposed conversion entails converting the two existing PGTPA production lines, TPA-1 and TPA-2, to crude terephthalic acid (CTA) production lines and adding a new PTA production line, which will convert the CTA to PTA. Production capacity at the Cape Fear Plant will increase from 550,000 metric tons of PGTPA per year to 1,430,000 metric tons of PTA per year.

The PTA conversion project involves:

- Modifying the existing air oxidation reactors and associated product recovery trains;
- Adding new air oxidation reactors and associated product recovery trains;
- Adding a hydrogen generation plant;
- Modifying the TPA powder handling area;
- Adding a new process heater with a maximum heat input rate of 135 million British thermal units per hour (mmBtu/hr);
- Adding two new xylene storage tanks;
- Adding a new xylene barge unloading facility; and,
- Upgrading the existing wastewater treatment plant.

The Cape Fear Plant is located in Leland, Brunswick County, North Carolina. Brunswick County is designated as “attainment” or “unclassifiable” for all PSD-regulated pollutants. The existing operations fall under the Standard Industrial Classification (SIC) code 2824, “manmade organic fiber production”. As a chemical process plant, the facility also falls under one of the “List of 28” industrial categories for which “major stationary source” is defined as a facility with the potential to emit 100 tpy or more of a regulated pollutant under PSD permitting program.<sup>1</sup>

Existing operations at the Cape Fear Plant have the potential to emit greater than 100 tpy of a PSD-regulated pollutant, and therefore the facility is an existing major stationary source. Emissions changes associated with the proposed modification are provided in Table 2.1-1 below:

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<sup>1</sup> 40 CFR 52.166(b)(1)(i)(a)

**Table 2.1-1. Net Emission Changes Associated with the Proposed Modification**

<b>Pollutant</b>	<b>Net Emissions Change (tpy)</b>	<b>PSD Significant Emissions Rate (tpy)</b>	<b>PSD Major Modification?</b>
PM	22.4	25	No
PM-10	13.5	15	No
SO <sub>2</sub>	<40*	40	Yes
<b>NO<sub>x</sub></b>	<b>120.5</b>	<b>40</b>	<b>Yes</b>
CO	-1,031.7	100	No
VOC	-201.5	40	No

\* The only potential increase in SO<sub>2</sub> emissions is associated with the modification is a new natural gas and No. 2 fuel oil-fired process heater (**ID No. ES15**) with a maximum heat input capacity of 135 million Btu per hour. DAK Americas is proposing an enforceable 40 tpy SO<sub>2</sub> emission limit for the boiler to avoid PSD permitting requirements.

Because the net emissions increase of nitrogen oxides (NO<sub>x</sub>) exceeds the PSD significant net emission rate, the proposed project must obtain a PSD permit for a major modification in accordance with the procedures in North Carolina Administrative Code Title 15A, Sub-Chapter 2D, Section .0530 (15A NCAC 2D .0530) prior to commencing construction.

The proposed modification will not result in emission increases at the existing polyethylene terephthalate (PET) production or finishing areas at the Cape Fear Plant. DAK is currently purchasing PTA from outside sources to supply its existing PET operations. While the proposed modification will enable DAK to supply PTA to the downstream PET production area, the PTA will simply be replacing materials that are currently purchased and brought on-site, and will not debottleneck the existing operations. DAK is also expecting to sell PTA to off-site customers.

This application is being processed in accordance with the procedures in 15A NCAC 2D .0530 and 15A NCAC 2Q .0300. **Within 12 months of initial start-up of any new or modified emission source at the proposed facility, DAK is required to submit an application for a Title V air quality permit in accordance with 15A NCAC 2Q .0501(c)(2) and 15A NCAC 2Q .0504.**

## **2.2 Preliminary Determination**

NC DAQ has reviewed the PSD application to determine compliance with applicable state and Federal air quality requirements, including the following:

- PSD review requirements including a determination of Best Available Control Technology (BACT), a source impact analysis, an additional impact analysis on soils, vegetation and visibility, and a Class I analysis.
- North Carolina Air Quality Rules pursuant to 15A NCAC 2D and 2Q.

From the review, NC DAQ has made a preliminary determination that the proposed modification complies with the applicable North Carolina air quality regulations, including the PSD requirements. Therefore, NC DAQ is placing a draft air quality permit for the proposed

modification in the record for public comment. A preliminary determination of compliance with the PSD requirements was contingent upon the following findings:

- For each emission unit that will contribute to an increase in NO<sub>x</sub> emissions, a demonstration that Best Available Control Technology (BACT) is applied.
- A demonstration that National Ambient Air Quality Standards (NAAQS) and PSD Class II increments will not be violated as a result of emissions from the proposed project.
- A demonstration that emissions from the proposed project will neither cause adverse impacts to soils and vegetation nor cause degradation of visibility, and that economic growth associated with the project will not cause a significant increase in regional air pollutant levels.
- A demonstration that air emissions resulting from the proposed project will not adversely impact a PSD Class I area.

Section 3 of this Preliminary Determination provides a general discussion of the existing facility and the proposed project. Section 4 provides information about the location of the facility, including general terrain, ecology, and proximity to Class I areas. Section 5 provides a regulatory analysis of the state and Federal air quality regulations that apply to the proposed modification. Section 6 presents the BACT analysis and determination. Sections 7 and 8 summarize the Air Impact Analysis and the Additional Impacts Analysis, respectively. A copy of the draft air quality permit is included in Appendix A.

In addition to the regulatory analysis, specific public notice requirements and a 30-day public comment period are required before NC DAQ can take final action on the PSD Application. NC DAQ solicits and encourages participation by the public, industry, and other affected persons impacted. Appendix B of this Preliminary Determination contains a copy of the Public Notice for this draft air quality permit.

### 3. GENERAL INFORMATION

#### 3.1 Existing Facility Information

The DAK Cape Fear Plant is located in Leland, Brunswick County, North Carolina. The existing facility includes three main process areas, as follows:

- Chemical Intermediates Area for PGTPA production;
- Continuous Polymerization (CP) Area for PET production; and,
- Finishing Area for PET resin and fiber products production.

Additional support operations include an ethylene glycol refining area (supporting PET production), combustion sources for steam and process heat, raw material and product storage vessels, and a wastewater treatment plant.

#### 3.2 Process Descriptions

DAK is proposing to modify the existing chemical intermediates area of the Cape Fear Plant by converting the existing PGTPA process to a PTA process and making associated changes to the wastewater treatment plant. Additional process steam demands resulting from the modification will be supplied by a new process heater with a maximum heat input rate of 135 mmBtu/hr. The proposed modification will not affect the ethylene glycol refining, CP, or finishing areas for PET production.

Like the current PGTPA process, PTA will be produced by oxidizing p-xylene in the presence of air, an acetic acid solvent, and a cobalt catalyst. The proposed conversion entails converting the two existing PGTPA production lines, TPA-1 and TPA-2, to crude terephthalic acid (CTA) production lines and adding a secondary process line to convert the CTA to PTA. The following sections provide additional information about the proposed PTA manufacturing process and associated support operations. Process flow diagrams for the proposed process are provided in Appendix E of the PSD application submitted by DAK (Application No. 1000013.08B).

##### *3.2.1 Crude Terephthalic Acid (CTA) Production*

The two existing PGTPA production lines will be converted into CTA production lines. Each CTA production line will be comprised of five major process sections, as follows:

- Feed Preparation and Reaction. Acetic acid solvent, p-xylene, catalyst solution, and air are continuously fed to oxidizer vessels. Off-gases from the oxidation reactors are scrubbed to recover organics and solvents, and then routed to a catalytic recuperative oxidizer followed by a scrubber for emissions control.

