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# CARBO Ceramics PSD Permit Application-Millen, GA Facility

## Volume I

**Application Narrative**

## August 2011

**Prepared by**


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# I.0 EXECUTIVE SUMMARY

CARBO Ceramics is proposing to construct and operate a kaolin clay processing plant located near the City of Millen (the Millen facility) in Jenkins County, which is classified as an "attainment area" for $PM_{2.5}$, $PM_{10}$, $SO_2$, $NO_x$, CO, and Ozone (as VOCs). The new plant CARBO is proposing to construct and operate will consist of four processing lines (Processing Lines 1, 2, 3, and 4), and will be considered a new major source in and of itself (potential emissions greater than 250 tpy) with respect to the Prevention of Significant Deterioration (PSD) program for nitrogen oxides ($NO_x$), carbon monoxide (CO), sulfur dioxide ($SO_2$), and particulate matter (PM). Therefore, the new facility will undergo a PSD review for these pollutants as implemented per Georgia Rule 391-3-1-.02(7). Additionally, the facility-wide potential VOC emissions will be greater than 40 tpy, potential $PM_{10}$ emissions will be greater than 15 tpy, and potential $PM_{2.5}$ emissions will be greater than 10 tpy. Therefore, Processing Lines 1 through 4 will undergo PSD review for VOC, $PM_{10}$, and $PM_{2.5}$, as the potential emissions for these pollutants are above their respective major modification significance thresholds. Also, as the new facility will be constructed after January 2, 2011, will be a major PSD source for criteria pollutants, and has potential Greenhouse Gas (GHG) emissions above 75,000 tpy $CO_2e$, the facility will undergo a PSD review for GHG as Georgia Rule 391-3-1-.02(7) has recently been revised to incorporate US EPA's GHG "Tailoring Rule".

The Millen facility will constitute the construction of a new major source of Hazardous Air Pollutant (HAP) emissions, as potential emissions of hydrogen chloride (HCl), hydrogen fluoride (HF), and methanol from these four process lines are greater than 10 tons per year, each. As such, CARBO has prepared this PSD review with respect to the construction and operation of the new facility consisting of Processing Lines 1, 2, 3, and 4, to include a case-by-case Maximum Achievable Control Technology (MACT) determination pursuant to Section 112(g)(2)(B) of the Clean Air Act. Additionally, the facility will be a major source with respect to the Title V Permitting Program, and as such, a Part 70 operating permit application will be submitted within twelve months after the commencement of operation of the facility.

## I.1 Overall Facility / Site Description

CARBO Ceramics is proposing to construct and operate four kaolin clay processing lines to be located near Millen, Georgia in Jenkins County, which is an "attainment area" for $PM_{2.5}$, $PM_{10}$, $SO_2$, $NO_x$, CO and Ozone (as VOCs). Attachment C to this Volume provides a vicinity site location map which includes the surrounding area as well as layout maps. The center of the site is located at a latitude of 32º 45' 52.15"N, and a longitude of 81º 53' 58.12"W (NAD83 datum).

The Millen facility will manufacture proppants using kaolin clay. Proppants are formed in Spray Dryers where excess water is driven off and then processed through a Direct-fired Rotary Calciner where chemically bound water is removed. Each processing line consists of two spray dryers, one direct-fired rotary calciner, and other associated equipment such as conveyors, screens, bucket elevators, process bins, and loading operations.

## I.2 Description of New Facility

The proposed new Millen facility will include Processing Lines 1, 2, 3, and 4. As such, the facility will include the following emission units:

**Table I.2-1: Millen Facility Emission Units**

| Emission Unit ID No. | Emission Unit Description |
|---|---|
| GP01 – GP04 | Kaolin Clay Feed Systems |
| SD01 – SD08 | Spray Dryers |
| KAE1 – KAE4 | Calciner Feed Systems |
| KLN1 – KLN4 | Direct-Fired Rotary Calciners |
| BS01 – BS16 | Product Storage Silos |
| RRL1 | Railcar Loading Operations |
| RRL2 | |
| BLR1 – BLR4 | Boilers |
| EDG1 – EDG4 | Emergency Generators |

## I.3 Emissions Summary Table

Table I.3-1 and Table I.3-2 below summarize the facility wide potential emissions with respect to Processing Lines 1, 2, 3, and 4. This new facility will have potential $NO_x$, $SO_2$, CO, and PM emissions each above 250 tpy. Therefore, the new facility triggers PSD review for these pollutants. Additionally, facility-wide potential VOC emissions are above 40 tpy, potential $PM_{10}$ emissions are above 15 tpy, and potential $PM_{2.5}$ emissions are above 10 tpy. Therefore, the new facility will undergo PSD review for these pollutants. As potential greenhouse gas (GHG) emissions are above 75,000 tpy $CO_2e$, as shown in Table I.3-1, the facility will undergo PSD review for GHG.

**Table I.3-1: Potential Emissions, NSR Pollutants**

| Line No. | Emission Unit ID Nos. | Emission Unit Descriptions | $NO_x$ (tpy) | $SO_2$ (tpy) | $H_2SO_4$ (tpy)[4] | CO (tpy) | PM/ $PM_{10}$ (tpy)[2] | $PM_{2.5}$ (tpy) | VOC (tpy)[5] | Fluoride (tpy)[1] | GHG (tpy $CO_2e$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SD01 | Spray Dryer No. 1 | 36.4 | 2.19 | ---- | 72.7 | 19.9 | 7.45 | 13.64 | --- | 28,760 |
| | SD02 | Spray Dryer No. 2 | 36.4 | 2.19 | ----- | 72.7 | 19.9 | 7.45 | | --- | 28,760 |
| | KLN1 | Calciner No. 1 | 530.0 | 150.0 | 1.71 | 108.2 | 12.1 | 12.1 | 2.30 | <0.7 | 36,715 |
| | BLR1 | Boiler 1 | 0.613 | 0.025 | ---- | 3.53 | 0.328 | 0.328 | 0.375 | --- | 5,997 |
| | EDG1 | Emergency Generator No. 1 | 8.09 | 0.008 | ---- | 4.38 | 0.093 | 0.093 | 0.413 | --- | 844 |
| | --- | Material Storage and Handling Units | --- | --- | ---- | --- | 9.20 | 4.60 | --- | --- | --- |
| 2 | SD03 | Spray Dryer No. 3 | 36.4 | 2.19 | ---- | 72.7 | 19.9 | 7.45 | 13.64 | --- | 28,760 |
| | SD04 | Spray Dryer No. 4 | 36.4 | 2.19 | ----- | 72.7 | 19.9 | 7.45 | | --- | 28,760 |
| | KLN2 | Calciner No. 2 | 530.0 | 150.0 | 1.71 | 108.2 | 12.1 | 12.1 | 2.30 | <0.7 | 36,715 |
| | BLR2 | Boiler 2 | 0.613 | 0.025 | ---- | 3.53 | 0.328 | 0.328 | 0.375 | --- | 5,997 |
| | EDG2 | Emergency Generator No. 2 | 8.09 | 0.008 | ---- | 4.38 | 0.093 | 0.093 | 0.413 | --- | 844 |
| | --- | Material Storage and Handling Units | --- | --- | ---- | --- | 9.20 | 4.60 | --- | --- | --- |
| 3 | SD05 | Spray Dryer No. 5 | 36.4 | 2.19 | ---- | 72.7 | 19.9 | 7.45 | 13.64 | --- | 28,760 |
| | SD06 | Spray Dryer No. 6 | 36.4 | 2.19 | ----- | 72.7 | 19.9 | 7.45 | | --- | 28,760 |
| | KLN3 | Calciner No. 3 | 530.0 | 150.0 | 1.71 | 108.2 | 12.1 | 12.1 | 2.30 | <0.7 | 36,715 |
| | BLR3 | Boiler 3 | 0.613 | 0.025 | ---- | 3.53 | 0.328 | 0.328 | 0.375 | --- | 5,997 |
| | EDG3 | Emergency Generator No. 3 | 8.09 | 0.008 | ---- | 4.38 | 0.093 | 0.093 | 0.413 | --- | 844 |
| | --- | Material Storage and Handling Units | --- | --- | ---- | --- | 9.20 | 4.60 | --- | --- | --- |
| 4 | SD07 | Spray Dryer No. 7 | 36.4 | 2.19 | ---- | 72.7 | 19.9 | 7.45 | 13.64 | --- | 28,760 |
| | SD08 | Spray Dryer No. 8 | 36.4 | 2.19 | ----- | 72.7 | 19.9 | 7.45 | | --- | 28,760 |
| | KLN4 | Calciner No. 4 | 530.0 | 150.0 | 1.71 | 108.2 | 12.1 | 12.1 | 2.30 | <0.7 | 36,715 |
| | BLR4 | Boiler 4 | 0.613 | 0.025 | ---- | 3.53 | 0.328 | 0.328 | 0.375 | --- | 5,997 |
| | EDG4 | Emergency Generator No. 4 | 8.09 | 0.008 | ---- | 4.38 | 0.093 | 0.093 | 0.413 | --- | 844 |
| | --- | Material Storage and Handling Units | --- | --- | ---- | --- | 9.20 | 4.60 | --- | --- | --- |
| 1-4 | RRL1 | Railcar Loading Operations | --- | --- | ---- | --- | 1.31 | 0.657 | --- | --- | --- |
| | RRL2 | | --- | --- | ---- | --- | 1.31 | 0.657 | --- | --- | --- |
| | | **Facility-wide Emissions**[4] | **2,446** | **618** | **6.83** | **1,046** | **249** | **129** | **66.9** | **<3.0** | **404,304** |
| | | PSD Major Source Thresholds/ PSD Significance Thresholds[3] | 250/ 40 | 250/ 40 | 250/ 7 | 250/ 100 | 250/ 25 | 250/ 10 | 250/ 40 | 250/ 3.0 | 100,000/ 75,000 |
| | | PSD Triggered? (Y/N) | Y | Y | N | Y | Y | Y | Y | N | Y |

[1]See Section 5.2 for detailed explanation of fluoride emissions
[2] Includes $PM_{10}$ and $PM_{2.5}$
[3] As the facility is a major source for a single pollutant, all other pollutants are subject to PSD review if they exceed the applicable significance threshold
[4] See Attachment B for detailed emission calculations and assumptions
[5] Includes VOC from fuel combustion plus process-related methanol emissions

**Table I.3-2: Potential Emissions, Hazardous Air Pollutants (HAPs)**

| Line No. | Emission Unit ID Nos. | Emission Unit Descriptions | Potential Combined HAP (tpy) | Potential Methanol (tpy) | Potential HCl (tpy) | Potential HF (tpy) | Potential Hexane (tpy) |
|---|---|---|---|---|---|---|---|
| 1 | SD01 | Spray Dryer No. 1 | 10.8 | 10.04 | --- | --- | 0.727 |
| | SD02 | Spray Dryer No. 2 | | | | | |
| | KLN1 | Calciner No. 1 | 47.1 | --- | 8.70 | 37.9 | 0.464 |
| | BLR1 | Boiler No. 1 | 0.079 | --- | --- | --- | 0.076 |
| | EDG1 | Emergency Generator No. 1 | 0.022 | --- | --- | --- | --- |
| 2 | SD03 | Spray Dryer No. 3 | 10.8 | 10.04 | --- | --- | 0.727 |
| | SD04 | Spray Dryer No. 4 | | | | | |
| | KLN2 | Calciner No. 2 | 47.1 | --- | 8.70 | 37.9 | 0.464 |
| | BLR2 | Boiler No. 2 | 0.079 | --- | --- | --- | 0.076 |
| | EDG2 | Emergency Generator No. 2 | 0.022 | --- | --- | --- | --- |
| 3 | SD05 | Spray Dryer No. 5 | 10.8 | 10.04 | --- | --- | 0.727 |
| | SD06 | Spray Dryer No. 6 | | | | | |
| | KLN3 | Calciner No. 3 | 47.1 | --- | 8.70 | 37.9 | 0.464 |
| | BLR3 | Boiler No. 3 | 0.079 | --- | --- | --- | 0.076 |
| | EDG3 | Emergency Generator No. 3 | 0.022 | --- | --- | --- | --- |
| 4 | SD07 | Spray Dryer No. 7 | 10.8 | 10.04 | --- | --- | 0.727 |
| | SD08 | Spray Dryer No. 8 | | | | | |
| | KLN4 | Calciner No. 4 | 47.1 | --- | 8.70 | 37.9 | 0.464 |
| | BLR4 | Boiler No. 4 | 0.079 | --- | --- | --- | 0.076 |
| | EDG4 | Emergency Generator No. 4 | 0.022 | --- | --- | --- | --- |
| **Facility-wide Emissions[1, 2]** | | | **232** | **40.2** | **34.8** | **152** | **5.06** |
| Section 112(g) Applicability Threshold | | | 25 | 10 | 10 | 10 | 10 |
| Section 112(g)(2)(B) Review Triggered?[3] (Y/N) | | | Y | Y | Y | Y | Y |

[1] HAP emissions are included as the facility will undergo a Section 112(g) case-by-case MACT review.
[2] See Attachment B for detailed emission calculations and assumptions.
[3] Section 112(g)(2)(B) review is triggered for all HAPs when review is triggered for a single HAP.

## I.4 BACT Summary

A summary of the proposed BACT for each NSR pollutant emitted in a significant amount is provided below in Table I.4-1.

**Table I.4-1: BACT Determinations**

| NSR Pollutant | Process | Emission Unit ID Nos. | Proposed BACT |
|---|---|---|---|
| $NO_x$ | Direct-fired Rotary Calciner Nos. 1 – 4 | KLN1 – KLN4 | The use of Low $NO_x$ process technology with a $NO_x$ emission limit of 121 lbs/hr, each |
| | Spray Dryer Nos. 1 – 8 | SD01 – SD08 | The use of Good Combustion Techniques with a $NO_x$ emission limit of 8.3 lbs/hr, each |
| | Gas Fired Boiler Nos. 1 – 4 | BLR1 – BLR4 | The use of Ultra-low $NO_x$ Burners to limit $NO_x$ emissions to 12ppm @ 3% $O_2$, each |
| | Emergency Generator Nos. 1 – 4 | EDG1 – EDG4 | The use of Good Combustion Techniques to control $NO_x$ emissions to 4.77 g/bhp-hr and a limit of 500 operating hours per year, each |
| CO | Direct-fired Rotary Calciner Nos. 1 – 4 | KLN1 – KLN4 | The use of Good Combustion Techniques with a CO emission limit of 24.7 lbs/hr, each |
| | Spray Dryer Nos. 1 – 8 | SD01 – SD08 | The use of Good Combustion Techniques with a CO emission limit of 16.6 lbs/hr, each |
| | Gas Fired Boiler Nos. 1 – 4 | BLR1 – BLR4 | The use of Good Combustion Techniques |
| | Emergency Generator Nos. 1 – 4 | EDG1 – EDG4 | The use of Good Combustion Techniques with a CO emission limit of 2.6 g/bhp-hr and a limit of 500 operating hours per year, each |
| $SO_2$ | Direct-fired Rotary Calciner Nos. 1 – 4 | KLN1 – KLN4 | Exclusive use of Natural Gas or Propane as fuel and the use of a wet scrubber as an add-on control device to limit emissions to 34.25 lbs/hr, each |
| | Spray Dryer Nos. 1 – 8 | SD01 – SD08 | Exclusive use of natural gas or propane as fuel |
| | Gas Fired Boiler Nos. 1 – 4 | BLR1 – BLR4 | Exclusive use of natural gas or propane as fuel |
| | Emergency Generator Nos. 1 – 4 | EDG1 – EDG4 | Limit sulfur in fuel to 15 ppm and a limit of 500 operating hours per year, each. |
| PM/ $PM_{10}$ | Direct-fired Rotary Calciner Nos. 1 – 4 | KLN1 – KLN4 | The use of a high efficiency baghouse with a PM/$PM_{10}$ emissions limit of 0.01 gr/dscf, each |
| | Spray Dryer Nos. 1 – 8 | SD01 – SD08 | The use of a high efficiency baghouse with a PM/$PM_{10}$ emissions limit of 0.02 gr/dscf, each |
| | Material Storage and Handling Systems | See Table 3.3-1 | The use of a high efficiency baghouse with a PM/$PM_{10}$ emissions limit of 0.01 gr/dscf, each |
| | Gas Fired Boiler Nos. 1 – 4 | BLR1 – BLR4 | Exclusive use of natural gas or propane as fuel |
| | Emergency Generator Nos. 1 – 4 | EDG1 – EDG4 | Exclusive use of diesel as fuel with a PM/$PM_{10}$ emission limit of 0.055 g/bhp-hr and a limit of 500 operating hours per year, each. |

**Table I.4-1: Summary of Proposed BACT by NSR Pollutant (Continued)**

| NSR Pollu-tant | Process | Emission Unit ID Nos. | Proposed BACT |
|---|---|---|---|
| $PM_{2.5}$ | Direct-fired Rotary Calciner Nos. 1 – 4 | KLN1 – KLN4 | The use of a high efficiency baghouse with a $PM_{2.5}$ emissions limit of 0.01 gr/dscf, each |
| | Spray Dryer Nos. 1 – 8 | SD01 - SD08 | The use of a high efficiency baghouse with a $PM_{2.5}$ emissions limit of 0.0075 gr/dscf, each |
| | Material Storage and Handling Systems | See Table 3.3-1 | The use of a high efficiency baghouse with a $PM_{2.5}$ emissions limit of 0.005 gr/dscf, each |
| | Gas Fired Boiler Nos. 1 – 4 | BLR1 – BLR4 | Exclusive use of natural gas or propane as fuel |
| | Emergency Generator Nos. 1 – 4 | EDG1 – EDG4 | Exclusive use of diesel as fuel with a $PM_{2.5}$ emission limit of 0.055 g/bhp-hr and a limit of 500 operating hours per year each. |
| VOC | Direct-fired Rotary Calciner Nos. 1 – 4 | KLN1 – KLN4 | The use of good combustion techniques and dedicated use of natural gas and propane as fuels |
| | Spray Dryer Nos. 1 – 8 | SD01 – SD08 | Pollution Prevention with a VOC emission limit of 13.64 tons per twelve-month rolling total period per line (spray dryer pair) |
| | Gas Fired Boiler Nos. 1 – 4 | BLR1 – BLR4 | The use of Good Combustion Techniques and dedicated use of natural gas and propane as fuels |
| | Emergency Generator Nos. 1 – 4 | EDG1 – EDG4 | The use of Good Combustion Techniques with a maximum 500 hours of operation per year each. |
| GHG | Direct-fired Rotary Calciner Nos. 1 – 4 | KLN1 – KLN4 | Limiting GHG emissions to 36,715 tpy $CO_2e$ through the use of the following technologies and practices:<br>○ Reject Heat Recovery<br>○ Good Combustion Practices<br>○ Efficient Process (Calciner) Design and Optimization |
| | Spray Dryer Nos. 1 – 8 | SD01 – SD08 | Limiting GHG emissions to 28,760 tpy $CO_2e$ through the use of the following technologies and practices:<br>○ Good Combustion Practices<br>○ Efficient Process (Dryer) Design and Optimization |
| | Gas Fired Boiler Nos. 1 – 4 | BLR1 – BLR4 | Limiting GHG emissions to 5,997 tpy $CO_2e$ through the use of the following technologies and practices:<br>○ Exclusive use of natural gas and LPG as fuels.<br>○ Insulation of boiler heated surfaces |
| | Emergency Generator Nos. 1 – 4 | EDG1 –EDG4 | Limiting GHG emissions to 844 tpy $CO_2e$ through the use of the following technologies and practices:<br>○ Efficient Design and Operational Practices<br>○ Good Maintenance Practices<br>○ Operation limit of 500 hours per year each |

Table I.4-2 below summarizes the BACT analysis and modeling emission rates. The table shows the BACT baseline, averaging period, and emission limit used to determine cost effectiveness in each analysis, as well as a basis for why each limit was chosen. Additionally, modeled emission rates and averaging periods are also shown, along with comments regarding the basis of the values.

**Table I.4-2: BACT Analysis and Dispersion Modeling Emission Rate Summary**

| | | BACT Emission Analysis | | | | | Modeled Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Unit[1]** | **Emission Unit ID Nos.** | **Baseline Emissions Used in Cost Effectiveness Analysis (lbs/hr)** | **Baseline Emissions Used in Cost Effectiveness Analysis (tpy)** | **Justification of Baseline Emissions Used in Cost Effectiveness** | **BACT Limit (averaging period)** | **BACT Technology** | **Hourly (lbs/hr)** | **3-Hour Average (lbs/ 3-hr)** | **8-Hour Average (lbs/ 8-hr)** | **Daily Average (lbs/ 24-hr)** | **Annual Average (tpy)** | **Comments** |
| **$NO_x$** | | | | | | | | | | | | |
| Direct-Fired Rotary Calciner Nos. 1 – 4 | KLN1-KLN4 | 121 | 530 | Based on engineering testing conducted from 2006-2010 at the Toomsboro facility and dispersion modeling impact analyses | 121 lbs/hr | Low $NO_x$ Technology | 121 | | | | 530 | |
| Spray Dryer Nos. 1 – 8 | SD01-SD08 | 8.30 | 36.4 | Based on engineering testing conducted from 2006-2010 at the Toomsboro facility and dispersion modeling impact analyses | 8.3 lbs/hr | Good Combustion Techniques | 8.3 | | | | 36.4 | |
| Gas-Fired Boiler Nos. 1 – 4 | BLR1-BLR4 | 0.140 | 0.613 | Based on engineering testing and dispersion modeling impact analyses | 12 ppm @ 3% $O_2$ | Ultra-low $NO_x$ Burners | 0.140 | | | | 0.613 | |
| Emergency Generator Nos. 1 – 4 | EDG1-EDG4 | 32.4 | 8.09 | Based on New Source Performance Standard (NSPS) requirements of 40 CFR 60, Subpart IIII emission standards for stationary compression-ignition engines | 4.77 g/bhp-hr<br>500 hr/yr operation | Good Combustion Techniques | 32.4 | | | | 8.04 | Based on 500 annual operating hours |
| **CO** | | | | | | | | | | | | |
| Direct-Fired Rotary Calciner Nos. 1 – 4 | KLN1-KLN4 | 24.7 | 108 | Based on engineering testing conducted from 2006-2010 at the Toomsboro facility and dispersion modeling impact analyses | 24.7 lbs/hr | Good Combustion Techniques | 24.7 | | 198 | | | |
| Spray Dryer Nos. 1 – 8 | SD01-SD08 | 16.6 | 72.7 | Based on engineering testing conducted from 2006-2010 at the Toomsboro facility and dispersion modeling impact analyses | 16.6 lb/hr | Good Combustion Techniques | 16.6 | | 133 | | | |
| Gas-Fired Boiler Nos. 1 – 4 | BLR1-BLR4 | 0.803 | 3.52 | Based on AP-42 factors and dispersion modeling impact analyses | N/A | Good Combustion Techniques | 0.803 | | 6.42 | | | |
| Emergency Generator Nos. 1 – 4 | EDG1-EDG4 | 17.5 | 4.38 | Based on EPA Tier II Standards and dispersion modeling impact analyses | 2.6 g/bhp-hr<br>500 hr/yr operation | Good Combustion Techniques | 17.5 | | 140 | | | Based on 500 annual operating hours |
| **$SO_2$** | | | | | | | | | | | | |
| Direct-Fired Rotary Calciner Nos. 1 – 4 | KLN1-KLN4 | No Economic Analysis Performed | | | 34.25 lb/hr | Exclusive use of natural gas or propane as fuel, and the use of a Wet Scrubber | 34.25 | 103 | | 822 | 150 | |
| Spray Dryer Nos. 1 – 8 | SD01-SD08 | 0.50 | 2.19 | Based on engineering testing conducted from 2006-2010 at the Toomsboro facility and dispersion modeling impact analyses | N/A | Exclusive use of natural gas or propane as fuel | 0.500 | 1.50 | | 12.0 | 2.19 | |
| Gas-Fired Boiler Nos. 1 – 4 | BLR1-BLR4 | 0.006 | 0.025 | Based on AP-42 emission factors for natural gas | N/A | Exclusive use of natural gas or propane as fuel | 0.010 | 0.030 | | 0.240 | 0.025 | |
| Emergency Generator Nos. 1 – 4 | EDG1-EDG4 | 0.03 | 0.008 | Based on the exclusive use of Ultra-Low Sulfur Diesel fuel (ULSD) with a maximum sulfur content of 15 ppm (0.0015%) | 0.0015 wt % S<br>500 hr/yr operation | Exclusive use of low-sulfur diesel | 0.03 | 0.09 | | 0.72 | 0.01 | Based on 500 annual operating hours |

[1] Values are per individual emission unit, not per total emission unit group

**Table I.4-2: BACT Analysis and Dispersion Modeling Emission Rate Summary (continued)**

| | | BACT Emission Analysis | | | | | Modeled Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emission Unit[1] | Emission Unit ID Nos. | Baseline Emissions Used in Cost Effectiveness Analysis (lbs/hr) | Baseline Emissions Used in Cost Effectiveness Analysis (tpy) | Justification of Baseline Emissions Used in Cost Effectiveness | BACT Limit (averaging period) | BACT Technology | Hourly (lbs/hr) | 3-Hour Average (lbs/ 3-hr) | 8-Hour Average (lbs/ 8-hr) | Daily Average (lbs/ 24-hr) | Annual Average (tpy) | Comments |
| **PM / $PM_{10}$** | | | | | | | | | | | | |
| Direct-Fired Rotary Calciner Nos. 1 – 4 | KLN1-KLN4 | No Economic Analysis Performed | | | 0.01 gr/dscf | High Efficiency Baghouse | 2.76 | | | 66.2 | 12.1 | As determined based on a dispersion modeling analysis and engineering testing |
| Spray Dryer Nos. 1 – 8 | SD01-SD08 | | | | 0.02 gr/dscf | High Efficiency Baghouse | 4.54 | | | 109 | 19.9 | |
| Gas-Fired Boiler Nos. 1 – 4 | BLR1-BLR4 | | | | N/A | Exclusive use of natural gas or propane as fuel | 0.075 | | | 1.80 | 0.328 | |
| Emergency Generator Nos. 1 – 4 | EDG1-EDG4 | | | | 0.055 g/bhp-hr 500 hr/yr operation | Exclusive use of diesel as fuel | 0.371 | | | 8.89 | 0.093 | |
| Pellet Feed System Nos. 1 – 4 | GP01-GP04 | | | | 0.01 gr/dscf | High Efficiency Baghouse | 1.63 | | | 39.1 | 7.14 | |
| Calciner Feed System Nos. 1 – 4 | KAE1-KAE4 | | | | | | 0.130 | | | 3.12 | 0.569 | |
| 16 Product Storage Silos | BS01-BS16 | | | | | | 0.090 | | | 2.16 | 0.394 | |
| Railcar Loading Operations | RRL1-RRL2 | | | | | | 0.210 | | | 5.14 | 0.920 | |
| **$PM_{2.5}$** | | | | | | | | | | | | |
| Direct-Fired Rotary Calciner Nos. 1 – 4 | KLN1-KLN4 | No Economic Analysis Performed | | | 0.010 gr/dscf | High Efficiency Baghouse | 1.24 | | | 29.8 | 5.43 | As determined based on a dispersion modeling analysis and engineering testing |
| Spray Dryer Nos. 1 – 8 | SD01-SD08 | | | | 0.0075 gr/dscf | High Efficiency Baghouse | 1.25 | | | 30.0 | 5.48 | |
| Gas – Fired Boiler Nos. 1 – 4 | BLR1-BLR4 | | | | N/A | Exclusive use of natural gas or propane as fuel | 0.075 | | | 1.80 | 0.328 | |
| Emergency Generator Nos. 1 – 4 | EDG1-EDG4 | | | | 0.055 g/bhp-hr 500 hr/yr operation | Exclusive use of diesel as fuel | 0.371 | | | 8.89 | 0.093 | |
| Pellet Feed System Nos. 1 – 4 | GP01-GP04 | | | | 0.005 gr/dscf | High Efficiency Baghouse | 0.450 | | | 10.8 | 1.97 | |
| Calciner Feed System Nos. 1 – 4 | KAE1-KAE4 | | | | | | 0.020 | | | 0.48 | 0.088 | |
| 16 Product Storage Silos | BS01-BS16 | | | | | | 0.010 | | | 0.24 | 0.044 | |
| Railcar Loading Operations | RRL1-RLL2 | | | | | | 0.020 | | | 0.48 | 0.088 | |

[1] Values are per individual emission unit, not per total emission unit group

**Table I.4-2: BACT Analysis and Dispersion Modeling Emission Rate Summary (continued)**

| | | BACT Emission Analysis | | | | | Modeled Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Unit[1]** | **Emission Unit ID Nos.** | **Baseline Emissions Used in Cost Effectiveness Analysis (lbs/hr)** | **Baseline Emissions Used in Cost Effectiveness Analysis (tpy)** | **Justification of Baseline Emissions Used in Cost Effectiveness** | **BACT Limit (averaging period)** | **BACT Technology** | **Hourly (lbs/hr)** | **3-Hour Average (lbs/ 3-hr)** | **8-Hour Average (lbs/ 8-hr)** | **Daily Average (lbs/ 24-hr)** | **Annual Average (tpy)** | **Comments** |
| **Ozone (VOCs)** | | | | | | | | | | | | |
| Direct-Fired Rotary Calciner Nos. 1 – 4 | KLN1-KLN4 | 0.525 | 2.30 | Based on rated heat input and AP-42 emission factors, and limited engineering testing | N/A | Good Combustion Techniques and exclusive use of natural gas and propane as fuel | No modeling performed for VOCs | | | | | |
| Spray Dryer Nos. 1 – 8 | SD01-SD08 | 3.11 (per line) | 13.64 (per line) | VOC emissions from methanol and fuel combustion. Methanol emissions per line based on a facility-wide adsorbate usage of 5,500 lbs/day composed of 1% methanol. Fuel combustion emissions, based on rated heat input and AP-42 emission factors, and limited engineering testing | VOC emission limit of 13.64 tons per twelve-month rolling total period for Spray Dryer Nos. 1 and 2, combined.<br>VOC emission limit of 13.64 tons per twelve-month rolling total period for Spray Dryer Nos. 3 and 4, combined.<br>VOC emission limit of 13.64 tons per twelve-month rolling total period for Spray Dryer Nos. 5 and 6, combined.<br>VOC emission limit of 13.64 tons per twelve-month rolling total period for Spray Dryer Nos. 7 and 8, combined. | Pollution Prevention | | | | | | |
| Gas-Fired Boiler Nos. 1 – 4 | BLR1-BLR4 | 0.086 | 0.375 | Based on rated heat input and AP-42 emission factors | N/A | Good Combustion Techniques and exclusive use of natural gas and propane as fuel | | | | | | |
| Emergency Generator Nos. 1 – 4 | EDG1-EDG4 | 1.65 | 0.413 | Based on rated heat input and AP-42 emission factors | 500 hr/yr operation | Good Combustion Techniques and exclusive use of diesel as fuel | | | | | | |

[1] Values are per individual emission unit, not per total emission unit group

**Table I.4-2: BACT Analysis and Dispersion Modeling Emission Rate Summary (continued)**

| | | BACT Emission Analysis | | | | | Modeled Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emission Unit[1] | Emission Unit ID Nos. | Baseline Emissions Used in Cost Effectiveness Analysis (lbs/hr) | Baseline Emissions Used in Cost Effectiveness Analysis (tpy) | Justification of Baseline Emissions Used in Cost Effectiveness | BACT Limit (averaging period) | BACT Technology | Hourly (lbs/hr) | 3-Hour Average (lbs/ 3-hr) | 8-Hour Average (lbs/ 8-hr) | Daily Average (lbs/ 24-hr) | Annual Average (tpy) | Comments |
| **Greenhouse Gases (as $CO_2e$)** | | | | | | | | | | | | |
| Direct-Fired Rotary Calciner Nos. 1 – 4 | KLN1-KLN4 | No Economic Analysis Performed | | | GHG emission limit of 36,715 tpy $CO_2e$ | Reject Heat Recovery, Efficient Process Design and Optimization, and Good Combustion Practices | No modeling performed for GHGs | | | | | |
| Spray Dryer Nos. 1 – 8 | SD01-SD08 | | | | GHG emission limit of 28,760 tpy $CO_2e$ | Efficient Process Design and Optimization, and Good Combustion Practices | | | | | | |
| Gas-Fired Boiler Nos. 1 – 4 | BLR1-BLR4 | | | | GHG emission limit of 5,997 tpy $CO_2e$ | Exclusive use of natural gas and LPG as fuels, Insulation of boiler heated surfaces | | | | | | |
| Emergency Generator Nos. 1 – 4 | EDG1-EDG4 | | | | GHG emission limit of 844 tpy $CO_2e$; 500 operating hours per year | Efficient Design and Operational Practices, Good Maintenance Practices, and a limit hours of operation to 500 hours per year each. | | | | | | |

[1] Values are per individual emission unit, not per total emission unit group

### I.5 112(g)(2)(B) Case-by-Case MACT Review Summary

Table I.5-1 below summarizes the Section 112(g) analysis as implemented by 40 CFR 63.40 through 63.44 (Subpart B) which has been adopted by reference per Georgia Rule 391-3-1-.02(9)(b)16. Modeled emission rates demonstrating compliance with Georgia Toxics Guidelines are specified below. The table below shows the MACT baseline used in cost effectiveness calculations, averaging period, and emission limit representing MACT, as well as a basis for why each limit was chosen. Additionally, modeled emission rates and averaging periods are also shown, along with comments regarding the basis of the values. The detailed case-by-case MACT review is contained in Attachment D of this volume.

**Table I.5-1: CAA §112(g) Analysis and Dispersion Modeling Emission Rate Summary**

| | | MACT Emission Analysis | | | | | Modeled Emission Rates | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Unit[1]** | **Emission Unit ID Nos.** | **Baseline Emissions Used in Cost Effectiveness Analysis (lbs/hr)** | **Baseline Emissions Used in Cost Effectiveness Analysis (tpy)** | **Justification of Baseline Emissions Used in Cost Effectiveness** | **112(g) Limit (averaging period)** | **MACT Technology** | **Hourly (lbs/hr)** | **3-Hour Average (lbs/ 3-hr)** | **8-Hour Average (lbs/ 8-hr)** | **Daily Average (lbs/ 24-hr)** | **Annual Average (tpy)** | **Comments** |
| **Hydrogen Chloride (HCl)** | | | | | | | | | | | | |
| Direct-Fired Rotary Calciner Nos. 1 – 4 | KLN1-KLN4 | 1.98 | 8.70 | CARBO engineering estimates | 1.98 lbs/hour (each calciner) 8.7 tpy (each calciner) | Wet Scrubber | N/A | N/A | N/A | 47.52 | N/A | Modeling performed for Georgia Toxics Guidelines |
| **Hydrogen Fluoride (HF)** | | | | | | | | | | | | |
| Direct-Fired Rotary Calciner Nos. 1 – 4 | KLN1-KLN4 | 8.70 | 37.9 | CARBO engineering estimates | 8.70 lbs/hour (each calciner) 37.92 tpy (each calciner) | Wet Scrubber | N/A | N/A | N/A | N/A | 37.92 | Modeling performed for Georgia Toxics Guidelines |
| **Methanol** | | | | | | | | | | | | |
| Spray Dryer Nos. 1 – 8 | SD01-SD08 | 2.29 | 10.04 | Mass balance basis | 10.04 tpy (SD01 and SD02, combined) | Pollution Prevention | N/A | N/A | N/A | 54.96 | N/A | Modeling performed for Georgia Toxics Guidelines |
| | | 2.29 | 10.04 | Mass balance basis | 10.04 tpy (SD03 and SD04, combined | Pollution Prevention | N/A | N/A | N/A | 54.96 | N/A | Modeling performed for Georgia Toxics Guidelines |
| | | 2.29 | 10.04 | Mass balance basis | 10.04 tpy (SD05 and SD06, combined | Pollution Prevention | N/A | N/A | N/A | 54.96 | N/A | Modeling performed for Georgia Toxics Guidelines |
| | | 2.29 | 10.04 | Mass balance basis | 10.04 tpy (SD07 and SD08, combined | Pollution Prevention | N/A | N/A | N/A | 54.96 | N/A | Modeling performed for Georgia Toxics Guidelines |
| **Hazardous Air Pollutants (HAP)** | | | | | | | | | | | | |
| Boiler Nos. 1-4 | BLR1-BLR4 | 0.018 (combined HAP) 0.017 (Hexane) | 0.079 (combined HAP) 0.076 (Hexane) | AP-42 Emission Factors (lb/MMBtu) | N/A | Biennial tune-ups conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule. | N/A | N/A | N/A | N/A | 0.076 (Hexane) | Modeling performed for Georgia Toxics Guidelines for Hexane |

## I.6 Air Quality Modeling Summary

As part of this PSD application, comprehensive air quality dispersion modeling was conducted for the Millen facility to evaluate compliance with the National Ambient Air Quality Standards (NAAQS), Class I and II PSD increments, thresholds for concern for visibility impairment and acidic deposition at Class I areas, and Georgia's acceptable ambient concentrations for toxic air pollutants. As a result of the analysis, the Millen facility will not cause or contribute to a violation in any area for any NAAQS or PSD increment effective at the time of this application, will not have an adverse impact to any air quality related value (AQRV) in any Class I area, and will not have an air quality impact for any toxic air pollutant in excess of the levels defined by GA EPD to protect the public's health, safety, and welfare. The detailed air quality analysis is contained in Volume III of this PSD application.

## I.7 Additional Impact Analysis

Volume III of this PSD application also contains the additional impacts analysis required to estimate the adverse impacts to soils, vegetation, and visibility that would occur as a result of the facility's construction and operation. Based upon the results of the analysis, the Millen facility will have no adverse impact to soils or vegetation or impair visibility at any sensitive Class II receptor as a result of emissions from the facility and associated growth.

# 1.0 INTRODUCTION

CARBO Ceramics is proposing to construct and operate a kaolin clay processing plant to be located near the City of Millen in Jenkins County, which is classified as "attainment" for $PM_{10}$/$PM_{2.5}$, $SO_2$, $NO_x$, CO, and Ozone (as VOCs). The new facility will consist of four processing lines (Processing Lines 1 through 4).

PSD review requirements apply for any new source contained in one of 28 specific source categories [as defined per 40 CFR 52.21(b)(1)(i)(a)] having potential emissions of 100 tons/year or more of any NSR pollutant, and for all other new sources having potential emissions of 250 tons/year or more of any NSR pollutant. A modification at a major stationary source which results in a significant net emission increase of any PSD regulated pollutant is also subject to PSD review. PSD regulations require that any major stationary source subject to the regulations meet the following requirements: (1) application of BACT for each regulated pollutant that would be emitted in significant amounts; (2) analysis of the ambient air impact (modeling); (3) analysis of existing ambient air quality (monitoring); (4) analysis of the impact on soils, vegetation, and visibility; (5) analysis of the impact of Class I areas, and (6) public notification of the proposed modification.

The facility will be considered a major source with respect to the Prevention of Significant Deterioration (PSD) program as $NO_x$, $SO_2$, CO, and particulate matter (PM) will be emitted at potential emission rates that exceed 250 tpy. The facility will have potential Volatile Organic Compound (VOC) emissions greater than 40 tpy, potential $PM_{10}$ emissions greater than 15 tpy, and potential $PM_{2.5}$ emissions greater than 10 tpy. Therefore, the facility will undergo PSD review for $NO_x$, $SO_2$, CO, PM, $PM_{10}$, $PM_{2.5}$ and VOC. Additionally, as the facility will be a major PSD source for criteria pollutants, and the potential Greenhouse Gas (GHG) emissions will exceed the 75,000 tpy $CO_2e$ major modification significant emissions increase threshold, the facility will undergo PSD review for GHG. As such, CARBO has prepared this PSD review permit application with respect to the construction and operation of Processing Lines 1 through 4 for the above NSR pollutants.

## 1.1 PSD Requirement

### 1.1.1 Attainment Status of Each Criteria Pollutant

The Millen facility is located in Jenkins County, which is in attainment of the $PM_{10}$/$PM_{2.5}$, $SO_2$, $NO_x$, CO and Ozone (as VOCs) standards.

### 1.1.2 Best Available Control Technology (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 Georgia 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 there are no economically reasonable or technologically feasible ways to measure the emissions, and hence to impose an enforceable emissions standard, the source may use a design, equipment, work practice, operations standard, or combination thereof, to reduce emissions of the pollutant to the maximum extent practicable.

Suggested procedures for performing a top down BACT analysis are set forth in EPA's Draft New Source Review Workshop Manual (Manual), dated October 1990. The five steps of a top-down BACT review procedure identified are listed below:

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

BACT is discussed in further detail in Section 5.0. Additionally, a detailed BACT analysis for all regulated pollutants for which this modification results in a significant emissions increase is provided in Volume II.

### 1.1.3 Modeling Requirements

The PSD regulations require an applicant to demonstrate that the proposed source would not cause or contribute to a violation of any National Ambient Air Quality Standard (NAAQS) or PSD increment. An additional impacts analysis is also required to determine the impairment to visibility, soils and vegetation that would occur as a result of the proposed source and any associated general commercial, residential, and industrial growth. For certain large source that may affect Class I areas, an analysis is required to determine if the sources would have an adverse impacts to any air quality related value, such as visibility or acid deposition. Sections 6.0 and 7.0 summarize the results of the air quality modeling conducted for the Millen facility with the comprehensive analysis provided as Volume III to this application.

### 1.1.4 Ambient Air Quality Monitoring Data

The PSD regulations require an applicant to collect ambient monitoring data to determine the existing air quality in the area the project would affect for NAAQS modeling requirements. A detailed discussion of ambient monitoring data collected for this purpose is provided in Section 2.3 of Volume III.

## 1.2 Applicability Analysis

### 1.2.1 NSR Pollutants Emitted

Table 1.2.1-1 provides a list of all NSR pollutants as defined in 40 CFR 52.21(b)(50). For purposes of this permit application non-HF fluorides are assumed to be less than 3 tpy. Notwithstanding minimal amounts of other fluoride compounds possibly emitted by the calciners, current codified performance testing methods do not provide an empirical mechanism to quantify non-HF fluoride emissions (in-and-of themselves). Fluorides are defined in New Source Performance Standards in 40 CFR Part 60 (Subpart S – Aluminum and Phosphate Fertilizer Manufacturing) as all fluoride compounds as measured per Method 13A or 13B (Method 13 does not exclude HF and measures all fluorides as captured in an impinger train). Additionally, Method 26A can be used to measure HF but in actuality Method 26A measures all gaseous fluorides, as captured in an impinger train. It would require the development of an alternative test method to accurately determine the net emissions of all non-HF fluorides. In the event that there are non-HF fluorides in an amount greater than 3 tpy, any particulate fluoride emissions would already be controlled as part of the $PM/PM_{10}$ BACT of 0.01 gr/dscf and $PM_{2.5}$ BACT of 0.01 gr/dscf. If there are any gaseous non-HF fluorides in an amount greater than 3 tpy, these emissions are essentially addressed in the case-by-case MACT determination required per CAA Section 112(g)(2)(B) which assumes all gaseous fluorides are HF. There would be no incremental environmental benefit in quantifying any non-HF fluorides, as the final magnitude of emissions reduction would be the same as currently proposed in this permit application.

**Table 1.2.1-1: PSD Applicability Analysis**

| Regulated NSR Pollutants | Facility-wide Emissions Increase (tpy) | PSD Significant Level (tpy) | PSD Triggered for Modification? |
|---|---|---|---|
| Nitrogen Oxide | 2,446 | 40 | Yes |
| Carbon Monoxide | 1,046 | 100 | Yes |
| Sulfur Dioxide | 618 | 40 | Yes |
| Particulate Matter (PM) | 249 | 25 | Yes |
| Particulate Matter ($PM_{10}$) | 249 | 15 | Yes |
| Particulate Matter ($PM_{2.5}$) | 129 | 10 | Yes |
| Ozone (VOCs) | 66.9 | 40 | Yes |
| Lead | 0 | 0.6 | No |
| Fluorides (excluding HF) | < 3 | 3 | No |
| Sulfuric Acid Mist [2] | 6.83 | 7 | No |
| Hydrogen sulfide ($H_2S$) | 0 | 10 | No |

**Table 1.2.1-1: PSD Applicability Analysis**

| Regulated NSR Pollutants | Facility-wide Emissions Increase (tpy) | PSD Significant Level (tpy) | PSD Triggered for Modification? |
|---|---|---|---|
| Total reduced sulfur (including $H_2S$) | 0 | 10 | No |
| Reduced sulfur compounds (including $H_2S$) | 0 | 10 | No |
| MWC Organics (total Dioxins and Furans) | 0 | 3.50E-06 | No |
| MWC Metals (as PM) | 0 | 15 | No |
| MWC Acid Gases (as $SO_2$ and HCl) | 0 | 40 | No |
| MWC Landfill emissions (non-methane organic compounds) | 0 | 50 | No |
| Greenhouse Gases (tpy $CO_2e$) | 404,304 | 75,000 [1] | Yes |

[1] Threshold emissions rate for greenhouse gases reported as $CO_2e$ (includes emissions of $CO_2$, $CH_4$, and $N_2O$)

[2] The facility is proposing federally enforceable emission limits on the calciners to limit sulfuric acid mist to 6.83 tpy to preclude PSD review.

### 1.2.2 Best Available Control Technology (BACT)

40 CFR Part 52.21(j) requires a new major PSD source to apply best available control technology (BACT) for each regulated NSR pollutant that has potential emissions above its respective major modification significance threshold. This requirement applies to each proposed emissions unit that would emit the pollutant for which PSD review is triggered. As demonstrated in Table 1.2.1-1 above, nitrogen oxide, carbon monoxide, sulfur dioxide, particulate matter (PM, $PM_{10}$, $PM_{2.5}$), VOC, and GHG are all emitted at a rate which exceeds the significant emission rate (for the facility as a major source). As such, any emission unit which has the potential to emit these pollutants as a result of this modification must apply BACT. See Section 5.0 for a list of these emission units.

### 1.2.3 Modeling

For each pollutant proposed to be emitted in significant amounts that also has an applicable NAAQS or PSD increment, dispersion modeling is required to be performed to demonstrate that potential emissions from the project, and all applicable emissions increases and decreases from other existing and proposed new sources, will not cause or contribute to a violation of any NAAQS or PSD increment.. Dispersion modeling is also used to perform an additional impacts analysis, which is required to determine the impairment to visibility, soils and vegetation that would occur as a result of the proposed source. Dispersion modeling is also required to determine if AQRV's in a Class I area will be impacted beyond the thresholds for concern for sources without a presumptive no adverse impact based on potential emissions. Sections 6.0 and 7.0 summarize the results of the air quality modeling conducted for the Millen facility with the comprehensive analysis provided as Volume III to this application.

# 2.0 EMISSIONS

## 2.1 Emission Source Types

The proposed facility includes the construction of Process Lines 1, 2, 3, and 4, including the following emission units:

**Table 2.1-1: Millen Facility Emission Units**

| Emission Unit ID No. | Emission Unit Description |
|---|---|
| GP01 – GP04 | Kaolin Clay Feed Systems |
| SD01 – SD08 | Spray Dryers |
| KAE1 – KAE4 | Calciner Feed Systems |
| KLN1 – KLN4 | Direct-Fired Rotary Calciners |
| BS01 – BS16 | Product Storage Silos |
| RRL1 – RRL2 | Railcar Loading Operations |
| BLR1 – BLR4 | Boilers |
| EDG1 – EDG4 | Emergency Generators |

## 2.2 Summary Table(s) of Emissions

The potential $NO_x$, $SO_2$, CO, PM/$PM_{10}$/$PM_{2.5}$, VOC, GHG, methanol, HCl, and HF emissions from the proposed new facility are specified in Table 2.2-1 and Table 2.2-2 below.

