Prevention of Significant Air Quality Deterioration Review

Preliminary Determination

October 2009

Facility Name: Carbo Ceramics, Inc. – McIntyre
City: McIntyre
County: Wilkinson
AIRS Number: 04-13-319 00027
Application Number: 18304
Date Application Received: June 24, 2008 & Revised on February 15, 2009 & August 14, 2009

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

Prepared by: Steve Neadow – Minerals Unit
Modeling Approved by: Pete Courtney - Data and Modeling Unit
Reviewed and Approved by: Hamid Yavari – Minerals Unit Coordinator Eric Cornwell – Stationary Source Permitting Program Manager James Capp – Chief, Air Protection Branch

SUMMARY

The Environmental Protection Division (EPD) has reviewed the application No. 18304 submitted by Carbo - McIntyre Plant for a permit to construct and operate a new Raw Material Calciner (CLN2) with associated supporting equipment and a new emergency generator (EDG3). In addition to the new equipment, 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 existing kaolin clay process operations. The new Raw Material Calciner (CLN2) with associated supporting equipment and a new emergency generator (EDG3) are subject to the same BACT as applicable to the existing operation.

The proposed project will result in an increase in emissions from the facility. The sources of these increases in emissions include the new Raw Material Calciner (CLN2) and the new emergency generator (EDG3).

The modification of the Carbo Ceramics, Inc. – McIntyre due to this project will result in an emissions increase in SO_2, $PM_{2.5}$ and PM_{10} and NO_X . 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. The PM_{10}, NO_X, SO_2 and CO emissions increase was above the PSD significant level thresholds.

The Carbo Ceramics, Inc. – McIntyre is located in Wilkinson County, which is classified as "attainment" or "unclassifiable" for SO_2, $PM_{2.5}$ and PM_{10}, NO_X, CO, and ozone (VOC).

The EPD review of the data submitted by Carbo Ceramics, Inc. – McIntyre 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 Best Available Control Technology (BACT) for the control of PM_{10}, NO_X, SO_2, 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. – McIntyre for the modifications necessary to implement the BACT to existing process, for the construction and operation of the new Raw Material Calciner (CLN2) with associated supporting equipment and a new emergency generator (EDG3), and for application of the same BACT to the new process operation. 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 June 24, 2008, Carbo Ceramics, Inc. – McIntyre (hereafter Carbo - McIntyre) submitted an application, which was revised on February 15, 2009 and August 14, 2009 for an air quality permit to implement BACT to existing process lines and to construct and operate a new Raw Material Calciner (CLN2) and a new emergency generator (EDG3). The facility is located at 2295 Wriley Road in McIntyre, Wilkinson County.

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				
H_2S				
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
3295-319-0027-V-03-1	January 29, 2009	The Title V Renewal Permit Number 3295-319-00270V-03-0 was issued on May 12, 2008, based on Applications TV-17036 and TV-17016. The permit was appealed on June 11, 2008. A settlement meeting was held and EPD agreed with the Company's request to change the permit conditions in order to resolve the appeal.
3295-319-0027-V-03-0	May 12, 2008	Title V Renewal

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	Baseline Years	Potential Emissions Increase (tpy)	PSD Significant Emission Rate (tpy)	Subject to PSD Review
PM	2007 – 2008	18.0	25	No
PM_{10}	2007 – 2008	18.0	15	Yes
VOC	2007 – 2008	1.5	40	No
NO_X	2007 – 2008	175.6	40	Yes
CO	2007 – 2008	88.0	100	No
SO_2	2007 – 2008	150.0	40	Yes
TRS	N/A	0.0	10	No
Pb	2007 – 2008	0.0	0.6	No
Fluorides	2007 – 2008	8.28	3	Yes
H_2S	N/A	0.0	10	No
SAM	N/A	0.0	7	No

Based on the information presented in Table 1-3 above, Carbo - McIntyre' s proposed modification/facility expansion, as specified per Georgia Air Quality Application No. 18304, is classified as a major modification under PSD/NSR rules because the potential net emission increases of 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 - McIntyre's 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. 18304, Carbo – McIntyre has proposed to implement BACT to the CO, NO_X, PM/PM_{10} and SO_2 emissions from its existing kaolin clay process lines. The implementation of the BACT is required because results of the 2006 emission testing revealed that the combined CO, NO_X and SO_2 emissions from the existing operations exceeded the corresponding major source thresholds and significant increase levels under NSR/PSD regulations.

In the application No. 18304, Carbo - McIntyre has also proposed the construction and operation of new Raw Material Calciner (CLN2) with associated supporting equipment and a new emergency generator (EDG3).

All the baghouses serving spray dryers and calciners/kilns will be equipped with COMS. 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 involved are listed in updated Table 3.1 of permit amendment No. 3295-319-0027-V-03-1 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. 3295-319-0027-V-03-0.

The stationary emergency diesel generator/engine will be subject to the NSPS standards under 40 CFR, Part 60, Subpart IIII.

Because the plant-wide emissions of Hazardous Air Pollutants (HAPs) [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 40CFR, the HAP emissions will be subject to a Case-by-Case Maximum Achievable Control Technology (MACT) determination under Section 112(g) of CAA. A separated Section 112(g) Case-by-Case MACT determination has been prepared for the HAP emissions.

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

3.0 REVIEW OF APPLICABLE RULES AND REGULATIONS

State Rules

Georgia Rule for Air Quality Control (Georgia Rule) 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 (p) [391-3-1-.02(2)(p)
Rule (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. The facility will use a high efficiency baghouse to control particulate matter emissions to demonstrate compliance with Georgia Rule (p). Compliance with NSPS Subpart UUU will subsume the requirements of Georgia Rule (p) [see Section 4.4].

Georgia Rule (b) "Visible Emissions"
The facility will use a high efficiency baghouse to control particulate matter emissions to demonstrate compliance with Georgia Rule (b). The facility will perform daily visible emission (VE) checks and weekly maintenance checks to ensure that the baghouse is functioning properly. This monitoring satisfies the visible emission requirements per Georgia Rule 391-3-1-.02-(2)(b).

Georgia Rule (g) "Sulfur Dioxide Emissions"
Rule (g) 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 - McIntyre 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)
Rule (n) "Fugitive Dust", commonly known as the fugitive dust rule, requires Carbo - McIntyre 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 Standard 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.

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 the Georgia Rules at 391-3-1-.02(7). 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.

New Source Performance Standards

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, and EDG3) 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 60, Subpart OOO, "Standards of Performance for Nonmetallic Mineral Processing Plants" is listed in the permit. This requirement applies to any crusher, grinding mill, screening operation, bucket elevator, belt conveyor, bagging operation, storage bin, enclosed truck or railcar loading station constructed, reconstructed, or modified after August 31, 1983. Emission requirements associated with this rule include no visible fugitive emissions greater than 10 percent opacity. Stack emissions shall not contain particulate matter in excess of 0.05 g/dscm (0.02 grains/dscf) and exhibit greater than 7 percent opacity. EPA has amended Subpart OOO on April 28, 2009. Emission requirements associated with this amendment include no visible fugitive emissions greater than 7 percent opacity. Stack emissions shall not contain particulate matter in excess of 0.032 g/dscm (0.014 grains/dscf) and exhibit greater than 7 percent opacity. Subpart OOO also requires record keeping, testing, compliance demonstration and reporting for each of the affected sources.

40 CFR, Part 60, Subpart UUU, "Standards of Performance for Calciners and Dryers in Mineral Industries" is listed in the permit. In order for 40 CFR, Part 60, Subpart UUU to be applicable, the emission sources shall have been constructed, reconstructed, or modified after April 23, 1986. Emission requirements associated with this rule include any gases, which contain particulate matter in excess of 0.092 grams/dscm (0.04 grains/dscf) for calciners and calciners and dryers installed in series. For dryers, which stand alone, the emissions shall not contain particulate matter in excess of 0.057 grams/dscm (0.025 grains/dscf). For both series and parallel operations, the opacity is limited not to exceed 10 percent opacity. Subpart UUU also requires record keeping, testing, compliance demonstration and reporting for each of the affected sources.

40 CFR Part 60, Subpart IIII - *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines* applies to the new stationary emergency diesel engine/generator identified as EDG3 (manufactured in 2009).

40 CFR Part 63, Subpart ZZZZ: *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines* applies to all the stationary emergency diesel engine/generator identified as EDG3. As emergency stationary diesel engine/generator rated greater than 500 brake horsepower located at a major stationary source, this unit does 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 this generator to emergency situations only.

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

Recent onsite stack tests indicate that each kiln emits approximately 6.26 tons per year of HCl and 36.27 tons per year of HF. Because the emissions of 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.

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 Raw Material Calciner (CLN2) and a new emergency generator (EDG3) associated with the proposed project would most likely results 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.

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.

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_{10} and SO_2. This section describes in details each piece of equipment with CO, NO_X, PM_{10} and SO_2 emissions, identifies possible control technologies for the pollutants involved, and determines source and emission-specific BACT.

4.1 PM Emissions

a. Fugitive PM Emissions

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

Operations/process units at this facility, which 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.

BACT Determination

Based on the nature of the sources and equipment involved, EPD has determined that timely removal of accumulated dusts from roads and working areas constitute 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 implement of the BACT. Some of these requirements are adopted from NSPS Subpart OOO.

b. PM Emissions from Materials Handling and process operations

Either generated or disturbed mechanically by process equipment or formed during chemical reactions involved, and consequently entrapped in the exhaust gas streams, PM/PM_{10} are emitted from various materials handling and processing operations, include loading and unloading, conveying and storage, weighing, mixing, grinding, spray drying, calcination, combustion, packaging and shipping operations. Exhaust gas streams in particular from the calciners and kilns contain large quantity of PM/PM_{10} generated by the entrapment in the process gaseous streams of the powdery materials or soot from fuel combustion, and to less degree, sulfate particulates formed via reaction between SO_2 and ammonia in the calciner/kiln exhaust. 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 from the process exhaust/ventilation stack exhaust gas streams. When required, clay-processing plants are almost exclusively using fabric filters (baghouses) for controlling PM/PM_{10} emission from stack/ventilation exhaust gas streams.

There are no PM emission from wet process such as milling and screening operations and therefore no BACT analysis is required for such sources. Three downstream PM control options have been identified wherever it is technically feasible to capture the PM emissions. Table 4.1-1 lists the control options identified for these sources according to their control efficiency.