The following changes to this process section are proposed:

- The three existing oxidizers at TPA-1 (**ID Nos. A11OX1, A11OX2, and A11OX3**) will be replaced by one large oxidizer (**ID No. A11OX**).
  - The three existing oxidizers at TPA-2 (**ID Nos. A21OX1, A21OX2, and A21OX3**) will be replaced by one large oxidizer (**ID No. A21OX**).
  - The existing packed bed absorber at TPA-1 (**ID No. RDC11**) will be replaced by a high pressure absorber (**ID No. RDA11**).
  - The existing packed bed absorber at TPA-2 (**ID No. RDC21**) will be replaced by a high pressure absorber (**ID No. RDA21**).
  - Streams from the high pressure absorbers (**ID Nos. RDA11 and RDA21**) will be split between the three oxidizer trains including:
    - The existing catalytic recuperative oxidizer (**ID No. CDA45**) and associated scrubber (**ID No. CDA46**).
    - A new low pressure catalytic recuperative oxidizer (**ID No. CDA47**) and associated scrubber (**ID No. CDA48**).
    - A new medium pressure catalytic recuperative oxidizer (**ID No. CDA49**) and associated scrubber (**ID No. CDA50**).
- Product Recovery. Effluent from the oxidation reactors is depressurized and cooled in a series of three flash crystallizer vessels. Solid CTA precipitates out of solution and is separated from the mother liquor by rotary vacuum filters. The CTA is then dried and conveyed to storage before being re-suspended and sent to the PTA production line.

The following changes to this process section are proposed:

- One crystallizer in each TPA line will be removed (**ID Nos. C11CRY2 and C21CRY6**).
  - Exhaust from the first crystallizers (**ID Nos. C11CRY1 and C21CRY5**) will be routed to the new high-pressure absorbers (**ID Nos. RDA11 and RDA21**).
  - Exhaust from the second crystallizers (**ID Nos. C11CRY3 and C21CRY7**) will be routed to the solvent recovery section.
  - Exhaust from the third crystallizers (**ID Nos. C11CRY4 and C21CRY8**) will be routed to the replaced atmospheric absorbers (**ID Nos. RDA13 and RDA23**).
- Solvent Recovery. This section includes equipment to recover and purify acetic acid solvent to be reused in the process. Solvent containing relatively high concentrations of water, dissolved intermediates, by-products, and catalyst is collected from various process equipment. The solvent is stripped from dissolved solids and then dehydrated by azeotropic distillation in three columns (80 trays each). Bottoms from the stripper are fed into a continuous residual concentrator, which recovers additional solvent. Portions of the remaining mother liquor are recycled to the oxidizers to reduce catalyst consumption. Collected residues are drummed for disposal. Several wastewater streams will be generated in the solvent recovery section (HON, Group 1). Exhaust from the solvent recovery section will be controlled by the replaced atmospheric absorber (**ID No. RDA13**).

Various changes will be made to the solvent recovery section in order to accommodate increased throughputs.

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Catalyst Recovery. Cobalt catalyst is recovered (~90% by weight) from the mother liquor using centrifuges (**ID Nos. A13CRT1, A13CRT2, A13CRT3, A13CRC1, and A13CRC2**). Recovered catalyst is returned to the oxidizer feed mix drums for reuse. Mother liquor is returned to the solvent recovery section. Exhaust from the catalyst recovery centrifuges will be controlled by the replaced atmospheric absorber (**ID No. RDA13**).

Various changes will be made to the catalyst recovery section in order to accommodate increased throughputs.

- Ingredients Recovery. Methyl acetate recovered from the oxidizer offgas scrubbers and solvent recovery section is routed to this section where it is hydrolyzed to form acetic acid and methanol. Acetic acid is reused in the oxidation process and methanol is sold. A wastewater stream is generated in the ingredients recovery section (HON, Group 2). Emissions from the hydrolysis/acetic acid recovery sections of the process are controlled by the existing propane-fired fume abatement system and packed bed scrubber (**ID Nos. CDA43 and CDA44**). The methanol recovery column (**ID No. MC-1**) is uncontrolled. Methanol storage and loading operations are controlled by the existing packed tower scrubber (**ID No. CDPR9**).

Various changes will be made to the ingredients recovery section in order to accommodate increased throughputs.

### 3.2.2 Purified Terephthalic Acid (PTA) Production

To form PTA, CTA is dissolved in water at an elevated temperature and pressure, and the resulting solution is catalytically treated with hydrogen to remove impurities. The PTA is then crystallized by depressurization, pressure filtering, and drying. The new PTA production line will include seven major process sections, as follows:

- Feed Preparation. Dry CTA is transferred from storage silos via conical feed screws and fed at a constant rate to re-slurry tanks where it is mixed with recycled process water and then to a Slurry Feed Drum. The replaced atmospheric absorbers (**ID Nos. RDA13 and RDA23**) will control exhaust from the re-slurry tanks. The Slurry Feed Drum will be uncontrolled.
- Reaction. The slurry is heated using waste heat from the downstream crystallizers and then fed to a hydrogenation reactor. In the reactor, the slurry is contacted with hydrogen from the hydrogen plant and then passed through a palladium-on-carbon catalyst bed. A new wet particle absorber (**ID No. CD-PTA-13**) will control exhaust from the reaction section.
- Crystallization. Water is flashed off of the hydrogenation reactor effluent in a series of five crystallizers. Waste heat from the crystallizers will be used to preheat the CTA slurry upstream of the hydrogenation reactor. A new wet particle absorber (**ID No. CD-PTA-13**) will control exhaust from the crystallizers.

- Product Recovery. Following crystallization, PTA is recovered from the mother liquid in high-pressure rotary filters. Exhaust from the rotary filters will pass through a scrubber filter and then to the new wet particle absorber (**ID No. CD-PTA-13**).
- Drying and Product Handling. Wet cake collected in the rotary filters is transported by screw conveyors to one of two rotary, steam-tube dryers (“east” and “west”). Dried PTA is conveyed pneumatically to PTA handling and storage. Each dryer will have an associated scrubber to knock out entrained particulate matter. Exhaust from the dryer scrubbers will then proceed to the new wet particle absorber (**ID No. CD-PTA-13**).
- Mother Liquor Solids Recovery. Mother liquor from the rotary filters will proceed to the recovery area where water will be removed in a flash drum and vacuum drum in series. The mother liquor will be routed to filters to recover precipitated solids. Wet cake from the filters will be reslurried and returned to the CTA process, and effluent will proceed to the wastewater treatment plant. Exhaust from the mother liquor vacuum drum (**ID No. PTA-15**) will be uncontrolled. All other exhaust from the recovery area will be routed to the new wet particle absorber (**ID No. CD-PTA-13**).
- Vent Scrubber (**ID No. CD-PTA-13**) and Process Water. As noted above, most process vent streams from the PTA process will be vented to a new wet particle absorber. These streams, particularly those from the crystallizers, contain solids that will be recovered in the scrubber. In addition, the scrubber will cool the vent streams and condense a significant portion of the flash steam to be reused as process water. Exhaust from the scrubber will be vented to the atmosphere.

### 3.2.3 Hydrogen Plant

A new skid-mounted (package unit) hydrogen generator (**ID No. PTA-A51**) using a conventional natural gas reformer process will provide hydrogen for the PTA process. Natural gas will be passed through a desulfurizer to remove sulfur-containing hydrocarbons (typically minimal) and then through a reformer where methane and steam react in the presence of a nickel catalyst to form hydrogen gas (H<sub>2</sub>) and carbon monoxide (CO). The vapor stream then proceeds to a shift converter, where water and CO react in the presence of copper and/or zinc catalyst to form carbon dioxide (CO<sub>2</sub>) and H<sub>2</sub>. CO is the only regulated pollutant emitted from this process.

### 3.2.4 Terephthalic Acid (TPA) Handling

DAK will transport and store crude and purified terephthalic acid, which are both solid powders. Powders will be conveyed pneumatically using off gases from the proposed medium pressure catalytic oxidizer (**ID No. CD-A47**) to storage silos and tank truck and railcar loading and unloading areas. Exhaust from the PTA transport, storage, and loading operations will be controlled by existing fabric filters. However, due to the concentration of entrained organic acids in the CTA powder, exhaust from CTA transport and storage operations will be controlled by new scrubbers.