**Table 2.2-1: Potential Emissions, NSR Pollutants**

| Line No. | Emission Unit ID Nos. | Emission Unit Descriptions | $NO_x$ (tpy) | $SO_2$ (tpy) | $H_2SO_4$ (tpy) [4] | CO (tpy) | PM/ $PM_{10}$ (tpy) [2] | $PM_{2.5}$ (tpy) | VOC (tpy) [5] | Fluoride (tpy) [1] | GHG (tpy $CO_2e$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SD01 | Spray Dryer No. 1 | 36.4 | 2.19 | ---- | 72.7 | 19.9 | 7.45 | 13.64 | --- | 28,760 |
| | SD02 | Spray Dryer No. 2 | 36.4 | 2.19 | ----- | 72.7 | 19.9 | 7.45 | | --- | 28,760 |
| | KLN1 | Calciner No. 1 | 530.0 | 150.0 | 1.71 | 108.2 | 12.1 | 12.1 | 2.30 | <0.7 | 36,715 |
| | BLR1 | Boiler 1 | 0.613 | 0.025 | ---- | 3.53 | 0.328 | 0.328 | 0.375 | --- | 5,997 |
| | EDG1 | Emergency Generator No. 1 | 8.09 | 0.008 | ---- | 4.38 | 0.093 | 0.093 | 0.413 | --- | 844 |
| | ---- | Material Storage and Handling Units | --- | --- | ---- | --- | 9.20 | 4.60 | --- | --- | --- |
| 2 | SD03 | Spray Dryer No. 3 | 36.4 | 2.19 | ---- | 72.7 | 19.9 | 7.45 | 13.64 | --- | 28,760 |
| | SD04 | Spray Dryer No. 4 | 36.4 | 2.19 | ----- | 72.7 | 19.9 | 7.45 | | --- | 28,760 |
| | KLN2 | Calciner No. 2 | 530.0 | 150.0 | 1.71 | 108.2 | 12.1 | 12.1 | 2.30 | <0.7 | 36,715 |
| | BLR2 | Boiler 2 | 0.613 | 0.025 | ---- | 3.53 | 0.328 | 0.328 | 0.375 | --- | 5,997 |
| | EDG2 | Emergency Generator No. 2 | 8.09 | 0.008 | ---- | 4.38 | 0.093 | 0.093 | 0.413 | --- | 844 |
| | ---- | Material Storage and Handling Units | --- | --- | ---- | --- | 9.20 | 4.60 | --- | --- | --- |
| 3 | SD05 | Spray Dryer No. 5 | 36.4 | 2.19 | ---- | 72.7 | 19.9 | 7.45 | 13.64 | --- | 28,760 |
| | SD06 | Spray Dryer No. 6 | 36.4 | 2.19 | ----- | 72.7 | 19.9 | 7.45 | | --- | 28,760 |
| | KLN3 | Calciner No. 3 | 530.0 | 150.0 | 1.71 | 108.2 | 12.1 | 12.1 | 2.30 | <0.7 | 36,715 |
| | BLR3 | Boiler 3 | 0.613 | 0.025 | ---- | 3.53 | 0.328 | 0.328 | 0.375 | --- | 5,997 |
| | EDG3 | Emergency Generator No. 3 | 8.09 | 0.008 | ---- | 4.38 | 0.093 | 0.093 | 0.413 | --- | 844 |
| | ---- | Material Storage and Handling Units | --- | --- | ---- | --- | 9.20 | 4.60 | --- | --- | --- |
| 4 | SD07 | Spray Dryer No. 7 | 36.4 | 2.19 | ---- | 72.7 | 19.9 | 7.45 | 13.64 | --- | 28,760 |
| | SD08 | Spray Dryer No. 8 | 36.4 | 2.19 | ----- | 72.7 | 19.9 | 7.45 | | --- | 28,760 |
| | KLN4 | Calciner No. 4 | 530.0 | 150.0 | 1.71 | 108.2 | 12.1 | 12.1 | 2.30 | <0.7 | 36,715 |
| | BLR4 | Boiler 4 | 0.613 | 0.025 | ---- | 3.53 | 0.328 | 0.328 | 0.375 | --- | 5,997 |
| | EDG4 | Emergency Generator No. 4 | 8.09 | 0.008 | ---- | 4.38 | 0.093 | 0.093 | 0.413 | --- | 844 |
| | ---- | Material Storage and Handling Units | --- | --- | ---- | --- | 9.20 | 4.60 | --- | --- | --- |
| 1-4 | RRL1 | Railcar Loading Operations | --- | --- | ---- | --- | 1.31 | 0.657 | --- | --- | --- |
| | RRL2 | | --- | --- | ---- | --- | 1.31 | 0.657 | --- | --- | --- |
| | | **Facility-wide Emissions[4]** | **2,446** | **618** | **6.83** | **1,046** | **249** | **129** | **66.9** | **<3.0** | **404,304** |
| | | PSD Major Source Thresholds/ PSD Significance Thresholds[3] | 250/ 40 | 250/ 40 | 250/ 7 | 250/ 100 | 250/ 25 | 250/ 10 | 250/ 40 | 250/ 3.0 | 100,000/ 75,000 |
| | | PSD Triggered? (Y/N) | Y | Y | N | Y | Y | Y | Y | N | Y |

[1] See Section 5.2 for detailed explanation of fluoride emissions
[2] Includes $PM_{10}$ and $PM_{2.5}$
[3] As the facility is a major source for a single pollutant, all other pollutants are subject to PSD review if they exceed the applicable significance threshold
[4] See Attachment B for detailed emission calculations and assumptions
[5] Includes VOC from fuel combustion plus process-related methanol emissions

**Table 2.2-2: Potential Emissions, Hazardous Air Pollutants (HAPs)**

| Line No. | Emission Unit ID Nos. | Emission Unit Descriptions | Potential Combined HAP (tpy) | Potential Methanol (tpy) | Potential HCl (tpy) | Potential HF (tpy) | Potential Hexane (tpy) |
|---|---|---|---|---|---|---|---|
| 1 | SD01 | Spray Dryer No. 1 | 10.8 | 10.04 | --- | --- | 0.727 |
| | SD02 | Spray Dryer No. 2 | | | | | |
| | KLN1 | Calciner No. 1 | 47.1 | --- | 8.70 | 37.9 | 0.464 |
| | BLR1 | Boiler No. 1 | 0.079 | --- | --- | --- | 0.076 |
| | EDG1 | Emergency Generator No. 1 | 0.022 | --- | --- | --- | --- |
| 2 | SD03 | Spray Dryer No. 3 | 10.8 | 10.04 | --- | --- | 0.727 |
| | SD04 | Spray Dryer No. 4 | | | | | |
| | KLN2 | Calciner No. 2 | 47.1 | --- | 8.70 | 37.9 | 0.464 |
| | BLR2 | Boiler No. 2 | 0.079 | --- | --- | --- | 0.076 |
| | EDG2 | Emergency Generator No. 2 | 0.022 | --- | --- | --- | --- |
| 3 | SD05 | Spray Dryer No. 5 | 10.8 | 10.04 | --- | --- | 0.727 |
| | SD06 | Spray Dryer No. 6 | | | | | |
| | KLN3 | Calciner No. 3 | 47.1 | --- | 8.70 | 37.9 | 0.464 |
| | BLR3 | Boiler No. 3 | 0.079 | --- | --- | --- | 0.076 |
| | EDG3 | Emergency Generator No. 3 | 0.022 | --- | --- | --- | --- |
| 4 | SD07 | Spray Dryer No. 7 | 10.8 | 10.04 | --- | --- | 0.727 |
| | SD08 | Spray Dryer No. 8 | | | | | |
| | KLN4 | Calciner No. 4 | 47.1 | --- | 8.70 | 37.9 | 0.464 |
| | BLR4 | Boiler No. 4 | 0.079 | --- | --- | --- | 0.076 |
| | EDG4 | Emergency Generator No. 4 | 0.022 | --- | --- | --- | --- |
| **Facility-wide Emissions[1, 2]** | | | **232** | **40.2** | **34.8** | **152** | **5.06** |
| Section 112(g) Applicability Threshold | | | 25 | 10 | 10 | 10 | 10 |
| Section 112(g)(2)(B) Review Triggered?[3] (Y/N) | | | Y | Y | Y | Y | Y |

[1] HAP emissions are included as the facility will undergo a Section 112(g) case-by-case MACT review.
[2] See Attachment B for detailed emission calculations and assumptions.
[3] Section 112(g)(2)(B) review is triggered for all HAPs when review is triggered for a single HAP.

## 2.3 Enforceable Permit Limitations Used in Emission Calculations

The following federally enforceable permit limitations specified in Table 2.3-1 are requested as BACT.

**Table 2.3-1: Proposed Federally Enforceable Limits to Implement Requirements of 40 CFR 52.21(j)(2) and Section 112(g)(2)(B) Review**

| Emission Unit ID | Emission Unit Description | Emission | Emission Limit |
|---|---|---|---|
| SD01, SD02<br>SD03, SD04<br>SD05, SD06<br>SD07, SD08 | Spray Dryers (each, unless specified) | $PM/PM_{10}$ | 0.020 gr/dscf |
| | | $PM_{2.5}$ | 0.0075 gr/dscf |
| | | $NO_x$ | 8.3 lb/hr |
| | | CO | 16.6 lb/hr |
| | | Methanol | 10.04 tpy (per pair) |
| KLN1, KLN2<br>KLN3, KLN4 | Calciners (each) | $PM/PM_{10}$ | 0.010 gr/dscf |
| | | $PM_{2.5}$ | 0.010 gr/dscf |
| | | $NO_x$ | 121 lb/hr |
| | | $SO_2$ | 34.25 lb/hr |
| | | CO | 24.7 lb/hr |
| | | HCl | 8.7 tpy and 1.98 lb/hr |
| | | HF | 37.92 tpy and 8.66 lb/hr |
| BLR1, BLR2<br>BLR3, BLR4 | Boilers (each) | $NO_x$ | 12 ppm |
| GP01-GP04,<br>KAE1-KAE4,<br>BS01-BS16,<br>FBS1, TL01<br>BG01 | Material Storage and Handling Units (each) | $PM/PM_{10}$ | 0.010 gr/dscf |
| | | $PM_{2.5}$ | 0.005 gr/dscf |
| EDG1, EDG2,<br>EDG3, EDG4 | Emergency Generators (each) | $PM/PM_{10}$ | 0.055 g/bhp-hr<br>500 operating hours/year |
| | | $PM_{2.5}$ | 0.055 g/bhp-hr<br>500 operating hours/year |
| | | $NO_x$ | 4.77 g/bhp-hr<br>500 operating hours/year |
| | | $SO_2$ | 0.0015% Sulfur in fuel<br>500 operating hours/year |
| | | CO | 2.6 g/bhp-hr<br>500 operating hours/year |
| | | VOC | 500 operating hours/year |
| | | GHG | 500 operating hours/year |

The facility will accept sulfuric acid ($H_2SO_4$) mist emission limits on each calciner to ensure potential emissions are below 7 tpy in order to avoid PSD review for this NSR pollutant.

## 2.4 Netting Analysis

This project involves the construction of four new process lines at a Greenfield site. Per 40 CFR 52.21(b)(48)(iii), the baseline actual emissions for purposes of determining the emissions increase that will result from the initial construction and operation of these units shall equal zero. As such, a detailed netting analysis is not applicable and has not been performed for the purposes of this application.

# 3.0 PROJECT DESCRIPTION

## 3.1 Site Location and Layout

The new CARBO Ceramics facility consisting of four kaolin clay processing lines is to be located near Millen, Georgia in Jenkins County, which is an "attainment area" for $PM_{10}$, $PM_{2.5}$, $SO_2$, $NO_x$, CO and Ozone (as VOCs) per 40 CFR Part 81. Attachment C provides a vicinity site location map which includes the surrounding area as well as layout maps.

The center of the site is located at a latitude of 32º 45' 52.15"W and a longitude of 81º, 53', and 58.12"N. This information relates to the revised 1983 North American Datum.

## 3.2 Overall Operations

The Millen facility will manufacture proppants using kaolin clay. Kaolin slurry is formed by the addition of binders and colloids. Ammonia is added to the clay slurry to adjust the pH to the desired level. Proppants are formed in the spray dryers where excess water is driven off and then processed through a direct-fired rotary calciner where chemically bound water is removed from the proppants. The proppants are then packaged and shipped to clients using railcar load outs.

## 3.3 Description of Project (New Sources)

CARBO ceramics is proposing the construction and operation of a new ceramic proppant manufacturing facility which will include the following equipment in Table 3.3-1:

**Table 3.3-1: Millen Facility Equipment**

| Emission Unit ID No. | Emission Unit Description | Emission Unit Group ID Nos. |
|---|---|---|
| DSB1 | Spray Dryer No. 1 Feed Bin | GP01 |
| DUB1 | Spray Dryer No. 1 Unders Bin | |
| DSB2 | Spray Dryer No. 2 Feed Bin | |
| DUB2 | Spray Dryer No. 2 Unders Bin | |
| OC01 | Overflow Conveyor No. 1 | |
| ABC1 | Accepts Belt Conveyor No. 1 | |
| GPC1 | Pellet Collection Conveyor No. 1 | |
| GPT1 | Pellet Transfer Conveyor No. 1 | |
| GPE1 | Pellet Bucket Elevator No. 1 | |
| GSH1 | Screen Surge Hopper No. 1 | |
| GSC1 | Pellet Screen No. 1-1 | |
| GSC2 | Pellet Screen No. 1-2 | |
| GSC3 | Pellet Screen No. 1-3 | |
| OBC1 | Oversize Collection Belt Conveyor No. 1 | |
| ORB1 | Oversize Surge Bin No. 1 | |
| UBC1 | Unders Collection Belt Conveyor No. 1 | |
| URC1 | Unders Reversible Belt Conveyor No. 1 | |
| KFE1 | Calciner No. 1 Feed Bin Bucket Elevator | |
| KFB1 | Calciner No. 1 Feed Bin | |
| KRB1 | Calciner No. 1 Recycle Feed Bin | |
| KRE1 | Calciner No. 1 Recycle Feed Bin Bucket Elevator | |
| KFC1 | Calciner No. 1 Feed Conveyor | |

**Table 3.3-1: Millen Facility Equipment**

| Emission Unit ID No. | Emission Unit Description | Emission Unit Group ID Nos. |
|---|---|---|
| KCE1 | Calciner No. 1 Cooler Bucket Elevator | KAE1 |
| KPS1 | Calciner No. 1 Product Screen | |
| KFS1 | Calciner No. 1 Fines Screen | |
| KQC1 | Calciner No. 1 Product QC Bin A | |
| KQC2 | Calciner No. 1 Product QC Bin B | |
| KQC3 | Calciner No. 1 Product QC Bin C | |
| KQC4 | Calciner No. 1 Product QC Bin D | |
| KCS1 | Calciner No. 1 Product Screen DPCS | |
| KCS2 | Calciner No. 1 Fines Screen DPCS | |
| RRL1 | Railcar Loading Operations No. 1 | ---- |
| BS01 | Bulk Product Silo No. 1-1 | |
| BS02 | Bulk Product Silo No. 1-2 | |
| BS03 | Bulk Product Silo No. 1-3 | |
| BS04 | Bulk Product Silo No. 1-4 | |
| DSB3 | Spray Dryer No. 3 Feed Bin | GP02 |
| DUB3 | Spray Dryer No. 3 Unders Bin | |
| DSB4 | Spray Dryer No. 4 Feed Bin | |
| DUB4 | Spray Dryer No. 4 Unders Bin | |
| OC02 | Overflow Conveyor No. 2 | |
| ABC2 | Accepts Belt Conveyor No.2 | |
| GPC2 | Pellet Collection Conveyor No. 2 | |
| GPT2 | Pellet Transfer Conveyor No. 2 | |
| GPE2 | Pellet Bucket Elevator No. 2 | |
| GSH2 | Screen Surge Hopper No. 2 | |
| GSC4 | Pellet Screen No. 2-1 | |
| GSC5 | Pellet Screen No. 2-2 | |
| GSC6 | Pellet Screen No. 2-3 | |
| OBC2 | Oversize Collection Belt Conveyor No. 2 | |
| ORB2 | Oversize Surge Bin No. 2 | |
| UBC2 | Unders Collection Belt Conveyor No. 2 | |
| URC2 | Unders Reversible Belt Conveyor No. 2 | |
| KFE2 | Calciner No. 2 Feed Bin Bucket Elevator | |
| KFB2 | Calciner No. 2 Feed Bin | |
| KRB2 | Calciner No. 2 Recycle Feed Bin | |
| KRE2 | Calciner No. 2 Recycle Feed Bin Bucket Elevator | |
| KFC2 | Calciner No. 2 Feed Conveyor | |
| KCE2 | Calciner No. 2 Cooler Bucket Elevator | KAE2 |
| KPS2 | Calciner No. 2 Product Screen | |
| KFS2 | Calciner No. 2 Fines Screen | |
| KQC5 | Calciner No. 2 Product QC Bin A | |
| KQC6 | Calciner No. 2 Product QC Bin B | |
| KQC7 | Calciner No. 2 Product QC Bin C | |
| KQC8 | Calciner No. 2 Product QC Bin D | |
| KCS3 | Calciner No. 2 Product Screen DPCS | |
| KCS4 | Calciner No. 2 Fines Screen DPCS | |
| BS05 | Bulk Product Silo No. 2-1 | ---- |
| BS06 | Bulk Product Silo No. 2-2 | |
| BS07 | Bulk Product Silo No. 2-3 | |
| BS08 | Bulk Product Silo No. 2-4 | |
| DSB5 | Spray Dryer No. 5 Feed Bin | GP03 |
| DUB5 | Spray Dryer No. 5 Unders Bin | |
| DSB6 | Spray Dryer No. 6 Feed Bin | |
| DUB6 | Spray Dryer No. 6 Unders Bin | |
| OC03 | Overflow Conveyor No. 3 | |
| ABC3 | Accepts Belt Conveyor No. 3 | |
| GPC3 | Pellet Collection Conveyor No. 3 | |
| GPT3 | Pellet Transfer Conveyor No. 3 | |
| GPE3 | Pellet Bucket Elevator No. 3 | |
| GSH3 | Screen Surge Hopper No. 3 | |

**Table 3.3-1: Millen Facility Equipment**

| Emission Unit ID No. | Emission Unit Description | Emission Unit Group ID Nos. |
|---|---|---|
| GSC7 | Pellet Screen No. 3-1 | |
| GSC8 | Pellet Screen No. 3-2 | |
| GSC9 | Pellet Screen No. 3-3 | |
| OBC3 | Oversize Collection Belt Conveyor No. 3 | |
| ORB3 | Oversize Surge Bin No. 3 | |
| UBC3 | Unders Collection Belt Conveyor No. 3 | |
| URC3 | Unders Reversible Belt Conveyor No. 3 | |
| KFE3 | Calciner No. 3 Feed Bin Bucket Elevator | |
| KFB3 | Calciner No. 3 Feed Bin | |
| KRB3 | Calciner No. 3 Recycle Feed Bin | |
| KRE3 | Calciner No. 3 Recycle Feed Bin Bucket Elevator | |
| KFC3 | Calciner No. 3 Feed Conveyor | |
| KCE3 | Calciner No. 3 Cooler Bucket Elevator | KAE3 |
| KPS3 | Calciner No. 3 Product Screen | |
| KFS3 | Calciner No. 3 Fine Screen | |
| KQC9 | Calciner No. 3 Product QC Bin A | |
| KQ10 | Calciner No. 3 Product QC Bin B | |
| KQ11 | Calciner No. 3 Product QC Bin C | |
| KQ12 | Calciner No. 3 Product QC Bin D | |
| KCS5 | Calciner No. 3 Product Screen DPCS | |
| KCS6 | Calciner No. 3 Fines Screen DPCS | |
| PBC3 | Calciner No. 3 Product Screen Belt Conveyor | ---- |
| PBE3 | Calciner No. 3 Product Screen Bucket Elevator | |
| FBC3 | Calciner No. 3 Fines Screen Belt Conveyor | |
| FBE3 | Calciner No. 3 Fines Screen Bucket Elevator | |
| RRL2 | Railcar Loading Operations No. 2 | |
| BS09 | Bulk Product Silo No. 3-1 | |
| BS10 | Bulk Product Silo No. 3-2 | |
| BS11 | Bulk Product Silo No. 3-3 | |
| BS12 | Bulk Product Silo No. 3-4 | |
| DSB7 | Spray Dryer No. 7 Feed Bin | GP04 |
| DUB7 | Spray Dryer No. 7 Unders Bin | |
| DSB8 | Spray Dryer No. 8 Feed Bin | |
| DUB8 | Spray Dryer No. 8 Unders Bin | |
| OC04 | Overflow Conveyor No. 4 | |
| ABC4 | Accepts Belt Conveyor No.4 | |
| GPC4 | Pellet Collection Conveyor No. 4 | |
| GPT4 | Pellet Transfer Conveyor No. 4 | |
| GPE4 | Pellet Bucket Elevator No. 4 | |
| GSH4 | Screen Surge Hopper No. 4 | |
| GS10 | Pellet Screen No. 4-1 | |
| GS11 | Pellet Screen No. 4-2 | |
| GS12 | Pellet Screen No. 4-3 | |
| OBC4 | Oversize Collection Belt Conveyor No. 4 | |
| ORB4 | Oversize Surge Bin No. 4 | |
| UBC4 | Unders Collection Belt Conveyor No. 4 | |
| URC4 | Unders Reversible Belt Conveyor No. 4 | |
| KFE4 | Calciner No. 4 Feed Bin Bucket Elevator | |
| KFB4 | Calciner No. 4 Feed Bin | |
| KRB4 | Calciner No. 4 Recycle Feed Bin | |
| KRE4 | Calciner No. 4 Recycle Feed Bin Bucket Elevator | |
| KFC4 | Calciner No. 4 Feed Conveyor | |
| KCE4 | Calciner No. 4 Cooler Bucket Elevator | KAE4 |
| KPS4 | Calciner No. 4 Product Screen | |
| KFS4 | Calciner No. 4 Fine Screen | |
| KQ13 | Calciner No. 4 Product QC Bin A | |
| KQ14 | Calciner No. 4 Product QC Bin B | |

**Table 3.3-1: Millen Facility Equipment**

| Emission Unit ID No. | Emission Unit Description | Emission Unit Group ID Nos. |
|---|---|---|
| KQ15 | Calciner No. 4 Product QC Bin C | |
| KQ16 | Calciner No. 4 Product QC Bin D | |
| KCS7 | Calciner No. 4 Product Screen DPCS | |
| KCS8 | Calciner No. 8 Fines Screen DPCS | |
| PB04 | Line No. 4 Product Belt | ---- |
| BS13 | Bulk Product Silo No. 4-1 | |
| BS14 | Bulk Product Silo No. 4-2 | |
| BS15 | Bulk Product Silo No. 4-3 | |
| BS16 | Bulk Product Silo No. 4-4 | |
| KLN1 | Direct-Fired Rotary Calciner No. 1 | |
| KLN2 | Direct-Fired Rotary Calciner No. 2 | |
| KLN3 | Direct-Fired Rotary Calciner No. 3 | |
| KLN4 | Direct-Fired Rotary Calciner No. 4 | |
| SD01 | Spray Dryer No. 1 | |
| SD02 | Spray Dryer No. 2 | |
| SD03 | Spray Dryer No. 3 | |
| SD04 | Spray Dryer No. 4 | |
| SD05 | Spray Dryer No. 5 | |
| SD06 | Spray Dryer No. 6 | |
| SD07 | Spray Dryer No. 7 | |
| SD08 | Spray Dryer No. 8 | |
| BLR1 | Boiler No. 1 | |
| BLR2 | Boiler No. 2 | |
| BLR3 | Boiler No. 3 | |
| BLR4 | Boiler No. 4 | |
| EDG1 | Emergency Generator No. 1 | |
| EDG2 | Emergency Generator No. 2 | |
| EDG3 | Emergency Generator No. 3 | |
| EDG4 | Emergency Generator No. 4 | |

# 4.0 REGULATORY REVIEW

## 4.1 Review of Federal Rules

### 4.1.1 Federal Rules – Air Permitting

*40 CFR 52.21 - Prevention of Significant Air Quality Deterioration (PSD)*

The PSD review requirements apply for 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 all other sources having potential emissions of 250 tons per year or more of any regulated pollutant; or modification of a major stationary source which results in a significant net emission increase of any regulated pollutant.

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

- Application of best available control technology (BACT) for each regulated pollutant that would be emitted in significant amounts.
- Analysis of the source's ambient air impact.
- Analysis of existing ambient air quality.
- Analysis of the impact on soils, vegetation, and visibility.
- Analysis of the impact on Class I areas.
- Public notification of the proposed plant in a newspaper of general circulation.

*40 CFR Part 70 – Title V Permitting*

The requirements of 40 CFR Part 70 are adopted by reference into the Georgia Rules for Air Quality Control 391-3-1-.03(10). The new proppant manufacturing facility will be considered a major source, as defined in 40 CFR Part 70.2. As such, the facility will submit a complete Title V permit application for the new facility within twelve months after commencing operation per Georgia Rule 391-3-1-.03(10)(c)1.(ii).

### 4.1.2 Federal Rules – Air Quality Emission Standards

The facility is subject to the following federal rules:

- 40 CFR Part 60
    - Subpart OOO, NSPS for Nonmetallic Mineral Processing Plants
    - Subpart UUU, NSPS for Calciners and Dryers in Mineral Industry
    - Subpart IIII, NSPS for Stationary Compression Ignition Internal Combustion Engines (CI ICE)

- 40 CFR Part 63
  - Subpart B, Section 112(g) of the Clean Air Act
  - Subpart ZZZZ, MACT for Stationary Reciprocating Internal Combustion Engines (RICE)
  - Subpart DDDDD, Boiler MACT

*NSPS Subpart OOO*

All Process Line 1 through 4 conveyors, bins, bucket elevators, screens, and crushers are subject to NSPS Subpart OOO (40 CFR 60.672, as amended April 28, 2009) as the process units are involved with kaolin processing and will be constructed after August 22, 2008. Fugitive emissions (including those escaping capture systems) are limited to 7 percent opacity. Stack PM emissions from capture systems feeding a dry control device are limited to 0.014 grains/dscf, except for individually enclosed storage bins (subject to 7% opacity). For any transfer point on a conveyor belt or any other emissions unit enclosed in a building, the unit's or building's fugitive emissions from the building openings (except vents with mechanically induced air flow for exhausting PM emissions from the building) are limited to 7 percent opacity, and PM emissions from any building vent with mechanically induced air flow for exhausting PM emissions is limited to 0.014 grains/dscf.

The modification includes the addition of the following equipment:

**Table 4.1.2-1: NSPS Subpart OOO Facility Emission Unit Applicability**

| Emission Unit ID No. | Emission Unit Name | Applicable NSPS Subpart OOO Limit |
|---|---|---|
| GP01 – GP04 | Kaolin Clay Feed Systems | 0.014 gr/dscf PM limit<br>7% Opacity |
| KAE1 – KAE4 | Calciner Feed Systems | |
| RRL1 – RRL2 | Railcar Loading Operations | |
| BLR1 – BLR4 | Boilers | N/A |
| EDG1 – EDG4 | Emergency Generators | |
| SD01 – SD08 | Spray Dryers | |
| KLN1 – KLN4 | Direct-Fired Rotary Calciners | |
| BS01 – BS16 | Product Storage Silos | |

The facility will utilize high efficiency baghouses to comply with the PM emissions limitation of 0.014 gr/dscf and the opacity limitation of 7 percent (as applicable) and will perform weekly maintenance checks as well as daily visible emissions (VE) checks to ensure that the baghouses are functioning properly. However, the facility's proposed BACT will have a more restrictive BACT $PM/PM_{10}$ emissions limit of 0.010 gr/dscf and $PM_{2.5}$ emissions limit of 0.005 gr/dscf, which subsumes the grain loading standard of this regulation. The periodic monitoring described above will ensure that the applicable process units at the facility are in compliance with NSPS Subpart OOO.

*NSPS Subpart UUU*

Spray Dryer Nos. 1 through 8 and Direct-fired Rotary Calciner Nos. 1 through 4 are subject to NSPS Subpart UUU since these emission units are considered dryers and calciners per NSPS Subpart UUU [40 CFR 60.730(a)] and they will be constructed after April 23, 1986. Stack particulate emissions from Direct-fired Rotary Calciners are limited to 0.04 gr/dscf and 10 percent opacity. Stack particulate emissions from Spray Dryers are limited to 0.025 gr/dscf and 10 percent opacity. The exhaust from the Spray Dryers will not be routed through the Direct-fired Rotary Calciners. The facility will utilize high efficiency baghouses to comply with the PM emissions limitation of 0.025 gr/dscf and opacity limitation of 10 percent for Spray Dryer Nos. 1 through 8. However, the facility's permit will have a more restrictive BACT PM emission limit of 0.020 gr/dscf for $PM/PM_{10}$ and 0.0075 gr/dscf for $PM_{2.5}$, which subsumes the grain loading limit of this regulation. The facility will utilize high efficiency baghouses to comply with the PM emissions limitation of 0.04 gr/dscf and opacity limitation of 10 percent for Direct-fired Rotary Calciner Nos. 1 through 4. However, the facility's permit will have a more restrictive BACT PM emissions limit of 0.010 gr/dscf for $PM/PM_{10}$ and $PM_{2.5}$, which subsumes the grain loading limits of this regulation.

The facility will use a Continuous Opacity Monitoring System (COMS) for the baghouses controlling Spray Dryer and Direct-fired Rotary Calciner emissions to ensure proper operation and compliance with the 10 % opacity NSPS limit and the PM emission limits of 0.025 gr/dscf and 0.04 gr/dscf respectively. The facility will also continuously monitor the gas temperature at the inlet of the baghouses and record the time and date of each incident when the temperature exceeds the filter bag design temperature. In lieu of monitoring temperature at the baghouse inlet, the facility may monitor a surrogate temperature (e.g., clay temperature or calciner/dryer outlet temperature). The above periodic monitoring will ensure that Spray Dryer Nos. 1 through 8 and Direct-fired Rotary Calciner Nos. 1 through 4 are in compliance with NSPS Subpart UUU.

*NSPS Subpart IIII*

Owners and operators who order stationary Compression Ignition Internal Combustion Engines (CI ICE) after July 11, 2005 that are manufactured after April 1, 2006 are subject to NSPS Subpart IIII. The Emergency Diesel Generators will be manufactured after April 1, 2006 and are subject to this rule. Emergency Diesel Generator Nos. 1 through 4 are subject to the $NO_x$ and PM emissions limitations specified in 40 CFR Part 60.4205(b), which incorporates the standards of §60.4202, which itself specifies that engines of these specifications must comply with the standards of 40 CFR 89.112 and 113. The facility will comply with the NSPS Subpart IIII emissions limitation by owning and operating emergency CI ICE that are certified to meet the Tier II standards, as applicable. In addition, the emergency generators will be restricted to combusting diesel fuel that meets the sulfur requirements for nonroad, locomotive, and marine (NRLM) diesel fuel specified in 40 CFR 80.510(a) and (b).

*Implementing Section 112(g) of the Clean Air Act (40 CFR §§63.40 through 63.44)*

Under 40 CFR 63 Subpart B, the construction of the new facility is considered to be a major source of HAP emissions with potential emissions in-and-of itself greater than 10 tons per year of any individual HAP. As a newly constructed major source of HAPs without a promulgated Part 63 National Emission Standard for Hazardous Air Pollutants (NESHAP), Process Line Nos. 1 through 4 are subject to a case-by-case Maximum Achievable Control Technology (MACT) determination pursuant to Section 112(g)(2)(B) of the Clean Air Act. The requirements for such case-by-case control technology reviews are codified in 40 CFR Part 63, Subpart B and adopted by reference, into the Georgia Rules for Air Quality Control 391-3-1-.02(9)(b)16. The spray dryers of each processing line emit methanol due to the use of additives in the manufacturing process; methanol is an impurity in these additives. The direct-fired rotary calciners of each process line emit HF and HCl due to the presence of fluorides and chlorides in the raw clay material. The boilers of each processing line emit HAPs from the combustion of natural gas and propane. A case-by-case MACT analysis for the spray dryers, the direct-fired rotary calciners, and the boilers[1] has been included in Attachment D of this volume.

*MACT Subpart ZZZZ – NESHAP for Stationary RICE*

40 CFR 63 Subpart ZZZZ establishes national emission limitations and operating standards for HAP emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. Each Emergency Diesel Generator (ID Nos. EDG1, EDG2, EDG3, and EDG4) is an affected source under this standard. All emergency diesel generators at the facility are considered new units under this standard, as the facility is a major source of HAP, the units are rated at greater than 500 brake horsepower, and the units were constructed after December 19, 2002. However, according to §63.6590(b)(1)(i), emergency RICE rated at more than 500 brake horsepower located at major sources of HAP are not subject to the requirements of the rule. Submittal of a Notification of Compliance Status is required under §63.6645(f), however.

*MACT Subpart DDDDD – NESHAP for Boilers and Process Heaters*

40 CFR 63 Subpart DDDDD establishes national emission limitations and operating limitations for hazardous air pollutants (HAP) emitted from boilers and process heaters located at major sources of HAP emissions. The four natural gas fired boilers (each with a maximum heat input below 10 MMBtu/hr) at the facility are considered new units under this standard (constructed after June 4, 2010) and are considered to be in the small gaseous fueled subcategory per 40 CFR 63.7499. Therefore, the only work practice standard required is a biennial

[1] On May 16, 2011, USPEA delayed the effective date of the National Emission Standard for Hazardous Air Pollutants (NESHAP) for industrial, commercial and institutional boilers and process heaters (40 CFR 63, Subpart DDDDD). Therefore, as the proposed facility's boilers are not subject to a Section 112(d) standard, a case-by-case MACT determination for Boiler Nos. 1 through 4 has been included in Attachment D of this volume.

tune-up of each boiler per 40 CFR 63.7540(a)(11). There are no applicable emission standards for this subcategory of boilers in NESHAP Subpart DDDDD. However, it should be noted that on January 24, 2011, Subpart DDDDD for major sources was delayed to provide EPA additional time to consider additional information, with the provisions to be re-proposed by October 2011 and repromulgated by April 2012.

## 4.2 Review of State Rules

### 4.2.1 State Rules – Air Permitting

Georgia Rule for Air Quality Control (Georgia Rule) 391-3-1-.03(1) requires that a permit be obtained prior to beginning the construction or modification of any facility which may result in pollution. Georgia Rules 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).

### 4.2.2 State Rules – Air Standards

The Millen Plant is subject to the following State Rules:

- 391-3-1-.02(2)(a)3.(ii) General Provisions [Georgia Toxics Guideline]
- 391-3-1-.02(2)(b) Visible Emissions
- 391-3-1-.02(2)(d) Fuel Burning Equipment
- 391-3-1-.02(2)(g) Sulfur Dioxide
- 391-3-1-.02(2)(p) Particulate Emissions from Kaolin and Fuller's Earth Processes

*Georgia Rule (a)3(ii) "General Provisions"*

Under Georgia Rule 391-3-1-.02(2)(a)3(ii), the Director may require emissions limitations when necessary to safeguard the public health, safety, and welfare of the people of the State of Georgia. The Georgia Air Toxics Guideline is a guide for estimating the environmental impact of sources of toxic air pollutants. A toxic air pollutant 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. Toxic air pollutants emitted during the facility's processing operations include ammonia, methanol, hydrogen fluoride, hydrogen chloride, and speciated organics from fuel combustion (primarily hexane and formaldehyde). Prior to spray drying, the pH of the clay is adjusted with an aqueous ammonia solution and dispersed into the slurry using a colloid. Methanol is an impurity contained in an additive to the slurry and is volatilized during spray drying. At the temperatures encountered in the calciners, naturally occurring fluorides and chlorides found in the raw clay are released to the atmosphere as HF and HCl. Speciated organics, primarily hexane, are emitted from all fuel burning sources during combustion of natural gas.

A complete toxics assessment was performed using the Georgia Air Toxics Guideline. The toxic impact assessment can be found in Volume III, Attachment D. This assessment indicates that the current facility along with the new proposed equipment is in full compliance with the Georgia Air Toxics Guideline.

*Georgia Rule (b) "Visible Emissions"*

This rule limits opacity from any air contaminant source to 40%, unless the source is subject to a more restrictive rule in Chapter 391-3-1-.02. The spray dryers and calciners are limited to 10% opacity per 40 CFR Part 60 Subpart UUU, fugitive emissions from the material handling units are limited to 7% opacity per 40 CFR Part 60 Subpart OOO, and boiler emissions are limited to 20% opacity per Georgia Rule 391-3-1-.02(2)(d). As such, the units subject to this rule include non-fugitive emissions from material handling units. Emergency generators are not subject to this rule per 391-3-1-.02(2)(b)4, which excludes sources not subject to some other emission limitation per Section 391-3-1-.02(2). The facility will use high efficiency baghouses 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 baghouses are functioning properly. This monitoring satisfies the visible emissions requirements of Georgia Rule 391-3-1-.02(2)(b).

*391-3-1-.02 (d) "Fuel Burning Equipment"*

This rule limits particulate matter, opacity, and $NO_x$ emissions from certain fuel-burning equipment, as defined in 391-3-1-.01(cc). This rule is applicable to Boilers 1 through 4 according to the following table:

**Table 4.2.2-1: Fuel-Burning Equipment**

| Fuel-Burning Equipment | Description | Construction Date/ Modification Date | Maximum Rated Heat Input (MMBtu/hr) | Rule (d) PM Limit (lb/MMBtu) | Rule (d) Opacity Limit | Rule (d) $NO_x$ Limit (lb/MMBtu) |
|---|---|---|---|---|---|---|
| Boiler 1 | Natural Gas-fired Boiler | After 2010 | 9.8 | 0.50 | <20% with one 6-min period <27% | N/A |
| Boiler 2 | Natural Gas-fired Boiler | After 2010 | 9.8 | 0.50 | <20% with one 6-min period <27% | N/A |

| Fuel-Burning Equipment | Description | Construction Date/ Modification Date | Maximum Rated Heat Input (MMBtu/hr) | Rule (d) PM Limit (lb/MMBtu) | Rule (d) Opacity Limit | Rule (d) $NO_x$ Limit (lb/MMBtu) |
|---|---|---|---|---|---|---|
| Boiler 3 | Natural Gas-fired Boiler | After 2010 | 9.8 | 0.50 | <20% with one 6-min period <27% | N/A |
| Boiler 4 | Natural Gas-fired Boiler | After 2010 | 9.8 | 0.50 | <20% with one 6-min period <27% | N/A |

Compliance is achieved through the sole use of natural gas and propane as fuels.

*Georgia Rule (g) "Sulfur Dioxide Emissions"*

The fuel fired in Spray Dryers Nos. 1 – 8, Direct-fired Rotary Calciners Nos. 1 – 4, Gas Fired Boilers Nos. 1 – 4, and Emergency Generators Nos. 1 – 4 will be limited to 2.5 percent sulfur, by weight, per Georgia Rule (g). The spray dryers, direct-fired rotary calciners, and boilers will comply with Georgia Rule (g) through the use of natural gas and propane as the only fuels combusted in the spray dryers and direct-fired rotary calciners. The emergency generators will comply with this rule through the use of diesel fuel with less than 0.0015% sulfur content (proposed BACT limit). The exclusive use of these fuels will ensure compliance with the requirements of Georgia Rule (g).

*Georgia Rule (p) "Particulate Emissions from Kaolin and Fuller's Earth Processes"*

The process equipment at the Millen facility is subject to Georgia Rule (p). Georgia Rule (p) limits the particulate matter emissions from each emission units based on the following equations.

For sources constructed after January 1, 1972:

$P \leq 30$ *ton/hr,* $E = 3.59\, P^{0.62}$
*For* $P > 30$ *ton/hr,* $E = 17.31\, P^{0.16}$

Where,

P = Process input rate (tons/hour)
E = Allowable Emission Rate of Particulate Emissions (lbs/hour)

The facility will use baghouses and bin vents to control particulate matter emissions to demonstrate compliance with Georgia Rule (p). For Material Storage and Handling units, the facility will perform daily visible emission (VE) checks and weekly maintenance checks to ensure that the baghouses are functioning properly. For the Direct-fired Rotary Calciners and Spray Dryers, the facility will use a COMS (Continuous Opacity Monitoring System) to ensure the baghouses are working properly. Compliance with NSPS Subpart OOO and UUU subsumes the requirements of Georgia Rule (p).

# 5.0 CONTROL TECHNOLOGY REVIEW

## 5.1 BACT Applicability and Methodology

This Section offers a condensed summary of the BACT requirements applicable to the project and the proposed BACT findings for each pollutant and emission unit combination subject to BACT. For detailed BACT analysis, including calculation and discussion of energy, environmental, and economic impacts, see Volume II.

The PSD regulation requires that the Best Available Control Technology (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 Georgia 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 there are no economically reasonable or technologically feasible ways to measure the emissions, and hence to impose an enforceable emissions standard, the source may use a design, equipment, work practice, operations standard, or combination thereof, to reduce emissions of the pollutant to the maximum extent practicable.

The BACT determination should, at a minimum, meet two core requirements.[1] The first core requirement is that the determination follows a "top-down" approach. The second core requirement is that the selection of a particular control system as BACT must be justified in terms of the statutory criteria, be supported by the permit record, and explain the basis for the rejection of other more stringent candidate control systems.

Suggested procedures for performing a top-down BACT analysis are set forth in EPA's Draft New Source Review Workshop Manual (Manual), dated October 1990. One critical step in the BACT analysis is to determine if a control option is technically feasible.[2] If a control is determined to be infeasible, it is eliminated from further consideration. The Manual applies several criteria for determining technical feasibility. The first is straightforward. If the control has been installed and operated by the type of source under review, it is demonstrated and technically feasible.

For controls not demonstrated using this straightforward approach, the Manual applies a more complex approach that involves two concepts for determining technical feasibility: availability and applicability. A technology is considered available if it can be obtained through commercial channels. An available control is applicable if it can be reasonably installed and operated on the source type under consideration. A technology that is available and applicable is technically feasible.

[1] The discussion of the core requirements is taken from the Preamble to the Proposed NSR Reform, 61 FR38272.
[2] Discussion on technical feasibility is taken from the PSD Final Determination for AES Londonderry, L.L. C., Rockingham County, New Hampshire. The PSD Final Determination was written by the U.S. EPA Region I, Air Permits Program.

The Manual also requires available technologies to be applicable to the source type under consideration before a control is considered technically feasible. For example, deployment of the control technology on the existing source with similar gas stream characteristics is generally sufficient basis for concluding technical feasibility. However, even in this instance, the Manual would allow an applicant to make a demonstration to the contrary. For example, the applicant could show that unresolved technical difficulties with applying a control to the source under consideration (e.g., because of size of the unit, location of the proposed site and operating problems related to the specific circumstances of the source) make a control technically infeasible.

## 5.2 Summary of Emission Units Subject to BACT

40 CFR Part 52.21(j) requires a application of the best available control technology (BACT) for each regulated NSR pollutant for which it would result in a significant net emissions increase at the source undergoing a major modification. This requirement applies to each proposed emissions unit at which a net emissions increase in the pollutant would occur as a result of a physical change or change in the method of operation in the unit. Table 5.2-1 below displays the NSR pollutants for which a BACT analysis is required and the proposed emission units for which a net increase in those pollutants will occur.

For purposes of this permit application, the facility-wide increase for Processing Lines 1 through 4 of non-HF fluorides is assumed to be less than 3 tpy. Notwithstanding minimal amounts of other fluoride compounds possibly emitted by the calciners, current codified performance testing methods do not provide an empirical mechanism to quantify non-HF fluoride emissions (in-and-of themselves). Fluorides are defined in New Source Performance Standards in 40 CFR Part 60 (Subpart S – Aluminum and Phosphate Fertilizer Manufacturing) as all fluoride compounds as measured per Method 13A or 13B. However, Method 13 does not exclude HF and measures all fluorides as captured in an impinger train. Additionally, Method 26A can be used to measure HF but in actuality Method 26A measures all gaseous fluorides as captured in an impinger train. It would require the development of an alternative test method to accurately determine the net emissions of all non-HF fluorides. In the event that there are non-HF fluorides in an amount greater than 3 tpy, any particulate fluoride emissions would already be controlled as part of the $PM/PM_{10}$ BACT of 0.01 gr/dscf and $PM_{2.5}$ BACT of 0.01 gr/dscf. If there are any gaseous non-HF fluorides in an amount greater than 3 tpy, these emissions are essentially addressed in the case-by-case MACT determination required per Section 112(g)(2)(B) which assumes all gaseous fluorides are HF. There would be no incremental environmental benefit in quantifying any non-HF fluorides, as the final magnitude of emissions reduction would be the same as currently proposed in this permit application.

**Table 5.2-1: BACT Applicability Summary**

| Regulated NSR Pollutants[1] | Facility-wide Net Emissions Increase (tpy) | PSD Significance Threshold[1] (tpy) | BACT Applicable? |
|---|---|---|---|
| Nitrogen Oxide | 2,446 | 40 | Yes |
| Carbon Monoxide | 1,046 | 100 | Yes |
| Sulfur Dioxide | 618 | 40 | Yes |
| Particulate Matter (PM) /<br>Particulate Matter ($PM_{10}$) /<br>Particulate Matter ($PM_{2.5}$) | 249 /<br>249 /<br>129 | 25 /<br>15 /<br>10 | Yes /<br>Yes /<br>Yes |
| Ozone (VOCs) | 66.9 | 40 | Yes |
| Lead | 0 | 0.6 | No |
| Fluorides (excluding HF) | <3 | 3 | No |
| Sulfuric Acid Mist | 6.83 | 7 | No |
| Hydrogen sulfide ($H_2S$) | 0 | 10 | No |
| Total reduced sulfur (TRS)[2] | 0 | 10 | No |
| Reduced sulfur compounds[3] | 0 | 10 | No |
| MWC Organics (total Dioxins and Furans) | 0 | 3.50E-06 | No |
| MWC Metals (as PM) | 0 | 15 | No |
| MWC Acid Gases (as $SO_2$ and HCl) | 0 | 40 | No |
| MWC Landfill emissions (non-methane organic compounds) | 0 | 50 | No |
| Greenhouse gases (as $CO_2e$) | 404,304 | 75,000 | Yes |

[1] Per 40 CFR 52.21(b)(23)
[2] Per 40 CFR 63.1579; includes carbonyl sulfide and carbon disulfide as measured using Method 15, and expressed as an equivalent sulfur dioxide concentration
[3] Per 40 CFR 63.1579; includes hydrogen sulfide, carbonyl sulfide, and carbon disulfide.

## 5.3 Summary of Top-Down BACT Analysis: Direct Fired Rotary Calciner Nos. 1 – 4

Table 5.3-1 below summarizes the BACT analysis conducted and proposed BACT findings for the Direct-Fired Rotary Calciner Nos. 1 – 4.

**Table 5.3-1: Summary of BACT Analysis and Findings- Direct-Fired Rotary Calciner Nos. 1 – 4**

| Pollutant | Technologies Evaluated | Proposed BACT | Reference |
|---|---|---|---|
| $NO_x$ | Selective Non-Catalytic Reduction (SNCR)<br>$NO_x$ Wet Scrubbing<br>Selective Catalytic Reduction (SCR)<br>Catalytic Baghouse<br>Regenerative Selective Catalytic Reduction (RSCR)<br>Low $NO_x$ Process Technology | The use of Low $NO_x$ Process Technology to control $NO_x$ emissions to no more than 121 lb/hr, each | Vol. II Attachment A |
| CO | BPI RSCR system with CO Catalyst<br>Regenerative Thermal Oxidation<br>Catalytic Oxidation<br>Good Combustion Techniques | The use of Good Combustion Techniques with a CO emission limit of 24.7 lb/hr, each | Vol. II Attachment B |
| $SO_2$ | Fuel/Raw Material Pretreatment<br>Wet Scrubber<br>Dry Scrubber (Spray Dryer)<br>Dry Scrubber (Injection System)<br>Use of Natural Gas or Propane as fuel | Exclusive use of Natural Gas or Propane as fuel and the use of a wet scrubber as an add-on control device to limit emissions to 34.3 lbs/hr, each | Vol. II Attachment C |
| $PM/PM_{10}$ | High Efficiency Baghouse<br>Electrostatic Precipitator<br>Wet Scrubber | The use of a high efficiency baghouse to limit $PM/PM_{10}$ emissions to 0.01 gr/dscf, each | Vol. II Attachment D |
| $PM_{2.5}$ | High Efficiency Baghouse<br>Electrostatic Precipitator<br>Wet Scrubber | The use of a high efficiency baghouse to limit $PM_{2.5}$ emissions to 0.01 gr/dscf, each | Vol. II Attachment D |
| VOC | Carbon Adsorption<br>Regenerative Thermal Oxidation<br>Catalytic Oxidation<br>Biofiltration<br>Pollution Prevention/Good Combustion Techniques | The use of good combustion techniques and dedicated use of natural gas and propane as fuels | Vol. II Attachment E |
| GHG | Fluxes/Mineralizers to Reduce Required Calciner Temperature<br>Raw Material Substitution<br>Carbon Capture and Sequestration (CCS)<br>Fuel Switching<br>Baseline Control Measures Package | Limiting GHG emissionsto 36,715 tpy $CO_2e$ through the use of the following technologies and practices:<br>o Reject Heat Recovery<br>o Efficient Process Design and Optimization<br>o Good Combustion Practices | Vol. II Attachment F |

## 5.4 Summary of Top-Down BACT Analysis: Spray Dryer Nos. 1 – 8

Table 5.4-1 below summarizes the BACT analysis conducted and proposed BACT findings for Spray Dryer Nos. 1 – 8.

**Table 5.4-1: Summary of BACT Analysis and Findings- Spray Dryer Nos. 1 – 8**

| Pollutant | Technologies Evaluated | Proposed BACT | Reference |
|---|---|---|---|
| $NO_x$ | Selective Non-Catalytic Reduction (SNCR)<br>$NO_x$ Wet Scrubbing<br>Selective Catalytic Reduction (SCR)<br>Good Combustion Techniques | The use of Good Combustion Techniques to control $NO_x$ emissions to 8.3 lb/hr, each | Vol. II Attachment A |
| CO | Regenerative Thermal Oxidation<br>Catalytic Oxidation<br>Good Combustion Techniques | The use of Good Combustion Techniques with a CO emission limit of 16.6 lb/hr, each | Vol. II Attachment B |
| $SO_2$ | Fuel/Raw Material Pretreatment<br>Wet Scrubber<br>Semi-Dry Scrubber (Spray Dryer Type)<br>Dry Scrubber (Injection System)<br>Use of Natural Gas or Propane as fuel | Exclusive use of natural gas or propane as fuel | Vol. II Attachment C |
| $PM/PM_{10}$ | High Efficiency Baghouse<br>Electrostatic Precipitator<br>Wet Scrubber | The use of a high efficiency baghouse to limit $PM/PM_{10}$ emissions to 0.02 gr/dscf, each | Vol. II Attachment D |
| $PM_{2.5}$ | High Efficiency Baghouse<br>Electrostatic Precipitator<br>Wet Scrubber | The use of a high efficiency baghouse to limit $PM_{2.5}$ emissions from to 0.0075 gr/dscf, each | Vol. II Attachment D |
| VOC | Carbon Adsorption<br>Regenerative Thermal Oxidation<br>Catalytic Oxidation<br>Biofiltration<br>Pollution Prevention / Good Combustion Techniques | Pollution Prevention with a VOC emission limit of 13.64 tons per twelve-month rolling total period for each line (2 spray dryers). | Vol. II Attachment E |
| GHG | Raw Material Substitution<br>Carbon Capture and Sequestration (CCS)<br>Fuel Switching<br>Baseline Control Measure Package | Limiting GHG emissionsto 28,760 tpy $CO_2e$ through the use of the following technologies and practices:<br>o Efficient Process Design and Optimization<br>o Good Combustion Practices | Vol. II Attachment F |

## 5.5 Summary of Top-Down BACT Analysis: Boiler Nos. 1 – 4

Table 5.5-1 below summarizes the BACT analysis conducted and proposed BACT findings for Boiler Nos. 1 – 4.