Table 4.1-1: Ranking of Technically Feasible PM Emissions from Materials Handling and process Operations

Control Technology Ranking	Control Technology	Control Efficiency
1	High Efficiency Baghouses	>99%
2	Electrostatic Precipitators (ESPs)	>99%
3	Wet Scrubber	70-90%

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 mitigate 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 from 70% to greater than 99% 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. On the other hand, ESPs are not a feasible control option when the exhaust airflow rates of the PM capture system fluctuates, as occurring in the material handling and storage units, which may not operate continuously.

BACT Determination

Carbo - McIntyre proposed to use a number of baghouses to control the PM emissions from each of the emission sources. In some cases, the collected fines will be returned to the production process.

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

The BACT PM emission limit is no greater than 0.010 gr./dscf of PM/PM_{10} in the exhaust gas streams from the calciners and kilns, and no greater than 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.

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

4.2 PM Emissions from Diesel Generators/Engines

Combustion units/sources with PM emissions include three stationary emergency diesel generators/engines. Table 4.2-1 list respectively the emission control or abatement options identified for these sources according to their control efficiency.

Table 4.2-1: Ranking of PM Control Technology for Internal Combustion Engines

Control Technology Ranking	Control Technology	Control Efficiency
1	High Efficiency Baghouse	99%
2	Electrostatic Precipitators (ESPs)	99%
3	Wet Scrubber	99%
4	Exclusive use of diesel as fuel	N/A

The facility currently has two Emergency Generators and is proposing to install one diesel fired emergency generator as part of this modification. Emergency Generator Nos. 1 an 2 are driven by engines rated at 1,232 hp and the proposed Emergency Generator No. 3 will be driven by and engine rated at 268 hp. Due to good combustion practices, use of the unit during emergencies only and low PM emissions associated with the combustion of Diesel, there are minimal particulate matter emissions from the Diesel Fired Emergency Generator. Restricting the generator to the combustion of Diesel and other Control Technologies such as a high efficiency baghouse, and electrostatic precipitator ESP) and a wet scrubber are evaluated to control PM emissions from the Diesel Fired Emergency Generator at the facility.

BACT Determination

Carbo - McIntyre proposed the following BACT for the emergency diesel generators/engines:

Table 4.2-2: Proposed PM BACT for Internal Combustion Engines

Process Description	Emission ID No.	BACT Requirement
Existing Diesel Fired Emergency Generator Nos. 1 and 2	EDG1 EDG2	Exclusive use of low sulfur diesel as fuel; PM emission limit of 0.15g/bhp-hr. Limited to 500 hours annual operating time for emergency
New Diesel Fired Emergency Generator No. 3	EDG3	Exclusive use of low sulfur diesel as fuel; PM emission limit of 0.059g/bhp-hr. Limited to 500 hours annual operating time for emergency

The Division has determined that the company's proposal as listed in Table 4.2-2 as BACT. 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 for diesel Fired Emergency Generator No. 3 (EDG3) which is subject to NSPS Subpart IIII.

4.3 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 calciners and 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 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 and kilns such as the ones at Carbo - McIntyre's 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. Both excess O_2 in the flame and the temperature of the flame controls the rate of thermal conversion from N_2 in the combustion air to NO_X. 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.

The combustion process of the stationary diesel-fired emergency generators/engines also generates thermal and fuel NO_X via high temperature oxidation of fuel nitrogen and nitrogen in the air supplied for combustion.

Technically feasible control technologies for the NO_X emissions from the combustion sources discussed are ranked by their control effectiveness in Tables 4.3-1, 4.3-2, 4.3-3, 4.3-4, 4.3-5, 4.3-6, and 4.3-7 respectively. Application No. 18304 as revised on February 15, 2009 and August 14, 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 4.3-1: Ranking of Technically Feasible Control Technology for NO_X Emissions from Direct Gas - Fired Rotary Calciners (KLN1 & KLN2)

Emission Source	Ranking	Control Technology	Control Efficiency
Direct gas-fired Rotary Calciner (KLN1, KLN2)	1	NO_X Wet Scrubbing	90%
	2	Selective Catalytic Reduction (SCR)	90%
	3	Regenerative SCR	70%
	4	Low NO_X Process Technology	N/A

Table 4.3-2: Ranking of Technically Feasible Control Technology for NO_X Emissions from Natural Gas- Fired Spray Dryers (DRY1 & DRY2)

Emission Source	Ranking	Control Technology	Control Efficiency
Rotary Dryers (DRY01, DRY02)	1	NO_X Wet Scrubbing	90%
	2	Selective Catalytic Reduction (SCR)	80%
	3	Good Combustion techniques	N/A

Table 4.3-3: Ranking of Technically Feasible Control Technology for NO_X Emissions from Cage Mill (CMD1)

Emission Source	Ranking	Control Technology	Control Efficiency
Cage Mill (CMD1)	1	NO_X Wet Scrubbing	90%
	2	Selective Catalytic Reduction (SCR)	80%
	3	Good Combustion techniques	N/A

Table 4.3-4: Ranking of Technically Feasible Control Technology for NO_X Emissions from Pulverizers (PUL1 & PUL2)

Emission Source	Ranking	Control Technology	Control Efficiency
Pulverizers (PUL1, PUL2)	1	NO_X Wet Scrubbing	90%
	2	Selective Catalytic Reduction (SCR)	80%
	3	Good Combustion techniques	N/A

Table 4.3-5: Ranking of Technically Feasible Control Technology for NO_X Emissions from Indirect – fired Rotary Calciner (CLN1)

Emission Source	Ranking	Control Technology	Control Efficiency
Indirect – fired Rotary Calciner (CLN1)	1	NO_X Wet Scrubbing	90%
	2	Selective Catalytic Reduction (SCR)	80%
	3	Low NO_X Process Technology	N/A

Table 4.3-6: Ranking of Technically Feasible Control Technology for NO_X Emissions from Raw Material Calciner No. 2 (CLN2)

Emission Source	Ranking	Control Technology	Control Efficiency
Raw Material Calciner No. 2 (CLN2)	1	NO_X Wet Scrubbing	90%
	2	Selective Catalytic Reduction (SCR)	80%
	3	Low NO_X Process Technology	N/A

Table 4.3-7: Ranking of Technically Feasible Control Technology for NO_X Emissions from Diesel Fired Emergency Generators (EDG1, EDG2, & EDG3)

Emission Source	Ranking	Control Technology	Control Efficiency
Diesel Fired Emergency Generators (EDG1, EDG2, & EDG3)	1	NO_X Wet Scrubbing	90%
	2	Selective Catalytic Reduction (SCR)	90%
	3	Good Combustion techniques	N/A

Cost analyses of each technically feasible control technology/system for controlling NO_X emissions from the combustion sources at Carbo - McIntyre facility are summarized in Table 4.3.8 below:

Table 4.3-8: Cost Effectiveness of All Technically Feasible Add-on Control Technology for NO_X Emissions from Carbo - McIntyre's Facility

Emission Source	Control Technology/Option and Associated Control Cost Dollar/ton NO_X Removed		
	Wet Scrubbing	SCR	Regenerative SCR
Direct gas-fired Rotary Calciners (KLN1 & KLN2)	$13,219	$8,148	$11,057
Rotary Dryers (DRY01 & DRY02)	$38,931	$113,884	N/A
Cage Mill (CMD1)	$22,743	$53,858	N/A
Pulverizers (PUL1, PUL2)	$16,116	$33,101	N/A
Indirect – fired Rotary Calciner (CLN1)	$60,809	$52,317	N/A
Raw Material Calciner No. 2 (CLN2)	$18,607	$20,208	N/A
Each Emergency Diesel Generator Nos. 1 and 2	$121,055	$37,564	N/A
Emergency Diesel Generator No. 3	$523,151	$187,722	N/A

BACT Determination

The Division has determined that, based on the cost estimation data in Table 4.3.8, none of the technically feasible add-on NO_X emission control technologies identified for Carbo - McIntyre is 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 Direct-fired Calciner Nos. 1 and 2 (KLN1 & KLN2) to no more than 82.0 lbs/hr;

- Using Good Combustion Techniques to control NO_X emissions from Rotary dryers (DRY01 & DRY02) to no more than 5.32 lbs/hr.

- Using Good Combustion Techniques to control NO_X emissions from the Cage Mill (CMD1) to no more than 12.0 lbs/hr.

- Using Good Combustion Techniques to control NO_X emissions from Pulverizers (PUL1 & PUL2) to no more than 10.0 lbs/hr.

- Using Low NO_X burner technology to limit NO_X emissions from the Indirect-fired Rotary Calciner (CLN1) to no more than 5 lbs/hr.

- Using Low NO_X burner technology to limit NO_X emissions from the Raw Materials Calciner (CLN2) to no more than 40 lbs/hr.

- 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 and 3 to no more than 500 hours.

- Using Good Combustion Techniques to limit NOX emissions from EDG1 & EDG2 to 4.5 g/bhp-hr each and EDG3 to 2.98 g/bhp-hr.

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, 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.

4.4 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 cage mill, pulverizers, rotary dryers, calciners, kilns; and (2) internal combustion process units, i.e., diesel-fired generators/engines.

For diesel-fired generators, fuel sulfur is the only source of SO_2 emissions.

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

Technically feasible control technologies for the SO_2 emissions from this facility are ranked by control effectiveness in Table 4.4-1. 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 - McIntyre's four types of combustion sources should be similar.

Application No. 18304 as revised on February 15, 2009 and August 14, 2009 has extensive discussions on the mechanisms, characteristics and technically 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 4.4-1: Ranking of Technically Feasible Control Technology for SO_2 Emissions

Emission Source	Ranking	Control Technology	Control Efficiency
Direct gas-fired Rotary Calciners (KLN1 & KLN2) Rotary Dryers (DRY1 & DRY2) Cage Mill (CMD1) Pulverizers (PUL1, PUL2) Indirect – fired Rotary Calciner (CLN1) Raw Material Calciner No. 2 (CLN2) Each Emergency Diesel Generator Nos. 1, 2, & 3	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 4.4-2 below:

Table 4.4-2: Cost Effectiveness of All the Technically Feasible Add-on Control Technologies for SO_2 Emissions

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)
Direct gas-fired Rotary Calciners (KLN1 & KLN2)	$15,014	$9,391	$8,740
Rotary Dryers (DRY1 & DRY2)	$224,492	$528,705	$436,627
Cage Mill (CMD1)	$220,047	$541,557	$456,115
Pulverizers (PUL1, PUL2)	$184,128	$338,795	$201,608
Indirect – fired Rotary Calciner (CLN1)	$15,304	$9,622	$9,317
Raw Material Calciner No. 2 (CLN2)	$15,094	$10,147	$9,204
Each Emergency Diesel Generator Nos. 1 and 2	$2,758,327	$3,353,037	$2,458,222
Emergency Diesel Generator No. 3	$11,603,907	$9,220,135	$8,859,962

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 Direct-fired Calciner Nos. 1 and 2 (KLN1 & KLN2) and Raw Materials Calciner No. 2 (CLN2) to 34.25 lbs/hr.
- Exclusive use of natural gas or propane as fuel for Rotary dryers (DRY1 & DRY2), Cage Mill (CMD1), Pulverizers (PUL1 & PUL2), Direct-fired Calciner Nos. 1 and 2 (KLN1 & KLN2), Indirect-fired Rotary Calciner No. 1 (CLN1), and Raw Materials Calciner No. 2 (CLN2).
- Limiting the SO_2 emissions from Indirect-fired Rotary Calciner No. 1 (CLN1) to 32.0 lbs/hr.
- Exclusive use of extreme low sulfur diesel fuels 0.05 wt. % required by NSPS Subpart IIII for all the Diesel-fired Emergency Generators (EDG1, EDG2, & EDG3) and limit operations to 500 hours for each emergency generator.
- Judicious use of kaolin clay to manage the sulfur input rate to each process.