Various changes will be made to the ingredients recovery section in order to accommodate increased throughputs including the addition of five new silos (**ID Nos. A53, A54, A55, A56, and A57**) and three new scrubbers (**ID Nos. CDA15, CDA25, and CDA26**). In addition, several existing silos/receiver bins at the existing loading/unloading operations will be removed and the existing tank truck/railcar loading operations will be replaced with six PTA loading stations (**ID Nos. A58 through A63**).

### *3.2.5 Barge Unloading*

DAK is proposing to construct a p-xylene barge unloading facility and two associated p-xylene storage tanks (**ID Nos. ST-2 and ST-3**). Aside from fugitive emissions, all emissions from p-xylene unloading are expected to occur at the storage tanks as vapor space in the tanks is displaced. Each of the proposed tanks have a storage capacity of 3.5 million gallons and are equipped with a fixed, dome roof. No add-on control is proposed for the new p-xylene unloading and storage operations.

### *3.2.6 Wastewater Treatment Plant (WWTP)*

DAK plans to upgrade the existing WWTP to address new intake characteristics and increased throughputs associated with the conversion to PTA production. The existing WWTP consists of an equalization pond, four aerobic reactors, two clarifiers, and one polishing ponds. The plant is permitted to discharge 3.5 million gallons per day (MGD) of effluent into the Cape Fear River.

The new WWTP will process up to 5 MGD, and will include an anaerobic reactor discharging to the existing aerobic reactors, which will be converted to fine bubble diffusers. DAK will also add a new aerated biotreatment basin and replace the final clarifiers with larger units. DAK will continue to use the existing polishing pond and will add sand filters for final, tertiary treatment.

Methane from the new anaerobic reactor will either be used as an auxiliary fuel in an existing combustion source or destroyed using a flare. **NOTE: DAK is currently permitted to burn process waste in various on-site boilers. However, additional permitting will be required to install/operate a flare or burn methane in a boiler that is not currently permitted to burn process waste.**

### *3.2.7 New Process Heater*

To meet the additional process steam and heat demands created by the modification, DAK will install a new process heater with a maximum heat input rate of 135 mmBtu/hr. The process heater will have No. 2 fuel oil and natural gas firing capabilities.

## **3.3 Emissions Increases**

Emissions increases from the proposed modification are estimated to determine PSD applicability by calculating Future-Potential Emissions (in tpy) for the new and modified emissions sources and subtracting Baseline Actual Emissions of the modified emissions sources

based on the average annual emission rates for Calendar Years 2005 and 2006. The project will not debottleneck the downstream PET manufacturing operation, nor did DAK include any creditable contemporaneous emissions changes in the emissions estimation. A summary of Baseline Actual and Future-Potential emissions is provided in Table 3.3-1 below.

**Table 3.3-1. Summary of Emissions Increases Associated with the Proposed Modification**

<b>Pollutant</b>	<b>Baseline Actual Emissions<sup>1</sup> (tpy)</b>	<b>Future-Potential Emissions<sup>2</sup> (tpy)</b>	<b>Net Emissions Change (tpy)</b>
PM-10	17.6	31.1	13.5
SO <sub>2</sub>	2.1	-	< 40*
<b>NO<sub>x</sub></b>	<b>10.8</b>	<b>131.3</b>	<b>120.5</b>
CO	2,534.1	1,502.4	-1,031.7
VOC	709.6	508.0	-201.5

<sup>1</sup> Baseline actual emissions are average annual emission rates at the existing emissions sources affected by the proposed project, including the chemical intermediate areas and wastewater treatment plant, determined from Calendar Years 2005 and 2006.

<sup>2</sup> Future-potential emissions are potential emission rates for new and modified emission sources, including the chemical intermediate areas, new process heater, and wastewater treatment plant.

\* The only potential increase in SO<sub>2</sub> emissions is associated with the modification is a new natural gas and No. 2 fuel oil-fired process heater (**ID No. ES15**) with a maximum heat input capacity of 135 million Btu per hour. DAK Americas is proposing an enforceable 40 tpy SO<sub>2</sub> emission limit for the boiler to PSD permitting requirements.

#### 4. REGIONAL DESCRIPTION

DAK is located in Leland, Brunswick County, North Carolina, which is approximately 10 miles northwest of downtown Wilmington at 3500 Daniels Road Northeast (Latitude: 34.3208, Longitude: -78.0383). Wilmington lies within the tidewater portion of North Carolina's Coastal Plain and is characterized by generally flat topography. The area is often swampy and predominantly consists of soft sediment with little or no underlying rock near the soil surface. The area is in a Humid Subtropical climatic region with moderate temperatures, long summers, and brief winters. Summer weather is dominated by a "Bermuda High" pressure system with calm, virtually cloudless weather conditions. Average air temperatures in Wilmington range between 44.5 °F in January and 80.1 °F in July. Annual precipitation averages 50.24 inches per year.

Air quality with respect to the National Ambient Air Quality Standards (NAAQS) in Brunswick County is classified as follows:

<u>Pollutant</u>	<u>Attainment Status</u>
PM-10	Attainment/Unclassifiable
Sulfur Dioxide	Attainment/Unclassifiable
Nitrogen Dioxide	Attainment/Unclassifiable
Carbon Monoxide	Attainment/Unclassifiable
Ozone	Attainment/Unclassifiable

Two Class I areas are located approximately 200 kilometers (km) from the facility: Swanquarter National Wildlife Refuge in Hyde County, North Carolina and Cape Romain National Wildlife Refuge near Awendaw, South Carolina.

## 5. REGULATORY ANALYSIS

The following discussion pertains to the Federal and state regulatory requirements that would be applicable to the proposed modification.

### 5.1 Prevention of Significant Deterioration (15A NCAC 2D .0530)

Congress established the Prevention of Significant Deterioration (PSD) program as part of the 1977 Clean Air Act Amendments. The PSD program requires pre-construction review prior to obtaining a permit. The basic goal of PSD is to ensure that the air quality in clean (i.e. attainment) areas does not significantly deteriorate while maintaining a margin for future industrial growth. The PSD regulations focus on industrial facilities, both new and modified, that create significant increases in the emission of certain pollutants.

Pursuant to the Federal Register notice on February 23, 1982, North Carolina (NC) has full authority from the EPA to implement the PSD regulations in the State effective May 25, 1982. NC's State Implementation Plan (SIP)-approved PSD regulations have been codified in 15A NCAC 2D .0530, which implement the requirements of 40 CFR 51.166. The Code of Federal Regulations (CFR) are incorporated by reference in 15A NCAC 2D .0530 unless a specific reference states otherwise. The version of the CFR incorporated in 15A NCAC 2D .0530 is that as of November 7, 2003, except those provisions noticed as stayed in 69 FR 40274, and does not include any subsequent amendments or editions to the referenced material. The PSD regulations applicable to this project are the regulations in 15A NCAC 2D .0530 in effect as of the final permit issuance date. The latest revisions to 15A NCAC 2D .0530 became effective on May 1, 2008.

Under PSD requirements, all major new or modified stationary sources of air pollutants as defined in Section 169 of the Federal Clean Air Act (CAA) must be reviewed and permitted prior to construction by EPA or permitting authority, as applicable, in accordance with Section 165 of CAA. A "major stationary source" is defined as any one of 28 named source categories, which emits or has a potential to emit 100 tons per year of any regulated pollutant, or any other stationary source, which emits or has the potential to emit 250 tons per year of any PSD regulated pollutant.