**Table 5.5-1: Summary of BACT Analysis and Findings- Boiler Nos. 1 – 4**

<table>
<tr><th>Pollutant</th><th>Technologies Evaluated</th><th>Proposed BACT</th><th>Reference</th></tr>
<tr><td rowspan="4">$NO_x$</td><td>$NO_x$ Wet Scrubbing</td><td rowspan="4">The use of Ultra-low $NO_x$ Burners to limit $NO_x$ emissions to 12ppm @ 3% $O_2$, each</td><td rowspan="4">Vol. II Attachment A</td></tr>
<tr><td>Selective Catalytic Reduction (SCR)</td></tr>
<tr><td>Selective Non-Catalytic Reduction (SNCR)</td></tr>
<tr><td>Ultra-low $NO_x$ Burners</td></tr>
<tr><td rowspan="3">CO</td><td>Recuperative Thermal Oxidation</td><td rowspan="3">The use of Good Combustion Techniques</td><td rowspan="3">Vol. II Attachment B</td></tr>
<tr><td>Catalytic Oxidation</td></tr>
<tr><td>Good Combustion Techniques</td></tr>
<tr><td rowspan="5">$SO_2$</td><td>Fuel Pretreatment</td><td rowspan="5">Exclusive use of natural gas or propane as fuel</td><td rowspan="5">Vol. II Attachment C</td></tr>
<tr><td>Wet Scrubber</td></tr>
<tr><td>Semi-Dry Scrubber (Spray Dryer Type)</td></tr>
<tr><td>Dry Scrubber (Injection System)</td></tr>
<tr><td>Use of Natural Gas or Propane as fuel</td></tr>
<tr><td rowspan="4">$PM/PM_{10}$</td><td>High Efficiency Baghouse</td><td rowspan="4">Exclusive use of natural gas or propane as fuel</td><td rowspan="4">Vol. II Attachment D</td></tr>
<tr><td>Electrostatic Precipitator</td></tr>
<tr><td>Wet Scrubber</td></tr>
<tr><td>Use of Natural Gas or Propane as fuel</td></tr>
<tr><td rowspan="4">$PM_{2.5}$</td><td>High Efficiency Baghouse</td><td rowspan="4">Exclusive use of natural gas or propane as fuel</td><td rowspan="4">Vol. II Attachment D</td></tr>
<tr><td>Electrostatic Precipitator</td></tr>
<tr><td>Wet Scrubber</td></tr>
<tr><td>Use of Natural Gas or Propane as fuel</td></tr>
<tr><td rowspan="5">VOC</td><td>Carbon Adsorption</td><td rowspan="5">The use of Good Combustion Techniques and exclusive use of natural gas or propane as fuel</td><td rowspan="5">Vol. II Attachment E</td></tr>
<tr><td>Recuperative Thermal Oxidation</td></tr>
<tr><td>Catalytic Oxidation</td></tr>
<tr><td>Biofiltration</td></tr>
<tr><td>Pollution Prevention/Good Combustion Techniques</td></tr>
<tr><td rowspan="9">GHG</td><td>Carbon Capture and Sequestration (CCS)</td><td rowspan="9">Limiting GHG emissionsto 5,997 tpy $CO_2e$ through the use of the following technologies and practices:<br>o Exclusive use of natural gas and propane as fuels<br>o Insulation of boiler heated surfcaces</td><td rowspan="9">Vol. II Attachment F</td></tr>
<tr><td>Biomass Firing/Co-Firing</td></tr>
<tr><td>Fuel Switching</td></tr>
<tr><td>Combined Heat and Power (CHP)</td></tr>
<tr><td>Firetube Turbulators</td></tr>
<tr><td>Economizer/Air Preheater</td></tr>
<tr><td>Condensate Recovery</td></tr>
<tr><td>Blowdown Heat Recovery</td></tr>
<tr><td>Baseline Control Measures</td></tr>
</table>

## 5.6 Summary of Top-Down BACT Analysis: Emergency Generator Nos. 1 – 4

Table 5.6-1 below summarizes the BACT analysis conducted and proposed BACT findings for Emergency Generator Nos. 1 – 4.

**Table 5.6-1: Summary of BACT Analysis and Findings- Emergency Generator Nos. 1 – 4**

| Pollutant | Technologies Evaluated | Proposed BACT | Reference |
|---|---|---|---|
| $NO_x$ | Selective Non-Catalytic Reduction (SNCR)<br>$NO_x$ Wet Scrubbing<br>Selective Catalytic Reduction (SCR)<br>Good Combustion Techniques | The use of Good Combustion Techniques to control $NO_x$ emissions to 4.77 g/bhp-hr per unit and to limit hours of operation to 500 hours per year, each. | Vol. II Attachment A |
| CO | Recuperative Thermal Oxidation<br>Catalytic Oxidation<br>Good Combustion Techniques | The use of Good Combustion Techniques with a CO emission limit of 2.6 g/bhp-hr and a limit of 500 operating hours per year, each. | Vol. II Attachment B |
| $SO_2$ | Wet Scrubber<br>Semi-Dry Scrubber (Spray Dryer Type)<br>Dry Scrubber (Injection System)<br>Exclusive use of Ultra-low Sulfur fuel | Limit sulfur in fuel to 0.0015 wt. % and limit to 500 hours of operation per year, each. | Vol. II Attachment C |
| $PM/PM_{10}$ | High Efficiency Baghouse<br>Electrostatic Precipitator<br>Wet Scrubber<br>Good Combustion Practices | Exclusive use of Diesel as fuel with a PM emission limit of 0.055 g/bhp-hr and maximum 500 hours of operation per year, each. | Vol. II Attachment D |
| $PM_{2.5}$ | High Efficiency Baghouse<br>Electrostatic Precipitator<br>Wet Scrubber<br>Good Combustion Practices | Exclusive use of Diesel as fuel with a PM emission limit of 0.055 g/bhp-hr and maximum 500 hours of operation per year, each. | Vol. II Attachment D |
| VOC | Carbon Adsorption<br>Recuperative Thermal Oxidation<br>Catalytic Oxidation<br>Biofiltration<br>Pollution Prevention/Good Combustion Techniques | Good Combustion Techniques with a maximum 500 hours of operation per year each. | Vol. II Attachment E |
| GHG | Carbon Capture and Sequestration (CCS)<br>Biomass Firing/Co-Firing<br>Fuel Switching<br>Waste Heat Recovery<br>Efficient Design and Operational Practices | Limiting GHG emissionsto 844 tpy $CO_2e$ through the use of the following technologies and practices:<br>○ Efficient Design and Operational Practices<br>○ Good Maintenance Practices<br>○ Operation limited to 500 hours per year | Vol. II Attachment F |

## 5.7 Summary of Top-Down BACT Analysis: Material Storage and Handling Systems

This section covers the proposed Material Storage and Handling emission units as listed in Table 5.7-1 below.

**Table 5.7-1: Proposed Material Storage and Handling Emission Units**

| Emission Unit ID No. | Emission Unit Description | Emission Unit Group ID Nos. |
|---|---|---|
| DSB1 | Spray Dryer No. 1 Feed Bin | GP01 |
| DUB1 | Spray Dryer No. 1 Unders Bin | |
| DSB2 | Spray Dryer No. 2 Feed Bin | |
| DUB2 | Spray Dryer No. 2 Unders Bin | |
| OC01 | Overflow Conveyor No. 1 | |
| ABC1 | Accepts Belt Conveyor No. 1 | |
| GPC1 | Pellet Collection Conveyor No. 1 | |
| GPT1 | Pellet Transfer Conveyor No. 1 | |
| GPE1 | Pellet Bucket Elevator No. 1 | |
| GSH1 | Screen Surge Hopper No. 1 | |
| GSC1 | Pellet Screen No. 1-1 | |
| GSC2 | Pellet Screen No. 1-2 | |
| GSC3 | Pellet Screen No. 1-3 | |
| OBC1 | Oversize Collection Belt Conveyor No. 1 | |
| ORB1 | Oversize Surge Bin No. 1 | |
| UBC1 | Unders Collection Belt Conveyor No. 1 | |
| URC1 | Unders Reversible Belt Conveyor No. 1 | |
| KFE1 | Calciner No. 1 Feed Bin Bucket Elevator | |
| KFB1 | Calciner No. 1 Feed Bin | |
| KRB1 | Calciner No. 1 Recycle Feed Bin | |
| KRE1 | Calciner No. 1 Recycle Feed Bin Bucket Elevator | |
| KFC1 | Calciner No. 1 Feed Conveyor | |
| KCE1 | Calciner No. 1 Cooler Bucket Elevator | KAE1 |
| KPS1 | Calciner No. 1 Product Screen | |
| KFS1 | Calciner No. 1 Fines Screen | |
| KQC1 | Calciner No. 1 Product QC Bin A | |
| KQC2 | Calciner No. 1 Product QC Bin B | |
| KQC3 | Calciner No. 1 Product QC Bin C | |
| KQC4 | Calciner No. 1 Product QC Bin D | |
| KCS1 | Calciner No. 1 Product Screen DPCS | |
| KCS2 | Calciner No. 1 Fines Screen DPCS | |
| RRL1 | Railcar Loading Operations No. 1 | ---- |
| BS01 | Bulk Product Silo No. 1-1 | |
| BS02 | Bulk Product Silo No. 1-2 | |
| BS03 | Bulk Product Silo No. 1-3 | |
| BS04 | Bulk Product Silo No. 1-4 | |
| DSB3 | Spray Dryer No. 3 Feed Bin | GP02 |
| DUB3 | Spray Dryer No. 3 Unders Bin | |
| DSB4 | Spray Dryer No. 4 Feed Bin | |
| DUB4 | Spray Dryer No. 4 Unders Bin | |
| OC02 | Overflow Conveyor No. 2 | |
| ABC2 | Accepts Belt Conveyor No.2 | |
| GPC2 | Pellet Collection Conveyor No. 2 | |
| GPT2 | Pellet Transfer Conveyor No. 2 | |
| GPE2 | Pellet Bucket Elevator No. 2 | |
| GSH2 | Screen Surge Hopper No. 2 | |
| GSC4 | Pellet Screen No. 2-1 | |
| GSC5 | Pellet Screen No. 2-2 | |
| GSC6 | Pellet Screen No. 2-3 | |
| OBC2 | Oversize Collection Belt Conveyor No. 2 | |
| ORB2 | Oversize Surge Bin No. 2 | |

**Table 5.7-1: Proposed Material Storage and Handling Emission Units**

| Emission Unit ID No. | Emission Unit Description | Emission Unit Group ID Nos. |
|---|---|---|
| UBC2 | Unders Collection Belt Conveyor No. 2 | |
| URC2 | Unders Reversible Belt Conveyor No. 2 | |
| KFE2 | Calciner No. 2 Feed Bin Bucket Elevator | |
| KFB2 | Calciner No. 2 Feed Bin | |
| KRB2 | Calciner No. 2 Recycle Feed Bin | |
| KRE2 | Calciner No. 2 Recycle Feed Bin Bucket Elevator | |
| KFC2 | Calciner No. 2 Feed Conveyor | |
| KCE2 | Calciner No. 2 Cooler Bucket Elevator | KAE2 |
| KPS2 | Calciner No. 2 Product Screen | |
| KFS2 | Calciner No. 2 Fines Screen | |
| KQC5 | Calciner No. 2 Product QC Bin A | |
| KQC6 | Calciner No. 2 Product QC Bin B | |
| KQC7 | Calciner No. 2 Product QC Bin C | |
| KQC8 | Calciner No. 2 Product QC Bin D | |
| KCS3 | Calciner No. 2 Product Screen DPCS | |
| KCS4 | Calciner No. 2 Fines Screen DPCS | |
| BS05 | Bulk Product Silo No. 2-1 | ---- |
| BS06 | Bulk Product Silo No. 2-2 | |
| BS07 | Bulk Product Silo No. 2-3 | |
| BS08 | Bulk Product Silo No. 2-4 | |
| DSB5 | Spray Dryer No. 5 Feed Bin | GP03 |
| DUB5 | Spray Dryer No. 5 Unders Bin | |
| DSB6 | Spray Dryer No. 6 Feed Bin | |
| DUB6 | Spray Dryer No. 6 Unders Bin | |
| OC03 | Overflow Conveyor No. 3 | |
| ABC3 | Accepts Belt Conveyor No. 3 | |
| GPC3 | Pellet Collection Conveyor No. 3 | |
| GPT3 | Pellet Transfer Conveyor No. 3 | |
| GPE3 | Pellet Bucket Elevator No. 3 | |
| GSH3 | Screen Surge Hopper No. 3 | |
| GSC7 | Pellet Screen No. 3-1 | |
| GSC8 | Pellet Screen No. 3-2 | |
| GSC9 | Pellet Screen No. 3-3 | |
| OBC3 | Oversize Collection Belt Conveyor No. 3 | |
| ORB3 | Oversize Surge Bin No. 3 | |
| UBC3 | Unders Collection Belt Conveyor No. 3 | |
| URC3 | Unders Reversible Belt Conveyor No. 3 | |
| KFE3 | Calciner No. 3 Feed Bin Bucket Elevator | |
| KFB3 | Calciner No. 3 Feed Bin | |
| KRB3 | Calciner No. 3 Recycle Feed Bin | |
| KRE3 | Calciner No. 3 Recycle Feed Bin Bucket Elevator | |
| KFC3 | Calciner No. 3 Feed Conveyor | |
| KCE3 | Calciner No. 3 Cooler Bucket Elevator | KAE3 |
| KPS3 | Calciner No. 3 Product Screen | |
| KFS3 | Calciner No. 3 Fine Screen | |
| KQC9 | Calciner No. 3 Product QC Bin A | |
| KQ10 | Calciner No. 3 Product QC Bin B | |
| KQ11 | Calciner No. 3 Product QC Bin C | |
| KQ12 | Calciner No. 3 Product QC Bin D | |
| KCS5 | Calciner No. 3 Product Screen DPCS | |
| KCS6 | Calciner No. 3 Fines Screen DPCS | |
| PBC3 | Calciner No. 3 Product Screen Belt Conveyor | ---- |
| PBE3 | Calciner No. 3 Product Screen Bucket Elevator | |
| FBC3 | Calciner No. 3 Fines Screen Belt Conveyor | |
| FBE3 | Calciner No. 3 Fines Screen Bucket Elevator | |
| RRL2 | Railcar Loading Operations No. 2 | |
| BS09 | Bulk Product Silo No. 3-1 | |
| BS10 | Bulk Product Silo No. 3-2 | |
| BS11 | Bulk Product Silo No. 3-3 | |

**Table 5.7-1: Proposed Material Storage and Handling Emission Units**

| Emission Unit ID No. | Emission Unit Description | Emission Unit Group ID Nos. |
|---|---|---|
| BS12 | Bulk Product Silo No. 3-4 | |
| DSB7 | Spray Dryer No. 7 Feed Bin | GP04 |
| DUB7 | Spray Dryer No. 7 Unders Bin | |
| DSB8 | Spray Dryer No. 8 Feed Bin | |
| DUB8 | Spray Dryer No. 8 Unders Bin | |
| OC04 | Overflow Conveyor No. 4 | |
| ABC4 | Accepts Belt Conveyor No.4 | |
| GPC4 | Pellet Collection Conveyor No. 4 | |
| GPT4 | Pellet Transfer Conveyor No. 4 | |
| GPE4 | Pellet Bucket Elevator No. 4 | |
| GSH4 | Screen Surge Hopper No. 4 | |
| GS10 | Pellet Screen No. 4-1 | |
| GS11 | Pellet Screen No. 4-2 | |
| GS12 | Pellet Screen No. 4-3 | |
| OBC4 | Oversize Collection Belt Conveyor No. 4 | |
| ORB4 | Oversize Surge Bin No. 4 | |
| UBC4 | Unders Collection Belt Conveyor No. 4 | |
| URC4 | Unders Reversible Belt Conveyor No. 4 | |
| KFE4 | Calciner No. 4 Feed Bin Bucket Elevator | |
| KFB4 | Calciner No. 4 Feed Bin | |
| KRB4 | Calciner No. 4 Recycle Feed Bin | |
| KRE4 | Calciner No. 4 Recycle Feed Bin Bucket Elevator | |
| KFC4 | Calciner No. 4 Feed Conveyor | |
| KCE4 | Calciner No. 4 Cooler Bucket Elevator | KAE4 |
| KPS4 | Calciner No. 4 Product Screen | |
| KFS4 | Calciner No. 4 Fine Screen | |
| KQ13 | Calciner No. 4 Product QC Bin A | |
| KQ14 | Calciner No. 4 Product QC Bin B | |
| KQ15 | Calciner No. 4 Product QC Bin C | |
| KQ16 | Calciner No. 4 Product QC Bin D | |
| KCS7 | Calciner No. 4 Product Screen DPCS | |
| KCS8 | Calciner No. 8 Fines Screen DPCS | |
| PB04 | Line No. 4 Product Belt | ---- |
| BS13 | Bulk Product Silo No. 4-1 | |
| BS14 | Bulk Product Silo No. 4-2 | |
| BS15 | Bulk Product Silo No. 4-3 | |
| BS16 | Bulk Product Silo No. 4-4 | |
| KLN1 | Direct-Fired Rotary Calciner No. 1 | |
| KLN2 | Direct-Fired Rotary Calciner No. 2 | |
| KLN3 | Direct-Fired Rotary Calciner No. 3 | |
| KLN4 | Direct-Fired Rotary Calciner No. 4 | |
| SD01 | Spray Dryer No. 1 | |
| SD02 | Spray Dryer No. 2 | |
| SD03 | Spray Dryer No. 3 | |
| SD04 | Spray Dryer No. 4 | |
| SD05 | Spray Dryer No. 5 | |
| SD06 | Spray Dryer No. 6 | |
| SD07 | Spray Dryer No. 7 | |
| SD08 | Spray Dryer No. 8 | |
| BLR1 | Boiler No. 1 | |
| BLR2 | Boiler No. 2 | |
| BLR3 | Boiler No. 3 | |
| BLR4 | Boiler No. 4 | |
| EDG1 | Emergency Generator No. 1 | |
| EDG2 | Emergency Generator No. 2 | |
| EDG3 | Emergency Generator No. 3 | |
| EDG4 | Emergency Generator No. 4 | |

Table 5.7-2 below summarizes the BACT analysis conducted and proposed BACT findings for the new New Material Storage and Handling Systems.

**Table 5.7-2: Summary of BACT Analysis and Findings- Material Storage and Handling Systems**

| Pollutant | Emission Unit No. | Technologies Evaluated | Proposed BACT | Reference |
|---|---|---|---|---|
| $PM/PM_{10}$ | All Material Storage and Handling | High Efficiency Baghouse<br>Electrostatic Precipitator<br>Wet Scrubber | The use of a high efficiency baghouse to control PM emissions from each baghouse stack to 0.01 gr/dscf | Vol. II Attachment D |
| $PM_{2.5}$ | All Material Storage and Handling | High Efficiency Baghouse<br>Electrostatic Precipitator<br>Wet Scrubber | The use of a high efficiency baghouse to control PM emissions from each baghouse stack to 0.005 gr/dscf | Vol. II Attachment D |

# 6.0 AIR QUALITY ANALYSIS

This Section offers a condensed summary of the source and air quality analyses conducted as part of PSD review. Please refer to Volume III of this application for the full, detailed air quality analysis conducted for $NO_x$, $SO_2$, CO, $PM_{10}$, and $PM_{2.5}$ to demonstrate compliance with the applicable NAAQS and PSD increments.

## 6.1 Ambient Air Quality Review

### 6.1.1 NAAQS Analysis Summary

Based on the preliminary impact assessment presented in Section 2.2 of Volume III, the Millen facility was predicted to have a significant impact for $NO_x$, $SO_2$, $PM_{10}$, and $PM_{2.5}$. Therefore, a full impact analysis for each pollutant was performed, including the collection of ambient monitoring data to establish the existing air quality in the area impacted by the project and development of regional source inventories. Section 2.3 of Volume III provides a discussion of PSD ambient monitoring requirements and background concentrations used for the NAAQS analysis and Section 2.4 of Volume III provides a discussion of the regional inventories developed to estimate the air quality impact of nearby sources. Section 2.5 of Volume III contains the NAAQS air quality analysis. The NAAQS analysis demonstrates that the Millen facility will not cause or contribute to a violation in any area for any NAAQS.

### 6.1.2 Class II Increment Analysis Summary

Since emissions of $NO_x$, $SO_2$, and $PM_{10}$ were predicted to have a significant impact in the preliminary impact assessment, a cumulative increment consumption analysis was also performed for each pollutant. Section 2.6 of Volume III contains the PSD increment air quality analysis. The analysis demonstrates that the Millen facility will not cause or contribute to a violation in any area for any Class II PSD increment effective at the time of this application.

### 6.1.3 Class I Increment and AQRV Analysis Summary

Emissions of $NO_x$, $SO_2$, and $PM_{10}$ from the Millen facility were also evaluated for significance with respect to the Class I SIL's in four Class I areas – Cape Romain, Okefenokee, Wolf Island, and Shining Rock. This analysis is presented along with an evaluation of the facility's impacts to visibility and acidic deposition in Section 3.0 of Volume III. The analysis demonstrates that the Millen facility will result in *de minimis* impacts with respect to $NO_x$, $SO_2$, and $PM_{10}$ and will not adversely impact AQRV's in the Class I areas evaluated.

# 7.0 ADDITIONAL IMPACT ANALYSIS

As part of preconstruction review, PSD applicants are required to conduct an analysis of the adverse impacts to visibility, soils and vegetation that would occur as a result of the project and from associated growth. The analysis need not address impacts to receptors sensitive to visibility impairment not located within the largest of the annual $NO_2$ or $PM_{10}$ SIA's, soils and vegetation having no significant commercial or recreational value, or growth associated with mobile source or temporary emissions.

## 7.1 Soils and Vegetation

In order to determine if any adverse impacts to soils or vegetation would occur as a result of the project, a screening procedure was used based on guidance provided by US EPA in *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals*, December 1980. The screening guidance lists pollutants which have both direct and indirect impacts on soils and vegetation. For pollutants which are said to have direct adverse impacts, such as $NO_2$, $SO_2$, and CO, the minimum levels of pollutant concentrations in the ambient air at which adverse effects have been reported were used as screening concentrations. For this analysis, refined dispersion modeling was conducted using AERMOD to estimate the total air quality concentration to compare to the screening thresholds, including the contribution of applicable nearby sources represented in the NAAQS inventory and other sources represented by the background concentration. If the maximum model concentration exceeds the screening level, further analysis is required based on an estimation of indirect impacts via soil deposition and plant uptake. Certain pollutants, such a particulate forms of trace elements boron (B), copper (Cu), vanadium (V), and zinc (Zn) have adverse impacts via indirectly pathways only. In order to perform a screening assessment for these pollutants, potential project emissions were compared to significant emission rate thresholds (SER's). The respective SER for each pollutant was originally developed based on a source lifetime of 10 years. Therefore, the SER's were adjusted to reflect a 40 year lifetime for the project.

Table 7.1-1 provides a summary of the total air quality concentration predicted for $NO_2$, $SO_2$, and CO in comparison to the screening concentrations. For the analysis, the results of the NAAQS air quality analysis for $SO_2$ and annual $NO_2$ were used for comparison to the screening concentrations since the averaging times are consistent with the screening concentrations. For the 4-hour, 8-hour, and 1 month averaging periods for $NO_2$ and 1 week averaging period for CO, the results of the 1-hour $NO_2$ NAAQS analysis and 1-hour CO preliminary impact assessment were used as a conservative measure for comparison to the screening concentrations on these averaging periods. As shown in Table 7.1-1, the total air quality impacts for each pollutant and averaging period are well below the screening concentrations for adverse impacts.

**Table 7.1-1: Comparison of Air Quality Impacts of $NO_2$, $SO_2$, and CO to the Direct Acting Pollutant Screening Concentrations**

| Pollutant | Avg. Period | Background Concentration [1] (μg/m$^3$) | Total Air Quality Concentration [2] (μg/m$^3$) | Screening Conc. [3] (μg/m$^3$) | Above Screening Threshold |
|---|---|---|---|---|---|
| $NO_2$ | 4-hr | 33.24 | 93.98 [4] | 3,760 | No |
| | 8-hr | | | 3,760 | No |
| | 1-month | | | 564 | No |
| | Annual | 5.2 | 18.03 [5] | 94 | No |
| $SO_2$ | 1-hr | 67.18 | 112.67 [5] | 917 | No |
| | 3-hr | 54.18 | 111.32 [5] | 786 | No |
| | Annual | 3.89 | 7.49 [5] | 18 | No |
| CO | 1-week | 943 | 1,050.44 [6] | 1,800,000 | No |

1 Background concentrations representing the contribution from *other* sources are listed in Table 2.3-2 of Volume III.
2 For $NO_2$ and $SO_2$, the total air quality concentration includes the contribution from *nearby* sources in the NAAQS inventory and background concentrations. For CO, only the Millen facility is included in the total air quality concentrations since the ambient impacts were *de minimis*
3 Screening concentrations for each pollutant and averaging period are based on the most stringent provided in Table 3.1 of *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals*, December 1980
4 Since the additional impacts assessment is only required to be carried out within the largest SIA for deterministic NAAQS, the total air quality concentration from the 1-hour $NO_2$ NAAQS air quality analysis used as a conservative surrogate for the 4-hour, 8-hour and 1-month averaging periods is the greatest impact occurring within 6.5 km of the Millen facility (416,900 m east, 3,629,300 m north)
5 Maximum impacts for each averaging period from the NAAQS air quality analysis presented in Table 2.5-2 of Volume III
6 Maximum impact for the 1-hour averring period from the preliminary impact assessment presented in Table 2.2.2-1 of Volume III plus the background concentration

Table 7.1-2 provides a comparison of total project emissions for Cu, V, and Zn to the adjusted SER's; there is no data or applicable emission factor available to CARBO at this time to estimate emissions of boron from any of the project sources. Since the original SER for each pollutant was based on a 10-year source life, the SER's were adjusted downward by a factor of 4 to account for an estimated 40-year source life for the Millen facility. As shown in Table 7.1-2, total project emissions are below the adjusted SER's for indirect acting pollutants.

**Table 7.1-2: Comparison of Potential Project Emissions of Cu, V, and Zn to the Significant Emission Rate Thresholds**

| Pollutant | Project Emissions [1] (tpy) | SER [2] (tpy) | Adjusted SER [3] (tpy) | Above Threshold |
|---|---|---|---|---|
| Copper (Cu) | 0.024 | 0.21 | 0.053 | No |
| Vanadium (V) | 0.065 | 0.33 | 0.083 | No |
| Zinc (Zn) | 0.816 | 63 | 15.75 | No |

[1] Based on facility-wide maximum hourly natural gas consumption of 642,353 scfh (8 spray dryers, 4 direct-fired rotary kilns, and 4 boilers totaling 655 mmBtu/hr) and emission factors published in AP-42 Table 1.4-4 for copper ($8.5 \times 10^{-4}$ lb/$10^6$ scf), vanadium ($2.3 \times 10^{-3}$ lb/$10^6$ scf) and zinc ($2.9 \times 10^{-2}$ lb/$10^6$ scf)

[2] SER's for each pollutant are based on the most stringent for soils or plants provided in Table 5.7 of *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals*, December 1980

[3] SER's are adjusted downward by a factor of 4 to account for the fact that the published SER's are only based on a 10-year source life

## 7.2 Visibility Impairment

The Class II visibility impairment screening analysis evaluates the visual plume impacts at potentially sensitive receptors within the largest of the annual $NO_2$ or $PM_{10}$ SIA. Potentially sensitive receptors include state parks, historic sites and airports. The receptor nearest to the project site is Magnolia Springs State Park, which is located 13 km from the project site, 8 km north of Millen. Since there are no receptors with potential sensitivity to visibility impairment within either the annual $NO_2$ (6.5 km) or $PM_{10}$ (3.4 km) SIA's, no screening assessment was required to be performed.

## 7.3 Growth

The impacts of growth associated with a PSD project are referred to as secondary emissions. Secondary emissions are not emitted directly by the proposed project, but are indirectly associated with the construction and/or operation the facility. The growth analysis, if warranted, is intended to quantify the amount of new growth that is likely to occur in support of the facility and to estimate emissions resulting from that growth. Associated growth includes new residential and commercial/industrial growth resulting from the new facility but excludes temporary and mobile source emissions.

Secondary emissions associated with construction of the facility will be temporary and are not required to be evaluated. With respect to residential growth, the number of new permanent jobs created by the project is expected to be between 50 to 75. To the extent possible, these jobs will be filled from the local labor pool. However, if this expectation can not be accommodated, there is a supply of existing vacant housing in Jenkins and surrounding counties sufficient to serve those who will move to the area. According to the 2005-2009 American Community Survey (ACS), there are thousands of vacant housing units for sale and for rent within reasonable commuting distances from Bulloch, Burke, Candler, Emanuel, Jenkins and Screven counties. Other than the Millen facility, no industrial growth is anticipated to be associated with the project as the supply of kaolin and other materials for the manufacture of proppant will come from existing mines and suppliers both inside and outside of central Georgia. Accordingly, for the purposes of an additional impacts assessment, negligible new growth is anticipated as a result of the proposed facility.

# Volume I, Attachment A –

# SIP Forms

State of Georgia
Department of Natural Resources
Environmental Protection Division
Air Protection Branch

Stationary Source Permitting Program
4244 International Parkway, Suite 120
Atlanta, Georgia 30354
404/363-7000
Fax: 404/363-7100

# SIP AIR PERMIT APPLICATION

**EPD Use Only**

Date Received: ____________ Application No. ____________

## FORM 1.00: GENERAL INFORMATION

**1. Facility Information**

Facility Name: CARBO Ceramics, Inc.

AIRS No. (if known):

Facility Location: Street:

City: Millen Georgia Zip: County: Jenkins

**2. Facility Coordinates**

Latitude: 32° 45' 52" **NORTH** Longitude: 81° 53' 58" **WEST**

UTM Coordinates: ______ **EAST** ______ **NORTH** **ZONE** ______

**3. Facility Owner**

Name of Owner: CARBO Ceramics, Inc.

Owner Address Street: 575 N. Dairy Ashford, Suite 300

City: Houston State: Texas Zip: 77079

**4. Permitting Contact and Mailing Address**

Contact Person: Jason Goodwin Title: EHS Director

Telephone No.: 281.921.6472 Ext. Fax No.: 281.582.3170

Email Address: Jason.goodwin@carboceramics.com

Mailing Address: Same as: Facility Location: ☐ Owner Address: ☒ Other: ☐

If Other: Street Address:

City: State: Zip:

**5. Authorized Official**

Name: Jason Goodwin Title: EHS Director

Address of Official Street: 575 N. Dairy Ashford, Suite 300

City: Houston State: Texas 77079

This application is submitted in accordance with the provisions of the Georgia Rules for Air Quality Control and, to the best of my knowledge, is complete and correct.

Signature: ____________ Date: August 10, 2011

**6. Reason for Application: (Check all that apply)**

- ☒ New Facility (to be constructed)
- ☐ Existing Facility (initial or modification application)
- ☒ Permit to Construct
- ☒ Permit to Operate
- ☐ Change of Location
- ☐ Permit to Modify Existing Equipment: Affected Permit No.: ________

☐ Revision of Data Submitted in an Earlier Application

Application No.: ________

Date of Original Submittal: ________

**7. Permitting Exemption Activities (for permitted facilities only):**

Have any exempt modifications based on emission level per Georgia Rule 391-3-1-.03(6)(i)(3) been performed at the facility that have not been previously incorporated in a permit?

☐ **No** ☐ **Yes, please fill out the SIP Exemption Attachment** (See Instructions for the attachment download)

**8. Has assistance been provided to you for any part of this application?**

☐ **No** ☐ **Yes, SBAP** ☒ **Yes, a consultant has been employed or will be employed.**

**If yes, please provide the following information:**

Name of Consulting Company: Smith Aldridge, Inc.

Name of Contact: Craig A. Smith, Ph.D.

Telephone No.: (404) 255-0928 ext. 112 Fax No.: (404) 255-0948

Email Address: csmith@smithaldridge.com

Mailing Address: Street: 6000 Lake Forrest Drive, Suite 385

City: Atlanta State: Georgia Zip: 30328

Describe the Consultant's Involvement:

Submittal and application preparation and regulatory analysis.

**9. Submitted Application Forms:** Select only the necessary forms for the facility application that will be submitted.

| No. of Forms | Form |
|---|---|
| 9 | 2.00 Emission Unit List |
| 1 | 2.01 Boilers and Fuel Burning Equipment |
| | 2.02 Storage Tank Physical Data |
| | 2.03 Printing Operations |
| | 2.04 Surface Coating Operations |
| | 2.05 Waste Incinerators (solid/liquid waste destruction) |
| 14 | 2.06 Manufacturing and Operational Data |
| 5 | 3.00 Air Pollution Control Devices (APCD) |
| 1 | 3.01 Scrubbers |
| 5 | 3.02 Baghouses & Other Filter Collectors |
| | 3.03 Electrostatic Precipitators |
| 14 | 4.00 Emissions Data |
| 3 | 5.00 Monitoring Information |
| | 6.00 Fugitive Emission Sources |
| 5 | 7.00 Air Modeling Information |

**10. Construction or Modification Date**

Estimated Start Date: ________

**11. If confidential information is being submitted in this application, were the guidelines followed in the "Procedures for Requesting that Submitted Information be treated as Confidential"?**

☐ No ☐ Yes

**12. New Facility Emissions Summary**

| Criteria Pollutant | New Facility | |
|---|---|---|
| | Potential (tpy) | Actual (tpy) |
| Carbon monoxide (CO) | 1,046 | 1,046 |
| Nitrogen oxides (NOx) | 2,446 | 2,446 |
| Particulate Matter (PM) | 248 | 248 |
| PM <10 microns (PM10) | 248 | 248 |
| PM <2.5 microns (PM2.5) | 129 | 129 |
| Sulfur dioxide ($SO_2$) | 618 | 618 |
| Volatile Organic Compounds (VOC) | 66.9 | 66.9 |
| Total Hazardous Air Pollutants (HAPs) | 232 | 232 |
| Individual HAPs Listed Below: | | |
| | | |

**13. Existing Facility Emissions Summary**

| Criteria Pollutant | Current Facility | | After Modification | |
|---|---|---|---|---|
| | Potential (tpy) | Actual (tpy) | Potential (tpy) | Actual (tpy) |
| Carbon monoxide (CO) | | | | |
| Nitrogen oxides (NOx) | | | | |
| Particulate Matter (PM) | | | | |
| PM <10 microns (PM10) | | | | |
| PM <2.5 microns (PM2.5) | | | | |
| Sulfur dioxide ($SO_2$) | | | | |
| Volatile Organic Compounds (VOC) | | | | |
| Total Hazardous Air Pollutants[4] (HAPs) | | | | |
| Individual HAPs Listed Below: | | | | |
| | | | | |
| | | | | |

**14. 4-Digit Facility Identification Code:**

SIC Code: 1455 SIC Description: Kaolin and Ball Clay Processing

NAICS Code: ______ NAICS Description: ______

**15. Description of general production process and operation for which a permit is being requested. If necessary, attach additional sheets to give an adequate description. Include layout drawings, as necessary, to describe each process. References should be made to source codes used in the application.**

CARBO Ceramics is proposing to construct and operate a kaolin clay processing plant to be located in Jenkins County, which is classified as "attainment" for $PM_{10}$/$PM_{2.5}$, $SO_2$, $NO_x$, CO, and Ozone (as VOCs). The new facility will consist of four processing lines that manufacture ceramic proppants using kaolin clay. Proppants are formed in Spray Dryers where excess water is driven off and then processed through a Direct-fired Rotary Calciner where chemically bound water is removed. The facility will be considered a major source with respect to the Prevention of Significant Deterioration (PSD) program as $NO_x$, $SO_2$, CO, and particulate matter (PM) will be emitted at potential emission rates that exceed 250 tpy, Volatile Organic Compounds (VOCs) will be emitted at potential emission rates 40 tpy, $PM_{10}$ will be emitted at potential emission rates 15 tpy, $PM_{2.5}$ will be emitted at potential emission rates 10 tpy, and potential Greenhouse Gas (GHG) emissions will exceed the 75,000 tpy $CO_2e$. As such, CARBO has prepared this PSD review permit application with respect to the construction and operation of Processing Lines 1 through 4 for the above NSR pollutants.

**16. Additional information provided in attachments as listed below:**

Attachment A - ______

Attachment B - ______

Attachment C - ______

Attachment D - ______

Attachment E - ______

Attachment F - ______

**17. Additional Information: Unless previously submitted, include the following two items:**

☒ Plot plan/map of facility location or date of previous submittal: ______

☒ Flow Diagram or date of previous submittal: ______

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.00 – EMISSION UNIT LIST

| Emission Unit ID | Name | Manufacturer and Model Number | Description |
|---|---|---|---|
| DSB1 | Spray Dryer No. 1 Feed Bin | TBD | Spray Dryer No. 1 Feed Bin |
| DUB1 | Spray Dryer No. 1 Unders Bin | TBD | Spray Dryer No. 1 Unders Bin |
| DSB2 | Spray Dryer No. 2 Feed Bin | TBD | Spray Dryer No. 2 Feed Bin |
| DUB2 | Spray Dryer No. 2 Unders Bin | TBD | Spray Dryer No. 2 Unders Bin |
| OC01 | Overflow Conveyor No. 1 | TBD | Overflow Conveyor for Process Line No. 1 |
| ABC1 | Accepts Belt Conveyor No. 1 | TBD | Accepts Belt Conveyor for Process Line No. 1 |
| GPC1 | Pellet Collection Conveyor No. 1 | TBD | Pellet Connection Conveyor for Process Line No. 1 |
| GPT1 | Pellet Transfer Conveyor No. 1 | TBD | Pellet Transfer Conveyor for Process Line No. 1 |
| GPE1 | Pellet Bucket Elevator No. 1 | TBD | Pellet Bucket Elevator for Process Line No. 1 |
| GSH1 | Screen Surge Hopper No. 1 | TBD | Screen Surge Hopper for Process Line No. 1 |
| GSC1 | Pellet Screen No. 1-1 | TBD | Pellet Screen No. 1-1 |
| GSC2 | Pellet Screen No. 1-2 | TBD | Pellet Screen No. 1-2 |
| GSC3 | Pellet Screen No. 1-3 | TBD | Pellet Screen No. 1-3 |
| OBC1 | Oversize Collection Belt Conveyor No. 1 | TBD | Oversize Collection Belt Conveyor for Process Line No. 1 |
| ORB1 | Oversize Surge Bin No. 1 | TBD | Oversize Surge Bin for Process Line No. 1 |
| UBC1 | Unders Collection Belt Conveyor No. 1 | TBD | Unders Collection Belt Conveyor for Process Line No. 1 |
| URC1 | Unders Reversible Belt Conveyor No. 1 | TBD | Unders Reversible Belt Conveyor for Process Line No. 1 |
| KFE1 | Calciner No. 1 Feed Bucket Elevator | TBD | Calciner No. 1 Feed Bucket Elevator |
| KFB1 | Calciner No. 1 Feed Bin | TBD | Calciner No. 1 Feed Bin |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.00 – EMISSION UNIT LIST

| Emission Unit ID | Name | Manufacturer and Model Number | Description |
|---|---|---|---|
| KRB1 | Calciner No. 1 Recycle Feed Bin | TBD | Calciner No. 1 Recycle Feed Bin |
| KRE1 | Calciner No. 1 Recycle Feed Bin Bucket Elevator | TBD | Calciner No. 1 Recycle Feed Bin Bucket Elevator |
| KFC1 | Calciner No. 1 Feed Conveyor | TBD | Calciner No. 1 Feed Conveyor |
| KCE1 | Calciner No. 1 Cooler Bucket Elevator | TBD | Calciner No. 1 Cooler Bucket Elevator |
| KPS1 | Calciner No. 1 Product Screen | TBD | Calciner No. 1 Product Screen |
| KFS1 | Calciner No. 1 Fine Screen | TBD | Calciner No. 1 Fine Screen |
| KQC1 | Calciner No. 1 Product QC Bin A | TBD | Calciner No. 1 Product QC Bin A |
| KQC2 | Calciner No. 1 Product QC Bin B | TBD | Calciner No. 1 Product QC Bin B |
| KQC3 | Calciner No. 1 Product QC Bin C | TBD | Calciner No. 1 Product QC Bin C |
| KQC4 | Calciner No. 1 Product QC Bin D | TBD | Calciner No. 1 Product QC Bin D |
| KCS1 | Calciner No. 1 Product Screen DPCS | TBD | Calciner No. 1 Product Screen DPCS |
| KCS2 | Calciner No. 1 Fines Screen DPCS | TBD | Calciner No. 1 Fines Screen DPCS |
| BS01 | Bulk Product Silo No. 1-1 | TBD | Bulk Product Silo No. 1-1 |
| BS02 | Bulk Product Silo No. 1-2 | TBD | Bulk Product Silo No. 1-2 |
| BS03 | Bulk Product Silo No. 1-3 | TBD | Bulk Product Silo No. 1-3 |
| BS04 | Bulk Product Silo No. 1-4 | TBD | Bulk Product Silo No. 1-4 |
| DSB3 | Spray Dryer No. 3 Feed Bin | TBD | Spray Dryer No. 3 Feed Bin |
| DUB3 | Spray Dryer No. 3 Unders Bin | TBD | Spray Dryer No. 3 Unders Bin |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.00 – EMISSION UNIT LIST

| Emission Unit ID | Name | Manufacturer and Model Number | Description |
|---|---|---|---|
| DSB4 | Spray Dryer No. 4 Feed Bin | TBD | Spray Dryer No. 4 Feed Bin |
| DUB4 | Spray Dryer No. 4 Unders Bin | TBD | Spray Dryer No. 4 Unders Bin |
| OC02 | Overflow Conveyor No. 2 | TBD | Overflow Conveyor for Process Line No. 2 |
| ABC2 | Accepts Belt Conveyor No.2 | TBD | Accepts Belt Conveyor No.2 |
| GPC2 | Pellet Collection Conveyor No. 2 | TBD | Pellet Collection Conveyor for Process Line No. 2 |
| GPT2 | Pellet Transfer Conveyor No. 2 | TBD | Pellet Transfer Conveyor for Process Line No. 2 |
| GPE2 | Pellet Bucket Elevator No. 2 | TBD | Pellet Bucket Elevator for Process Line No. 2 |
| GSH2 | Screen Surge Hopper No. 2 | TBD | Screen Surge Hopper for Process Line No. 2 |
| GSC4 | Pellet Screen No. 2-1 | TBD | Pellet Screen No. 2-1 |
| GSC5 | Pellet Screen No. 2-2 | TBD | Pellet Screen No. 2-2 |
| GSC6 | Pellet Screen No. 2-3 | TBD | Pellet Screen No. 2-3 |
| OBC2 | Oversize Collection Belt Conveyor No. 2 | TBD | Oversize Collection Belt Conveyor for Process Line No. 2 |
| ORB2 | Oversize Surge Bin No. 2 | TBD | Oversize Surge Bin for Process Line No. 2 |
| UBC2 | Unders Collection Belt Conveyor No. 2 | TBD | Unders Collection Belt Conveyor for Process Line No. 2 |
| URC2 | Unders Reversible Belt Conveyor No. 2 | TBD | Unders Reversible Belt Conveyor for Process Line No. 2 |
| KFE2 | Calciner No. 2 Feed Bin Bucket Elevator | TBD | Calciner No. 2 Feed Bin Bucket Elevator |
| KFB2 | Calciner No. 2 Feed Bin | TBD | Calciner No. 2 Feed Bin |
| KRB2 | Calciner No. 2 Recycle Feed Bin | TBD | Calciner No. 2 Recycle Feed Bin |
| KRE2 | Calciner No. 2 Recycle Feed Bin Bucket Elevator | TBD | Calciner No. 2 Recycle Feed Bin Bucket Elevator |