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.

4.5 CO Emissions from Direct-Fired Rotary Calciners (KLN1 & KLN2), Rotary Dryers (DRY01 & DRY02), Pulverizers (PU, and Cage mill (CMD1)

Carbon Monoxide (CO) is emitted from the Direct-Fired Rotary Calciners (KLN1 & KLN2), Rotary Dryers (DRY01 & DRY02), Cage Mill (CMD1), pulverizers (PUL1 & PUL2), Indirect-fired Rotary Calciner (CLN1), and Emergency Generators (EDG1, EDG2, & EDG3) due to incomplete oxidation of fuel. Pre-Combustion control technology such as good combustion techniques was evaluated for control of CO emissions from the Direct-Fired Rotary Calciners (KLN1 & KLN2), Rotary Dryers (DRY01 & DRY02), Cage Mill (CMD1), pulverizers (PUL1 & PUL2), Indirect-fired Rotary Calciner (CLN1), and Emergency Generators (EDG1, EDG2, & EDG3) at the facility. This includes optimization of the design, operation, and maintenance to the calciner and combustion system and its efficient operation. Post-Combustion control technology such as Regenerative Thermal Oxidizer (RTO) and catalytic Oxidizer were also evaluated for control of CO emissions from the Direct-Fired Rotary Calciners (KLN1 & KLN2), Rotary Dryers (DRY01 & DRY02), Cage Mill (CMD1), pulverizers (PUL1 & PUL2), Indirect-fired Rotary Calciner (CLN1), and Emergency Generators (EDG1, EDG2, & EDG3) at the facility.

Carbon Monoxide can be oxidized to carbon dioxide and water vapor at high temperatures (generally about 1,800^{O}F). Thermal oxidizers can be recuperative or regenerative. A regenerative thermal oxidizer (RTO) can achieve a high rate of heat recovery and usually consists of two chambers packed with stone media. The waste gas stream enters the first stone bed where the gas is heated to desired combustion temperature (only a minimal amount of fuel is needed at this point), then subsequently enters the second stone bed where heat is released from combustion and is recovered and stored in the bed. The beds alternate so the waste gas enter the second bed first in order to heat up to the desired combustion temperature, with the system operating on an alternation cycle to recover up to 90% of the thermal energy during oxidation. The use of RTO's to control CO from the Direct-Fired Rotary Calciners (KLN1 & KLN2), Rotary Dryers (DRY01 & DRY02), Cage Mill (CMD1), pulverizers (PUL1 & PUL2), Indirect-fired Rotary Calciner (CLN1), and Emergency Generators (EDG1, EDG2, & EDG3) are deemed technically feasible. The control efficiency of a RTO can be as high as 98%.

Catalytic oxidation is a post combustion control technique for reducing emissions of CO and hydrocarbons. A catalytic oxidation system is a passive reactor, which consists of a honeycomb grid of metal panels, typically coated with platinum or rhodium. The catalyst grid is placed in the exhaust where the optimum reaction temperature can be maintained (450-1200^{O}F). The oxidation process takes place spontaneously, without the requirement for introducing reactants (such as ammonia) into the flue gas stream. The catalyst serves to lower the activation energy necessary for complete oxidation of this incomplete combustion by products to carbon dioxide. The active component that most catalytic oxidation systems utilize is platinum metal, which is applied over a metal or ceramic substrate. The use of Catalytic Oxidizer to control CO from the Direct-Fired Rotary Calciners (KLN1 & KLN2), Rotary Dryers (DRY01 & DRY02), Cage Mill (CMD1), pulverizers (PUL1 & PUL2), Indirect-fired Rotary Calciner (CLN1), and Emergency Generators (EDG1, EDG2, & EDG3) is deemed technically feasible and can have a control efficiency as high as 95%.

Optimization of the design, operation, and maintenance of the Direct-Fired Rotary Calciners (KLN1 & KLN2), Rotary Dryers (DRY01 & DRY02), Cage Mill (CMD1), pulverizers (PUL1 & PUL2), Indirect-fired Rotary Calciner (CLN1), and Emergency Generators (EDG1, EDG2, & EDG3) combustion systems is the primary mechanism available for lowering CO. This process is often referred to as good combustion techniques. The factors involved include continuous mixing of air and fuel in the proper proportions and suitable temperatures in the combustion chamber. As a result, a properly designed combustion system is effective at limiting CO by maintaining the optimum temperature and amount of excess oxygen.

The addition of excess air and maintenance of high combustion temperatures for control of CO, many times, can result in an increase in NO_X emissions. Consequently, typical practice is to design the furnace/combustion system (specifically, the air/fuel mixture and furnace temperature) such that CO are reduced as much as possible without causing NO_X levels to significantly increase. This includes maintaining the air/fuel ratio at the specified design point, having the proper air and fuel condition at the burner, and maintaining the fans and dampers in proper working condition. Proper operation and maintenance of the Direct-Fired Rotary Calciners (KLN1 & KLN2), Rotary Dryers (DRY01 & DRY02), Cage Mill (CMD1), pulverizers (PUL1 & PUL2), and Indirect-fired Rotary Calciner (CLN1) will help to minimize the formation and emission of CO by ensuring that the combustion system operates as designed.

The Diesel Fired Emergency Generators are certified to meet the required US EPA Tier II (EDG1 and EDG2) and Tier III (EDG3) emission standards for Nonroad Diesel Equipment based on their model year and size. In order to achieve this certification, the engine is optimized to perform at its best design capacity. Good Combustion Practices would include firing practices to minimize the possibility of formation of CO along with operation at optimum conditions and proper maintenance ensuring that the combustion system operates as designed.

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 kilns, rotary dryers, calciners, pulverizers, and cage mill;
- Creating sufficient residence time from proper design of kilns, rotary dryers, calciners, pulverizers, and cage mill size and duct lengths to complete fuel burnout.

The control technologies identified as technically feasible for CO emissions from Carbo - McIntyre's rotary calciners/kilns are ranked by control efficiency in Table 4.5-1 below:

Table 4.5-1: Ranking of Control Technology for CO Emissions from Direct gas-fired Rotary Calciners (KLN1 & KLN2), Rotary Dryers (DRY1 & DRY2), Cage Mill (CMD1), Pulverizers (PUL1, PUL2), and Indirect – fired Rotary Calciner (CLN1).

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

Table 4.5-2: Ranking of Technically Feasible Control Technology for CO Emissions from Diesel Fired Emergency Generators (EDG1, EDG2, & EDG3)

Emission Source	Ranking	Control Technology	Control Efficiency
Diesel Fired Emergency Generators (EDG1, EDG2, & EDG3)	1	Regenerative Thermal Oxidation	98%
	2	Catalytic oxidation	95%
	3	Good Combustion Techniques	N/A

Cost analyses of each add-on control system controlling each type of CO emissions are summarized in Table 4.5-3 below:

Table 4.5-3: Cost Effectiveness of All the Technically Feasible Add-on Control Technologies for CO Emissions

Emission Source	Control Technology/Option and Associated Control Cost $/ton CO Removed		
	Regenerative Thermal Oxidation	Catalytic Oxidation	Good Combustion Techniques
Direct gas-fired Rotary Calciners (KLN1 & KLN2)	$6,967	$5,944	N/A
Rotary Dryers (DRY1 & DRY2)	$16,139	$15,063	N/A
Cage Mill (CMD1)	$27,384	$25,403	N/A
Pulverizers (PUL1, PUL2)	$33,660	$31,722	N/A
Indirect – fired Rotary Calciner (CLN1)	$12,356	$10,710	N/A
Raw Material Calciner No. 2 (CLN2)			N/A
Each Emergency Diesel Generator Nos. 1 and 2	$202,061	$177,166	N/A
Emergency Diesel Generator No. 3	$661,518	$529,702	N/A

BACT Determination

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 calciners/kilns, dryers, cage mill, pulverizers are as follow:

- Limiting the CO emissions from each Direct-fired Calciner Nos. 1 and 2 (KLN1 & KLN2) to 24.5 lbs/hr.
- Limiting the CO emissions from each Rotary Dryers (DRY1 & DRY2) to 13.80 lbs/hr.
- Limiting the CO emissions from the Cage Mill (CMD1) to 6.75 lbs/hr.
- Limiting the CO emissions from each Pulverizers (PUL1, PUL2) to 3.5 lbs/hr.
- Limiting the CO emissions from each Indirect-fired Rotary Calciner No. 1 (CLN1) to 6.3 lbs/hr.

The use of Good Combustion Techniques with a CO emission limit of 2.61 g/bhp-hr to control emissions from each Diesel-fired Emergency Generators (EDG1, EDG2, & EDG3) and limit annual operation to 500 hours for each emergency generator is also considered as BACT.

5.0 TESTING AND MONITORING REQUIREMENTS

<u>Testing Requirements:</u>

Depending on the regulatory status, Carbo - McIntyre's will be subject to mainly testing requirements under federal rules including PSD/NSR/BACT and NSPS Subparts OOO and UUU. 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 which is 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 - McIntyre shall follow the applicable procedures specified in Subpart OOO to conduct the PM, visible, and fugitive emission testing. The results of the tests may be used to demonstrate compliance with the applicable BACT PM, visible, and/or fugitive limits for the same sources.

