Prevention of Significant Air Quality Deterioration Review

Preliminary Determination

October, 2009

Facility Name: Carbo Ceramics, Inc. - Toomsboro Plant
City: Toomsboro
County: Wilkinson
AIRS Number: 04-13-319-00029
Application Number: 18293
Date Application Received: August 22, 2008
Date Application Revised: February 9, 2009, August 17

Review Conducted by:
State of Georgia - Department of Natural Resources
Environmental Protection Division - Air Protection Branch
Stationary Source Permitting Program

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SUMMARY

The Environmental Protection Division (EPD) has reviewed the application No. 18293 submitted by Carbo Ceramics, Inc. – Toomsboro Plant for a permit to construct and operate two new kaolin clay process lines at the company's ceramic pellet manufacturing facility located in Toomsboro, Georgia. In addition to the new process lines, the application has also proposed Best Available Control Technology (BACT) for the emissions of particulate matter and particulate matter of 10 micrometers or less (PM/PM_{10}), carbon monoxide (CO), nitrogen oxides (NO_x), and sulfur dioxide (SO_2) from the two existing kaolin clay process lines. The two new process lines are subject to the same BACT as applicable to the existing process lines due to the similarity.

Similar to the existing lines, the new kaolin clay process lines will consist of mainly materials handling and storage, milling, slurry preparing, screening, spray drying, rotary calcining, and packaging and shipping operations. Two new 9.8 MM Btu/hr natural gas-fired boilers will be installed to serve each of the process lines. Additional material receipt and product packaging and shipping operations will be added with the new process lines. Two 2007 model year or later stationary emergency diesel generators/engines will be installed to serve each of the new process lines.

The modification of the Carbo Ceramics, Inc. – Toomsboro Plant as proposed by the application No. 18293 will result in an emissions increase in ammonia (NH_3), chlorides, fluorides, CO, NO_x, PM/PM_{10}, SO_2, and volatile organic compounds (VOC) due to the addition of two kaolin clay process lines and associated equipment and operations. A Prevention of Significant Deterioration (PSD) analysis was performed for the facility for all pollutants to determine if any increase was above the "significance" level under New Source Review (NSR)/PSD rules. The CO, PM_{10}, SO_2 and NO_x emission increases were above the corresponding NSR/PSD significant level thresholds.

The EPD review of the data submitted by Carbo Ceramics, Inc. – Toomsboro Plant related to the proposed modifications indicates that the project will be in compliance with all applicable state and federal air quality regulations.

It is the preliminary determination of the EPD that the proposal provides for the application of BACT for the control of SO_2, PM/PM_{10}, NO_x and CO, as required by federal PSD regulation 40 CFR 52.21(j).

It has been determined through approved modeling techniques that the estimated emissions will not cause or contribute to a violation of any ambient air standard or allowable PSD increment in the area. It has further been determined that the proposal will not cause impairment of visibility or detrimental effects on soils or vegetation. Any air quality impacts produced by project-related growth should be inconsequential.

This Preliminary Determination concludes that an Air Quality Permit should be issued to Carbo Ceramics, Inc. – Toomsboro Plant for the modification necessary to implement the BACT to existing kaolin clay process lines, for the construction and operation of the two new kaolin process lines, and for application of the same BACT to the new process lines. Various conditions have been incorporated into the current Title V operating permit to ensure and confirm compliance with all applicable air quality regulations. A copy of the draft permit amendment is included in Appendix B. This Preliminary Determination also acts as a narrative for the Title V Permit.

1.0 INTRODUCTION – FACILITY INFORMATION AND EMISSIONS DATA

On August 22, 2008, Carbo Ceramics, Inc. – Toomsboro Plant (hereafter "Carbo Ceramics") submitted an application (No. 18293) for an air quality permit to implement BACT to existing kaolin clay process lines and to construct and operate two new kaolin process lines which are also subject to the same BACT. The facility is located at 1880 Dent Road, Toomsboro, Wilkinson County, Georgia.

Table 1-1: Title V Major Source Status

Pollutant	Is the Pollutant Emitted?	If emitted, what is the facility's Title V status for the Pollutant?		
		Major Source Status	Major Source Requesting SM Status	Non-Major Source Status
PM	√	√		
PM_{10}	√	√		
SO_2	√	√		
VOC	√			√
NO_x	√	√		
CO	√	√		
TRS	N/A			
H_2S	N/A			
Individual HAP	√	√		
Total HAPs	√	√		

Table 1-2 below lists all current Title V permits, all amendments, 502(b)(10) changes, and off-permit changes, issued to the facility, based on a review of the "Permit" file(s) on the facility found in the Air Branch office.

Table 1-2: List of Current Permits, Amendments, and Off-Permit Changes

Permit Number and/or Off-Permit Change	Date of Issuance/ Effectiveness	Purpose of Issuance
3295-319-0029-V-02-0	11/06/2008	Initial Title V operating permit

Based on the proposed project description and data provided in the permit application, the estimated incremental increases of regulated pollutants from the facility are listed in Table 1-3 below:

Table 1-3: Emissions Increases from the Project

Pollutant	Potential Emissions Increase (tpy)	PSD Significant Emission Rate (tpy)	Subject to PSD Review
PM	146	25	Yes
PM_{10}	146[1]	15	Yes
VOC	<40	40	No
NO_X	1,223	40	Yes
CO	523	100	Yes
SO_2	309	40	Yes
TRS	N/A	10	N/A
Pb	<0.6	0.6	No
Non-HF Fluorides	0.66	3	No
H_2S	N/A	10	N/A
Sulfuric Acidic Mist (SAM)	N/A	7	N/A

[1] All PM were assumed as PM_{10}.

Based on the information presented in Table 1-3 above, Carbo Ceramics' proposed modification/facility expansion, as specified per Georgia Air Quality Application No. 18293, is classified as a major modification under PSD/NSR rules because the potential net emission increases of CO, NO_x, PM/PM_{10} and SO_2 caused by the modification have exceeded the corresponding NSR/PSD significant level thresholds as listed in Table 1-3.

Through its new source review procedure, EPD has evaluated Carbo Ceramics' proposal for compliance with State and Federal requirements. The findings of EPD have been assembled in this Preliminary Determination.

2.0 PROCESS DESCRIPTION

In the Application No. 18293, Carbo Ceramics has proposed to implement BACT to the CO, NO_x, PM/PM_{10} and SO_2 emissions from its two existing kaolin clay process lines. The implementation of the BACT is required because results of the 2006 emission testing revealed that the CO, NO_x and SO_2 emissions from the existing process line Nos. 1 and 2 exceeded the corresponding major source thresholds and significant increase levels under NSR/PSD regulations.

In the application No. 18293, Carbo Ceramics has also proposed the construction and operation of two new kaolin clay process lines (Process Line Nos. 3 and 4) at this facility. Consisting of mainly materials handling and storage, milling, slurry preparing, screening, spray drying, calcining and packaging and shipping operations, both new process lines will be almost identical to the two existing kaolin clay process lines (Process Line Nos. 1 and 2) in terms of process nature, production capacity, and configurations of process and pollution control equipment, as described in detail in the current Part 70 Operating Permit No. 3295-319-0029-V-02-0 issued to the facility. The same BACT for the existing facility will also apply to the two new process lines.

All the baghouses serving spray dryers and calciners/kilns will be equipped with COMS. The volumetric flow rate of the exhaust/flue gas from each calciner/kiln will be also be continuously monitored. Annual NO_x and SO_2 performance testing will be required for all the calciners/kilns, which account for over 93% of NO_x and 97% of SO_2 emissions from the facility.

Details of the equipment are listed in updated Table 3.1 of permit amendment No. 3295-319-0029-V-02-1 prepared for the proposed modification/facility expansion. Detailed facility and process description can be found in the current Part 70/Title V Operating Permit No. 3295-319-0029-V-02-0.

Because the plant-wide emissions of Hazardous Air Pollutants (HAPs) [methanol, hydrogen fluoride (HF) and hydrogen chloride (HCl)] exceed the major source threshold under Section 112 of the Clean Air Act (CAA) of 1990 and Part 63 of 40 CFR, the HAP emissions will be subject to a Case-by-Case Maximum Achievable Control Technology (MACT) determination under Section 112(g) of CAA. A separate Section 112(g) Case-by-Case MACT determination has been prepared for the HAP emissions.

Carbo Ceramics' permit application and supporting documentation are included in Appendix C of this Preliminary Determination and can be found online at www.georgiaair.org/airpermit.

3.0 REVIEW OF APPLICABLE RULES AND REGULATIONS

3.1 State Rules

The Georgia Rule for Air Quality Control (Georgia Rules) 391-3-1-.03(1) requires that any person prior to beginning the construction or modification of any facility which may result in an increase in air pollution shall obtain a permit for the construction or modification of such facility from the Director upon a determination by the Director that the facility can reasonably be expected to comply with all the provisions of the Act and the rules and regulations promulgated thereunder. Georgia Rule 391-3-1-.03(8)(b) continues that no permit to construct a new stationary source or modify an existing stationary source shall be issued unless such proposed source meets all the requirements for review and for obtaining a permit prescribed in Title I, Part C of the Federal Act [i.e., Prevention of Significant Deterioration of Air Quality (PSD)], and Section 391-3-1-.02(7) of the Georgia Rules (i.e., PSD).

- Georgia Rule (b) [391-3-1-.02(2)(b): *Visible Emissions*] is a general rule limiting the opacity of stack visible emissions from a source to less than 40%. This regulation applies to any source with stack visible emissions but is not subject to other more restrictive source specific limit for the same visible emissions.

- Georgia Rule (p) [391-3-1-.02(2)(p): *Particulate Emissions from Kaolin and Fuller's Earth Processes*], which uses process input rate based equations similar to the process weight rule to set PM emission limits, depending on if the sources were constructed or extensively modified before or after January 1, 1972. The applicable stack PM emission rate is determined using either of one of four equations, depending on the process input rate and age of the equipment.

- Georgia Rule (g) [391-3-1-.02(2)(g): *Sulfur Dioxide*] limits the sulfur content of liquid or solid fossil fuel(s) or wood residue burned by a new fuel-burning source constructed or extensively modified after January 1, 1972. The limitation is based on the type of the fossil fuel(s) (liquid, solid or wood residue) and the heat input rate of the source. Since none of the fuel burning sources at this facility has a heat input rate greater than 100 MM BTU/hr, the sulfur content of fuel(s) used for these sources shall not exceed 2.5% by weight. Firing these sources with only natural gas and propane, Carbo Ceramics will comply with this limit because the sulfur content of commercial available natural gas and propane in Georgia is substantially below this limit.

- Georgia Rule (n) [391-3-1-.02(2)(n): *Fugitive Dust*], commonly known as the fugitive dust rule, requires the Permittee to take all reasonable precautions to prevent fugitive dust emissions from any operation, process, handling, transportation or storage facility prone to such emissions, and lists a number of such precautions. In addition, Georgia Rule (n) limits the opacity of such fugitive emissions to less than 20%.

Because the emission standards/limits under pertinent NSPS, National Emission Standards for Hazardous Air Pollutants (NESHAP)/Maximum Achievable Control Technology (MACT) or PSD/NSR rules are more stringent than those in the aforementioned rules, these SIP rules are subsumed by the pertinent federal rules.

3.2 Federal Rule - PSD

The regulations for PSD in 40 CFR 52.21 require that any new major source or modification of an existing major source be reviewed to determine the potential emissions of all pollutants subject to regulations under the Clean Air Act. The PSD review requirements apply to any new or modified source which belongs to one of 28 specific source categories having potential emissions of 100 tons per year or more of any regulated pollutant, or to all other sources having potential emissions of 250 tons per year or more of any regulated pollutant. They also apply to any modification of a major stationary source which results in a significant net emission increase of any regulated pollutant.

Georgia has adopted a regulatory program for PSD permits, which the Unites States Environmental Protection Agency (EPA) has approved as part of Georgia's State Implementation Plan (SIP). This regulatory program is located in Chapter 391-3-1-.02(7) of the Georgia Rules. This means that Georgia EPD issues PSD permits for new major sources pursuant to the requirements of Georgia's regulations. It also means that Georgia EPD considers, but is not legally bound to accept, EPA comments or guidance. A commonly used source of EPA guidance on PSD permitting is EPA's Draft October 1990 New Source Review Workshop Manual for Prevention of Significant Deterioration and Nonattainment Area Permitting (NSR Workshop Manual). The NSR Workshop Manual is a comprehensive guidance document on the entire PSD permitting process.

The PSD regulations require that any major stationary source or major modification subject to the regulations meet the following requirements:

- Application of BACT for each regulated pollutant that would be emitted in significant amounts;
- Analysis of the ambient air impact;
- Analysis of the impact on soils, vegetation, and visibility;
- Analysis of the impact on Class I areas; and
- Public notification of the proposed plant in a newspaper of general circulation

Definition of BACT

The PSD regulation requires that BACT be applied to all regulated air pollutants emitted in significant amounts. Section 169 of the Clean Air Act defines BACT as an emission limitation reflecting the maximum degree of reduction that the permitting authority (in this case, EPD), on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such a facility through application of production processes and available methods, systems, and techniques. In all cases BACT must establish emission limitations or specific design characteristics at least as stringent as applicable New Source Performance Standards (NSPS). In addition, if EPD determines that there is no economically reasonable or technologically feasible way to measure the emissions, and hence to impose and enforceable emissions standard, it may require the source to use a design, equipment, work practice or operations standard or combination thereof, to reduce emissions of the pollutant to the maximum extent practicable.

EPA's NSR Workshop Manual includes guidance on the 5-step top-down process for determining BACT. In general, Georgia EPD requires PSD permit applicants to use the top-down process in the BACT analysis, which EPA reviews. The five steps of a top-down BACT review procedure identified by EPA per BACT guidelines are listed below:

Step 1: Identification of all control technologies;
Step 2: Elimination of technically infeasible options;
Step 3: Ranking of remaining control technologies by control effectiveness;
Step 4: Evaluation of the most effective controls and documentation of results; and
Step 5: Selection of BACT.

The following is a discussion of the applicable federal rules and regulations pertaining to the equipment that is the subject of this preliminary determination, which is then followed by the top-down BACT analysis.

3.3 New Source Performance Standard (NSPS)

40 CFR Part 60, Subpart A - *General Provisions*, imposes generally applicable provisions for initial notifications, initial compliance testing, monitoring, and recordkeeping requirements for equipment at the facility subject to a specific NSPS standard, as indicated by the pertinent NSPS standard.

40 CFR Part 60, Subpart OOO – *Standards of Performance for Nonmetallic Mineral Processing Plants* applies to each of the conveyors, bins, bucker elevators, screens, crushers, and mills associated with the new kaolin clay processing line Nos. 3 and 4. Subpart OOO establishes process/source specific PM, visible and fugitive emissions limits, and record keeping, testing, compliance demonstration and reporting requirements for each of the affected sources.

40 CFR Part 60, Subpart UUU – *Standards of Performance for Calciners and Dryers in Mineral Industries* applies to each of the spray dryers and rotary kilns (also referred to as calciners on occasion in the application). Subpart UUU establishes process/source specific PM and visible emissions limits, and record keeping, testing, compliance demonstration and reporting requirements for each of the affected sources.

40 CFR Part 60, Subpart IIII - *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines* applies to one of the two existing 1,990 kW stationary emergency diesel engines/generators identified as EDG2 (manufactured on December 19, 2006), and the two new 2,880 kW stationary emergency diesel engines/generators (EDG3 and EDG4) manufactured after 2006.

The modification will add two 9.8 MMBtu/hr natural gas-fired boilers (BLR3 and BLR4) to the facility, in additional to the two existing boilers (BLR1 and BLR2). With their heat input capacity less than 10 MMBtu/hr. each, these boilers are not subject to 40 CFR 60, Subpart Dc - *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units.*

3.4 National Emissions Standards For Hazardous Air Pollutants

40 CFR Part 63, Subpart A, *General Provisions*, imposes general requirements for initial notifications, initial compliance testing, monitoring, and recordkeeping. Constructed after December 19, 2002 and with capacity exceeding 500 brake horse power, all Carbo Ceramics' four emergency stationary diesel engines/generators (EDG1, EDG2, EDG3 and EDG4) are considered as "new stationary RICE" by 40 CFR Part 63, Subpart ZZZZ and are subject to MACT standard. Subpart ZZZZ contain tables listing the applicable provisions of 40 CFR Part 63, Subpart A.

40 CFR Part 63, Subpart ZZZZ: *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines* applies to all the four stationary emergency diesel engines/generators identified as EDG1, EDG2, EDG3 and EDG4. As emergency stationary diesel engines/generators rated greater than 500 brake horsepower located at a major stationary source, these units do not have to meet the requirements of Subpart ZZZZ and of Subpart A of 40 CRP Part 63, except for the initial notification requirements of 40 CFR 63.6645(f). Therefore, this permit amendment establishes conditions to limit the use of these generators to emergency situations only.

3.5 Section of 112(g)(2)(B) of the Clean Air Act (CAA) Amendment of 1990

Carbo Ceramics uses an additive/chemical compound as disperser during the preparation of clay slurry, which contains less than 1% by weight of methanol (a EPA listed HAP) as an impurity. This facility has the potential to emit more than 10 tons per year of methanol into the atmosphere during spray drying of the clay slurry. Recent onsite stack tests[1] also indicate that each kiln emits approximately 8.7 tons per year of HCl and 37.89 tons per year of HF. Because the emissions of methanol, HF and HCl each exceed major source threshold for a single HAP of 10 tons per year, and major source threshold for combined HAPs of 25 tons per year under 40 CFR Part 63 Subpart B, and there is no NESHAP Part 63 MACT standard for the ceramic pellet manufacturing facilities like Carbo Ceramic's facility, the HAPs emissions are subject to a Case-by-Case MACT determination under 112(g) of CAA Amendment of 1990.

3.6 State and Federal – Startup and Shutdown and Excess Emissions

Excess emission provisions for startup, shutdown, and malfunction are provided in Georgia Rule 391-3-1-.02(2)(a)7. Excess emissions from the new process units on process line Nos. 3 and 4 associated with the proposed project, as listed in Section 3.1 of Air Quality Permit Amendment No. 3295-319-0029-V-02-0, would most likely result from a malfunction of the associated control equipment. The facility cannot anticipate or predict malfunctions. However, the facility is required to minimize emissions during periods of startup, shutdown, and malfunction.

3.7 Federal Rule – 40 CFR 64 – Compliance Assurance Monitoring

Under 40 CFR 64, the *Compliance Assurance Monitoring* Regulations (CAM), facilities are required to prepare and submit monitoring plans for certain emission units with the Title V application. The CAM Plans provide an on-going and reasonable assurance of compliance with emission limits. Under the general applicability criteria, this regulation applies to units that use a control device to achieve compliance with an emission limit and whose pre-controlled emissions levels exceed the major source thresholds under the Title V permitting program. Although other units may potentially be subject to CAM upon renewal of the Title V operating permit, such units are not being modified under the proposed project and need not be considered for CAM applicability at this time.