This chemical processing facility (SIC Code 2824) is one of the 28 named source categories. The existing facility has the potential to emit greater than 100 tpy of at least one NSR-regulated pollutant, and is therefore a PSD major stationary source as defined in 40 CFR 51.166(b)(1)(i)(a). The proposed modification will result in potential emissions increases of greater than 40 tpy for NO<sub>x</sub>, which is the significant emission rate pursuant to 40 CFR 51.166(b)(23)(i). Therefore, PSD permitting for a major modification is required for NO<sub>x</sub> pursuant to 15A NCAC 2D .0530.

In accordance with the PSD requirements for major source permitting pursuant to 15A NCAC 2D .0530 and 40 CFR 51.166, DAK performed the following reviews and analyses for VOC emissions associated with the project:

- Best Available Control Technology (BACT) determination (See Section 6.0 of application);
- Air Quality Impact Analysis including air dispersion modeling to determine the extent and significance of any potential air quality impact (See Section 7.0 of application); and,
- Additional Impacts Analysis including effects on soils, vegetation, and visibility (See Section 8.0 of application).

## 5.2 Title V Permitting (15A NCAC 2Q .0500)

The proposed modification constitutes a significant modification of the Title V Air Quality Permit. DAK Americas has chosen to use the 2-Step significant modification procedures pursuant to 15A NCAC 2Q .0501(c)(2). This “1<sup>st</sup>-Step” modification is being processed in accordance with state permitting procedures in 15A NCAC 2Q .0300 and the PSD permitting procedures in 15A NCAC 2D .0530. **Within 12 months of initial start-up of any of the new or modified equipment, DAK Americas is required to submit “2<sup>nd</sup>-Step” application for significant modification of the Title V permit pursuant to 15A NCAC 2Q .0504.**

## 5.3 Regulations Applicable to the New/Modified Process Equipment

### 5.3.1 15A NCAC 2D. 1111: 40 CFR 63, Subpart G – Hazardous Organic NESHP (“HON”)

The existing operations at DAK are affected by the HON. A summary of post-modification source classification and proposed changes is provided in the following Table:

**Table 5.3.1-1. Summary of HON Affected Sources**

Source Category	Affected Sources	Standard/Compliance Strategy
Group 1 Process Vents (TRE≤1.0)	Atmospheric Absorbers (ID Nos. CTA-RDA13 and CTA-RDA23)  Ingredients Recover Vents (ID Nos. REC-RDA41, REC-RDA42, and REC-RDA52)	Reduce Organic HAP by 98% by weight.  Control Device: Fume Abatement System with Thermal Oxidizer and Packed Bed Scrubber (ID Nos. CD-A43 and CD-A44)
Group 2 Process Vents (1.0>TRE≥4.0)	High Pressure Absorbers (ID Nos. CTA-RDA11, CTA-RDA21)	Monitoring of the high pressure absorbers, including the exit scrubbing liquid temperature and the specific gravity.
Group 2 Process Vents (TRE>4.0)	PTA Process Vent (ID No. PTA-13)  Methanol Column (ID No. REC-MC1)	Retain records of the TRE index determination.
Group 1 Storage Vessels	Methanol Storage Tanks (ID Nos. REC-ST2 and REC-PR9DMST)*	Reduce Organic HAP by 90% by weight.  Control Device: Packed Tower Scrubber (ID No. CD-PR9)

Source Category	Affected Sources	Standard/Compliance Strategy
Group 2 Storage Vessels	p-Xylene Storage Tanks (ID Nos. S5, S6, ST-1, ST-2, and ST-3)**	Recordkeeping Only
Group 1 Transfer Operations	Methanol Loading Rack (ID No. REC-PR9MLR)***	Reduce Organic HAP by 98% by weight. Control Device: Packed Tower Scrubber (ID No. CD-PR9)
Group 2 Wastewater Streams	CROA Packed Bed Scrubber (ID No. CD-A46) Bleed Stream MP CROA Packed Bed Scrubber (ID No. CD-A48) Bleed Stream HP CROA Packed Bed Scrubber (ID No. CD-A50) Bleed Stream Fume Abatement Halogen Control Scrubber (ID No. CD-A44) Bleed Stream CTA Line No. 1 Condensate Drum Stream (ID No. CTA-RDA13) CTA Line No. 2 Condensate Drum Stream (ID No. CTA-RDA23) Methanol Column (ID No. REC-MC1) Bottoms Stream PTA Re-Slurry Solvent (ID No. PTA-14) Drum Stream Wastewater Treatment Plant (ID Nos. W1 through W18)	Recordkeeping Only

\* These storage vessels are also affected by 15A NCAC 2D .0949 – Storage of Miscellaneous VOCs. However, the HON requirements are more stringent, and monitoring/recordkeeping/reporting for the HON is sufficient to demonstrate compliance with this regulation.

\*\* These storage vessels are also affected Group 2 storage vessels under 40 CFR 60, Subpart JJJ – NESHAP for Polymers and Resins IV. However, the recordkeeping requirements for the two applicable regulations are identical.

\*\*\* These transfer operations is also affected by 15A NCAC 2D .0948 – VOC Emissions for Transfer Operations. This standard only requires that the transfer operations be equipped with and use submerged loading.

The proposed permit requires DAK to conduct a performance test of the fume abatement system (ID No. CD-A43 and CD-A44) within 180 days of completing the proposed modification to demonstrate compliance with the 98% organic HAP control requirements and re-establish allowable operating parameters for the system.

The Permittee must submit a permit application within 90 days of completing the performance test to incorporate the operating parameters into the permit.

### 5.3.2 15A NCAC 2D .0524: 40 CFR 60, Subpart III – NSPS for SOCM I Air Oxidation Unit Processes

Several process vents at the facility are affected Group 2 process vents under the NSPS for SOCM I Air Oxidation Unit Processes (ID Nos. CTA-RDA11, CTA-RDA13, CTA-RDA21 and CTA-RDA23). DAK is only required to comply with the process change and TRE index value recalculation requirements, and associated recordkeeping and reporting to demonstrate compliance with this regulation.

5.3.3 15A NCAC 2D .0524: 40 CFR 60, Subpart NNN – NSPS for SOCMI  
Distillation Operations

The methanol column (**ID No. REC-MC1**) is affected by 40 CFR 60, Subpart NNN with a TRE value greater than or equal to 1. Because it is also an affected Group 2 process vent pursuant to 40 CFR 63, Subpart G, the Permittee is only required to comply with limited recordkeeping and reporting requirements associated with the rule, as provided in the proposed permit.

5.3.4 15A NCAC 2Q. 0317: Avoidance Condition for 15A NCAC 2D. 0530:  
Prevention of Significant Deterioration (CO)

CO emissions from the existing TPA lines are limited to no greater than 11,315 tpy. This limit was established to avoid PSD permitting for a previous modification. Under the existing configuration, DAK demonstrates compliance with this avoidance condition by limited production from each of the TPA lines to no greater than 473,000.000 pounds per consecutive 12-month period.

As part of the proposed modification, DAK will be modifying the existing TPA lines to produce CTA. DAK will continue to be affected by the 11,315 tpy CO emission limitation. However, because the modifications to the line will also reduce the CO emission rate (in lbs CO/lbs produced), the production limitation at the modified lines will increase.

DAK estimates that the new, uncontrolled CO emission rate from the modified lines will be 2,991 lb CO/hr/line. To determine the new production limitation, DAK conservatively assumed that the catalytic oxidizers associated with the production lines would only be operational 85% of the time, and that the oxidizers would only reduce CO emissions by 85% by weight while operating. Under these assumptions, the p-xylene feed rate to each of the CTA production lines must not exceed 862,000 tons per consecutive 12-month period.

The proposed permit requires DAK to test each of the three catalytic oxidizers to determine the CO control efficiency within 60 days after achieving the maximum production rate at which the lines will be operated, but no later than 180 days after initial startup following the modification. If the required 85% control efficiency is not achieved, the Permittee must submit a permit application to revised the PSD avoidance condition, or comply with the PSD permitting requirements, as appropriate.