40 CFR Part 60, Subpart UUU: This NSPS standard requires the company to conduct initial performance tests on the newly constructed raw material calciner (CLN2) to demonstrate compliance with the applicable PM and visible emission limits using Method 5 and Method 9. Carbo - McIntyre shall follow the applicable procedures specified in Subpart UUU to conduct the emissions testing. COMS shall be used to monitor the visible emissions from the affected source. The results of the tests may be used to demonstrate compliance with the applicable BACT 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 - McIntyre shall conduct Method 9, Method 22 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, 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. PM_{10} emissions performance tests will be repeated every three years for each calciner/kiln and one of the spray dryers.

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.

Carbo - McIntyre must conduct initial performance tests for the CO, NO_X and SO_2 emissions from the existing rotary calciners/kilns and NO_X, SO_2, CO, HF and HCl from Raw Materials Calciner No. 2 to demonstrate compliance with the corresponding BACT emission limits. The CO, SO_2, and NO_X performance tests will be repeated annually thereafter. The NO_X emission performance tests from one of the dryers will be conducted every three years. 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.

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. 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 - McIntyre's manufacturing operations at this facility are subject to mainly the monitoring requirements under PSD/BACT, NSPS Subpart UUU, NSPS Subpart IIII, 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 - McIntyre 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 main PM emission sources, i.e., spray dryers and calciners/kilns, Carbo - McIntyre is required to install devices to continuously monitor and record the pressure drop across each of the baghouses. For the rest of baghouses, the company shall record the pressure drop at least on a weekly basis. In addition, a Prevention Maintenance Program (PMP) including scheduled equipment inspection requirements shall be developed for all the baghouses as supplement to the daily VE check.

Carbo - McIntyre 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. Carbo - McIntyre 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 NSPS Subpart IIII and 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 - McIntyre' facility are small Pollution Specific Emission Units (PSEUs) with post-control emissions less than 100 tpy. Therefore, they are subject to CAM requirements to be established during next renewal of the facility's Part 70/Title V operating permit No. 3295-319-0029-V-03-0.

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 at the Carbo - McIntyre triggers PSD review for PM_{10}, NO_X, SO_2, and CO. An air quality analysis was conducted to demonstrate the facility's compliance with the NAAQS and PSD Increment standards for PM_{10}, NO_X, SO_2, and CO. 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 Report of the application and in the additional information packages.

<u>Modeling Requirements</u>

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 PM_{10}, NO_X, SO_2, and CO 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.

<u>Significance Analysis: Ambient Monitoring Requirements and Source Inventories</u>

Initially, a Significance Analysis is conducted to determine if the PM_{10}, NO_X, SO_2, and CO emission increases at the Carbo - McIntyre 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 PM_{10}, NO_X, SO_2, and CO.

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. $PM_{2.5}$ does not yet have established SILs (3 options proposed on 9/12/07)

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	--
TRS	1-Hour	---	10

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_X	Annual	100 / 100	0.053 / 0.053
CO	8-Hour	10,000 / None	9 / None
	1-Hour	40,000 / None	35 / None
Pb	3-month	1.5 / None	--

If the maximum pollutant impact calculated in the Significance Analysis exceeds the MSL at an off-property receptor, a NAAQS analysis is required. The NAAQS analysis would include the potential emissions from all emission units at the Carbo - McIntyre, 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 second-high impact would be assessed for the short-term averaging periods.

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 or $PM_{2.5}$ (however, $PM_{2.5}$ increments are expected to be added soon). The PSD Increments are further broken into Class I, II, and III Increments. The Carbo - McIntyre is located in a Class II area. The PSD Increments for Class I and II 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_X	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 MSL 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. The minor source baseline dates have been set for PM_{10} and SO_2 as January 30, 1980, and for NO_2 as April 12, 1991.

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

Table 6-4 show that the proposed project will not cause ambient impacts of CO above the appropriate MSLs. Because the emissions increases from the proposed project result in ambient impacts less than the MSLs, no further PSD analyses were conducted for these pollutants.

However, ambient impacts above the MSLs were predicted for PM_{10} 24-hour averaging periods, requiring NAAQS and Increment analyses be performed for PM_{10}, NO_X, and SO_2.

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**	**1987**	**297**	**3,635**	**12.83**	**1**	**Yes**
PM_{10}	**24-hour**	**1989**	**297**	**3,635**	**42.86**	**5**	**Yes**
	Annual	**1987**	**298**	**3,635**	**4.18**	**1**	**Yes**
SO_2	**3-hour**	**1988**	**298**	**3,635**	**264.89**	**25**	**Yes**
	24-hour	**1988**	**297**	**3,635**	**77.98**	**5**	**Yes**
	Annual	**1989**	**297**	**3,635**	**9.09**	**1**	**Yes**
CO	1-hour	1989	297	3,635	414.07	2000	No
	8-hour	1989	298	3,635	207.33	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 MSL, 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 calculated. 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. For the short-term averaging periods, the impacts are the highest second-high impacts. For the annual averaging period, the impacts are the highest impact. When the total impact at all significant receptors 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)	Background (ug/m^3)	Total Impact (ug/m^3)	NAAQS (ug/m^3)	Exceed NAAQS?
NO_2	Annual	1987	298	3,635	15.14	7.9	23.04	100	No
PM_{10}	24-hour	1990	293	3,636	151.51	38	189.51	150	Yes
	Annual	1989	293	3,636	38.55	20	58.55	50	Yes
SO_2	3-hour	1989	288	3,640	340.74	58.9	399.64	1300	No
	24-hour	1989	289	3,636	63.03	22.2	85.23	365	No
	Annual	1989	293	3,636	12.13	5.2	17.33	80	No

As indicated in Table 6-5 above, the total modeled impact for the 24-hour and annual averaging period for PM_{10} exceeds the corresponding NAAQS. All of the other total modeled impacts at all significant receptors within the SIA are below the corresponding NAAQS.

Similar to the PSD increment analysis, PM10 NAAQS exceeding values occurred in several years and in different receptors. So in order to identify all possible violations, exceeding concentrations beyond the highest concentration for the annual period and beyond the highest sixth high concentration for the 24-hour period, were also assessed. Results show that several additional NAAQS-exceeding events occurred in receptors located in the surrounding area of BASF – Edgar Plant, three miles west of the permitted facility (see Figure 2 in the Appendix).

To determine if such exceeding values were caused by Carbo Ceramics – McIntyre or by BASF – Edgar, a second set of AERMOD runs was undertaken for those receptors only, assessing the SIL for the impact of the emissions of the permitted facility alone, without the influence of any off-site source. The results of the maximum predicted concentrations for each averaging period are presented in Table VI, and they show values below the SILs, hence it can be concluded that the contribution of Carbo Ceramics – McIntyre to any of these exceeding values is negligible. Again, as in the PSD increment situation, further analysis would be required to establish the degree of responsibility of BASF – Edgar Plant for those results.

Table 6-6 Class II Area NAAQS Assessment Second Set of AERMOD Runs to Assess SILs at the Trouble receptors for PM_{10}

Criteria Pollutant	Averaging Period	Significance Level	Maximum Projected Concentration*	Receptor Location UTM Zone: 17		Model Met Data Period
		(µg/m^3)	(µg/m^3)	X(km)	Y(km)	[year]
PM_{10}	Annual	1	0.12	293	3,636	1987
	24-Hour	5	1.25	293	3,636	1987

* Highest concentration

Increment Analysis

The modeled impacts from the NAAQS run were evaluated to determine whether compliance with the Increment was demonstrated. The results are presented in Table 6-7.

Table 6-7: 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	1987	298	3,635	14.13	25	No
PM_{10}	**24-hour**	**1989**	**294**	**3,635**	**49.48**	**30**	**Yes**
	Annual	1987	300	3,636	13.08	17	No
SO_2	3-hour	1988	293	3,636	84.11	512	No
	24-hour	1988	292	3,636	22.93	91	No
	Annual	1989	293	3,636	5.6	20	No

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

Table 6-7 demonstrates that the impacts are below the corresponding increments for NO_X and SO_2, and PM_{10} even with the conservative modeling assumption that all NAAQS sources were Increment sources.

Although not shown in the previous table, PM_{10} exceeding values occurred in all five years modeled, and at different receptors. So in order to identify all possible increment violations, exceeding concentrations beyond the highest second high value were also assessed – all second highs, third highs, fourth highs, etc. – and it was found that several additional increment-exceeding events occurred in receptors located within and in the surrounding area of one of the off-site facilities: UNIMIN Corporation, about two miles west of the permitted facility (see Figure 1 in the Appendix).

To determine if such exceeding values were caused by Carbo Ceramics – McIntyre or by UNIMIN Corporation, a second set of AERMOD runs was undertaken for those receptors only, assessing the SIL for the impact of the emissions of the permitted facility alone, without the influence of any off-site source. The result of the maximum predicted concentration can be seen in Table IV, and it shows that it does not exceed the SIL and consequently neither will any of the other troubled receptors, hence it can be concluded that the contribution of Carbo Ceramics – McIntyre to any of these exceeding values is negligible. Further analysis would be required to establish the degree of responsibility of UNIMIN Corporation for those results.

Table 6-8. Class II Area PSD Increment Assessment Second Set of AERMOD Runs to Assess SILs at the Trouble Receptors for PM_{10}

Criteria Pollutant	Averaging Period	Significance Level	Maximum Projected Concentration*	Receptor Location UTM Zone: 17		Model Met Data Period
		(μg/m^3)	(μg/m^3)	X(km)	Y(km)	[year]
PM_{10}	24-Hour	5	2.97777	294	3,635	1990

* Highest concentration.

Ambient Monitoring Requirements

Table 6-9: 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	1987	297	3635	14	12.83	No
PM_{10}	24-hour	1989	297	3635	10	42.86	Yes
SO_2	24-hour	1989	297	3635	13	77.98	Yes
CO	8-hour	1989	298	3635	575	207.33	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.

Predicted concentrations of NO_2 and CO are below their respective monitoring de minimus threshold values and therefore no pre-construction monitoring is required for these pollutants. But that is not the case for PM10 and SO_2, which showed predicted concentrations that do exceed the monitoring de minimis levels; hence preconstruction monitoring would be necessary. In lieu of such monitoring effort, existing ambient air data from a representative regional monitoring station can be used. Such station (site ID 130210012) is located in Macon, Bibb County, GA, approximately 21 miles west of the permitted facility. Being operated by GA EPD, the data from that monitoring station can be considered as contemporaneous, representative, and fulfilling all the QA/QC requirements.

Preconstruction monitoring evaluation was not conducted for other pollutants since their emissions are below their corresponding significant emission rates.

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 200 kilometers has been used for all facilities that do not combust coal.

