Southern Nuclear
Operating Company, Inc.
40 Inverness Center Parkway
Birmingham, Alabama 35242

RECEIVED

SEP 14 2009

AIR PROTECTION BRANCH

SOUTHERN COMPANY

Energy to Serve Your World℠

September 11, 2009

FEDERAL EXPRESS

ND-09-1451

Vogtle Electric Generating Plant
Air Quality Permit Application No. 18986
Vogtle Units 3 and 4 Project
AIRS No.: 033-00030

Mr. Bradley Belflower
Georgia Environmental Protection Division
Air Protection Branch
4244 International Parkway, Suite 120
Atlanta, Georgia 30354

Dear Mr. Belflower:

In response to the Georgia Environmental Protection Division (EPD) comments and requests associated with the Vogtle Units 3 & 4 Air Quality Permit Application No. 18986, Southern Nuclear Operation Company (SNC) provides the following information as related to the "Top-down" BACT analysis and Yan Huang's request for additional information on the PSD model. The following responses are provided and the supporting documentation attached to facilitate EPD's review of the Air Quality Permit Application No. 18986:

1. **EPD Comment**: After reviewing the BACT analysis in the PSD permit application dated May 2009 for Southern Nuclear's Plant Vogtle Units 3 & 4, EPD has determined that the BACT analysis was not fully documented. The analysis should fully document the "top-down" approach. The analysis, for example, did not list any possible control technologies (including technologies that are not practical or are unproven). When conducting the analysis for cost per ton of emissions reduced as part of the BACT analysis, EPD suggests assuming each engine operate for 500 hours per year (see Page D-1, Emergency Generator Example, of the Division's Procedure to Calculate a Facility's "Potential to Emit" and to determine its Classification, which I have attached to this email). Note that EPD believes that this calculation is appropriately performed at 500 hours per year and will not limit the hours of operation on the engines.

   SNC Response: Supplemental information for the "Top-down" BACT analysis described in the PSD application is included in Attachment 1.

2. **EPD Comment:** Ozone ambient impact analysis: According to federal regulations (40 CFR 52.21(i)(5), 'any application proposing a net emission increase of 100 tpy or more of VOC or NOx subject to PSD would be required to perform an ambient impact analysis including the gathering air quality data'. We didn't see any discussion and analysis on this. Please refer to the attached document for such discussion. You can find the recent 3 years Ozone data at www.epa.gov/air/data. You need to obtain the H4H 8-hour Ozone concentration from recent three years, and average over the three values. Vogtle is close to Augusta and Evans monitoring sites. A justification is needed to use Evans site instead of Augusta because the latter one is in a non-attainment area.

   SNC Response: The response to the Ozone ambient impact analysis comment is included in Attachment 2.

3. **EPD Comment**: In Section 7.3.1, further refinements were used to eliminate some fugitive sources and sources less than 1 lb/hr. We don't have the ability to approve such a deviation from federal guidelines regarding this, and will put back those off-site sources for modeling review.

   SNC Response: The revised list of fugitive sources, including sources with emissions less than 1 lb/hr are included on the CDs in attachment 3. Also included on the CDs are the revised modeling files.

Please direct questions, comments, or requests for information associated with this Air Quality Permit Application to me at (205) 992-7536.

Sincerely,

Dale L. Fulton
Environmental Specialist
Southern Nuclear Operating Company

DLF:dmw

Enclosure:

Attachment 1 – Top-down BACT Analysis Supporting Documentation
Attachment 2 – Ozone Ambient Impact Analysis
Attachment 3 – Fugitive Sources (<1 lb/hr) & Modeling Revision (CDs)

cc: <u>w/o Attachments</u>
M. K. Smith
C. R. Pierce
A. D. Mitchell

<u>w/ Attachments</u>
J. A. Joyner
Document Services RTYPE: AR01.1053
EA File: E.05.93
EA File: E.03.93
ND File AR.01.04

ND-09-1451
Mr. Bradley Belflower
State of Georgia Environmental Protection Division

ATTACHMENT 1

to ND-09-1451
Air Quality Permit Application No. 18986

SNC Response to Comment 1 – Top-down BACT Analysis Supporting Documentation

As discussed in sections 4.4.1, Control Technology Review and 6.0, Best Available Control Technology of the Vogtle Units 3&4 Air Quality Permit Application No. 18986, a BACT analyses was conducted using the top-down analysis approach. The methodology of the top-down approach is described in Section 6.0 of the application. The following information is provided as a supplement to the analysis included in the application.