In addition, the proposed permit requires the Permittee to monitor and record the p-xylene feed rates at the CTA lines to demonstrate compliance with the permitted limits.

## 5.4 Regulations Applicable to the New Process Heater

### 5.4.1 Particulates from Fuel Burning Indirect Heat Exchangers (15A NCAC 2D .0503)

This regulation limits particulate matter (PM) emissions from the firing of fuel in indirect heat exchangers (in lb/mmBtu) based on the facility-wide heat input. The PM limit for the new process heater (**ID No. ES15**) is determined by summing its maximum heat input capacity with the maximum heat inputs of the existing fuel-fired sources. The PM limit for the new process heater shall be 0.166 lb/mmBtu, as demonstrated below:

<u>Indirect Heat Exchanger</u>	<u>Heat Input Rate</u>
Boiler ( <b>ID No. ES01</b> )	240.0 mmBtu/hr
Boiler ( <b>ID No. ES02</b> )	240.0 mmBtu/hr
Dowtherm heater ( <b>ID No. ES03</b> )	80 mmBtu/hr
Dowtherm heater ( <b>ID No. ES04</b> )	80 mmBtu/hr
Monomer boiler ( <b>ID No. ES07</b> )	168 mmBtu/hr
Monomer boiler ( <b>ID No. ES08</b> )	168 mmBtu/hr
Monomer boiler ( <b>ID No. ES10</b> )	168 mmBtu/hr
Dowtherm vaporizer ( <b>ID No. ES11</b> )	27 mmBtu/hr
Dowtherm vaporizer ( <b>ID No. ES12</b> )	27 mmBtu/hr
Dowtherm vaporizer ( <b>ID No. ES13</b> )	32 mmBtu/hr
Dowtherm vaporizer ( <b>ID No. ES14</b> )	32 mmBtu/hr
NEW Process Heater ( <b>ID No. ES15</b> )	135 mmBtu/hr
<u>Fume Abatement w/ Heat Recovery (<b>ID No. CDA43</b>)</u>	<u>10.0 mmBtu/hr</u>
Total Heat Input	1,407.0 mmBtu/hr

#### PM Limit, as calculated pursuant to 15A NCAC 2D .0503(c)

$$E = 1.090(Q)^{-0.2594}$$

Where: E = Allowable emission limit for PM (in lb/mmBtu); and,  
Q = Maximum heat input in mmBtu/hr

$$E = 1.090(1,407.0)^{-0.2594}$$

$$E = 0.166$$

Using AP-42 emission factors, PM emissions from the worst-case fuel (No. 2 fuel oil) are estimated to be less than 0.03 lb/mmBtu, as follows:

$$\frac{\left( 2 \frac{lbPM_{filterable}}{1,000 gal} + 1.3 \frac{lbPM_{condensable}}{1,000 gal} \right)}{140 \frac{mmBtu}{1,000 gal}} = 0.023 \frac{lbPM_{total}}{mmBtu}$$

Because worst-case PM emission rates are estimated to be less than the allowable PM emission rate, no monitoring, recordkeeping, or reporting shall be required to demonstrate compliance with this limitation.

#### 5.4.2 *Sulfur Dioxide Emissions from Combustion Sources (15A NCAC 2D .0516)*

This regulation limits sulfur dioxide (SO<sub>2</sub>) emissions to no greater than 2.3 lb/mmBtu of heat input for combustion sources. The new process heater (**ID No. ES15**) will be permitted to fire either natural gas, which has inherently low sulfur contents, and very low sulfur No. 2 fuel oil with the sulfur content limited to 0.3% by weight.

As shown in the following calculation, based on AP-42 emission factors, combustion of No. 2 fuel oil with a sulfur content of 0.3% by weight results in sulfur dioxide emissions less than the allowable limit:

$$142(0.3) \text{ lb SO}_2/1,000 \text{ gal} / 140 \text{ mmBtu}/1,000 \text{ gal} = 0.30 \text{ lb SO}_2/\text{mmBtu}$$

Because worst-case SO<sub>2</sub> emission rates are estimated to be less than the allowable emission rate, no monitoring, recordkeeping, or reporting shall be required to demonstrate compliance with this limitation.

#### 5.4.3 *Control of Visible Emissions (15A NCAC 2D .0521)*

This regulation limits visible emissions to no more than 20 percent opacity when averaged over a 6-minute period, except that 6-minute periods averaging more than 87 percent opacity may occur not more than once in any hour not more than four times in any 24-hour period.

Due to inherently low visible emissions from No. 2 fuel oil and natural gas firing, no monitoring, recordkeeping, or reporting shall be required to demonstrate compliance with this limitation.

#### 5.4.4 *New Source Performance Standards (15A NCAC 2D .0524), 40 CFR 60, Subpart Db – Steam Generating Units*

As part of this modification, DAK is proposing to install a new steam-generating process heater with a maximum heat input capacity of 135 million British thermal units per hour (MMBtu/hr). The new process heater will be subject to the provisions of 40 CFR 60, Subpart Db pursuant to 40 CFR 60.40b(a).

The proposed process heater will be fired by both natural gas and very low sulfur fuel oil. As defined in 40 CFR 60.41b, “very low sulfur fuel” for affected units constructed after February 28, 2005 means, “an oil that contains no more than 0.3 weight percent sulfur. . .”

- Sulfur Dioxide. Pursuant to 40 CFR 60.42(k)(2), units firing only very low sulfur oil and/or a mixture of gaseous fuels with a potential SO<sub>2</sub> emission rate of 0.32 lb/MMBtu or less are

except from SO<sub>2</sub> emission limits. Initial SO<sub>2</sub> testing is not required pursuant to 40 CFR 60.45b(j).

- Particulate Matter/ Visible Emissions. Pursuant to 40 CFR 60.43b(h)(5), affected sources constructed after February 28, 2005 that only fire natural gas and fuel oil are not affected by the particulate matter or visible emission limits.
- Nitrogen Dioxide. Pursuant to 40 CFR 60.44b(a), NO<sub>x</sub> emissions from natural gas and distillate-fired units with a high heat release rate are limited to not greater than 0.20 lb/MMBtu.

DAK will be required to conduct a performance test of the boiler within 180 days of initial start-up to demonstrate compliance with the underlying standard. In addition, DAK will be required to install a CEMS to monitor NO<sub>x</sub> emissions. Within 360 days of the initial startup of the affected process heater the Permittee may submit to the DAQ Permits Section for approval a plan that identifies the operating conditions to be monitored, including steam generating unit load, to predict NO<sub>x</sub> emission rates and the records to be maintained. Approval of such plan will allow the removal of the CEMS.

*5.4.5 15A NCAC 2Q. 0317: Avoidance Condition for 15A NCAC 2D. 0530:  
Prevention of Significant Deterioration (SO<sub>2</sub>)*

The modification will include the addition of a new natural gas and No. 2 fuel oil fired process heater with a maximum heat input of 135 million Btu per hour (**ID No. ES15**). Potential emissions from the proposed process heater are shown in Table 5.7-1.

**Table 5.7-1. Potential Emission Rates of Process Heater (ID No. ES15)**

<b>Pollutant</b>	<b>Potential Emissions (tpy)</b>	<b>PSD Significant Emissions Rate (tpy)</b>	<b>Emission Factor Reference</b>
PM-10	4.22	15	AP-42, Chapter 1.3
<b>SO<sub>2</sub></b>	<b>179.92</b>	<b>40</b>	AP-42, Chapter 1.3 (S=0.3 per 40 CFR 60, Subpart Db)
<b>NO<sub>x</sub></b>	<b>41.39</b>	<b>40</b>	BACT (0.07 lb/MMBtu)
CO	21.12	100	AP-42, Chapter 1.3
VOC	0.84	40	AP-42, Chapter 1.3

The process heater is the only potential source of increased SO<sub>2</sub> emissions from this modification. In order to avoid applicability of the PSD permitting requirements for SO<sub>2</sub> pursuant to 15A NCAC 2D .0530, total SO<sub>2</sub> emissions from the process heater will be limited to less than 40 tpy. To demonstrate compliance with the limit, the Permittee will be required to track natural gas and No. 2 fuel oil usage at the process heater, obtain and maintain a record of fuel oil certifications for the fuel oil listing the sulfur content, and conduct monthly compliance demonstrations by calculating actual SO<sub>2</sub> emissions from the heater for the previous calendar month and the previous 12-month period.