All the PM/PM_{10} emissions units with control involved in this modification/plant expansion are small Pollution Specific Emission Units (PSEUs) with post-control emissions less than 100 tons per year (TPY). Therefore, they are considered as newly built small PSEUs subject to CAM requirements during next Title V permit renewal.

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[1] August 17, 2009 Supplement to Georgia Air Quality Permit Application No. 18293, Toomsboro Plant.

4.0 CONTROL TECHNOLOGY REVIEW

The proposed project will result in emissions that are significant enough to trigger PSD review for the following pollutants: CO, NO_x, PM/PM_{10} and SO_2. This section describes in details each piece of equipment with CO, NO_x, PM/PM_{10} and/or SO_2 emissions, identifies possible control technologies for the pollutants involved, and determines source and emission-specific BACT.

4.1 Fugitive PM Emissions

Because the potential PM/PM_{10} emissions from Carbo Ceramics has triggered PSD applicability, and PSD rule requires quantifiable fugitive emissions from this source to be included in the PSD applicability analysis.

Operation/process units at this facility that generate fugitive emissions include front loaders, truck and rail car loading and unloading, roads and non-closed storage buildings where designated dust capture systems are not feasible. Fugitive dust sources generally involve the re-entrainment of settled dusts by wind, machine movement, and material transport. Wind-blown dusts from the working area such as stockpiles and roads also contribute to the fugitive PM emissions.

Of geographical and seasonal factors, the primary variables affecting the fugitive PM emissions are wind and material moisture content. Wind parameters vary with geographical location, season, and weather. It can be expected that the level of the fugitive emissions will be greater during periods of high winds. The material moisture content also varies with geographical location, season, and weather.

The moisture content of the material processed can have a substantial effect on fugitive emissions. Surface wetness causes fine particles to agglomerate on or to adhere to the faces of larger stones, with a resulting dust suppression effect.

Kaolin clay becomes extremely slick when wet, making travel across wet surfaces dangerous. For this reason, Carbo Ceramics has proposed the use of road-cleaning and scraping measures to minimize dust.

BACT Determination

Based on the nature of the sources and equipment involved, EPD has determined that timely removal of accumulated dusts from such roads and working areas constitutes BACT for the existing as well as new fugitive emission sources at the Plant. The corresponding emission limit for the BACT is 10% opacity for visible emissions from any fugitive PM sources, and no visible emissions from any enclosed process buildings and wet operations. Specific operating, monitoring, testing, record keeping, and reporting requirements are contained in this permit amendment to ensure the implementation of the BACT. Some of these requirements are adopted from NSPS Subpart OOO.

4.2 PM Emissions from Materials Handling, Storage, Conveying, Milling, Calciner/Kiln, Packaging and Shipping Operations

PM/PM_{10} are emitted from various materials handling and processing operations, include loading and unloading, conveying and storage, weighing, mixing, grinding, spray drying, calcining, packaging and shipping operations. These operations are either part of the existing or new process line Nos. 1, 2, 3 or 4. Exhaust gas streams from the spray dryers and rotary calciners/kilns contain PM/PM_{10} generated by the entrainment, in the calciner/kiln exhaust gas streams, of the powdery materials or soot from fuel combustion, and to a lesser degree, sulfate particulates formed via reaction between SO_2 and ammonia. Excluding those generated from fuel combustion and sulfate, most of the process PM/PM_{10} emissions are finely dispersed solids as either part of the raw materials, intermediate or final products. Some of them can be returned to the process once captured.

Control of such PM/PM_{10} emissions is achieved by the collection of the particles/dusts from the process exhaust/ventilation stack exhaust gas streams. Most clay processing plants use fabric filters (baghouses) for controlling PM/PM_{10} emission from stack/ventilation exhaust gas streams.

There are no PM emissions from wet processes such as milling and screening operations and therefore no BACT analysis is required for such sources. Five downstream PM control options have been identified wherever it is technically feasible to capture the PM emissions. Table 4.2-1 lists the control options identified for these sources according to their control efficiency.

Table 4.2-1: Ranking of Technically Feasible PM Emission Controls from Materials Handling, Storage, Conveying, Milling, Calciner/Kiln, Packaging and Shipping Operations

Control Technology Ranking	Control Technology	Control Efficiency
1	Fabric Filter Collectors(Baghouses), Electrostatic Precipitators (ESPs)	>99%
2	Wet Scrubbing/Washing	<99%
3	Cyclone and Venturi Scrubbers	<90%

Fabric filter collectors (also known as baghouses) are one of the most efficient means to separate particulate matter from a gas stream. Baghouses are capable of maintaining mass collection efficiencies of greater than 99% down to a particle size approaching 0.3 µm in most applications. In baghouses, dust-laden gas streams from capture or ventilation systems are passed through a felted or woven fabric, causing PM in the gas streams to be collected/captured on the surface of the fabric by sieving and other capturing mechanisms including impaction, Brownian diffusion, and electrostatic attraction.

ESPs use an electrostatic field to charge particulate matter contained the gas streams. The charged particulates then migrate to grounded collecting surfaces/plates due to electrostatic attraction. The collected particles are then dislodged by vibrating or rapping the collector surface, and subsequently collected in a hopper at the bottom of the ESP. ESPs are capable of very high collection efficiencies, even for very small particles.

Wet scrubbers remove PM via mainly impact between the scrubbing solution and the PM-laden gas, and are less efficient than baghouses or ESPs. Inertial separators (cyclonic and Venturi scrubbers) can have efficiencies around 90% within narrow particle size ranges. These devices have not been demonstrated as effective controls at similar clay processing plants. The PM control efficiency of a wet scrubber (spraying or packed bed) is higher than that of a cyclone, but not as high as that of a baghouse or ESP due mainly to short-circuiting. Wet scrubbing is known for creating wastewater and sludge disposal problems, straining water supply, and requiring substantially additional energy for pumping water and propelling cooled exhaust air stream out the stacks.

The baghouses and ESPs are considered equivalent as the most efficient/top technology for controlling the PM emissions. Coupled with a properly designed and designated capture system(s), properly designed, maintained and operated baghouses or ESPs can readily reduce such PM emissions by more that 99%. A review of previous BACT determinations and various permits issued to nonmetallic mineral processing plants indicated that baghouses are almost exclusively used for such operations and considered as BACT for controlling such PM emissions.

BACT Determination

Carbo Ceramics proposed to use a number of baghouses to control the PM emissions from each of the process line Nos. 1, 2, 3 and 4. In some cases, the collected fines will be returned to the production process.

The Division has determined that Carbo Ceramics' proposal of using baghouses wherever feasible to control the emissions of PM from raw materials handling and storage, milling, spray drying, calcining, product storage, packaging and shipping processes constitutes BACT.

The BACT PM emission limit is 0.010 gr/dscf of PM/PM_{10} in the exhaust gas streams from the calciners/kilns, and 0.020 gr./dscf of PM/PM_{10} in the exhaust gas streams from the spray dryers. This limit is substantially below the NSPS Subpart UUU limits for the same sources. The BACT limit for visible emissions is 10% for both sources, identical to that under the NSPS Subpart UUU for the same sources. Averaging time is 3 hours (equal to stack test length).

The BACT limit for PM emissions from the material storage, milling and handling systems controlled by baghouses are set at 0.010 gr/dscf. This limit is below the newly revised NSPS Subpart OOO limit of 0.014 gr/dscf for similar sources. Visible emissions from those baghouse-controlled stacks are limited to no more than 7% opacity, the same as that in NSPS Subpart OOO for the same processes.

4.3 PM Emissions from Boilers and Stationary Diesel Generators/Engines

Combustion units/sources with PM emissions include the four 9.8 MMBtu/hr natural gas-fired boilers and four stationary emergency diesel generators/engines. Tables 4.3-1 and 4.3.2 list the emission control or abatement options identified for these sources according to their control efficiency.

Table 4.3-1: Ranking of PM Control Technologies for Boilers

Control Technology Ranking	Control Technology	Control Efficiency
1	Fabric Filter Collectors(Baghouses), Electrostatic Precipitators (ESPs)	>99%
2	Wet Scrubber	<99%
3	Exclusive use of natural gas or propane as fuel	N/A

Table 4.3-2: Ranking of PM Control Technologies for Internal Combustion Engines

Control Technology Ranking	Control Technology	Control Efficiency
1	Fabric Filter Collectors(Baghouses), Electrostatic Precipitators (ESPs)	>99%
2	Wet Scrubber	<99%
3	Exclusive use of diesel as fuel	N/A

Based on review of known existing commercial and institutional size boilers identified in the RACT/BACT/LEAR database, no baghouses, ESPs or wet scrubbers have ever been utilized for controlling PM emissions from a natural gas-fired boiler of this size or with a similar magnitude of PM emissions. At approximately 0.66 tons per year of uncontrolled PM, using any baghouse, ESP or wet scrubber is considered economically infeasible. The same situation applies also to the four stationary emergency diesel generators/engines. Limited to 500 hours of operating time per year and fueled only with low sulfur diesel fuels, additional controls to reduce approximate 0.01 tpy of PM emissions is economically infeasible.

BACT Determination

Carbo Ceramics proposed compliance with NSPS IIII and NESHAP ZZZZ as BACT for the emergency diesel generators/engines and exclusive combustion of natural gas or propane as BACT for the boilers:

Table 4.3-3: Proposed PM BACT for Boilers & Internal Combustion Engines

Process Description	Emission ID No.	BACT Requirement
Natural Gas Fired Boiler Nos. 1, 2, 3 and 4	BLR1, BLR2, BLR3, BLR4	Exclusive use of natural gas or propane as fuel
1,990 kW Stationary Emergency Diesel Generator Nos. 1 and 2	EDG1, EDG2	Exclusive use of low sulfur diesel as fuel[1]; Limited to 500 hours annual operating time for emergency; PM emission limit of 0.54 g/kW-hr (0.40 g/HP-hr.)[2]
2,880 kW Stationary Emergency Diesel Generator Nos. 3 and 4	EDG3 and EDG4	Exclusive use of low sulfur diesel as fuel[3]; Limited to 500 hours annual operating time for emergency; PM emission limit of 0.20 g/kW-hr (0.15g/HP-hr) [4].

[1,3] 40 CFR Part 60, Subpart IIII fuel requirement.
[2,4] 40 CFR Part 60, Subpart IIII Emission limits.

The Division has determined that the company's proposal as listed in Table 4.3-3 as BACT is acceptable. This permit amendment will establish corresponding operational, maintenance and recordkeeping requirements to ensure the compliance with the BACT. In addition, applicable requirements incorporated into this permit amendment per NSPS Subpart IIII will also ensure the compliance with the fuel requirements and PM emission limitations, as the emergency diesel generators/engines are certified under 40 CFR Part 89 to the Tier I or Tier II emission standards from new nonroad compression ignition engines, as required by 40 CFR Part 60, Subpart IIII. The Permittee is required to install, operate and maintain each engine according to manufacturer's specifications and applicable NSPS Subpart IIII requirements. The Tier I and Tier II nonroad compression ignition engine emission standards for PM are numerically equivalent or more stringent than NSPS Subpart IIII for the same model year and engine power.

4.4 CO Emissions from Rotary Calciners/Kilns

Because the CO emissions from these sources have triggered PSD applicability, the CO emissions are evaluated for BACT.

Each of the calciner/kiln Nos. 1, 2, 3 and 4's CO emissions are from two independent sources: (1) incomplete fuel combustion in the calciners/kilns; and (2) incomplete oxidation/combustion of carbonaceous materials in the feed/raw materials introduced to the calciners/kilns. For the company, emissions of CO represent a waste of fuel that should be minimized. For this reason, the exhaust gas from each calciner/kiln is continually analyzed for O_2 and CO via a computerized data acquisition and process control system at the Plant.

The amount of the CO generated in the sources depends on the operating conditions of the calciners/kilns involved and, more specifically, on the amount of excess oxygen/air available for the fuel combustion. CO levels also depend on the calciner/kiln design specifically the features for reducing NO_x. For example, more aggressive staged combustion creates reducing conditions (for less NO_x formation) in the low stages of the calciners/kilns that will increase CO levels. On the other hand, the CO can be oxidized back to CO_2 by using secondary or tertiary combustion air. Such oxidation is the function of the calciner/kiln design that decides the residence time and turbulence after introducing the secondary or tertiary combustion air. Therefore, more NO_x control via more reducing conditions in the combustion will increase CO levels, and vice versa.

In the calciner/kiln, organic materials naturally occurring in the kiln feed are progressively heated and begin to degrade. A significant fraction of such materials is oxidized to CO_2, with the rest as short-chain VOC's and CO. The amount of CO generated from such pyrolitic process depends on the nature of the organics present in the feed materials. Light hydrocarbon species typically produce more VOC and less CO, and vice versa. Depending on the geological strata of the feed materials, the composition and content of the organic materials in the kiln feed may vary significantly.

Review of literature, the BACT/LAER Clearinghouse, and permits issued to facilities with similar operations such as structural clay product manufacturing, ceramic product manufacturing and Portland cement manufacturing indicates that proper equipment design and process operation (i.e., good combustion techniques) represents BACT for CO emissions from rotary calciners/kilns. Properly controlled combustion in these calciners/kilns minimizes CO formation by ensuring that temperature profile and O_2 availability are adequate for complete combustion of fuel. Therefore, a properly designed and operated rotary ceramic calciner/kiln acts as a thermal oxidizer, capable of converting majority of the CO generated to CO_2.

In conclusion, maximum CO emissions can be achieved by the combination of following approaches:

- Using raw materials containing relatively low carbonaceous matter and hydrocarbons;
- Employing good combustion techniques at the calciner/kiln;
- Creating sufficient residence time from proper design of calciner/kiln size and duct lengths to complete fuel burnout.

In addition to proper equipment design, good combustion technique and raw material selection and add-on controls can achieve further reduction of CO emissions. Such controls would involve some type of thermal oxidation from CO to CO_2 in clean gas streams with minimal amounts of PM. The oxidation technology includes direct flame oxidation and energy-saving regenerative thermal oxidation (RTO) and catalytic oxidation. Thermal oxidation can also control VOC emissions via combustion and turn organic compounds/hydrocarbons into basically water and CO_2. Because of the presence of chlorides and sulfur which could foul the catalysts, and the relatively high post-control gas stream dust concentration which could mask catalyst surface and reduce the effectiveness and operational time of the catalysts, the catalytic oxidation is technically feasible but difficult for control of CO and VOC emissions from rotary ceramic calciners/kilns.

To date, two RTOs have been installed to serve kilns in the U.S. Both are employed by cement manufacturers. In 1998, TXI Corporations, LP (TXI) in Texas installed a RTO, a wet scrubber, and a baghouse on a cement kiln for CO and VOC emission reduction in order to avoid a PSD review during a plant expansion[2]. The RTO was not considered as BACT by Texas Commission on Environmental Quality (TCEQ) and had a control efficiency of 75%.

The other RTO application in cement manufacturing process in the U.S. is at the Holcim Plant in Dundee, Michigan. The main purpose of the two RTOs is for the control of relatively high VOC emissions from two wet cement kilns using raw materials containing high levels of kerogen. The units replaced existing carbon injection systems for VOC control and did not go through PSD/BACT analysis.

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[2] Texas Commission on Environmental Quality. *Construction Permit Amendment – Review Analysis and Technical Review, Permit No. 1360A/PSE-TX-632MI. September, 2005.*

The control technologies identified as technically feasible for CO emissions from Carbo Ceramics' rotary calciners/kilns are ranked by control efficiency in Table 4.4-1 below:

Table 4.4-1: Ranking of Control Technologies for CO Emissions from Rotary Ceramic Calciner/Kiln

Control Technology Ranking	Control Technology	Control Efficiency[3]
1	Regenerative Thermal Oxidation	98%
2	Catalytic Oxidation	95%
3	Good Combustion Techniques	0-20%

Using RTO or catalytic oxidizers to reduce CO (and also VOC) emissions from ceramic calciner/kiln incurs high cost. The current cost of controlling CO with a RTO system is estimated approximately between $13,130 per ton of CO reduced, and $10,270 per ton of CO with a catalytic oxidizer[4].

BACT Determination

The Division has determined, based on the cost estimations, that neither the RTO nor the catalytic oxidation system discussed above is economically feasible as BACT for controlling the CO emissions from Carbo Ceramics' rotary calciners/kilns.

The Division has determined that Carbo Ceramics' proposal of optimization of design, operation, and maintenance of the calciner/kiln and associated combustion systems to minimize the CO emissions constitutes BACT. Based on the available on-site emission testing results, the Division has determined that the BACT limit for the CO emissions from each calciner/kiln is not to exceed 24.7 lbs/hr (3-hour average).

4.5 CO Emissions from Spray Dryers

Because the temperature in Carbo Ceramics' spray dryers are substantially lower than that in the rotary calciners/kilns, too low for the sizeable oxidation/combustion of carbonaceous materials in the slurry/raw materials to occur, CO emissions from the spray dryers are almost exclusively from incomplete fuel combustion. For the company, emissions of CO represent a waste of fuel that should be minimized. For this reason, the firing/combustion process and burners in each spray dryer have been optimized and then maintained during the production.

Review of literature, the BACT/LAER Clearinghouse, and permits issued to facilities with similar operations such as structural clay product manufacturing, ceramic product manufacturing and cement manufacturing by other states indicates that proper equipment design and process operation (i.e., good combustion technology) represents BACT for CO emissions from dryers. Properly controlled combustion in the spray dryers minimizes CO formation by ensuring that temperature profiles and O_2 availability are adequate for complete combustion of fuel.

Add-on control systems identical to those discussed for the rotary calciners/kilns can be used in a same way to further reduce the CO emission from Carbo Ceramics' spray dryers, though literature research indicates that up to date no such system has been used for such sources in this industry.

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[3] Per US EPA Air Pollution Control Cost Manual – 6th Edition

[4] Table 5.3.1-5, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant

As in the case of calciner/kiln, using RTO or catalytic oxidizers to reduce CO (and VOC) emissions from spray dryers incurs high cost. The current cost of controlling CO with a RTO system is estimated approximately between $21,284 per ton of CO reduced, and $18,875 per ton of CO with a catalytic oxidizer[5].

BACT Determination

The Division has determined, based on the cost estimations, that neither the RTO nor the catalytic oxidation system discussed above is economically feasible as BACT for controlling the CO emissions from Carbo Ceramics' spray dryers.

The Division has determined that Carbo Ceramics' proposal of optimization of design, operation, and maintenance of the spray dryers and associated combustion systems to minimize the emissions of CO constitutes BACT. Based on the available on-site emission testing results, the Division has determined that the BACT limit for the CO emissions from the spray dryers is 16.6 lbs./hr (3-hour average).