PM/PM10

Under proper combustion conditions only a small amount of PM results from the combustion of diesel fuel in internal combustion engines. However, carbon soot particles can form black smoke due to insufficient oxygen, and lubricating oil leaks that reach the combustion chamber can form a blue smoke when they are partially burned.

<u>Identify Potentially Available Control Technologies</u>

The following control technologies were evaluated as being potentially available for controlling PM/PM10 from the diesel engines:

- Particulate Filters
- Combustion Process Design
- Ultra Low Sulfur Fuel Oil
- Proper Maintenance

Particulate Filters

Because of combustion controls included in modern internal combustion engines, the uncontrolled PM/PM10 emissions are very low. Based on a review of the RBLC database, no diesel engines include an add-on control for PM/PM10. The engine manufacturers may use catalyzed diesel particulate filters in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Combustion Process Design

Carbon soot particles can form black smoke in the combustion chamber if the combustion reaction is oxygen deficient. Therefore, good combustion process design that ensures the proper air and fuel mixing, extended combustion chamber residence times, and consistent high combustion chamber temperatures can reduce the formation carbon soot and black smoke. Good combustion process design is a standard feature of modern engines.

Ultra Low Sulfur Fuel Oil

The quality of the diesel fuel can influence the particulate emissions in that typically more refined products have lower ash contents. Ultra low sulfur diesel fuel has the lowest sulfur content (0.0015%) of any readily available diesel fuel.

Proper Maintenance

Lubricating oil leaks that reach the combustion chamber and are partially burned can produce blue smoke. Proper maintenance is the most effective method of preventing blue smoke from internal combustion engines.

<u>Technical Feasibility</u>

Particulate Filters
Conventional add-on particulate control technologies are not considered feasible for use on the internal combustion engines proposed for this project since none have been identified as currently in use in similar engines in the RBLC. However, the engine manufacturers may use catalyzed diesel particulate filters in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Combustion Process Design
Combustion controls including combustion system design, proper operation, and routine maintenance have been applied successfully in similar engines for lowering carbon soot emissions and are considered technically feasible.

Ultra Low Sulfur Fuel Oil
Ultra low sulfur fuel is readily available and is therefore considered technically feasible.

Proper Maintenance
Proper maintenance has been proven to be effective in minimizing the formation blue smoke in internal combustion engines; therefore, it is considered technically feasible.

Rank Control Technologies/Evaluate the Most Effective
Any of the technologies identified above are potentially feasible for the control of PM/PM10 from stationary diesel engines. Although the specific engines proposed for this project have not yet been selected, it is likely that each of the identified technologies would be considered technically feasible for the final choice in engine design. However, without specific engine data it is not possible to analyze the economic justification of all of these potentially feasible control options. Accordingly, this application proposes limits that are among the lowest of the recently permitted facilities identified in the RBLC and will therefore require the use of the top level available and economically justifiable control technology.

CO

Carbon Monoxide is formed in an internal combustion engine as an intermediate combustion product that appears in the exhaust when the reaction of CO to CO2 cannot proceed to completion. This situation occurs if there is a lack of available oxygen near the hydrocarbon molecule during combustion, if the gas temperature is too low, or if the residence time in the cylinder is too short.

Identify Potentially Available Control Technologies

The following control technologies were evaluated as being potentially available for controlling CO from the diesel engines:

- Combustion Process Design
- Catalytic Oxidation

Combustion Process Design

CO emissions from internal combustion engines result from the incomplete combustion of carbon and are indicative of inefficient combustion and unused energy. Factors affecting CO emissions include firing temperatures, residence time in the combustion zone, and combustion chamber fuel and air mixing characteristics. Therefore, good combustion process design that ensures the proper air and fuel mixing, extended combustion chamber residence times, and consistent high combustion chamber temperatures can reduce emissions of CO. Good combustion process design is a standard feature of modern engines.