## FORM 2.00 – EMISSION UNIT LIST

| Emission Unit ID | Name | Manufacturer and Model Number | Description |
|---|---|---|---|
| KFC2 | Calciner No. 2 Feed Conveyor | TBD | Calciner No. 2 Feed Conveyor |
| KCE2 | Calciner No. 2 Cooler Bucket Elevator | TBD | Calciner No. 2 Cooler Bucket Elevator |
| KPS2 | Calciner No. 2 Product Screen | TBD | Calciner No. 2 Product Screen |
| KFS2 | Calciner No. 2 Fine Screen | TBD | Calciner No. 2 Fine Screen |
| KQC5 | Calciner No. 2 Product QC Bin A | TBD | Calciner No. 2 Product QC Bin A |
| KQC6 | Calciner No. 2 Product QC Bin B | TBD | Calciner No. 2 Product QC Bin B |
| KQC7 | Calciner No. 2 Product QC Bin C | TBD | Calciner No. 2 Product QC Bin C |
| KQC8 | Calciner No. 2 Product QC Bin D | TBD | Calciner No. 2 Product QC Bin D |
| KCS3 | Calciner No. 2 Product Screen DPCS | TBD | Calciner No. 2 Product Screen DPCS |
| KCS4 | Calciner No. 2 Fines Screen DPCS | TBD | Calciner No. 2 Fines Screen DPCS |
| BS05 | Bulk Product Silo No. 2-1 | TBD | Bulk Product Silo No. 2-1 |
| BS06 | Bulk Product Silo No. 2-2 | TBD | Bulk Product Silo No. 2-2 |
| BS07 | Bulk Product Silo No. 2-3 | TBD | Bulk Product Silo No. 2-3 |
| BS08 | Bulk Product Silo No. 2-4 | TBD | Bulk Product Silo No. 2-4 |
| RRL1 | Railcar Loading Operations No. 1 | TBD | Railcar loadout system |
| RRL2 | Railcar Loading Operations No. 2 | TBD | Railcar loadout system |
| DSB5 | Spray Dryer No. 5 Feed Bin | TBD | Spray Dryer No. 5 Feed Bin |
| DUB5 | Spray Dryer No. 5 Unders Bin | TBD | Spray Dryer No. 5 Unders Bin |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.00 – EMISSION UNIT LIST

| Emission Unit ID | Name | Manufacturer and Model Number | Description |
|---|---|---|---|
| DSB6 | Spray Dryer No. 6 Feed Bin | TBD | Spray Dryer No. 6 Feed Bin |
| DUB6 | Spray Dryer No. 6 Unders Bin | TBD | Spray Dryer No. 6 Unders Bin |
| OC03 | Overflow Conveyor No. 3 | TBD | Overflow Conveyor for Process Line No. 3 |
| ABC3 | Accepts Belt Conveyor No.3 | TBD | Accepts Belt Conveyor No.3 |
| GPC3 | Pellet Collection Conveyor No. 3 | TBD | Pellet Collection Conveyor for Process Line No. 3 |
| GPT3 | Pellet Transfer Conveyor No. 3 | TBD | Pellet Transfer Conveyor for Process Line No. 3 |
| GPE3 | Pellet Bucket Elevator No. 3 | TBD | Pellet Bucket Elevator for Process Line No. 3 |
| GSH3 | Screen Surge Hopper No. 3 | TBD | Screen Surge Hopper for Process Line No. 3 |
| GSC7 | Pellet Screen No. 3-1 | TBD | Pellet Screen No. 3-1 |
| GSC8 | Pellet Screen No. 3-2 | TBD | Pellet Screen No. 3-1 |
| GSC9 | Pellet Screen No. 3-3 | TBD | Pellet Screen No. 3-3 |
| OBC3 | Overs Collection Belt Conveyor No. 3 | TBD | Oversize Collection Belt Conveyor for Process Line No. 3 |
| ORB3 | Overs Surge Bin No. 3 | TBD | Oversize Surge Bin for Process Line No. 3 |
| UBC3 | Unders Collection Belt Conveyor No. 3 | TBD | Unders Collection Belt Conveyor for Process Line No. 3 |
| URC3 | Unders Reversible Belt Conveyor No. 3 | TBD | Unders Reversible Belt Conveyor for Process Line No. 3 |
| KFE3 | Calciner No. 3 Feed Bin Bucket Elevator | TBD | Calciner No. 3 Feed Bin Bucket Elevator |
| KFB3 | Calciner No. 3 Feed Bin | TBD | Calciner No. 3 Feed Bin |
| KRB3 | Calciner No. 3 Recycle Feed Bin | TBD | Calciner No. 3 Recycle Feed Bin |
| KRE3 | Calciner No. 3 Recycle Feed Bin Bucket Elevator | TBD | Calciner No. 3 Recycle Feed Bin Bucket Elevator |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.00 – EMISSION UNIT LIST

| Emission Unit ID | Name | Manufacturer and Model Number | Description |
|---|---|---|---|
| KFC3 | Calciner No. 3 Feed Conveyor | TBD | Calciner No. 3 Feed Conveyor |
| PBC3 | Calciner No. 3 Product Screen Belt Conveyor | TBD | Calciner No. 3 Product Screen Belt Conveyor |
| PBE3 | Calciner No. 3 Product Screen Bucket Elevator | TBD | Calciner No. 3 Product Screen Bucket Elevator |
| FBC3 | Calciner No. 3 Fines Screen Belt Conveyor | TBD | Calciner No. 3 Fines Screen Belt Conveyor |
| FBE3 | Calciner No. 3 Fines Screen Bucket Elevator | TBD | Calciner No. 3 Fines Screen Bucket Elevator |
| KCE3 | Calciner No. 3 Cooler Bucket Elevator | TBD | Calciner No. 3 Cooler Bucket Elevator |
| KPS3 | Calciner No. 3 Product Screen | TBD | Calciner No. 3 Product Screen |
| KFS3 | Calciner No. 3 Fine Screen | TBD | Calciner No. 3 Fine Screen |
| KQC9 | Calciner No. 3 Product QC Bin A | TBD | Calciner No. 3 Product QC Bin A |
| KQ10 | Calciner No. 3 Product QC Bin B | TBD | Calciner No. 3 Product QC Bin B |
| KQ11 | Calciner No. 3 Product QC Bin C | TBD | Calciner No. 3 Product QC Bin C |
| KQ12 | Calciner No. 3 Product QC Bin D | TBD | Calciner No. 3 Product QC Bin D |
| KCS5 | Calciner No. 3 Product Screen DPCS | TBD | Calciner No. 3 Product Screen DPCS |
| KCS6 | Calciner No. 3 Fines Screen DPCS | TBD | Calciner No. 3 Fines Screen DPCS |
| BS09 | Bulk Product Silo No. 3-1 | TBD | Bulk Product Silo No. 3-1 |
| BS10 | Bulk Product Silo No. 3-2 | TBD | Bulk Product Silo No. 3-2 |
| BS11 | Bulk Product Silo No. 3-3 | TBD | Bulk Product Silo No. 3-3 |
| BS12 | Bulk Product Silo No. 3-4 | TBD | Bulk Product Silo No. 3-4 |
| DSB7 | Spray Dryer No. 7 Feed Bin | TBD | Spray Dryer No. 7 Feed Bin |
| DUB7 | Spray Dryer No. 7 Unders Bin | TBD | Spray Dryer No. 7 Unders Bin |
| DSB8 | Spray Dryer No. 8 Feed Bin | TBD | Spray Dryer No. 8 Feed Bin |
| DUB8 | Spray Dryer No. 8 Unders Bin | TBD | Spray Dryer No. 8 Unders Bin |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.00 – EMISSION UNIT LIST

| Emission Unit ID | Name | Manufacturer and Model Number | Description |
|---|---|---|---|
| OC04 | Overflow Conveyor No. 4 | TBD | Overflow Conveyor for Process Line No. 4 |
| ABC4 | Accepts Belt Conveyor No.4 | TBD | Accepts Belt Conveyor No.4 |
| GPC4 | Pellet Collection Conveyor No. 4 | TBD | Pellet Collection Conveyor for Process Line No. 4 |
| GPT4 | Pellet Transfer Conveyor No. 4 | TBD | Pellet Transfer Conveyor for Process Line No. 4 |
| GPE4 | Pellet Bucket Elevator No. 4 | TBD | Pellet Bucket Elevator for Process Line No. 4 |
| GSH4 | Screen Surge Hopper No. 4 | TBD | Screen Surge Hopper for Process Line No. 4 |
| GS10 | Pellet Screen No. 4-1 | TBD | Pellet Screen No. 4-1 |
| GS11 | Pellet Screen No. 4-2 | TBD | Pellet Screen No. 4-2 |
| GS12 | Pellet Screen No. 4-3 | TBD | Pellet Screen No. 4-3 |
| OBC4 | Oversize Collection Belt Conveyor No. 4 | TBD | Oversize Collection Belt Conveyor for Process Line No. 4 |
| ORB4 | Oversize Surge Bin No. 4 | TBD | Oversize Surge Bin for Process Line No. 4 |
| UBC4 | Unders Collection Belt Conveyor No. 4 | TBD | Unders Collection Belt Conveyor for Process Line No. 4 |
| URC4 | Unders Reversible Belt Conveyor No. 4 | TBD | Unders Reversible Belt Conveyor for Process Line No. 4 |
| KFE4 | Calciner No. 4 Feed Bin Bucket Elevator | TBD | Calciner No. 4 Feed Bin Bucket Elevator |
| KFB4 | Calciner No. 4 Feed Bin | TBD | Calciner No. 4 Feed Bin |
| KRB4 | Calciner No. 4 Recycle Feed Bin | TBD | Calciner No. 4 Recycle Feed Bin |
| KRE4 | Calciner No. 4 Recycle Feed Bin Bucket Elevator | TBD | Calciner No. 4 Recycle Feed Bin Bucket Elevator |
| KFC4 | Calciner No. 4 Feed Conveyor | TBD | Calciner No. 4 Feed Conveyor |
| KCE4 | Calciner No. 4 Cooler Bucket Elevator | TBD | Calciner No. 4 Cooler Bucket Elevator |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.00 – EMISSION UNIT LIST

| Emission Unit ID | Name | Manufacturer and Model Number | Description |
|---|---|---|---|
| KPS4 | Calciner No. 4 Product Screen | TBD | Calciner No. 4 Product Screen |
| KFS4 | Calciner No. 4 Fine Screen | TBD | Calciner No. 4 Fine Screen |
| KQ13 | Calciner No. 4 Product QC Bin A | TBD | Calciner No. 4 Product QC Bin A |
| KQ14 | Calciner No. 4 Product QC Bin B | TBD | Calciner No. 4 Product QC Bin B |
| KQ15 | Calciner No. 4 Product QC Bin C | TBD | Calciner No. 4 Product QC Bin C |
| KQ16 | Calciner No. 4 Product QC Bin D | TBD | Calciner No. 4 Product QC Bin D |
| KCS7 | Calciner No. 4 Product Screen DPCS | TBD | Calciner No. 4 Product Screen DPCS |
| KCS8 | Calciner No. 4 Fines Screen DPCS | TBD | Calciner No. 4 Fines Screen DPCS |
| BS13 | Bulk Product Silo No. 4-1 | TBD | Bulk Product Silo No. 4-1 |
| BS14 | Bulk Product Silo No. 4-2 | TBD | Bulk Product Silo No. 4-2 |
| BS15 | Bulk Product Silo No. 4-3 | TBD | Bulk Product Silo No. 4-3 |
| BS16 | Bulk Product Silo No. 4-4 | TBD | Bulk Product Silo No. 4-4 |
| PB04 | Line No. 4 Product Belt | TBD | Product Belt |
| KLN1 | Direct-Fired Rotary Calciner No. 1 | TBD | Direct-Fired Rotary Calciner No. 1 |
| KLN2 | Direct-Fired Rotary Calciner No. 2 | TBD | Direct-Fired Rotary Calciner No. 2 |
| KLN3 | Direct-Fired Rotary Calciner No. 3 | TBD | Direct-Fired Rotary Calciner No. 3 |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.00 – EMISSION UNIT LIST

| Emission Unit ID | Name | Manufacturer and Model Number | Description |
|---|---|---|---|
| KLN4 | Direct-Fired Rotary Calciner No. 4 | TBD | Direct-Fired Rotary Calciner No. 4 |
| SD01 | Spray Dryer No. 1 | TBD | Spray Dryer No. 1 |
| SD02 | Spray Dryer No. 2 | TBD | Spray Dryer No. 2 |
| SD03 | Spray Dryer No. 3 | TBD | Spray Dryer No. 3 |
| SD04 | Spray Dryer No. 4 | TBD | Spray Dryer No. 4 |
| SD05 | Spray Dryer No. 5 | TBD | Spray Dryer No. 5 |
| SD06 | Spray Dryer No. 6 | TBD | Spray Dryer No. 6 |
| SD07 | Spray Dryer No. 7 | TBD | Spray Dryer No. 7 |
| SD08 | Spray Dryer No. 8 | TBD | Spray Dryer No. 8 |
| BLR1 | Boiler No. 1 | TBD | Boiler No. 1 |
| BLR2 | Boiler No. 2 | TBD | Boiler No. 2 |
| BLR3 | Boiler No. 3 | TBD | Boiler No. 3 |
| BLR4 | Boiler No. 4 | TBD | Boiler No. 4 |
| EDG1 | Emergency Generator No. 1 | TBD | Emergency Generator No. 1 |
| EDG2 | Emergency Generator No. 2 | TBD | Emergency Generator No. 2 |
| EDG3 | Emergency Generator No. 3 | TBD | Emergency Generator No. 3 |
| EDG4 | Emergency Generator No. 4 | TBD | Emergency Generator No. 4 |
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**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.01 – BOILERS AND FUEL BURNING EQUIPMENT

| Emission Unit ID | Type of Burner | Type of Draft[1] | Design Capacity of Unit (MMBtu/hr Input) | Percent Excess Air | Dates | | Date & Description of Last Modification |
|---|---|---|---|---|---|---|---|
| | | | | | Construction | Installation | |
| BLR1 | Low NOx | TBD | 9.8 | TBD | 2011 | 2011 | N/A |
| BLR2 | Low NOx | TBD | 9.8 | TBD | 2011 | 2011 | N/A |
| BLR3 | Low NOx | TBD | 9.8 | TBD | 2011 | 2011 | N/A |
| BLR4 | Low NOx | TBD | 9.8 | TBD | 2011 | 2011 | N/A |
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[1] This column does not have to be completed for natural gas only fired equipment.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FUEL DATA

| Emission Unit ID | Fuel Type | Potential Annual Consumption | | | | Hourly Consumption | | Heat Content | | Percent Sulfur | | Percent Ash in Solid Fuel | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total Quantity | | Percent Use by Season | | | | | | | | | |
| | | Amount | Units | Ozone Season May 1 - Sept 30 | Non-ozone Season Oct 1 - Apr 30 | Max. | Avg. | Min. | Avg. | Max. | Avg. | Max. | Avg. |
| **BLR1** | **Natural Gas** | **84,200,000** | **Cubic Feet** | **50** | **50** | **9,608** | **9,608** | **1020** | **1020** | **TBD** | **TBD** | **TBD** | **TBD** |
| **BLR1** | **Propane** | **938,230** | **Gal.** | **50** | **50** | **107.1** | **107.1** | **91,500** | **91,500** | **TBD** | **TBD** | **TBD** | **TBD** |
| **BLR2** | **Natural Gas** | **84,200,000** | **Cubic Feet** | **50** | **50** | **9,608** | **9,608** | **1020** | **1020** | **TBD** | **TBD** | **TBD** | **TBD** |
| **BLR2** | **Propane** | **938,230** | **Gal.** | **50** | **50** | **107.1** | **107.1** | **91,500** | **91,500** | **TBD** | **TBD** | **TBD** | **TBD** |
| **BLR3** | **Natural Gas** | **84,200,000** | **Cubic Feet** | **50** | **50** | **9,608** | **9,608** | **1020** | **1020** | **TBD** | **TBD** | **TBD** | **TBD** |
| **BLR3** | **Propane** | **938,230** | **Gal.** | **50** | **50** | **107.1** | **107.1** | **91,500** | **91,500** | **TBD** | **TBD** | **TBD** | **TBD** |
| **BLR4** | **Natural Gas** | **84,200,000** | **Cubic Feet** | **50** | **50** | **9,608** | **9,608** | **1020** | **1020** | **TBD** | **TBD** | **TBD** | **TBD** |
| **BLR4** | **Propane** | **938,230** | **Gal.** | **50** | **50** | **107.1** | **107.1** | **91,500** | **91,500** | **TBD** | **TBD** | **TBD** | **TBD** |
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### Fuel Supplier Information

| Fuel Type | Name of Supplier | Phone Number | Supplier Location | | | |
|---|---|---|---|---|---|---|
| | | | Address | City | State | Zip |
| **Natural Gas** | **TBD** | **TBD** | **TBD** | **TBD** | **TBD** | **TBD** |
| **Propane** | **TBD** | **TBD** | **TBD** | **TBD** | **TBD** | **TBD** |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

### PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| DSB1 | Spray Dryer No. 1 Feed Bin | 2011 | Non-Metallic Mineral Slurry | | | | |
| DUB1 | Spray Dryer No. 1 Unders Bin | 2011 | Non-Metallic Mineral Slurry | | | | |
| DSB2 | Spray Dryer No. 2 Feed Bin | 2011 | Non-Metallic Mineral Slurry | | | | |
| DUB2 | Spray Dryer No. 2 Unders Bin | 2011 | Non-Metallic Mineral Slurry | | | | |
| OC01 | Overflow Conveyor No. 1 | 2011 | Non-Metallic Mineral | | | | |
| ABC1 | Accepts Belt Conveyor No. 1 | 2011 | Non-Metallic Mineral | | | | |
| GPC1 | Pellet Collection Conveyor No. 1 | 2011 | Non-Metallic Mineral | | | | |
| GPT1 | Pellet Transfer Conveyor No. 1 | 2011 | Non-Metallic Mineral | | | | |
| GPE1 | Pellet Bucket Elevator No. 1 | 2011 | Non-Metallic Mineral | | | | |
| GSH1 | Screen Surge Hopper No. 1 | 2011 | Non-Metallic Mineral | | | | |
| GSC1 | Pellet Screen No. 1-1 | 2011 | Non-Metallic Mineral | | | | |
| GSC2 | Pellet Screen No. 1-2 | 2011 | Non-Metallic Mineral | | | | |
| GSC3 | Pellet Screen No. 1-3 | 2011 | Non-Metallic Mineral | | | | |

1 ANNUAL AND HOURLY PROCESS INPUT RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

### PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

# FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

## PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| OBC1 | Oversize Collection Belt Conveyor No. 1 | 2011 | Non-Metallic Mineral | | | | |
| ORB1 | Oversize Surge Bin No. 1 | 2011 | Non-Metallic Mineral | | | | |
| UBC1 | Unders Collection Belt Conveyor No. 1 | 2011 | Non-Metallic Mineral | | | | |
| URC1 | Unders Reversible Belt Conveyor No. 1 | 2011 | Non-Metallic Mineral | | | | |
| KFE1 | Calciner No. 1 Feed Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KFB1 | Calciner No. 1 Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| KRB1 | Calciner No. 1 Recycle Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| KRE1 | Calciner No. 1 Recycle Feed Bin Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KFC1 | Calciner No. 1 Feed Conveyor | 2011 | Non-Metallic Mineral | | | | |
| KCE1 | Calciner No. 1 Cooler Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KPS1 | Calciner No. 1 Product Screen | 2011 | Non-Metallic Mineral | | | | |
| KFS1 | Calciner No. 1 Fine Screen | 2011 | Non-Metallic Mineral | | | | |
| KQC1 | Calciner No. 1 Product QC Bin A | 2011 | Non-Metallic Mineral | | | | |

1 ANNUAL AND HOURLY PROCESS INPUT RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

## PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

### PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| KQC2 | Calciner No. 1 Product QC Bin B | 2011 | Non-Metallic Mineral | | | | |
| KQC3 | Calciner No. 1 Product QC Bin C | 2011 | Non-Metallic Mineral | | | | |
| KQC4 | Calciner No. 1 Product QC Bin D | 2011 | Non-Metallic Mineral | | | | |
| KCS1 | Calciner No. 1 Product Screen DPCS | 2011 | Non-Metallic Mineral | | | | |
| KCS2 | Calciner No. 1 Fines Screen DPCS | 2011 | Non-Metallic Mineral | | | | |
| BS01 | Bulk Product Silo No. 1-1 | 2011 | Non-Metallic Mineral Slurry | | | | |
| BS02 | Bulk Product Silo No. 1-2 | 2011 | Non-Metallic Mineral Slurry | | | | |
| BS03 | Bulk Product Silo No. 1-3 | 2011 | Non-Metallic Mineral Slurry | | | | |
| BS04 | Bulk Product Silo No. 1-4 | 2011 | Non-Metallic Mineral Slurry | | | | |
| DSB3 | Spray Dryer No. 3 Feed Bin | 2011 | Non-Metallic Mineral Slurry | | | | |
| DUB3 | Spray Dryer No. 3 Unders Bin | 2011 | Non-Metallic Mineral Slurry | | | | |
| DSB4 | Spray Dryer No. 4 Feed Bin | 2011 | Non-Metallic Mineral Slurry | | | | |

1 ANNUAL AND HOURLY PROCESS INPUT RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

### PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

# FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

## PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| DUB4 | Spray Dryer No. 4 Unders Bin | 2011 | Non-Metallic Mineral Slurry | | | | |
| OC02 | Overflow Conveyor No. 2 | 2011 | Non-Metallic Mineral | | | | |
| ABC2 | Accepts Belt Conveyor No.2 | 2011 | Non-Metallic Mineral | | | | |
| GPC2 | Pellet Collection Conveyor No. 2 | 2011 | Non-Metallic Mineral | | | | |
| GPT2 | Pellet Transfer Conveyor No. 2 | 2011 | Non-Metallic Mineral | | | | |
| GPE2 | Pellet Bucket Elevator No. 2 | 2011 | Non-Metallic Mineral | | | | |
| GSH2 | Screen Surge Hopper No. 2 | 2011 | Non-Metallic Mineral | | | | |
| GSC4 | Pellet Screen No. 2-1 | 2011 | Non-Metallic Mineral | | | | |
| GSC5 | Pellet Screen No. 2-2 | 2011 | Non-Metallic Mineral | | | | |
| GSC6 | Pellet Screen No. 2-3 | 2011 | Non-Metallic Mineral | | | | |
| OBC2 | Oversize Collection Belt Conveyor No. 2 | 2011 | Non-Metallic Mineral | | | | |
| ORB2 | Oversize Surge Bin No. 2 | 2011 | Non-Metallic Mineral | | | | |
| UBC2 | Unders Collection Belt Conveyor No. 2 | 2011 | Non-Metallic Mineral | | | | |

1 ANNUAL AND HOURLY PROCESS INPUT RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

## PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

### PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| URC2 | Unders Reversible Belt Conveyor No. 2 | 2011 | Non-Metallic Mineral Slurry | | | | |
| KFE2 | Calciner No. 2 Feed Bin Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KFB2 | Calciner No. 2 Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| KRB2 | Calciner No. 2 Recycle Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| KRE2 | Calciner No. 2 Recycle Feed Bin Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KFC2 | Calciner No. 2 Feed Conveyor | 2011 | Non-Metallic Mineral | | | | |
| KCE2 | Calciner No. 2 Cooler Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KPS2 | Calciner No. 2 Product Screen | 2011 | Non-Metallic Mineral | | | | |
| KFS2 | Calciner No. 2 Fine Screen | 2011 | Non-Metallic Mineral | | | | |
| KQC5 | Calciner No. 2 Product QC Bin A | 2011 | Non-Metallic Mineral | | | | |
| KQC6 | Calciner No. 2 Product QC Bin B | 2011 | Non-Metallic Mineral | | | | |
| KQC7 | Calciner No. 2 Product QC Bin C | 2011 | Non-Metallic Mineral | | | | |
| KQC8 | Calciner No. 2 Product QC Bin D | 2011 | Non-Metallic Mineral | | | | |
| KCS3 | Calciner No. 2 Fines Screen DPCS | 2011 | Non-Metallic Mineral | | | | |

### PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maxim um | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

# FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

## PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| KCS4 | Calciner No. 2 Fines Screen DPCS | 2011 | Non-Metallic Mineral | | | | |
| BS05 | Bulk Product Silo No. 2-1 | 2011 | Non-Metallic Mineral Slurry | | | | |
| BS06 | Bulk Product Silo No. 2-2 | 2011 | Non-Metallic Mineral Slurry | | | | |
| BS07 | Bulk Product Silo No. 2-3 | 2011 | Non-Metallic Mineral Slurry | | | | |
| BS08 | Bulk Product Silo No. 2-4 | 2011 | Non-Metallic Mineral Slurry | | | | |
| RRL1 | Railcar Loading Operations No. 1 | 2011 | Non-Metallic Mineral | | | | |
| RRL2 | Railcar Loading Operations No. 2 | 2011 | Non-Metallic Mineral | | | | |
| DSB5 | Spray Dryer No. 5 Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| DUB5 | Spray Dryer No. 5 Unders Bin | 2011 | Non-Metallic Mineral | | | | |
| DSB6 | Spray Dryer No. 6 Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| DUB6 | Spray Dryer No. 6 Unders Bin | 2011 | Non-Metallic Mineral | | | | |
| OC03 | Overflow Conveyor No. 3 | 2011 | Non-Metallic Mineral | | | | |

## PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

### PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| ABC3 | Accepts Belt Conveyor No.3 | 2011 | Non-Metallic Mineral | | | | |
| GPC3 | Pellet Collection Conveyor No. 3 | 2011 | Non-Metallic Mineral | | | | |
| GPT3 | Pellet Transfer Conveyor No. 3 | 2011 | Non-Metallic Mineral | | | | |
| GPE3 | Pellet Bucket Elevator No. 3 | 2011 | Non-Metallic Mineral | | | | |
| GSH3 | Screen Surge Hopper No. 3 | 2011 | Non-Metallic Mineral | | | | |
| GSC7 | Pellet Screen No. 3-1 | 2011 | Non-Metallic Mineral | | | | |
| GSC8 | Pellet Screen No. 3-2 | 2011 | Non-Metallic Mineral | | | | |
| GSC9 | Pellet Screen No. 3-3 | 2011 | Non-Metallic Mineral | | | | |
| OBC3 | Overs Collection Belt Conveyor No. 3 | 2011 | Non-Metallic Mineral | | | | |
| ORB3 | Overs Surge Bin No. 3 | 2011 | Non-Metallic Mineral | | | | |
| UBC3 | Unders Collection Belt Conveyor No. 3 | 2011 | Non-Metallic Mineral | | | | |
| URC3 | Unders Reversible Belt Conveyor No. 3 | 2011 | Non-Metallic Mineral | | | | |
| KFE3 | Calciner No. 3 Feed Bin Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |

*1 ANNUAL AND HOURLY PROCESS INPUT RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.*

### PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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*1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.*

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

# FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

## PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| KFB3 | Calciner No. 3 Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| KRB3 | Calciner No. 3 Recycle Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| KRE3 | Calciner No. 3 Recycle Feed Bin Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KFC3 | Calciner No. 3 Feed Conveyor | 2011 | Non-Metallic Mineral | | | | |
| KCE3 | Calciner No. 3 Cooler Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KPS3 | Calciner No. 3 Product Screen | 2011 | Non-Metallic Mineral | | | | |
| KFS3 | Calciner No. 3 Fine Screen | 2011 | Non-Metallic Mineral | | | | |
| KQC9 | Calciner No. 3 Product QC Bin A | 2011 | Non-Metallic Mineral | | | | |
| KQ10 | Calciner No. 3 Product QC Bin B | 2011 | Non-Metallic Mineral | | | | |
| KQ11 | Calciner No. 3 Product QC Bin C | 2011 | Non-Metallic Mineral | | | | |
| KQ12 | Calciner No. 3 Product QC Bin D | 2011 | Non-Metallic Mineral | | | | |
| KCS5 | Calciner No. 3 Product Screen DPCS | 2011 | Non-Metallic Mineral | | | | |

## PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

# FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

## PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| KCS6 | Calciner No. 3 Fines Screen DPCS | 2011 | Non-Metallic Mineral | | | | |
| BS09 | Bulk Product Silo No. 3-1 | 2011 | Non-Metallic Mineral Slurry | | | | |
| BS10 | Bulk Product Silo No. 3-2 | 2011 | Non-Metallic Mineral Slurry | | | | |
| BS11 | Bulk Product Silo No. 3-3 | 2011 | Non-Metallic Mineral Slurry | | | | |
| BS12 | Bulk Product Silo No. 3-4 | 2011 | Non-Metallic Mineral Slurry | | | | |
| DSB7 | Spray Dryer No. 7 Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| DUB7 | Spray Dryer No. 7 Unders Bin | 2011 | Non-Metallic Mineral | | | | |
| DSB8 | Spray Dryer No. 8 Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| DUB8 | Spray Dryer No. 8 Unders Bin | 2011 | Non-Metallic Mineral | | | | |
| OC04 | Overflow Conveyor No. 4 | 2011 | Non-Metallic Mineral | | | | |
| ABC4 | Accepts Belt Conveyor No.4 | 2011 | Non-Metallic Mineral | | | | |
| GPC4 | Pellet Collection Conveyor No. 4 | 2011 | Non-Metallic Mineral | | | | |

*1 ANNUAL AND HOURLY PROCESS INPUT RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.*

## PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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*1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.*

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

### PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| GPT4 | Pellet Transfer Conveyor No. 4 | 2011 | Non-Metallic Mineral | | | | |
| GPE4 | Pellet Bucket Elevator No. 4 | 2011 | Non-Metallic Mineral | | | | |
| GSH4 | Screen Surge Hopper No. 4 | 2011 | Non-Metallic Mineral | | | | |
| GS10 | Pellet Screen No. 4-1 | 2011 | Non-Metallic Mineral | | | | |
| GS11 | Pellet Screen No. 4-2 | 2011 | Non-Metallic Mineral | | | | |
| GS12 | Pellet Screen No. 4-3 | 2011 | Non-Metallic Mineral | | | | |
| OBC4 | Oversize Collection Belt Conveyor No. 4 | 2011 | Non-Metallic Mineral | | | | |
| ORB4 | Oversize Surge Bin No. 4 | 2011 | Non-Metallic Mineral | | | | |
| UBC4 | Unders Collection Belt Conveyor No. 4 | 2011 | Non-Metallic Mineral | | | | |
| URC4 | Unders Reversible Belt Conveyor No. 4 | 2011 | Non-Metallic Mineral | | | | |
| KFE4 | Calciner No. 4 Feed Bin Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KFB4 | Calciner No. 4 Feed Bin | 2011 | Non-Metallic Mineral | | | | |
| KRB4 | Calciner No. 4 Recycle Feed Bin | 2011 | Non-Metallic Mineral | | | | |

*1 ANNUAL AND HOURLY PROCESS INPUT RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.*

### PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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*1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.*

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

# FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

## PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| KRE4 | Calciner No. 4 Recycle Feed Bin Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KFC4 | Calciner No. 4 Feed Conveyor | 2011 | Non-Metallic Mineral | | | | |
| KCE4 | Calciner No. 4 Cooler Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| KPS4 | Calciner No. 4 Product Screen | 2011 | Non-Metallic Mineral | | | | |
| KFS4 | Calciner No. 4 Fine Screen | 2011 | Non-Metallic Mineral | | | | |
| KQ13 | Calciner No. 4 Product QC Bin A | 2011 | Non-Metallic Mineral | | | | |
| KQ14 | Calciner No. 4 Product QC Bin B | 2011 | Non-Metallic Mineral | | | | |
| KQ15 | Calciner No. 4 Product QC Bin C | 2011 | Non-Metallic Mineral | | | | |
| KQ16 | Calciner No. 4 Product QC Bin D | 2011 | Non-Metallic Mineral | | | | |
| KCS7 | Calciner No. 4 Product Screen DPCS | 2011 | Non-Metallic Mineral | | | | |
| KCS8 | Calciner No. 4 Fines Screen DPCS | 2011 | Non-Metallic Mineral | | | | |

## PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

### PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| BS13 | Bulk Product Silo No. 4-1 | 2011 | Non-Metallic Mineral | | | | |
| BS14 | Bulk Product Silo No. 4-2 | 2011 | Non-Metallic Mineral | | | | |
| BS15 | Bulk Product Silo No. 4-3 | 2011 | Non-Metallic Mineral | | | | |
| BS16 | Bulk Product Silo No. 4-4 | 2011 | Non-Metallic Mineral | | | | |
| KLN1 | Direct-Fired Rotary Calciner No. 1 | 2011 | Non-Metallic Mineral | | | | |
| KLN2 | Direct-Fired Rotary Calciner No. 2 | 2011 | Non-Metallic Mineral | | | | |
| KLN3 | Direct-Fired Rotary Calciner No. 3 | 2011 | Non-Metallic Mineral | | | | |
| KLN4 | Direct-Fired Rotary Calciner No. 4 | 2011 | Non-Metallic Mineral | | | | |
| SD01 | Spray Dryer No. 1 | 2011 | Non-Metallic Mineral | | | | |
| SD02 | Spray Dryer No. 2 | 2011 | Non-Metallic Mineral | | | | |

### PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/ week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

### PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| SD03 | Spray Dryer No. 3 | 2011 | Non-Metallic Mineral | | | | |
| SD04 | Spray Dryer No. 4 | 2011 | Non-Metallic Mineral | | | | |
| SD05 | Spray Dryer No. 5 | 2011 | Non-Metallic Mineral | | | | |
| SD06 | Spray Dryer No. 6 | 2011 | Non-Metallic Mineral | | | | |
| SD07 | Spray Dryer No. 7 | 2011 | Non-Metallic Mineral | | | | |
| SD08 | Spray Dryer No. 8 | 2011 | Non-Metallic Mineral | | | | |
| BLR1 | Boiler No. 1 | 2011 | Natural Gas/Propane | | | | |
| BLR2 | Boiler No. 2 | 2011 | Natural Gas/Propane | | | | |
| BLR3 | Boiler No. 3 | 2011 | Natural Gas/Propane | | | | |
| BLR4 | Boiler No. 4 | 2011 | Natural Gas/Propane | | | | |
| EDG1 | Emergency Generator No. 1 | 2011 | Diesel Fuel | | | | |
| EDG2 | Emergency Generator No. 2 | 2011 | Diesel Fuel | | | | |
| EDG3 | Emergency Generator No. 3 | 2011 | Diesel Fuel | | | | |
| EDG4 | Emergency Generator No. 4 | 2011 | Diesel Fuel | | | | |

*1 ANNUAL AND HOURLY PROCESS INPUT RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.*

### PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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*1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.*

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 2.06 – MANUFACTURING AND OPERATIONAL DATA

**Normal Operating Schedule:** 24 hours/day 7 days/week 52 weeks/yr

Additional Data Attached? ☒ - No ☐ - Yes, please include the attachment in list on Form 1.00, Item 16.

**Seasonal and/or Peak Operating Periods:** None

**Dates of Annually Occurring Shutdowns:** None

### PRODUCTION INPUT FACTORS

| Emission Unit ID | Emission Unit Name | Const. Date | Input Raw Material(s) | Annual Input[1] | Hourly Process Input Rate[1] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Design | Normal | Maximum |
| PBC3 | Calciner No. 3 Product Screen Belt Conveyor | 2011 | Non-Metallic Mineral | | | | |
| PBE3 | Calciner No. 3 Product Screen Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| FBC3 | Calciner No. 3 Fines Screen Belt Conveyor | 2011 | Non-Metallic Mineral | | | | |
| FBE3 | Calciner No. 3 Fines Screen Bucket Elevator | 2011 | Non-Metallic Mineral | | | | |
| PB04 | Line No. 4 Product Belt | 2011 | Non-Metallic Mineral | | | | |
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### PRODUCTS OF MANUFACTURING[1]

| Emission Unit ID | Description of Product | Production Schedule[1] | | Hourly Production Rate[1] (Give units: e.g. lb/hr, ton/hr) | | | |
|---|---|---|---|---|---|---|---|
| | | Tons/yr | Hr/yr | Design | Normal | Maximum | Units |
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1 PRODUCTION SCHEDULE AND HOURLY PRODUCTION RATES WILL BE PROVIDED TO GA EPD UPON REQUEST.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## Form 3.00 – AIR POLLUTION CONTROL DEVICES - PART A: GENERAL EQUIPMENT INFORMATION

| APCD Unit ID | Emission Unit ID | APCD Type (Baghouse, ESP, Scrubber etc) | Date Installed | Make & Model Number (Attach Mfg. Specifications & Literature) | Unit Modified from Mfg Specifications? | Gas Temp. °F | | Inlet Gas Flow Rate (acfm) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Inlet | Outlet | |
| SB01 | SD01 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB02 | SD01 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB03 | SD01 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB04 | SD01 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB05 | SD02 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB06 | SD02 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB07 | SD02 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB08 | SD02 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB09 | SD03 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB10 | SD03 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB11 | SD03 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB12 | SD03 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB13 | SD04 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB14 | SD04 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB15 | SD04 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB16 | SD04 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## Form 3.00 – AIR POLLUTION CONTROL DEVICES – PART B: EMISSION INFORMATION

| APCD Unit ID | Pollutants Controlled | Percent Control Efficiency | | Inlet Stream To APCD[2] | | Exit Stream From APCD[1] | | Pressure Drop Across Unit (Inches of water) |
|---|---|---|---|---|---|---|---|---|
| | | Design | Actual | lb/hr | Method of Determination | lb/hr | Method of Determination | |
| SB01 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB02 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB03 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB04 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB05 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB06 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB07 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB08 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB09 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB10 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB11 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB12 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB13 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB14 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB15 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB16 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |

1 PM outlet emissions as calculated based on proposed BACT limits as in Volume II, Attachment D.
2 PM inlet emissions calculated by dividing outlet emissions by 0.001 to represent a 99.9% control efficiency.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## Form 3.00 – AIR POLLUTION CONTROL DEVICES - PART A: GENERAL EQUIPMENT INFORMATION

| APCD Unit ID | Emission Unit ID | APCD Type (Baghouse, ESP, Scrubber etc) | Date Installed | Make & Model Number (Attach Mfg. Specifications & Literature) | Unit Modified from Mfg Specifications? | Gas Temp. °F | | Inlet Gas Flow Rate (acfm) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Inlet | Outlet | |
| SB17 | SD05 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB18 | SD05 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB19 | SD05 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB20 | SD05 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB21 | SD06 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB22 | SD06 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB23 | SD06 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB24 | SD06 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB25 | SD07 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB26 | SD07 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB27 | SD07 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB28 | SD07 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB29 | SD08 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB30 | SD08 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB31 | SD08 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |
| SB32 | SD08 | Baghouse | 2011 | TBD | No | 210 | 206 | 26,500 |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

**Form 3.00 – AIR POLLUTION CONTROL DEVICES – PART B: EMISSION INFORMATION**

| APCD Unit ID | Pollutants Controlled | Percent Control Efficiency | | Inlet Stream To APCD[2] | | Exit Stream From APCD[1] | | Pressure Drop Across Unit (Inches of water) |
|---|---|---|---|---|---|---|---|---|
| | | Design | Actual | lb/hr | Method of Determination | lb/hr | Method of Determination | |
| SB17 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB18 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB19 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB20 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB21 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB22 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB23 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB24 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB25 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB26 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB27 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB28 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB29 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB30 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB31 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |
| SB32 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1135/425 | Mass Balance | 1.135/0.425 | Proposed BACT limit | TBD |

1 PM outlet emissions as calculated based on proposed BACT limits as in Volume II, Attachment D.
2 PM inlet emissions calculated by dividing outlet emissions by 0.001 to represent a 99.9% control efficiency.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

**Form 3.00 – AIR POLLUTION CONTROL DEVICES - PART A: GENERAL EQUIPMENT INFORMATION**

| APCD Unit ID | Emission Unit ID | APCD Type (Baghouse, ESP, Scrubber etc) | Date Installed | Make & Model Number (Attach Mfg. Specifications & Literature) | Unit Modified from Mfg Specifications? | Gas Temp. °F | | Inlet Gas Flow Rate (acfm) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Inlet | Outlet | |
| KB01 | KLN1 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB02 | KLN1 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB03 | KLN1 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB04 | KLN1 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB05 | KLN2 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB06 | KLN2 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB07 | KLN2 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB08 | KLN2 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB09 | KLN3 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB10 | KLN3 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB11 | KLN3 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB12 | KLN3 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB13 | KLN4 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB14 | KLN4 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB15 | KLN4 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |
| KB16 | KLN4 | Baghouse | 2011 | TBD | No | 425 | 400 | 32,191 |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

**Form 3.00 – AIR POLLUTION CONTROL DEVICES – PART B: EMISSION INFORMATION**

| APCD Unit ID | Pollutants Controlled | Percent Control Efficiency | | Inlet Stream To APCD[2] | | Exit Stream From APCD[1] | | Pressure Drop Across Unit (Inches of water) |
|---|---|---|---|---|---|---|---|---|
| | | Design | Actual | lb/hr | Method of Determination | lb/hr | Method of Determination | |
| KB01 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB02 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB03 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB04 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB05 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB06 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB07 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB08 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB09 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB10 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB11 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB12 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB13 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB14 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB15 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |
| KB16 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 690/690 | Mass Balance | 0.690/0.690 | Proposed BACT limit | TBD |

1 PM outlet emissions as calculated based on proposed BACT limits as in Volume II, Attachment D.

2 PM inlet emissions calculated by dividing outlet emissions by 0.001 to represent a 99.9% control efficiency.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## Form 3.00 – AIR POLLUTION CONTROL DEVICES - PART A: GENERAL EQUIPMENT INFORMATION

| APCD Unit ID | Emission Unit ID | APCD Type (Baghouse, ESP, Scrubber etc) | Date Installed | Make & Model Number (Attach Mfg. Specifications & Literature) | Unit Modified from Mfg Specifications? | Gas Temp. °F | | Inlet Gas Flow Rate (acfm) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Inlet | Outlet | |
| GPB1 | GP01[1] | Baghouse | 2011 | TBD | No | Ambient | Ambient | 19,000 |
| GPB2 | GP02[1] | Baghouse | 2011 | TBD | No | Ambient | Ambient | 19,000 |
| GPB3 | GP03[1] | Baghouse | 2011 | TBD | No | Ambient | Ambient | 19,000 |
| GPB4 | GP04[1] | Baghouse | 2011 | TBD | No | Ambient | Ambient | 19,000 |
| KNB1 | KAE1[1] | Baghouse | 2011 | TBD | No | 150 | 150 | 1,500 |
| KNB2 | KAE2[1] | Baghouse | 2011 | TBD | No | 150 | 150 | 1,500 |
| KNB3 | KAE3[1] | Baghouse | 2011 | TBD | No | 150 | 150 | 1,500 |
| KNB4 | KAE4[1] | Baghouse | 2011 | TBD | No | 150 | 150 | 1,500 |
| RCB1 | RRL1 | Baghouse | 2011 | TBD | No | Ambient | Ambient | 2,500 |
| RCB2 | RRL2 | Baghouse | 2011 | TBD | No | Ambient | Ambient | 2,500 |
| BB01 | BS01 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB02 | BS02 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB03 | BS03 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB04 | BS04 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB05 | BS05 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |

1 Emission Unit group name used for brevity.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## Form 3.00 – AIR POLLUTION CONTROL DEVICES – PART B: EMISSION INFORMATION

| APCD Unit ID | Pollutants Controlled | Percent Control Efficiency | | Inlet Stream To APCD[2] | | Exit Stream From APCD[1] | | Pressure Drop Across Unit (Inches of water) |
|---|---|---|---|---|---|---|---|---|
| | | Design | Actual | lb/hr | Method of Determination | lb/hr | Method of Determination | |
| GPB1 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1,630/814 | Mass Balance | 1.63/0.814 | Proposed BACT limit | TBD |
| GPB2 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1,630/814 | Mass Balance | 1.63/0.814 | Proposed BACT limit | TBD |
| GPB3 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1,630/814 | Mass Balance | 1.63/0.814 | Proposed BACT limit | TBD |
| GPB4 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 1,630/814 | Mass Balance | 1.63/0.814 | Proposed BACT limit | TBD |
| KNB1 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 129/64.0 | Mass Balance | 0.129/0.064 | Proposed BACT limit | TBD |
| KNB2 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 129/64.0 | Mass Balance | 0.129/0.064 | Proposed BACT limit | TBD |
| KNB3 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 129/64.0 | Mass Balance | 0.129/0.064 | Proposed BACT limit | TBD |
| KNB4 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 129/64.0 | Mass Balance | 0.129/0.064 | Proposed BACT limit | TBD |
| RCB1 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 300/150 | Mass Balance | 0.30/0.15 | Proposed BACT limit | TBD |
| RCB2 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 300/150 | Mass Balance | 0.30/0.15 | Proposed BACT limit | TBD |
| BB01 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB02 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB03 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB04 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB05 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |

1 PM outlet emissions as calculated based on proposed BACT limits as in Volume II, Attachment D.
2 PM inlet emissions calculated by dividing outlet emissions by 0.001 to represent a 99.9% control efficiency.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

**Form 3.00 – AIR POLLUTION CONTROL DEVICES - PART A: GENERAL EQUIPMENT INFORMATION**

| APCD Unit ID | Emission Unit ID | APCD Type (Baghouse, ESP, Scrubber etc) | Date Installed | Make & Model Number (Attach Mfg. Specifications & Literature) | Unit Modified from Mfg Specifications? | Gas Temp. °F | | Inlet Gas Flow Rate (acfm) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Inlet | Outlet | |
| BB06 | BS06 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB07 | BS07 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB08 | BS08 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB09 | BS09 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB10 | BS10 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB11 | BS11 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB12 | BS12 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB13 | BS13 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB14 | BS14 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB15 | BS15 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| BB16 | BS16 | Bin Vent Filter | 2011 | TBD | No | Ambient | Ambient | 1,000 |
| SC01 | KLN1 | Scrubber | 2011 | TBD | No | TBD | TBD | TBD |
| SC02 | KLN2 | Scrubber | 2011 | TBD | No | TBD | TBD | TBD |
| SC03 | KLN3 | Scrubber | 2011 | TBD | No | TBD | TBD | TBD |
| SC04 | KLN4 | Scrubber | 2011 | TBD | No | TBD | TBD | TBD |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

**Form 3.00 – AIR POLLUTION CONTROL DEVICES – PART B: EMISSION INFORMATION**

| APCD Unit ID | Pollutants Controlled | Percent Control Efficiency | | Inlet Stream To APCD[2,3] | | Exit Stream From APCD[1] | | Pressure Drop Across Unit (Inches of water) |
|---|---|---|---|---|---|---|---|---|
| | | Design | Actual | lb/hr | Method of Determination | lb/hr | Method of Determination | |
| BB06 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB07 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB08 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB09 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB10 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB11 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB12 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB13 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB14 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB15 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| BB16 | $PM/PM_{10}$ / $PM_{2.5}$ | 99.9 | 99.9 | 86.0/43.0 | Mass Balance | 0.086/0.043 | Proposed BACT limit | TBD |
| SC01 | $SO_2$ | 95.0 | 95.0 | 685 | Mass Balance | 34.25 | Proposed BACT limit | TBD |
| SC02 | $SO_2$ | 95.0 | 95.0 | 685 | Mass Balance | 34.25 | Proposed BACT limit | TBD |
| SC03 | $SO_2$ | 95.0 | 95.0 | 685 | Mass Balance | 34.25 | Proposed BACT limit | TBD |
| SC04 | $SO_2$ | 95.0 | 95.0 | 685 | Mass Balance | 34.25 | Proposed BACT limit | TBD |

1 PM outlet emissions as calculated based on proposed BACT limits as in Attachment C.
2 PM inlet emissions calculated by dividing outlet emissions by 0.001 to represent a 99.9% control efficiency.
3 $SO_2$ inlet emissions calculated by dividing outlet emissions by 0.05 to represent a 95% control efficiency.

**Facility Name:** Carbo Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 3.01 – SCRUBBERS

| APCD Unit ID | Scrubber Type | Materials of Construction (Plastic, 1040 steel, etc.) | Scrubbant | pH Range | Pressure Drop Range (inches of H2O) | Minimum Scrubbant Flow Rate (Gal/min) | Is Scrubbant Recirculated? | Minimum Makeup Rate (Gal/min) | Size of Pond or Holding Tank (Acre-ft or gal) |
|---|---|---|---|---|---|---|---|---|---|
| SC01 | Spray Dryer, Wet | TBD | TBD | TBD | TBD | TBD | ☐ | TBD | TBD |
| SC02 | Spray Dryer, Wet | TBD | TBD | TBD | TBD | TBD | ☐ | TBD | TBD |
| SC03 | Spray Dryer, Wet | TBD | TBD | TBD | TBD | TBD | ☐ | TBD | TBD |
| SC04 | Spray Dryer, Wet | TBD | TBD | TBD | TBD | TBD | ☐ | TBD | TBD |
| | | | | | | | ☐ | | |
| | | | | | | | ☐ | | |
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| | | | | | | | ☐ | | |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 3.02 – BAGHOUSES & OTHER FILTER COLLECTORS

| APCD ID | Filter Surface Area (ft$^2$) | No. of Bags | Inlet Gas Dew Point Temp. (°F) | Inlet Gas Temp. (°F) | Bag or Filter Material | Pressure Drop (inches of water) | Cleaning Method | Gas Cooling Method | Leak Detection System Type |
|---|---|---|---|---|---|---|---|---|---|
| SB01 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB02 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB03 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB04 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB05 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB06 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB07 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB08 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB09 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB10 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB11 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB12 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB13 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB14 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB15 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB16 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 3.02 – BAGHOUSES & OTHER FILTER COLLECTORS

| APCD ID | Filter Surface Area ($ft^2$) | No. of Bags | Inlet Gas Dew Point Temp. (°F) | Inlet Gas Temp. (°F) | Bag or Filter Material | Pressure Drop (inches of water) | Cleaning Method | Gas Cooling Method | Leak Detection System Type |
|---|---|---|---|---|---|---|---|---|---|
| SB17 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB18 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB19 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB20 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB21 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB22 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB23 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB24 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB25 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB26 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB27 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB28 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB29 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB30 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB31 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| SB32 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

**FORM 3.02 – BAGHOUSES & OTHER FILTER COLLECTORS**

| APCD ID | Filter Surface Area ($ft^2$) | No. of Bags | Inlet Gas Dew Point Temp. (°F) | Inlet Gas Temp. (°F) | Bag or Filter Material | Pressure Drop (inches of water) | Cleaning Method | Gas Cooling Method | Leak Detection System Type |
|---|---|---|---|---|---|---|---|---|---|
| KB01 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB02 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB03 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB04 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB05 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB06 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB07 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB08 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB09 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB10 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB11 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB12 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB13 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB14 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB15 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KB16 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 3.02 – BAGHOUSES & OTHER FILTER COLLECTORS

| APCD ID | Filter Surface Area ($ft^2$) | No. of Bags | Inlet Gas Dew Point Temp. (°F) | Inlet Gas Temp. (°F) | Bag or Filter Material | Pressure Drop (inches of water) | Cleaning Method | Gas Cooling Method | Leak Detection System Type |
|---|---|---|---|---|---|---|---|---|---|
| GPB1 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| GPB2 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| GPB3 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| GPB4 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KNB1 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KNB2 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KNB3 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| KNB4 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse jet | N/A | N/A |
| RBC1 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| RBC2 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB01 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB02 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB03 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB04 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB05 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 3.02 – BAGHOUSES & OTHER FILTER COLLECTORS

| APCD ID | Filter Surface Area ($ft^2$) | No. of Bags | Inlet Gas Dew Point Temp. (°F) | Inlet Gas Temp. (°F) | Bag or Filter Material | Pressure Drop (inches of water) | Cleaning Method | Gas Cooling Method | Leak Detection System Type |
|---|---|---|---|---|---|---|---|---|---|
| BB06 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB07 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB08 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB09 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB10 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB11 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB12 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB13 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB14 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB15 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |
| BB16 | TBD | TBD | TBD | TBD | TBD | TBD | Pulse Jet | N/A | N/A |

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| SD01 | SB01, SB02, SB03, and SB04 | S001 | PM/$PM_{10}$<br>$PM_{2.5}$ | 4.54<br>1.70 | 4.54<br>1.70 | 19.9<br>7.45 | 19.9<br>7.45 | Calculated based on Proposed Grain Loading BACT limit. |
| SD01 | SB01, SB02, SB03, and SB04 | S001 | $NO_x$ | 8.30 | 8.30 | 36.4 | 36.4 | Proposed BACT limit. |
| SD01 | SB01, SB02, SB03, and SB04 | S001 | CO | 16.6 | 16.6 | 72.7 | 72.7 | Proposed BACT limit. |
| SD01 | SB01, SB02, SB03, and SB04 | S001 | $SO_2$ | 0.5 | 0.5 | 2.19 | 2.19 | Maximum estimated emissions from facility data. |
| SD01 | SB01, SB02, SB03, and SB04 | S001 | VOC | 1.56 | 1.56 | 6.83 | 6.83 | AP-42 Factors and proposed methanol MACT limit |
| SD01 | SB01, SB02, SB03, and SB04 | S001 | Combined HAP | 1.23 | 1.23 | 5.40 | 5.40 | AP-42 Factors and proposed methanol MACT limit |
| SD01 | SB01, SB02, SB03, and SB04 | S001 | GHG | 6,566 | 6,566 | 28,760 | 28,760 | AP-42 Factors |
| SD02 | SB05 SB06, SB07, and SB08 | S002 | PM/$PM_{10}$<br>$PM_{2.5}$ | 4.54<br>1.70 | 4.54<br>1.70 | 19.9<br>7.45 | 19.9<br>7.45 | Calculated based on Proposed Grain Loading BACT limit. |
| SD02 | SB05 SB06, SB07, and SB08 | S002 | $NO_x$ | 8.30 | 8.30 | 36.4 | 36.4 | Proposed BACT limit. |
| SD02 | SB05 SB06, SB07, and SB08 | S002 | CO | 16.6 | 16.6 | 72.7 | 72.7 | Proposed BACT limit. |
| SD02 | SB05 SB06, SB07, and SB08 | S002 | $SO_2$ | 0.5 | 0.5 | 2.19 | 2.19 | Maximum estimated emissions from facility data. |

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| SD02 | SB05 SB06, SB07, and SB08 | S002 | VOC | 1.56 | 1.56 | 6.83 | 6.83 | AP-42 Factors and proposed methanol MACT limit |
| SD02 | SB05 SB06, SB07, and SB08 | S002 | Combined HAP | 1.23 | 1.23 | 5.40 | 5.40 | AP-42 Factors and proposed methanol MACT limit |
| SD02 | SB05 SB06, SB07, and SB08 | S002 | GHG | 6,566 | 6,566 | 28,760 | 28,760 | AP-42 Factors |
| SD03 | SB9, SB10, SB11, and SB12 | S012 | $PM/PM_{10}$<br>$PM_{2.5}$ | 4.54<br>1.70 | 4.54<br>1.70 | 19.9<br>7.45 | 19.9<br>7.45 | Calculated based on Proposed Grain Loading BACT limit. |
| SD03 | SB9, SB10, SB11, and SB12 | S012 | $NO_x$ | 8.30 | 8.30 | 36.4 | 36.4 | Proposed BACT limit. |
| SD03 | SDB9, SDB10, SDB11, and SDB12 | S012 | CO | 16.6 | 16.6 | 72.7 | 72.7 | Proposed BACT limit. |
| SD03 | SB9, SB10, SB11, and SB12 | S012 | $SO_2$ | 0.5 | 0.5 | 2.19 | 2.19 | Maximum estimated emissions from facility data. |
| SD03 | SB9, SB10, SB11, and SB12 | S012 | VOC | 1.56 | 1.56 | 6.83 | 6.83 | AP-42 Factors and proposed methanol MACT limit |
| SD03 | SB9, SB10, SB11, and SB12 | S012 | Combined HAP | 1.23 | 1.23 | 5.40 | 5.40 | AP-42 Factors and proposed methanol MACT limit |
| SD03 | SB9, SB10, SB11, and SB12 | S012 | GHG | 6,566 | 6,566 | 28,760 | 28,760 | AP-42 Factors |
| SD04 | SB13, SB14, SB15, and SB16 | S013 | $PM/PM_{10}$<br>$PM_{2.5}$ | 4.54<br>1.70 | 4.54<br>1.70 | 19.9<br>7.45 | 19.9<br>7.45 | Calculated based on Proposed Grain Loading BACT limit. |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **Hourly Actual Emissions** (lb/hr) | **Hourly Potential Emissions** (lb/hr) | **Actual Annual Emission** (tpy) | **Potential Annual Emission** (tpy) | **Method of Determination** |
| SD04 | SB13, SB14, SB15, and SB16 | S013 | $NO_x$ | 8.30 | 8.30 | 36.4 | 36.4 | Proposed BACT limit. |
| SD04 | SB13, SB14, SB15, and SB16 | S013 | CO | 16.6 | 16.6 | 72.7 | 72.7 | Proposed BACT limit. |
| SD04 | SB13, SB14, SB15, and SB16 | S013 | $SO_2$ | 0.5 | 0.5 | 2.19 | 2.19 | Maximum estimated emissions from facility data. |
| SD04 | SB13, SB14, SB15, and SB16 | S013 | VOC | 1.56 | 1.56 | 6.83 | 6.83 | AP-42 Factors and proposed methanol MACT limit |
| SD04 | SB13, SB14, SB15, and SB16 | S013 | Combined HAP | 1.23 | 1.23 | 5.40 | 5.40 | AP-42 Factors and proposed methanol MACT limit |
| SD04 | SB13, SB14, SB15, and SB16 | S013 | GHG | 6,566 | 6,566 | 28,760 | 28,760 | AP-42 Factors |
| SD05 | SB17, SB18, SB19, and SB20 | S022 | $PM/PM_{10}$<br>$PM_{2.5}$ | 4.54<br>1.70 | 4.54<br>1.70 | 19.9<br>7.45 | 19.9<br>7.45 | Calculated based on Proposed Grain Loading BACT limit. |
| SD05 | SB17, SB18, SB19, and SB20 | S022 | $NO_x$ | 8.30 | 8.30 | 36.4 | 36.4 | Proposed BACT limit. |
| SD05 | SB17, SB18, SB19, and SB20 | S022 | CO | 16.6 | 16.6 | 72.7 | 72.7 | Proposed BACT limit. |
| SD05 | SB17, SB18, SB19, and SB20 | S022 | $SO_2$ | 0.5 | 0.5 | 2.19 | 2.19 | Maximum estimated emissions from facility data. |
| SD05 | SB17, SB18, SB19, and SB20 | S022 | VOC | 1.56 | 1.56 | 6.83 | 6.83 | AP-42 Factors and proposed methanol MACT limit |