4.6 CO Emissions from Natural Gas-Fired Boilers

Incomplete fuel combustion is the sole source of the CO emissions from the four 9.8 MMBtu/hr natural gas-fired boilers. Excessive CO emissions from boilers represent a waste of fuel that should be minimized. Therefore, boiler manufacturers have made efforts to optimize the design, operation and maintenance of their boilers including associated combustion systems for allowing good combustion and thus minimizing the CO emissions. Such optimization process is often referred to as combustion controls, and based on maintaining continuous mixing of air and fuel in a proper proportion via appropriate turbulence, residence time, and combustion chamber temperature. In theory, excess air/oxygen and higher furnace temperature could minimize CO emissions, but such approach can often result in an increase in NO_x emission from the same process. Consequently, efforts have been made by boiler manufacturers to design their boiler's combustion systems (specifically the air/fuel mixing ratios and furnace temperatures) such that CO levels are reduced as much as possible without causing NO_x levels to increase significantly.

The boilers are purchased as a "packaged boiler" each integrated with all of its components - burner, controls and auxiliary equipment, designed as a single engineered package, and ready for on-site installation. Their performances including emission levels, are guaranteed by the manufacturer(s)

Add-on control systems identical to those discussed for the rotary calciners/kilns and spray dryer could be used in a same way to further reduce the CO emission from these boilers, though literature research indicates that up to date no such system has been used for natural gas-fired boilers at such capacity.
Table 4.6-1 ranks the technically feasible control technologies for controlling CO emission from the boilers in term of control efficiency.

Table 4.6-1: Ranking of Technically Feasible Control Technologies for CO Emissions from Natural Gas-Fired Boiler

Control Technology Ranking	Control Technology	Control Efficiency[6]
1	Regenerative Thermal Oxidation	98%
2	Catalytic Oxidation	95%
3	Good Combustion Techniques	0-20%

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[5] Table 5.3.2-4, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant

[6] Per US EPA Air Pollution Control Cost Manual – 6th Edition

Control cost of using RTO and catalytic oxidizers to reduce CO (and also VOC) emissions from the boilers is high, estimated at approximately $77,883 per ton and $63,755 per ton of CO removed by RTO and catalytic oxidizer respectively[7].

BACT Determination

The Division agrees with Carbo Ceramics' conclusion that based on the cost estimations, neither the RTO nor the catalytic oxidation system as discussed above is economically feasible as BACT for controlling the CO emissions from the 9.8 MMBtu/hr natural gas-fired boilers. The Division has determined that good combustion practices are BACT for CO from the small boilers.

4.7 CO Emissions from Stationary Emergency Diesel Generators/Engines

CO emissions from these diesel generators/engines are the results of incomplete fuel combustion. Incomplete combustion of fuel reduces the fuel efficiency, increases operational cost and worsens the performance of the engines involved. For these reasons, engine manufactures have made efforts to optimize the design, control and operation of the engines (referred as Good Combustion Techniques) to minimize the incomplete fuel combustion. To regulate CO emissions from diesel engines, EPA has promulgated NSPS Subpart IIII which limits the CO emissions from diesel based on the manufacturing data/model year and capacity.

Technically feasible add-on/post combustion control technology is based on thermal oxidation/ combustion of CO in the exhaust gas into CO_2 and water, and embodied as Regenerative Thermal Oxidizer (RTO) and Catalytic Oxidizer.

Because of the limited operating time (500 hours/year each) as emergency units, potential emissions of CO from each of the generators/engines at this facility are estimated at 12.51 tpy for the existing generator/engine (Nos. 1 and 2) and 4.38 tpy for new generator/engine (Nos. 3 and 4). The estimated costs of add-on control range from $66,582 to $210,000 per ton of CO removed[8].

BACT Determination

The Division has determined that, based on the cost estimations, neither the RTO nor the catalytic oxidizer discussed above is economically feasible as BACT for controlling the CO emissions from Carbo Ceramics' stationary emergency diesel generators/engines.

The Division has determined that Carbo Ceramics' proposed CO BACT of complying with NSPS IIII and NESHAP ZZZZ is acceptable BACT for CO. Diesel generators/engines certified to the Tier I and Tier II nonroad compression ignition engine emission standards specified in 40 CFR Part 89 will meet or exceed the BACT for CO for the same model year and engine power.

4.8 SO_2 Emissions from the Combustion Sources

SO_2 emissions are generated when sulfur contained in the fuel and raw material is oxidized by oxygen in the air at high temperature. Two types of SO_2 emission sources exit at this facility: (1) external combustion process units including the boilers (indirect heating process) and spray dryers and calciners/kilns (direct heating process); and (2) internal combustion process units, i.e., diesel-fired generators/engines.

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[7] Table 5.3.3-4, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant

[8] Table 5.3.4-4, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant

For boilers and diesel-fired generators, fuel sulfur is the only source of SO_2 emissions. Most likely it is also true for spray dryers because the working temperature of the spray dryers is not high enough for the sizable oxidation of natural occurring sulfur contained in the kaolin clay into SO_2 (formation of small amounts of SO_2 still occurs at the vicinity of the burner flame zones). Since these boilers and spray dryers only burn natural gas and propane, and the diesel-fired generators only use extreme low sulfur diesel fuels, SO_2 emissions from these units are insignificant.

Consequently, at this facility SO_2 emissions are generated primarily from the oxidation of the naturally occurring sulfur contained in kaolin clay at high temperature in the rotary calciners/kilns. Based on the results of on-site testing, SO_2 emission from these rotary calciners/kilns account for approximately 97% of the facility-wide SO_2 emissions[9].

Technically feasible control technologies for the SO_2 emissions from this facility are ranked by control effectiveness in Table 4.8-1. Because all the technologies except the use of low sulfur fuels are post-combustion/add-on control devices designed to remove SO_2 from exhaust gases via absorption, their control efficiencies for the SO_2 emissions from Carbo Ceramics' four types of combustion sources should be similar.

Application No. 18293 as revised on February 9, 2009 has extensive discussions on the mechanisms, characteristics and technical feasibilities of all the SO_2 emission control technology options identified. Please refer to Section 5.0 of Volume 1 of the application for details.

Table 4.8-1: Ranking of Technically Feasible Control Technologies for SO_2 Emissions[10]

Emission Source	Ranking	Control Technology	Control Efficiency
Calciners/Kilns; Spray Dryers; Natural Gas-Fired Boilers; Diesel-Fired Emergency Generators	1	Wet Scrubber	95%
	2	Semi-Dry Scrubber (Spray Dryer Type)	80%
	3	Dry Scrubber (Injection System)	50%
	4	Use of natural Gas or Propane as a fuel or extreme low sulfur diesel fuel	N/A

Cost analyses of each add-on control system controlling each type of SO_2 emissions are summarized in Table 4.8-2 below:

Table 4.8-2: Cost Effectiveness of All the Technically Feasible Add-on Control Technologies for SO2 Emissions[11]

Emission Source	Control Technology/Option and Associated Control Cost $/ton SO_2 Removed		
	Wet Scrubber	Semi-Dry Scrubber (Spray Dryer Type)	Dry Scrubber (Injection System)
Each Calciner/Kiln	$25,891	$15,061	$12,746
Each Spray Dryer	$259,080	$694,092	$550,176
Each Natural Gas-Fired Boiler	$6,722,939	$8,938,119	$4,275,130
Each of Diesel-Fired Emergency Generator Nos. 1 and 2	$107,600	$150,559	$98,896
Each of Diesel-Fired Emergency Generator Nos. 3 and 4	$99,786	$150,621	$96,680

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[9] Table 2-2, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

[10] Tables 5.4.1-3, 5.4.2-2, 5.4.3-2and 5.4.4.-3, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

[11] Tables 5.4.1-4, 5.4.1-5, 5.4.1-6, 5.4.2-4, 5.4.2-5, 5.4.2-6, 5.4.3-4, 5.4.3-5, 5.4.3-6, 5.4.4-4, 5.4.4-5 and 5.4.4-6, Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

BACT Determination

The Division has determined that, based on the cost estimations, none of the add-on control technology discussed above is economically feasible as BACT for controlling the SO_2 emission sources at this facility. The Division has determined that the following constitutes BACT for the SO_2 emissions from this facility:

- Limiting the SO_2 emissions from each calciner/kiln to 34.2 lbs/hr (daily average).

- Exclusive use of natural gas and propane as fuels for all the boilers, spray dryers and rotary calciners/kilns.

- Exclusive use of extreme low sulfur diesel fuels required by NSPS Subpart IIII for all the stationary diesel-fired emergency generators/engines

- Judicious use of kaolin clay to manage the sulfur input rate to each of the process lines.

To ensure the compliance with the BACT limits, conditions in this permit amendment will establish the relevant SO_2 emission limits and operating, monitoring, testing, record keeping, compliance demonstration and reporting requirements for the BACT, including, but not limited to, production records, fuel usage and fuel certification records, and daily analyses of sulfur content in kaolin clay processed by each calciner/kiln. A mass balance based on the records of kaolin clay sulfur content and kaolin input rate will be utilized to demonstrate compliance with the BACT limit for each calciner/kiln.

4.9 NO_x Emissions from Combustion Sources

NO_x is formed as a result of oxidation of nitrogen occurring at high temperature such as during fuel combustion in boilers, spray dryers, calciners/kilns and internal combustion engines. NO_x is produced mainly through two mechanisms during combustion: (1) high temperature oxidation of fuel nitrogen into fuel NO_x, and (2) thermal formation of NO_x from nitrogen in combustion air.

Fuel NO_x is formed due to the oxidation of nitrogen or its compounds contained in fuel. In general, approximately 60% of fuel nitrogen is converted to NO_x during combustion. The resulting NO_x emissions are primarily affected by the fuel nitrogen content and excess air/oxygen in the flame. Nitrogen compounds in the kiln feed may also contribute to NO_x emissions but to a much smaller extent.

In general, substituting a fuel with one that has a higher heating value will reduce NO_x emissions in part because fuel/heating efficiency is increased and less total fuel is consumed. Increasing fuel efficiency has the same result. Modern rotary calciners/kilns such as the ones at Carbo Ceramics are optimized in both design and operation to maximize fuel efficiency.

Thermal NO_x is the most significant NO_x source in calciner/kiln combustion. The rate of thermal conversion from N_2 in the combustion air to NO_x is controlled by both excess O_2 in the flame and the temperature of the flame. In general, NO_x levels increase with the higher flame temperatures that are typical in the kiln burning zone. In addition, the burner design, as it affects flame shape, and the fuel to air ratio, can mitigate the formation of thermal NO_x. In most modern rotary calciners/kilns like these at this facility, low-NO_x burners and Good Combustion Techniques consisting of appropriate equipment design and process control are commonly used to reduce the thermal NO_x emissions.

The NO_x formation mechanism of the spray dryers is similar to that of the calciners/kilns, except that the spray dryers work at much low temperature range than calciner/kiln. Consequently, spray dryer's high temperature zone where thermal NO_x can form is significantly smaller that of the calciners/kilns. Results of on-site testing indicated that the NO_x emissions from the existing spray dryers were less than 7% of that from the calciners/kilns.

Technically feasible control technologies for the NO_x emissions from the combustion sources discussed are ranked by their control effectiveness in Tables 4.9-1, 4.9-2 and 4.9-3 respectively. Application No. 18293 as revised on February 9, 2009 has extensive discussions on the mechanisms, characteristics and feasibilities of all the NO_x emission control technology options identified. Please refer to Section 5.0 of Volume 1 of the application for details.

Table 4.9-1: Ranking of Technically Feasible Control Technologies for NO_x Emissions from Natural Gas- Fired Rotary Calciners/Kilns[12]

Emission Source	Ranking	Control Technology	Control Efficiency
Calciner/Kiln Nos. 1, 2, 3 and 4	1	NO_x Wet Scrubbing	90%
		Selective Catalytic Reduction (SCR)	90%
	2	Regenerative SCR	70%
	3	Low NO_x Process Technology	N/A

Table 4.9-2: Ranking of Technically Feasible Control Technologies for NO_x Emissions from Natural Gas- Fired Spray Dryers[13]

Emission Source	Ranking	Control Technology	Control Efficiency
Spray Dryer Nos. 1 - 8	1	NO_x Wet Scrubbing	90%
	2	Selective Catalytic Reduction (SCR)	80%
	3	Good Combustion techniques/Low NO_x Process Technology	N/A

Table 4.9-3: Ranking of Technically Feasible Control Technologies for NO_x Emissions from Natural Gas-Fired Boilers[14]

Emission Source	Ranking	Control Technology	Control Efficiency
Natural Gas-Fired 9,8 MMBtu/hr Boiler No. 1 -4	1	NO_x Wet Scrubbing	90%
	2	Selective Catalytic Reduction (SCR)	80%
	3	Selective Non-catalytic Reduction (SNCR)	50%
	4	Good Combustion techniques/Low NO_x Process Technology	N/A

Table 4.9-4: Ranking of Technically Feasible Control Technology for NO_x Emissions from Stationary Emergency Diesel Generators/Engines[15]

Emission Source	Ranking	Control Technology	Control Efficiency
Stationary Emergency Diesel Generators/Engine Nos. 1 - 4	1	NO_x Wet Scrubbing	90%
		Selective Catalytic Reduction (SCR)	90%
	2	Good Combustion techniques/Low NO_x Process Technology	N/A

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[12] Tables 5.2.1-3, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

[13] Tables 5.2.2-3, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

[14] Tables 5.2.3-3, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

[15] Tables 5.2.4-3, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

Cost analyses of each technically feasible control technology/system for controlling the NO_x emissions from the four types of combustion sources at Carbo Ceramic' facility are summarized in Table 4.9-5 below:

Table 4.9-5: Cost Effectiveness of All Technically Feasible Add-on Control Technologies for NO_x Emissions from Carbo Ceramic's Facility[16]

Emission Source	Control Technology/Option and Associated Control Cost Dollar/ton NO_x Removed			
	Wet Scrubbing	SCR	Regenerative SCR	SNCR
Each Calciner/Kiln	$15,322	$8,338	$9,478	N/A
Each Spray Dryer	$39,358	$89,459	N/A	N/A
Each Natural Gas-Fired Boiler	$393,031	$197,355	N/A	$440,402
Each Emergency Diesel Generator Nos. 1 and 2	$54,318	$14,800	N/A	N/A
Each Emergency Diesel Generator Nos. 3 and 4	$70,757	$19,131	N/A	N/A

There was contradictory information received regarding the reliability of the RSCR equipment. Currently RSCR is used in limited operations at biomass-fired power plants.

BACT Determination

The Division has determined that, based on the cost estimation data in Table 4.9-5, none of the technically feasible add-on NO_x emission control technologies identified for Carbo Ceramics are economically feasible as BACT.

The Division has determined that the following constitutes BACT for the NO_x emissions from this facility:

- Using Low NO_x technology to control NO_x emissions from each calciner/kiln to no more than 121.0 lbs/hr (3-hour average);

- Using Good Combustion Techniques to control NO_x emissions from each spray dryer to no more than 8.3 lbs/hr;

- Using Ultra-low NO_x burners to limit NO_x emissions from each boiler to no more than 12 ppmv@3% O_2 on dry standard conditions;

- Certification to the Tier I or II emission standards from nonroad compression ignition engines, which are equivalent or more stringent than the 40 CFR Part 60, Subpart IIII NO_x standard for the diesel engines.

- Limiting the accumulated annual operating time for each of stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 to no more than 500 hours.

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[16] Tables 5.2.1-4, 5.2.1-5, 5.2.1-6, 5.2.2-4, 5.2.2-5, 5.2.3-4, 5.2.3-5, 5.2.3-6, 5.2.4-4 and 5.2.4-5, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

To ensure the compliance with the BACT limits, conditions in this permit amendment will establish the relevant NO_x emission limits, operational, work practice, maintenance, monitoring, testing, record keeping, compliance demonstration and reporting requirements for the NO_x BACT, which include, but not limited to, operating records for Good Combustion Techniques and for emergency generator operating time, EPA issued engine certification or manufacturer guaranteed or site-testing engine emission data, and annual inspection and tune-up records. For each calciner/kiln, annual performance testing is required. In addition, the NO_x emissions from each calciner/kiln will be monitored routinely using a portable NO_x analyzer.

5.0 TESTING AND MONITORING REQUIREMENTS

Testing Requirements:

Depending on the regulatory status, Carbo Ceramics' emission sources will be subject to testing requirements under federal rules including PSD/NSR/BACT, NSPS Subparts OOO and UUU and 112(g) case-by-case MACT. These testing requirements are emission or source/process specific, and sometimes complementary to each other.

40 CFR Part 60, Subpart OOO: This NSPS standard requires the company to conduct initial performance tests on the newly constructed sources as a part of this modification/plant expansion which are subject to the applicable PM and visible emissions limits under the Subpart. The tests shall demonstrate compliance with the applicable emission limits using Method 5, Method 9 and/or Method 22, depending on the nature of the source involved. Carbo Ceramics shall follow the applicable procedures specified in Subpart OOO to conduct the PM, visible and/or fugitive emission testing. The results of the tests may be used to demonstrate compliance with the BACT PM, visible and/or fugitive limits for the same source.

40 CFR Part 60, Subpart UUU: This NSPS standard requires the company to conduct initial performance tests on the newly constructed spray dryers and calciners/kilns to demonstrate compliance with the applicable PM and visible emission limits using Method 5 and Method 9. Carbo Ceramics shall follow the applicable procedures specified in Subpart UUU to conduct the PM and visible emission testing. COMS shall be used to monitor the visible emissions from the affected sources. The results of the tests may be used to demonstrate compliance with BACT PM and visible limits for the same source.

PSD/NSR/BACT: Results from the PM and visible emission performance tests for sources subject to NSPS Subpart OOO and UUU are considered adequate to demonstrate compliance with the PSD/BACT PM and/or visible emission limits for the same sources. No additional PSD/BACT tests are required for these emission units.

All the point and fugitive PM emission sources directly involving the kaolin clay processing not only have visible and/or PM emission limits under either Subpart OOO or Subpart UUU, but also are subject to the visible and PM emission limits under PSD/BACT rules. Carbo Ceramics shall conduct Method 9, Method 22 and/or Method 5 tests on the sources respectively if required to demonstrate initial compliance with the applicable BACT visible and PM emission limits. The point sources may include, but not be limited to, baghouse-controlled raw material handling operations, raw or finished product storage bins/silos, material conveying system transfer points, milling, screening, packaging systems, bulk loading or unloading systems, spray dryers and calciners/kilns.

The Permittee may be required by the Division to determine the PM_{10} emissions from each of the stacks/point sources of PM emissions when (1) no Division-approved PM_{10} emission factor(s) is available; (2) actual PM emissions from the Method 5 test exceed the applicable PM_{10} emission limit; or (3) the assumption that 100% of the PM emissions from Method 5 testing were PM_{10} is no longer endorsed by Carbo Ceramics. Compliance with the PM_{10} emission limits is important because the ambient impacts of the potential PM_{10} emissions from Carbo Ceramics have been assessed via computerized atmospheric dispersion modeling.

To ensure continuous compliance with the BACT PM emissions limits, the Permittee is required to conduct PM/PM_{10} emission performance tests on each calciner/kiln and on one of the spray dryers on each kaolin clay processing line every three years. The spray dryers shall be tested on a rotating schedule.

When any source modifications or change in operation(s) that may adversely affect the PM/PM_{10} emissions or visible emissions from any such source, Carbo Ceramics shall conduct a performance test on the source using Method 5, Method 9 or Method 22 accordingly, and establish new operational parameter(s) that could affect the PM emissions.