Catalytic Oxidation

Oxidation catalysts lower CO emissions as a post combustion control. In a catalytic oxidation process precious metals (commonly rhodium, platinum, or palladium) are used to promote oxidation of CO to CO_2 at temperatures lower than would be necessary for oxidation without a catalyst. Although there are several potential oxidation catalysts that can be used, including the catalyzed diesel particulate filters discussed in the PM/PM10 section, they all achieve CO reduction through the same mechanism. The engine manufacturers may use catalytic oxidation in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Technical Feasibility

Combustion Process Design

Combustion controls including combustion system design, proper operation, and routine maintenance have been applied successfully in similar engines for lowering CO emissions and are considered technically feasible.

Catalytic Oxidation

Based on a review of the RBLC database, no diesel engines were identified as using oxidation catalysts for the control of CO. However, the engine manufacturers may utilize catalytic oxidation in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Rank Control Technologies/Evaluate the Most Effective

Any of the technologies identified above are potentially feasible for the control of CO from stationary diesel engines. Although the specific engines proposed for this project have not yet been selected, it is likely that each of the identified technologies would be considered technically feasible for the final choice in engine design. However, without specific engine data it is not possible to analyze the economic justification of all of these potentially feasible control options. Accordingly, this application proposes limits that are among the lowest of the recently permitted facilities identified in the RBLC and will therefore require the use of the top level available and economically justifiable control technology.

VOC

Volatile Organic Compounds (VOC), commonly classified as hydrocarbons, consist of a wide variety of organic compounds that are discharged into the atmosphere when some of the fuel remains unburned or is only partially burned during the combustion process. Most unburned hydrocarbon emissions result from fuel droplets that were transported or injected into the quench layer, where temperatures are too low to support combustion. Partially burned hydrocarbons can occur if there is a lack of available oxygen near the hydrocarbon molecule during combustion, if the gas temperature is too low, if the fuel droplet is too large, or if the residence time in the cylinder is too short.

Identify Potentially Available Control Technologies

The following control technologies were evaluated as being potentially available for controlling CO from the diesel engines:

- Combustion Process Design
- Catalytic Oxidation

Combustion Process Design
VOC emissions from internal combustion engines result from the incomplete combustion of carbon and are indicative of inefficient combustion and unused energy. Factors affecting VOC emissions include firing temperatures, residence time in the combustion zone, and combustion chamber fuel and air mixing characteristics. Therefore, good combustion process design that ensures the proper air and fuel mixing, extended combustion chamber residence times, and consistent high combustion chamber temperatures can reduce emissions of VOC. Good combustion process design is a standard feature of modern engines.

Catalytic Oxidation
Oxidation catalysts lower VOC emissions as a post combustion control. In a catalytic oxidation process precious metals (commonly rhodium, platinum, or palladium) are used to promote oxidation of the carbon atoms in the hydrocarbons to CO_2 at temperatures lower than would be necessary for oxidation without a catalyst. Although there are several potential oxidation catalysts that can be used, including the catalyzed diesel particulate filters discussed in the PM/PM10 section, they all achieve VOC reduction through the same mechanism. The engine manufacturers may use catalytic oxidation in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Technical Feasibility

Combustion Process Design
Combustion controls including combustion system design, proper operation, and routine maintenance have been applied successfully in similar engines for lowering CO emissions and are considered technically feasible.

Catalytic Oxidation
Based on a review of the RBLC database, no diesel engines were identified as using oxidation catalysts for the control of VOC. However, the engine manufacturers may

utilize catalytic oxidation in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Rank Control Technologies/Evaluate the Most Effective

Any of the technologies identified above are potentially feasible for the control of VOC from stationary diesel engines. Although the specific engines proposed for this project have not yet been selected, it is likely that each of the identified technologies would be considered technically feasible for the final choice in engine design. However, without specific engine data it is not possible to analyze the economic justification of all of these potentially feasible control options. Accordingly, this application proposes limits that are among the lowest of the recently permitted facilities identified in the RBLC and will therefore require the use of the top level available and economically justifiable control technology.

NO_X

Nitrogen oxide (NO_X) emissions from combustion sources are formed by two different mechanisms. The predominant mechanism in an internal combustion engine is thermal NO_X which arises from the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. The second mechanism, fuel NO_X, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Most distillate oils have no chemically-bound fuel N_2 and essentially all NO_X formed is thermal NO_X. In general, NO_X and CO/VOC emissions are inversely related (i.e. decreasing NO_X emissions will result in increasing CO/VOC emissions).