PSD permitting is required for NO<sub>x</sub> emissions increases, and BACT for the process heater is discussed further in Section 6.0 of this document.

## **5.5 15A NCAC 2D .1100: Control of Toxic Air Pollutants – State-Enforceable Only**

North Carolina has state-enforceable toxic air pollutant (TAP) standards that limit ambient impacts of regulated TAPs. Pursuant to the rule, if facility-wide emissions of a regulated TAP exceed the associated Toxic Permitting Emissions Rate (TPER) provided in 15A NCAC 2Q .0711, the facility must demonstrate that the ambient impact of the affected pollutant does not exceed the Acceptable Ambient Level (AAL) pursuant to 15A NCAC 2D .1100 using air dispersion modeling. The proposed modification will result in increases of various regulated TAP and/or changes to the previously modeled emission points. Therefore, DAK Americas submitted a revised air dispersion modeling analysis to demonstrate that ambient impacts of the TAP emissions are below the associated AALs.

The modeled emission rates depend upon the 95% reduction of benzene, toluene, and xylene by the catalytic oxidizers (**ID Nos. CDA45, CDA47, and CDA49**) and a 98% reduction of benzene, toluene, and xylene by the fume abatement system (**ID No. CDA43**). The fume abatement system is subject to the “HON” monitoring requirements, which should be sufficient to demonstrate compliance with the applicable TAP standards. However, the catalytic oxidizers are not subject to any other monitoring provisions. Therefore, the TAP section of the proposed permit includes new performance testing and monitoring requirements for the catalytic oxidizers.

A summary of the air toxics compliance demonstration is provided in Section 7.2 of this Preliminary Determination.

## **5.6 Non-Applicable Regulations**

### *5.6.1 Non-Attainment New Source Review (15A NCAC 2D .0531)*

New Hanover County is designated as “attainment” or “unclassifiable” for all New Source Review (NSR)-regulated pollutants. Therefore, NA-NSR permitting requirements pursuant to 15A NCAC 2D .0531 do not apply.

## 6. BEST AVAILABLE CONTROL TECHNOLOGY

### 6.1 Introduction

For each pollutant subject to a PSD review, the Permittee must determine and apply the Best Available Control Technology (BACT). BACT is defined, in pertinent part, at 40 CFR 51.166(b)(12) as:

*An emissions limitation . . . based on the maximum degree of reduction for each pollutant . . . which would be emitted from any proposed major stationary source or major modification which the reviewing authority, on a case-by-case basis, taking into account energy, environment, and economic impacts and other costs, determines is achievable . . . for control of such a pollutant.*

The BACT requirements are intended to ensure that the control systems incorporated in the design of the proposed modification reflect the latest control technologies and take into consideration existing and future air quality in the vicinity of the facility. Given the variation between emission sources, facility configuration, local airsheds, and other case-by-case considerations, Congress determined that it was impossible to establish a single BACT determination for a particular pollutant or source. Economics, energy, and environmental impact are mandated in the CAA to be considered in the determination of case-by-case BACT for specific emission sources. In most instances, BACT may be defined through an emission limitation. In cases where this is impossible, BACT can be defined by the use of a particular type of control device and its achievable emission reduction efficiency. In no event can a technology be recommended which would not comply with any applicable standard of performance under NSPS (40 CFR Part 60) and NESHAPS (40 CFR Part 61).

To assist in bringing consistency to the BACT process, U.S. EPA developed guidance for PSD applicants to use the "top-down" approach to BACT. However, NC DAQ does not strictly adhere to EPA's top-down guidance. Rather NC DAQ implements BACT in strict accordance with the statutory and regulatory language. As such, NC DAQ's BACT conclusions may differ from those of the applicant or U.S. EPA.

### 6.2 BACT Determination – NO<sub>x</sub>

The proposed modification results in a significant net emissions increase of NO<sub>x</sub>. Pursuant to 40 CFR 51.166(j), BACT must be applied to each new and/or modified emission source resulting in a net NO<sub>x</sub> emissions increase. For the proposed modification, the new natural gas/No. 2 fuel oil fired process heater (**ID No. ES15**) is the only potential source of increased NO<sub>x</sub>. The uncontrolled NO<sub>x</sub> emissions increase from the process heater is 101 tpy.

6.2.1 Identification of Control Technologies

The new natural gas/No. 2 fuel oil fired process heater (**ID No. ES15**) will have a maximum heat input capacity of 135 million Btu/hr. To identify commercially available emission controls, the DAK conducted a search of the RACT/BACT/LAER Clearinghouse (RBLC) for distillate fuel oil fired boilers with heat input capacities between 100 million Btu/hr and 250 million Btu/hr. The search identified the following controls:

**Table 6.2.1-1. Available NOx Control Option for Fuel Oil/Natural Gas Combustion**

Control Technology	NOx Emission Reduction (by weight)
Selective Catalytic Reduction (SCR)	70%
Low NOx Burners with Flue Gas Recirculation (FGR)	42%
Over-fire and Side-fire Air	10%-25%
Good Design/Operation	Base Case

DAK determined that each of the emission control options listed above is technically feasible.

6.2.2 BACT Determination and Emission Limitations

**SCR Evaluation**

The most effective emission control technology identified is the SCR. In an SCR, NOx in the exhaust stream reacts with ammonia (NH<sub>3</sub>) in the presence of a catalyst to form nitrogen gas (N<sub>2</sub>) and water vapor. Components of an SCR include a reactor vessel, a catalyst, and an ammonia storage and injection system. The NOx emission reduction efficiency of an SCR system generally varies between 70% and 90% by weight.

Cost:

A summary of the cost analysis for this control device is summarized in Table 6.2.2-1 below:

**Table 6.2.1-1. Summary of SCR Cost Analysis**

Uncontrolled NOx Emission Rate <sup>(1)</sup>	101 tpy
Estimated Annual Costs	\$615,311/yr
SCR NOx Emission Control Efficiency	70% - 90%
Estimated NOx Emission Reduction	71 tpy - 91 tpy
<b>Estimated Cost of Emissions Control</b>	<b>\$8,666/ton - \$6,761/ton</b>

1. Uncontrolled emission rate calculated using AP-42 emission factors for NOx, assuming the maximum firing rate for 8,760 hr/yr

Estimated annual costs include both direct costs (maintenance, energy, labor, etc.) and indirect costs (capital recovery). Capital recovery costs were based on an equipment & instrumentation cost of \$2.5 million, contributing to a total capital investment of nearly \$5 million, an equipment life of 20 years, and a 7% interest rate. A detailed cost analysis is provided in Appendix B of the PSD permit application.

#### Environmental & Energy Impacts:

The use of an SCR to control emissions from the proposed process heater would reduce NOx emissions by 70% to 90% by weight, resulting in a total NOx emission reduction of between 71 tpy and 91 tpy. As a comparison, use of the next most efficient control (low NOx burners with flue gas recirculation) would result in a NOx emission reduction of just over 42 tpy. Therefore, the incremental NOx emissions reductions from the SCR are between 29 tpy and 49 tpy.

NOx can cause respiratory problems in animals and people, contribute to the formation of acid rain, and contribute to atmospheric particles that cause visibility impairment. In addition, NOx is a precursor to the formation of atmospheric ozone, and modeling has showed that ozone formation in North Carolina is NOx-limited. Ozone is the primary constituent of smog, can cause respiratory problems in animals and people, and damages vegetation and ecosystems.