Because of the operational similarities between Portland cement plants and Carbo Ceramics, some applicable monitoring, testing, compliance demonstration and reporting requirements for PM and visible emissions under 40 CFR Part 63, Subpart LLL, i.e. the NESHAP MACT standards for Portland cement plants, will be adapted as BACT requirements for the similar operations/sources at Carbo Ceramics. This adoption is reasonable because these MACT requirements are more updated, detailed, and/or stringent than those established during previous BACT determinations for the similar sources. In addition, the BACT requires the Permittee to perform daily visible emissions check and keep record of daily VE check, as currently required under the State rules.

The Permittee shall conduct initial performance tests for the CO, NO_x and SO_2 emissions from each rotary calciner/kiln to demonstrate compliance with the corresponding BACT emission limits. The CO and NO_x performance tests will be repeated annually thereafter. In addition, the NO_x emissions from each calciner/kiln will be monitored routinely using a portable NO_x analyzer following the methodology and protocol approved by the Division.

To ensure continuous compliance with the BACT CO, NO_x and SO_2 emission limits, the Permittee is required to conduct annual emission performance tests for these pollutants on each calciner/kiln.

Every three years the Permittee is required to conduct NO_x and CO emission performance tests on one of the spray dryers on each kaolin clay processing line to demonstrate compliance with the BACT emission limits. The spray dryers shall be tested on a rotating schedule.

The Permittee is required to conduct annual HCl and HF emission performance tests on each calciner/kiln to demonstrate compliance with the case-by-case MACT emission limits.

The SO_2 emissions from each calciner/kiln will be determined daily via analysis of the sulfur content of the kaolin clay processed by the calciner/kiln and mass balance calculation.

Appropriate operating parameters that may affect the emissions, such as kiln feed rate, fuel/air ratio, exhaust flow rate, temperature profile and burner setting, shall be determined during the tests, and utilized once the results of the tests are approved by the Division.

Monitoring Requirements:

Carbo Ceramics' manufacturing operations are subject to the monitoring requirements under NSPS (Subpart IIII and Subpart UUU), and SIP regulations. These monitoring requirements are emission or source/process specific and, depending on the regulatory status of the source, may be complementary to each other.

The visible emissions from both spray dryers and calciners/kilns are monitored by COMS since they are major sources of PM emissions which contribute to the visible emissions. Available on-site testing data indicate that the rotary calciners/kilns emit majority of the emissions (97% of SO_2 and 87% of NO_x) from the whole plant, meanwhile the emissions fluctuate significantly, especially SO_2 due to the variation of clay sulfur content. The NO_x emissions from each calciner/kiln will be monitored routinely using a portable NO_x analyzer following the methodology and protocol approved by the Division. The SO_2 emissions from each calciner/kiln will be monitored by daily analyzing of sulfur content of the kaolin clay processed by the calciner/kiln, and subsequently by the determination of the SO_2 emissions from the calciner/kiln based on mass balance calculation.

Carbo Ceramics is required to install devices to continuously monitor the inlet temperature of baghouses receiving hot gases and to record the time of each incident when the temperature exceeds the filter bag design temperature. This requirement prevents the heat damage of the filter bags.

Carbo Ceramics is required to conduct daily visible emission check (VE) on all PM baghouse except those having COMS, and retain a record in a daily VE log suitable for inspection or submittal. The daily VE check log shall also include causes of any visible emission and corrective actions taken.

To ensure the proper function of the baghouses serving PM emission sources, Carbo Ceramics is required to record the pressure drop at least on a weekly basis. In addition, a Prevention Maintenance Program (PPM) including scheduled equipment inspection requirements shall be developed for all the baghouses as supplement to the daily VE check.

Carbo Ceramic is required to perform daily operation and maintenance inspections on the dust/fugitive emissions suppression and cleanup systems, and keep records of the inspection.

NSPS Subpart IIII and SIP rules require each of the stationary emergency diesel generators/engines to be equipped with a non-resettable hour meter to track its operating time. The Permittee shall use the meter to record the time of operation and the nature of the operation. Compliance with the relevant annual operating time limits is a requirement by SIP rule for the generator to remain as an emergency generator and one of the presumptions used in the BACT determination for the generator.

CAM Applicability:

All the new PM/PM_{10} emissions units with baghouse control at Carbo Ceramics' facility are small Pollution Specific Emission Units (PSEUs) with post-control emissions less than 100 tpy. Therefore, they will be subject to applicable CAM requirements during next renewal of the facility's Part 70/Title V operating permit.

6.0 AMBIENT AIR QUALITY REVIEW

An air quality analysis is required to determine the ambient impacts associated with the construction and operation of the proposed modifications. The main purpose of the air quality analysis is to demonstrate that emissions emitted from the proposed modifications, in conjunction with other applicable emissions from existing sources (including secondary emissions from growth associated with the new project), will not cause or contribute to a violation of any applicable National Ambient Air Quality Standard (NAAQS) or PSD increment in a Class I or Class II area. NAAQS exist for NO_2, CO, $PM_{2.5}$,, PM_{10}, SO_2, Ozone (O_3), and lead. PSD increments exist for SO_2, NO_2, and PM_{10}.

The proposed project triggers PSD review for CO, PM_{10}, NO_2, and SO_2. An air quality analysis was conducted to demonstrate the facility's compliance with the NAAQS and PSD Increment standards for these pollutants. An additional analysis was conducted to demonstrate compliance with the Georgia air toxics program. This section of the application discusses the air quality analysis requirements, methodologies, and results. Supporting documentation may be found in the Air Quality Dispersion Modeling Report of the application and in the additional information packages.

Modeling Requirements

The air quality modeling analysis was conducted in accordance with Appendix W of Title 40 of the Code of Federal Regulations (CFR) §51, *Guideline on Air Quality Models*, and Georgia EPD's *Guideline for Ambient Impact Assessment of Toxic Air Pollutant Emissions (Revised).*

The proposed project will cause net emission increases of CO, PM_{10}, NO_2, and SO_2 that are greater than the applicable PSD Significant Emission Rates. Therefore, air dispersion modeling analyses are required to demonstrate compliance with the NAAQS and PSD Increment.

Significance Analysis: Ambient Monitoring Requirements and Source Inventories

Initially, a Significance Analysis is conducted to determine if the CO, PM_{10}, NO_2, and SO_2 emissions increases at Carbo Ceramics would significantly impact the area surrounding the facility. Maximum ground-level concentrations are compared to the pollutant-specific U.S. EPA-established Significant Impact Level (SIL). The SIL for the pollutants of concern are summarized in Table 6-1.

If a significant impact (i.e., an ambient impact above the SIL) does not result, no further modeling analyses would be conducted for that pollutant for NAAQS or PSD Increment. If a significant impact does result, further refined modeling would be completed to demonstrate that the proposed project would not cause or contribute to a violation of the NAAQS or consume more than the available Class II Increment.

Under current U.S. EPA policies, the maximum impacts due to the emissions increases from a project are also assessed against monitoring *de minimis* levels to determine whether pre-construction monitoring should be considered. These monitoring *de minimis* levels are also listed in Table 6-1. If either the predicted modeled impact from an emission increase or the existing ambient concentration is less than the monitoring *de minimis* concentration, the permitting agency has the discretionary authority to exempt an applicant from pre-construction ambient monitoring. This evaluation is required for CO, PM_{10}, NO_2, and SO_2.

If any off-site pollutant impacts calculated in the Significance Analysis exceed the SIL, a Significant Impact Area (SIA) would be determined. The SIA encompasses a circle centered on the facility with a radius extending out to (1) the farthest location where the emissions increase of a pollutant from the project causes a significant ambient impact, or (2) a distance of 50 km, whichever is less. All sources within a distance of 50 km of the edge of a SIA are assumed to potentially contribute to ground-level concentrations within the SIA and would be evaluated for possible inclusion in the NAAQS and PSD Increment analyses.

Table 6-1: Summary of Modeling Significance Levels

Pollutant	Averaging Period	PSD Significant Impact Level (ug/m^3)	PSD Monitoring Deminimis Concentration (ug/m^3)
PM_{10}	Annual	1	--
	24-Hour	5	10
SO_2	Annual	1	--
	24-Hour	5	13
	3-Hour	25	--
NO_X	Annual	1	14
CO	8-Hour	500	575
	1-Hour	2000	--

NAAQS Analysis

The primary NAAQS are the maximum concentration ceilings, measured in terms of total concentration of pollutant in the atmosphere, which define the "levels of air quality which the U.S. EPA judges are necessary, with an adequate margin of safety, to protect the public health." Secondary NAAQS define the levels that "protect the public welfare from any known or anticipated adverse effects of a pollutant." The primary and secondary NAAQS are listed in Table 6-2 below.

Table 6-2: Summary of National Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS	
		Primary / Secondary (ug/m^3)	Primary / Secondary (ppm)
PM_{10}	Annual	*Revoked 12/17/06	*Revoked 12/17/06
	24-Hour	150 / 150	--
$PM_{2.5}$	Annual	15 / 15	--
	24-Hour	35 / 35	--
SO_2	Annual	80 / None	0.03 / None
	24-Hour	365 / None	0.14 / None
	3-Hour	None/1300	None / 0.5
NO_2	Annual	100 / 100	0.053 / 0.053
CO	8-Hour	10,000 / None	9 / None
	1-Hour	40,000 / None	35 / None

If the maximum pollutant impact calculated in the Significance Analysis exceeds the SIL at an off-property receptor, a NAAQS analysis is required. The NAAQS analysis would include the potential emissions from all emission units at Carbo Ceramics, except for units that are generally exempt from permitting requirements and are normally operated only in emergency situations. The emissions modeled for this analysis would reflect the results of the BACT analysis for the modified emission unit. Facility emissions would then be combined with the allowable emissions of sources included in the regional source inventory. The resulting impacts, added to appropriate background concentrations, would be assessed against the applicable NAAQS to demonstrate compliance. For an annual average NAAQS analysis, the highest modeled concentration among five consecutive years of meteorological data would be assessed, while the highest sixth-high impact would be assessed for the 24-hour PM_{10} concentration, and the highest second-high impact for the rest of the short-term averaging periods of the rest of the pollutants.

PSD Increment Analysis

The PSD Increments were established to "prevent deterioration" of air quality in certain areas of the country where air quality was better than the NAAQS. To achieve this goal, U.S. EPA established PSD Increments for certain pollutants. The sum of the PSD Increment concentration and a baseline concentration defines a "reduced" ambient standard, either lower than or equal to the NAAQS that must be met in an attainment area. Significant deterioration is said to have occurred if the change in emissions occurring since the baseline date results in an off-property impact greater than the PSD Increment (i.e., the increased emissions "consume" more that the available PSD Increment).

U.S. EPA has established PSD Increments for NO_x, SO_2, and PM_{10}; no increments have been established for CO. The PSD Increments are further broken into Class I, II, and III Increments. Carbo Ceramics is located in a Class II area. The PSD Increments for Class I and II areas are listed in Table 6-3.

Table 6-3: Summary of PSD Increments

Pollutant	Averaging Period	PSD Increment	
		Class I (ug/m^3)	Class II (ug/m^3)
PM_{10}	Annual	4	17
	24-Hour	8	30
SO_2	Annual	2	20
	24-Hour	5	91
	3-Hour	25	512
NO_2	Annual	2.5	25

To demonstrate compliance with the PSD Increments, the increment-affecting emissions (i.e., all emissions increases or decreases after the appropriate baseline date) from the facility and those sources in the regional inventory would be modeled to demonstrate compliance with the PSD Class II increment for any pollutant greater than the SIL in the Significance Analysis. For an annual average analysis, the highest incremental impact will be used. For a short-term average analysis, the highest second-high impact will be used.

The determination of whether an emissions change at a given source consumes or expands increment is based on the source classification (major or minor) and the time the change occurs in relation to baseline dates. The major source baseline date for NO_x is February 8, 1988, and the major source baseline for SO_2 and PM_{10} is January 5, 1976. Emission changes at major sources that occur after the major source baseline dates affect Increment. In contrast, emission changes at minor sources only affect Increment after the minor source baseline date, which is set at the time when the first PSD application is completed in a given area, usually arranged on a county-by-county basis. For Wilkinson County, the minor source baseline dates have been set for PM_{10} as July 18, 1978, for SO_2 as November 25, 1981, and for NO_2 as April 3, 1989.

Modeling Methodology

Refined dispersion modeling was used for this modeling analysis. Details on the dispersion model, including meteorological data, source data, and receptors can be found in *GA EPD's PSD Dispersion Modeling and Air Toxics Assessment Review in Appendix C of this Preliminary Determination* and/or in the permit application.

Modeling Results

Class II area significant impact analysis was conducted using AERMOD model (version 07026) for NO_x, PM_{10}, SO_2, and CO, which are the criteria pollutants emitted in significant amounts from the permitted facility. AERMOD runs were undertaken using a rectangular receptor grid 13x12 kilometer, centered on the facility, and with spacing between receptors as follows: every 100 meters from the facility's fence line covering 9 km x 7.5 km around the facility, and every 250 meters over the rest of the domain.

Table 6-4 show that the proposed project will not cause ambient impacts of CO above the appropriate SILs. Because the emissions increases from the proposed project result in ambient impacts less than the SILs, no further PSD analyses were conducted for CO.
However, ambient impacts above the SILs were predicted for NO_2, PM_{10}, and SO_2 for all the applicable time-averaging periods, requiring NAAQS and Increment analyses be performed for these pollutants.

Table 6-4: Class II Significance Analysis Results – Comparison to SILs

Pollutant	Averaging Period	Year	UTM East (km)	UTM North (km)	Maximum Impact* (ug/m^3)	SIL (ug/m^3)	Significant?
NO_2	Annual	1989	301283.9	3636356.5	8.62	1	**Yes**
PM_{10}	24-hour	87041224	301200	3636700	26.61	5	**Yes**
	Annual	1989	301283.9	3636356.5	4.86	1	**Yes**
SO_2	3-hour	87121206	302600	3637300	67.49	25	**Yes**
	24-hour	87041224	301200	3636900	23.01	5	**Yes**
	Annual	1987	301200	3636800	2.52	1	**Yes**
CO	1-hour	89020307	302700	3637500	198.82	2000	No
	8-hour	91030624	301200	3636700	96.09	500	No

* Highest values; Data for worst year provided only.

Significant Impact Area

For any off-site pollutant impact calculated in the Significance Analysis that exceeds the SIL, a Significant Impact Area (SIA) must be determined. The SIA encompasses a circle centered on the facility being modeled with a radius extending out to the lesser of either: 1) the farthest location where the emissions increase of a pollutant from the proposed project causes a significant ambient impact, or 2) a distance of 50 kilometers. All sources of the pollutants in question within the SIA plus an additional 50 kilometers are assumed to potentially contribute to ground-level concentrations and must be evaluated for possible inclusion in the NAAQS and Increment Analysis.

Based on the results of the Significance Analysis, the distance between the facility and the furthest receptor from the facility that showed modeled concentrations exceeding the corresponding SIL was determined as 5.1km, 5.2km, and 5.3km for PM_{10}, SO_2, and NO_2 respectively. To be conservative, regional source inventories for the above three pollutants were prepared for sources located within 55.5 km of the facility.

NAAQS and Increment Modeling

The next step in completing the NAAQS and Increment analyses was the development of a regional source inventory. Nearby sources that have the potential to contribute significantly within the facility's SIA are ideally included in this regional inventory. Carbo Ceramics prepared an inventory of NAAQS and PSD Increment sources, GA EPD did an extensive review and revision on the regional source inventories provided by the facility.

The distance from the facility of each source listed in the regional inventories was calculated, and all sources located more than 55.5 kilometers from the facility were excluded from the analysis. Additionally, pursuant to the "20D Rule," facilities outside the SIA were also excluded from the inventory if the entire facility's emissions (expressed in tons per year) were less than 20 times the distance (expressed in kilometers) from the facility to the edge of the SIA. In applying the 20D Rule, facilities in close proximity to each other (within approximately 2 kilometers of each other) were considered as one source. For the PSD increment analysis, the major source PSD baseline dates were used for all the counties located within 55.5km to conservatively determine if a source should be included in the increment inventory. The NAAQS and Increment regional source inventory used in the analysis is included in the permit application.

NAAQS Analysis

In the NAAQS analysis, impacts within the facility's SIA due to the potential emissions from all sources at the facility and those sources included in the regional inventory were estimated. Since the modeled ambient air concentrations only reflect impacts from industrial sources, a "background" concentration was added to the modeled concentrations prior to assessing compliance with the NAAQS.

The results of the NAAQS analysis are shown in Table 6-5. As indicated, the worse-case total modeled impact at all applicable averaging period within the SIA are below the corresponding NAAQS, compliance is demonstrated.

Table 6-5: NAAQS Analysis Results

Pollutant	Averaging Period	Year	UTM East (km)	UTM North (km)	Maximum Impact* (ug/m^3)	Back-ground (ug/m^3)	Total Impact* (ug/m^3)	NAAQS (ug/m^3)	Exceed NAAQS?
NO_2	Annual	1989	301283.9	3636356.5	9.91	7.9	17.8	100	No
PM_{10}	24-hour	87111824	296130	3634987	53.37	38	91.4	150	No
	Annual	1989	296130	3634987	14.34	20	34.3	50	No
SO_2	3-hour	88010812	302830	3641387	309.60	58.5	368.1	1300	No
	24-hour	91012224	302530	3641087	69.81	23.6	93.4	365	No
	Annual	1989	295530	3635687	10.47	5.2	15.7	80	No

* Highest concentration for annual averaging periods; highest second high concentration for 24-hour and 3-hour averaging periods for SO_2; and highest sixth high concentration for 24 hour averaging period for PM_{10}.

** Total impact equals project source impact, plus impact from offsite sources, plus background concentration.

Increment Analysis

The modeled impacts from the project and increment consuming/expanding sources were evaluated to determine whether compliance with the Increment was demonstrated. The results are presented in Table 6-6, which demonstrates that the impacts are below the corresponding increments for all three pollutants.