The Carbo - McIntyre Plant is located approximately 214.4 km (133.1 miles) north-northwest of the Okefenokee National Wilderness Area and approximately 238.8 km (148.4 miles) of the Wolf Island National Wilderness Area. After review of the previous PSD applications by the Fish and Wildlife Service, the Federal Land Manager indicated that a Class I increment or air quality related values analysis was not required since potential emissions from the facility's existing and new proposed equipment are less than the Q/d screening threshold of concern.

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

See Modeling memo dated June 1, 2009

Growth

Carbo - McIntyre states that no additional growth in residential or other areas is anticipated. No secondary emissions are expected from the operation of the new equipment.

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's SIP and Georgia *Rules for Air Quality Control* provide no specific prohibitions against visibility impairment other than regulations limiting source opacity and protecting visibility at federally protected Class I areas. To otherwise demonstrate that visibility impairment will not result from continued operation of the mill, the VISCREEN model was used to assess potential impacts on ambient visibility at so-called "sensitive receptors" within the SIA of the Carbo - McIntyre. Since there is no ambient visibility protection standard for Class II areas, this analysis is presented for informational purposes only and predicted impacts in excess of screening criteria are not considered "adverse impacts" nor cause further refined analyses to be conducted.

The primary variables that affect whether a plume is visible or not at a certain location are (1) quantity of emissions, (2) types of emissions, (3) relative location of source and observer, and (4) the background visibility range. For this exhaust plume visibility analysis, a Level-1 visibility analysis was performed using the latest version of the EPA VISCREEN model according to the guidelines published in the *Workbook for Plume Visual Impact Screening and Analysis* (EPA-450/4-88-015). The VISCREEN model is designed specifically to determine whether a plume from a facility may be visible from a given vantage point. VISCREEN performs visibility calculations for two assumed plume- viewing backgrounds (horizon sky and a dark terrain object). The model assumes that the terrain object is perfectly black and located adjacent to the plume on the side of the centerline opposite the observer.

In the visibility analysis, the total project NO_X and PM_{10} emissions increases were modeled using the VISCREEN plume visibility model to determine the impacts. For both views inside and outside the Class II area, calculations are performed by the model for the two assumed plume-viewing backgrounds. The VISCREEN model output shows separate tables for inside and outside the Class II area. Each table contains several variables: theta, azi, distance, alpha, critical and actual plume delta E, and critical and actual plume contrast. These variables are defined as:

1. *Theta* – Scattering angle (the angle between direction solar radiation and the line of sight). If the observer is looking directly at the sun, theta equals zero degrees. If the observer is looking away from the sun, theta equals 180 degrees.

2. *Azi* – The azimuthal angle between the line connecting the observer and the line of sight.

3. *Alpha* – The vertical angle between the line of sight and the plume centerline.

4. *delta E* – Used to characterize the perceptibility of a plume on the basis of the color difference between the plume and a viewing background. A delta E of less than 2.0 signifies that the plume is not perceptible.

5. *Contrast* – The contrast at a given wavelength of two colored objects such as plume/sky or plume/terrain.

The analysis is generally considered satisfactory if *delta E* and *Contrast* are less than critical values of 2.0 and 0.05, respectively, both of which are Class I, not Class II, area thresholds. The Division has reviewed the VISCREEN results presented in the permit application and have determined that the visual impact criteria (*delta E* and *Contrast*) at the affected sensitive receptors are not exceeded as a result of the proposed project. Since the project passes the Level-1 analysis for a Class I area for the Class II area of interest, no further analysis of exhaust plume visibility is required as part of this air quality analysis.

The analysis is generally considered satisfactory if *delta E* and *Contrast* are less than critical values of 2.0 and 0.05, respectively, both of which are Class I, not Class II, area thresholds. The Division has reviewed the VISCREEN results presented in the permit application and determined that the visual impact criteria (*delta E* and *Contrast*) at the affected sensitive receptors are exceeded at none of the sensitive receptors as a result of the proposed project. Therefore, a Level II analysis is required for these receptors.

A Level II analysis refines selected Level I input parameters by using representative wind speed and atmospheric stability conditions in the region encompassing both emission source and the sensitive receptor. In contrast, the Level I analysis assumed worst-case parameters (Pasquill-Gifford stability class F and wind speed of 1.0 meters per second) that are not necessarily indicative of local weather patterns that affect visibility when winds blow emission from the Carbo - McIntyre toward each of these sensitive receptors. For the Level II analysis, the representative meteorological conditions were determined by creating a joint frequency distribution of atmospheric stability and wind speeds during daylight hours (i.e., 7 am to 6 pm) for the 1987 – 1991 made from observations at meteorological station 03813 in Macon, GA and upper air data from station 03881 in Centerville, AL. This analysis indicated the combination of atmospheric stability and wind speed conditions at each sensitive receptor that is most likely to occur when the wind direction is such that plume impairment would potentially occur.

As an additional refinement to the Level II analysis, the NOx emission rate was scaled by 75 percent following the Ambient Ration Method to account for the conversion of NOx to NO_2 in the atmosphere, since the latter is the specific visibility-impairing species. All other parameters were input as Level I default options. A background visual range of 25 kilometers was used for Carbo - McIntyre.

The results of the Level II VISCREEN analysis show that the screening criteria are not exceeded at any of the sensitive receptors when evaluated using the Level II input parameters. Therefore, the proposed modifications to facility are not anticipated to cause adverse impacts on visibility at the sensitive receptors in the area surrounding the mill.

Moreover, an analysis of the Class II increment inventory at the Carbo - McIntyre indicates that, since 1975, decreases in actual emissions of visibility-affecting pollutants from the facility far exceed any corresponding increases in potential emissions of these pollutants. Because the perception of industrial plumes has not been an issue in the past, this indicates there is little reason to expect visible industrial plumes from this site will be a substantial future issue.

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 TAP 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. To conduct a facility-wide TAP impact evaluation for any pollutant that could conceivably be emitted by the facility is impractical. A literature review would suggest that at least one molecule of hundreds of organic and inorganic chemical compounds could be emitted from the various combustion units. This is understandable given the nature of the natural gas and propane fed to the combustion sources, and the fact that there are complex chemical reactions and combustion of fuel taking place in some. The vast majority of compounds potentially emitted however are emitted in only trace amounts that are not reasonably quantifiable.

At Carbo Ceramics, more than three-dozen TAP compounds are emitted from fuel combustion in spray dryers, calciners, and 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 (5^{th} 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 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. 18304 revised on February 14, 2009 and August 14, 2009 identified three TAP compounds (HF, HCl, and Hexane) for the ambient impact modeling. According to the application, plant-wide total potential emissions of these TAP compounds are 127.6 TPY, including 18.79 TPY of HCl, 108.80 TPY of HF, and 1.84 TPY of Hexane.

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*.

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*. Figure 8-3 of Georgia EPD's *Guideline* contains a flow chart of the process for determining long-term and short-term ambient thresholds. Carbo - McIntyre referenced the resources previously detailed to determine the long-term (i.e., annual average) and short-term AAC (i.e., 24-hour or 15-minute). The AACs were verified by the EPD.

<u>Determination of Toxic Air Pollutant Impact</u>

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.

<u>Initial Screening Analysis Technique</u>

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.

<u>Initial Screening Analysis Technique</u>

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.

Two 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 two 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.

The permitted facility updated the air toxics analysis for HF, and HCl. Some Acceptable Ambient Concentrations (AACs) were also updated as new data became available. The AACs and their sources are shown on Table I.

Table 7-1. Air Toxic Assessment. Acceptable Ambient Concentrations

Pollutant	Averaging Period	AAC (µg/m^3)	Source
HF	15 Minutes	245	ACGIH STEL
	Annual*	14	RfC (CARB)
HCl	15 Minutes	700	IRIS RfC
	Annual	20	RfC

*EPA does not establish a RfC or RfD for HF, however, CARB suggests 14 µg/m^3 inhalation reference exposure level, which EPA adopted (see EPA Prioritized Chronic Dose-Response Values at *http://www.epa.gov/ttn/atw/toxsource/table1.pdf*).

The maximum ground-level concentrations (MGLCs) for these contaminants were calculated using the ISCST3 model for 1 hour and annual averaging periods. The 1-hour results were converted to 15 minutes averages in order to compare them to the corresponding AAC. All MGLCs assessed were found to be less than their respective AACs as presented in Table II.

Table 7-2. Air Toxics Assessment MGLCs

Pollutant	Averaging Period	AAC (µg/m^3)	MGLC		Receptor Location (UTM Z17)		Met Data Year
			µg/m^3	% of AAC	Easting (km)	Northing (km)	
HF	15 Minutes	245	55.91	22.82	297	3,635	1976
	Annual	14	1.06	7.59	297	3,635	1977
HCl	15 Minutes	700	9.65	1.38	297	3,635	1976
	Annual	20	0.182	0.91	297	3,635	1976

8.0 EXPLANATION OF DRAFT PERMIT CONDITIONS

The permit requirements for this proposed facility are included in draft Permit Amendment No. 3295-319-0027-V-03-2.

<u>Section 1.0: Facility Description</u>

Carbo - McIntyre is engaged in the production of ceramic pellets for use in the natural gas mining industry. The major raw materials are alumina-rich clay, water and bauxite. Clay, rich in alumina is unloaded in the covered crude storage area to wait processing. The clay is shredded and then fed to a cage mill dryer and a cyclone. Emissions from the cage mill dryer and cyclone operations are controlled by baghouses (BH) 01, 02 and standby (SB) and are released through stack S001. The clay is next fed to a calciner. Emissions from the calcining operations are controlled by BH04 and BH05 (SB) and are released through stack S002. The material is then fed to a calciner cooler where emissions are controlled by BH24 and BH25 (SB) and are released through stack S016. Nuisance BH06 controls dust generated from the transfer of material in both the cage mill and calciner feed bins and is emitted through stack S003.

Submitted application No. 18304 requests that Carbo – McIntyre add a new Raw Material Calciner (CLN2) with associated supporting equipment, add a new emergency generator (EDG3), and retroactively incorporate BACT criteria including a facility-wide potential increase in PM/PM_{10}, NO_X, SO_2, and CO emissions above the PSD major source threshold because results of emission tests conducted in 2006 indicate that emission rates of these criteria pollutants exceed either the corresponding major source thresholds or significant increase levels under NSR/PSD rules.

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

Condition 3.2.1 deleted – This condition is revised to such an extent; the condition was deleted and emission requirements addressed under Condition 3.2.6.