However, there are also negative environmental impacts resulting from the use of an SCR, primarily resulting from the imperfect reaction of ammonia in the catalyst bed. Small concentrations of ammonia will pass through the bed without reacting, and will be emitted to the atmosphere. In a well-operated SCR, the exhaust stream will contain unreacted ammonia at a concentration of 5-10 ppm by weight. Like NOx, ammonia can contribute to the formation of fine particles that cause visibility impairment. In addition, the deposition of the ammonium ion ( $\text{NH}_4^+$ ), which is derived from atmospheric ammonia, in soils and surface water can contribute to acidification and eutrophication. In North Carolina, ammonia is a state-regulated toxic air pollutant (TAP).

In addition, the catalyst used in the SCR must be replaced approximately every 7 years. Spent catalyst is disposed of as a waste. The catalyst is generally vanadium oxide, and does not need to be handled as a hazardous waste.

#### Other:

There are additional safety concerns associated with the handling and storage of ammonia. Ammonia is toxic if swallowed or inhaled and can irritate or burn the eyes, skin, nose, or throat. In addition, ammonia vapors, when mixed with air, are potentially explosive. OSHA regulations require that facility where ammonia is used be trained in safe use and handling of ammonia. Ammonia is a commonly used reagent and can be handled and stored without incident.

#### Summary:

In this case, considerable weight is given to the cost analysis, which shows an estimated cost of control between \$6,750 and \$8,750 per ton of NOx controlled. This is higher than costs associated with other BACT determinations in North Carolina. From an environmental impact consideration, while North Carolina remains primarily NOx limited, there is only a relatively small incremental emission reduction from SCR as compared to the use of low NOx burners with flue gas recirculation. In conclusion, after consideration of the economic, environmental, and energy impacts discussed above, the DAQ does not believe SCR represents BACT for this emissions unit.

### **Low NOx Burner with Flue Gas Recirculation Evaluation**

A low NOx burner operates by creating multiple combustion zones. Generally, there is a primary combustion zone, where combustion begins in a lean-oxygen environment, and then a secondary combustion zone where combustion is completed in an oxygen-rich environment.<sup>2</sup> Flue gas recirculation (FGR) works by mixing some flue gas with the incoming combustion air, increasing the mass flow through the combustion zone and decreasing the oxygen concentration. These controls reduce the formation of thermal NOx emissions by reducing the combustion temperature.

#### Cost:

The application did not include a cost analysis for the use of a low NOx burner with FGR. However, these controls, which are integral to the operation of the combustion source, generally have significantly lower capital costs and direct operating costs than an add-on control device.

#### Environmental & Energy Impacts:

The use of a low NOx burner with FGR would reduce NOx emissions by about 42% by weight, resulting in a total NOx emission reduction of just over 42 tpy. The importance of NOx emissions reductions in North Carolina was discussed in the SCR evaluation provided above.

While low NOx burners with FGR have the potential to reduce the combustion efficiency, the efficiency reduction is negligible in well-designed and well-operated systems.

#### Summary:

Based on lack of cost information, potential NOx emissions reductions, and negligible harmful environmental and energy impacts, NC DAQ has determined BACT be low NOx burners with a flue gas recirculation design.

**NOx emissions from the affected process heater (ID No. ES15) will be limited to no greater than 0.07 lbs/MMBtu, which is equivalent to a 42% NOx emission reduction.**

A search of the RBLC database from 1998 to present identified at least six No. 2 fuel oil fired boilers with heat input capacities ranging between 120-211 MMBtu/hr, and for which BACT was identified as low NOx burners. The BACT emission limits for these facilities varied between 0.1-0.2 lbs/MMBtu.

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<sup>2</sup> NOTE: Low NOx burners designs vary widely, including the use of two or more combustion zones. However, the general goal is to reduce combustion temperature by manipulating the oxygen concentration and temperature in the combustion zones.

## 7. AIR QUALITY IMPACT ANALYSIS

PSD regulations [40 CFR 51.166(k)] require an applicant to perform an ambient impact analysis to determine if the Class II Area National Ambient Air Quality Standards (NAAQS), Class II Area increment, and Class I Area increment standards will be exceeded at any location and during any time period where the proposed modification will have significant impact.

In addition, North Carolina has state-enforceable toxic air pollutant (TAP) standards that limit ambient impacts of regulated TAPs. Pursuant to the rule, if facility-wide emissions of a regulated TAP exceed the associated *de minimus* TAP Permitting Emissions Rate (TPER) provided in 15A NCAC 2Q .0711, the facility must demonstrate that the ambient impact of the affected pollutant does not exceed the Acceptable Ambient Level (AAL) pursuant to 15A NCAC 2D .1100 using air dispersion modeling.

This modeling analysis review addresses the ambient impacts of NO<sub>x</sub>, a PSD-regulated pollutant, and various state-regulated TAP. The modeling analysis demonstrates that the proposed modification will not cause or contribute to an exceedence of the Class II NAAQS and PSD Increment, Class I Increment, or NC air toxic AAL.

The DAK Americas facility is located near Phoenix, North Carolina in a coastal area with predominantly flat terrain that is generally agricultural, industrial, and forestland. For modeling purposes, the area is classified as rural based on the land-use type scheme established by Auer 1978.

### 7.1 Nitrogen Oxides (NO<sub>x</sub>)

#### 7.1.1 Class II Preliminary Impact Analysis

DAK Americas conducted the required air quality impact analysis using the EPA AERMOD model and five years (1988-1992) of National Weather Service (NWS) surface (Wilmington, NC) and upper air (Charleston, SC) meteorological data. Full terrain evaluations were included, as were normal regulatory defaults and representative land use data. The receptor grid began at the fence line and extended outwards to 20 kilometers at 100-meter intervals.

Maximum potential emission rates were modeled to determine the maximum annual (High-1<sup>st</sup>-High, H1H) impacts for NO<sub>x</sub>. The modeled impact rates were then compared to the associated Class II Significant Impact Level (SIL). As shown in Table 7.1.1-1, the modeled impacts exceeded SIL for NO<sub>x</sub>. Therefore, a full PSD air quality impact analysis is required for this pollutant, which is discussed further in Section 7.1.2 of this document.

**Table 7.1.1-1. Class II Preliminary Impact Analysis**

Pollutant	Averaging Period	Maximum Modeled Impacts <sup>1</sup> (µg/m <sup>3</sup> )	Class II Area SILs (µg/m <sup>3</sup> )
NOx	Annual	1.13	1

<sup>1</sup> High First-High (H1H) modeled impact.

### 7.1.2 Class II Full Impact Analyses

The full impact analyses, including a NAAQS Analysis and a PSD Increment Analysis, use the same modeling software, meteorological data, and receptor grid network described in Section 7.1.1. above, but are more comprehensive than the preliminary analysis. The NAAQS Analysis includes a NOx annual background value of 27.4 µg/m<sup>3</sup>, which is the highest background value determined from the extensive monitoring network in North Carolina (Charlotte monitor). In addition, both the NAAQS and PSD Increment Analyses include both on-site and off-site NOx emissions sources. NC DAQ requires that any off-site source within 60 kilometers of the facility be included in the full impact analysis if it meets the following “Screening Threshold”:

$$Q/D \geq 20$$

Where, Q = Emissions (in tpy); and,  
D = Distance (in km)

The NAAQS Analysis, summarized in Table 7.1.2-1, and the PSD Increment Analysis, summarized in Table 7.1.2-2, demonstrates compliance with the respective standards.

**Table 7.1.2-1. Class II NAAQS Analysis**

Pollutant	Averaging Period	Modeled Impacts <sup>1</sup> (µg/m <sup>3</sup> )	Background (µg/m <sup>3</sup> )	Total Impact (µg/m <sup>3</sup> )	NAAQS (µg/m <sup>3</sup> )	% of NAAQS
NOx	Annual	32.2	27.4	59.6	100	59.6

<sup>1</sup> Combined impact of both on-site and off-site sources.