Table 6-6: Increment Analysis Results

Pollutant	Averaging Period	Year	UTM East (km)	UTM North (km)	Maximum Impact (ug/m^3)	Increment (ug/m^3)	Exceed Increment?
NO_2	Annual	1989	301283.9	3636356.5	9.14	25	No
PM_{10}	24-hour	89080624	301283.9	3636356.5	28.21	30	No
	Annual	1989	301283.9	3636356.5	6.06	17	No
SO_2	3-hour	89032824	302630.0	3637187.0	93.65	512	No
	24-hour	89011824	296530.0	3635087.0	22.17	91	No
	Annual	1989	301283.9	3636356.5	4.82	20	No

* Highest concentration for annual averaging periods, and highest second high concentration for 24-hour and 3-hour averaging periods

Ambient Monitoring Requirements

Table 6-7: Significance Analysis Results – Comparison to Monitoring De Minimis Levels

Pollutant	Averaging Period	Year*	UTM East (km)	UTM North (km)	Monitoring De Minimis Level (ug/m^3)	Modeled Maximum Impact (ug/m^3)	Significant?
NO_2	Annual	1989	301283.9	3636356.5	14	8.62	No
PM_{10}	24-hour	87041224	301200	3636700	10	26.61	Yes
SO_2	24-hour	87041224	301200	3636900	13	23.01	Yes
CO	8-hour	91030624	301200	3636700	575	96.09	No

Data for worst year provided only

The impacts for NO_X, CO, SO_2, and PM_{10} quantified in Table 6-4 of the Class I Significance Analysis are compared to the Monitoring *de minimis* concentrations, shown in Table 6-7, to determine if ambient monitoring requirements need to be considered as part of this permit action. Monitoring *de minimus* concentrations of CO and NO_2 are less than their respective, prescribing threshold concentration, so no monitoring is required for CO and NO_2. Though PM_{10} and SO_2 concentration are greater than the Monitoring *de minimis* concentrations, no pre-construction monitoring is required because the GA EPD monitoring network ambient PM_{10} and SO_2 monitoring data is contemporaneous, representative, and regularly quality assured/controlled.

Class I Area Analysis

Federal Class I areas are regions of special national or regional value from a natural, scenic, recreational, or historic perspective. Class I areas are afforded the highest degree of protection among the types of areas classified under the PSD regulations. U.S. EPA has established policies and procedures that generally restrict consideration of impacts of a PSD source on Class I Increments to facilities that are located near a federal Class I area. Historically, a distance of 100 km has been used to define "near", but more recently, a distance of 300 kilometers has been used for all facilities that do not combust coal.

The sum of visibility-affecting pollutants due to the project, calculated on a worst-case 24-hr period basis by the US Forest Service Federal Land Manager (USFS FLM), is 3324 tpy. The distance to the nearest USFS Class I area is to the Cohutta Wilderness Area, GA, about 260 km away from Carbo Ceramics. This yields a Q/D ratio of 12.8, exceeding the ratio value of 4 currently used by the FLM to screen projects which may be required to assess Air Quality Related Values in nearby Class I areas (those within 300 km of the project site). Other Class I areas assessed by the applicant were: Okefenokee National Wildlife Refuges, GA; Wolf Island Wildlife Refuges, GA; Joyce Kilmer/Slickrock Wilderness Area, NC; Shining Rock Wilderness Area, NC; and the Great Smoky Mountains National Park, TN-NC.

CALPUFF was used to assess the maximum concentration without building downwash since all Class I areas are at least 50 km from the project site. The modeled impacts of any criteria pollutant were below their respective Class I area Significance levels for all six Class I areas, as indicated on Tables 6-8a ~ e. For this reason, a refined Class I Increment assessment was not required.

Table 6-8a:Project Impacts VS. Significance Level (CLASS I AREAS) Cohutta Wilderness Area

Criteria Pollutant	**Averaging Period**	**Significance Level**	**Maximum* Project Concentration**	**Receptor UTM Zone: 16**		**Model Met Data Period**
		(µg/m^3)	**(µg/m^3)**	**(meters East)**	**(meters North)**	**[yymmddhh]**
SO_2	Annual	0.1	0.0006	719060.4	3858367.5	2002
	24-Hour	0.2	0.0133	720584.6	3858404.0	02022024
	3-Hour	1.0	0.0410	715968.5	3860144.2	02100406
PM_{10}	Annual	0.2	0.0005	719060.4	3858367.5	2002
	24-Hour	0.3	0.0107	719060.4	3858367.5	02022024
NO_2	Annual	0.1	0.0010	719060.4	3858367.5	2002

*Highest concentration - = ALL averaging periods

Table 6-8b: Project Impacts VS. Significance Level (CLASS I AREAS) Joyce Kilmer-Slickrock Wilderness Area

Criteria Pollutant	Averaging Period	Significance Level	Maximum* Project Concentration	Receptor UTM Zone: 17		Model Met Data Period
		(µg/m^3)	(µg/m^3)	(meters East)	(meters North)	[yymmddhh]
SO$_2$	Annual	0.1	0.0003	230790.7	3916150.6	2003
	24-Hour	0.2	0.0083	231548.2	3916127.9	03091524
	3-Hour	1.0	0.0297	230790.7	3916150.6	03112403
PM$_{10}$	Annual	0.2	0.0003	230790.7	3916150.6	2003
	24-Hour	0.3	0.0067	231548.2	3916127.9	03091524
NO$_2$	Annual	0.1	0.0004	230790.7	3916150.6	2003

*Highest concentration - = ALL averaging periods

Table 6-8c: Project Impacts VS. Significance Level (CLASS I AREAS) Shining Rock Wilderness Area

Criteria Pollutant	Averaging Period	Significance Level	Maximum* Project Concentration	Receptor UTM Zone: 17		Model Met Data Period
		(µg/m^3)	(µg/m^3)	(meters East)	(meters North)	[yymmddhh]
SO$_2$	Annual	0.1	0.0003	334517.9	3911794.2	2003
	24-Hour	0.2	0.0132	334517.9	3911794.2	03041824
	3-Hour	1.0	0.0565	334517.9	3911794.2	03041709
PM$_{10}$	Annual	0.2	0.0003	334517.9	3911794.2	2002
	24-Hour	0.3	0.0129	334517.9	3911794.2	03111724
NO$_2$	Annual	0.1	0.0004	334517.9	3911794.2	2001

*Highest concentration - = ALL averaging periods

Table 6-8d: Project Impacts VS. Significance Level (CLASS I AREAS) Great Smoky Mountains National Park

Criteria Pollutant	Averaging Period	Significance Level	Maximum* Project Concentration	Receptor UTM Zone: 17		Model Met Data Period
		(µg/m^3)	(µg/m^3)	(meters East)	(meters North)	[yymmddhh]
SO$_2$	Annual	0.1	0.0003	259796.8	3923655.3	2003
	24-Hour	0.2	0.0103	289031.8	3943268.8	01062824
	3-Hour	1.0	0.0332	270438.2	3925226.7	02032909
PM$_{10}$	Annual	0.2	0.0003	247741.1	3925836.9	2003
	24-Hour	0.3	0.0107	287566.0	3945153.6	01062824
NO$_2$	Annual	0.1	0.0003	259796.8	3923655.3	2003

*Highest concentration - = ALL averaging periods

Table 6-8e: Project Impacts VS. Significance Level (CLASS I AREAS) Okefenokee National Wildlife Refuges

Criteria Pollutant	Averaging Period	Significance Level	Maximum* Project Concentration	Receptor UTM Zone: 17		Model Met Data Period
		(µg/m^3)	(µg/m^3)	(meters East)	(meters North)	[yymmddhh]
SO_2	Annual	0.1	0.0014	377955.4	3437047.4	2002
	24-Hour	0.2	0.0605	368321.9	3429772.5	01122224
	3-Hour	1.0	0.1669	390582.3	3427672.5	02112906
PM_{10}	Annual	0.2	0.0011	377955.4	3437047.4	2002
	24-Hour	0.3	0.0393	369936.0	3431600.2	01122224
NO_2	Annual	0.1	0.0026	377955.4	3437047.4	2002

*Highest concentration - = ALL averaging periods

The USFS FLM reviewed the Air Quality Related Values (AQRV) assessment as presented in the permit application for the USFS Class I area, the Cohutta Wilderness Area, located closest to the project site. The FLM found no visibility would occur due to the operation of the project as proposed.

The USFS FLM also reviewed the level of potential nitrogen and sulfur deposition estimated to be due to the operation of the project. The FLM found that the maximum estimated deposition rate would be less than 0.0031 kg/ha/yr for nitrogen and 0.0016 kg/ha/yr for sulfur, which is lower than the FLM level of concern threshold deposition rate of 0.01 kg/ha/yr.

The USFS FLM found that, at the closest Class I Wilderness area (Cohutta) to the project site, the proposed emission increases at the Plant Toomsboro facility would not cause or contribute to an adverse impact on any AQRV.

7.0 ADDITIONAL IMPACT ANALYSES

PSD requires an analysis of impairment to visibility, soils, and vegetation that will occur as a result of a modification to the facility and an analysis of the air quality impact projected for the area as a result of the general commercial, residential, and other growth associated with the proposed project.

Soils and Vegetation

The proposed facility estimated the potential impacts from the proposed project to soils, vegetation, and wildlife. GA EPD added the regional source inventories for such assessment using AERMOD model (version 07026). The maximum emissions of NO_2 and SO_2 from proposed project and regional sources were compared to threshold levels of harm as presented in '*A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals'*, US EPA 450/2-81-078, 12/1980. Modeling of worst-case project emissions was conducted at 1hour, 3 hour, and annual averaging period for SO_2, and 4 hour, 8 hour, 1 month and annual averaging period for NO_2. The results are tabulated in Table 7-1. Worst-case impacts from the project and offsite source emissions plus appropriate monitored ambient background concentrations were all estimated to be less than any applicable screening threshold-of-harm concentration.

Table 7-1: Class I Area Vegetative Impact Results

Pollutant	Averaging Period	All Source Impact[1]	Background Concentration[2]	Total Potential Impact	Receptor UTM Zone: 17		Model Met Data Period	Screening Level	Exceed Screening Level?
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(meters East)	(meters North)	(yymmddhh)	($\mu g/m^3$)	
SO_2	1 hour	828.3	83.7[3]	912	301530	3641487	90013008	917	No
	3 hour	365.6	58.5[3]	424.1	297030	3639987	89010915	786	No
	Annual	10.47	5.2[3]	15.7	295530	3635687	1989	18	No
NO_2	4 hour	143.2	46.1	189.3	302630	3637587	88011604	3760	No
	8 hour	104.4	40.8	145.2	301030	3636987	90120324	3760	No
	1 month	17.3	19.2	36.5	301283.9	3636356.5	90063024	564	No
	Annual	9.9	7.9[3]	17.8	301283.9	3636356.5	1989	100	No
Fluorine	24 hour	Less Than Significant Emission Rate							

[1] Highest, first highest concentration for all averaging period modeled with both project and offsite inventories.

[2] 4hour, 8hour and 1month background concentration for NO_2 are derived from 1-hour averaging period based on the conversion factors in the Screening Procedure, Table A.2, which are approximate 0.79, 0.70, and 0.33, respectively.

[3] Actual monitored background value.

Growth

The purpose of a growth analysis is to predict how much new growth is likely to occur as a result of the project and the resulting air quality impacts from this growth. No adverse impacts on growth are anticipated from the project since any workforce growth and residential and commercial growth that would be associated with the proposed project (expected to be minimal) would not cause a quantifiable impact on the air quality of the area surrounding the facility.

Visibility

There are no potentially sensitive visible plume receptors located within the maximum SID of the project site. For this reason, it is not necessary to conduct an analysis of visible plume impacts.

Georgia Toxic Air Pollutant Modeling Analysis

Georgia EPD regulates the emissions of toxic air pollutant (TAP) emissions through a program covered by the provisions of *Georgia Rules for Air Quality Control*, 391-3-1-.02(2)(a)3.(ii). A TAP is defined as any substance that may have an adverse effect on public health, excluding any specific substance that is covered by a State or Federal ambient air quality standard. Procedures governing the Georgia EPD's review of TAP emissions as part of air permit reviews are contained in the agency's "*Guideline for Ambient Impact Assessment of Toxic Air Pollutant Emissions (Revised).*"

Selection of Toxic Air Pollutants for Modeling

For projects with quantifiable increases in TAP emissions, an air dispersion modeling analysis is generally performed to demonstrate that off-property impacts are less than the established Acceptable Ambient Concentration (AAC) values. The TAPs evaluated are restricted to those that may increase due to the proposed project. Thus, the TAP analysis would generally be an assessment of off-property impacts due to facility-wide emissions of any TAP emitted by a facility.

At Carbo Ceramics, more than three dozen TAP compounds are emitted from fuel combustion in spray dryers, boilers and calciners/kilns. According to the emission factors for natural gas combustion listed in Tables 1.4-3 and 1.4-4, Subchapter 1.4: *Natural Gas Combustion,* AP 42 (5th Edition), the vast majority of these TAP compounds are emitted in only trace amounts that are not expected to have significant impacts on ambient air quality.

TAP emissions from raw materials and additives used in the production processes at Carbo Ceramics include evaporation of Ammonia (NH_3) and Methanol from clay slurry in spray dryers, and release of HCl and HF from clay via chemical reactions at high temperature in calciners/kilns. The amount of these TAP emissions depend on the chloride and fluoride contents of the raw materials and the usage of NH_3 and the additives containing methanol.

Attachment K of the application No. 18293 revised on February 9, 2009 and August 14, 2009 identified five TAP compounds (Ammonia, HF, HCl, Hexane and Methanol) for the ambient impact modeling. According to the application, plant-wide total potential emissions of these TAP compounds are 1,542.94 TPY, including 1,350 TPY of NH_3, 34.80 TPY of HCl, 151.56 TPY of HF, and 4.43 TPY of Hexane. Georgia EPD added 40.16 TPY of potential Methanol emissions into its own TAP ambient impact modeling.

All the TAP emission sources at Carbo Ceramics are assumed to operate 24 hour per day at an average input rate of approximately 20 tons kiln feed to each calciner/kiln.

For each TAP identified for further analysis, both the short-term and long-term AAC were calculated following the procedures given in Georgia EPD's *Guideline*.

Determination of Toxic Air Pollutant Impact

The Georgia EPD Guideline recommends a tiered approach to model TAP impacts, beginning with screening analyses using SCREEN3, followed by refined modeling, if necessary, with ISCST3 or ISCLT3. For the refined modeling completed, the infrastructure setup for the SIA analyses was relied upon with appropriate sources added for the TAP modeling. Note that per the Georgia EPD's Guideline, downwash was not considered in the TAP assessment.

Initial Screening Analysis Technique

Generally, an initial screening analysis is performed in which the total TAP emission rate is modeled from the stack with the lowest effective release height to obtain the maximum ground level concentration (MGLC). Note the MGLC could occur within the facility boundary for this evaluation method. The individual MGLC is obtained and compared to the smallest AAC. Due to the likelihood that this screening would result in the need for further analysis for most TAP, the analyses were initiated with the secondary screening technique.

Five TAP contaminant concentrations were modeled for this proposed project with the ISCST3 model (version 02035) for comparison to their short- and long-term Acceptable Ambient Concentrations (AAC). The ISCST3 model was employed in the air toxics impact assessment since it gives a conservative maximum ground level concentration (MGLC), hence used in the development of the GA EPD *Guideline for Ambient Impact Assessment of Toxic Air Pollutant Emissions,* (1998). The GA EPD guideline document does not require assessment of downwash influences on estimated concentrations.

Acceptable Ambient Concentrations (AACs) were obtained from EPA's Integrated Risk Information System (IRIS) as an inhalation reference concentration (RfC) or calculated as a risk based ambient concentration (RBAC), OSHA's Permissible Exposure Limits as times weighted averages or Ceiling limit, American Conference of Governmental and Industrial Hygienists (ACGIH) as short-term exposure limits (STEL), etc. Maximum ground-level concentrations (MGLCs) of five evaluated contaminants emitted from the Plant Toomsboro site were assessed without downwash using maximum capacity emission rates and source characteristics (see Appendix K of application report, updated February 2009). Table 7-2 listed the projected TAP impact and the applicable AACs. All air toxic concentrations/MGLCs assessed were found to be less than their respective AACs.

Table 7-2 Projected Impacts – Air Toxic (unit: µg/m3)

Contaminant	Averaging period	MGLC	AAC	Averaging period	AAC	MGLC	Pass/Fail
HCl	Annual	0.12	20	15-min	700	7.35	Pass
Hexane	Annual	0.1306	700	15-min	17600	12.3671	Pass
NH_3	Annual	8.8499	100	15-min	2400	617.3815	Pass
HF	Annual	0.53	14	15-min	245	31.95	Pass
Methanol	24-hour	3.3273	619	15-min	32800	18.3625	Pass

8.0 EXPLANATION OF DRAFT PERMIT CONDITIONS

The permit requirements for this proposed facility are included in draft Permit Amendment No. 3295-319-0029-V-02-1.

Section 2.0: Requirements Pertaining to the Entire Facility

The ambient impacts of the criteria pollutants emitted from this modification have been assessed using atmospheric dispersion models and determined to be acceptable under pertinent NSR/PSD rules. During the modeling, “model receptors” inside the area bounded by “boundary receptors” were removed from modeling. Upon the request from the Divisions’ air impact modeling program, Condition 2.2.2 is added to require measures restricting public access to the property “non-ambient” air.

Condition 2.3.1 is added as part of an effort to keep the permit updated and to reduce ambiguity.

Section 3.0: Requirements for Emission Units

Table 3.1 has been updated for Carbo Ceramic’s modified Toomsboro Plant. All the emission units and operations listed in the table have been grouped according to each process line. Condition 3.2.2 has been updated to identify all the sources subject to the BACT gaseous fuel usage requirement.

The construction at Carbo Ceramics’ facility has two phases: (1) the construction of process line Nos. 1 and 2 in 2004 to 2007; and (2) the construction of process line Nos. 3 and 4 in 2009 thereafter. To allow the VOC emissions from each construction to avoid BACT review, Condition 3.2.3 is added to limit the VOC emissions from each construction phase to less 40 tons per year, i.e., below the VOC significant increase level under PSD/NSR rules.

Condition 3.2.4 is added to establish requirements necessary for the process and control systems involved to comply with the BACT emission limits in this permit amendment. These requirements are considered as part of the BACT for the emission sources and control systems. The requirements also include O&M and work practice plans to ensure proper function of the process and control equipment.

Condition 3.2.5 is added to establish the BACT requirements for fugitive emissions from the production related traffic.

To allow each of the stationary diesel generators/engines to retain the status of an emergency unit under SIP regulation and implement BACT, Condition 3.2.6 is added to limit the accumulated annual operating time for each generator/engine to no more than 500 hours per year.

Condition 3.3.2 has been updated to include reference to the two new process lines. This condition contains the PM and visible emission limits for spray dryers and calciners/kilns under NSPS Subpart UUU.

Condition 3.3.3 is added to establish the equipment/source and/or emission-specific BACT emission standards, corresponding compliance methods and data average time if applicable. The stacks serving spray dryers and calciners/kilns are main PM/PM_{10} emission sources, and equipped with COMS. Calciners/kilns also are main sources of NO_x and SO_2 emissions. Consequently, calciners/kilns are required to have annual performance tests for NO_x and SO_2 emissions to demonstrate compliance with the BACT limitations. The NO_x emissions from each calciner/kiln will be monitored routinely using a portable NO_x analyzer following the methodology and protocol approved by the Division. The SO_2 emissions from each calciner/kiln will be monitored by daily analyzing of sulfur content of the kaolin clay processed by the calciner/kiln, and subsequently by the determination of the SO_2 emissions from the calciner/kiln based on mass balance calculation. The use of COMS will also greatly enhance the PM/PM_{10} emission monitoring. The BACT for the stationary emergency diesel generators/engines requires all the generators/engines to be certified to the applicable Tier I or II emission standard for nonroad compression ignition engines for the same model year and rated engine power specified in 40 CFR Part 89 and comply with NSPS Subpart IIII emission and fuel standards. The Tier I or II emission standards are equivalent or more stringent than the NSPS Subpart IIII emission standards for PM, NO_x and CO. The exclusive use of natural gas and propane is considered BACT for PM/PM_{10}, SO_2 and VOC emissions from the boilers. The BACT visible emission limit for minor PM/PM_{10} emission sources with control (most of them are materials handling operations) is established as 7%, which is equal to the limit in the revised NSPS Subpart OOO for any baghouse controlling PM emissions from an individual, enclosed storage bin[17].