Condition 3.2.2 deleted – This condition is revised to such an extent; the condition was deleted and emission requirements addressed under Condition 3.2.13 and 3.2.14.

Condition 3.2.3 is added to establish the BACT requirements for fugitive emissions from the production related traffic.

Condition 3.2.4 requires Carbo – McIntyre to only use natural gas and/or propane as fuel in Direct–fired Rotary Calciner 1 (KLN1), Direct–fired Rotary Calciner 2 (KLN2), Indirect-fired Rotary Calciner (CLN1), Raw Material Calciner No. 2 (CLN2), Rotary Dryer No. 1 (DRY1), Rotary Dryer No. 2 (DRY2), Pulverizer No. 1 (PUL1), Pulverizer No. 2 (PUL2), and Cage Mill No. 1 (CMD1).

Condition 3.2.5 requires Carbo to not exceed 500 hours per year annual operating time for each of the stationary emergency diesel generators/engines Nos. 1, 2, and 3 (EDG1, EDG2, and EDG3).

Conditions 3.3.3-3.3.8 require Carbo – McIntyre to comply with 40 CFR Part 60, Subpart IIII: *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines for* emergency diesel generator/engine No. 3 (EDG3). EDG3 shall be certified for emission standards for new nonroad compress ignition engines for the same model year and maximum engine power in 40 CFR 89.112 and 40 CFR 89.113 for all pollutants, operated and maintained according to the manufacturer’s written specifications/instructions or procedures developed by Carbo – McIntyre that are approved by the engine manufacturer, over the entire life of the engines. On and after startup of the operation, stationary emergency diesel generator/engine No. 3 (EDG3) shall comply with the applicable emission limits of 40 CFR Part 60, Subpart IIII during the entire life of the engine. The engine is in compliance with these applicable emissions limits provided that it is certified by the manufacturer per 40 CFR 89.112 and 40 CFR 89.113 for all pollutants and operated and maintained according to manufacturer’s specification.

Carbo – McIntyre must operate the stationary emergency diesel generator/engine No. 3 (EDG3) using diesel fuel that has a maximum sulfur content of 500 parts per million (ppm) (0.05% by weight) and either a minimum cetane index of 40 or maximum aromatic content of 35 volume percent. Beginning on October 1, 2010, Carbo – McIntyre must only use diesel fuel that has a maximum sulfur content of 15 ppm (0.0015% by weight) and either a minimum cetane index of 40 or maximum aromatic content of 35 volume percent. The accumulated maintenance check and readiness testing time for the stationary emergency diesel generator/engine No. 3 (EDG3) shall not exceed 100 hours per year Carbo – McIntyre may petition the Division for approval of additional hours for maintenance checks and readiness testing, but a petition is not required if Carbo – McIntyre maintains records indicating that Federal, State, or local standards require maintenance and testing of the new emergency stationary diesel engine/generator beyond 100 hours per year. Any operation other than emergency power generation, and maintenance check and readiness testing is prohibited. Emergency diesel generator/engine No. 3 (EDG3) and any associated control devices, shall be installed and configured according to the manufacturer's written instructions. Carbo – McIntyre shall operate the stationary emergency diesel generator/engine No. 3 (EDG3) only in an emergency situation such as to produce power for critical networks or equipment (including power supplied to portions of a facility) when electric power from the local utility is interrupted, or to pump water in the case of fire or flood, etc. They may be operated for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by the manufacturer, the vendor, or the insurance company associated with the engine.

Condition 3.3.9 requires Carbo – McIntyre to comply with the updated provisions of 40 CFR, Part 60, Subpart OOO, *"Standards of Performance for Nonmetallic Mineral Processing Plants"* as amended on April 28, 2009. In particular, Carbo – McIntyre must not discharge, or cause the discharge, into the atmosphere, from any subject equipment/affected facility constructed, modified, or reconstructed on or after April 22, 2008. This includes fugitive emissions which exhibits greater than of 12% opacity from any crusher without a capture system, fugitive emissions which exhibit greater than 7% opacity from grinding mills, screening operations, bucket elevators, transfer points on belt conveyors, bagging operations, storage bins, enclosed truck or railcar loading stations or from any other affected facility (as defined in 40 CFR §§60.670 and 60.671), and any exhaust air from dry control device stack which contains particulate matter in excess of 0.032 g/dscm (0.014 gr/dscf).

Condition 3.3.10 requires Carbo - McIntyre to limit NO_X emissions from KLN1, KLN2, DRY1, DRY2, PUL1, PUL2, CMD1, CLN1, CLN2, EDG1, EDG2, and EDG3 such that will not equal or exceed the BACT emissions limit as listed in the table.

Condition 3.3.11 requires Carbo - McIntyre to limit CO emissions from KLN1, KLN2, DRY1, DRY2, PUL1, PUL2, CMD1, CLN1, CLN2 EDG1, EDG2, and EDG3 such that will not equal or exceed the BACT emissions limit as listed in the table.

Condition 3.3.12 requires Carbo - McIntyre to limit SO_2 emissions from KLN1, KLN2, CLN1, CLN2, EDG1, EDG2, and EDG3 such that will not equal or exceed the BACT emissions limit as listed in the table.

Condition 3.3.13 requires Carbo – McIntyre to limit PM_{10} emissions from the listed sources such that will not equal or exceed the BACT emissions limit as listed in the table.

Condition 3.3.14 requires Carbo – McIntyre not to discharge, or cause the discharge, into the atmosphere, from any process equipment except for Spray Dryers and Calciners/kilns, any gases which exhibit visible emissions, the opacity of which is equal to or greater than 7 percent. Visible emissions limit for the Spray Dryers and Calciners/kilns is less than 10 percent opacity.

Condition 3.3.15 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 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[1].

Condition 3.3.16 requires Carbo Ceramics to comply with all applicable provisions of the National Emission Standard for hazardous Air Pollutants (NESHAP) as found in 40 CFR Part 63, Subpart B – *"Requirements for Control Technology Determinations for Major Sources in Accordance With Clean Air Act Sections 112(g)"*.

Condition 3.3.17 requires Carbo Ceramics to not discharge, or cause the discharge, into the atmosphere, from New Raw Material Calciner No. 2 (CLN2), any gases, which contain Hydrogen Fluoride (HF) emissions equal to or greater than 8.28 lbs/hr.

Condition 3.3.18 requires Carbo Ceramics to not discharge, or cause the discharge, into the atmosphere, from New Raw Material Calciner No. 2 (CLN2), any gases, which contain Hydrogen Chloride (HCl) emissions equal to or greater than 1.43 lbs/hr.

Section 4.0: Requirements for Testing

Condition 4.1.3 in the current Title V operating permit No. 3295-319-0029-V-03-0 has been updated to list all the applicable methods for performance testing and monitoring of the emissions from the existing plant/facility and from the new process equipment.

Condition 4.2.2 requires initial performance testing on the existing plant/facility and the new calciner for the demonstration of compliance with the BACT and/or MACT emission standards. While a noticeable detached plume on the calciner/kiln stack suggests some amount of condensable PM, 40 CFR 52.166 (amended on May 16, 2008) specifies that PM limits issued prior to January 1, 2011 need not account for these (i.e., only account for filterable PM).

Condition 4.2.3 requires Carbo – McIntyre within 60 days after achieving the maximum production rate at which each of the new Raw Material Calciner (CLN2) will be operated, but no later than 180 days of the initial startup to determine compliance with the NSPS Subpart UUU PM and visible emission limits.

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

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 4.2.6 allows an alternative testing procedure when the fugitive emissions from two or more sources continuously interfere with each other. Condition 4.2.7 reduces the advance notification of test to 7 days instead of 30 days.

Condition 4.2.8 requires Carbo - McIntyre to perform a CO performance test every 12 months.

Condition 4.2.9 requires Carbo - McIntyre to repeat a PM/PM_{10} performance test every 3 years.

Condition 4.2.10 requires Carbo - McIntyre to conduct NO_X and CO emission performance tests on one spray dryer every three years to demonstrate compliance with the BACT emission limits.

Condition 4.2.11 requires Carbo - McIntyre to conduct an annual NO_X and SO_2 emission performance tests on each calciner/ kiln to demonstrate compliance with the BACT emission limits.

Condition 4.2.12 requires Carbo - McIntyre to conduct an annual HCl and HF emission performance tests on New Materials Calciner CLN2 respectively to demonstrate that the calciner is in compliance with the case-by-case MACT emission limits in Condition 3.3.17 and 3.3.18.

Section 5.0: Requirements for Monitoring

Condition 5.2.1 in the current Part 70/Title V operating permit No. 3295-319-0027-V-03-0 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 spray dryers and calciners/kilns will be equipped with COMS.

Condition 5.2.2 has been updated to require installation of a device to continuously monitor the temperature at the baghouses BH44 and BH45 for Raw Materials Calciner CLN2**.**

Condition 5.2.8 requires each of the stationary emergency diesel generators/engines Nos. 1, 2, and 3 (EDG1, EDG2, and EDG3) be equipped with a non-resettable hour meter to track the number of hours operated during any type of operation and during each calendar month. Carbo - McIntyre must record the time of operation and the reason the engine/generator was in operation during that time.

Condition 5.2.9 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 5.2.10 requires Carbo – McIntyre when controlling fugitive dust via weekly cleaning, the use of a vacuum street sweeper(s) or a truck washing station(s) as specified to keep daily operation records of the control equipment involved.

Condition 5.2.11 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. 3295-319-0027-V-03-0 has been modified to include new or updated reporting requirements due mainly to the establishment of the BACT, NSPS emission limitations and/or operating requirements.

Emergency diesel generators/engines

Conditions 6.2.4 – 6.2.7 require Carbo - McIntyre to maintain monthly operating records of the stationary emergency diesel generator/engine No. 3 (EDG3), including operating hours and reasons of the operation, i.e., emergency power generation and/or fire distinguishing, readiness testing and/or maintenance check. Carbo - McIntyre must use monthly operating time records to calculate the 12-month rolling total of the operating and/or maintenance check and readiness testing time for each generator/engines. Carbo - McIntyre must demonstrate compliance with the applicable emission limits in Condition 3.3.5 by purchasing the stationary emergency diesel generator/engine No. 3 (EDG3) that is certified to the applicable emission standards in 40 CFR 60.4205(b), for the same model year and maximum engine power. Carbo - McIntyre must keep records verifying that each shipment of diesel fuel received for firing the stationary emergency diesel generators/engines. Verification shall consist of the fuel oil receipts and/or fuel supplier certifications or results of analyses of the fuel oils conducted by methods of sampling and analysis, which have been specified or approved, by the EPA or the Division. Carbo - McIntyre must comply with all the applicable requirements of the General Provisions of 40 CFR Part 60 as listed in Table 8 to 40 CFR Part 60, Subpart IIII.