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **Hourly Actual Emissions** (lb/hr) | **Hourly Potential Emissions** (lb/hr) | **Actual Annual Emission** (tpy) | **Potential Annual Emission** (tpy) | **Method of Determination** |
| SD05 | SB17, SB18, SB19, and SB20 | S022 | Combined HAP | 1.23 | 1.23 | 5.40 | 5.40 | AP-42 Factors and proposed methanol MACT limit |
| SD05 | SB17, SB18, SB19, and SB20 | S022 | GHG | 6,566 | 6,566 | 28,760 | 28,760 | AP-42 Factors |
| SD06 | SB21, SB22, SB23, and SB24 | S023 | $PM/PM_{10}$<br>$PM_{2.5}$ | 4.54<br>1.70 | 4.54<br>1.70 | 19.9<br>7.45 | 19.9<br>7.45 | Calculated based on Proposed Grain Loading BACT limit. |
| SD06 | SB21, SB22, SB23, and SB24 | S023 | $NO_x$ | 8.30 | 8.30 | 36.4 | 36.4 | Proposed BACT limit. |
| SD06 | SB21, SB22, SB23, and SB24 | S023 | CO | 16.6 | 16.6 | 72.7 | 72.7 | Proposed BACT limit. |
| SD06 | SB21, SB22, SB23, and SB24 | S023 | $SO_2$ | 0.5 | 0.5 | 2.19 | 2.19 | Maximum estimated emissions from facility data. |
| SD06 | SB21, SB22, SB23, and SB24 | S023 | VOC | 1.56 | 1.56 | 6.83 | 6.83 | AP-42 Factors and proposed methanol MACT limit |
| SD06 | SB21, SB22, SB23, and SB24 | S023 | Combined HAP | 1.23 | 1.23 | 5.40 | 5.40 | AP-42 Factors and proposed methanol MACT limit |
| SD06 | SB21, SB22, SB23, and SB24 | S023 | GHG | 6,566 | 6,566 | 28,760 | 28,760 | AP-42 Factors |
| SD07 | SB25, SB26, SB27, and SB28 | S033 | $PM/PM_{10}$<br>$PM_{2.5}$ | 4.54<br>1.70 | 4.54<br>1.70 | 19.9<br>7.45 | 19.9<br>7.45 | Calculated based on Proposed Grain Loading BACT limit. |
| SD07 | SB25, SB26, SB27, and SB28 | S033 | $NO_x$ | 8.30 | 8.30 | 36.4 | 36.4 | Proposed BACT limit. |

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## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| SD07 | SB25, SB26, SB27, and SB28 | S033 | CO | 16.6 | 16.6 | 72.7 | 72.7 | Proposed BACT limit. |
| SD07 | SB25, SB26, SB27, and SB28 | S033 | $SO_2$ | 0.5 | 0.5 | 2.19 | 2.19 | Maximum estimated emissions from facility data. |
| SD07 | SB25, SB26, SB27, and SB28 | S033 | VOC | 1.56 | 1.56 | 6.83 | 6.83 | AP-42 Factors and proposed methanol MACT limit |
| SD07 | SB25, SB26, SB27, and SB28 | S033 | Combined HAP | 1.23 | 1.23 | 5.40 | 5.40 | AP-42 Factors and proposed methanol MACT limit |
| SD07 | SB25, SB26, SB27, and SB28 | S033 | GHG | 6,566 | 6,566 | 28,760 | 28,760 | AP-42 Factors |
| SD08 | SB29, SB30, SB31, and SB32 | S034 | $PM/PM_{10}$<br>$PM_{2.5}$ | 4.54<br>1.70 | 4.54<br>1.70 | 19.9<br>7.45 | 19.9<br>7.45 | Calculated based on Proposed Grain Loading BACT limit. |
| SD08 | SB29, SB30, SB31, and SB32 | S034 | $NO_x$ | 8.30 | 8.30 | 36.4 | 36.4 | Proposed BACT limit. |
| SD08 | SB29, SB30, SB31, and SB32 | S034 | CO | 16.6 | 16.6 | 72.7 | 72.7 | Proposed BACT limit. |
| SD08 | SB29, SB30, SB31, and SB32 | S034 | $SO_2$ | 0.5 | 0.5 | 2.19 | 2.19 | Maximum estimated emissions from facility data. |
| SD08 | SB29, SB30, SB31, and SB32 | S034 | VOC | 1.56 | 1.56 | 6.83 | 6.83 | AP-42 Factors and proposed methanol MACT limit |
| SD08 | SB29, SB30, SB31, and SB32 | S034 | Combined HAP | 1.23 | 1.23 | 5.40 | 5.40 | AP-42 Factors and proposed methanol MACT limit |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| SD08 | SB29, SB30, SB31, and SB32 | S034 | GHG | 6,566 | 6,566 | 28,760 | 28,760 | AP-42 Factors |
| KLN1 | KB01, KB02, KB03, KB04, SC01 | S005 | $PM/PM_{10}$<br>$PM_{2.5}$ | 2.76<br>2.76 | 2.76<br>2.76 | 12.1<br>12.1 | 12.1<br>12.1 | Calculated based on Proposed Grain Loading BACT limit. |
| KLN1 | KB01, KB02, KB03, KB04, SC01 | S005 | $NO_x$ | 121 | 121 | 530 | 530 | Proposed BACT limit. |
| KLN1 | KB01, KB02, KB03, KB04, SC01 | S005 | CO | 24.7 | 24.7 | 108 | 108 | Proposed BACT limit. |
| KLN1 | KB01, KB02, KB03, KB04, SC01 | S005 | $SO_2$ | 34.3 | 34.3 | 150 | 150 | Proposed BACT limit. |
| KLN1 | KB01, KB02, KB03, KB04, SC01 | S005 | VOC | 0.525 | 0.525 | 2.30 | 2.30 | AP-42 Factors |
| KLN1 | KB01, KB02, KB03, KB04, SC01 | S005 | Combined HAP | 10.7 | 10.7 | 47.1 | 47.1 | AP-42 Factors and proposed HCL and HF MACT limits |
| KLN1 | KB01, KB02, KB03, KB04, SC01 | S005 | GHG | 8,382 | 8,382 | 36,715 | 36,715 | AP-42 Factors |
| KLN1 | KB01, KB02, KB03, KB04, SC01 | S005 | $H_2SO_4$ | 0.390 | 0.390 | 1.71 | 1.71 | Proposed PSD Avoidance Limit |
| KLN2 | KB05, KB06, KB07, KBH8, and SC02 | S016 | $PM/PM_{10}$<br>$PM_{2.5}$ | 2.76<br>2.76 | 2.76<br>2.76 | 12.1<br>12.1 | 12.1<br>12.1 | Calculated based on Proposed Grain Loading BACT limit. |
| KLN2 | KB05, KB06, KB07, KBH8, and SC02 | S016 | $NO_x$ | 121 | 121 | 530 | 530 | Proposed BACT limit. |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| KLN2 | KB05, KB06, KB07, KB08, and SC02 | S016 | CO | 24.7 | 24.7 | 108 | 108 | Proposed BACT limit. |
| KLN2 | KB05, KB06, KB07, KB08, and SC02 | S016 | $SO_2$ | 34.3 | 34.3 | 150 | 150 | Proposed BACT limit. |
| KLN2 | KB05, KB06, KB07, KB08, and SC02 | S016 | VOC | 0.525 | 0.525 | 2.30 | 2.30 | AP-42 Factors |
| KLN2 | KB05, KB06, KB07, KB08, and SC02 | S016 | Combined HAP | 10.7 | 10.7 | 47.1 | 47.1 | AP-42 Factors and proposed HCL and HF MACT limits |
| KLN2 | KB05, KB06, KB07, KB08, and SC02 | S016 | GHG | 8,382 | 8,382 | 36,715 | 36,715 | AP-42 Factors |
| KLN2 | KB05, KB06, KB07, KB08, and SC02 | S016 | $H_2SO_4$ | 0.390 | 0.390 | 1.71 | 1.71 | Proposed PSD Avoidance Limit |
| KLN3 | KB09, KB10 KB11, KB12, and SC03 | S026 | $PM/PM_{10}$<br>$PM_{2.5}$ | 2.76<br>2.76 | 2.76<br>2.76 | 12.1<br>12.1 | 12.1<br>12.1 | Calculated based on Proposed Grain Loading BACT limit. |
| KLN3 | KB09, KB10 KB11, KB12, and SC03 | S026 | $NO_x$ | 121 | 121 | 530 | 530 | Proposed BACT limit. |
| KLN3 | KB09, KB10 KB11, KB12, and SC03 | S026 | CO | 24.7 | 24.7 | 108 | 108 | Proposed BACT limit. |
| KLN3 | KB09, KB10 KB11, KB12, and SC03 | S026 | $SO_2$ | 34.3 | 34.3 | 150 | 150 | Proposed BACT limit. |
| KLN3 | KB09, KB10 KB11, KB12, and SC03 | S026 | VOC | 0.525 | 0.525 | 2.30 | 2.30 | AP-42 Factors |

Facility Name: CARBO Ceramics, Inc. Date of Application: August 10, 2011

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| KLN3 | KB09, KB10 KB11, KB12, and SC03 | S026 | Combined HAP | 10.7 | 10.7 | 47.1 | 47.1 | AP-42 Factors and proposed HCL and HF MACT limits |
| KLN3 | KB09, KB10 KB11, KB12, and SC03 | S026 | GHG | 8,382 | 8,382 | 36,715 | 36,715 | AP-42 Factors |
| KLN3 | KB09, KB10 KB11, KB12, and SC03 | S026 | $H_2SO_4$ | 0.390 | 0.390 | 1.71 | 1.71 | Proposed PSD Avoidance Limit |
| KLN4 | KB13, KB14 KB15, KB16, and SC04 | S037 | $NO_x$ | 121 | 121 | 530 | 530 | Proposed BACT limit. |
| KLN4 | KB13, KB14 KB15, KB16, and SC04 | S037 | CO | 24.7 | 24.7 | 108 | 108 | Proposed BACT limit. |
| KLN4 | KB13, KB14 KB15, KB16, and SC04 | S037 | $SO_2$ | 34.3 | 34.3 | 150 | 150 | Proposed BACT limit. |
| KLN4 | KB13, KB14 KB15, KB16, and SC04 | S037 | $PM/PM_{10}$<br>$PM_{2.5}$ | 2.76<br>2.76 | 2.76<br>2.76 | 12.1<br>12.1 | 12.1<br>12.1 | Calculated based on Proposed Grain Loading BACT limit. |
| KLN4 | KB13, KB14 KB15, KB16, and SC04 | S037 | VOC | 0.525 | 0.525 | 2.30 | 2.30 | AP-42 Factors |
| KLN4 | KB13, KB14 KB15, KB16, and SC04 | S037 | Combined HAP | 10.7 | 10.7 | 47.1 | 47.1 | AP-42 Factors and proposed HCL and HF MACT limits |
| KLN4 | KB13, KB14 KB15, KB16, and SC04 | S037 | GHG | 8,382 | 8,382 | 36,715 | 36,715 | AP-42 Factors |
| KLN4 | KB13, KB14 KB15, KB16, and SC04 | S037 | $H_2SO_4$ | 0.390 | 0.390 | 1.71 | 1.71 | Proposed PSD Avoidance Limit |

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| BLR1 | None | B001 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.075<br>0.075 | 0.075<br>0.075 | 0.328<br>0.328 | 0.328<br>0.328 | AP-42 Factors |
| BLR1 | None | B001 | $NO_x$ | 0.140 | 0.140 | 0.613 | 0.613 | Proposed BACT limit. |
| BLR1 | None | B001 | CO | 0.807 | 0.807 | 3.53 | 3.53 | AP-42 Factors |
| BLR1 | None | B001 | $SO_2$ | 0.006 | 0.006 | 0.025 | 0.025 | AP-42 Factors |
| BLR1 | None | B001 | VOC | 0.086 | 0.086 | 0.375 | 0.375 | AP-42 Factors |
| BLR1 | None | B001 | Combined HAP | 0.018 | 0.018 | 0.079 | 0.079 | AP-42 Factors |
| BLR1 | None | B001 | GHG | 1,369 | 1,369 | 5,997 | 5,997 | AP-42 Factors |
| BLR2 | None | B002 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.075<br>0.075 | 0.075<br>0.075 | 0.328<br>0.328 | 0.328<br>0.328 | AP-42 Factors |
| BLR2 | None | B002 | $NO_x$ | 0.140 | 0.140 | 0.613 | 0.613 | Proposed BACT limit. |
| BLR2 | None | B002 | CO | 0.807 | 0.807 | 3.53 | 3.53 | AP-42 Factors |
| BLR2 | None | B002 | $SO_2$ | 0.006 | 0.006 | 0.025 | 0.025 | AP-42 Factors |
| BLR2 | None | B002 | VOC | 0.086 | 0.086 | 0.375 | 0.375 | AP-42 Factors |
| BLR2 | None | B002 | Combined HAP | 0.018 | 0.018 | 0.079 | 0.079 | AP-42 Factors |
| BLR2 | None | B002 | GHG | 1,369 | 1,369 | 5,997 | 5,997 | AP-42 Factors |
| BLR3 | None | B003 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.075<br>0.075 | 0.075<br>0.075 | 0.328<br>0.328 | 0.328<br>0.328 | AP-42 Factors |
| BLR3 | None | B003 | $NO_x$ | 0.140 | 0.140 | 0.613 | 0.613 | Proposed BACT limit. |
| BLR3 | None | B003 | CO | 0.807 | 0.807 | 3.53 | 3.53 | AP-42 Factors |
| BLR3 | None | B003 | $SO_2$ | 0.006 | 0.006 | 0.025 | 0.025 | AP-42 Factors |
| BLR3 | None | B003 | VOC | 0.086 | 0.086 | 0.375 | 0.375 | AP-42 Factors |
| BLR3 | None | B003 | Combined HAP | 0.018 | 0.018 | 0.079 | 0.079 | AP-42 Factors |

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **Hourly Actual Emissions** (lb/hr) | **Hourly Potential Emissions** (lb/hr) | **Actual Annual Emission** (tpy) | **Potential Annual Emission** (tpy) | **Method of Determination** |
| BLR3 | None | B003 | GHG | 1,369 | 1,369 | 5,997 | 5,997 | AP-42 Factors |
| BLR4 | None | B004 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.075<br>0.075 | 0.075<br>0.075 | 0.328<br>0.328 | 0.328<br>0.328 | AP-42 Factors |
| BLR4 | None | B004 | $NO_x$ | 0.140 | 0.140 | 0.613 | 0.613 | Proposed BACT limit. |
| BLR4 | None | B004 | CO | 0.807 | 0.807 | 3.53 | 3.53 | AP-42 Factors |
| BLR4 | None | B004 | $SO_2$ | 0.006 | 0.006 | 0.025 | 0.025 | AP-42 Factors |
| BLR4 | None | B004 | VOC | 0.086 | 0.086 | 0.375 | 0.375 | AP-42 Factors |
| BLR4 | None | B004 | Combined HAP | 0.018 | 0.018 | 0.079 | 0.079 | AP-42 Factors |
| BLR4 | None | B004 | GHG | 1,369 | 1,369 | 5,997 | 5,997 | AP-42 Factors |
| EDG1 | None | E001 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.371<br>0.371 | 0.371<br>0.371 | 0.093<br>0.093<br>(500 hours) | 0.093<br>0.093<br>(500 hours) | Proposed BACT limit. |
| EDG1 | None | E001 | $NO_x$ | 32.4 | 32.4 | 8.09<br>(500 hours) | 8.09<br>(500 hours) | Proposed BACT limit. |
| EDG1 | None | E001 | CO | 17.5 | 17.5 | 4.38<br>(500 hours) | 4.38<br>(500 hours) | Proposed BACT limit. |
| EDG1 | None | E001 | $SO_2$ | 0.031 | 0.031 | 0.008<br>(500 hours) | 0.008<br>(500 hours) | Proposed BACT limit. |
| EDG1 | None | E001 | VOC | 1.65 | 1.65 | 0.413<br>(500 hours) | 0.413<br>(500 hours) | AP-42 Factors |
| EDG1 | None | E001 | Combined HAP | 0.088 | 0.088 | 0.022<br>(500 hours) | 0.022<br>(500 hours) | AP-42 Factors |
| EDG1 | None | E001 | GHG | 3,376 | 3,376 | 844<br>(500 hours) | 844<br>(500 hours) | AP-42 Factors |
| EDG2 | None | E002 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.371<br>0.371 | 0.371<br>0.371 | 0.093<br>0.093<br>(500 hours) | 0.093<br>0.093<br>(500 hours) | Calculated based on Proposed Grain Loading BACT limit. |
| EDG2 | None | E002 | $NO_x$ | 32.4 | 32.4 | 8.09<br>(500 hours) | 8.09<br>(500 hours) | Proposed BACT limit. |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| EDG2 | None | E002 | CO | 17.5 | 17.5 | 4.38<br>(500 hours) | 4.38<br>(500 hours) | Proposed BACT limit. |
| EDG2 | None | E002 | $SO_2$ | 0.031 | 0.031 | 0.008<br>(500 hours) | 0.008<br>(500 hours) | Proposed BACT limit. |
| EDG2 | None | E002 | VOC | 1.65 | 1.65 | 0.413<br>(500 hours) | 0.413<br>(500 hours) | AP-42 Factors |
| EDG2 | None | E002 | Combined HAP | 0.088 | 0.088 | 0.022<br>(500 hours) | 0.022<br>(500 hours) | AP-42 Factors |
| EDG2 | None | E002 | GHG | 3,376 | 3,376 | 844<br>(500 hours) | 844<br>(500 hours) | AP-42 Factors |
| EDG3 | None | E003 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.371<br>0.371 | 0.371<br>0.371 | 0.093<br>0.093<br>(500 hours) | 0.093<br>0.093<br>(500 hours) | Calculated based on Proposed Grain Loading BACT limit. |
| EDG3 | None | E003 | $NO_x$ | 32.4 | 32.4 | 8.09<br>(500 hours) | 8.09<br>(500 hours) | Proposed BACT limit. |
| EDG3 | None | E003 | CO | 17.5 | 17.5 | 4.38<br>(500 hours) | 4.38<br>(500 hours) | Proposed BACT limit. |
| EDG3 | None | E003 | $SO_2$ | 0.031 | 0.031 | 0.008<br>(500 hours) | 0.008<br>(500 hours) | Proposed BACT limit. |
| EDG3 | None | E003 | VOC | 1.65 | 1.65 | 0.413<br>(500 hours) | 0.413<br>(500 hours) | AP-42 Factors |
| EDG3 | None | E003 | Combined HAP | 0.088 | 0.088 | 0.022<br>(500 hours) | 0.022<br>(500 hours) | AP-42 Factors |
| EDG3 | None | E003 | GHG | 3,376 | 3,376 | 844<br>(500 hours) | 844<br>(500 hours) | AP-42 Factors |
| EDG4 | None | E004 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.371<br>0.371 | 0.371<br>0.371 | 0.093<br>0.093<br>(500 hours) | 0.093<br>0.093<br>(500 hours) | Calculated based on Proposed Grain Loading BACT limit. |
| EDG4 | None | E004 | $NO_x$ | 32.4 | 32.4 | 8.09<br>(500 hours) | 8.09<br>(500 hours) | Proposed BACT limit. |
| EDG4 | None | E004 | CO | 17.5 | 17.5 | 4.38<br>(500 hours) | 4.38<br>(500 hours) | Proposed BACT limit. |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| EDG4 | None | E004 | $SO_2$ | 0.031 | 0.031 | 0.008 (500 hours) | 0.008 (500 hours) | Proposed BACT limit. |
| EDG4 | None | E004 | VOC | 1.65 | 1.65 | 0.413 (500 hours) | 0.413 (500 hours) | AP-42 Factors |
| EDG4 | None | E004 | Combined HAP | 0.088 | 0.088 | 0.022 (500 hours) | 0.022 (500 hours) | AP-42 Factors |
| EDG4 | None | E004 | GHG | 3,376 | 3,376 | 844 (500 hours) | 844 (500 hours) | AP-42 Factors |
| GP01 | GPB1 | S003 | $PM/PM_{10}$<br>$PM_{2.5}$ | 1.63<br>0.814 | 1.63<br>0.814 | 7.13<br>3.57 | 7.13<br>3.57 | Calculated based on Proposed Grain Loading BACT limit. |
| GP02 | GPB2 | S014 | $PM/PM_{10}$<br>$PM_{2.5}$ | 1.63<br>0.814 | 1.63<br>0.814 | 7.13<br>3.57 | 7.13<br>3.57 | Calculated based on Proposed Grain Loading BACT limit. |
| GP03 | GPB3 | S024 | $PM/PM_{10}$<br>$PM_{2.5}$ | 1.63<br>0.814 | 1.63<br>0.814 | 7.13<br>3.57 | 7.13<br>3.57 | Calculated based on Proposed Grain Loading BACT limit. |
| GP04 | GPB4 | S035 | $PM/PM_{10}$<br>$PM_{2.5}$ | 1.63<br>0.814 | 1.63<br>0.814 | 7.13<br>3.57 | 7.13<br>3.57 | Calculated based on Proposed Grain Loading BACT limit. |
| KAE1 | KNB1 | S006 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.129<br>0.064 | 0.129<br>0.064 | 0.563<br>0.282 | 0.563<br>0.282 | Calculated based on Proposed Grain Loading BACT limit. |
| KAE2 | KNB2 | S017 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.129<br>0.064 | 0.129<br>0.064 | 0.563<br>0.282 | 0.563<br>0.282 | Calculated based on Proposed Grain Loading BACT limit. |
| KAE3 | KNB3 | S027 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.129<br>0.064 | 0.129<br>0.064 | 0.563<br>0.282 | 0.563<br>0.282 | Calculated based on Proposed Grain Loading BACT limit. |
| KAE4 | KNB4 | S038 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.129<br>0.064 | 0.129<br>0.064 | 0.563<br>0.282 | 0.563<br>0.282 | Calculated based on Proposed Grain Loading BACT limit. |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| RRL1 | RCB1 | S011 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.300<br>0.150 | 0.300<br>0.150 | 1.314<br>0.657 | 1.314<br>0.657 | Calculated based on Proposed Grain Loading BACT limit. |
| RRL2 | RCB2 | S032 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.300<br>0.150 | 0.300<br>0.150 | 1.314<br>0.657 | 1.314<br>0.657 | Calculated based on Proposed Grain Loading BACT limit. |
| BS01 | BB01 | S007 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS02 | BB02 | S008 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS03 | BB03 | S009 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS04 | BB04 | S010 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS05 | BB05 | S018 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS06 | BB06 | S019 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS07 | BB07 | S020 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS08 | BB08 | S021 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS09 | BB09 | S028 | $PM/PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 4.00 – EMISSION INFORMATION

| Emission Unit /Emission Group ID[1] | Air Pollution Control Device ID | Stack ID | Pollutant Emitted | Emission Rates | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Hourly Actual Emissions (lb/hr) | Hourly Potential Emissions (lb/hr) | Actual Annual Emission (tpy) | Potential Annual Emission (tpy) | Method of Determination |
| BS10 | BB10 | S029 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS11 | BB11 | S030 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS12 | BB12 | S031 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS13 | BB13 | S039 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS14 | BB14 | S040 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS15 | BB15 | S041 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |
| BS16 | BB16 | S042 | PM/$PM_{10}$<br>$PM_{2.5}$ | 0.086<br>0.043 | 0.086<br>0.043 | 0.375<br>0.188 | 0.375<br>0.188 | Calculated based on Proposed Grain Loading BACT limit. |

1 Actual hourly emission rates are considered equal to potential hourly emission rates. Hourly rates are determined by dividing annual actual emissions by 8,760 hours/year.

2 Hourly PM emission rates are estimated based on grain loading limits proposed as BACT.

**Facility Name:** CARBO Ceramics, Inc **Date of Application:** August 10, 2011

## FORM 5.00 MONITORING INFORMATION

| APCD ID | APCD Name | Monitored Parameter | | Monitoring Frequency |
|---|---|---|---|---|
| | | Parameter | Units | |
| SB01 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB02 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB03 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB04 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB05 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB06 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB07 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB08 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB09 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB10 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB11 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB12 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB13 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB14 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB15 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB16 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB17 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB18 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB19 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB20 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB21 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB22 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB23 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB24 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |

**Comments:**

**Facility Name:** CARBO Ceramics, Inc **Date of Application:** August 10, 2011

## FORM 5.00 MONITORING INFORMATION

| APCD ID | APCD Name | Monitored Parameter | | Monitoring Frequency |
|---|---|---|---|---|
| | | Parameter | Units | |
| SB25 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB26 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB27 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB28 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB29 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB30 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB31 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| SB32 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB01 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB02 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB03 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB04 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB05 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB06 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB07 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB08 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB09 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB10 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB11 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB12 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB13 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB14 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB15 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |
| KB16 | Baghouse | Opacity/ Temperature | % Opacity/ °F | COMS/ Continuous |

**Comments:**

**Facility Name:** CARBO Ceramics, Inc **Date of Application:** August 10, 2011

## FORM 5.00 MONITORING INFORMATION

| APCD ID | APCD Name | Monitored Parameter | | Monitoring Frequency |
|---|---|---|---|---|
| | | Parameter | Units | |
| GPB1 | Baghouse | Visible Emissions | % Opacity | Daily |
| GPB2 | Baghouse | Visible Emissions | % Opacity | Daily |
| GPB3 | Baghouse | Visible Emissions | % Opacity | Daily |
| GPB4 | Baghouse | Visible Emissions | % Opacity | Daily |
| KNB1 | Baghouse | Visible Emissions/ Temperature | % Opacity/ °F | Daily/ Continuous |
| KNB2 | Baghouse | Visible Emissions/ Temperature | % Opacity/ °F | Daily/ Continuous |
| KNB3 | Baghouse | Visible Emissions/ Temperature | % Opacity/ °F | Daily/ Continuous |
| KNB4 | Baghouse | Visible Emissions/ Temperature | % Opacity/ °F | Daily/ Continuous |
| SC01 | Wet Scrubber | Flow rate | gal/min | Continuous |
| SC01 | Wet Scrubber | Pressure drop | in. water | Continuous |
| SC02 | Wet Scrubber | Flow rate | gal/min | Continuous |
| SC02 | Wet Scrubber | Pressure drop | in. water | Continuous |
| SC03 | Wet Scrubber | Flow rate | gal/min | Continuous |
| SC03 | Wet Scrubber | Pressure drop | in. water | Continuous |
| SC04 | Wet Scrubber | Flow rate | gal/min | Continuous |
| SC04 | Wet Scrubber | Pressure drop | in. water | Continuous |
| RCB1 | Baghouse | Visible Emissions | % Opacity | Daily |
| RCB2 | Baghouse | Visible Emissions | % Opacity | Daily |

**Comments:**

The baghouses for the calciner systems, KNB1 – KNB4, will monitor inlet gas temperature to the baghouse for periodic monitoring.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 7.00 – AIR MODELING INFORMATION: Stack Data

| Stack ID | Emission Unit ID(s) | Stack Information | | | Dimensions of largest Structure Near Stack | | Exit Gas Conditions at Maximum Emission Rate | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Height Above Grade (ft) | Inside Diameter (ft) | Exhaust Direction | Height (ft) | Longest Side (ft) | Velocity (ft/sec) | Temperature (°F) | Flow Rate[2] (acfm) Average | Flow Rate[2] (acfm) Maximum |
| S001 | SD01 | 180 | 3 | TBD | TBD | TBD | 108.46 | 206 | 46000 | 46000 |
| S002 | SD02 | 180 | 3 | TBD | TBD | TBD | 108.46 | 206 | 46000 | 46000 |
| S003 | GP01 | 160 | 2.3 | TBD | TBD | TBD | 85.75 | 80 | 22000 | 22000 |
| S004 | KLN1 | TBD | 5.3 | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| S005 | KLN1/ SC01 | 245 | 4 | TBD | TBD | TBD | 83.56 | 160 | 63000 | 63000 |
| S006 | KAE1 | 125 | 1.58 | TBD | TBD | TBD | 16.93 | 150 | 2000 | 2000 |
| S007 | BS01 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S008 | BS02 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S009 | BS03 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S010 | BS04 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S011 | RRL1 | 65 | 1.17 | TBD | TBD | TBD | 33.01 | 80 | 3500 | 3500 |
| S012 | SD03 | 180 | 3 | TBD | TBD | TBD | 108.46 | 206 | 46000 | 46000 |
| S013 | SD04 | 180 | 3 | TBD | TBD | TBD | 108.46 | 206 | 46000 | 46000 |

**NOTE:** If emissions are not vented through a stack, describe point of discharge below and, if necessary, include an attachment. List the attachment in Form 1.00 *General Information*, Item 16.

## FORM 7.00 – AIR MODELING INFORMATION: Stack Data

| Stack ID | Emission Unit ID(s) | Stack Information | | | Dimensions of largest Structure Near Stack | | Exit Gas Conditions at Maximum Emission Rate | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Height Above Grade (ft) | Inside Diameter (ft) | Exhaust Direction | Height (ft) | Longest Side (ft) | Velocity (ft/sec) | Temperature (°F) | Flow Rate(2) (acfm) Average | Flow Rate(2) (acfm) Maximum |
| S014 | GP02 | 160 | 2.3 | TBD | TBD | TBD | 85.75 | 80 | 22000 | 22000 |
| S015 | KLN2 | TBD | 5.3 | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| S016 | KLN2/ SC02 | 245 | 4 | TBD | TBD | TBD | 83.56 | 160 | 63000 | 63000 |
| S017 | KAE2 | 125 | 1.58 | TBD | TBD | TBD | 16.93 | 150 | 2000 | 2000 |
| S018 | BS05 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S019 | BS06 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S020 | BS07 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S021 | BS08 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S022 | SD05 | 180 | 3 | TBD | TBD | TBD | 108.46 | 206 | 46000 | 46000 |
| S023 | SD06 | 180 | 3 | TBD | TBD | TBD | 108.46 | 206 | 46000 | 46000 |
| S024 | GP03 | 160 | 2.3 | TBD | TBD | TBD | 85.75 | 80 | 22000 | 22000 |
| S025 | KLN3 | TBD | 5.3 | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| S026 | KLN3/ SC03 | 245 | 4 | TBD | TBD | TBD | 83.56 | 160 | 63000 | 63000 |

**NOTE:** If emissions are not vented through a stack, describe point of discharge below and, if necessary, include an attachment. List the attachment in Form 1.00 *General Information*, Item 16.

## FORM 7.00 – AIR MODELING INFORMATION: Stack Data

| Stack ID | Emission Unit ID(s) | Stack Information | | | Dimensions of largest Structure Near Stack | | Exit Gas Conditions at Maximum Emission Rate | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Height Above Grade (ft) | Inside Diameter (ft) | Exhaust Direction | Height (ft) | Longest Side (ft) | Velocity (ft/sec) | Temperature (°F) | Flow Rate(2) (acfm) Average | Flow Rate(2) (acfm) Maximum |
| S027 | KAE3 | 125 | 1.58 | TBD | TBD | TBD | 16.93 | 150 | 2000 | 2000 |
| S028 | BS09 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S029 | BS10 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S030 | BS11 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S031 | BS12 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S032 | RRL2 | 65 | 1.17 | TBD | TBD | TBD | 54.74 | 80 | 3500 | 3500 |
| S033 | SD07 | 180 | 3 | TBD | TBD | TBD | 108.46 | 206 | 46000 | 46000 |
| S034 | SD08 | 180 | 3 | TBD | TBD | TBD | 108.46 | 206 | 46000 | 46000 |
| S035 | GP04 | 160 | 2.3 | TBD | TBD | TBD | 85.75 | 80 | 22000 | 22000 |
| S036 | KLN4 | TBD | 5.3 | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| S037 | KLN4/ SC04 | 245 | 4 | TBD | TBD | TBD | 83.56 | 160 | 63000 | 63000 |
| S038 | KAE4 | 125 | 1.58 | TBD | TBD | TBD | 16.93 | 150 | 2000 | 2000 |
| S039 | BS13 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |

**NOTE:** If emissions are not vented through a stack, describe point of discharge below and, if necessary, include an attachment. List the attachment in Form 1.00 *General Information*, Item 16.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 7.00 – AIR MODELING INFORMATION: Stack Data

| Stack ID | Emission Unit ID(s) | Stack Information | | | Dimensions of largest Structure Near Stack | | Exit Gas Conditions at Maximum Emission Rate | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Height Above Grade (ft) | Inside Diameter (ft) | Exhaust Direction | Height (ft) | Longest Side (ft) | Velocity (ft/sec) | Temperature (°F) | Flow Rate[2] (acfm) | |
| | | | | | | | | | Average | Maximum |
| S040 | BS14 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S041 | BS15 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| S042 | BS16 | 225 | 1.7 | TBD | TBD | TBD | 7.64 | 80 | 1000 | 1000 |
| B001 | BLR1 | 29 | 1.5 | TBD | TBD | TBD | 23.58 | 380 | 2500 | 2500 |
| B002 | BLR2 | 29 | 1.5 | TBD | TBD | TBD | 23.58 | 380 | 2500 | 2500 |
| B003 | BLR3 | 29 | 1.5 | TBD | TBD | TBD | 23.58 | 380 | 2500 | 2500 |
| B004 | BLR4 | 29 | 1.5 | TBD | TBD | TBD | 23.58 | 380 | 2500 | 2500 |
| | | | | | | | | | | |
| | | | | | | | | | | |

**NOTE:** If emissions are not vented through a stack, describe point of discharge below and, if necessary, include an attachment. List the attachment in Form 1.00 *General Information*, Item 16.

**Facility Name:** CARBO Ceramics, Inc. **Date of Application:** August 10, 2011

## FORM 7.00 AIR MODELING INFORMATION: Chemicals Data

| Chemical | Potential Emission Rate (lb/hr) | Toxicity | Reference | MSDS Attached |
|---|---|---|---|---|
| | | | | ☐ |
| Hexane (CAS No. 2493-44-9) | 1.16 | 700 ug/$m^3$ (annual) | IRIS RfC | ☐ |
| Methanol (CAS No. 67-56-1) | 9.18 | 625 ug/$m^3$ (24-hr) | OSHA TWA | ☐ |
| | | 32,760 ug/$m^3$ (15-min) | ACGIH STEL | ☐ |
| Ammonia (CAS No. 7664-41-7) | 308.2 | 100 ug/$m^3$ (annual) | IRIS RfC | ☐ |
| | | 2,440 ug/$m^3$ (15-min) | ACGIH STEL | ☐ |
| Hydrogen Flouride (CAS No. 7664-39-3) | 35.2 | 14 ug/$m^3$ (annual) | CARB REL | ☐ |
| | | 165 ug/$m^3$ (15-min) | ACGIH STEL | ☐ |
| Hydrogen Chloride (CAS No. 7647-61-0) | 7.95 | 20 ug/$m^3$ (annual) | IRIS RfC | ☐ |
| | | 745 ug/$m^3$ (15-min) | OSHA | ☐ |
| | | | | ☐ |
| | | | | ☐ |
| | | | | ☐ |
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| | | | | ☐ |

# Volume I, Attachment B –

# Emission Calculations

# Table 1: CARBO Ceramics - Millen Facility-wide Emissions Summary

**Potential Emissions**

| Emissions Group | $NO_x$ (TPY) | CO (TPY) | $SO_2$ (TPY) | $PM/PM_{10}$ (TPY) | $PM_{2.5}$ (TPY) | VOC[3] (TPY) | GHG (TPY $CO_2e$) | Flourides (TPY)[2] | $H_2SO_4$ (TPY)[1] |
|---|---|---|---|---|---|---|---|---|---|
| Spray Dryers (8) | 291 | 582 | 17.5 | 159 | 59.6 | 54.6 | 230,081 | --- | --- |
| Calciners (4) | 2,120 | 433 | 601 | 48.3 | 48.4 | 9.19 | 146,860 | <3.0 | 6.83 |
| Material Handling Units | --- | --- | --- | 39.4 | 19.71 | --- | --- | --- | --- |
| Boilers (4) | 2.45 | 14.1 | 0.10 | 1.31 | 1.31 | 1.50 | 23,987 | --- | --- |
| Emergency Generators (4) | 32.4 | 17.5 | 0.03 | 0.37 | 0.37 | 1.65 | 3,376 | --- | --- |
| **Total Potential Emissions (TPY)** | **2,446** | **1,046** | **618** | **249** | **129.3** | **66.9** | **404,304** | **3.0** | **6.83** |

[1] The facility has proposed to accept federally enforceable emission limits to ensure potential Sulfur Acid mist emissions are below 6.9 tpy (limit each calciner to 0.39 lb/hr).

[2] See Section 5.2 of Volume 1 for explanation of potential emissions

[3] Includes Methanol Emissions

**Potential HAP/TAP Emissions**

| Emissions Group | Combined HAP (TPY) | Methanol (TPY) | HCl (TPY) | HF (TPY) | Hexane (TPY) | Ammonia (TPY) |
|---|---|---|---|---|---|---|
| Spray Dryers (8) | 43.2 | 40.2 | --- | --- | 2.91 | 1350 |
| Calciners (4) | 188 | --- | 34.8 | 152 | 1.86 | --- |
| Material Handling Units | --- | --- | --- | --- | --- | --- |
| Boilers (4) | 0.317 | --- | --- | --- | 0.303 | --- |
| Emergency Generators (4) | 0.086 | --- | --- | --- | --- | --- |
| **Total Potential HAP Emissions (TPY)** | **232** | **40.2** | **34.8** | **152** | **5.06** | **1350** |

## Table 2: PM/ $NO_x$/ $SO_2$/ CO/ Methanol/ HCl/ HF Emission Calculations - Spray Dryers, Calciners, and Combustion Units

### Spray Dryer / Calciner Potential Emissions

| | | | | | | PM/$PM_{10}$ | | | $PM_{2.5}$ | | | $NO_x$ | | $SO_2$ | | CO | | Methanol | HCl | HF | Ammonia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emission Unit ID | Emission Unit Description | APCD ID | APCD Description | Stack ID | Control Device(s) Total Flow Rate (dscfm) | BACT Limit[1] (gr/dscf) | Emissions[2] (lbs/hr) | Emissions[3] (tpy) | BACT Limit[1] (gr/dscf) | Emissions[2] (lb/hr) | Emissions[3] (tpy) | BACT Emission Limit[4] (lbs/hr) | BACT Emissions[3] (tpy) | BACT Emission Limit[5] (lbs/hr) | BACT Emissions[3,5] (tpy) | BACT Emission Limit[6] (lbs/hr) | BACT Emissions[3] (tpy) | MACT Emissions[7] (tpy) | MACT Emissions[8,9] (tpy) | MACT Emissions[8,9] (tpy) | Emissions[17] (tpy) |
| SD01 | Spray Dryer No. 1 | SB01, SB02, SB03, and SB04 | Spray Dryer No. 1 Baghouses | S001 | 26,500 | 0.020 | 4.54 | 19.9 | 0.0075 | 1.70 | 7.45 | 8.3 | 36.4 | N/A | 2.19 | 16.6 | 72.7 | 10.04 | N/A | N/A | 169 |
| SD02 | Spray Dryer No. 2 | SB05, SB06, SB07, and SB08 | Spray Dryer No. 2 Baghouses | S002 | 26,500 | 0.020 | 4.54 | 19.9 | 0.0075 | 1.70 | 7.45 | 8.3 | 36.4 | N/A | 2.19 | 16.6 | 72.7 | | N/A | N/A | 169 |
| SD03 | Spray Dryer No. 3 | SB09, SB10, SB11, and SB12 | Spray Dryer No. 3 Baghouses | S012 | 26,500 | 0.020 | 4.54 | 19.9 | 0.0075 | 1.70 | 7.45 | 8.3 | 36.4 | N/A | 2.19 | 16.6 | 72.7 | 10.04 | N/A | N/A | 169 |
| SD04 | Spray Dryer No. 4 | SB13, SB14, SB15, and SB16 | Spray Dryer No. 4 Baghouses | S013 | 26,500 | 0.020 | 4.54 | 19.9 | 0.0075 | 1.70 | 7.45 | 8.3 | 36.4 | N/A | 2.19 | 16.6 | 72.7 | | N/A | N/A | 169 |
| SD05 | Spray Dryer No. 5 | SB17, SB18, SB19, and SB20 | Spray Dryer No. 5 Baghouses | S022 | 26,500 | 0.020 | 4.54 | 19.9 | 0.0075 | 1.70 | 7.45 | 8.3 | 36.4 | N/A | 2.19 | 16.6 | 72.7 | 10.04 | N/A | N/A | 169 |
| SD06 | Spray Dryer No. 6 | SB21, SB22, SB23, and SB24 | Spray Dryer No. 6 Baghouses | S023 | 26,500 | 0.020 | 4.54 | 19.9 | 0.0075 | 1.70 | 7.45 | 8.3 | 36.4 | N/A | 2.19 | 16.6 | 72.7 | | N/A | N/A | 169 |
| SD07 | Spray Dryer No. 7 | SB25, SB26, SB27, and SB28 | Spray Dryer No. 7 Baghouses | S033 | 26,500 | 0.020 | 4.54 | 19.9 | 0.0075 | 1.70 | 7.45 | 8.3 | 36.4 | N/A | 2.19 | 16.6 | 72.7 | 10.04 | N/A | N/A | 169 |
| SD08 | Spray Dryer No. 8 | SB29, SB30, SB31, and SB32 | Spray Dryer No. 8 Baghouses | S034 | 26,500 | 0.020 | 4.54 | 19.9 | 0.0075 | 1.70 | 7.45 | 8.3 | 36.4 | N/A | 2.19 | 16.6 | 72.7 | | N/A | N/A | 169 |
| KLN1 | Calciner No. 1 | KB01, KB02, KB03, KB04, & SC01 | Calciner No. 1 Baghouses/Wet Scrubber | S005 | 32,191 | 0.010 | 2.76 | 12.1 | 0.0100 | 2.76 | 12.09 | 121 | 530 | 34.25 | 150 | 24.7 | 108 | N/A | 8.7 | 37.9 | N/A |
| KLN2 | Calciner No. 2 | KB05, KB06, KB07, KB08, & SC02 | Calciner No. 2 Baghouses/Wet Scrubber | S016 | 32,191 | 0.010 | 2.76 | 12.1 | 0.0100 | 2.76 | 12.09 | 121 | 530 | 34.25 | 150 | 24.7 | 108 | N/A | 8.7 | 37.9 | N/A |
| KLN3 | Calciner No. 3 | KB09, KB10, KB11, KB12, & SC03 | Calciner No. 3 Baghouses/Wet Scrubber | S026 | 32,191 | 0.010 | 2.76 | 12.1 | 0.0100 | 2.76 | 12.09 | 121 | 530 | 34.25 | 150 | 24.7 | 108 | N/A | 8.7 | 37.9 | N/A |
| KLN4 | Calciner No. 4 | KB13, KB14, KB15, KB16, & SC04 | Calciner No. 4 Baghouses/Wet Scrubber | S037 | 32,191 | 0.010 | 2.76 | 12.1 | 0.0100 | 2.76 | 12.09 | 121 | 530 | 34.25 | 150 | 24.7 | 108 | N/A | 8.7 | 37.9 | N/A |
| | | | | | | | Total (tpy): | 208 | | | 107.9 | | 2,411 | | 618 | | 1,014 | 40.2 | 34.8 | 151.6 | 1350 |

### Boiler Potential Emissions

| | | | | | PM/$PM_{10}$/$PM_{2.5}$ | | | $NO_x$ | | | $SO_2$ | | | CO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emission Unit ID | Emission Unit Description | Fuel Type | Heat Input (MMBtu/hr) | Stack ID | AP-42 EF (LPG)[10] (lb/MMBtu) | Emissions[11] (lbs/hr) | Emissions[3] (tpy) | BACT Emission Limit[12] (ppm) | Emissions[13] (lbs/hr) | BACT Emissions[3] (tpy) | AP-42 EF (NG)[10] (lb/MMBtu) | Emissions[11] (lbs/hr) | Emissions[3] (tpy) | AP-42 EF (NG)[10] (lb/MMBtu) | Emissions[11] (lbs/hr) | Emissions[3] (tpy) |
| BLR1 | Boiler No. 1 | Natural gas/ LPG | 9.8 | B001 | 0.00765 | 0.075 | 0.328 | 12 ppm | 0.140 | 0.613 | 0.0006 | 0.006 | 0.025 | 0.082 | 0.807 | 3.53 |
| BLR2 | Boiler No. 2 | Natural gas/ LPG | 9.8 | B002 | 0.00765 | 0.075 | 0.328 | 12 ppm | 0.140 | 0.613 | 0.0006 | 0.006 | 0.025 | 0.082 | 0.807 | 3.53 |
| BLR3 | Boiler No. 3 | Natural gas/ LPG | 9.8 | B003 | 0.00765 | 0.075 | 0.328 | 12 ppm | 0.140 | 0.613 | 0.0006 | 0.006 | 0.025 | 0.082 | 0.807 | 3.53 |
| BLR4 | Boiler No. 4 | Natural gas/ LPG | 9.8 | B004 | 0.00765 | 0.075 | 0.328 | 12 ppm | 0.140 | 0.613 | 0.0006 | 0.006 | 0.025 | 0.082 | 0.807 | 3.53 |
| | | | | | | Total (tpy): | 1.31 | | | 2.45 | | | 0.101 | | | 14.1 |

### Emergency Generator Potential Emissions

| | | | | | | PM/$PM_{10}$/$PM_{2.5}$ | | | $NO_x$ | | | $SO_2$ | | | CO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emission Unit ID | Emission Unit Description | Fuel Type | Heat Input (MMBtu/hr) | Mech. Power Output (hp) | Stack ID | 40 CFR Part 89 Standard[14] (g/bhp-hr) | Emissions[15] (lbs/hr) | Emissions[3] (tpy) | 40 CFR Part 89 Standard[14] (g/bhp-hr) | Emissions[15] (lb/hr) | Emissions[3] (tpy) | AP-42 EF[16] (lb/MMBtu) | Emissions[11] (lb/hr) | Emissions[3] (tpy) | 40 CFR Part 89 Standard[14] (g/bhp-hr) | Emissions[15] (lb/hr) | Emissions[3] (tpy) |
| EDG1 | Emergency Generator No.1 | Diesel (ULSD) | 20.2 | 3,058 | E001 | 0.055 | 0.371 | 0.093 | 4.80 | 32.4 | 8.09 | 0.002 | 0.031 | 0.008 | 2.6 | 17.5 | 4.38 |
| EDG2 | Emergency Generator No. 2 | Diesel (ULSD) | 20.2 | 3,058 | E002 | 0.055 | 0.371 | 0.093 | 4.80 | 32.4 | 8.09 | 0.002 | 0.031 | 0.008 | 2.6 | 17.5 | 4.38 |
| EDG3 | Emergency Generator No. 3 | Diesel (ULSD) | 20.2 | 3,058 | E003 | 0.055 | 0.371 | 0.093 | 4.80 | 32.4 | 8.09 | 0.002 | 0.031 | 0.008 | 2.6 | 17.5 | 4.38 |
| EDG4 | Emergency Generator No. 4 | Diesel (ULSD) | 20.2 | 3,058 | E004 | 0.055 | 0.371 | 0.093 | 4.80 | 32.4 | 8.09 | 0.002 | 0.031 | 0.008 | 2.6 | 17.5 | 4.38 |
| | | | | | | | Total (tpy): | 0.371 | | | 32.4 | | | 0.031 | | | 17.5 |