Conditions 3.3.4, 3.3.5 and 3.3.6 incorporate the applicable NSPS emission and fuel standards for the new emergency stationary diesel generators/engines under 40 CFR Part 60, Subpart IIII. The engines' manufacturer is required to certify with EPA that the engines are in compliance with applicable emission limits under Subpart IIII before marketing the engines. Please note that the diesel fuel to be used by the engines is subject to the Subpart IIII sulfur and cetane index or aromatic content standards that become more stringent with later compliance date. The same emission and fuel standards also are deemed as BACT for the existing emergency stationary diesel generator/engine No.1 which is not subject to NSPS Subpart IIII.

Conditions 3.3.7 and 3.3.8 establish the case-by-case MACT emission requirements and limits under Section 112(g) of CAA Amendment of 1990 for methanol emissions from the spray dryers, and HCl and HF from calciners/kilns. No add-on control is required. Condition 3.3.8 also outlines the corresponding compliance methods for easy reference.

Condition 3.3.9 has been added to incorporate new PM and visible emission limits in NSPS Subpart OOO as amended by EPA on April 28, 2009. These new limits apply to affected facilities constructed, modified and reconstructed on or after April 22, 2008.

New Conditions 3.3.10 and 3.3.11 incorporate applicable operating requirements and limitations for the stationary emergency diesel generators/engines subject to 40 CFR Part 60, Subpart IIII, i.e., the NSPS standard for stationary compression ignition internal combustion engines. Carbo Ceramics shall purchase diesel generators/engines certified by EPA for compliance with all the applicable NSPS emission standards.

Because the entire facility is a major source for HAP emission, Condition 3.3.12 contains the applicable operating requirements for the stationary emergency diesel generators/engines subject to 40 CFR Part 63, Subpart ZZZZ, i.e., the NESHAP MACT standard for stationary reciprocating internal combustion engines. Condition 3.3.13 incorporates an applicable notification requirement for the new stationary emergency diesel generators/engines subject to 40 CFR Part 63, Subpart ZZZZ.

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[17] Proposed 40 CFR part 60, Subpart OOO, http://www.epa.gov/ttn/caaa/t3/fr_notices/nonm-rev.pdf.

Conditions 3.4.3 and 3.4.4 in the current Part 70/Title V operation permit No. 3295-319-0029-V-02-0 have been modified to include references to the two new 9.8 MMBtu/hr natural gas-fired boilers.

Section 4.0: Requirements for Testing

Condition 4.1.3 in the current Title V operating permit No. 3295-319-0029-V-02-0 has been updated to list all the applicable methods for performance testing and monitoring of the emissions from the existing facility and from the new process lines.

Condition 4.2.2 in the Part 70/Title V operating permit No. 3295-319-0029-V-02-0 has been revised to require necessary performance testing on the existing processing lines for demonstrating compliance with the BACT and MACT emission standards in Part 3.0. Condition 4.2.2 also outlines the corresponding compliance methods for easy reference. Condition 4.2.3 is added to require initial performance tests for PM and visible emissions from new spray dryers and calciners/kilns subject to NSPS Subpart UUU.

Conditions 4.2.4 through 4.2.7 incorporate applicable testing and reporting requirements for the visible and fugitive emissions from the sources subject to 40 CFR Part 60, Subpart OOO. Condition 4.2.5 allows the duration of testing to be reduced to 30 minutes when testing reveals that the source meets certain conditions. Condition 4.2.6 allows an alternative testing procedure when the fugitive emissions from two or more sources continuously interfere with each other.

Conditions 4.2.8 and 4.2.9 require initial performance testing for all the new sources with BACT and/or MACT emission standards. No such testing is required when a testing pursuant to NSPS Subpart UUU or Subpart OOO has already been conducted for same sources under the same operating conditions. Testing using Method 201 or 201A may be required, in conjunction with Method 202 when necessary. Carbo Ceramics shall record all operating parameters, production information and data affecting the emissions and/or required in the emission calculations. While a noticeable detached plume on the calciner/kiln stack suggests some amount of condensable PM, 40 CFR 52.166 (amended 5/16/08) specifies that PM limits issued prior to January 1, 2011 need not account for these (i.e, only account for filterable PM).

Condition 4.2.10 requires annual testing of HCl and HF emissions from calciners/kilns to ensure compliance with the case-by case MACT limitations.

Condition 4.2.11 requires annual testing of CO emissions from calciners/kilns to ensure compliance with the BACT limit.

Condition 4.2.12 requires the Permittee to conduct testing every three years for PM/PM_{10} emissions from one spray dryer on each kaolin clay processing line and from each calciner/kiln to ensure compliance with the BACT limits. The spray dryers on each processing line will be tested on a rotating schedule.

Condition 4.2.13 requires the Permittee to conduct testing every three years for NO_x and CO emissions from one spray dryer on each kaolin clay processing line to ensure compliance with the BACT limits. The spray dryers on each processing line will be tested on a rotating schedule.

Condition 4.2.14 is added to require annual performance testing for NO_x and SO_2 emissions from each calciner/kiln.

Section 5.0: Requirements for Monitoring

Condition 5.2.1 in the current Part 70/Title V operating permit No. 3295-319-0029-V-02-0 has been updated mainly to require the use of a portable NO_x analyzer following the methodology and protocol approved by the Division to monitor the NO_x emissions from each calciner/kiln. The SO_2 emissions from each calciner/kiln will be monitored by daily analyzing of sulfur content of the kaolin clay processed by the calciner/kiln, and subsequently by the determination of the SO_2 emissions from the calciner/kiln based on mass balance calculation. All the new spray dryers and calciners/kilns will be equipped with COMS, similar to those on the existing process lines.

To ensure compliance with the fugitive emission limits, Conditions 5.2.6 is added to establish the monitoring requirements for the dust/fugitive emission wet suppression systems.

New condition 5.2.7 establishes the monitoring requirements under NSPS Subpart IIII and PSD/BACT for using a non-resettable hour meter to track the number of hours operated for each of the stationary emergency diesel generators/engines during any type of operation. The 500 hour per year operating time limit is also one of the presumptions used in the determination of BACT for these engines.

Condition 5.2.8 requires quarterly Method 22 visible emission inspections on affected facilities that use baghouse to control PM emissions. This is a new monitoring requirement under 40 CFR Part 60, Subpart OOO as amended on April 28, 2009.

Condition 5.2.9 is added to establish detailed procedures for the routine monitoring of the NO_x emissions from each calciner/kiln using a portable NO_x analyzer.

Section 6.0: Other Recordkeeping and Reporting Requirements

Condition 6.1.7 in the current Title V operation permit No. 3295-319-00290V-02-0 has been modified to include new or updated reporting requirements due mainly to the establishment of the BACT, NSPS, MACT emission limitations and/or operating requirements.

Condition 6.2.3 in the current Title V operation permit No. 3295-319-00290V-02-0 has been modified to include reference to the new conditions. The records required by this condition ensure the proper control of fugitive emissions.

Condition 6.2.4 is added to require the permit to keep production records necessary in the calculation/determination of the emission rates or for compliance demonstrations.

New Conditions 6.2.5 and 6.2.6 establish the compliance determination and reporting requirements for the case-by-case MACT limits for methanol emissions.

Conditions 6.2.7 and 6.2.8 are added to establish the compliance determination and reporting requirements for the 40 tpy VOC BACT avoidance limit.

Conditions 6.2.9 and 6.2.10 are added to establish the reporting requirements for performance testing and startup of affected sources.

Conditions 6.2.11 through 6.2.14 establish the recordkeeping, compliance determination and reporting requirements to ensure that operation of each of the stationary emergency diesel generators/engines not to exceed the annual operating time limits under pertinent NSPS and SIP rules.

The source startup notification requirements in Condition 6.2.15 establishes the time frames for NSPS, MAACT, BACT and/or SIP requirements such as monitoring, testing, record keeping, compliance determination, and/or reporting.

Condition 6.2.17 is added to establish the compliance requirement for SO2 emissions from each calciner/kin using mass balance based on the daily sulfur content and input rate records of the kaolin clay processed by each calciner/kiln.

Conditions 6.1.8 and 6.1.9 are added to establish the compliance determination and reporting requirements for the 8.70 tpy HCl emission limit and the 37.92 tpy HF limit determined per 112(g) of CAA.

Section 7.0: Other Specific Requirements

Condition 7.14.1 is added to establish the conditions for the expiration and extension of this permit amendment under NSR/PSD regulation.

APPENDIX A: 112(g) of CAA Case-By-Case Maximum Achievable Control Technology Determination

112(g) of CAA Case-By-Case Maximum Achievable Control Technology (MACT)
Determination Review of Carbo Ceramics, Inc. - Toomsboro Plant
Operation of Existing Ceramic Pellet Manufacturing Plant &
Construction & Operation of Ceramic Pellet Process Line Nos. 3 & 4
Located in Toomsboro, Georgia (Wilkinson County)

NOTICE OF MACT APPROVAL

Air Quality Permit Application No. 18293
Dated August 19, 2008 & Revised on February 9, 2009 and August 14, 2009

Reviewing Authority

State of Georgia
Department of Natural Resources
Environmental Protection Division
Air Protection Branch
Stationary Source Permitting Program (SSPP)

Prepared By:

Wei-Wei Qiu – Environmental Engineer, Mineral Unit

James Capp – Chief, Air Protection Branch
Eric Cornwell – Program Manager, Stationary Source Permitting Program
Hamid Yavari – Mineral Unit Manager, Stationary Source Permitting Program

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1.0 EXECUTIVE SUMMARY

Carbo Ceramics, Inc. – Toomsboro Plant (Carbo Ceramics) operates a ceramic pellet manufacturing facility located at 1880 Dent Road, Toomsboro, Wilkinson County, Georgia. Wilkinson County is classified as “attainment” or “unclassifiable” for all criteria pollutants.

Carbo Ceramics submitted application No. 18293 proposing to add two ceramic pellet process lines (Process Line Nos. 3 and 4) to the facility. This facility expansion also includes two new 9.8 MMBtu/hr natural gas-fired boilers, two new stationary emergency diesel generators, a truck loadout system, and a bagging system.

Consisting of mainly materials handling and storage, milling, slurry preparation, screening, spray drying, calcining and packaging and shipping operations, the new process lines will be almost identical to the two existing process lines (Process Line Nos. 1 and 2) in terms of process nature, production capacity, and configurations of process and pollution control equipment, as described in details in the current Title V operating permit No. 3295-319-0029-V-02-0.

The application No. 18293 also proposes to implement BACT for CO, NO_x, PM/PM_{10} and SO_2 emissions from the existing Process Line Nos. 1 and 2, because results of 2006 emission tests indicate that the emission rates of these criteria pollutants exceeded either the corresponding major source thresholds or significant increase levels under NSR/PSD rules. The same BACT will apply to the CO, NO_x, PM/PM_{10} and SO_2 emissions from the two new process lines because these emissions also exceed either the corresponding major source thresholds or the significant increase levels under NSR/PSD rules and thus make the construction of these new process lines a major source/modification under PSD/NSR regulations.

Carbo Ceramics uses an additive/chemical compound as disperser during the preparation of clay slurry. The chemical compound contains less than 1% by weight of methanol (EPA listed HAP) as an impurity. This facility has the potential to emit more than 10 tons per year of methanol into the atmosphere during spray drying of the clay slurry. Recent on-site stack tests also indicate that each kiln emits approximately 8.7 tons per year of HCl and 37.92 tons per year of HF. Because the emissions of methanol, HF and HCl each exceed major source threshold of 10 tons per year for a single HAP and major source threshold of 25 tons per year for combined HAPs under 40 CFR Part 63 Subpart B, and there is no NESHAP Part 63 MACT standard for the ceramic pellet manufacturing facilities like Carbo Ceramic’s facility, the HAPs emissions are subject to a Case-by-Case MACT determination under 112(g) of CAA Amendment of 1990.

The Section 112(g)(2)(B) trigger date for Georgia is June 29, 1998. Constructed after this date and having no 40 CFR Part 63 NESHAP standard, each process line is a “newly constructed major source” pursuant to Section 112(g) of the CAA Amendments of 1990, and is subject to a case-by-case MACT determination. The requirements for such case-by-case control technology reviews are codified in 40 CFR Part 63, Subpart B and are adopted by reference, with a few revisions and clarifications, into the Georgia Rules for Air Quality Control.

To satisfy the 112(g) case-by-case MACT requirements (40 CFR 63.40 through 63.44, *Control Technology Requirements in Accordance with Section 112(g)(2)(B) of the 1990 Clean Air Act Amendments*), Carbo Ceramics submitted with the application No. 18293 a proposed case-by-case MACT determination specifying control technology intending to meet the MACT emission limitations. Carbo Ceramics’ analysis of similar facilities indicates that the case-by-case MACT should be the limitation of the potential methanol emissions to the levels as dictated by the potential usage rate of the methanol-containing additive without add-on control. Carbo Ceramics has requested that methanol, HF and HCl emissions be limited for each process line. The Division has conducted case-by-case MACT determination for the sources subject to the 112(g) case-by-case MACT determination. Numerical MACT emission rate limits have been established for the HCl and HF emissions from each calciner/kiln plus initial and annual testing for compliance assurance.

2.0 APPLICATION INFORMATION

2.1 Application Content

The permit application No. 18293 includes the following information:

(1) SIP and Part 70 permit application forms for the existing and new emission sources as necessary;

(2) Description of the existing process lines and the new process lines.

(3) Emissions inventory/calculation sheets indicating the existing emissions and emissions changes due to the proposed modification/facility expansion;

(4) Proposed BACT for CO, NO_x, PM/PM_{10} and SO_2 emissions from the facility;

(5) Proposed 112(g) of CAA case-by-case MACT for methanol, HF and HCl emissions from the facility;

(6) Analyses of air quality/ambient impact modeling for CO, NO_x, PM/PM_{10} and SO_2 emissions from the facility per PSD/NSR requirements; and

(7) Ambient impact assessments/modeling for emissions of air toxic pollutants emissions from the facility per SIP rule requirements.

2.2 Applicant Information

(1) Facility Owner:

Carbo Ceramics, Inc.
6565 MacArthur Boulevard, Suite 1050
Irving, Texas 75039

(2) Facility Information:

Carbo Ceramics, Inc. - Toomsboro Plant
1880 Dent Road
Toomsboro, Georgia 31090 (Wilkinson County)

2.3 Authorized Representative

Tim Stafford
Plant Manager

2.4 Application Submittals

August 22, 2008:	Date of initial application assigned Application No. 18293
February 12, 2009	Date of final revised Application No. 18293 with 112(g) case-by-case MACT determination application for methanol emission from spray dryers

August 14, 2009	Revised HF and HCl emission data, ambient impact analyses and case-by-case MACT determination for the HF and HCl emissions

3.0 BACKGROUND

3.1 Facility Location

Carbo Ceramics operates a ceramic pellet manufacturing facility at 1880 Dent Road, Toomsboro, Wilkinson County, Georgia. Wilkinson County is classified as “attainment” or “unclassifiable” for all criteria pollutants.

Currently Carbo Ceramics’ facility has two existing ceramic pellet process lines consists of mainly materials handling and storage, milling, slurry preparing, screening, spray drying, calcining and packaging and shipping operations. Each process line is served by a 9.8 MMBtu/hr natural gas-fired boiler and a stationary emergency diesel generator/engine.

3.2 Permit Status of Facility Operations

Currently Carbo Ceramics’ facility is regulated by Title V Operating Permit No. 3295-319-0029-V-02-0 issued on November 6, 2008. Carbo Ceramic has submitted application No. 18293 proposing to construct two ceramic pellet process lines (Process Line Nos. 3 and 4) to the facility. The facility expansion also includes two new 9.8 MMBtu/hr natural gas-fired boilers, two new stationary emergency diesel generators, a truck loadout system, and a bagging system.

In addition to the facility expansion, Carbo Ceramics requested a permit for BACT for CO, NO_x, PM/PM_{10} and SO_2 emissions from the existing facility. The same BACT also will apply to the new emission units associated with the facility expansion.

The application No. 18293 as revised on February 9, 2009 also includes a retroactive 112(g) case-by-case MACT proposed for the methanol emission from the existing facility. The same 112(g) case-by-case MACT also will apply to the methanol emission sources associated with the facility expansion.

A supplement dated August 14, 2009 to the application No. 18293 was submitted by Carbo Ceramics to revise the HF and HCl emission data from kilns based on on-site stack tests. The submittal also includes revised ambient impact analyses and case-by-case MACT determination for the HF and HCl emissions

3.3 Project Schedule

Construction of the new kaolin clay process lines is expected to begin in second half of 2009. Regular production operations are scheduled to commence in 2011.

3.4 Existing and Proposed Operation

The facility currently consists of two similar ceramic pellet process lines (Process Line Nos. 1 and 2) which produce ceramic pellets (proppant) used during the hydraulic fracturing process to improve reservoir productivity of oil and natural gas wells. Both process lines consist mainly of a raw material slurry system, two spray dryers, a calciner/kiln feed system, a calciner/kiln and cooler, and product storage and loading operations.

The facility receives truck-loads of kaolin clay from nearby clay mines. After grinding, the kaolin clay is mixed with water and a dispersing agent to form a slurry in the slurry system, consisting of a feed conveyor, a shredder, three conveyors, one bin, and three media mills.

Ammonia is added to the clay slurry to adjust the pH value. Then the clay slurry is processed in the spray dryers where external water and ammonia added to the clay is driven off and clay granules are formed. There are five bins, six conveyors, one bucket elevator, one hopper, and three screens associated with each pair of the spray dryers serving each process line. After the dried clay granules exit the spray dryers, they are screened for the appropriate sizes. The screened clay granules with desired sizes are fed continuously into each calciner/kiln where combined (chemically bonded) water is removed. There are three bucket elevators, six bins, two conveyors, and four screens associated with each of the calciners/kilns. Ceramic pellets produced by the calciners/kilns are cooled via coolers, conveyed to storage silos, and finally packaged or loaded directly railcars for shipment.

The facility currently operates two 9.8 MMBtu/hr natural gas-fired boilers Nos. 1 and 2 to provide process steam for the process lines respectively. Two stationary emergency diesel generators will provide power for each of the process lines during power outage.

In the application No. 18293, Carbo Ceramics proposed to add two ceramic pellet process lines (Process Line Nos. 3 and 4) to the existing facility. The facility expansion also includes the installation of two 9.8 MMBtu/hr natural gas-fired boilers and two stationary emergency diesel generators to serve the new process lines respectively. Both new process lines are almost identical to the two existing process lines (Process Line Nos. 1 and 2) in terms of process nature, production capacity, and configurations of process and pollution control equipment.