Conditions 6.2.8 and 6.2.9 are added to establish the reporting requirements for performance testing and startup of affected sources under NSPS Subpart OOO.

Condition 6.2.10 requires Carbo - McIntyre to submit an initial notification for the new Raw Material Calciner (CLN2) with associated supporting equipment and stationary emergency diesel generator/engine No. 3 (EDG3) no later than 15 days after the startup.

Condition 6.2.11 requires Carbo - McIntyre to maintain a record of the operating hours and the hourly input rate of kiln feed to each of the calciners and kilns (KLN1, KLN2, CLN1, and CLN2). The Permittee shall obtain a representative sample daily from each kaolin clay slurry tank or each calciner/kiln's feed stream feeding any calciner/kiln and analyze the sample for the sulfur in percent by weight. The daily samples shall be acquired and analyzed for sulfur content by methods acceptable to the Division. The sulfur content results shall be used to determine SO_2 emissions.

Condition 6.2.12 is added to establish the compliance requirement for SO_2 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.

Condition 6.2.13 is added requiring Carbo - McIntyre utilize the monthly calciner/kiln feed input rate records (ton per month) in Condition 6.2.11 and the HCl and HF emission factors (ponds of HCl or HF emitted per ton of kiln feed) established during the most recent Division-approved performance tests to calculate the monthly HCl and HF emission rates for each of the Kilns (kiln #1, Kiln #2 and CLN2) during each calendar month. Carbo - McIntyre must notify the Division in writing if any monthly HCl or HF emission rate exceeds the notification level of one - twelfth (1/12) of the annual HCl or HF emission limit in Conditions 3.3.17 and 3.3.18.

Condition 6.2.14 is added requiring Carbo - McIntyre use the monthly HCl and HF emission data in Condition 6.2.13 to calculate total HCl and HF emissions from each of the Kilns (kiln #1, Kiln #2 and CLN2) during each period of 12 consecutive months. Carbo - McIntyre must notify the Division in writing if any 12-month rolling total of the HCl or HF emissions from each kilns (Kiln #1, Kiln #2, and CLN2) exceed the 6.26 tons or 38.27 tons limit in Conditions 3.3.17 and 3.3.18.

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 Carbo Ceramics, Inc. - McIntyre Plant
Operation of Existing Ceramic Pellet Manufacturing Plant &
Construction & Operation of Raw Material Calciner (CLN2) with associated supporting equipment and emergency generator (EDG3)
Located in McIntyre, Georgia (Wilkinson County)

NOTICE OF MACT APPROVAL

Air Quality Permit Application No. 18304
Dated June 24, 2008 & Revised on February 15, 2009 & August 14, 2009

Reviewing Authority

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

Prepared and Reviewed By:

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

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1.0 EXECUTIVE SUMMARY

Carbo Ceramics, Inc. – McIntyre Plant (Carbo Ceramics) operates a ceramic pellet manufacturing facility located at 2295 Wriley Road, McIntyre, Wilkinson County, Georgia. Wilkinson County is classified as “attainment” or “unclassifiable” for all criteria pollutants. Carbo Ceramics submitted application No. 18304 proposing the construction and operation of a new Raw Material Calciner No.2 associated Material Handling equipment and an Emergency Generator. The facility is currently permitted under Title V Permit No. 3295-319-0027-V-03-0, dated May 12, 2008.

The Environmental Protection Division (EPD) has reviewed the application No. 18304 submitted by Carbo - McIntyre Plant for a permit to construct and operate a new Raw Material Calciner (CLN2) with associated supporting equipment and a new emergency generator (EDG3). In addition to the new equipment, 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 existing kaolin clay process operations. The new Raw Material Calciner (CLN2) with associated supporting equipment and a new emergency generator (EDG3) are subject to the same BACT as applicable to the existing operation.

The proposed project will result in an increase in emissions from the facility. The sources of these increases in emissions include the new Raw Material Calciner (CLN2) and the new emergency generator (EDG3).

This permit application is being updated to include revised emission rates of hydrogen fluoride (HF) and hydrogen chloride (HCl) from the Direct-fired Rotary Calciners (KLN1 and KLN2) and the new proposed Raw Material Calciner No.2 (CLN2) based upon performance testing conducted May 27, 2009, and June 30, 2009. These performance tests indicated higher emission rates of HF and HCl than previously indicated in the previous submittal. As a result the Section 112(g)(2)(B) case-by-case Maximum Achievable Control Technology (MACT) review has been prepared on August 14, 2009. It is important to note the HF is considered to be the only fluoride emitted by the facility.

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, the new Raw Material Calciner No.2 (CLN2) 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. 18304 a proposed case-by-case MACT determination specifying control technology intending to meet the MACT emission limitations. Carbo Ceramics has requested that HF and HCl emissions be limited for the new Raw Material Calciner No.2 (CLN2). 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 the new Raw Material Calciner No.2 (CLN2) plus initial and annual testing for compliance assurance.

Assessment

This Case-by-Case Maximum Achievable Control Technology (MACT) Assessment provides (1) background information on the Carbo Ceramics project and its regulatory status, and (2) a MACT Assessment for acid gas HAPs (HF and HCl), and organic HAPs as requested by the Georgia Environmental Protection Division (EPD) – Air Protection Branch.

Plant Description

- CARBO Ceramics operates a kaolin clay processing plant in McIntyre Georgia located in Wilkinson County, The facility is submitting an application for the construction and operation of a new Raw Material Calciner No.2, associated Material Handling equipment and an Emergency Generator.

2.0 APPLICATION INFORMATION

2.1 Application Content

The permit application No. 18304 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 processing equipment and New Raw Materials Calciner.

(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) 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

(6) Proposed 112(g) of CAA Case-by-Case MACT for HF and HCl emissiojns from the facility.

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

2.2 Applicant Information

Facility Owner:

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

Facility Information:

Carbo Ceramics, Inc. - McIntyre Plant
2295 Wriley Road
McIntyre, Georgia 31054 (Wilkinson County)

2.3 Authorized Representative

Chris DiBiase
Plant Manager

2.4 Application Submittals

June 24, 2008: Date of initial application assigned Application No. 18304

February 15, 2009	Revised Application No. 18304 with updated emissions inventory including the addition of a new Raw Material Calciner No. 2 associated material handling equipment and an Emergency Generator.
August 14, 2009	Date of final revised Application No. 18304 with 112(g) case-by-case MACT determination HF and HCl emission from calciners/kilns.

3.0 BACKGROUND

3.1 Facility Location

Carbo Ceramics operates a ceramic pellet manufacturing facility at 2295 Wriley Road, McIntyre, Wilkinson County, Georgia. Wilkinson County is classified as "attainment" or "unclassifiable" for all criteria pollutants.

Currently, Carbo Ceramics – McIntyre operates a facility containing one calciner, two rotary dryers, two kilns, cage mill, two emergency generators and several pieces of supporting equipment. The Carbo Ceramics, Inc. facility in McIntyre, GA is engaged in the production of ceramic pellets for use in the natural gas mining industry. The major raw materials are alumina-rich clay, water and bauxite.

3.2 Permit Status of Facility Operations

Currently Carbo Ceramics' facility is regulated by Title V Operating Permit No. 3295-319-0027-V-03-0 issued on November 6, 2008. Carbo Ceramic has submitted application No. 18304 proposing to construct and operate a new Raw Material Calciner No.2, associated Material Handling equipment, and an Emergency Generator.

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.

Application No. 18304 as revised on February 15, 2009 and August 14, 2009 also includes a 112(g) case-by-case MACT proposed for the HF and HCl emissions from the new Raw Material Calciner No. 2 and the new Emergency Generator.

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

Clay, rich in alumina is unloaded in the covered crude storage area to wait processing. The clay is shredded and then fed to a cage mill dryer and a cyclone. Emissions from the cage mill dryer and cyclone operations are controlled by baghouses. The clay is next fed to a calciner. Emissions from the calcining operations are controlled by a baghouse. The material is then fed to a calciner cooler where emissions are controlled by baghouse. A nuisance baghouse controls dust generated from the transfer of material in both the cage mill and calciner feed bins.

After the calcining operations, the clay is fed to one of two ball mills where the clay is crushed and classified to the proper size. Bauxite can enter the process at this point as well. Emissions from #1 ball mill are controlled by a baghouse. Emissions from #2 ball mill are controlled by a baghouse. Nuisance dust generated from the feeding of #1 ball mill is controlled by a baghouse. Nuisance dust generated from the feeding of #2 ball mill is controlled by a baghouse. The clay is then fed to several mixers where water is added. Dust emissions from this process are controlled by two baghouses. The mixed clay is then dried in one of two dryers. Emissions from dryer #1 are controlled by three baghouse. Emissions from dryer #2 are controlled by a baghouse.

The dried clay is fed to several screens and then fired in one of two rotary kilns. Emissions generated from kilns #1 and #2 are controlled by two sets of baghouses each. The fired product is then fed to product screens where emissions are controlled by a baghouse for #1 and #2 product screens. The finished product can be bagged an/or shipped by truck or rail. Dust emissions from product bulk storage area are controlled by a baghouse.

CARBO Ceramics has submitted an application for the construction and operation of a new Raw Material Calciner No.2, associated Material Handling equipment and an Emergency Generator.

4.0 EMISSION RATES AND CHANGES

The methodologies used to quantify emissions from the emission units at Carbo Ceramics' McIntyre Plant are summarized in the application No. 18304 as revised on February15, 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 McIntyre's 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, existing and new equipment 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 ……".

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, calciner/kiln, spray dryer, and diesel generator at Carbo Ceramics are sources of HAP emissions. In addition, HAP compounds are released from raw materials via chemical reactions at high temperature such as chlorides and fluorides emitted from calciners and kilns.

Attachment C of the application No. 18304 revised on August 14, 2009 submittal lists the estimations of the HAP emissions from the emissions units. According to the application, No. 18304, plant-wide total potential HAP emissions are 131.3 TPY, including 108.8 TPY of HF, 18.7 TPY of HCl, 1.8 tpy of Hexane, and 2.0 remaining other HAPs.

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 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 a 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"* 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 3 – 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 environmental impacts, and energy requirements associated with using each control technology.

Step 4 - 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 5- 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 6 - 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 7 - 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 8- 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".