Identify Potentially Available Control Technologies

The following control technologies were evaluated as being potentially available for controlling NO_X from the diesel engines:

- Combustion Process Design
- Non-Selective Catalytic Reduction
- Exhaust Gas Recirculation (with NSCR)
- Selective Catalytic Reduction
- EMx™ (SCONO$_x$™)

Combustion Process Design

Potential combustion process designs for NO_X reduction include injection timing retard (ITR), preignition chamber combustion (PCC), air-to-fuel ratio, and derating. ITR involves retarding the timing of the diesel fuel injection into the combustion chamber causing the combustion process to occur later in the power stroke when the piston is in the downward motion and combustion chamber volume is increasing. By increasing the volume, the combustion temperature and pressure are lowered, thereby reducing NO_X formation. A PCC is an antechamber that ignites a fuel rich mixture that propogates to the main combustion chamber. The high exit velocity results in improved mixing and complete combustion of the lean/fuel mixture which lowers the combustion temperature, thereby reducing NO_X emissions. Air-to-fuel ratios can be adjusted to control the amount of fuel entering each cylinder. Fuel rich mixtures lower the amount of available oxygen thereby lowering temperatures and NO_X emissions. Derating involves restricting engine operation to lower than normal levels of power production. This lowers cylinder pressure and temperature, thereby lowering NO_X emissions. The engine manufacturers could potentially use any of these methods in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Non-Selective Catalytic Reduction

Non-Selective Catalytic Reduction (NSCR) reduces NOX emissions as a post combustion control. NSCR typically utilizes two or three precious metal catalysts to reduce NOX emissions in two discrete and sequential steps. Step 1 removes excess oxygen from the exhaust gas while step 2 reduces the NOX concentration. NSCR is also referred to as 3-way catalysts because it can simultaneously reduce NOX, CO, and VOC. NSCR are not effective if high levels of oxygen are present in the exhaust gas; therefore, they are only applicable in fuel-rich engines. The engine manufacturers could potentially use NSCR in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Exhaust Gas Recirculation (with NSCR)
Exhaust gas recirculation (EGR) involves recirculating exhaust gas into the combustion chamber. This results in lower oxygen levels in the combustion chamber, which results in less oxygen available and lower NO_X emissions. Lowering oxygen levels in the combustion chamber can also result in less oxygen in the exhaust gas to levels acceptable for NSCR operation. The engine manufacturers could potentially use EGR either alone or in combination with NSCR in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Selective Catalytic Reduction
Selective Catalytic Reduction (SCR) reduces NO_x emissions by reacting ammonia or urea with exhaust gas NO_x to yield nitrogen and water vapor in the presence of a catalyst. The engine manufacturers may use SCR in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

EMx™ (SCONO$_x$™)
EMx™ (formerly referred to as SCONO$_x$™) is a multi-pollutant reduction catalytic control system offered by EmeraChem. EMx™ is a complex technology that is designed to simultaneously reduce NO_x, VOC, and CO through a series of oxidation/absorption catalytic reactions. The EMx™ system employs a single catalyst to simultaneously oxidize CO to CO_2 and NO to NO_2. NO_2 formed by the oxidation of NO is subsequently absorbed onto the catalyst surface through the use of a potassium carbonate absorber coating. There have been no installations of this technology on reciprocating engines.

<u>Technical Feasibility</u>

Combustion Process Design
The combustion process designs identified have been applied successfully and the engine manufacturers may use any of these methods in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Non-Selective Catalytic Reduction
Based on a review of the RBLC database, no diesel engines were identified as using NSCR for the control of NO_X. Additionally, NSCR are not effective if high levels of oxygen are present in the exhaust gas; therefore, they are only applicable in engines operated in fuel-rich conditions. Diesel engines are typically designed to operate in lean conditions. However, the engine manufacturers may use NSCR in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Exhaust Gas Recirculation with NSCR
Based on a review of the RBLC database, no diesel engines were identified as using EGR either alone or in combination with NSCR for the control of NO_X. However, the engine manufacturers may use EGR either alone or in combination with NSCR in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

Selective Catalytic Reduction
Based on a review of the RBLC database, no diesel engines were identified as using SCR for the control of NO_X. However, the engine manufacturers may use SCR in the design of their engines to meet the requirements of NSPS Subpart IIII and the proposed permit limits.