**Table 7.1.2-2. PSD Class II Increment Analysis**

Pollutant	Averaging Period	Modeled Impacts <sup>1</sup> (µg/m <sup>3</sup> )	Increment (µg/m <sup>3</sup> )	% of Increment
NOx	Annual	8.62	25	34.5

<sup>1</sup> Combined impact of both on-site and off-site sources.

### 7.1.3 Class I Area Impacts

The two closest Class I areas to the DAK Americas facility are the Swanquarter National Wildlife Refuge (Hyde County, North Carolina) and the Cape Romain National Wildlife Refuge (Awendaw, South Carolina). Both are located approximately 185 kilometers from the facility.

NC DAQ did require a Class I SIL analysis for NOx. The Applicant used the CALPUFF model with the 4 km, VISTAS-produced, 3-year (2001-2003) meteorology dataset and used Class I coordinates provided by the National Park Service to locate receptors. The model, summarized in Table 7.1.3-1, showed that Class I impact was less than the SIL.

**Table 7.1.3-1. Class I Area Preliminary Impact Analysis (SILs)**

Pollutant	Averaging Period	Maximum Modeled Impacts ( $\mu\text{g}/\text{m}^3$ )		Class I Area SILs ( $\mu\text{g}/\text{m}^3$ )
		Cape Romain	Swanquarter	
NOx	Annual	0.008	0.007	0.1

Based on the Class I SIL analysis results summarized above, a full Class I increment analysis is not required for the proposed modification.

## 7.2 Non-Regulated Pollutant Impact Analysis (North Carolina Toxics)

The existing Air Quality Permit has state-enforceable emissions limitations under the North Carolina Air Toxics Program pursuant to 15A NCAC 2D .1100. DAK Americas submitted a revised compliance demonstration to show the ambient impacts of facility-wide toxics air pollutant (TAP) emissions will continue to be less than the Acceptable Ambient Levels (AALs) following the proposed modification. The AERMOD software was used with the same receptor grid that was utilized in the NAAQS analysis. TAP emissions limits in the draft permit have been revised to be consistent with the revised compliance demonstration. Table 7.2-1 provides a summary of the TAP modeling results.

**Table 7.2-1. NC Toxics Modeling Results**

Pollutant	Averaging Period	Modeled Impacts ( $\mu\text{g}/\text{m}^3$ )	AAL ( $\mu\text{g}/\text{m}^3$ )	% of AAL
Acetic Acid	1-hour	2,448	3,700	66
Benzene	Annual	0.08	0.12	67
Xylene	24-hour	61	2,700	2.2
	1-hour	954	65,000	1.5
Toluene	24-hour	28	4,700	0.6
	1-hour	347	56,000	0.6
Acetaldehyde	1-hour	1,790	27,000	33
1,4-Dioxane	24-hour	11	560	1.9

Note that off-gases from the medium pressure catalytic oxidizers (**ID No. CD-A47**) associated scrubbers, including uncontrolled TAP emissions, are used in the pneumatic transfer material to the various storage silos. Therefore, process emissions from this control device are released to the atmosphere from the silos, and the silos are included in the model as point sources of TAP.

## **8. ADDITIONAL IMPACT ANALYSIS**

### **8.1 Local Visibility, Soils, and Vegetation**

PSD regulations [40 CFR 51.166(o)(1)] require that applications for major modifications include an analysis of the impairment to visibility, soils, and vegetation that would occur as a result of the proposed modification and the associated commercial, residential, industrial, and other growth. The analysis need not include an evaluation of the impact on vegetation having no significant commercial or recreational value.

DAK Americas is located in the Coastal Plains of North Carolina. The local geography is characterized by flat terrain with a mix of forestland (predominated by pine), agricultural crops, and herbaceous vegetation.

A Level 1 visibility impairment analysis was performed using the VISCREEN model to demonstrate that screening criteria will not be exceeded in any Class II Areas. With background visibility set at 80 km, the model showed that the emissions increases from the modification will result in a perceptibility ( $\Delta E$ ) impact of 0.538 and a plume contrast ( $C_p$ ) impact of 0.006 at a distance of 70 km beyond the facility boundary. These values are well below the screening thresholds of 2.00 and 0.05 for  $\Delta E$  and  $C_p$ , respectively. There are no special visibility protection areas within a 70 km radius of the facility. Therefore, based on the results of this conservative screening analysis, no significant impacts to local visibility are expected to result from the proposed sulfuric acid plant. (See Section 8.3 for a review of Class I visibility impacts.)

Secondary NAAQS for  $\text{NO}_x$  was established at  $100 \mu\text{g}/\text{m}^3$  (0.053 ppb) on an annual average, the same as the primary NAAQS for  $\text{NO}_x$ , to protect the public welfare from any known or anticipated adverse effects, including impacts to soil and crops. Air dispersion modeling, summarized in Section 7 of this Preliminary Determination, predicts the annual  $\text{NO}_x$  impact to be  $8.63 \mu\text{g}/\text{m}^3$ , or about 35% of the secondary NAAQS. The modeled impact includes both background concentration and off-site impacts. The highest modeled impacts occur at or near the proposed facility fenceline. No significant impacts to local soils or vegetation are expected to result from the proposed modification.

### **8.2 Growth Impacts**

PSD regulations [40 CFR 51.166(o)(2)] requires that applications include an analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial, and other growth associated with the proposed modification.

In the permit application, DAK Americas indicated that the proposed modification will not result in any appreciable increase in employment at the facility. Growth impacts and secondary emissions resulting from the proposed project are expected to be minimal.

### 8.3 Visibility Impacts on Class I Areas

PSD regulations [40 CFR 51.166(p)] provides an opportunity for the Federal Land Manager (FLM) to determine whether the proposed modification would have an adverse impact on an air quality related value (AQRV), including visibility, on any Class I areas. The closest Class I areas are the Swanquarter National Wildlife Refuge in Hyde County, North Carolina and Cape Romain National Wildlife Refuge near Awendaw, South Carolina, each of which are approximately 200 km from the Cape Fear Plant in Leland, Brunswick County, North Carolina.

As provided in Section 7.1.3 of this Preliminary Determination, the proposed project did not exceed the significant impact level (SIL), a screening parameter, for the Class I areas. Therefore, it is presumed that the proposed project will not exceed any Class I increment. As such, NC DAQ is not statutorily required to provide an early notification and visibility analysis to the FLM.

While no prior notification is required, Mr. Chuck Buckler (NC DAQ) contacted Ms. Jill Webster, the FLM for Swanquarter, on March 27, 2008 to discuss the proposed project. At that time, anticipated emissions increases associated with the proposed project were as follows:

<b>Pollutant</b>	<b>Anticipated Emissions Increase</b>
TSP	30 tpy
PM-10	25 tpy
SO <sub>2</sub>	300 tpy
NO <sub>x</sub>	100 tpy

DAK Americas subsequently refined the emissions estimates, and anticipated emissions increases projected in the final permit application are far smaller, as provided in Table 2.1-1 of this permit. In particular, DAK Americas is accepting as emissions limitation on the new process heater, which will limit SO<sub>2</sub> emissions increases associated with the proposed modification to less than 40 tpy.

In an email to Mr. Buckler and Ms. Fern Paterson (NC DAQ) dated March 27, 2008, Ms. Webster indicated that, based on the higher anticipated emissions increases listed above and the distance between the facility and Swanquarter, the U.S. Fish and Wildlife Service did not expect the proposed project to adversely impact the Class I area.

Any further analysis related to AQRV's in the Class I areas provided by the FLM during the comment period will be considered by NC DAQ prior to taking any final action on the proposed PSD permit.

**APPENDIX A**  
**DRAFT PERMIT**

**APPENDIX B**  
**PUBLIC NOTICE**