5.2 Potential Control Options Review

HAP emissions sources/process units at Carbo Ceramic's include natural gas-fired dryers, natural gas-fired rotary ceramic calciners and kilns, and stationary emergency diesel generators/engines. Since the three existing calciner/kiln (KLN1, KLN2, and CLN1) were permitted on December 30, 1997 and constructed before the effective date of Section 112(g)(2)(B), therefore, only the New Raw Materials Calciner CLN2 is addressed.

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. But neither dryers nor calciners and 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 and 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 higher temperature. Because of the high temperature (>3,000°F), calciners and 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 and 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 and kilns at Carbo Ceramics, they are considered as two source categories with regard to this 112(g) 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 dryers and calciners and 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

Tier I: Making a MACT floor finding

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 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.

Step 1 – Identify the Case-by-Case MACT-affected emissions unit

This case-by-case MACT analysis is being conducted on Hydrogen Chloride and Hydrogen Fluoride emissions from the proposed Raw Material Rotary Calciner No.2 (CLN2). The emission unit is located at the CARBO Ceramics facility in McIntyre, Georgia. The calciner has a potential to emit 36.3 tons per year of Hydrogen Fluoride and 2.8 tons per year of Hydrogen Chloride as detailed in Attachment C, Table 1-d of application No. 18304 revised on August 14, 2009.

Step 2 – Make a MACT floor finding

A MACT floor refers to the level of emission control that is achieved in practice by the best-controlled similar source. EPA defines a similar source as "a stationary source or process that has comparable emissions and is structurally similar in design and capacity to a constructed or reconstructed major source such that the source could be controlled using the same control technology."

Based on our review of available databases, it appears that there are no identical sources. No other processing plants are a similar material source to the proposed Raw Material Calciner No.2, which have emission limits for Hydrogen Chloride and Hydrogen Fluoride. Therefore, no MACT floor can be established. As such, a Tier II Case-by-Case MACT analysis including all control technologies for HF and HCl will be performed.

Tier II: Considering all control technologies

Step 3 – List all available/reasonable applicable control technologies

In reviewing the available technologies to control emissions of Hydrogen Chloride and Hydrogen Fluoride from the new proposed Raw Material Calciner, Wet Scrubber, Dry Lime Adsorber, Dry Scrubber (Injection System) and Pollution Prevention has been considered as possible control technology options as noted in Table L-2.1

Table L-2.1: Evaluated Control Options for HF/HCl Emissions –New proposed Raw Material Calciner No.2.

Option No.	Control Technology
1	Wet Scrubber
2	Dry Lime Adsorber
3	Dry Scrubber (Injection System)
4	Pollution Prevention

Step 4 – Eliminate technically infeasible control technologies

All the above control technology options are deemed technically feasible.

Step 5 – Determine efficiency of applicable control technologies

It is important to note that collateral SO_2 emissions from the new Raw Material Calciner No. 2 were also included in baseline emission scenarios with respect to the cost effectiveness for each of the evaluated control technologies, even though SO_2 is not a Section 112(b) pollutant.

Table L-2.2: Evaluated Control Options for HF/HCl Emissions –New proposed Raw Material Calciner No.2.

Option No.	Control Technology	Control Efficiency (HF, HCl)	Control Efficiency (SO_2)
1	Wet Scrubber	98%	95%
2	Dry Lime Adsorber	92% (HF); 20% (HCl)	10%
3	Dry Scrubber (Injection System)	90%	50%
4	Pollution Prevention	N/A	N/A

Tier III - Identifying MACT

Step 6 – Identify the maximum emission reduction control technology

Option 1–Wet Scrubber

Wet scrubbing systems remove HCl and HF from exhaust streams by utilizing an alkaline reagent. Wet scrubber systems will generate wastewater and wet sludge streams requiring treatment and disposal. The use of a wet scrubber has been found to be technically feasible for the new proposed Raw Material Calciner No.2. The control efficiency of wet scrubber systems is considered to be 98 percent. [1]

Option 2 – Dry Lime Adsorber

A Dry Lime Adsorber is a single tower with Granular Limestone Packed Bed Filter/ Adsorber for adsorption of fluorine constituents (HF), sulfur oxides (SO_X), hydrogen chlorides (HCL) and dust. Normally broken Jurassic limestone (Calcium Carbonate $CaCO_3$) with a mesh size of 4mm -6 mm is used for the adsorption media. Above the adsorption cascade tower is a storage silo, which feeds a constant supply of fresh limestone by gravity. The Adsorber itself comprises of single gas tight cascades, which are connected in series. The waste gas volume and the HF loading determine the number of cascades. The waste gas is evenly distributed by the Raw Gas Hood (Inlet Cap) over all the cascades and is drawn out via the Clean Gas Hood (Outlet Cap). The patented OHLMANN system of gas filtration ensures even distribution of the flue gases through the limestone filter bed. Layer thickness and reaction time of the waste gases in the limestone is controlled according to the contaminant loading.

In order to be able to adsorb a certain quantity of contaminants a corresponding quantity of limestone is necessary. A special discharge device valve controls the cycling of this limestone quantity and the removal of saturated limestone. This system ensures that the limestone is evenly discharged over the whole filter cross section without bridging or compaction. The consumed limestone is then collected in the discharge hopper. According to vendor claims, this system provides over 90% control of HF with HCl reduced by approximately 20%.

Option 3- Dry Scrubber (Injection System)

Dry injection based dry scrubbing systems involve the injection of a dry lime or sodium based reagent into the flue gas from the Calciners. Fluorine and chlorine constituents react directly with the reagent, which is collected in a downstream particulate control device. Dry injection systems are found to be technically feasible for application to the new proposed Raw Material Calciner No.2 and typically have removal efficiencies for HF and HCl of about 90% per vendor data.

[1] Control Efficiencies as published by the EPA Cost Control Manual – Sixth Edition January 2002.

Option 4: Pollution Prevention

Continued use of raw material with minimized amounts of Fluorides and Chlorides and operating the new Raw Material Calciner at optimum temperatures is the primary mechanism available for minimizing HF and HCl emissions.

Step 7 – Conduct an impact analysis

A cost analysis has been carried out on each of the above mentioned control options in accordance with EPA issued "Guidelines for MACT Determinations under Section 112(j)

Requirements". The wet scrubber costing was derived from a vendor quote for another facility; the cost was adjusted to reflect the reduced airflow rate in the calciner. The reagent costs were adjusted according to the ratio of emissions of the two emission units. CARBO Ceramics has obtained a vendor quote for a Dry Lime Adsorber system on the Direct-fired Rotary Calciner No. 1 and it was scaled to operate on the new proposed Raw Material Calciner No.2. The costing for the injection based dry scrubbing system was derived from a vendor quote for a similar application at another facility[2]. The cost was adjusted according to the airflow rate in the calciner. The reagent costs were adjusted according to the ratio of acid gas emissions of the two emission units.

Cost effectiveness for each of these control technologies was calculated for two scenarios:

1) 112(b) pollutants (HF and HCl)
2) 112(b) pollutants (HF and HCl) and collateral SO_2 emissions

The cost effectiveness of a Wet Scrubber on the new proposed Raw Material Calciner No.2 would be approximately \$66,183/ton for Scenario 1 and approximately \$15,639/ton for Scenario 2. The cost effectiveness of a Dry Lime Adsorber on the new proposed Raw Material Calciner No.2 would be approximately \$32,452/ton for Scenario 1 and \$22,625/ton for Scenario 2. The cost effectiveness of a Dry Scrubber (Injection System) on the new proposed Raw Material Calciner No.2 would be approximately \$32,387/ton for Scenario 1 and \$12,097/ton for Scenario 2.

Carbo Ceramics proposes that it is not economically feasible to reduce HF and HCl emissions using any of the above mentioned control technologies and/or scenarios.

Table L-3.3: Control Technology Cost Effectiveness Summary

Option No.	Control Technology	Cost Effectiveness for each Direct-fired Rotary Calciner (\$/ton HAP reduced)
1	Wet Scrubber	\$66,183
2	Dry Lime Adsorber	\$32,452
3	Dry Scrubber (Injection System)	\$32,387

Step 8 – Establish the MACT emission limitation

Since there is not enough information available to compute a MACT floor, all control technologies were evaluated as possible options. Based on the case-by-case analysis, control technology options 1, 2 and 3 prove to be economically infeasible. As such, the facility proposes pollution prevention as a control measure and a MACT emission limitation for the new proposed Raw Material Calciner No. 2 of 8.28 lbs/hr for HF and 1.43 lbs/hr for HCl.

[2] Per vendor quote provided by McGill Air Clean for a Dry Injection Scubber.

Case-by-case MACT analysis – Hydrogen Chloride and Hydrogen Fluoride emissions from new proposed Raw Material Calciner No.2.

Table L-3.3: Control Technology Cost Effectiveness Summary

Option No.	Control Technology	Cost Effectiveness for each Direct-fired Rotary Calciner ($/ton HAP reduced)
1	Wet Scrubber	$66,183
2	Dry Lime Adsorber	$32,452
3	Dry Scrubber (Injection System)	$32,387

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 Raw Materials Calciner No. 2, 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 Raw Material Calciner No. 2 consists of the use of only natural gas as fuel with propane as backup and the maintenance of the performance of the production unit/source with regard to the HAP emissions at the designed level. To define the performance of the calciner 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:

- 6.26 tons of HCl and 38.27 tons of HF per year for Raw Material Calciner No. 2;

- (6.26 tons of HCl/year)(2,000 lbs/ton)/[(8,760 hours/year)(20 tons kiln feed/hour)] = 0.072 lbs HCl/ton of kiln feed; and

- (38.27 tons of HF/year)(2,000 lbs/ton)/[(8,760 hours/year)(20 tons kiln feed/hour)] = 0.437 lbs HF/ton of kiln feed.

Carbo Ceramics will be required to conduct an initial performance test on Raw Material Calciner No. 2 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 every 12 months is required to demonstrate continuous compliance with the MACT limits.

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. - McIntyre Plant

Affected Source	Pollutant	Control Technology	Proposed 112(g) Limit	Averaging Time	Compliance Method
Raw Material Calciner No. 2	HCl	Use only natural gas with propane as back-up	6.26 tons per year	N/A	Mass balance calculation based on annual testing result & production records
			0.072 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		38.27 tons per year	N/A	Mass balance calculation based on annual testing result & production records
			0.437 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 Raw Material Calciner No. 2 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 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. 3295-319-0027-V-03-2 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. 18304 revised on February 15, 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. 3295-319-0027-V-03-2

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

Contents Include:

1. PSD Permit Application No. 18304 revised on February 15, 2009
2. Additional Information Package Dated August 14, 2009

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