4.0 EMISSION RATES AND CHANGES

The methodologies used to quantify emissions from the emission units at Carbo Ceramics' Toomsboro Plant are summarized in the application No. 18293 as revised on February 9, 2009 and August 14, 2009. The emission rates are estimated either using results of onsite testing if available, AP 42 emission factors, or mass balance based on production records except for PM/PM_{10}. Potential emission rates of PM/PM_{10} are estimated based on the grain loading limits and the corresponding the exhaust flow rates of the stacks.

4.1 Case-by-Case MACT Applicability Under Section 112(g) of the CAA Amendment of 1990

Under the Clean Air Act (CAA) Amendments of 1990, EPA is required to regulate large or "major" industrial facilities that emit one or more of EPA listed hazardous air pollutants (HAPs). HAPs are those pollutants that are known or suspected of causing cancer or other serious health effects, such as developmental effects or birth defects. On July 16, 1992, EPA published a list of industrial source categories that emit one or more of these hazardous air pollutants. EPA is required to develop standards for listed industrial categories of "major" sources (those that have the potential to emit 10 tons/year (TPY) or more of a listed pollutant or 25 TPY or more of a combination of pollutants) that will require the application of stringent controls, known as maximum achievable control technology (MACT).

The Section 112(g) provision is designed to ensure that emissions of toxic air pollutants do not increase if a facility is constructed or reconstructed before EPA issues a MACT for that particular category of sources or facilities. A newly constructed or reconstructed major source of HAP without a promulgated Part 63 NESHAP MACT standard will be subject to the requirements of 40 CFR 63.40 through 63.44, including a case-by-case MACT determination as described by the Section 112(g) of the 1990 Clean Air Act Amendments.

Carbo Ceramics' existing facility and the proposed plant expansion are considered respectively a "construction of a major source" as defined by 40 CFR 63.41 because each has the potential to emit more than 10 tons per year of any individual HAP or 25 tons per year of any combination of HAPs. Constructed after the Section 112(g)(2)(B) trigger date for Georgia of June 29, 1998 and having no promulgated 40 CFR Part 63 NESHAP MACT standard, each existing and new process line is considered a newly constructed major source under Section 112(g) of CAA Amendment of 1990 and subject a case-by-case MACT determination.

Newly constructed major sources subject to Section 112(g) of CAA Amendment of 1990 would be subject to stringent air pollution control requirements, referred to as "new source MACT." Under the Clean Air Act, new source MACT control is required to be no less stringent than "the best controlled similar source". At least two questions should be answered to determine if an emission unit is similar: (1) Do the two emission units have similar emission types, and (2) Can the emission units be controlled with the same type of control technology. If the two emission units do have similar emission types and are controllable to approximately the same extent with the same control technologies, then the two emission units can be considered similar for the purposes of a case-by-case MACT determination ……".[18]

4.2 HAP Emissions Profile

All fuel combustion processes emit gaseous and solid HAP compounds as combustion by-products. The amount of the HAP emissions depends mainly on the type and quantity of the fuel. Therefore, each boiler, spray dryer, calciner/kiln and diesel generator at Carbo Ceramics is a source of HAP emissions. In addition, HAP compounds are released from raw materials via evaporation such as the methanol emitted from spray dryers, and via chemical reactions at high temperature such as chlorides and fluorides emitted from calciners/kilns.

Attachment C of the application No. 18293 revised on February 9, 2009[19] and August 14, 2009[20] estimates the plant-wide total potential HAP emissions to be 226.62 TPY, including 40.16 TPY of methanol, 34.80 TPY of HCl, 151.56 TPY of HF, and 4.43 tpy of Hexane.

5.0 112(G) OF CAA CASE-BY CASE MACT ANALYSIS

A 112(g) case-by-case MACT determination is required for this facility. MACT emission limitation for new sources is defined as:

> "…the emission limitation which is not less stringent that the emission limitation achieved in practice by the best controlled similar source, and which reflects the maximum degree of deduction in emissions that the permitting authority, taking into consideration the cost of achieving such emission reduction, and any non-air quality health and environmental impacts and energy requirements, determines is achievable by the constructed or reconstructed major source."
> [40 CFR 63.41]

The requirements of the determination are set forth in 40 CFR 63.40 through 63.44.

5.1 MACT Technical Approach

Because EPA could not immediately issue MACT standards for all industries (and there was a potential for significant new sources of toxic air emissions to remain uncontrolled), Section 112(g) of the Clean Air Act acts as a "gap-filler" requiring MACT-level control of air toxics

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[18] US EPA, *Guidelines for MACT Determinations under Section 112(j) Requirements*, EPA 453/R-02-001, February 2002; http://epa.gov/ttn/atw/112j/guidance.pdf.

[19] Tables 1-a, 1-b and 1-c, Attachment C, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

[20] Table 1-a, Attachment C, Supplement to Georgia Air Quality Permit Application No. 18293, August 14, 2009, Carbo Ceramics – Toomsboro Plant.

when a new major source of HAP is constructed or reconstructed. The facility provides basic information about the source and its potential emissions through its air quality permit application. The application also specifies the emission controls that will ensure that new source MACT will be met. The Division reviews and approves (or disapproves) the application, and provides an opportunity for public comment on the determination.

The principles of an 112(g) case-by-case MACT determination are outlined in 40 CFR 63.43(d)(1) through (4) as follows:

"……

(d) *Principles of MACT Determinations.* The following general principles shall govern preparation by the owner or operator of each permit application or other application requiring a case-by-case MACT determination concerning construction or reconstruction of a major source, and all subsequent review of and actions taken concerning such an application by the permitting authority:

(1) The MACT emission limitation or MACT requirements recommended by the applicant and approved by the permitting authority shall not be less stringent than the emission control which is achieved in practice by the best controlled similar source, as determined by the permitting authority.

(2) Based upon available information, as defined in this subpart, the MACT emission limitation and control technology (including any requirements under paragraph (d)(3) of this section) recommended by the applicant and approved by the permitting authority shall achieve the maximum degree of reduction in emissions of HAP which can be achieved by utilizing those control technologies that can be identified from the available information, taking into consideration the costs of achieving such emission reduction and any non-air quality health and environmental impacts and energy requirements associated with the emission reduction.

(3) The applicant may recommend a specific design, equipment, work practice, or operational standard, or a combination thereof, and the permitting authority may approve such a standard if the permitting authority specifically determines that it is not feasible to prescribe or enforce an emission limitation under the criteria set forth in section 112(h)(2) of the Act.

*(*4) If the Administrator has either proposed a relevant emission standard pursuant to section 112(d) or section 112(h) of the Act or adopted a presumptive MACT determination for the source category which includes the constructed or reconstructed major source, then the MACT requirements applied to the constructed or reconstructed major source shall have considered those MACT emission limitations and requirements of the proposed standard or presumptive MACT determination.

……".

In February 2002, EPA issued *"Guidelines for MACT Determination under Section 112(j) Requirements"*[21] for a major HAP source in a source category for which EPA missed the deadline for promulgating a MACT Standard. These guidelines offer a suggested step-by-step process for making a MACT determination consistent with the above principles. The process is summarized as followings:

Tier I: Making a MACT floor finding

Step 1 - Identify all the MACT affected emission unit(s). These emission points will be grouped into emission units (MACT emission units) subject to a MACT determination. When no relevant emission standard has been proposed, the MACT emission unit will be determined on a case-by-case basis.

Step 2 - Make a MACT floor finding. Using the available information provided by the EPA, other permitting authorities, and/or the permit applications, a level of HAP emission control that is equal to the MACT floor for each type of emission unit undergoing review should be calculated. Section 112(d) of CAA 1990 Amendment instructs the EPA to set emission standards for new sources based on the emissions control achieved in practice by the best controlled similar source and to set emission standards for existing sources based on an average emission limitation achieved by the best performing 12% of existing sources or best performing five sources in the source category or subcategory for categories with fewer than 30 sources. The word "average" can have several different meanings, including arithmetic mean, median, and mode.

It is not necessary for the MACT floor to be determined based on emissions information from every existing source in the source category or subcategory if such information is not available. The permitting authority, however, should check with EPA Regional Offices and EPA Headquarters for any available information that could be used in determining the MACT floor. If a MACT floor is determined, it is only necessary to complete Tier I and Tier III of the MACT analysis. If, under Tier I, the MACT floor cannot be determined or is equal to "no control", Tier II of the analysis should be completed before moving on to Tier III.

Tier II: Considering all control technologies

Step 1 – Identify all commercially available and demonstrated control technologies that are reasonably applicable to such source. Available control technologies include but are not limited to: reducing the volume of, or eliminating emissions of pollutants through process changes, substitution of materials or other techniques; enclosing systems or processes to eliminate emissions; collecting, capturing, or treating pollutants when released from a process, stack, storage, or fugitive emission point; using design, equipment, work practices, or operational standards (including requirements for operator training or certification); or, a combination of any of these methods. Each control technology should be evaluated to consider the costs, non-air quality health and

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[21] EPA, *Guidelines for MACT Determinations under Section 112(j) Requirements*, EPA 453/R-02-001, February 2002; http://epa.gov/ttn/atw/112j/guidance.pdf.

environmental impacts, and energy requirements associated with using each control technology.

Step 2- Eliminate technically infeasible control technologies. A technology is generally considered technically infeasible if there are structural, design, physical or operational constraints that prevent the application of the control technology to the emission unit. A technology may also be eliminated if the permitting authority deems it unreasonable. A technology is considered unreasonable if the operational reliability and performance have not been demonstrated by approved methods under conditions representative of those applicable to the source for which MACT is being determined.

Step 3- Determine efficiency of applicable control technologies via a detailed analysis of all of the available reasonably applicable control technologies. The efficiency of each control technology in reducing overall HAP emissions should be determined. Generally, MACT has been selected based on an overall reduction of all HAP emissions.

Tier III - Identifying MACT

Step 1 - Identify the maximum emission reduction control technology. When a MACT floor finding is made, the permitting authority will need to use available information to identify the control technology(s) that reduce HAP emissions from the MACT emission units to the maximum extent considering the factors in Section 112(d)(2) of the Act and to a level that is at least equal to or greater than the MACT floor.
As in Tier II, the permitting authority should conduct an analysis to eliminate any technically infeasible control technologies, to determine the efficiency of applicable control technologies and at the same time take into consideration "the cost of achieving such emission reduction, and any non-air quality health and environmental impacts and energy requirements" [section112(d)(2)].

Step 2 - Conduct an impacts analysis. The control technology that achieves the maximum degree of HAP emission reductions with consideration to costs, non-air quality health and environmental impacts, and energy requirements is MACT. The Act does not provide direction on the significance of one consideration to another. The EPA believes that it is inappropriate to provide specific guidance for determining the amount of consideration that should be given to any one factor. Such decisions will need to be made based on the information available at the time of the MACT determination.

Step 3 -- Establish the MACT emission limitation. The MACT emission limitation established by the permitting authority is based on the degree of emission reduction that can be obtained by the affected source if MACT is applied and is properly operated and maintained.

However, the Guideline also states that "This process is presented here as suggested guidance in determining MACT. Permitting authorities are free to use the process with which they are most familiar to determine MACT"[22].

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[22] Page 3-5, *"Guidelines for MACT Determinations under Section 112(j) Requirements"*, EPA 453/R-02-001, February 2002; http://epa.gov/ttn/atw/112j/guidance.pdf.

5.2 Potential Control Options Review

HAP emissions sources/process units at Carbo Ceramic's include natural gas-fired spray dryers, natural gas-fired rotary ceramic calciners/kilns, natural gas-fired boilers, and stationary emergency diesel generators/engines. They are grouped into the following source categories:

- Industrial Boilers: 9.8 MMBtu/hr natural gas-fired boiler Nos. 1, 2, 3 and 4.
- Reciprocating Internal Combustion Engines & Stationary Internal Combustion Engines: stationary emergency diesel generators/engine Nos. 1, 2, 3 and 4.
- Calciners/Kilns Nos. 1, 2, 3 and 4.
- Spray Dryers Nos. 1 through 8.

The first two sources categories are listed in EPA's Source Category List under 112(c) of CAA Amendment of 1990, as revised on June 30, 2005[23]. But neither spray dryers nor calciners/kilns are listed in as a source category in the List. Both are direct heating process units where flue gases are in tough with materials being heated/processed. Spray dryers remove physically-bound water and volatile organic substances from clay slurry via evaporation in hot air, and thus emit most if not all the methanol discussed previously. Calciners/kilns further drive off residue physically-bound water and volatile organic substances from semi- dried slurry/kiln feed and then remove chemically-bond water from the kiln feed/clay to produce ceramic pellets via sintering at a much high temperature. Because of the high temperature (>3,000°F), calciners/kilns can readily oxidize/burn most of the organic and inorganic compounds contained in the calciner/kiln feed, and turn them into water, CO_2 and other oxidizes including CO, NO_x, and SO_2. With regard to the HAP emissions, the calciners/kilns release chlorides and fluorides contained in the clay into the air mainly in forms of acidic gases (HCl and HF), plus less amounts of solid chlorides and fluorides which are also EPA listed HAPs. Because the significant differences in the process and emission nature and characteristics between the spray dryers and the calciners/kilns at Carbo Ceramics, they are considered as two source categories with regard to this 112(g) case-by-case MACT determination.

All the stationary emergency diesel generators/engines at Carbo Ceramics' are subject to the promulgated NESHAP/MACT standard, 40 CFR Part 63, Subpart ZZZZ - *National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines [RICE].* They are not subject to this case-by-case MACT determination.

No currently promulgated NESHAP MACT Standards under 40 CFR Part 63 has been identified to be applicable to the rest of the HAP emissions source categories. They are the subjects of this case-by-case MACT determination.

The existing and new natural gas-fired boilers, spray dryers and calciners/kilns were evaluated to determine the appropriate MACT level controls under Section 112(g) of the CAA Amendments of 1990. This evaluation included a review of any proposed NESHAPs under Section 112(d) that have not yet been promulgated and an evaluation of the best-controlled similar sources in the industry located elsewhere in the United States and its territories.

5.3 Technical Feasibility Review

A control method or technology is considered available if it can be obtained through commercial channels or applied within the common sense meaning of the term. An available control

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[23] *Federal Register*, Volume 70, No. 125, June 30/Notices; http://www.epa.gov/fedrgstr/EPA-AIR/2005/June/Day-30/a12942.htm

technology is applicable if it can reasonably be installed and operated. A technology that is both available and applicable is technically feasible. EPA has identified the potential control options in the proposed MACT standard as being available and applicable.

5.4 Case-by-Case MACT Determination for Spray Dryer Nos. 1 - 8

Tier I: Making a MACT floor finding

Step 1: Identify the Case-by-Case MACT – Affected Emission Unit

The kaolin clay slurry injected into each of the spray dryers contains an additive with less than 1% by weight of methanol, which is assumed to be driven off in the spray dryers since the operating temperature of the spray dryers is above the boiling point for methanol. The methanol content is an impurity in the additive. The usage of the additive is 5,500 lbs/day per process line with two spray dryers. Based on these data, the potential methanol emission are calculated as 10.04 TPY for each process line Nos. 1 through 4[24]. All the spray dryers are considered as "new sources" under Section 112(g) of CAA Amendment of 1990.

Step 2: Make a MACT Floor Finding

According to Section 112(d) of the CAA Amendment of 1990, the MACT floor for a new source is the level of HAP emission control achieved in practice by the best controlled similar source. EPA's RBLC database indicates that no source similar to Carbo Ceramics' spray dryers (Process Code 90.017, Calciners & Dryer and Mineral Processing Facilities) has add-on control for VOC or methanol.

Table 5.4-1: Best Methanol/VOC Control Technology Determination for Spray Dryers

Facility Name	Agency	Database	Process Type	Permit Date	Process Description	Controls/Type	Emission Limits/Description
Dalitalia LLC	OK, DEQ	RBLC	90.017	10/05	Spray Dryers	Pollution Prevention/Good Combustion Techniques	0.25 lbs/ton material
Dalitalia LLC	OK, DEQ	RBLC	90.017	10/05	Vertical Dryers	Pollution Prevention/Good Combustion Techniques	4.26 lbs/hr

According to EPA, there are no known cases of similar spray dryers using any add-on VOC/volatile HAPs control in clay and ceramic products manufacturing industries[25]. An information search also confirms that there are no known cases of add-on VOC control being utilized for similar calciners/kilns. Therefore, the MACT floor for the methanol emissions from Carbo Ceramics' spray dryers is equal to "no control" since the group of similar sources on which the MACT floor determination is based on are not currently controlling HAP emissions. Consequently, a more detailed analysis is required in order to determine the appropriate level of control. Tier II of the analysis is required before moving on to Tier III.

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[24] Table 1-d, Attachment C, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

[25] Per a telephone conversion with Mr. Jeff Telander, Project Lead of 40 CFR Part 63, Subpart JJJJJ (NESHAP MACT standard for Brick & Structural Clay Products Manufacturing) and Subpart KKKKK (NESHAP MACT standard for Clay Ceramics Manufacturing), 919-541-5427, telander.jeff@epa.gov.

Tier II: Considering all control technologies

Step 1 – Identify all commercially available and demonstrated control technologies that are reasonably applicable to such source

For controlling the methanol emissions from the spray dryers, regenerative thermal oxidation (RTO), catalytic oxidation, biofiltration using a biotrickling filter, quencher/scrubber system (direct contact condensation) and pollution prevention/substitute material are being considered as possible control technology options as listed in Table 5.4-2.

Table 5.4-2: Evaluated Control Options for the Methanol Emissions from Spray Dryers

Control Option No.	Control Technology
1	Quencher/Scrubber System (Direct Contact Condensation)
2	Regenerative Thermal Oxidation (RTO)
3	Catalytic Oxidation
4	Biofiltration
5	Pollution Prevention & Substitute Material

Step 2- Eliminate technically infeasible control technologies.

Option 1: Quencher/Scrubber System (Direct Contact Condensation)

In theory, the methanol emissions from Carbo Ceramics' spray dryers can be reduced by chilling the exhaust gas streams from the spray dryers. As the temperature of the exhaust gas streams is lowered, a portion of the methanol in the exhaust gas streams could be condensed and thus removed. Nevertheless, the methanol concentration in each of the exhaust gas streams from Carbo Ceramics' spray dryers is approximately 6.2 ppm by volume, which is substantially below the low bound of the concentration range (1,000 ppm by volume) for VOC condensation control technology to be effective[26]. In addition to the low VOC/methanol concentration, the spray dryers' exhaust gas streams are rich in water vapor. Condensation of large quantity of water would make the operation of the condensation system even less cost-effective and practical. Based on these findings, condensation is deemed technically infeasible and not considered further for this MACT analysis.