**Notes:**

| | |
|---|---|
| 1 | PM/$PM_{10}$ BACT emission limits (0.010 gr/dscf for calciners, 0.020 gr/dscf for dryers) & $PM_{2.5}$ BACT emission limits (0.010 gr/dscf for calciners, 0.0075 gr/dscf for dryers) based on dispersion modeling analyses and engineering testing |
| 2 | Emissions, lb/hr = (BACT, gr/dscf) * (flow rate, dscfm) * (60 min/hr) / (7000 gr/lb) |
| 3 | Emissions, tpy = (Emissions, lb/hr) * (Hours of operation, hr/yr) / (2000 lb/ton); hours of operation are equal to 8,760, except emergency generators, for which hours of operation equal 500 hr/yr |
| 4 | $NO_x$ BACT emission limits (121 lb/hr for calciner, 8.3 lb/hr for dryers) based on engineering testing conducted at the Toomsboro facility 2006-2010 on Calciners 1 and 2 and Spray Dryers 1-4<br>Testing results for Kilns at Toomsboro include 124 lb/hr for Kiln 1 on 6/7/2006, 102 lb/hr for Kiln 2 on 6/29/2010, and 83.7 for Kiln 2 on 11/11/2010<br>Testing results for Spray Dryers at Toomsboro include 11.98 lb/hr for Spray Dryer 2 on 6/6/2006, and 6.9 lb/hr for Spray Dryer 2 on 3/6/2007 |
| 5 | Potential $SO_2$ emissions are based upon BACT Limits (34.25 lbs/hr for each calciner) and engineering test data for spray dryers. BACT limits for calciners derived from baseline emissions and an estimated control efficiency of 95%.<br>$SO_2$ Calciner Emissions (tpy) = (baseline emissions, tpy)*(1 - control efficiency) = (3,000 tpy)*(1-0.95) = 150 tpy. $SO_2$ Baseline Emissions (tpy) = (Max % S in clay)*(SO2/S MW ratios, 64/32)*(20.9 tph clay feed)*(8,760 hrs/yr) = 3,000 tpy<br>Maximum sulfur content of clay feed has been found to be as high as 0.82%. |
| 6 | CO BACT emission limits (24.7 lb/hr for calciners, 16.6 lb/hr for dryers) based on engineering testing and dispersion modeling analyses |
| 7 | 10.04 tpy of methanol is emitted by the spray dryers on each line based on a facility-wide adsorbate usage of 5,500 lbs/day composed of 1% methanol. Each line has two spray dryers. |
| 8 | Emissions based upon proposed Section 112(g) limits of 1.98 lbs HCl/hr and 8.7 lbs HF/hr, for each calciner. These limits are derived from baseline emissions and an estimated control efficiency of 95% for both HCl and HF.<br>Potential HCl/HF Emissions (tpy) = baseline emissions (tpy) * (1-control efficiency)<br>HF emissions = (HF baseline, 758 tpy) * (1-0.95) = 37.9 tpy, HCl emissions = (HCl baseline, 174 tpy) * (1-0.95) = 8.67 tpy. HF/HCl Baseline = (Max % F or Cl in clay)*(maximum calciner throuput, 20.9 tph)*8,760 hrs/yr<br>Maximum fluoride content in feed clay has been found to be at 0.414%. Maximum chloride content in feed clay has been found to be at 0.095%. |
| 9 | Baseline emissions are considered to be equivalent to the highest chloride and fluoride clay feed sample concentrations assuming all chlorides and fluorides in clay are emitted to atmosphere (MW ratios of HF/F and HCl/Cl is considered to be 1.0). |
| 10 | Emission factors for natural gas were derived from AP-42, Chapter 1.4, Tables 1.4-1, 1.4-2, 1.4-3, and 1.4-4. Emission factors were converted to a lbs/MMBtu basis by dividing by the heating value of natural gas, 1,020 Btu/scf.<br>Emission factors for propane were derived from AP-42, Chapter 1.5, Table 1.5-1, for Industrial Boilers (SCC 1-02-010-02). Emission factors were converted to a lbs/MMBtu basis by dividing by the heating value of propane, 91.5 MMBtu/1000 gallons.<br>The greater EF (of either natural gas or propane) was used to determine potential PM, $SO_2$, and CO emissions from the boilers. |
| 11 | Emissions, lb/hr = (EF, lb/MMBtu) * (Heat input, MMBtu/hr) |
| 12 | $NO_x$ BACT emission limit for boiler (12 ppm @ 3% oxygen) based on engineering testing and dispersion modeling analyses |
| 13 | Hourly emissions based upon 12 ppm emissions concentration limit |
| 14 | Tier 2 emissions standards for existing and new non-road compression-ignition engines as specified in 40 CFR Part 89 |
| 15 | Emissions, lb/hr = (EF, g/bhp-hr) / (453.6 lb/g) * (Power, hp) |
| 16 | $SO_2$ emission factor for Diesel Generators derived from AP-42, Chapter 3.4, Table 3.4-1. Sulfur content equal to 0.0015% (ULSD) as required by 40 CFR 80.510(b). |
| 17 | Emissions based upon a maximum of 2,250,000 lb/yr per line of ammonia solution (at 30%). Emissions (tpy) = 2,250,000 lbs/yr/line / 2 spray dryers/line *0.3 (30% ammonia solution) / 2000 lb/hr |

## Table 3: PM/$PM_{10}$ and $PM_{2.5}$ Emission Calculations - Material Handling[1]

| Emission Unit ID / Emission Group ID[2] | Emission Unit Description | APCD ID Nos. | APCD Description | Stack ID No. | Control Device(s) Total Flow Rate (dscfm) | PM/$PM_{10}$ BACT Limit[3] (gr/dscf) | PM/$PM_{10}$ Emissions[4] (lbs/hr) | PM/$PM_{10}$ Emissions[5] (tpy) | $PM_{2.5}$ BACT Limit[3] (gr/dscf) | $PM_{2.5}$ Emissions[4] (lbs/hr) | $PM_{2.5}$ Emissions[5] (tpy) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GP01 | Pellet Feed System No. 1 | GPB1 | Pellet Nuisance BH #1 | S003 | 19,000 | 0.010 | 1.63 | 7.13 | 0.0050 | 0.814 | 3.57 |
| KAE1 | Calciner No. 1 System No. 1 | KNB1 | Calciner 1 Nuisance BH | S006 | 1,500 | 0.010 | 0.129 | 0.563 | 0.0050 | 0.064 | 0.282 |
| BS01 | Bulk Product Silo No. 1-1 | BB01 | Bin vent filter | S007 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS02 | Bulk Product Silo No. 1-2 | BB02 | Bin vent filter | S008 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS03 | Bulk Product Silo No. 1-3 | BB03 | Bin vent filter | S009 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS04 | Bulk Product Silo No. 1-4 | BB04 | Bin vent filter | S010 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| GP02 | Pellet Feed System No. 2 | GPB2 | Pellet Nuisance BH #2 | S014 | 19,000 | 0.010 | 1.63 | 7.13 | 0.0050 | 0.814 | 3.57 |
| KAE2 | Calciner No. 2 System No. 2 | KNB2 | Calciner 2 Nuisance BH | S017 | 1,500 | 0.010 | 0.129 | 0.563 | 0.0050 | 0.064 | 0.282 |
| BS05 | Bulk Product Silo No. 2-1 | BB05 | Bin vent filter | S018 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS06 | Bulk Product Silo No. 2-2 | BB06 | Bin vent filter | S019 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS07 | Bulk Product Silo No. 2-3 | BB07 | Bin vent filter | S020 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS08 | Bulk Product Silo No. 2-4 | BB08 | Bin vent filter | S021 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| GP03 | Pellet Feed System No. 3 | GPB3 | Pellet Nuisance BH #3 | S024 | 19,000 | 0.010 | 1.63 | 7.13 | 0.0050 | 0.814 | 3.57 |
| KAE3 | Calciner No. 3 System No. 3 | KNB3 | Calciner 3 Nuisance BH | S027 | 1,500 | 0.010 | 0.129 | 0.563 | 0.0050 | 0.064 | 0.282 |
| BS09 | Bulk Product Silo No. 3-1 | BB09 | Bin vent filter | S028 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS10 | Bulk Product Silo No. 3-2 | BB10 | Bin vent filter | S029 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS11 | Bulk Product Silo No. 3-3 | BB11 | Bin vent filter | S030 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS12 | Bulk Product Silo No. 3-4 | BB12 | Bin vent filter | S031 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| GP04 | Pellet Feed System No. 4 | GPB4 | Pellet Nuisance BH #4 | S035 | 19,000 | 0.010 | 1.63 | 7.13 | 0.0050 | 0.814 | 3.57 |
| KAE4 | Calciner No. 4 System No. 4 | KNB4 | Calciner 4 Nuisance BH | S038 | 1,500 | 0.010 | 0.129 | 0.563 | 0.0050 | 0.064 | 0.282 |
| BS13 | Bulk Product Silo No. 4-1 | BB13 | Bin vent filter | S039 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS14 | Bulk Product Silo No. 4-2 | BB14 | Bin vent filter | S040 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS15 | Bulk Product Silo No. 4-3 | BB15 | Bin vent filter | S041 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| BS16 | Bulk Product Silo No. 4-4 | BB16 | Bin vent filter | S042 | 1,000 | 0.010 | 0.086 | 0.375 | 0.0050 | 0.043 | 0.188 |
| RRL1 | Railcar Loading Operations | RCB1 | Railcar Loading #1 BH | S011 | 3,500 | 0.010 | 0.300 | 1.314 | 0.0050 | 0.150 | 0.657 |
| RRL2 | | RCB2 | Railcar Loading #2 BH | S032 | 3,500 | 0.010 | 0.300 | 1.314 | 0.0050 | 0.150 | 0.657 |
| | | | | | | | Total (tpy): | 39.4 | | Total (tpy): | 19.71 |

Notes:

1 Only Emission Units with exhaust stacks are included in this table.

2 Emission groups include the following emission units:
GP01= DSB1, DUB1, DSB2, DUB2, OC1, GPC1, GPT1, GPE1, GSH1, GSC1, GSC2, GSC3, OBC1 , ORB1, UBC1, URC1, KFE1, KFB1, KRB1, KRE1, KFC1
GP02= DSB2, DUB2, DSB3, DUB3, OC2, GPC2, GPT2, GPE2, GSH2, GSC4, GSC5, GSC6, OBC6, ORB2, UBC2, URC2, KFE2, KFB2, KRB2, KRE2, KFC2
GP03= DSB5, DUB5, DSB6, DUB6, OC3, GPC3, GPT3, GPE3, GSH3, GSC7, GSC8, GSC9, OBC3, ORB3, UBC3, URC3, KFE3, KFB3, KRB3, KRE3, KFC3
GP04= DSB7, DUB7, DSB8, DUB8, OC4, GPC4, GPT4, GPE4, GSH4, GS10, GS11, GS12, OBC4 , ORB4, UBC4, URC4, KFE4, KFB4, KRB4, KRE4, KFC4
KAE1= KCE1, KPS1, KFS1, KQC1, KQC2, KQC3, KQC4, KCS1, KCS2
KAE2= KCE2, KPS2, KFS2, KQC5, KQC6, KQC7, KQC8, KCS3, KCS4
KAE3= KCE3, KPS3, KFS3, KQC9, KQ10, KQ11, KQ12, KCS5, KCS6
KAE4= KCE4, KPS4, KFS4, KQ13, KQ14, KQ15, KQ16, KCS7, KCS8

3 PM BACT emission limits determined based on dispersion modeling analyses and engineering testing

4 Potential Emissions, lb/hr = (BACT limit, gr/dscf) * (Flow rate, dscfm) * (60 min/hour) / (7,000 gr/lb)

5 Potential Emissions, tpy = (Emissions, lb/hr) * (8760 hr/yr) / (2000 lb/ton)

## Table 4: VOC/HAP Combustion Emission Calculations

**AP-42 Emission Factors (lb/MMBtu)**

| | VOC | Total HAP | Hexane | Benzene |
|---|---|---|---|---|
| Natural Gas Combustion[1] | 0.00539 | **0.0018** | **0.0018** | **0.000002** |
| LPG Combustion[1] | **0.00874** | na | na | na |
| Diesel Combustion[2] | 0.08190 | 0.0043 | na | 0.0008 |

| | | | VOC | | HAPs | | |
|---|---|---|---|---|---|---|---|
| Emission Unit ID | Emission Unit Description | Heat Input (MMBtu/hr) | Emissions (lbs/hr)[3] | Emissions (tpy)[4] | Combined HAP Emissions (tpy)[4] | Hexane Emissions (tpy)[4] | Benzene Emissions (tpy)[4] |
| SD01 | Spray Dryer No. 1 | 47.0 | 0.411 | 1.80 | 0.380 | 0.363 | 0.000 |
| SD02 | Spray Dryer No. 2 | 47.0 | 0.411 | 1.80 | 0.380 | 0.363 | 0.000 |
| SD03 | Spray Dryer No. 3 | 47.0 | 0.411 | 1.80 | 0.380 | 0.363 | 0.000 |
| SD04 | Spray Dryer No. 4 | 47.0 | 0.411 | 1.80 | 0.380 | 0.363 | 0.000 |
| SD05 | Spray Dryer No. 5 | 47.0 | 0.411 | 1.80 | 0.380 | 0.363 | 0.000 |
| SD06 | Spray Dryer No. 6 | 47.0 | 0.411 | 1.80 | 0.380 | 0.363 | 0.000 |
| SD07 | Spray Dryer No. 7 | 47.0 | 0.411 | 1.80 | 0.380 | 0.363 | 0.000 |
| SD08 | Spray Dryer No. 8 | 47.0 | 0.411 | 1.80 | 0.380 | 0.363 | 0.000 |
| KLN1 | Calciner No. 1 | 60.0 | 0.525 | 2.30 | 0.485 | 0.464 | 0.001 |
| KLN2 | Calciner No. 2 | 60.0 | 0.525 | 2.30 | 0.485 | 0.464 | 0.001 |
| KLN3 | Calciner No. 3 | 60.0 | 0.525 | 2.30 | 0.485 | 0.464 | 0.001 |
| KLN4 | Calciner No. 4 | 60.0 | 0.525 | 2.30 | 0.485 | 0.464 | 0.001 |
| BLR1 | Boiler No. 1 | 9.8 | 0.086 | 0.375 | 0.079 | 0.076 | 0.000 |
| BLR2 | Boiler No. 2 | 9.8 | 0.086 | 0.375 | 0.079 | 0.076 | 0.000 |
| BLR3 | Boiler No. 3 | 9.8 | 0.086 | 0.375 | 0.079 | 0.076 | 0.000 |
| BLR4 | Boiler No. 4 | 9.8 | 0.086 | 0.375 | 0.079 | 0.076 | 0.000 |
| EDG1 | Emergency Generator No.1 | 20.2 | 1.65 | 0.413 | 0.022 | na | 0.004 |
| EDG2 | Emergency Generator No. 2 | 20.2 | 1.65 | 0.413 | 0.022 | na | 0.004 |
| EDG3 | Emergency Generator No. 3 | 20.2 | 1.65 | 0.413 | 0.022 | na | 0.004 |
| EDG4 | Emergency Generator No. 4 | 20.2 | 1.65 | 0.413 | 0.022 | na | 0.004 |
| | | | **Total (tpy):** | **26.7** | **5.38** | **5.06** | **0.022** |

| | |
|---|---|
| 1 | Emission factors for natural gas were derived from AP-42, Chapter 1.4, Tables 1.4-1, 1.4-2, 1.4-3, and 1.4-4.<br>Emission factors were converted to a lbs/MMBtu basis by dividing by the heating value of natural gas, 1020 Btu/scf.<br>Emission factors for propane were derived from AP-42, Chapter 1.5, Table 1.5-1, for Industrial Boilers (SCC 1-02-010-02)<br>Emission factors were converted to a lbs/MMBtu basis by dividing by the heating value of propane, 91.5 MMBtu/1000 gallons.<br>The greater of the two EF (natural gas or proane combustion) was used as a conservative estimate for calculating<br>VOC and HAP combustion emissions |
| 2 | Emission factors for Diesel Generators were derived from AP-42, Chapter 3.4, Table 3.4-1. Non-Methane Hydrocarbons assumed to be 91% of TOC |
| 3 | Emissions, lb/hr = (EF, lb/MMBtu) * (Heat Input, MMBtu/hr) |
| 4 | Emissions, tpy = (Emissions, lb/hr) * (Hours of operation) / (2000 lb/ton)<br>Hours of operation equal to 8,760 hr/yr, except emergency generators, for which hours of operation equal 500 hr/yr |

## Table 5: GHG Combustion Emission Calculations

**Emission Factors (EF)**

| | $CO_2$ | $CH_4$ | $N_2O$ | Composite GHG Emission Factor[4] |
|---|---|---|---|---|
| Global Warming Potential (GWP)[2] | 1 | 21 | 310 | |
| **External Combustion** | | | | |
| Natural Gas EF - (lb/MMBtu)[1] | 118 | 0.0023 | 0.0006 | 118 lb CO2e/MMBtu |
| LPG EF - (lb/MMBtu)[1] | 137 | 0.0022 | 0.010 | **140 lb CO2e/MMBtu** |
| **Internal Combustion** | | | | |
| EF - (lb/MMBtu)[3] | 165 | 0.090 | 0.0013 | **167 lb CO2e/MMBtu** |

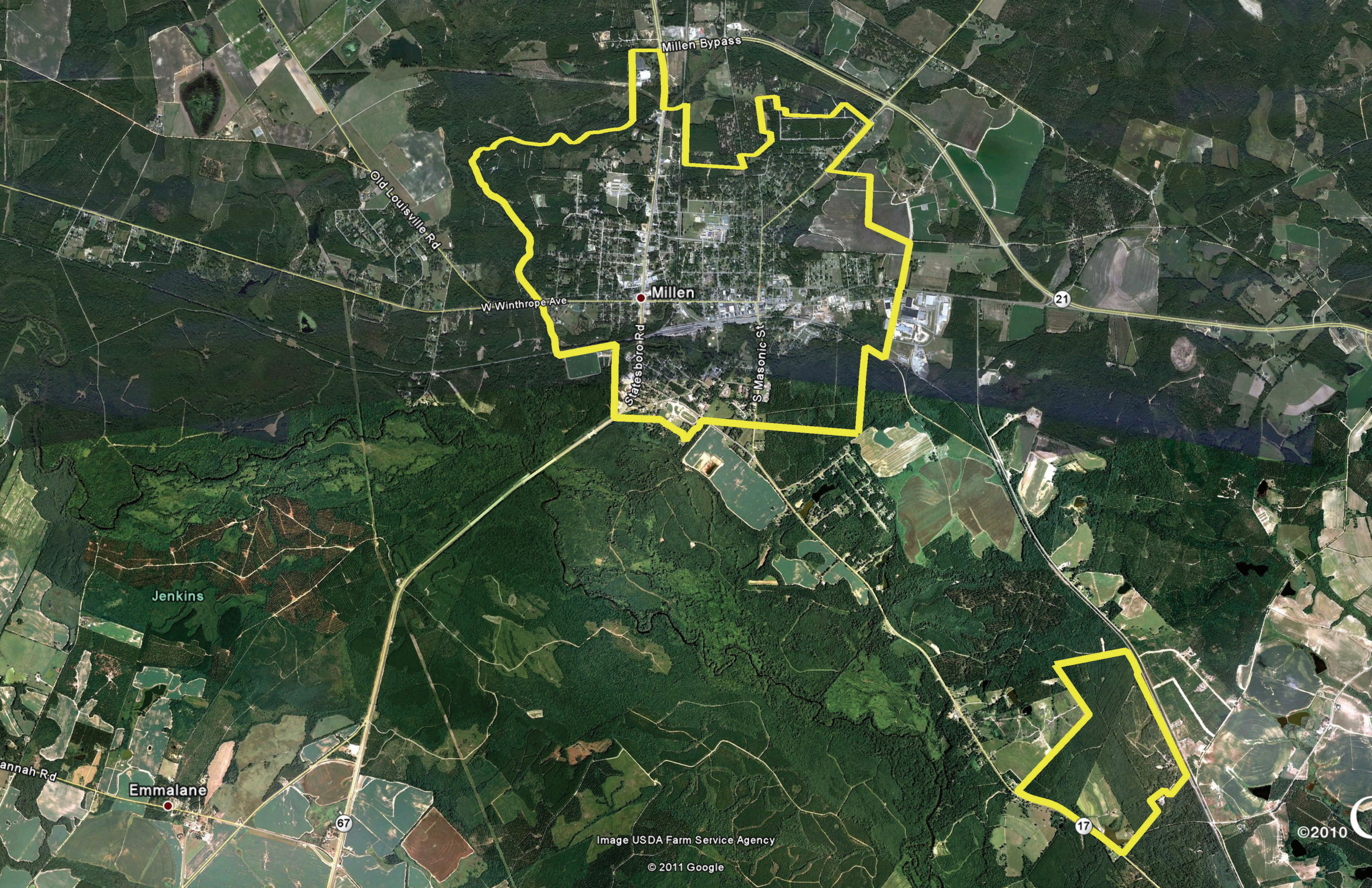
| Emission Unit ID | Emission Unit Description | Fuel Type | Heat Input (MMBtu/hr) | Potential Hours/Year | GHG Emissions (tpy $CO_2e$)[5] |
|---|---|---|---|---|---|
| SD01 | Spray Dryer No. 1 | Natural gas / LPG | 47.0 | 8,760 | 28,760 |
| SD02 | Spray Dryer No. 2 | Natural gas / LPG | 47.0 | 8,760 | 28,760 |
| SD03 | Spray Dryer No. 3 | Natural gas / LPG | 47.0 | 8,760 | 28,760 |
| SD04 | Spray Dryer No. 4 | Natural gas / LPG | 47.0 | 8,760 | 28,760 |
| SD05 | Spray Dryer No. 5 | Natural gas / LPG | 47.0 | 8,760 | 28,760 |
| SD06 | Spray Dryer No. 6 | Natural gas / LPG | 47.0 | 8,760 | 28,760 |
| SD07 | Spray Dryer No. 7 | Natural gas / LPG | 47.0 | 8,760 | 28,760 |
| SD08 | Spray Dryer No. 8 | Natural gas / LPG | 47.0 | 8,760 | 28,760 |
| KLN1 | Calciner No. 1 | Natural gas / LPG | 60.0 | 8,760 | 36,715 |
| KLN2 | Calciner No. 2 | Natural gas / LPG | 60.0 | 8,760 | 36,715 |
| KLN3 | Calciner No. 3 | Natural gas / LPG | 60.0 | 8,760 | 36,715 |
| KLN4 | Calciner No. 4 | Natural gas / LPG | 60.0 | 8,760 | 36,715 |
| BLR1 | Boiler No. 1 | Natural gas / LPG | 9.8 | 8,760 | 5,997 |
| BLR2 | Boiler No. 2 | Natural gas / LPG | 9.8 | 8,760 | 5,997 |
| BLR3 | Boiler No. 3 | Natural gas / LPG | 9.8 | 8,760 | 5,997 |
| BLR4 | Boiler No. 4 | Natural gas / LPG | 9.8 | 8,760 | 5,997 |
| EDG1 | Emergency Generator No.1 | Diesel | 20.2 | 500 | 844 |
| EDG2 | Emergency Generator No. 2 | Diesel | 20.2 | 500 | 844 |
| EDG3 | Emergency Generator No. 3 | Diesel | 20.2 | 500 | 844 |
| EDG4 | Emergency Generator No. 4 | Diesel | 20.2 | 500 | 844 |
| | | | | **Total (tpy):** | **404,304** |

Notes:

| | |
|---|---|
| 1 | Emission Factor for each species as specified in AP-42, 5th Edition, Tables 1.4-2 and1.5-1 (propane). LPG EF used for conservative estimate of potential $CO_2$ emissions (greater than natural gas). Low-$NO_x$ burners assumed for all external combustion sources. Emission factors were converted to an MMBtu basis based on 1020 Btu/scf (for natural gas) or 91,500 Btu/gallon (propane). Any $CO_2$ emissions that may result from organic impurities in the clay have been shown to be negligible and not included for purposes of these emission calculations. |
| 2 | Relative Global Warming Potential of each greenhouse gas species, as specified in 40 CFR 98, Table A-1. |
| 3 | Emission Factors for each $CO_2$ and $CH_4$ as specified in AP-42, 5th Edition, Tables 3.4-1. All TOC is assumed to be $CH_4$. No emission factor for $N_2O$ was available in AP-42 or WebFIRE, so factor specified in 40 CFR 98, Table C-2 is used instead. |
| 4 | Composite EF, lb $CO_2$e/MMBtu= ($CO_2$ EF * $CO_2$ GWP) + ($CH_4$ EF * $CH_4$ GWP) + ($N_2O$ EF * $N_2O$ GWP) |
| 5 | GHG Emissions, tpy $CO_2$e = (Heat Input, MMBtu/hr) * (Potential Hours/Year) * (Composite Emission Factor, lb $CO_2$e/MMBtu) |

# Volume I, Attachment C –

# Facility Map and Process Flow Diagram



Millen Bypass
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Millen
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Statesboro Rd
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Jenkins
Emmalane
annah Rd
67
17
Image USDA Farm Service Agency
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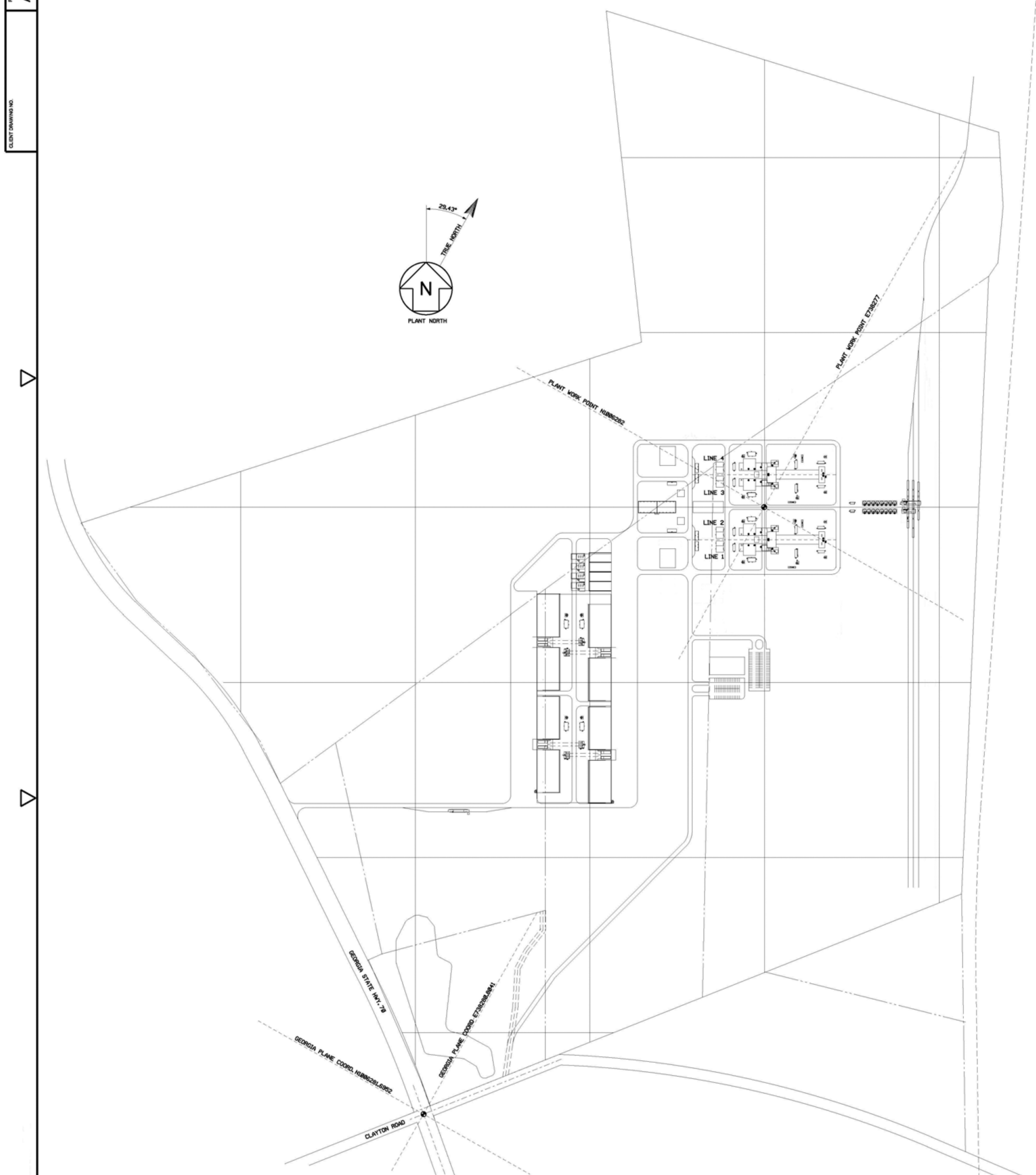
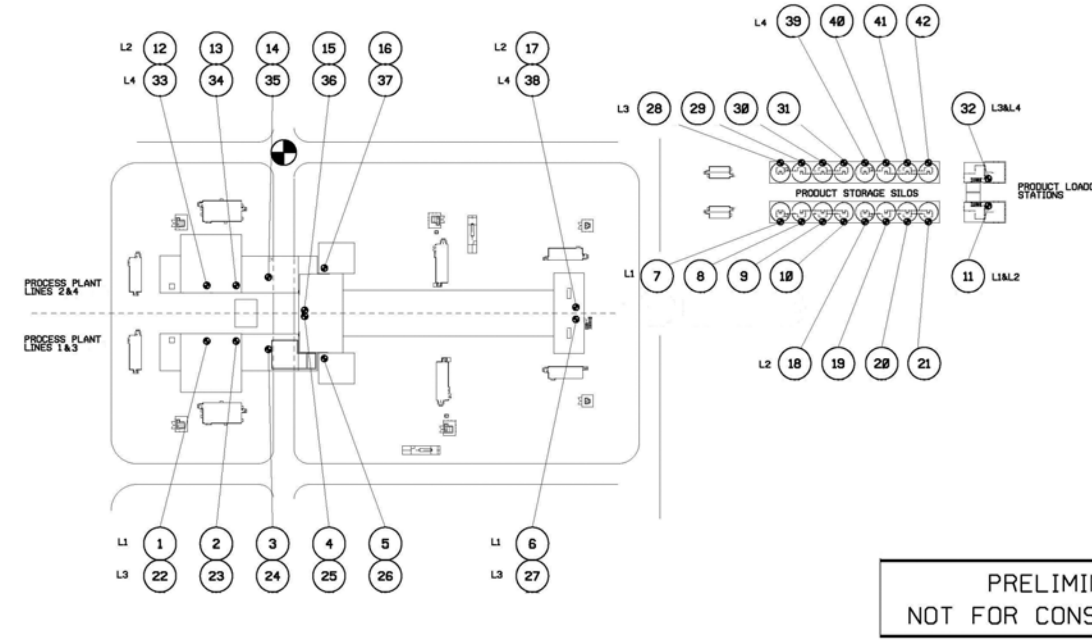



ENLARGED PLAN FOR TWO TYPICAL LINES

PRELIMINARY
NOT FOR CONSTRUCTION

| NO. | DATE | REVISIONS | DWN | CKD |
|---|---|---|---|---|
| A | XX/XX/XX | RELEASED FOR AIR PERMIT | | |

| | | | |
|---|---|---|---|
| DRAWN BY | DATE | CHECKED BY | DATE |
| DESIGNED BY | DATE | APPROVED BY | DATE |
| CAD FILE NO.: | | PLOT DATE: | |

CONFIDENTIAL
This drawing or other material is the exclusive and confidential property of Carbo Ceramics and must not be reproduced, distributed, published or used in any manner in the absence of the prior written consent of an authorized representative of Carbo Ceramics.

APPROVED :

DATE :

SIGNATURE SEAL

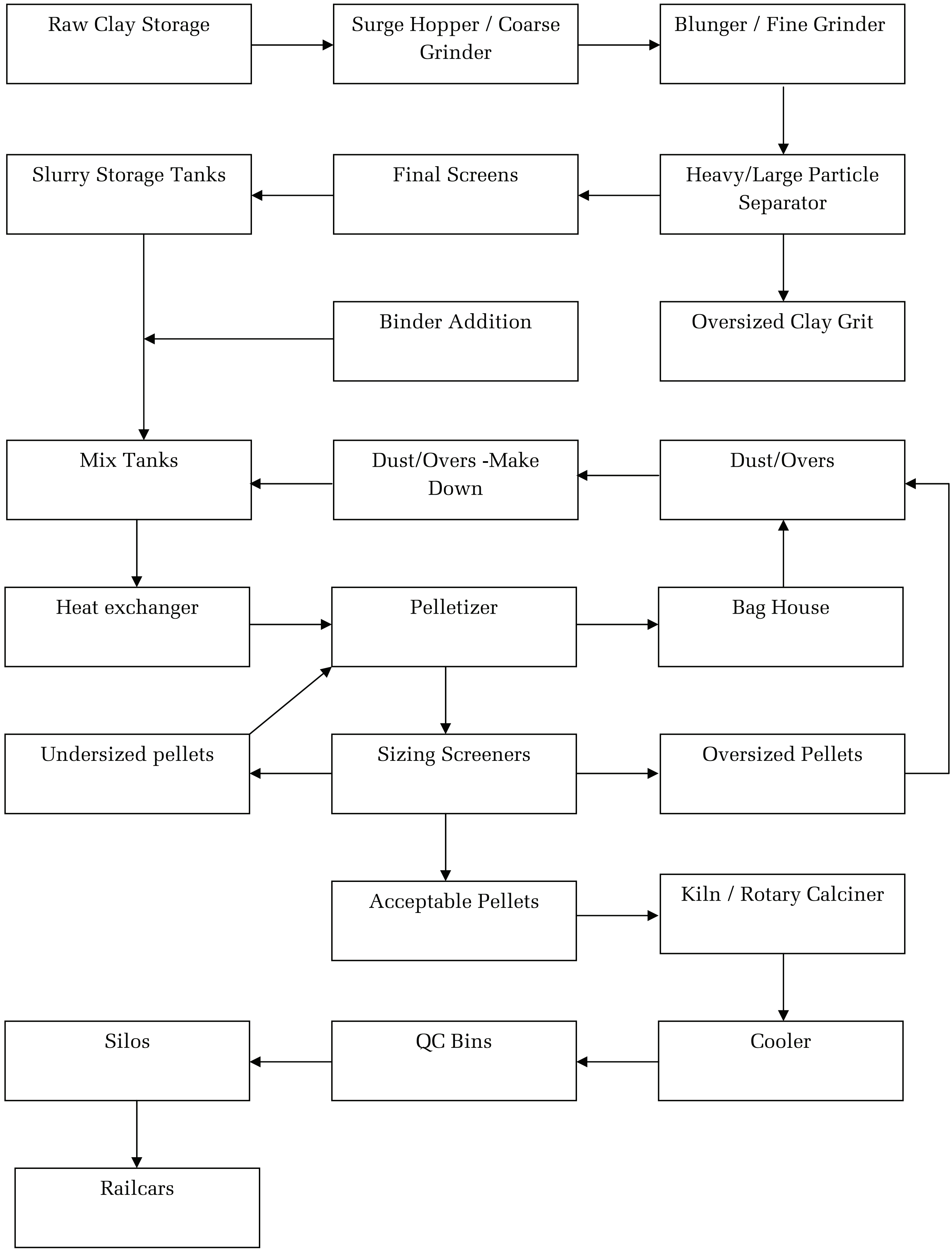
CARBO CERAMICS

NEW SITE
LIGHTWEIGHT PROPPANT PLANTS
SITE PLAN
EMISSION STACK LOCATIONS

| SCALE: | CONTRACT NO. | DRAWING NO. | |
|---|---|---|---|
| 1"=300' | | | |
| FILE: | | CLIENT DRAWING NO. | REV. A |

REV. A
CLIENT DRAWING NO.

# Flow Diagram: Millen Process



# Volume I, Attachment D –

# Section 112(g)(2)(B) Case-By-Case MACT Determination

# VOLUME I, ATTACHMENT D
# TABLE OF CONTENTS



## *Index of Attachment D Narrative Tables*

## *Index of Attachment D Calculation Tables*

**Methanol MACT- Spray Dryer Nos. 1 – 8 (per line)**



**HF/HCl MACT- Direct-Fired Rotary Calciner Nos. 1 – 4 (each)**

# D. MACT ANALYSIS

## D.1 Applicability and Introduction

CARBO Ceramics proposes to construct a proppant manufacturing operation in Millen, Georgia. The facility is submitting an application for the construction and operation of four new processing lines (Line Nos. 1 through 4). A case-by-case MACT determination has been prepared for methanol emissions from the Spray Dryers (Emission Unit ID Nos. SD01 – SD08), hydrogen fluoride (HF) and hydrogen chloride (HCl) from the Direct-Fired Rotary Calciners (Emission Unit ID Nos. KLN1 – KLN4), and HAP emissions from the boilers (Emission Unit ID Nos. BLR1-BLR4).

The addition of Processing Line Nos. 1 through 4 at the Millen facility triggers a case-by-case Maximum Achievable Control Technology (MACT) determination pursuant to Section 112(g)(2)(B) of the Clean Air Act as Processing Line Nos. 1 through 4 will have potential HAP emissions in-and-of themselves greater than 10 tpy of an individual HAP, and thus would constitute the construction of a major source as defined in 40 CFR 63.41. A case-by-case MACT analysis for Spray Dryer Nos. 1 – 8 and Direct-fired Rotary Calciner Nos. 1 – 4 has been included in this Attachment.

On May 16, 2011, USPEA delayed the effective date of the National Emission Standard for Hazardous Air Pollutants (NESHAP) for industrial, commercial and institutional boilers and process heaters (40 CFR 63, Subpart DDDDD). Therefore, as the proposed facility's boilers are not subject to a Section 112(d) standard, a case-by-case MACT determination has been prepared for Boiler Nos. 1 through 4.

40 CFR 63.43 sets forth the following two principles to be used in the establishment of MACT emission limitations in a case-by-case MACT determination:

(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, the MACT emission limitation and control technology 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."

In February 2002, EPA issued "Guidelines for MACT Determinations under Section 112(j) Requirements". These guidelines offer a step-by-step process for making a MACT determination consistent with the above two principles. The process can be summarized as follows:

Tier I:

Step 1 – Identify the MACT-affected emissions unit
Step 2 – Make a MACT floor finding

Tier II:

Step 3 – List all available/reasonable applicable control technologies
Step 4 – Eliminate technically infeasible control technologies
Step 5 – Determine efficiency of applicable control technologies

Tier III:

Step 6 – Identify the maximum emission reduction control technology
Step 7 – Conduct an impact analysis
Step 8 – Establish the MACT emission limitation

According to EPA guidance,[1] the MACT analysis has been divided into three tiers. Tier I consists of Steps 1-2 listed above. Tier II consists of Steps 3-5 and Tier III consists of Steps 6-8. If a MACT floor finding is determined in Step 2, 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. This eight-step process is used in this permit application to conduct a case-by-case MACT determination for the facility.

[1] *"Guidelines for MACT Determinations under Section 112(j) Requirements"*, February 2002.

## D.2 MACT Analysis: Methanol Emissions from Spray Dryer Nos. 1 – 8

Methanol emissions are associated with the slurry injected into the spray dryers. This slurry contains an additive with <1% wt. methanol. The methanol emissions from the spray dryers associated with Processing Line Nos. 1 through 4 will exit out of uncapped, vertical stacks of the spray dryers. All of the methanol emissions from Processing Line Nos. 1 through 4 are considered emitted from the spray dryers associated with each line as the operating temperature of the spray dryers reaches 210°F (above the boiling point for methanol of 148°F), thereby driving off all of the methanol. Methanol emissions are equal to 10.04 tpy from each Processing Line (Nos. 1 through 4) as detailed in Attachment B, Table 2.

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

This case-by-case MACT analysis is being conducted on methanol emissions from Spray Dryer Nos. 1 – 8 (Emission Unit ID Nos. SD01 – SD08.) The 1%, by weight, methanol content is an impurity in an additive used in the process. Methanol emissions are calculated as 10.04 tpy for each set of spray dryers associated with each process line as detailed in Table D.2-1 below.

**Table D.2-1: Process Line to Spray Dryer Pairings**

| Process Line | Set of Spray Dryers |
|---|---|
| Line 1 | SD01 – SD02 |
| Line 2 | SD03 – SD04 |
| Line 3 | SD05 – SD06 |
| Line 4 | SD07 – SD08 |

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."

There are no similar sources *(Process Code: 90.017 Calciners & Dryers and Mineral Processing Facilities)* in the RBLC database which have add-on controls for Volatile Organic Compounds (VOCs) or methanol. Methanol/VOC control is achieved through the use of pollution prevention and good combustion practices.

Based on our review of available databases, it appears there are no end-of-pipe controls installed on a source similar to the Spray Dryers at the facility to control methanol. Additionally, as there are an insufficient number of sources (i.e. less than 5),[2] a MACT floor

[2] Page 4-3 of *"Guidelines for MACT Determinations under Section 112(j) Requirements"*, February 2002.

cannot be established. As such, a Tier II Case-by-Case MACT analysis including all control technologies for methanol will be performed.

Step 3 – List all available/reasonable applicable control technologies

In reviewing the available technologies to control emissions of methanol from the Spray Dryers, Regenerative Thermal Oxidation (RTO), Catalytic Oxidation, Biofiltration using a Biotrickling Filter, and Quencher/Scrubber System (Direct Contact Condensation) are being considered as possible control technology options as noted in Table D.2-2 below.

**Table D.2-2: Evaluated Control Options for Methanol Emissions – Spray Dryers**

| Option No. | Control Technology |
|---|---|
| 1 | Quencher/Scrubber system (Direct Contact Condensation) |
| 2 | Carbon Adsorption |
| 3 | Regenerative Thermal Oxidation |
| 4 | Catalytic Oxidation |
| 5 | Biotrickling Filter |
| 6 | Pollution Prevention |

Step 4 – Eliminate technically infeasible control technologies

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

Methanol emissions from the spray dryers can be reduced by chilling the waste gas streams. As the temperature of the gas stream is lowered, a portion of the methanol in the exhaust stream will be condensed and removed. Direct contact condensation of the waste gas steams was determined to be technically infeasible because the concentrations by volume of VOC in the exhausts are well below 1,000 ppm. According to a US EPA report, this concentration is considered to be the lower bound of the range at which this control technology is effective for VOC reduction.[3] The concentrations of VOC by volume in the waste gas streams from the spray dryers are each approximately 6.2 ppm. Because of these low concentrations, condensation of the waste gas streams would be ineffective and impractical. Based on these findings, Option 1 was not considered further for this MACT analysis and is deemed technically infeasible.

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

Step 5 – Determine efficiency of applicable control technologies

**Table D.2-3: Evaluated Control Options for Methanol Emissions – Spray Dryers**

| Option No. | Control Technology | Control Efficiency |
|---|---|---|
| 2 | Carbon Adsorption | 98% |
| 3 | Regenerative Thermal Oxidation | 98% |
| 4 | Catalytic Oxidation | 95% |
| 5 | Biotrickling Filter | 90% |
| 6 | Pollution Prevention | N/A |

Step 6 – Identify the maximum emission reduction control technology

*Option 2 – Carbon Adsorption*

Carbon adsorbers typically employ activated carbon, which has an affinity to adsorb VOCs, along with a beneficial large surface area per unit volume. While variables such as the properties of the individual VOC being absorbed, the gas stream concentration of the VOC, and the gas stream temperature will affect the efficiency of the control process, a VOC-laden gas stream passing over a bed of activated carbon will cause VOC to be adsorbed in the carbon bed. Over time, the adsorptive capacity of the carbon is consumed, as its surface area becomes saturated with adsorbate. When this occurs, the carbon can either be exchanged with fresh carbon, or treated through a regeneration process to release the adsorbate.

The regeneration process typically involves heating the carbon bed via steam injection, then drying and cooling the bed using fan-forced air. The exhaust from the vessel during the regeneration process is passed through a condenser/decanter to recover the VOC. Carbon adsorption has the advantages of being relatively effective on low-concentration gas streams, compatibility with large airflow volumes, and greater energy efficiency in many cases as compared to thermal or catalytic oxidation techniques. The control efficiency of a Carbon adsorber, when properly maintained and operated, can be as high as 98%.[4] Although the use of a carbon adsorber has been found to be technically feasible in theory, our review indicates that a carbon adsorber has not been applied as a measure to control methanol in a process similar to the spray dryers.

*Option 3 – Regenerative Thermal Oxidation (RTO)*

Methanol can be oxidized to carbon dioxide and water vapor in a Regenerative Thermal Oxidizer (RTO). 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 a desired combustion temperature, then subsequently enters the second stone bed where heat is released from combustion and is

[4] US EPA, Document EPA-456/F-99-004, Choosing An Adsorption System for VOC: Carbon, Zeolite, or Polymers? May 1999, p. 16

recovered and stored in the bed. The beds alternate so the waste gas enters the second bed first in order to heat up to the desired combustion temperature, with the system operating on an alternating cycle to recover up to 90% of the thermal energy during oxidation. The control efficiency of an RTO, when properly maintained and operated, can be as high as 98%.[5] Although the use of an RTO has been found to be technically feasible in theory, our review indicates that an RTO has not been applied as a measure to control methanol in a process similar to the spray dryers.

*Option 4 – Catalytic Oxidation*

Catalytic oxidation is a post combustion control technique for reducing emissions of methanol and other VOCs. 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°F – 1200°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 these incomplete combustion byproducts 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 a catalytic oxidizer is technically feasible and can have a control efficiency as high as 95%. Although the use of a catalytic oxidizer has been found to be technically feasible in theory, there is no indication that it has ever been applied as a measure to control methanol in a process similar to the spray dryers.

*Option 5: Biofiltration*

Bioreactors use microbes to consume pollutants from a contaminated air stream. Microbes can easily decomposed organic compounds, or VOCs, into $CO_2$ and water. The control efficiency of a bioreactor is approximately 80% to 99%, and is assumed to be 90% in this analysis. Factors that affect the performance of the bioreactor include temperature, moisture, nutrients, acidity, and microbe population. Microbes can survive at temperatures between 60 and 105°F in a moist, neutral environment (pH=7) and need to be fed a diet of balanced nutrients.

The US EPA identifies three types of bioreactors: the basic biofilter, the biotrickling filter, and the bioscrubber. The basic biofilter consists of a large flat surface covered with bed media, such as peat, bark, coarse soil, or gravel. Air moves through the bed and comes into contact with microbes, which then decompose the pollutants. Basic biofilters have significant disadvantages. The traditional design requires large open areas and provides no continuous liquid flow in which to adjust pH, keep moisture, or add nutrients; thus it is not a practical design to control methanol from this facility. Biotrickling filters or bioscrubbers are more suited control options for this application. In a biotrickling filter, liquid is sprayed onto a plastic media, where a biofilm is formed. As the air passes through the media, pollutants are absorbed into the liquid phase and come into contact with the microbes. The

[5] Control Efficiencies for Regenerative Thermal Oxidation and Catalytic oxidation based upon information obtained from the EPA Air Pollution Cost Control Manual.

continuous flow of liquid allows the owner to neutralize acid build up and provide nutrients when required. The plastic bed can have a void space of up to 95%, which greatly reduces pressure drop across the packing, and the synthetic material is not consumed by the microbes. Bioscrubbers utilize a chemical scrubber and are more similar to chemical-processing equipment than other bioreactors. Discharge effluent is collected in a storage tank which allows additional time for the microbes to consume pollutants. In the US EPA Clean Air Technology Center's (CATC) report, Using Bioreactor's to Control Air Pollution[6], bioscrubbers were shown to have much greater capital costs and slightly greater annual costs than combustion control devices. Biotrickling filters were therefore chosen as the most feasible form of bioreactor for the spray dryers. The use of a biotrickling filter is technically feasible and can have a control efficiency of approximately 90%. Although the use of a biotrickling filter has been found to be technically feasible in theory, there is no indication that it has ever been applied as a measure to control methanol in a process similar to the spray dryers.

*Option 6 – Pollution Prevention*

The additive used by the facility in their process contains up to 1% wt. of methanol. Continued use of an additive with the minimum amount of methanol (which is an impurity) and operating the spray dryers at the appropriate temperatures is the primary mechanism available for minimizing methanol emissions.

<u>Step 7 – Conduct an impact analysis</u>

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". As a conservative measure, the economic analysis was carried out assuming one control device would control both spray dryers on each line. The Regenerative and Catalytic Oxidizers were costed using Vatavuk Air Pollution Control cost factors. In order to scale up costs from 1988 to 2007, published Vatavuk Air Pollution Control Cost Indexes (VAPCCI) were used. Due to unavailability of VAPCCI data after the first quarter of 2007, to be conservative no further scaling up of costs was done beyond the 4th quarter 2007 to current costs. The cost of the biofilter was determined using the US EPA Clean Air Technology Center's report and a 1999 report by University of Cincinnati's Dr. Rakesh Govind, Biofiltration from Ethanol Emissions from Bakery Ovens,[7] which includes the results of a pilot study and a preliminary cost analysis.

Annualized costs for each of these control technologies were calculated and divided by the tons of methanol controlled for each set of spray dryers to calculate a cost per ton of methanol reduced. The total annual cost effectiveness of carbon adsorption would be approximately $47,865/ton of methanol reduced from each set of spray dryers. The total annual cost effectiveness of oxidizers would be approximately $202,784/ton of methanol reduced from each set of spray dryers using the regenerative thermal oxidizer type, or $272,209 using the catalytic oxidizer type. The total annual cost effectiveness of a

[6] See http://www.epa.gov/ttn/catc/dir1/fbiorect.pdf
[7] See http://www.prdtechinc.com/PDF/PRDAWMAETHANOLBIOFILTRATIONPAPER(1999).pdf

biotrickling filter would be approximately $202,016/ton of methanol reduced from each set of spray dryers.

Based on our economic analysis it is not economically feasible to reduce methanol emissions using any of the above mentioned controlled technologies as the cost per ton of methanol reduced is in excess of $45,000/ton. This cost would prove to be a significant economic impact. The above cost analyses are detailed in Tables D.6-1 through D.6-4 of this attachment and are summarized below in Table D.2-4.

**Table D.2-4: Control Technology Cost Effectiveness Summary**

| Option No. | Control Technology | Cost Effectiveness for each set of Spray Dryers[1] ($/ton HAP reduced ) |
|---|---|---|
| 2 | Carbon Adsorption | $47,865 |
| 3 | Regenerative Thermal Oxidizer | $202,784 |
| 4 | Catalytic Oxidizer | $272,209 |
| 5 | Biotrickling Filter | $202,016 |

[1]Processing Line includes two spray dryers each. Cost effectiveness analysis conducted for each control technology option controlling each processing line separately.

<u>Step 8 – Establish the MACT emission limitation</u>

Since there is not enough information available to compute a MACT floor, all control technologies were evaluated as possible options. Due to the quantity of methanol emitted, control options 2, 3 and 4 prove to be economically infeasible and of little significant impact. As such, the facility proposes pollution prevention as a control measure and a MACT emission limitation for the Spray Dryers 1 – 8 as 10.04 tpy for each set of spray dryers as specified in Table D.2-5 below.