EMx™ (SCONO$_x$™)

There have been no installations of this technology on reciprocating engines; therefore, it is not considered applicable in this application.

Rank Control Technologies/Evaluate the Most Effective

Any of the applicable technologies identified above are potentially feasible for the control of NO_X from stationary diesel engines. Because the specific engines proposed for this project have not yet been selected, it is impossible to determine the top level control technology that will be technically feasible at this time. Likewise it is not possible to analyze the economic justification of the potentially feasible control options. Accordingly, this application proposes limits that are among the lowest of the recently permitted facilities identified in the RBLC and will therefore require the use of the top level available and economically justifiable control technology.

ATTACHMENT 2

to ND-09-1451
Air Quality Permit Application No. 18986

SNC Response to Comment 2 – Ozone Ambient Impact Analysis

GA EPD Comment: Ozone ambient impact analysis

According to federal regulations (40 CFR 52.21(i)(5), 'any application proposing a net emission increase of 100 tpy or more of VOC or NOx subject to PSD would be required to perform an ambient impact analysis including the gathering air quality data'. We didn't see any discussion and analysis on this. Please refer to the attached document for such discussion. You can find the recent 3 years Ozone data at www.epa.gov/air/data. You need to obtain the H4H 8-hour Ozone concentration from recent three years, and average over these three values. Vogtle is close to Augusta and Evans monitoring sites. A justification is needed to use Evans site instead of Augusta because the latter one is in a non-attainment area.

SNC Response:

Plant Vogtle is located in Burke County, Georgia and there are no ozone monitors in Burke County. Table 1 summarizes ozone data for the past three years from the five closest monitors to Plant Vogtle. Two of these five monitors are located in Georgia and three of these five monitors are located in South Carolina. Figure 1 shows the relative location of these monitors to Plant Vogtle. Note that Plant Vogtle is in a much more rural area than specifically the Richmond County monitor. In addition, Figure 1 shows a wind rose for 5 years (2003-2007) from Augusta Bushfield airport.

In order to select the monitor most representative of the Plant Vogtle Site, several criteria were evaluated. These criteria include: population density and NOx emission densities for Burke County along with the counties containing the five closest monitors as listed in Table 1. Because ozone is formed during a photochemical reaction between VOCs and NOx, ozone concentration are typically largely dependent on the level of NOx emissions in the area where the ozone monitor is located. Generally, higher NOx emissions levels can be associated with locations of industrial sources and in highly populated urban areas. Table 2 summarizes NOx emissions density and population density for the five counties with nearby ozone monitors. Table 2 also summaries NOx emissions density and population density for Burke County. Figure 2 and 3 graphically show NOx emissions density and population density maps, respectively.

The NOx emissions density map below shows that in year 2002 Barnwell County experienced emissions of approximately 2.3 tons of NOx per square mile and Burke County experienced a similar level (slightly less) of NOx emissions at approximately 1.9 tons of NOx per square mile. These counties also have similar population densities with the Barnwell County being slightly higher. Based on the data shown in Table 2 and graphically shown in Figures 2 and 3, Plant Vogtle proposes to use the ozone monitor located in Barnwell County, South Carolina. The evaluation criteria for determining the most representative ozone monitor clearly indicates that the Barnwell County monitor is much more representative than any other monitor examined in this analysis. Additionally, Plant Vogtle believes that, the ozone levels in Barnwell County are expected to slightly overstate the ozone levels in the project site area because the NOx emission and population densities are slightly higher in Barnwell County are compared to Burke County. Therefore, the Barnwell County ozone monitor is considered to be conservatively representative of the air quality at the project site and since this area is in attainment with the 8-hour ozone standard (75 ppb), Plant Vogtle would also be in attainment for ozone.