Step 3- Determine efficiency of applicable control technologies

The control/removal efficiencies of the rest evaluated control options for the methanol emissions from Carbo Ceramic's spray dryers are listed below:

Table 5.4-3: Efficiency of the Evaluated Applicable Control Options for Methanol Emissions from Carbo Ceramics' Spray Dryers

Control Option No.	Control Technology	Control Efficiency
2	Regenerative Thermal Oxidation (RTO)	99%
3	Catalytic Oxidation	95%
4	Biofiltration	90
5	Pollution Prevention & Substitute Material	N/A

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[26] EPA, *Survey of Control Technologies for Low Concentration Organic Vapor Streams*, EPA-456/R-95-003, May 1995.

Tier III - Identifying MACT

Step 1 - Identify the maximum emission reduction control technology

Option 2: Regenerative Thermal Oxidizer (RTO)

A proper designed, constructed, maintained and operated thermal oxidizer such as RTO can readily oxidize/burn methanol in the spray dryers' exhaust gas streams into carbon dioxide and water vapor. The advantage of an RTO over a direct flame thermal oxidizer is RTO's increased thermal efficiency via effective heat recovery. The control efficiency of an RTO, when properly maintained and operated, can be as high as 99%[27]. Although the use of an RTO has been determined to be technically feasible in theory, RTO has not been employed to control VOC/methanol emissions in a process similar to Carbo Ceramics' spray dryers.

Option 3. Catalytic Oxidizer

Like RTO, a catalytic oxidizer destroys methanol in the exhaust gas streams via oxidation in which methanol combusts with oxygen and turns into CO_2 and water vapor. The catalysts serves to reduce the activation energy required for the complete oxidation of methanol or other VOC compounds, thus enable the oxidation or burn-off of these compounds to take place at a relatively low temperature, which reduce the energy demand thus the cost of the control. The control efficiency of catalytic oxidizers can reach 95% when they are properly maintained and operated[28]. Although they are technically feasible in theory, no catalytic oxidizers have been found to control VOC/methanol emissions in a process unit/source similar to Carbo Ceramics' spray dryers.

Option 4: Biofiltration

Biofiltration uses microbes to consume pollutants from a contaminated air stream. In suitable environment, Microbes can easily decompose organic compounds or VOCs into CO_2, water and biomass via metabolism. Depending on the nature of the pollutants and suitability of the working environment, the efficiency of the system could reach 90%. Factors that affect the performance of the biofiltration system include temperature, moisture, nutrients, acidity, and microbe population.

EPA identifies three types of biofiltration systems: the basic biofilter, the biotrickling filter and the bioscrubber. The basic biofilter consists of a large flat surface covered with bed media, such as peat, bark, coarse soil, or gravel for microbes to reside. Contaminated air flows through the bed and comes into contact with microbe population, which in turn decompose the pollutants in the air. Requiring large open areas and providing no continuous liquid flow to allow pH, moisture and nutrient adjustment, this system is not practical for controlling Carbo Ceramics' methanol emissions. Bioscrubbers work like a chemical reactor which allows microbes rich suspends/slurry to be mixed or bubbled through by contaminated air. Discharging effluent is collected in a storage tank to allow additional time for the microbes to consume pollutants. Biotrickling system consist of a plastic media covered with a biofilm of the microbes, a liquid spray system for the media, and an air distributing system. As air passes through the media, pollutants are absorbed in to the liquid phase and come into contact with the microbes residing in the biofilm. The continuous flow of liquid allows easy pH adjustment and nutrient supplement. Among the three types of biofiltration systems, biotrickling filter is considered most suitable for the control of the methanol emissions from Carbo Ceramics' spray dryers.

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[27] Page 4-2, EPA, *Handbook: Control Technologies for Hazardous Air Pollutants*, EPA/625/6-91/014, June 1991.

[28] Page 4-12, EPA, *Handbook: Control Technologies for Hazardous Air Pollutants*, EPA/625/6-91/014, June 1991.

Option 5: Pollution Prevention and Substitute Materials

The additive used by Carbo Ceramics in the slurry preparation process contains up to 1% by weight of methanol as impurity. Continuous use of an additive with the minimum amount of methanol and operating the spray dryers at the appropriate temperature is the primary mechanism available for minimizing the methanol emissions. Efforts to find a supplier which could provide the same chemical with less methanol as impurity were not successful because industry grades of this chemicals from different suppliers contain almost the same amount on methanol as impurity. Agent grades of the same chemicals contain much less impurities including methanol, but are too expensive to be used in large scale commercial production.

Step 2 - Conduct an impact analysis

Application No. 18923 as revised on February 9, 2009 included a cost impact analysis of each of the applicable control technologies discussed above. The analysis was conducted in accordance with EPA's *"Guidelines for MACT Determinations under Section 112(j) Requirements"* as published in 2002. The costs of using RTO and catalytic oxidizers were estimated respectively using Vatavuk Air Pollution Control cost factors. The cost of the biofilter was estimated using EPA Clean Air Technology Center's report and a 1999 report by Dr. Rakesh Govind of University of Cincinnati on *"Biofiltration from Ethanol Emissions from Bakery Ovens*[29]". Table 5.4.-4 summarizes the results of the cost impact analysis.

Table 5.4-4: Cost Impact of the Evaluated Applicable Control Options for Methanol Emissions from Carbo Ceramics' Spray Dryers

Control Option No.	Control Technology	Cost Effectiveness ($/ton Methanol reduced)
2	Regenerative Thermal Oxidation (RTO)	$183,221
3	Catalytic Oxidation	$215,469
4	Biotrickling Filter	$169,423
5	Pollution Prevention & Substitute Material	N/A

The cost data indicate that the use of these technologies to control the methanol emissions from Carbo Ceramics' spray dryer would impose a significant economic impact. The cost impact analyses are detailed in Table L-2, L-3 and L-4 of Attachment L of Application No. 18923 as revised on February 9, 2009.

Step 3 -- Establish the MACT emission limitation.

Due to the relatively small quantity of methanol emissions emitted from each spray dryer compare to the large exhaust gas flow of each of the spray dryers (Exhaust gas flow rate generally dictates the size of the control system and thus the cost of the system), option 2, 3 and 4 is economically infeasible and would pose a significant cost impact. As such, "no control" based on pollution prevention remains as the MACT floor for the methanol emissions from Carbo Ceramics' spray dryers. The corresponding numerical MACT emission limitation is 10.04 tons from each process line during each period of 12 consecutive month periodand 0.057 lbs methanol per ton of calciner/kiln feed for each process line (monthly average). The second limit is necessary because it ensures the HAP emission performance or cleanness of the sources to be maintained at the designed level, i.e. the basis of this case-by-case MACT determination.

5.5 Case-by-Case MACT for Natural Gas-Fired Boiler Nos. 1 – 4

All the 9.8 MMBtu/hr natural gas-fired boilers are considered as "new sources" under Section 112(g) of CAA Amendment of 1990. Each of the two existing and the two new 9.8 MM Btu/hr

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[29] http://www.prdtechinc.com/pdf/prdawmaethanolbiofiltrayionpaper(1999).pdf

natural gas- fired boiler Nos. 1, 2 3 and 4 emits almost three dozens of HAPs as the result of fuel combustion, including both hazardous volatile organic compounds and hazardous metal compounds[30]. The potential emission rates of these HAPs are very low, ranging from 5.0×10^{-8} to 7.6×10^{-2} tons per year per boiler[31]. The combined potential HAPs emissions (including volatile organic HAP compounds and metal HAP compounds) from all the four boilers are approximately 0.32 tons per year. At this low emission level, no add-on control is economically feasible (even it is technically feasible), as indicated by the BACT analysis for PM emissions from these boilers in Chapter 4.0 of the Preliminary Determination (A majority of the hazardous metal compounds are solids). In addition , such low emission level could render certain control technologies almost ineffective or maybe technically infeasible. For instance, the volatile HAP concentration in the exhaust flue gas streams of these boilers is substantially below concentration range for VOC condensation control technology to be effective. The technical feasibility of using any thermal oxidizers to reduce the volatile organic HAP emissions from these natural gas-fired boilers could also be in question because the oxidizers would in most cases use natural gas as fuel, which could make the oxidizers' volatile organic HAP emissions at the same level as that of the boilers. This should explain why no add-on control has been identified for any HAP emissions (solids or gases) from natural gas-fired boilers at this capacity. Considering these facts, The Division has concluded that the case-by-case MACT for the HAP emissions from the boilers is no control, use of only natural gas as fuel with propane as backup, and maintenance of the HAP emission performance of the sources at the designed level. Since the HAP emissions from natural gas-fired boilers are well documented by AP 42, no monitoring and compliance testing is necessary. When required, the HAP emissions can be calculated using the appropriate emission factors in AP 42 and actual fuel usage records.

5.6 Case-by-Case MACT for Natural Gas-Fired Ceramic Calciner/Kiln Nos. 1 - 4

Each of the natural gas-fired rotary ceramic calciner/kiln Nos. 1, 2, 3 and 4 is considered as a "new source" under 112(g) of CAA Amendment of 1990. According to the application No. 18293 as revised on February 9, 2009, each calciner/kiln has potential to emit approximately 47.08 TPY of HAPs, including 8.70 TPY of HCl, 37.92 TPY of HF, and 0.46 TPY of Hexane.[32,33] Combined HAP emissions from all the four calciners/kilns are approximately 11 TPY, which account for 22% of the facility-wide HAP emissions. Except Hexane, HAP emissions from natural gas combustion were not included with the application. Based on the combined heat input capacity/maximum fuel usage rate of all four calciners/kilns, HAP emissions from the fuel combustion are approximately 1.95 TPY, including Hexane.

Similar to the natural gas-fired boilers discussed in the previous section, the case-by-case MACT for the HAP emissions from the natural gas combustion in these calciners/kilns is no control. No monitoring and compliance testing is necessary for these HAP emissions. When required, HAP emissions can be calculated using the appropriate emission factors in AP 42 and actual fuel usage records.

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[30] AP 42, Chapter 1.4: Natural Gas Combustion, 5th Edition, July 1998

[31] Tables 1.4-2 and 1.4-3, AP 42, Chapter 1.4: Natural Gas Combustion, 5th Edition, July 1998

[32] Table 1-e, Attachment L, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

[33] Table 1-a, Attachment C, Supplement to Georgia Air Quality Permit Application No. 18293, August 14, 2009, Carbo Ceramics – Toomsboro Plant.

Attachment C of the application No. 18293 revised on February 9, 2009[34] and August 14, 2009[35] estimates the plant-wide total potential HAP emissions to be 226.62 TPY, including 40.16 TPY of methanol, 34.80 TPY of HCl, 151.56 TPY of HF, and 4.43 tpy of Hexane.

HF and HCl emissions are the results of release of fluorides and chlorides contained in the raw materials processed in the calciners/kilns at high temperature.

A literature survey conducted by the Division indicates that wet, semi-dry and dry alkaline scrubbers have been used to control acidic gas emissions mainly SO_2 from various calciners/kilns used in cement, lime, brick, tile and sanitaryware manufacturing facilities. The same control systems can also reduce emissions of other acidic gases including HCl and HF at the same time.

Wet scrubbing systems remove HCl and HF from exhaust gas streams via neutralization by utilizing an alkaline reagent. Wet scrubber systems will generate wastewater and wet sludge streams which require treatment and disposal.

Dry injection based on dry scrubbing systems involves the continuous injection of a powdery dry lime (calcium) or sodium based reagent into the flue gas from the calciner/kiln. HF and HCl react directly with the powdery reagent, which is collected in a downstream PM control device such as baghouse.

A dry lime adsorber is a single tower with granular limestone (calcium carbonate $CaCO_3$) packed bed filter/adsorber for adsorption of HF and HCl. Normally crushed limestone with a mash size of 4 mm to 6 mm is used for the adsorption media. Above the adsorption cascade tower is a storage silo for continuous supply of fresh adsorption media by gravity. The adsorber itself consists of single gas tight cascades, which are connected in series. Exhaust gas is distributed evenly by an inlet cap over all the cascades and is drown out via an outlet cap. Table 5.6-1 ranks these control technologies by efficiency.

Table 5.6-1: Efficiency of the Evaluated Applicable Control Options for HF and HCl Emissions from Carbo Ceramics' Calciners/Kilns

Control Option No.	Control Technology	Average Control Efficiency[36]
1	Wet Scrubber	98%
2	Dry Scrubber (Injection System)	95%*
3	Dry Lime Adsorber	92% (HF); 20% (HCl)
4	Pollution Prevention & Substitute Material	N/A

* Adjusted by the Division.

Table 5.6-2 compares the cost of the control technologies aforementioned based on the data included in the revision to the application No. 18293 dated August 14, 2009.

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[34] Tables 1-a, 1-b and 1-c, Attachment C, Georgia Air Quality Permit Application No. 18293 revised on February 9, 2009, Carbo Ceramics – Toomsboro Plant.

[35] Table 1-a, Attachment C, Supplement to Georgia Air Quality Permit Application No. 18293, August 14, 2009, Carbo Ceramics – Toomsboro Plant.

[36] Table L-3.2, Attachment L, Supplement to Georgia Air Quality Permit Application No. 18293, August 14, 2009, Carbo Ceramics – Toomsboro Plant.

Table 5.6-2: Cost Impact of the Evaluated Applicable Control Options for HF and HCl Emissions from Carbo Ceramics' Calciners/Kilns[37]

Control Option No.	Control Technology	Cost Effectiveness ($/ton HF+HCl Reduced)
1	Wet Scrubber	$61,256
2	Dry Scrubber (Injection System)	$29,955*
3	Dry Lime Adsorber	$31,453

* Adjusted by the Division.

No information has indicated that any of such add-on acid gas control system is used by any natural gas-fired calciners/kilns utilized in ceramic pellet manufacturing facilities similar to Carbo Ceramics. Based on the cost analyses for the aforementioned add-on controls for the HF and HCl emissions from each kiln included with the application supplement dated August 14, 2009, Carbo Ceramics concluded that no add-on control is economically feasible for the control of the HF and HCl emissions from the kilns, and proposed no control would be the case-by-case MACT for HF and HCl emissions. The Division accepted the conclusion.

Therefore, the case-by-case MACT for the HAP emissions from Carbo Ceramic's natural gas–fired rotary ceramic calciners/kilns consists of the use of only natural gas as fuel with propane as backup and the maintenance of the performance of the production units/sources with regard to the HAP emissions at the designed level. To define the performance of the calciners/kilns with regard to the HCl and HF emissions, and thus to ensure the soundness of the basis of this case-by-case MACT determination and the toxic impact assessment on the emissions, the HCl and HF emissions are limited to:

- 8.70 tons of HCl and 37.92 tons of HF per year for each calciner/kiln;
- (8.70 tons of HCl/year)(2,000 lbs/ton)/[(8,760 hours/year)(20 tons kiln feed/hour) = 0.099 lbs HCl/ton of kiln feed; and
- (37.92 tons of HF/year)(2,000 lbs/ton)/[(8,760 hours/year)(20 tons kiln feed/hour) = 0.433 lbs HF/ton of kiln feed.

Carbo Ceramics will be required to conduct an initial performance test on each of the calciners/kilns to demonstrate compliance with the case-by-case MACT HCl and HF emission limits respectively, and subsequently, a similar test for HCl and HF emissions respectively on each calciner/kiln every 12 months to demonstrate continuous compliance with the MACT limits.

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[37] Table L-3.3, Attachment L, Supplement to Georgia Air Quality Permit Application No. 18293, August 14, 2009, Carbo Ceramics – Toomsboro Plant.

5.7 Summary of Preliminary MACT Determination

The 112(g) case-by-case MACT determinations are summarized in Table 5.7-1 below for easy reference:

Table 5.7-1: Section 112(g) Case-by-Case MACT Determinations for Carbo Ceramics, Inc. - Toomsboro Plant

Affected Source	Pollutant	Control Technology	Proposed 112(g) Limit	Averaging Time	Compliance Method
Spray Dryer Nos. 1 & 2	Methanol	Use only natural gas with propane as back-up Appropriate use of methanol-containing additive(s), Appropriate control of process temperature	10.04 tons per 12-month rolling period for each pair of the spray dryers/each process line 0.057 lbs/ton kiln feed for each pair of the spray dryers/each process line	12-month rolling Monthly	Mass balance based on material usage records and additive MSDS sheets
Spray Dryer Nos. 3 & 4					
Spray Dryer Nos. 5 & 6					
Spray Dryer Nos. 7 & 8					
9.8 MMBtu/hr Natural Gas-Fired Boiler Nos. 1, 2, 3 & 4	Volatile Organic and Metal HAP compounds	Use only natural gas with propane as back-up	N/A	None	Fuel usage records
Calciner/Kiln	HCl	Use only natural gas with propane as back-up	8.70 tons per year	N/A	Mass balance calculation based on annual testing result & production records
			0.099 lbs/ton kiln feed	Average of at least three 1-hour test runs	Method 26 or 26A of 40 CFR Part 60, Appendix A or Method 320 of 40 CFR Part 63, Appendix A
	HF		37.92 tons per year	N/A	Mass balance calculation based on annual testing result & production records
			0.433 lbs/ton kiln feed	Average of at least three 1-hour test runs	Method 26 or 26A of 40 CFR Part 60, Appendix A or Method 320 of 40 CFR Part 63, Appendix A

To demonstrate compliance with the case-by-case MACT limits, Carbo Ceramics shall maintain fuel and HAP-containing materials usage records necessary for tracking the amount and type of HAP-containing additives used at least on a monthly basis. All the records shall be kept for a period of five years from the date of record.

Initial performance tests are required for each calciner/kiln to demonstrate compliance with the HCl and HF emission limits. Same performance tests are required every 12 months thereafter. Carbo Ceramics is required to submit the results of all initial and required periodic performance testing within 60 days of the test for Division's review. Any excess emissions, exceedances, or excursions as described in the permit amendment No. 3295-319-0029-V-02-1 of the MACT emission limits and/or operating parameter limitations shall be reported during the semiannual reporting period.

3.0 AIR QUALITY ANALYSIS

Following the procedures as specified in the *"Guidelines for Ambient Impact Assessment of Toxic Air Pollutant Emissions"*, ambient impact modeling conducted by both the Division and the company indicate that the maximum ground level concentrations for the potential HAPs emissions involved in this 112(g) case-by-case MACT determination emitted from Carbo Ceramics' facility after the plant expansion are below the acceptable ambient concentrations. The toxic impact assessment (TIA) is addressed in the *Prevention of Significant Deterioration Preliminary Determination* included with Application No. 18293 revised on February 9, 2009, and August 14, 2009. Please refer to Part 7.0 of the Preliminary Determination for the discussion of the TIA and associated modeling.

APPENDIX B: Draft Title V Operating Permit Amendment No. 3295-319-0029-V-02-1

APPENDIX C: Carbo Ceramics, Inc. – Toomsboro Plant PSD Permit Application and Supporting Data

Contents Include:

1. PSD Permit Application No. 18293 revised on February 9, 2009
2. Supplement to PSD Permit Application No. 18293 submitted by Carbo Ceramics – Toomsboro Plant on August 14, 2009

APPENDIX D: EPD’S PSD Dispersion Modeling and Air Toxics Assessment Review