**Table D.2-5: Case-by-Case MACT Proposed for Spray Dryers (Emission Unit ID Nos. SD01 – SD08)**

| Process Operation | Emission Unit ID Nos. | Section 112(g)(2)(B) Case-by-Case MACT Emission Limit |
|---|---|---|
| Processing Line No. 1 | SD01 and SD02 | Pollution Prevention with a methanol emission limit of 10.04 tons per twelve-month rolling total period for Spray Dryer Nos. 1 and 2, combined. Exclusive use of natural gas and LPG to limit Hexane and other combustion HAP emissions. |
| Processing Line No. 2 | SD03 and SD04 | Pollution Prevention with a methanol emission limit of 10.04 tons per twelve-month rolling total period for Spray Dryer Nos. 3 and 4, combined. Exclusive use of natural gas and LPG to limit Hexane and other combustion HAP emissions. |
| Processing Line No. 3 | SD05 and SD06 | Pollution Prevention with a methanol emission limit of 10.04 tons per twelve-month rolling total period for Spray Dryer Nos. 5 and 6, combined. Exclusive use of natural gas and LPG to limit Hexane and other combustion HAP emissions. |
| Processing Line No. 4 | SD07 and SD08 | Pollution Prevention with a methanol emission limit of 10.04 tons per twelve-month rolling total period for Spray Dryer Nos. 7 and 8, combined. Exclusive use of natural gas and LPG to limit Hexane and other combustion HAP emissions. |

## D.3 MACT Analysis: Hydrogen Chloride and Hydrogen Fluoride Emissions from Direct-Fired Rotary Calciner Nos. 1 – 4

Hydrogen chloride and hydrogen fluoride emissions are associated with the fluoride and chloride content in the raw material processed in the Direct-fired Rotary Calciners.

Tier I:

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 Direct-fired Rotary Calciner Nos. 1-4 (Emission Unit ID Nos. KLN1 – KLN4). Each process Direct-fired Rotary Calciner Nos. 1-4 has baseline emissions of 758 tons per year hydrogen fluoride and 174 tons per year hydrogen chloride, as detailed in Attachment B, Table 2 (Note 8).

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". The US EPA RACT/BACT/LAER Clearing House listed *(Process Code: 90.017 Calciners & Dryers and Mineral Processing Facilities)*, there are no similar sources which have emission limits for HCl and HF. However, the CARBO-McIntyre facility has received a permit to install a scrubber to control $SO_2$ emissions that will also control HCl and HF emissions (Permit No. 3295-319-0027-V-03-3 issued 12/21/10). Therefore, a MACT floor can be established.[8] As such, a Tier II Case-by-Case MACT analysis does not need to be performed for control technologies for HF and HCl from calciners.

Tier III:

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 Direct-fired Rotary Calciner Nos. 1 – 4. The control efficiency of wet scrubber systems is considered to be 95 percent.[9]

[8] Page 4-3 of *"Guidelines for MACT Determinations under Section 112(j) Requirements"*, February 2002.
[9] Control Efficiencies as published by the EPA Cost Control Manual – Sixth Edition, January 2002.

*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 4-6 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. The cycling of this limestone quantity and the removal of saturated limestone is controlled by a special discharge device valve. 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%.[10]

*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 direct-fired rotary calciner. 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 a direct-fired rotary calciner and typically have removal efficiencies for HCl and HF of about 90% per vendor data.

*Option 4- Pollution Prevention*

Continued use of raw material with minimized amounts of fluorides and chlorides and operating the direct-fired rotary calciners at optimum temperatures is the primary mechanism available for minimizing HF and HCl emissions.

<u>Step 7 – Conduct an impact analysis</u>

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 the CARBO McIntyre facility, and the cost was adjusted to reflect the reduced airflow rate in the calciner. The reagent costs were adjusted according to the anticipated baseline HF and HCl emissions

[10] Based on 2009 vendor quote from Encertec, Inc. for a DLA system to control HF and HCl emissions.

of the new process emission units. Additionally, the collateral control of $SO_2$ emissions was considered in the economic analysis for the wet scrubber as well as the DLA and dry scrubber.

The cost effectiveness of a wet scrubber on each direct-fired rotary calciner would be approximately $3,956/ton as detailed in Table D.3-1 below. Given the large annualized cost value in terms of dollars per ton and acid gases reduced the use of a wet scrubber is being deemed in the MACT review as to not be cost effective for direct-fired rotary calciners. Additionally, cost-effectiveness analyses have been performed for options 2 and 3, Dry Lime Adsorber and Dry Scrubber (Injection System), respectively. The cost effectiveness of the control options 2 and 3 have been to be determined to be $1,832/ton and $987/ton, respectively, as summarized in Table D.3-1.

**Table D.3-1: Control Technology Cost Effectiveness Summary**

| Option No. | Control Technology | Cost Effectiveness for each set of Calciner[1] ($/ton HF/HCL reduced ) |
|---|---|---|
| 1 | Wet Scrubber | $3,956 |
| 2 | Dry Lime Adsorber (DLA) | $1,832 |
| 3 | Dry Scrubber (Injection System) | $987 |

[1]Cost effectiveness analysis conducted for each prevention control technology option controlling each process line separately.

Step 8 – Establish the MACT emission limitation

Based on the case-by-case analysis, control technology option 1 (wet scrubbing), option 2 (DLA), and option 3 (Dry Scrubber) prove to be economically feasible. However, since the facility is already proposing the use of a wet scrubber for the control of $SO_2$ (as BACT) the facility is proposing the use of a wet scrubber with emission limits for HF and HCl as MACT for each Direct-fired Rotary Calciner of 8.7 lbs/hr for HF and 1.98 lbs/hr for HCl as summarized below in Table D.3-2.

**Table D.3-2: Case-by-Case MACT Proposed for Direct-fired Rotary Calciner Nos. 1 – 4 (Emission Unit ID Nos. KLN1 – KLN4)**

| Emission Unit ID Nos. | Section 112(g)(2)(B) Case-by-Case MACT Emission Limit |
|---|---|
| KLN1 | Use of a wet scrubber with a HF emission limit of 8.7 lbs/hr and an HCl emissions limit of 1.98 lbs/hr for Direct-fired Rotary Calciner No. 1 |
| KLN2 | Use of a wet scrubber with a HF emission limit of 8.7 lbs/hr and an HCl emissions limit of 1.98 lbs/hr for Direct-fired Rotary Calciner No. 2 |
| KLN3 | Use of a wet scrubber with a HF emission limit of 8.7 lbs/hr and an HCl emissions limit of 1.98 lbs/hr for Direct-fired Rotary Calciner No. 3 |
| KLN4 | Use of a wet scrubber with a HF emission limit of 8.7 lbs/hr and an HCl emissions limit of 1.98 lbs/hr for Direct-fired Rotary Calciner No. 4 |

## D.4 MACT Analysis: HAP Emissions from Boilers Nos. 1 - 4

Hazardous air pollutant emissions are associated with the combustion of natural gas and LPG in the four 9.8 MMBtu/hr boilers.

Tier I:

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

This case-by-case MACT analysis is being conducted on HAP emissions from Boiler Nos. 1-4 (Emission Unit ID Nos. BLR1 – BLR4). Each Boiler Nos. 1-4 has emissions of 0.079 tons per year combined HAP, as detailed in Attachment B, Table 4.

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. 40 CFR 63 Subpart DDDDD *"National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters"* establishes national emission limitations and operating limitations for hazardous air pollutants (HAP) emitted from boilers and process heaters located at major sources of HAP emissions. The four natural gas fired boilers (each with a maximum heat input below 10 MMBtu/hr) at the facility are considered new units under this standard (constructed after June 4, 2010) and are considered to be in the small gaseous fueled subcategory per 40 CFR 63.7499. Therefore, the only work practice standard required is a biennial tune-up of each boiler per 40 CFR 63.7540(a)(11). There are no applicable emission standards for this subcategory of boilers in NESHAP Subpart DDDDD. However, it should be noted that on January 24, 2011, Subpart DDDDD for major sources was delayed to provide EPA additional time to consider additional information, with the provisions to be re-proposed by October 2011 and repromulgated by April 2012.

The biennial tune-up requirements under 40 CFR 63.7540(a)(11) are as follows:

1. As applicable, inspect the burner, and clean or replace any components of the burner as necessary (you may delay the burner inspection until the next scheduled unit shutdown, but you must inspect each burner at least once every 36 months);
2. Inspect the flame pattern, as applicable, and adjust the burner as necessary to optimize the flame pattern. The adjustment should be consistent with the manufacturer's specifications, if available;
3. Inspect the system controlling the air-to-fuel ratio, as applicable, and ensure that it is correctly calibrated and functioning properly;
4. Optimize total emissions of carbon monoxide. This optimization should be consistent with the manufacturer's specifications, if available;

5. Measure the concentrations in the effluent stream of carbon monoxide in parts per million, by volume, and oxygen in volume percent, before and after the adjustments are made (measurements may be either on a dry or wet basis, as long as it is the same basis before and after the adjustments are made); and
6. Maintain on-site and submit, if requested by the Administrator, an annual report containing the following information:
   (a) The concentrations of carbon monoxide in the effluent stream in parts per million by volume, and oxygen in volume percent, measured before and after the adjustments of the boiler;
   (b) A description of any corrective actions taken as a part of the combustion adjustment.

As EPA has promulgated the above mentioned work practice standard for HAP emitted from small gaseous fueled boilers located at major sources of HAP emissions, a MACT floor can be established. Therefore, a Tier II Case-by-Case MACT analysis does not need to be performed for control technologies for HAPs from the boilers.

<u>Tier III:</u>

<u>Step 6 – Identify the maximum emission reduction control technology</u>

In developing the March 21, 2011 NESHAP for boilers and process heaters rule, EPA determined that gas fired boilers with a maximum heat input capacity of less than 10 MMBtu/hr should be subject to a work practice standard in lieu of emission limits. Therefore, the identification of the maximum emission reduction control technology is not necessary for the boilers.

<u>Step 7 – Conduct an impact analysis</u>

The boilers at the facility will combust natural gas and only use LPG during periods of natural gas curtailment. Therefore, there are no economic, energy, or environmental impacts that need to be considered with respect to HAP emissions as no emission controls are necessary.

<u>Step 8 – Establish the MACT emission limitation</u>

The facility proposes the work practice standard specified in 40 CFR 63 Subpart DDDDD as MACT for each boiler as summarized below in Table D.4 1. The biennial tune-up will be conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule.

**Table D.4-1: Case-by-Case MACT Proposed for Boilers Nos. 1 – 4 (Emission Unit ID Nos. BLR1 – BLR4)**

| Emission Unit ID Nos. | Section 112(g)(2)(B) Case-by-Case MACT Emission Limit |
|---|---|
| BLR1 | Biennial tune-ups conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule. |
| BLR2 | Biennial tune-ups conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule. |
| BLR3 | Biennial tune-ups conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule. |
| BLR4 | Biennial tune-ups conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule. |

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## D.5 Summary

In order to effectively control methanol emissions from the four process lines and HF and HCl emissions from each of the four Direct-fired Rotary Calciners, pollution prevention with a methanol emission limit of 10.04 tons per twelve-month rolling period for each set of Spray Dryers (SD01 and SD02; SD03 and SD04; SD05 and SD06; SD07 and SD08) and an HF emission limit of 8.7 lbs/hr and an HCl emissions limit of 1.98 lbs/hr for each Direct-fired Rotary Calciner is proposed as MACT. The work practice standard specified in 40 CFR 63 Subpart DDDDD is proposed MACT for each boiler. Table D.5-1, Table D.5-2, and Table D.5-3 below summarize the MACT requirements being proposed.

**Table D.5-1: Case-by-Case MACT Proposed for Spray Dryers (Emission Unit ID Nos. SD01 – SD08)**

| Process Operation | Emission Unit ID Nos. | Section 112(g)(2)(B) Case-by-Case MACT Emission Limit |
|---|---|---|
| Process Line No. 1 | SD01 and SD02 | Pollution Prevention with a methanol emission limit of 10.04 tons per twelve-month rolling total period for Spray Dryer Nos. 1 and 2, combined. Exclusive use of natural gas and LPG to limit Hexane and other combustion HAP emissions. |
| Process Line No. 2 | SD03 and SD04 | Pollution Prevention with a methanol emission limit of 10.04 tons per twelve-month rolling total period for Spray Dryer Nos. 3 and 4, combined. Exclusive use of natural gas and LPG to limit Hexane and other combustion HAP emissions. |
| Process Line No. 3 | SD05 and SD06 | Pollution Prevention with a methanol emission limit of 10.04 tons per twelve-month rolling total period for Spray Dryer Nos. 5 and 6, combined. Exclusive use of natural gas and LPG to limit Hexane and other combustion HAP emissions. |
| Process Line No. 4 | SD07 and SD08 | Pollution Prevention with a methanol emission limit of 10.04 tons per twelve-month rolling total period for Spray Dryer Nos. 7 and 8, combined. Exclusive use of natural gas and LPG to limit Hexane and other combustion HAP emissions. |

**Table D.5-2: Case-by-Case MACT Proposed for Direct-fired Rotary Calciner Nos. 1 – 4 (Emission Unit ID Nos. KLN1 – KLN4)**

| Emission Unit ID Nos. | Section 112(g)(2)(B) Case-by-Case MACT Emission Limit |
|---|---|
| KLN1 | Use of a wet scrubber with a HF emission limit of 8.7 lbs/hr and an HCl emissions limit of 1.98 lbs/hr for Direct-fired Rotary Calciner No. 1 |
| KLN2 | Use of a wet scrubber with a HF emission limit of 8.7 lbs/hr and an HCl emissions limit of 1.98 lbs/hr for Direct-fired Rotary Calciner No. 2 |
| KLN3 | Use of a wet scrubber with a HF emission limit of 8.7 lbs/hr and an HCl emissions limit of 1.98 lbs/hr for Direct-fired Rotary Calciner No. 3 |
| KLN4 | Use of a wet scrubber with a HF emission limit of 8.7 lbs/hr and an HCl emissions limit of 1.98 lbs/hr for Direct-fired Rotary Calciner No. 4 |

**Table D.5-3: Case-by-Case MACT Proposed for Boilers Nos. 1 – 4 (Emission Unit ID Nos. BLR1 – BLR4)**

| Emission Unit ID Nos. | Section 112(g)(2)(B) Case-by-Case MACT Emission Limit |
|---|---|
| BLR1 | Biennial tune-ups conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule. |
| BLR2 | Biennial tune-ups conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule. |
| BLR3 | Biennial tune-ups conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule. |
| BLR4 | Biennial tune-ups conducted per 40 CFR 63.7540(a)(11) of the March 21, 2011 Rule. |

**Table D.6-1: Methanol MACT Cost Analysis:**
**Fixed-bed Carbon Adsober System on Spray Dryer Nos. 1 – 8 (per line)**

| Cost Element | Budget Amount | Comments |
|---|---|---|
| **Capital Cost** | | |
| **Direct Costs** | | |
| Absorber Vessel Cost | $1,108,284 | Base cost per EPA Cost Manual Section 3.1, Equation 1.27 in 1999 dollars<br>Cost correlations range: 4,000 to 500,000 scfm.<br>Escalation Based on Marshall & Swift Equipment Cost Index for the second quarter of 2010 (M&S Index, 2nd Q 2010 = 1,461.3, M&S Index, 1999 = 1,068.3)<br>Escalated Carbon Adsorber cost = [(M&S Index, 2nd Q 2010)/(M&S Index, 1999) *(Adsorber Cost, 1999 Dollars)] |
| Straight Duct Cost | $163,298 | Cost based upon 100 ft of ductwork using 304 SS plate from Section 2, Table 1.9 of EPA Cost Manual.<br>Cost of straight ductwork = 6.29 * (12 * Duct diameter)^1.23) *(Length of ducting) |
| Elbows Cost | $164,273 | Cost based upon 4 elbows constructed of 304 SS from Section 2, Table 1.10 of EPA Cost Manual.<br>Cost of elbows = 74.2 * (e^(0.0688 * Duct diameter * 12)) * (No. of elbows) |
| Instrumentation/Controls | $143,585 | Cost factor (0.10 * EC) per EPA Cost Manual, Section 3.1, Table 1.3<br>EC = RTO Cost + Straight Duct Cost + Elbows Cost |
| Freight | $71,793 | Cost factor (0.05 * EC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| **Total Purchased Equipment Cost (PEC)** | **$1,651,233** | |
| **Direct Installation Costs** | | |
| Foundations and Support | $132,099 | Cost factor (0.08 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Erection and Handling | $231,173 | Cost factor (0.14 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Electrical | $66,049 | Cost factor (0.04 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Piping | $33,025 | Cost factor (0.02 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Insulation | $16,512 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Painting | $16,512 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| **Direct Installation Costs (DIC)** | **$495,370** | |
| **Total Direct Cost (TDC)** | **$2,146,602** | **TDC=PEC+DIC** |
| **Indirect Costs** | | |
| Engineering | $165,123 | Cost factor (0.10 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Construction/Field | $82,562 | Cost factor (0.05 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Contractor Fees | $165,123 | Cost factor (0.10 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Start-up | $33,025 | Cost factor (0.02 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Performance Test | $16,512 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| Contingencies | $49,537 | Cost factor (0.03 * PEC) per EPA Cost Manual, Section 3.1, Table 1.3 |
| **Total Indirect Costs (TIC)** | **$511,882** | |
| **Total Capital Cost (TCC)** | **$2,658,485** | **TCC=TDC+TIC** |
| **Annual Cost** | | |
| Operating Labor | $16,425 | Based on 3 shifts/day, 8,760 operating hours per year at $30/hr, and a labor factor of 0.5 hrs/shift per EPA Cost Manual, Section 3.1, Table 1.6<br>Labor Cost = shifts * hours/shift * hourly rate |
| Supervisory Labor | $2,464 | 15% of Operator per EPA Cost Manual Section 3.1, Table 1.6 |
| Maintenance Labor | $18,068 | Based on 3 shifts/day, 8,760 operating hours per year at $33/hr, and a labor factor of 0.5 hrs/shift per EPA Cost Manual, Section 3.1, Table 1.6<br>Labor Cost = shifts * hours/shift * hourly rate |
| Maintenance Materials | $18,068 | Considered equal to maintenance labor cost per EPA Cost Manual, Section 3.1, Table 1.6 |
| Carbon Replacement Cost | $30 | Carbon Cost and Labor Carbon replacement cost based on of EPA Cost Manual Section 3.1, Chapter 1.4.1.4 with $1/lb carbon cost and replacement labor at $0.05/lb carbon replaced. Recovery factor for a 5-year life and a 7% interest.<br>Carbon Replacement Cost = ((Taxes & Freight Factor * Carbon Cost)+Carbon Replacement Cost) * (Carbon requirement * Capital Recovery Factor) |
| Steam | $739 | As determined in Table E.6-1a |
| System, Cool/Dry Fans | $10,437 | |
| Cooling Water | $72 | |
| Overhead | $33,014 | Overhead = 0.6*(cost of labor and materials) per EPA Cost Manual, Section 3.1, Table 1.6 |
| Insurance, administrative | $79,755 | Administrative costs based on 2% of capital cost and Insurance based on 1% of capital cost per EPA Cost Manual, Section 3.1, Table 1.6 |
| Capital Recovery Factor | 10.98% | Calculated using EPA Cost Manual Section 1, Eqn. 2.8a, using 7% interest (i) and 20 year equipment life:<br>CRF= [i*(1+i)^(equipment life)] / [(1+i)^(equipment life)-1)] |
| Capital recovery | $291,887 | Total Capital Cost * Capital Recovery Factor |
| **Total Annual Cost** | **$470,958** | |
| **Total Cost per ton Methanol controlled** | **$47,865** | Based on 10.04 tpy baseline and 98% control; 9.84 tons removed |

## Table D.6-1a: Methanol MACT Energy Cost Analysis: Fixed-bed Carbon Adsober System on Spray Dryers 1 – 8 (per line)

**Fixed-bed Carbon Adsorber Input Parameters**

| | | |
|---|---|---|
| Gas flowrate: | 92,000 | [acfm] |
| Inlet gas temperature: | 180 | [$^oF$] |
| Number of Adsorbing Vessels ($N_a$): | 15 | [ ] |
| Number of Desorbing Vessels ($N_d$): | 5 | [ ] |
| Capacity Factor (f):[1] | 1.333 | [ ] |
| Carbon Equilibrium Capacity ($w_e$):[2] | 0.67 | [lb VOC/lb C] |
| Working Capacity ($w_c$):[3] | 0.34 | [lb VOC/lb C] |
| Adsorption Time ($q_a$):[4] | 12 | [hrs] |
| Desorption Time ($q_d$):[4] | 4 | [hrs] |
| Carbon Requirement for Continuous System ($M_c$):[5] | 109.48 | [lb] |
| Superficial Bed Velocity ($v_b$):[6] | 65 | [fpm] |
| Carbon Vessel Diameter (D):[7] | 10.96 | [ft] |
| Carbon Vessel Length/Height (L):[8] | 4.00 | [ft] |
| Carbon Vessel Surface Area (S):[9] | 326.55 | [$ft^2$] |
| Carbon Bed Thickness ($t_b$):[10] | 0.03 | [in] |
| Carbon Bed Pressure Drop ($D p_b$):[11] | 0.01 | [$inH_2O$] |
| Total System Pressure Drop ($D p_s$):[11] | 1.01 | [$inH_2O$] |

**Potential Emissions**

| | | |
|---|---|---|
| Potential Methanol Emissions: | 10.04 | [tpy] |
| Tons Methanol Reduced:[12] | 9.84 | [tpy] |

| Utility Cost Inputs | Average Unit Cost[13, 14] | Usage | | |
|---|---|---|---|---|
| Steam[15] | 10.51 $/klbs | 70 klbs/yr | $ | 738.78 |
| System, Cool/Dry Fans[16] | 0.056 $/kWh | 187,373 kWh/yr | $ | 10,436.66 |
| Cooling Water[17] | 0.30 $/kgal | 241 kgal/yr | $ | 72.32 |

Footnotes

1 The capacity factor was determined from Equation 1.11 of EPA Air Pollution Control Cost Manual (EPA 452/B-02-001) Section 3.1 for continously operated systems.

2 Source: I.I. El-Sharkawy, B.B. Saha, K. Kuwahara, S. Koyama, and K.C., NG, Adsorption Rate Measurements of Activated Carbon Fiber/ Ethanol Pair for Adsorption Cooling System Application, White Paper, Figure 2, Ethanol Uptake on Activated Carbon with Time at Adsorption Temperature. Carbon equilibrium capacity based on 67% by mass at 27$^o$C. Typically, the carbon equilibrium capacity is based on application of the Freundlich isotherm function and partial pressure of the VOC in the gas stream. The Freundlich isotherm constants for ethanol were not available to apply this function.

3 Working capacity is 50% of equilibrium capacity per Section 3.1, Equation 1.15 of EPA 452/B-02-001

4 Time selected based on daily adsorption/desorption cycle.

5 Carbon mass required for each fixed bed determined from Equation 1.14 of EPA 452/B-02-001 Section 3.1 for continuously operating systems.

6 The superficial bed velocity was chosen based on the guidance in Chapter 1.3.1.2 of EPA Air Pollution Control Cost Manual (EPA 452/B-02-001) Section 3.1

7 The vessel diameter was determined from Equation 1.21 of EPA Air Pollution Control Cost Manual (EPA 452/B-02-001) Section 3.1.

8 The vessel length was determined from Equation 1.23 of EPA 452/B-02-001 Section 3.1 plus 2 feet clearance for gas distribution and disengagement.

9 The vessel surface area = ($\Pi$) * (Vessel diameter, D) * [(Vessel length, L) + ((Vessel diameter, D)/2)] per EPA 452/B-02-001 Section 3.1, Eqn. 1.24

10 Carbon bed thickness determined from Equation 1.22 of EPA 452/B-02-001 Section 3.1 for carbon density of 30 lb/$ft^3$.

11 Carbon bed and total system pressure drop determined from Equations 1.30 and 1.32 of EPA 452/B-02-001 Section 3.1

12 100 percent capture and 98 percent destruction efficiency considered.

13 Steam cost is per US EPA Cost Manual, 6th Edition, Section 3.1, Eqn 1.28.
Steam prices are based on 120% of the fuel cost (natural gas) and assuming 1 MMBtu/1000 lb steam.
Natural gas unit cost is the mean of the latest 6 years (2005-2010) of annual average natural gas price data for industrial sector consumers in Georgia per US Dept. of Energy, Energy Information Administration; see
http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_SGA_a.htm

14 Electricity unit cost is the mean of the latest 6 years (2004-2009) of annual average electricity price data for industrial sector consumers in Georgia per US Dept. of Energy, Energy Information Administration; see Table 8 of
http://www.eia.doe.gov/cneaf/electricity/st_profiles/georgia.html

15 Steam requirement estimated at 3.5 lb/lb Methanol adsorbed per Equation 1.28 of EPA 452/B-02-001 Section 3.1.

16 System and bed cooling/drying fan power requirements determined from Equations 1.32 and 1.33 of EPA 452/B-02-001 Section 3.1 for the calculated system pressure drop. System fan runs 8,760 hours/year. Volumetric flow rate for the bed cooling/drying fan was determined at 100 cfm per pound of carbon with an operating factor of 0.4 for the number of hours of the regeneration cycle needed for cooling/ drying. Average horsepower is converted to kilowatts by multiplying by 0.746 kW/hp.

17 Cooling water requirements determined by multiplying steam requirement by 3.43 per Equation 1.29 and Cooling water cost is per EPA 452/B-02-001 Section 3.1, Chapter 1.4.1.2.

**Table D.6-2: Methanol MACT Cost Analysis:**
**Regeneratrive Thermal Oxidizer (RTO) on Spray Dryer Nos. 1 – 8 (per line)**

| Cost Element | Budget Amount | Comments |
|---|---|---|
| **Capital Cost** | | |
| **Direct Costs** | | |
| **Purchased Equipment Costs (PEC)** | | |
| Regenerative Thermal Oxidizer (95% heat recovery - escalated) | $1,528,102 | Base cost per EPA Cost Manual Section 3.2, Equation 2.33, in 1999 dollars<br>Cost correlations range: 10,000 to 100,000 scfm<br>Escalation Based on Marshall & Swift Equipment Cost Index for the second quarter of 2010 (M&S Index, 2nd Q 2010 = 1,461.3, M&S Index, 1999 = 1,068.3)<br>Escalated oxidizer costs = [(M&S Index, 2nd Q 2010) / (M&S Index,1999) * (220,400 + 11.57 * (Waste gas flow rate))] |
| Straight Duct Cost | $146,584 | Cost based upon 100 ft of ductwork using 304 SS plate from Section 2, Table 1.9 of EPA Cost Manual.<br>Cost of straight ductwork = 6.29 * (12 * Duct diameter)^1.23) * (Length of ducting) |
| Elbows Cost | $96,612 | Cost based upon 4 elbows constructed of 304 SS from Section 2, Table 1.10 of EPA Cost Manual.<br>Cost of elbows = 74.2 * (e^(0.0688*Duct diameter * 12)) * (No. of elbows) |
| Instrumentation | $177,130 | Cost factor (0.10 * EC) per EPA Cost Manual, Section 3.2, Table 2.8<br>EC = RTO Cost+ Straight Duct Cost+Elbows Cost |
| Freight | $88,565 | Cost factor (0.05 * EC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| **Total Purchased Equipment Cost (PEC)** | **$2,036,993** | |
| **Direct Installation Costs** | | |
| Foundation and Supports | $162,959 | Cost factor (0.08 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Handling and Erection | $285,179 | Cost factor (0.14 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Electrical | $81,480 | Cost factor (0.04 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Piping | $40,740 | Cost factor (0.02 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Insulation of Duct Work | $20,370 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Painting | $20,370 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| **Direct Installation Costs (DIC)** | **$611,098** | |
| **Total Direct Cost (TDC)** | **$2,648,091** | **TDC=PEC+DIC** |
| **Indirect Costs** | | |
| Engineering | $203,699 | Cost factor (0.10 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Construction and Field Expenses | $101,850 | Cost factor (0.05 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Contractor Fees | $203,699 | Cost factor (0.10 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Start-up | $40,740 | Cost factor (0.02 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Performance Test | $20,370 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Contingencies | $61,110 | Cost factor (0.03 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| **Total Indirect Costs (TIC)** | **$631,468** | |
| **Total Capital Cost (TCC)** | **$3,279,559** | **TCC=TDC+TIC** |
| **Annual Cost** | | |
| Operating labor | $16,425 | Based on 3 shifts/day, 8,760 operating hours per year at $30/hr, and a labor factor of 0.5 hrs/shift per EPA Cost Manual, Section 3.2, Table 2.10<br>Labor Cost = shifts * hours/shift * hourly rate |
| Supervisory labor | $2,464 | 15% of Operating cost per EPA Cost Manual, Section 3.2, Table 2.10 |
| Maintenance labor | $18,068 | Based on 3 shifts/day, 8,760 operating hours per year at $33/hr, and a labor factor of 0.5 hrs/shift per EPA Cost Manual, Section 3.2, Table 2.10<br>Labor Cost = shifts * hours/shift * hourly rate |
| Maintenance materials | $18,068 | Considered equal to maintenance labor cost per EPA Cost Manual, Section 3.2, Table 2.10 |
| Natural gas | $1,469,743 | As determined in Table E.6-2a |
| Electricity | $29,498 | |
| Overhead | $33,014 | Overhead = 0.6*(cost of labor and materials) per EPA Cost Manual, Section 3.2, Table 2.10 |
| Insurance, administrative | $98,387 | Administrative costs based on 2% of capital cost and Insurance based on 1% of capital cost per EPA Cost Manual Section 3.2, Table 2.10 |
| Capital Recovery Factor | 9.44% | Calculated using EPA Cost Manual Section 1, Eqn. 2.8a, using 7% interest (i) and 20 year equipment life:<br>CRF= [i*(1+i)^(equipment life)] / [(1+i)^(equipment life)-1)] |
| Capital recovery | $309,567 | Total Capital Cost * Capital Recovery Factor |
| **Total Annual Cost** | **$1,995,232** | |
| **Total Cost per ton Methanol controlled** | **$202,784** | Based on 10.04 tpy baseline and 98% control; 9.84 tons removed |

## Table D.6-2a: Methanol MACT Energy Cost Analysis: Regenerative Thermal Oxidizers (RTO) on Spray Dryers 1 – 8 (per line)

**Regenerative Thermal Oxidizer Input Parameters**

| | | |
|---|---|---|
| Gas flowrate: | 92,000 | [acfm] |
| Reference temperature: | 77 | [$^oF$] |
| Inlet gas temperature: | 180 | [$^oF$] |
| Gas flowrate: | 77,186 | [scfm] |
| Inlet gas density:[1] | 0.062 | [lb/acf] |
| Primary heat recovery: | 0.950 | [fraction] |
| Waste gas heat content:[2] | 0.066 | [Btu/lb] |
| Waste gas heat capacity:[3] | 0.255 | [Btu/lb-$^oF$] |
| Combustion temperature: | 1,600 | [$^oF$] |
| Heat loss: | 0.100 | [fraction] |
| Exit temperature: | 251 | [$^oF$] |
| Fuel heat of combustion: | 23,808 | [Btu/lb] |
| Fuel density:[4] | 0.043 | [lb/ft$^3$] |

**Regenerative Thermal Oxidizer Design Parameters**

| | | |
|---|---|---|
| Auxiliary Fuel Requirement:[5] | 13.68 | [lb/min] |
| Auxiliary Fuel Requirement:[5] | 319.21 | [scfm] |
| Total Waste Gas Flowrate: | 77,505 | [scfm] |

**Concentration and Heat of Combustion (Waste Gas) Calculations**

| | Methanol | |
|---|---|---|
| Potential Emissions: | 10.04 | [tpy] |
| Molecular Weight: | 32.04 | [lb/lb-mol] |
| Concentration by Weight:[6] | 6.70 | [ppmw] |
| Concentration by Volume:[7] | 6.06 | [ppmv] |
| Waste Gas $O_2$ Content: | 20.9 | [%] |
| Lower Explosive Limit (LEL): | 6 | [%] |
| LEL of Methanol/Air Mixture: | 0.010 | [%] |
| Heat of Combustion:[2] | 9,800 | [Btu/lb] |
| Heat of Combustion of Waste Gas: | 0.066 | [Btu/lb] |
| Heat of Combustion of Waste Gas: | 0.005 | [Btu/scf] |

| Utility Cost Inputs | Average Unit Cost[8,9] | Unit | Hours per Year | |
|---|---|---|---|---|
| Natural Gas[10] | 8.76 $/Mscf | 19.2 Mscf/hr | 8,760 | $ 1,469,742.68 |
| Electricity[11] | 0.056 $/kWh | 60.5 kW | 8,760 | $ 29,497.52 |

Footnotes

1 Based on Ideal Gas Equation at waste gas exhaust temperature, assuming waste gas is principally air.
2 Heat of combustion per pound of inlet waste gas developed from heat of combustion of methanol multiplied by the methanol concentration by weight (ppmw).
3 Heat capacity, $c_p$, of air at average control temperature; Thermodynamics 3rd Edition, Black and Hartley, 1996.
4 Auxiliary fuel is natural gas with heating value assumed at 1,020 Btu/scf.
5 Auxiliary fuel needed to sustain the combustion zone temperature using the procedure specified in EPA Air Pollution Control Cost Manual (EPA 452/B-02-001) Section 3.2 Subsection 1.3.1.
6 Concentration by weight = ((Potential to emit, tpy) * (2000 lb/ton) / (8760 hrs/yr) / (60 min/hr)) * 1000000 / (Gas flowrate, acfm) * (Inlet gas density, lb/ft$^3$)
7 Parts per million concentration by weight to volume conversion from AP-42 Appendix A.
8 Natural gas unit cost is the mean of the latest 6 years (2005-2010) of annual average natural gas price data for industrial sector consumers in Georgia per US Dept. of Energy, Energy Information Administration; see http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_SGA_a.htm
9 Electricity unit cost is the mean of the latest 6 years (2004-2009) of annual average electricity price data for industrial sector consumers in Georgia per US Dept. of Energy, Energy Information Administration; see Table 8 of http://www.eia.doe.gov/cneaf/electricity/st_profiles/georgia.html
10 Natural Gas Units = (Auxiliary fuel requirement) * (60 min/hr)
11 Electricity Units = [0.000117 * (Waste gas exhaust flow) * (Total system pressure drop, assumed 4 w.c.) / 0.6]] per EPA 452/B-02-001, Section 3.2, Equation 2.42.

**Table D.6-3: Methanol MACT Cost Analysis:**
**Catalytic Oxidizer on Spray Dryer Nos. 1 – 8 (per line)**

| Cost Element | Budget Amount | Comments |
|---|---|---|
| **Capital Cost** | | |
| **Direct Costs** | | |
| **Purchased Equipment Costs (PEC)** | | |
| Catalytic Oxidizer (70 % heat recovery - escalated) | $1,356,413 | Base cost per EPA Cost Manual Section 3.2, Equation 2.37; in 1999 dollars<br>Cost correlations range: 2,000 to 50,000 scfm; twin oxidizers in parallel considered<br>Escalated to 2010 dollars using Marshall & Swift Equipment Cost Index for the second quarter of 2010 (M&S Index, 2nd Q 2010 = 1,461.3, M&S Index, 1999 = 1,068.3)<br>Escalated oxidizer costs = [(M&S Index, 2nd Q 2010)/(M&S Index,1999) * (1,443 * (Total gas flowrate)$^{0.5527}$)] |
| Straight Duct Cost | $146,584 | Cost based upon 100 ft of ductwork using 304 SS plate from Section 2, Table 1.9 of EPA Cost Manual.<br>Cost of straight ductwork = 6.29 * (12 * Duct diameter)^1.23) * (Length of ducting) |
| Elbows Cost | $96,612 | Cost based upon 4 elbows constructed of 304 SS from Section 2, Table 1.10 of EPA Cost Manual.<br>Cost of elbows = 74.2 * (e^(0.0688*Duct diameter * 12)) * (No. of elbows) |
| Purchased Equipment Cost (EC) | $1,599,609 | Total Capture System + Total RTO Costs |
| Instrumentation | $159,961 | Cost factor (0.10 * EC) per EPA Cost Manual, Section 3.2, Table 2.8<br>EC = RTO Cost+ Straight Duct Cost+Elbows Cost |
| Freight | $79,980 | Cost factor (0.05 * EC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| **Total Purchased Equipment Cost (PEC)** | **$3,439,160** | |
| **Direct Installation Costs (DIC)** | | |
| Foundation and Supports | $275,133 | Cost factor (0.08 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Handling and Erection | $481,482 | Cost factor (0.14 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Electrical | $137,566 | Cost factor (0.04 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Piping | $68,783 | Cost factor (0.02 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Insulation of Duct Work | $34,392 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Painting | $34,392 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| **Direct Installation Costs (DIC)** | **$1,031,748** | |
| **Total Direct Cost (TDC)** | **$4,470,908** | **TDC=PEC+DIC** |
| **Indirect Costs** | | |
| Engineering | $343,916 | Cost factor (0.10 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Construction and Field Expenses | $171,958 | Cost factor (0.05 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Contractor Fees | $343,916 | Cost factor (0.10 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Start-up | $68,783 | Cost factor (0.02 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Performance Test | $34,392 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| Contingencies | $103,175 | Cost factor (0.03 * PEC) per EPA Cost Manual, Section 3.2, Table 2.8 |
| **Total Indirect Costs (TIC)** | **$1,066,140** | |
| **Total Capital Cost (TCC)** | **$5,537,048** | **TCC=TDC+TIC** |
| **Annual Cost** | | |
| Operating labor | $16,425 | Based on 3 shifts/day, 8,760 operating hours per year at $30/hr, and a labor factor of 0.5 hrs/shift per EPA Cost Manual, Section 3.2, Table 2.10<br>Labor Cost = shifts * hours/shift * hourly rate |
| Supervisory labor | $2,464 | 15% of Operating cost per EPA Cost Manual, Section 3.2, Table 2.10 |
| Maintenance labor | $18,068 | Based on 3 shifts/day, 8,760 operating hours per year at $33/hr, and a labor factor of 0.5 hrs/shift per EPA Cost Manual, Section 3.2, Table 2.10<br>Labor Cost = shifts * hours/shift * hourly rate |
| Maintenance materials | $18,068 | Considered equal to maintenance labor cost per EPA Cost Manual, Section 3.2, Table 2.10 |
| Natural gas | $1,611,398 | As determined in Table E.6-3a |
| Electricity | $154,923 | |
| Catalyst Replacement | $53,199 | Catalyst replacement costs = (volume of catalyst) * (price of catalyst, $/ft3) * (catalyst capital recovery factor)<br>Catalyst volume is determined in Table E.6-3a<br>Recovery factor at 7% interest rate over 4 years = 0.2952<br>Catalyst Price = $650/ft$^3$ |
| Overhead | $33,014 | Overhead = 0.6*(cost of labor and materials) per EPA Cost Manual, Section 3.2, Table 2.10 |
| Insurance, administrative | $166,111 | Administrative costs based on 2% of capital cost and Insurance based on 1% of capital cost Per EPA Cost Manual Section 3.2, Table 2.10 |
| Capital Recovery Factor | 9.44% | Calculated using EPA Cost Manual Section 1, Eqn. 2.8a, using 7% interest (i) and 20 year equipment life:<br>CRF= [i*(1+i)^(equipment life)] / [(1+i)^(equipment life)-1)] |
| Capital recovery | $522,658 | Total Capital Cost * Capital Recovery Factor |
| **Total Annual Cost** | **$2,596,328** | |
| **Total Cost per ton Methanol controlled** | **$272,209** | Based on 10.04 tpy baseline and 95% control; 9.54 tons removed |

# Table D.6-3a: Methanol MACT Energy Cost Analysis: Catalytic Oxidizer on Spray Dryer Nos. 1 – 8 (per line)

| | | | |
|---|---|---|---|
| **Catalytic Oxidizer Input Parameters** | Gas flowrate: | 92,000 | [acfm] |
| | Reference temperature: | 77 | [°F] |
| | Inlet gas temperature: | 180 | [°F] |
| | Gas flowrate: | 77,186 | [scfm] |
| | Inlet gas density:[1] | 0.062 | [lb/acf] |
| | Primary heat recovery: | 0.700 | [fraction] |
| | Waste gas heat content:[2] | 0.066 | [Btu/lb] |
| | Waste gas heat capacity:[3] | 0.248 | [Btu/lb-°F] |
| | Combustion temperature: | 750 | [°F] |
| | Preheat Exit Temperature: | 579 | [°F] |
| | Fuel heat of combustion: | 23,808 | [Btu/lb] |
| | Fuel density:[4] | 0.041 | [lb/ft$^3$] |
| **Catalytic Oxidizer Design Parameters** | Total Auxiliary Fuel Requirement:[5] | 14.28 | [lb/min] |
| | Total Auxiliary Fuel Requirement:[5] | 349.98 | [scfm] |
| | Total Gas Flowrate: | 77,536 | [scfm] |
| | Total Catalyst Volume:[6] | 277.22 | [ft$^3$] |
| **Concentration and Heat of Combustion (Waste Gas) Calculations** | | Methanol | |
| | Potential Emissions: | 10.04 | [tpy] |
| | Molecular Weight: | 32.04 | [lb/lb-mol] |
| | Concentration by Weight:[7] | 6.70 | [ppmw] |
| | Concentration by Volume:[8] | 6.06 | [ppmv] |
| | Waste Gas O2 Content: | 20.9 | [%] |
| | Lower Explosive Limit (LEL): | 6 | [%] |
| | LEL of Methanol/Air Mixture: | 0.010 | [%] |
| | Heat of Combustion: | 9,800 | [Btu/lb] |
| | Heat of Combustion of Waste Gas:[2] | 0.066 | [Btu/lb] |
| | Heat of Combustion of Waste Gas: | 0.005 | [Btu/scf] |

| **Utility Cost Inputs** | Average Unit Cost[9, 10] | Unit | Hours per Year | |
|---|---|---|---|---|
| Natural Gas[11] | 8.76 $/Mscf | 21.0 Mscf/hr | 8,760 | $ 1,611,398.25 |
| Electricity[12] | 0.056 $/kWh | 318 kWh/hr | 8,760 | $ 154,923.43 |

| Footnotes | |
|---|---|
| 1 | Based on ideal gas equation at waste gas exhaust temperature assuming waste gas is principally air. |
| 2 | Heat of combustion per pound of inlet waste gas developed from heat of combustion of ethane multiplied by the concentration by weight (ppmw) of ethane. |
| 3 | Heat capacity, $c_p$, of air at average control temperature; Thermodynamics 3rd Edition, Black and Hartley, 1996. |
| 4 | Auxiliary fuel is natural gas with heating value assumed at 1,020 Btu/scf. |
| 5 | Auxiliary fuel needed to sustain the combustion zone temperature using the procedure specified in EPA Air Pollution Control Cost Manual (EPA 452/B-02-001) Section 3.2 Subsection 1.3.1. |
| 6 | Catalyst volume is determined by the following equation: Φ = (Waste Gas flow rate) / (catalyst volume)<br>Φ = space velocity, h-1 and waste gas flow is specified in cu feet/hour. Φ = 20,000 h-1, per Sec 2.4.1 Cost Manual<br>Therefore, catalyst volume = [(waste gas flow rate) * (60 min/hrs) * (460 + inlet temp) / (460 + ref temp)] / 20,000 h-1 |
| 7 | Parts per million concentration by volume to weight conversion from AP-42 Appendix A. |
| 8 | Concentration by weight = ((Potential to emit, tpy) * (2000 lb/ton) / (8760 hrs/yr) / (60 min/hr)) * 1000000 / (Gas flowrate, acfm) * (Inlet gas density, lb/ft$^3$). |
| 9 | Natural gas unit cost is the mean of the latest 6 years (2005-2010) of annual average natural gas price data for industrial sector consumers in Georgia per US Dept. of Energy, Energy Information Administration; see http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_SGA_a.htm |
| 10 | Electricity unit cost is the mean of the latest 6 years (2004-2009) of annual average electricity price data for industrial sector consumers in Georgia per US Dept. of Energy, Energy Information Administration; see Table 8 of http://www.eia.doe.gov/cneaf/electricity/st_profiles/georgia.html |
| 11 | Natural Gas Units = (Auxiliary fuel requirement) * (60 min/hr) |
| 12 | Electricity Units = [0.000117 * (Waste gas exhaust flow) * (Total system pressure drop, assumed 21" w.c.) / 0.6]] per EPA 452/B-02-001, Section 3.2, Equation 2.42. |

## Table D.6-4 Methanol MACT Cost Analysis: Biotrickling Filter on Spray Dryer Nos. 1 – 8 (per line)

| Cost Element | Budget Ammount | Comments |
|---|---|---|
| **Capital Cost** | | |
| **Direct Costs** | | |
| **Purchased Equipment Costs (PEC)** | | |
| Biofilter | $2,773,436 | Source: Using Bioreactors to Control Air Pollution, EPA CATC, Table 6<br>Escalation Based on Marshall & Swift Equipment Cost Index for the second quarter of 2010 (M&S Index, 2nd Q 2010 = 1,461.3, M&S Index, 1999 = 1,068.3)<br>Escalated Biofilter cost = [(M&S Index, 2nd Q 2010) / (M&S Index, 2000) * (25.1, $/acfm) * (actual gas flow rate, acfm)] |
| Heat Exchanger | $533,200 | Engineering company (Matches Engineering) estimate for a 304 SS U-Tube Shell and Tube heat exchanger in 2007 Dollars (twin 4,303 $ft^2$ in parallel) |
| Straight Duct Cost | $152,533 | Cost based upon 100 ft of ductwork using 304 SS plate from Section 2, Table 1.9 of EPA Cost Manual.<br>Cost of straight ductwork = 6.29 * (12 * Duct diameter)^1.23) * (Length of ducting) |
| Elbows Cost | $116,849 | Cost based upon 4 elbows constructed of 304 SS from Section 2, Table 1.10 of EPA Cost Manual.<br>Cost of elbows = 74.2 * (e^ (0.0688 * Duct diameter * 12)) * (No. of elbows) |
| Instrumentation/Controls | $357,602 | Cost factor (0.10 * EC) per EPA Cost Manual, Section 5.2, Table 1.3<br>EC = RTO Cost+ Straight Duct Cost+Elbows Cost |
| Freight | $178,801 | Cost factor (0.05 * EC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| **Total Purchase Equipment Cost (PEC)** | **$4,112,421** | |
| **Direct Installation Costs (DIC)** | | Average cost factors for packed tower absorber used as best esimate for biotrickling filter (EPA Cost Manual Section 5.2, Ch. 1) where noted |
| Foundations and Support | $493,491 | Cost factor (0.12 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Erection and Handling | $1,644,968 | Cost factor (0.40 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Electrical | $41,124 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Piping | $1,233,726 | Cost factor (0.30 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Insulation | $41,124 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Painting | $41,124 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Site Preparation costs | $411,242 | Site preparation and building costs are assumed to be 10% of purchased equipment costs per Biofiltration of Ethanol Emissions from Bakery Operations, Dr. Rakesh Govind (1999), Preliminary Cost Analysis, page 9 |
| **Direct Installation Cost (DIC)** | **$3,906,800** | |
| **Total Direct Costs (TDC)** | **$8,019,221** | **TDC=PEC+DIC** |
| **Indirect Cost** | | |
| Engineering/Supervision | $411,242 | Cost factor (0.10 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Construction/Field | $411,242 | Cost factor (0.10 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Contractor Fees | $411,242 | Cost factor (0.10 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Start-up | $41,124 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Performance Test | $41,124 | Cost factor (0.01 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| Contingencies | $123,373 | Cost factor (0.03 * PEC) per EPA Cost Manual, Section 5.2, Table 1.3 |
| **Total Indirect Cost (TIC)** | **$1,439,347** | |
| **Total Capital Costs (TCC)** | **$9,458,569** | **TCC=TDC+TIC** |

**Table D.6-4 Methanol MACT Cost Analysis:**
**Biotrickling Filter on Spray Dryer Nos. 1 – 8 (per line)**

| | | | |
|---|---|---|---|
| **Annual Cost** | | | |
| | Operating Labor | $16,425 | Based on 3 shifts/day, 8,760 operating hours per year at $30/hr, and a labor factor of 0.5 hrs/shift per Biofiltration of Ethanol Emissions from Bakery Operations, Dr. Rakesh Govind (1999), Preliminary Cost Analysis, page 9 |
| | Supervisory Labor | $2,464 | 15% of Operating cost per EPA Cost Manual, Section 5.2, Table 1.4 |
| | Maintenance Labor | $18,068 | Based on 3 shifts/day, 8,760 operating hours per year at $33/hr, and a labor factor of 0.5 hrs/shift per Biofiltration of Ethanol Emissions from Bakery Operations, Dr. Rakesh Govind (1999), Preliminary Cost Analysis, page 9 |
| | Maintenance Materials | $189,171 | Maintenance materials 2% of the total capital cost per Biofiltration of Ethanol Emissions from Bakery Operations, Dr. Rakesh Govind (1999), Preliminary Cost Analysis, page 9 |
| | Biofilter Media Cost | $152,072 | Source: Table 9 of EPA 456-R-03-003 "Using Bioreactors to Control Air Pollution"<br>Escalation Based on Marshall & Swift Equipment Cost Index for the second quarter of 2010 (M&S Index, 2nd Q 2010 = 1,461.3, M&S Index, 1999 = 1,068.3)<br>Escalation Based on Marshall & Swift Equipment Cost Index for the second quarter of 2010 (M&S Index, 2nd Q 2010 = 1,461.3, M&S Index, 1999 = 1,068.3)<br>Escalated Media cost = (M&S Index, 2nd Q 2010) / (M&S Index, 2003) * (1.42, $/acfm) * (actual gas flow rate, acfm) |
| | Electricity (Biofilter) | $103,529 | As determined in Table E.6-4a |
| | Water | $2,686 | |
| | Overhead | $135,677 | Overhead = 0.6*(cost of labor and materials) per EPA Cost Manual, Section 5.2, Table 1.4 |
| | Insurance, administrative | $283,757 | Administrative costs based on 2% of capital cost and Insurance based on 1% of capital cost per EPA Cost Manual, Section 5.2, Table 1.4 |
| | Capital Recovery Factor | 10.98% | Calculated using EPA Cost Manual Section 1, Eqn. 2.8a, using 7% interest (i) and 15 year equipment life:<br>CRF= [i*(1+i)^(equipment life)] / [(1+i)^(equipment life)-1)] |
| | Capital Recovery | $1,038,500 | Total Capital Cost * Capital Recovery Factor |
| **Total Annualized Cost** | | **$1,825,419** | |
| **Total Cost per ton Methanol controlled** | | **$202,016** | Based on 10.04 tpy baseline and 90% control; 9.04 tons removed |