Table 1: Ozone Monitoring Concentrations

4th Max (ppb)					
2006	**2007**	**2008**	**3-yr Ave**	**Monitor Address**	**County**
83	80	76	80	2216 Bungalow Rd, Augusta GA	Richmond Co
74	74	75	74	Evans 4431 Hardy Mcmanus Road, Evans, GA	Columbia Co
68	73	71	71	660 Woodyard Rd, SC	Edgefield Co
73	82	75	77	8217 Atomic Rd, Jackson, SC	Aiken Co
74	**73**	**64**	**70**	**5795 Seven Pines Rd, SC**	**Barnwell Co**

Table 2: NOx Emissions Density and Population Density

NOx Emissions Density (tons / sq. mile)	Population Density (people / sq. mile)	Location	County
41.97	324	2216 Bungalow Rd, Augusta GA	Richmond Co
12.43	308	Evans 4431 Hardy Mcmanus Road, Evans, GA	Columbia Co
2.05	49	660 Woodyard Rd, SC	Edgefield Co
14.22	133	8217 Atomic Rd, Jackson, SC	Aiken Co
2.29	43	5795 Seven Pines Rd, SC	Barnwell Co
1.94	27	Plant Vogtle	Burke Co

Figure 1: Ozone Monitors and 5-Year Wind Rose from Augusta Bushfield Airport

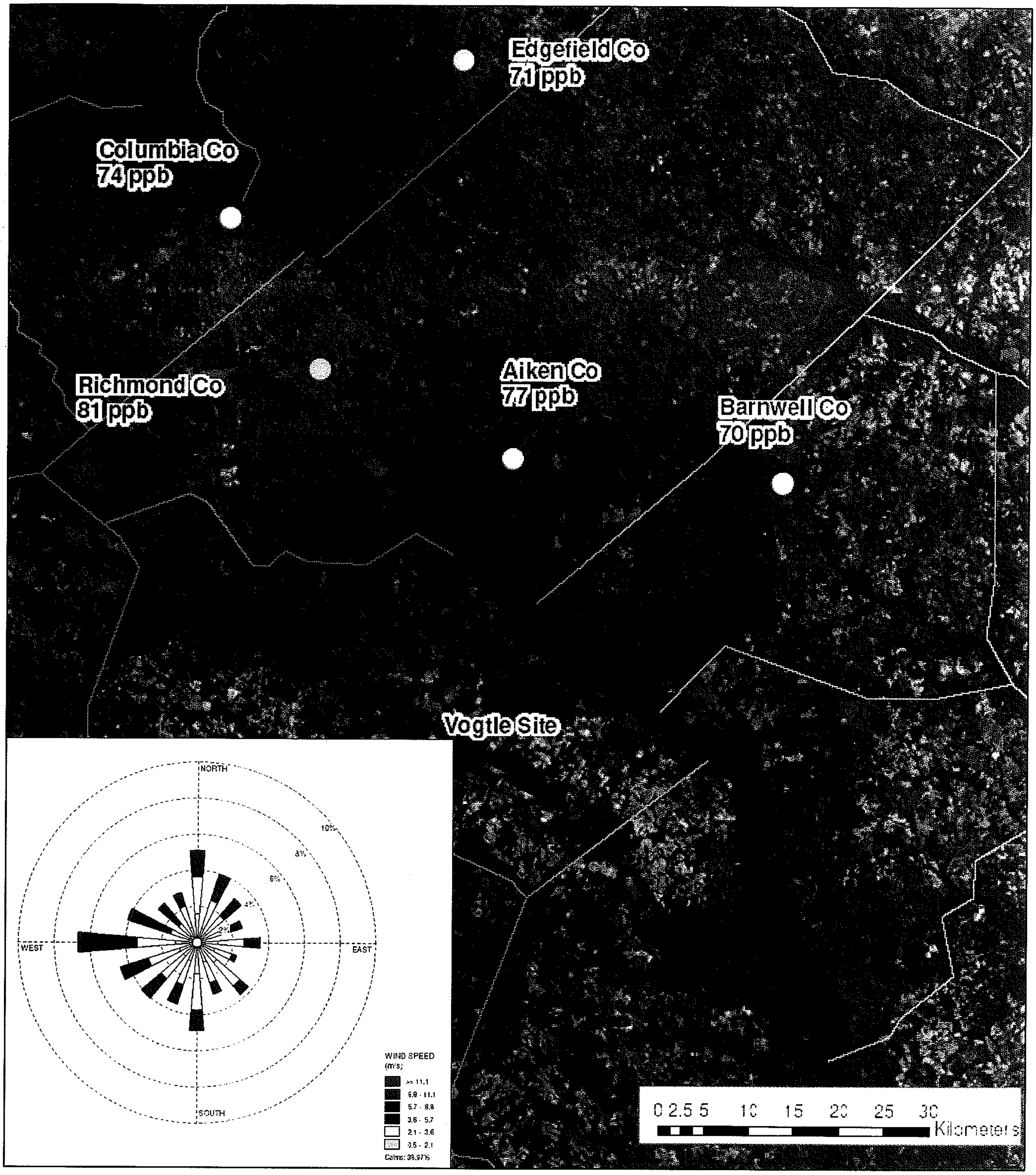


Figure 2: NOx Emissions Density

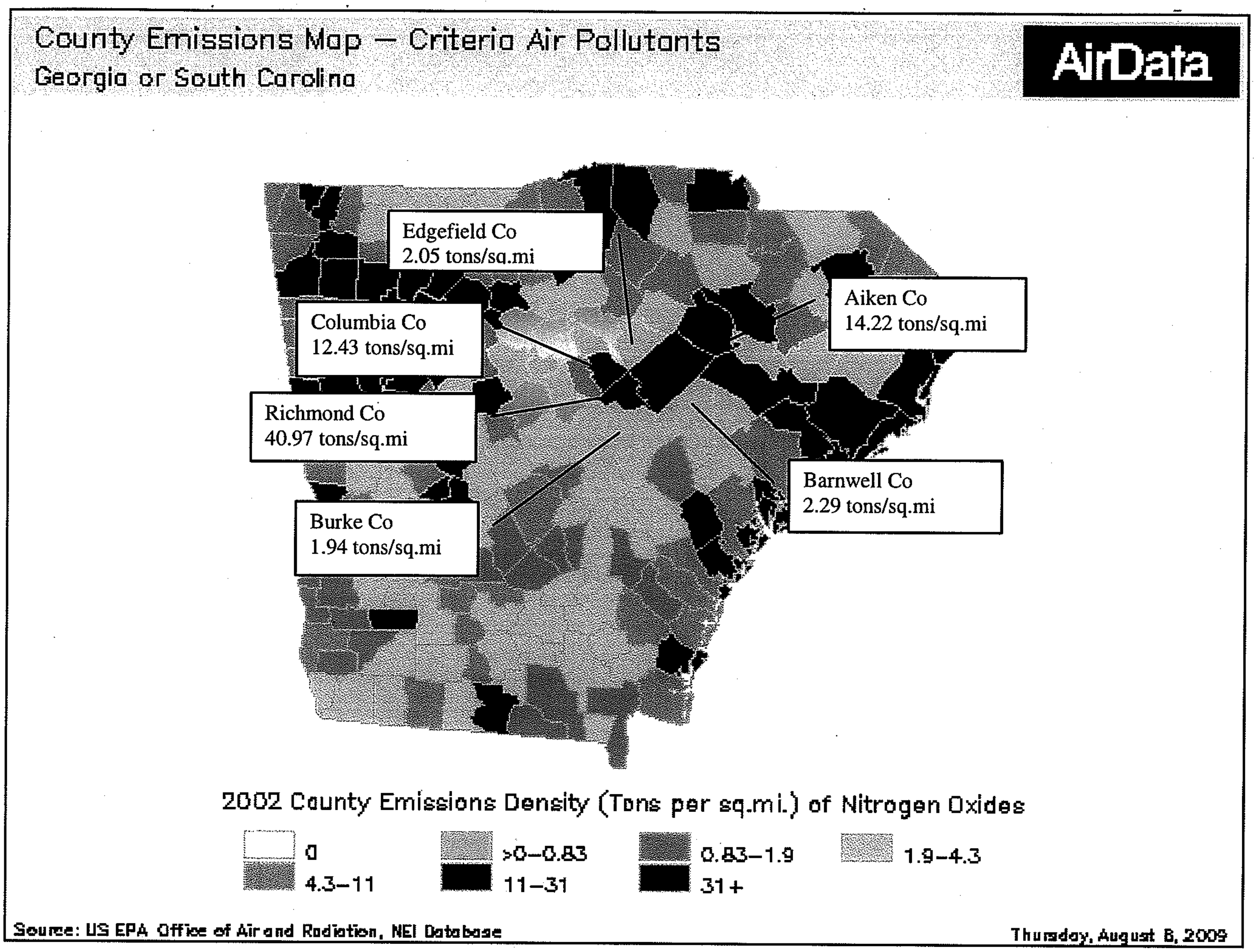
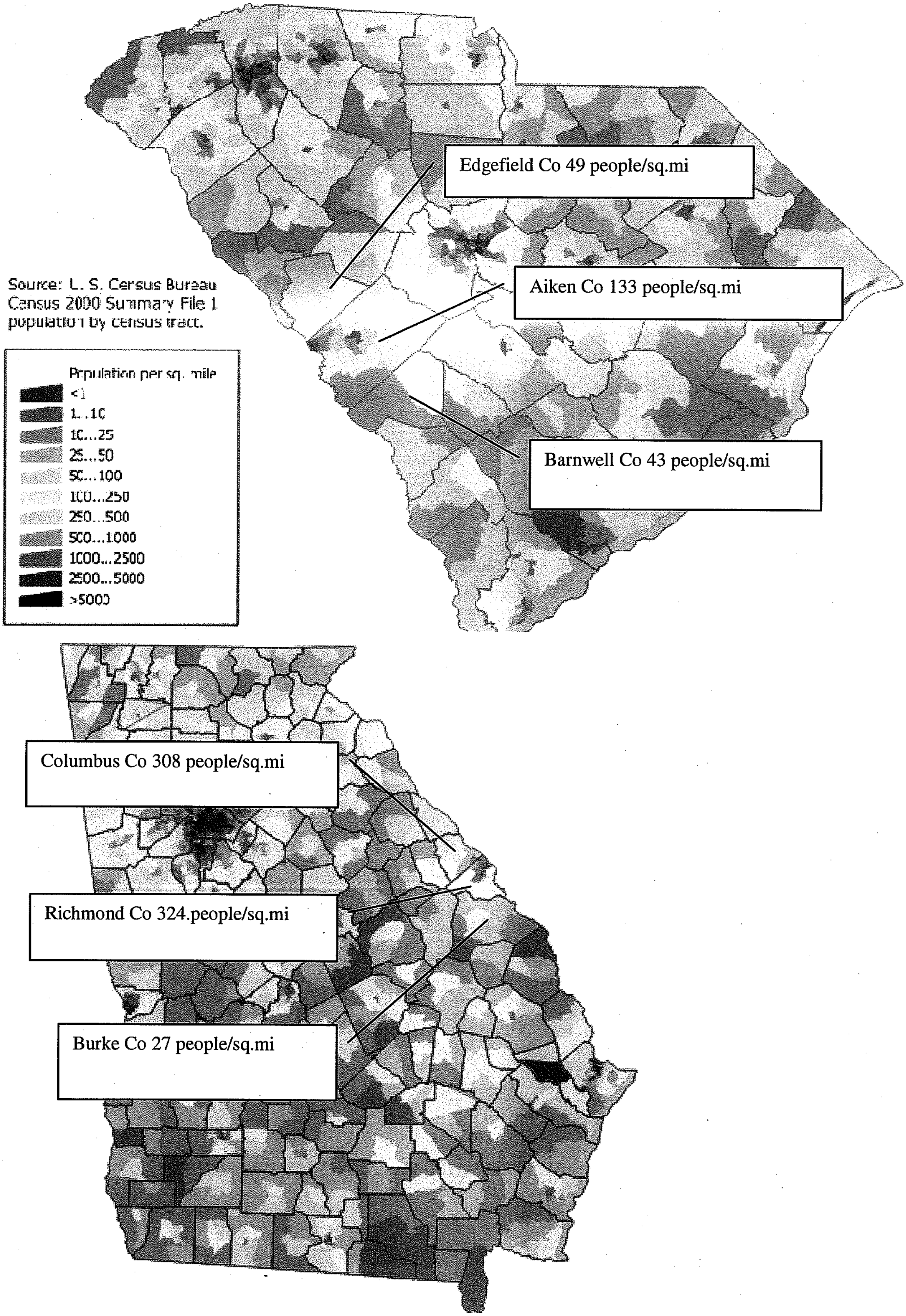


Figure 3: Population Density



ATTACHMENT 3

to ND-09-1451
Air Quality Permit Application No. 18986

SNC Response to Comment 3 – Fugitive Sources (< 1 lb/hr) & Modeling Revision (CDs)