## Table D.6-4a: Methanol MACT Energy Cost Analysis: Biotrickling Filter on Spray Dryer Nos. 1 – 8 (per line)

**Biotrickling Filter Input Parameters**

| | | |
|---|---|---|
| Gas flowrate: | 92,000 | [acfm] |
| Reference temperature: | 77 | [°F] |
| Inlet gas temperature: | 180 | [°F] |
| Gas flowrate: | 77,186 | [scfm] |
| Inlet gas density:[1] | 0.062 | [lb/acf] |
| Fractional moisture content of inlet gas: | 10% | |

**Shell-and-Tube Heat Exchanger Parameters**

| | | |
|---|---|---|
| **Inlet at 10% moisture, 180 °F:** | | |
| Mass flow rate of water vapor:[2] | 360.9 | [lb/min] |
| Mass flow rate of dry air:[3] | 5232.6 | [lb/min] |
| Total mass flow rate: | 5593.5 | [lb/min] |
| Gas mixing ratio:[4] | 0.069 | [lb/lb] |
| Gas mixing ratio:[4] | 483 | [gr/lb] |
| Enthalpy of gas:[5] | 122.0 | [Btu/lb] |
| Temperature of cool fluid at inlet: | 70 | [°F] |
| **Outlet at 100% humidity, 100 °F:** | | |
| Gas temperature to biofilter:[6] | 100 | [°F] |
| Enthalpy of gas:[5] | 71.8 | [Btu/lb] |
| Change in enthalpy: | 50.2 | [Btu/lb] |
| Temperature of cool fluid at outlet: | 80 | [°F] |
| Heat transfer rate:[7] | 16.86 | [MMBtu/hr] |
| Heat transfer coefficient:[8] | 20.0 | [Btu/ft$^2$*hr*°F] |
| Log mean temperature difference:[9] | 52.8 | [°F] |
| Total surface area:[10] | 15,969 | [ft$^2$] |
| Gas humid volume:[5] | 15.09 | [ft$^3$/lb] |
| Standard gas flow rate:[11] | 78,960 | [scfm] |
| Actual gas flow rate: | 82,344 | [acfm] |

**Potential Emissions**

| | | |
|---|---|---|
| Potential Methanol Emissions: | 10.04 | [tpy] |
| Tons Methanol Reduced with 90% efficiency:[12] | 9.04 | [tpy] |

| Utility Cost Inputs | Average Unit Cost[13] | Unit[14, 15] | No. Hours per Year | |
|---|---|---|---|---|
| Electricity | 0.056 $/kWh | 212.2 kW | 8,760 | $ 103,528.60 |
| Water | 0.30 $/kgal | 1.0 kgal/hr | 8,760 | $ 2,685.71 |

| Footnotes | |
|---|---|
| 1 | Based on Ideal Gas Equation at waste gas exhaust temperature assuming waste gas is principally air. |
| 2 | Mass flow rate of water vapor (lb/min) = (flowrate, acfm)*(moisture content)*(molecular weight/volume of one mole of air) |
| 3 | Mass flow rate of air (lb/min) = (flowrate, acfm)*(1-moisture content)*(molecular weight/volume of one mole of air) |
| 4 | Mixing ratio = ratio of mass of water vapor to mass of dry air |
| 5 | Calculated using psychrometric equations |
| 6 | Temperature at which biomass can survive |
| 7 | Heat transfer rate, MMBtu/hr = (total mass flow rate, lb/min) * (change in enthalpy, Btu/lb) * (60 min/hr) / (10$^6$ Btu/MMBtu) |
| 8 | Source: Weider, Seader, and Lewin. "Product and Process Design Principles, 2nd edition." p. 431, Table 13.5, "Typical Overall Heat Transfer Coefficients for Shell-and-Tube Heat Exchangers." Shell side water, tube side air (2004) |
| 9 | $T_{lm}$, °F = (($T_{h,o}$-$T_{c,o}$) - ($T_{h,i}$-$T_{c,i}$)) / ln(($T_{h,o}$ - $T_{c,o}$) / ($T_{h,i}$-$T_{c,i}$)) where i is inlet, o is outlet, h is hot air, and c is cool fluid |
| 10 | Area, ft$^2$ = (heat transfer rate) / ((Heat transfer coefficient) * (log mean temperature difference)) |
| 11 | Gas flow rate (scfm) = (heat exchanger outlet gas humid volume, ft$^3$/lb) * (mass flow rate of air, lb/min) |
| 12 | 100 percent capture and 90 percent destruction efficiency considered. |
| 13 | Electricity unit cost is the mean of the latest 6 years (2004-2009) of annual average electricity price data for industrial sector consumers in Georgia per US Dept. of Energy, Energy Information Administration; see Table 8 of http://www.eia.doe.gov/cneaf/electricity/st_profiles/georgia.html |
| 14 | Source: Average of power demand specifications from two vendor quotes for biotrickling filters at 24,338 scfm. Electricity Unit = ((65.4 kW) / (24,338 scfm exhaust gas)) * (standard gas flow rate, scfm) |
| 15 | Source: Average of water usage specifications from two vendor quotes for biotrickling filters at 24,338 scfm. Water cost =( (5.25 gal/min) * (60 min/hr) / (1000 gal/kgal) / (24338 scf/min) ) * (standard gas flow rate, scfm) Water cost is per Chapter 1.4.1.2 of EPA Air Pollution Control Cost Manual (EPA 452/B-02-001) Section 3.1 for Carbon Adsorbers (closest available reference for water cost from non-municipal sources). |

**Table D.7-1: HF/HCl Cost Analysis for Wet Scrubbers on Direct-fired Rotary Calciner Nos. 1 – 4 (each)**

| Expense | Scaled Cost[1] | Comments |
|---|---|---|
| **Capital Costs** | | |
| **Direct Costs** | | |
| **Purchased Equipment Cost (PEC)** | | |
| Scrubber & Accessories | $329,464 | Per vendor quote; see Table C.5-1a for details |
| Wastewater Treatment Plant (WWTP) | $9,019,872 | |
| Ductwork | $371,032 | |
| Electrical | $105,616 | |
| Safety and Security | $13,212 | |
| Tanks | $109,262 | |
| Pumps | $126,667 | |
| Air Compressor/Receiver | $63,560 | |
| Oxidation System | $53,501 | |
| Other Equipment | $150,282 | |
| Freight | $36,607 | |
| **Total Purchased Equipment Cost:** | **$10,379,074** | |
| **Direct Installation Cost (DIC)** | | |
| Site Preparation | $299,875 | Per vendor quote; see Table C.5-1a for details |
| Foundations and Supports | $345,978 | |
| Electrical and Instrumentation | $715,902 | |
| Piping | $220,743 | |
| Spare Parts | $68,810 | |
| **Total Direct Installation Costs (DIC)** | **$1,651,309** | |
| **Total Direct Costs (TDC):** | **$12,030,383** | **TDC=PEC+DIC** |
| **Indirect Costs** | | |
| Engineering | $939,948 | Per vendor quote; see Table C.5-1a for details |
| Start-Up | $235,971 | |
| Contractor Fees | $4,247,796 | |
| Contingency and Taxes | $746,591 | |
| **Total Indirect Costs (TIC):** | **$6,170,307** | |
| **Total Capital Costs (TCC):** | **$18,200,690** | **TCC=TDC+TIC** |
| **Annual Costs** | | |
| Operating Labor @ $30/hr | $16,425 | 0.5 hour of Labor per 8-hour shift with 1,095 shifts/year; per EPA Cost Manual Section 5.2, Table 1.4 Labor Cost = shifts * hours/shift * hourly rate |
| Maintenance Labor @ $33/hr | $18,068 | |
| Maintenance Materials | $18,068 | 100% of Maintenance Labor per EPA Cost Manual Section 5.2, Table 1.4 |
| Supervisory Labor | $2,464 | 15% of Operating Labor; per EPA Cost Manual Section 5.2, Table 1.4 |
| Electricity | $90,142 | MCI Orange project indicated incremental power demand of 145.5 HP, assuming 0.746 kW/HP. Consumption was scaled based on ratio of exhaust flow rates; assumes 8,760 hrs/yr operation. Electricity rate is $0.056/kWh. Electricity Cost = (145.5 HP * 0.746 kW/H) * 8,760 hr/yr * $0.056/kWh * (63,000/37,000) |
| Caustic | $754,273 | Caustic usage of 164.5 tpy at $297/ton was scaled up based on ratio of HF and HCl controlled. Ratio of HF and HCl controlled is 45.67/57.35 which is ~0.80 Caustic Cost = 164.5/57.35 * (HF/HCl Emissions Reduction, tpy) * $297/ton |
| Water | $26,206 | Water usage based on quench evaporation and blowdown requirements as calculated for the $NO_x$ wet scrubber; water price is $0.30/kgal |
| Insurance and Administrative Expenses | $546,021 | 3% of TCC per EPA Cost Manual Section 5.2, Table 1.4 |
| Overhead | $33,014 | 60% of Labor and materials as specified in EPA Cost Manual Section 5.2, Table 1.4 |
| Capital Recovery Factor | 10.98% | Calculated using EPA Cost Manual Section 1, Eqn. 2.8a, using 7% interest (i) and 15 year equipment life: CRF= [i*(1+i)^(equipment life)] / [(1+i)^(equipment life)-1)] |
| Capital Recovery Costs | $1,998,338 | Calculated using EPA Cost Manual Section 1, Eqn. 2.8 Capital Recovery Cost = Capital Recovery Factor * TCC |
| **Total Annual Costs:** | **$3,503,018** | |
| HF/HCl Emissions Reductions (tpy) | 885.40 | Based on potential uncontrolled HF emission rate of 758 tpy and HCl emission rate of 174 tpy with a control efficiency of 95% |
| **Control Cost ($/ton HF/HCl abated)** | **$3,956** | |

**Notes**

1 6/10th rule: Cost A = Cost B (Flow Rate A/Flow Rate B)$^{0.6}$

**Table D.7-1a: HF/HCl Detailed Budetary Capital Cost Analysis for Wet Scrubbers**

***Per BE&K Engineering estimate on MCI Orange Project for Carbo Ceramics, McIntyre, GA, July, 19, 2010***
***Unless otherwise noted, scaled costs are scaled from 37,000 acfm to 63,000 acfm using "6/10th rule" (Cost A = Cost B (Flow Rate A/Flow Rate B) $^{0.6}$ )***

| Equipment | Equipment Cost | Notes | Vendor Source |
|---|---|---|---|
| **Direct Costs** | | | |
| ***Detailed Purchased Equipment Costs (PEC)*** | | | |
| ***Scrubbers/Scrubber Accessories*** | | | |
| Scrubber | $169,400 | | Turbosonic |
| ID Fan | $70,000 | Includes fan, motor, and inlet box | Carbo Ceramics |
| **Total Cost of Scrubber:** | **$239,400** | | |
| **Scaled Cost of Scrubber:** | **$329,464** | | |
| ***Additional Necessary Equipment Not Included In Scrubber Cost*** | | | |
| ***Wastewater Treatment*** | | | |
| Wastewater Treatment Plant (WWTP) | $34,000,000 | Scaled to four calciners using 6/10ths rule based on blowdown flow rates; divided by four to apportion cost on a per-calciner basis | Separate vendor quote for a WWTP to treat scrubber blowdown @ 720kgal/day. |
| **Total Cost of Wastewater Treatment:** | **$34,000,000** | | |
| **Scaled Cost of Wastewater Treatment:** | **$9,019,872** | | |
| ***Ductwork*** | | | |
| Additional Ductwork | $116,700 | | Warren |
| Dampers & Expansion Joints | $47,605 | | Air Techniques/ LR Gorell |
| Stack Liner | $105,300 | | Warren |
| **Total Cost of Ductwork:** | **$269,605** | | |
| **Scaled Cost of Ductwork:** | **$371,032** | | |
| ***Electrical*** | | | |
| Motor Control Center, Starters and Breaker | $76,744 | | BE&K |
| **Total Cost of Electrical:** | **$76,744** | | |
| **Scaled Cost of Electrical:** | **$105,616** | | |
| ***Safety/Security*** | | | |
| Eye Wash and Shower No. 1 and 2 | $6,600 | | Bradley |
| Entrance Security Camera, Phone, and Card Reader | $3,000 | | Allowance |
| **Total Cost of Safety/Security:** | **$9,600** | | |
| **Scaled Cost of Safety/Security:** | **$13,212** | | |
| ***Tanks*** | | | |
| 50% Caustic Storage Tank | $43,883 | Including insulation | Addison Fabricators |
| Heat Tracing | $35,511 | | Delta-Therm |
| **Total Cost of Tanks:** | **$79,394** | | |
| **Scaled Cost of Tanks:** | **$109,262** | | |
| ***Pumps*** | | | |
| Caustic Pumps | $21,716 | Includes motor | GPM Industries |
| Header and Standby Recycle Pumps | $33,750 | 4 header pumps, 1 standby recycle pump | Turbo Sonic |
| Sump Pumps | $26,575 | Includes 5 sumps pumps at $5,315 each | Blake & Pendleton |
| Booster Pump | $5,000 | Includes motor | BE&K |
| Filter | $5,000 | For suction line of recycle pumps | |
| **Total Cost of Pumps:** | **$92,041** | | |
| **Scaled Cost of Pumps:** | **$126,667** | | |
| ***Air Compressor/Receiver*** | | | |
| Air Compressor | $41,396 | Includes motor | Blake & Pendleton |
| Process Air Receiver | $4,789 | | |
| **Total Cost of Air Compressor/Receiver:** | **$46,185** | | |
| **Scaled Cost of Air Compressor/Receiver:** | **$63,560** | | |
| ***Oxidation System*** | | | |
| Oxidation Tank | $29,700 | | Turbosonic |
| Oxidation Tank Blower System | | | Air Systems Engineering |
| Oxidation Tank Pump | $9,176 | Includes motor | GPM Industries |
| **Total Cost of Oxidation** | **$38,876** | | |
| **Scaled Cost of Oxidation** | **$53,501** | | |
| ***Other Equipment*** | | | |
| Water Supply System | $20,000 | For potable water supply to area | Carbo Ceramics |
| Scrubber Seal Pot | $6,600 | | BE&K |
| Vendor Service | $22,500 | | - |
| Miscellaneous | $60,100 | | - |
| **Total Cost of Other Equipment:** | **$109,200** | | |
| **Scaled Cost of Other Equipment:** | **$150,282** | | |
| ***Freight*** | | | |
| Freight | $26,600 | | - |
| **Total Cost of Freight:** | **$26,600** | | |
| **Scaled Cost of Freight:** | **$36,607** | | |
| **Total PEC:** | **$34,987,645** | | |
| **Scaled PEC:** | **$10,379,074** | | |

**Table D.7-1a: HF/HCl Detailed Budetary Capital Cost Analysis for Wet Scrubbers**

*Per BE&K Engineering estimate on MCI Orange Project for Carbo Ceramics, McIntyre, GA, July, 19, 2010*
*Unless otherwise noted, scaled costs are scaled from 37,000 acfm to 63,000 acfm using "6/10th rule" (Cost A = Cost B (Flow Rate A/Flow Rate B) $^{0.6}$ )*

| Equipment | Equipment Cost | Included in Quote |
|---|---|---|
| **Direct Costs Continued** | | |
| ***Detailed Direct Installation Costs (DIC)*** | | |
| *All DIC Costs are Per BE&K Construction detailed estimate for construction of wet scrubber at nearby CARBO McIntyre facility* | | |
| ***Site Preparation*** | | |
| Site work, demolition, earthwork | $217,900 | Site preparation, paving and surfacing, underground utilities, erosion control |
| **Total Cost of Site Preparation:** | **$217,900** | |
| **Scaled Cost of Site Preparation:** | **$299,875** | |
| ***Foundations & Supports*** | | |
| Concrete | $94,300 | Insulation, foundation, concrete wall, pier, stair footing, equipment pads |
| Structural Steel | $157,100 | Steel, grating, handrail, treads |
| **Total Cost of Foundations & Supports:** | **$251,400** | |
| **Scaled Cost of Foundations & Supports:** | **$345,978** | |
| ***Electrical and Instrumentation*** | | |
| Electrical | $362,300 | Feeders, motor control stations, caustic tank electric heat tracing, lighting, baghouse control system wiring, I/O rack communication and power |
| Instrumentation | $157,900 | Field devices, tubing, freight, calibration, control systems |
| **Total Cost of Electrical/Instrumentation:** | **$520,200** | |
| **Scaled Cost of Electrical/Instrumentation:** | **$715,902** | |
| ***Piping*** | | |
| Process Piping | $160,400 | |
| **Total Cost of Piping:** | **$160,400** | |
| **Scaled Cost of Piping:** | **$220,743** | |
| ***Spare Parts*** | | |
| Capitalized Spares | $50,000 | |
| **Total Cost of Spare Parts:** | **$50,000** | |
| **Scaled Cost of Spare Parts:** | **$68,810** | |
| **Total Direct Installation Cost (DIC):** | **$1,199,900** | |
| **Scaled Direct Installation Cost (DIC):** | **$1,651,309** | |
| **Total Direct Cost (TDC):** | **$12,030,383** | |
| **Indirect Costs** | | |
| *All IC Costs, except as noted, are per BE&K Construction detailed estimate for construction of wet scrubber at nearby CARBO McIntyre facility* | | |
| ***Engineering*** | | |
| Architectural | $181,900 | |
| Design Engineering | $501,100 | |
| **Total Cost of Engineering:** | **$683,000** | |
| **Scaled Cost of Engineering:** | **$939,948** | |
| ***Start-Up*** | | |
| Start-up | $4,300 | |
| Design Firm Assistance during start-up | $75,165 | Not included in BE&K estimate; necessary for the project based on past experience on comparable jobs. Design firm assistance is 15% of design engineering cost. |
| Wastewater and Air Pollution Control Consultant Assistance during start-up | $75,000 | |
| Stack Testing | $12,000 | |
| Other Testing | $5,000 | |
| **Total Cost of Start-Up:** | **$171,465** | |
| **Scaled Cost of Start-Up:** | **$235,971** | |
| ***Contractor Fees*** | | |
| Site Preparation Labor | $404,600 | |
| Foundations & Supports Labor | $243,100 | |
| Equipment Labor | $185,600 | |
| Piping Labor | $525,000 | |
| Electrical Labor | $633,100 | |
| Start-Up Labor | $10,500 | |
| Subcontractor Costs | $875,700 | |
| Owner's Cost | $164,000 | |
| Construction Management | $45,000 | |
| **Total Cost of Contractor Fees:** | **$3,086,600** | |
| **Scaled Cost of Contractor Fees:** | **$4,247,796** | |
| ***Contingency and Taxes*** | | |
| Contingency @ 7.7% | $503,900 | |
| Taxes @ 0.6% | $38,600 | |
| **Total Cost of Contingency and Taxes:** | **$542,500** | |
| **Scaled Cost of Contingency and Taxes:** | **$746,591** | |
| **Total Indirect Cost (TIC):** | **$6,170,307** | |
| **Grand Total Capital Cost:** | **$18,200,690** | |

## Table D.7-2: HF/HCl Cost Analysis for Injection Based Dry Scrubbers on Direct-fired Rotary Calciner Nos. 1 – 4 (each)

| Expense | | Cost | Comments |
|---|---|---|---|
| **Capital Costs** | | | |
| **Direct Costs** | | | |
| | **Purchased Equipment Cost (PEC)** | | |
| | Purchased Equipment Cost (PEC) | $2,445,792 | See Table C.6-3a |
| | **Total PEC** | **$2,445,792** | |
| | **Direct Installation Cost (DIC)** | | |
| | Foundations and Support | $178,907 | See Table C.6-3a |
| | Other Equipment | $297,260 | |
| | Piping | $6,881 | |
| | Ductwork | $27,524 | |
| | Controls Integration | $41,286 | |
| | Electrical | $34,405 | |
| | **Total DIC:** | **$586,264** | |
| | **Total Direct Cost:** | **$3,032,056** | |
| **Indirect Costs** | | | |
| | Start-Up Preparation | $27,524 | See Table C.6-3a |
| | Engineering | $68,810 | |
| | Contractor Fees | $144,502 | |
| | **Total Indirect Cost** | **$240,836** | |
| | Contingency | $490,934 | See Table C.5-6a |
| | Lost Production | $525,000 | |
| **Total Capital Costs** | | **$4,288,826** | |
| **Annual Costs** | | | |
| | Operating Labor @ $30/hr | $16,425 | 0.5 hour of Labor per 8-hour shift with 1,095 shifts/year; per EPA Cost Manual Section 5.2, Table 1.4 |
| | Maintenance Labor @ $33/hr | $18,068 | Labor Cost = shifts * hours/shift * hourly rate |
| | Maintenance Materials | $18,068 | 100% of Maintenance Labor per EPA Cost Manual Section 5.2, Table 1.4 |
| | Supervisory Labor | $2,464 | 15% of Operating Labor; per EPA Cost Manual Section 5.2, Table 1.4 |
| | Electricity (kW-hr/yr) | $99,420 | See Table C.6-3b |
| | Lime Reagent | $40,662 | Vendor estimated Lime usage at $308,869 annually for $SO_2$ emissions of 80.85 lb/hr. Lime usage was scaled based on ratio of uncontrolled emissions of HF and HCL.<br>Lime Reagent Cost = $308,869 * (10.64 lb/hr / 80.85lb/hr) |
| | Overhead | $33,014 | 60% of Labor and materials as specified in EPA Cost Manual Section 5.2, Table 1.4 |
| | Insurance and Administrative Expenses | $128,665 | 3% of TCI per EPA Cost Manual Section 2, Table 1.13 |
| | Capital Recovery Factor | 10.98% | Calculated using EPA Cost Manual Section 1, Eqn. 2.8a, using 7% interest (i) and 15 year equipment life:<br>CRF= [i*(1+i)^(equipment life)] / [(1+i)^(equipment life)-1)] |
| | Capital Recovery Costs (15 year depreciation + 7% interest) | $470,890 | Calculated using EPA Cost Manual Section 1, Eqn. 2.8<br>Capital Recovery Cost = Capital Recovery Factor * TCC |
| **Total Annual Costs** | | **$827,675** | |
| | **HF/HCL Emission Reductions (tpy)** | 838.80 | Based on potential uncontrolled HF emission rate of 758 tpy and HCl emission rate of 174 tpy with a control efficiency of 90% |
| **Control Costs($/ton HF/HCL abated)** | | **$987** | |

## Table D.7-2a: Detailed Budetary Cost Analysis for Injection Based Dry Scrubbers

***Estimated by TMTS Associates based on a 2009 quote from Fuel Tech High Inc. for Dry Lime Injection.***
***Unless otherwise noted, scaled costs are scaled from 37,000 acfm to 63,000 acfm using "6/10th rule" (Cost A = Cost B (Flow Rate A/Flow Rate B)$^{0.6}$ )***

| Equipment | Budgetary Cost | Notes | Source |
|---|---|---|---|
| **Direct Costs** | | | |
| ***Purchased Equipment Costs (PEC)*** | | | |
| ***Purchased Equipment Costs (PEC)*** | | | |
| Injection Based Dry Scrubber | $1,777,200 | Estimated Capital Cost from a vendor quote for a control system for a boiler with an airflow rate of 37,000 acfm. | Fuel Tech |
| **Total PEC:** | **$1,777,200** | | |
| **Scaled PEC:** | **$2,445,792** | | |
| **PEC:** | **$2,445,792** | | |
| ***Direct Installation Costs (DIC)*** | | | |
| ***Foundations and Support*** | | | |
| Foundations/ roadways | $50,000 | Assumes use of slab-not pilings | Estimated by CARBO project engineering |
| Structural Steel | $80,000 | Belt support, dust collector support, duct, pipe supports, Waste Hopper cover | Estimated by CARBO project engineering |
| **Total Cost of Foundations/Support:** | **$130,000** | | |
| **Scaled Cost of Foundations/Support:** | **$178,907** | | |
| ***Other Equipment*** | | | |
| Nuisance Dust Collector | $36,000 | | Comparable Experience on other jobs |
| Broken Bag detectors (2) | $9,000 | | Recent quote |
| Nuisance collector stack | $15,000 | | Estimated by CARBO project engineering |
| Belt Conveyor | $80,000 | Air supported belt conveyor 24"x 66', 3 hp | Comparable experience on other jobs - costing developed by CARBO project engineers |
| Spare Parts | $40,000 | | |
| Waste Hoppers | $36,000 | 20 yard capacity with cover and teflon liner, quantity of 3 @ $12,000 ea. | Estimated by CARBO project engineering |
| **Total Cost of Other Equipment:** | **$216,000** | | |
| **Scaled Cost of Other Equipment:** | **$297,260** | | |
| ***Piping*** | | | |
| Piping | $5,000 | Air | Estimated by CARBO project engineering |
| **Total Cost of Piping:** | **$5,000** | | |
| **Scaled Cost of Piping:** | **$6,881** | | |
| ***Ductwork*** | | | |
| Ductwork | $20,000 | For Nuisance Dust | Estimated by CARBO project engineering |
| **Total Cost of Ductwork:** | **$20,000** | | |
| **Scaled Cost of Ductwork:** | **$27,524** | | |
| ***Controls Integration*** | | | |
| Controls Integration | $30,000 | Includes HMI/Graphics development, logic programming for extra items outside of vendor scope | |
| **Total Cost of Controls Integration:** | **$30,000** | | |
| **Scaled Cost of Controls Integration:** | **$41,286** | | |
| ***Electrical*** | | | |
| 4 motors, 6 devices | $20,000 | | Estimated by CARBO project engineering |
| Yard and Local Lighting | $5,000 | Includes 2 pole mounted HPS at 40' high and 2 LPS area lights | |
| **Total Cost of Electrical:** | **$25,000** | | |
| **Scaled Cost of Electrical:** | **$34,405** | | |
| **Total DIC:** | **$586,264** | | |
| **Total Direct Cost:** | **$3,032,056** | | |

## Table D.7-2a: Detailed Budetary Cost Analysis for Injection Based Dry Scrubbers

***Estimated by TMTS Associates based on a 2009 quote from Fuel Tech High Inc. for Dry Lime Injection.***
***Unless otherwise noted, scaled costs are scaled from 37,000 acfm to 63,000 acfm using "6/10th rule" (Cost A = Cost B (Flow Rate A/Flow Rate B)$^{0.6}$ )***

| Equipment | Budgetary Cost | Notes | Source |
|---|---|---|---|
| **Indirect Costs** | | | |
| ***Start-Up Preparation*** | | | |
| Stack Testing | $20,000 | | |
| **Total Cost of Start-Up Preparation:** | **$20,000** | | |
| **Scaled Cost of Start-Up Preparation:** | **$27,524** | | |
| ***Engineering*** | | | |
| Detailed Design and Engineering Review of Detailed Design | $50,000 | | |
| **Total Cost of Engineering:** | **$50,000** | | |
| **Scaled Cost of Engineering:** | **$68,810** | | |
| ***Contractor Fees*** | | | |
| Project Management for 4 months | $80,000 | | |
| Labor for Setting/Installation | $25,000 | For nuisance collector, conveyor etc | Estimated by CARBO project engineering |
| **Total Cost of Contractor Fees:** | **$105,000** | | |
| **Scaled Cost of Contractor Fees:** | **$144,502** | | |
| **Total Indirect Cost:** | **$240,836** | | |
| Contingency @ 15% | $490,934 | 15% of direct + indirect costs | Chapter 6 of Plant Design and Economics for Chemical Engineers, Peters and Timmerhaus, 4th Edition |
| Cost of Lost Production | $525,000 | | |
| **Grand Total Capital Cost:** | **$4,288,826** | | |

**Table D.7-2b: HF/HCL Energy Cost Analysis for Injection Based Dry Scrubber for Direct-fired Rotary Calciner Nos. 1 – 4 (each)**

| | | |
|---|---|---|
| Gas flowrate: | 63,000 | [acfm] |
| Reference temperature: | 77 | [$^oF$] |
| Inlet gas temperature (after baghouse): | 405 | [$^oF$] |
| Gas flowrate: | 39,102 | [scfm] |

| | Average Unit Cost[1] | Energy Required | No. Hours per Year[2] | | |
|---|---|---|---|---|---|
| Incremental Electricity at ID Fan[3,4] | 0.056 $/kWh | 130 kW | 8,592 | $ | 62,034.10 |
| Direct System Load[5] | 0.056 $/kWh | 77 kW | 8,760 | $ | 37,386.14 |
| Total Annual Electricity Usage: | 1,784,924 kWh/yr | | | $ | 99,420.24 |

| Footnotes | |
|---|---|
| 1 | Electricity unit cost is the mean of the latest 6 years (2004-2009) of annual average electricity price data for industrial sector consumers in Georgia per US Dept. of Energy, Energy Information Administration; see Table 8 of http://www.eia.doe.gov/cneaf/electricity/st_profiles/georgia.html |
| 2 | ID fan load assumes 8,760 hour per year potential minus one week (7 days * 24 hours) annual downtime for system maintenance and repair. Direct system load includes freeze protection and related heaters and so is assumed 8,760 hr/year. |
| 3 | Incremental electricity required to compensate for additional pressure drop of control system is assumed to include additional ductwork (7"w.c.), and baghouse pressure drop (10"w.c. per vendor). |
| 4 | Power requirement calculated as specified in EPA Air Pollution Control Cost Manual, 6th Edition, Chapter 3.2, Equation 2.42, assuming 60% combined efficiency of the fan and motor. |
| 5 | Based on vendor quoted load of 45kW for equipment included in quote, scaled by ratio of quoted system flow rate (37,000 acfm) to calciner rate (63,000 acfm) |

## Table D.7-3: HF/HCl Cost Analysis for a Dry Limestone Adsorber on Direct-fired Rotary Calciner Nos. 1 through 4 (each)

| Expense | | Cost | Comments |
|---|---|---|---|
| **Capital Costs** | | | |
| **Direct Costs** | | | |
| | **Purchased Equipment Costs** | | |
| | Purchased Equipment Costs | $680,000 | See Table C-5.4a |
| | **Total Purchased Equipment Cost:** | **$680,000** | |
| | **Direct Installation Costs** | | |
| | Site Preparations | $73,000 | See Table C-5.4a |
| | Foundations and Support | $116,000 | |
| | Electrical | $69,000 | |
| | Safety Systems and Equipment | $27,000 | |
| | Piping | $11,000 | |
| | Controls integration | $40,000 | |
| | Ductwork | $180,000 | |
| | Spare Parts and Storage | $85,000 | |
| | Freight | $5,000 | |
| | **Total Direct Installation Costs:** | **$606,000** | |
| | **Total Direct Installation Costs:** | **$1,286,000** | |
| **Indirect Costs** | | | |
| | Engineering | $83,000 | See Table C-5.4a |
| | Start-up | $31,000 | |
| | Contractor Fees | $361,000 | |
| | **Total Indirect Costs** | **$475,000** | |
| | Contingency | $264,150 | See Table C-5.4a |
| | Cost of Lost Production | $525,000 | |
| **Total Capital Costs** | | **$2,550,150** | |
| **Annual Costs** | | | |
| | Operating Labor @ $30/hr | $16,425 | 0.5 hour of Labor per 8-hour shift with 1,095 shifts/year; per EPA Cost Manual Section 5.2, Table 1.4 Labor Cost = shifts * hours/shift * hourly rate |
| | Maintenance Labor @ $33/hr | $16,425 | |
| | Maintenance Materials | $16,425 | 100% of Maintenance Labor per EPA Cost Manual Section 5.2, Table 1.4 |
| | Supervision Labor | $2,464 | 15% of Operating Labor; per EPA Cost Manual Section 5.2, Table 1.4 |
| | Cost of Lost Production for Annual Maintenance & Repair | $525,000 | Assumes 1 week annual shutdown for maintenance and repair. |
| | Electricity | $24,791 | Assumes incremental load is 40 HP at .$056/kWh Electricity Cost = (40 HP * 0.746 kW/HP) * 8,760 hr/yr * $0.056/kWh * (63,000/37,000) |
| | Reagent Chemicals | $17,748 | Calculated based on information provided by Encertec, usage and price for dry Jurassic limestone. |
| | Cost of off-site disposal, spent limestone | $0 | Cost omitted from this analysis |
| | Training Expense | $15,000 | Based on comparable experience on other jobs |
| | Overhead | $346,043 | 60% of Labor and materials as specified in EPA Cost Manual Section 5.2, Table 1.4 |
| | Insurance and Administrative Expenses | $76,505 | 3% of TCI per EPA Cost Manual Section 5.2, Table 1.4 |
| | Capital Recovery Factor | 10.98% | Calculated using EPA Cost Manual Section 1, Eqn. 2.8a, using 7% interest (i) and 15 year equipment life: CRF= [i*(1+i)^(equipment life)] / [(1+i)^(equipment life)-1)] |
| | Capital Recovery Cost | $279,993 | Calculated using EPA Cost Manual Section 1, Eqn. 2.8 Capital Recovery Cost = Capital Recovery Factor * TCC |
| **Total Annual Costs** | | **$1,336,818** | |
| | HF/HCL Emission Reductions, tpy | 729.9 | Based on potential uncontrolled HF emission rate of 758 tpy and HCl emission rate of 174 tpy with a control efficiency of 91.7% for HF, and 20% for HCl per vendor specifications. |
| **Control Costs ($/ton HF/HCl abated)** | | **$1,832** | |

## Table D.7-3a: HF/HCl Detailed Budetary Capital Cost Analysis for Dry Limestone Adsorber

**Per Encertec, Inc. estimate on a Dry Limestone Adsorber System for Carbo Ceramics, Toomsboro, GA, July, 9, 2009**

| Equipment | Budgetary Cost | Notes | Source |
|---|---|---|---|
| **Direct Costs** | | | |
| ***Purchased Equipment Costs (PEC)*** | | | |
| ***Purchased Equipment Costs (PEC)*** | | | |
| Dry Limestone Adsorber System | $680,000 | Quote includes system equipment, freight, erection, and commissioning | Encertec, Inc. |
| **Total PEC:** | **$680,000** | | |
| **Total PEC:** | **$680,000** | | |
| ***Direct Installation Costs (DIC)*** | | | |
| ***Site Preparation*** | | | |
| Modifications and additions to existing plant exhaust system. | $44,000 | Assumes 200 LF hot gas ductwork, 5' dia., 11 ga., material portion | Means Constr Cost Data |
| Civil/site prep work | $29,000 | Includes survey, soil test, clear grub, fine grade 1 acre for Encertec process area, additional limestone storage area, and driveway/turnaround; includes excavation for footings | |
| **Total Cost of Site Preparation:** | **$73,000** | | |
| ***Foundations and Support*** | | | |
| Foundations, Footings, Driveways, & Turnarounds | $116,000 | Reinforced Concrete Pad with outer curbs/segregation curbs, equipment footings, and roadway/driveway access | Means Constr Cost Data |
| **Total Cost of Foundations/Support:** | **$116,000** | | |
| ***Electrical*** | | | |
| Yard and Local Lighting | $19,000 | Includes 4 pole mounted HPS at 40' high and 4 LPS area lights | Means Constr Cost Data |
| Insulation and Freeze Protection materials | $10,000 | Assumes water line insulation, FG w/ASJ insulation and heat tracing, material portion | |
| Associated Electrical Equipment not provided by Encertec | $40,000 | Includes MCC, motor starters, breakers, distribution panels, overload protection, and distribution wiring | Comparable Experience |
| **Total Cost of Electrical:** | **$69,000** | | |
| ***Safety*** | | | |
| Showers/Eyewash Stations | $2,000 | Assumes 2 combination ES/EW stations | Means Constr Cost Data |
| Safety Equipment | $25,000 | Misc spill protection and other safety equipment | Comparable Experience |
| **Total Cost of Safety:** | **$27,000** | | |
| ***Piping*** | | | |
| DLA piping materials for air, water, and limestone pneumatic conveyors | $11,000 | Piping for DLA system, schedule 40, and hangers 10' OC, air, water, and limestone pneumatic conveyors, material portion | Means Constr Cost Data and File quote, Tarmac |
| **Total Cost of Piping:** | **$11,000** | | |
| ***Controls Integration*** | | | |
| Controls Integration | $40,000 | Includes HMI/Graphics development, logic programming, BMS integration | Comparable Experience |
| **Total Cost of Controls Integration:** | **$40,000** | | |
| ***Ductwork*** | | | |
| Ductwork for DLA system, including interconnecting ductwork to/from DLA and ID fan, Y damper, and access doors | $108,000 | Assumes 400' hot gas ductwork, 5' dia, 11 ga., material portion | Means Constr Cost Data |
| Duct Insulation | $72,000 | Insulation, 4" thick, 1# density, FSK facing with exterior finish, material portion | |
| **Total Cost of Ductwork:** | **$180,000** | | |
| ***Spare Parts and Storage*** | | | |
| Initial Spare Parts Inventory | $40,000 | For DLA system | Comparable Experience |
| Limestone Storage Vessel | $45,000 | Provided by customer | TMTS file records re tank quote by Tarmac Internationa |
| **Total Cost of Spare Parts/Storage:** | **$85,000** | | |
| ***Freight*** | | | |
| Freight | $5,000 | Encertec equipment freight cost is included in their price; value shown is for remainder of equipment purchased | - |
| **Total Cost of Freight:** | **$5,000** | | |
| **Total DIC:** | **$606,000** | | |
| **Total Direct Cost:** | **$1,286,000** | **TDC=PEC+DIC** | |

## Table D.7-3a: HF/HCl Detailed Budetary Capital Cost Analysis for Dry Limestone Adsorber

**Per Encertec, Inc. estimate on a Dry Limestone Adsorber System for Carbo Ceramics, Toomsboro, GA, July, 9, 2009**

| Equipment | Budgetary Cost | Notes | Source |
|---|---|---|---|
| **Indirect Costs** | | | |
| ***Engineering*** | | | |
| Detailed Design Firm Assistance during start-up | $6,000 | - | 15% of Detailed Design Cost |
| APC Consultant Assistance during start-up | $37,000 | 160 hours at $200/hour for advance prep and on-site assistance plus $5k expenses | - |
| Detailed Design and Engineering Review of Detailed Design | $40,000 | - | Comparable Experience |
| **Total Cost of Engineering:** | **$83,000** | | |
| ***Start-Up Preparation*** | | | |
| Building Permit | $1,000 | - | Comparable Experience |
| Stack Testing | $20,000 | - | Comparable Experience |
| Other Testing | $10,000 | - | Comparable Experience |
| **Total Cost of Start-Up Preparation:** | **$31,000** | | |
| ***Contractor Fees*** | | | |
| Installation of Associated equipment and hardware not provided by Encertec | $45,000 | Includes crane rental, unload/transport of Encertec equipment, rigging, and installation for additional limestone storage tank | Comparable Experience |
| Installation of associated electrical equipment not provided/installed by Encertec | $50,000 | Feeds, Controls, and Interconnects | Comparable Experience |
| Project Management | $40,000 | Oversight of site preparation, equipment construction, and equipment startup | Comparable Experience |
| Labor for piping | $11,000 | - | Means Constr Cost Data |
| Labor for Ductwork and Insulation | $215,000 | - | Means Constr Cost Data |
| **Total Cost of Contractor Fees:** | **$361,000** | | |
| **Total Indirect Cost:** | **$475,000** | | |
| Contingency @ 15% | $264,150 | 15% of direct + indirect costs | Chapter 6 of Plant Design and Economics for Chemical Engineers, Peters and Timmerhaus, 4th Edition. |
| Cost of Lost Production | $525,000 | Assumes 1 week for tie-in and start-up | - |
| **Grand Total Budgeted Cost** | **$2,550,150** | | |

# Volume I, Attachment E –

# Proposed PSD Permit Language

# AIR QUALITY PERMIT

**Permit No.** **Effective Date**
**3295-165-0xxx-P-01-0**

In accordance with the provisions of the Georgia Air Quality Act, O.C.G.A. Section 12-9-1, et seq and the Rules, Chapter 391-3-1, adopted pursuant to and in effect under that Act,

Facility Name: **CARBO Ceramics**

Mailing Address: xxxxxxxxxxxx
Millen, Georgia 30442

is issued a Permit for the following:

Construction and Operation of a ceramic proppant facility including four (4) processing lines (see Appendix 1 for detailed emission unit listing).

Facility Location: xxxxxxxxxxxxxxx
Millen, Georgia 30442 (Jenkins County)

This Permit is conditioned upon compliance with all provisions of The Georgia Air Quality Act, O.C.G.A. Section 12-9-1, et seq, the Rules, Chapter 391-3-1, adopted and in effect under that Act, or any other condition of this Permit.

This Permit may be subject to revocation, suspension, modification or amendment by the Director for cause including evidence of noncompliance with any of the above; or for any misrepresentation made in Application No. 2xxxx dated August xx, 2011; any other applications upon which this Permit is based; supporting data entered therein or attached thereto; or any subsequent submittals or supporting data; or for any alterations affecting the emissions from this source.

This Permit is further subject to and conditioned upon the terms, conditions, limitations, standards, or schedules contained in or specified on the attached **45** pages, which pages are a part of this Permit.

Director
Environmental Protection Division

## 1.0 General Requirements

1.1 At all times, including periods of startup, shutdown, and malfunction, the Permittee shall maintain and operate this source, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Division which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection or surveillance of the source.

1.2 The Permittee shall not build, erect, install or use any article, machine, equipment or process the use of which conceals an emission which would otherwise constitute a violation of an applicable emission standard. Such concealment includes, but is not limited to, the use of gaseous diluents to achieve compliance with an opacity standard or with a standard that is based on the concentration of a pollutant in the gases discharged into the atmosphere.

1.3 The Permittee shall submit a Georgia Air Quality Permit application to the Division prior to the commencement of any modification, as defined in 391-3-1-.01(pp), which may result in air pollution and which is not exempt under 391-3-1-.03(6). Such application shall be submitted sufficiently in advance of any critical date involved to allow adequate time for review, discussion, or revision of plans, if necessary. The application shall include, but not be limited to, information describing the precise nature of the change, modifications to any emission control system, production capacity and pollutant emission rates of the plant before and after the change, and the anticipated completion date of the change.

1.4 Unless otherwise specified, all records required to be maintained by this Permit shall be recorded in a permanent form suitable for inspection and submission to the Division and shall be retained for at least five (5) years following the date of entry.

1.5 In cases where conditions of this Permit conflict with each other for any particular source or operation, the most stringent condition shall prevail.

## 2.0 Allowable Emissions

2.1 The Permittee shall fire boilers, spray dryers and calciners with natural gas or propane only.
[40 CFR 52.21-PSD/BACT, 391-3-1-.02(2)(g) subsumed]

2.2 VOC emissions from each process line’s spray dryers combined shall not equal or exceed the following limits:
[40 CFR 52.21-PSD/BACT]

Table 2-1: Annual VOC Emission Limits for Spray Dryers

| Source Description | Emission Unit ID No. | VOC Emission Limit, tons per 12 consecutive months |
|---|---|---|
| Spray Dryers Nos. 1 and 2 | SD01 and SD02 | 13.64 |
| Spray Dryers Nos. 3 and 4 | SD03 and SD04 | 13.64 |
| Spray Dryers Nos. 5 and 6 | SD05 and SD06 | 13.64 |
| Spray Dryers Nos. 7 and 8 | SD07 and SD08 | 13.64 |

2.3 The Permittee shall use the following technologies and/or procedures to comply with the relevant BACT emission limits:
[40 CFR 52.21-PSD/BACT]

a. $NO_x$ emissions:

i. Good Combustion Techniques (e.g., those such as equipment design, maintenance, and combustion process control such as appropriate combustion temperature, air to fuel ratio, staged and/or controlled combustion including water injection that can lower the $NO_x$ emissions.);

ii. Low $NO_x$ burner;

iii. Use of “clean fuels”, i.e., natural gas and propane.

b. Stack PM emissions:

i. Fabric filters/baghouses

c. Fugitive PM Emissions:

i. Wet suppression or timely cleanup;

ii. Enclosure if applicable;

iii. Covering if applicable.

d. $SO_2$ emissions:

i. Use of “clean fuels”, i.e., natural gas and propane.

ii. The use of a Wet Scrubber (SC01, SC02, SC03, and SC04) to control $SO_2$ emissions from the Calciners No. 1, 2, 3, and 4 (KLN1, KLN2, KLN3, and KLN4).

e. CO emissions

i. Equipment design, maintenance and combustion process control with good operating practices (i.e., adequate combustion temperature, residence time and/or excess air, etc.) that can lower the CO emissions.

The Permittee shall develop written operation, inspection and maintenance procedures and work practice requirements/plans with regard to paragraphs a, b, c, d and e of this condition. These procedures and requirements/plans shall be developed and implemented to ensure the satisfaction of the applicable operating requirements in this condition. All inspection and maintenance activities shall be recorded in a permanent form suitable for inspection and submission to the Division.

2.4 The Permittee shall implement measures to remove kaolin residue from plant roads, including, at a minimum, cleaning the roads at least weekly. The Permittee may use a vacuum street sweeper(s) and a truck washing station(s) to prevent accumulation of fugitive dusts on paved roads used to haul raw materials into the facility.
[40 CFR 52.21 - PSD/BACT]

2.5 The accumulated annual operating time for each of the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) shall not exceed 500 hours per year.
[40 CFR 52.21(j) – PSD/BACT, 391-3-1-.03(6)(b)(11)(v)(l)]

2.6 The Permittee shall comply with the provisions of 40 CFR, Part 60, Subpart UUU, *"Standards of Performance for Calciners and Dryers in Mineral Industries,"* for all subject equipment. In particular, sources subject to Subpart UUU, the Permittee shall comply with the following conditions for each calciner and dryer:
[40 CFR 60.732(a) & (b)]

The Permittee shall not discharge or cause the discharge into the atmosphere, from each of the processing equipment subject to 40 CFR, Part 60, Subpart UUU, any gases which:

a. Contain particulate matter in excess of 0.04 grains/dscf (0.092 grams/dscm) for calciners and dryers installed in series.

b. Contain particulate matter in excess of 0.025 grains/dscf (0.057 grams/dscm) for dryers.

c. Exhibit greater than 10 percent opacity.

2.7 Emissions from each of the listed process units shall not exceed the following pertinent BACT limits:
[40 CFR 52.21 - PSD/BACT]

**Table 2-2: BACT Emission Limits for Process Units**

| Operation | Emission | Emission Limit | Compliance Method | Averaging Time |
|---|---|---|---|---|
| Each calciner | $PM/PM_{10}$ | 0.010 gr/dscf | Method 201 or 201A, in conjunction with Method 202 | 3 hours |
| Each calciner | $PM_{2.5}$ | 0.01 gr/dscf | Method 201 or 201A, in conjunction with Method 202 | 3 hours |
| Each calciner | GHG | 36,715 tpy $CO_2e$ | Natural gas/LPG usage records and Division approved emission factors | 12-month rolling total |
| Each spray dryer | $PM/PM_{10}$ | 0.020 gr/dscf | Method 201 or 201A in conjunction with Method 202 | 3 hours |
| Each spray dryer | $PM_{2.5}$ | 0.0075 gr/dscf | Method 201 or 201A in conjunction with Method 202 | 3 hours |
| Each spray dryer | GHG | 28,760 tpy $CO_2e$ | Natural gas/LPG usage records and Division approved emission factors | 12-month rolling total |
| Each spray dryer and calciner | Visible | 10% opacity | COMS | 6-minute average |
| All emission units with baghouse control excluding spray dryers and calciners | $PM/PM_{10}$ | 0.010 gr/dscf | Method 201 or 201A in conjunction with Method 202 | 3 hours |
| | $PM_{2.5}$ | 0.005 gr/dscf GP01 – GP04 | Method 201 or 201A in conjunction with Method 202 | 3 hours |

| Operation | Emission | Emission Limit | Compliance Method | Averaging Time |
|---|---|---|---|---|
| | | 0.005 gr/dscf KAE1 – KAE4 | Method 201 or 201A in conjunction with Method 202 | 3 hours |
| | | 0.005 gr/dscf RRL1 – RRL2 | Method 201 or 201A in conjunction with Method 202 | 3 hours |
| | Visible | 7% opacity | Method 9 | 6-minute average |
| All fugitive PM sources | Fugitive PM | 10% opacity | Method 22 and/or Method 9 | Per Method 22 or Method 9 |
| Each calciner | $SO_2$ | 34.25 lb/hr | Method 6 or 6C; Daily Analysis of Kaolin Clay Sulfur Content | 3 hours; daily average |
| | $NO_x$ | 121 lbs/hr | Method 7 or 7E | 3 hours |
| | CO | 24.7 lbs/hr | Method 10 | 3 hours |
| Each spray dryer | $NO_x$ | 8.3 lbs/hr | Method 7 or 7E | 3 hours |
| | CO | 16.6 lbs/hr | Method 10 | 3 hours |
| 9.8 MMBtu/hr natural gas fired boiler No. 1, 2, 3 and 4 | $NO_x$ | 12 ppmv@ 3% $O_2$ at dry standard conditions | Manufacturer’s written guarantee | N/A |
| 9.8 MMBtu/hr natural gas fired boiler No. 1, 2, 3 and 4 | GHG | 5,997 tpy $CO_2e$ | Natural gas/LPG usage records and Division approved emission factors | 12-month rolling total |
| Emergency diesel generators/engines Nos. 1, 2, 3 and 4 | $PM/PM_{10}$ | 0.055 g/bhp-hr | Operation and maintenance according to manufacture’s written specifications | N/A |
| Emergency diesel generators/engines Nos. 1, 2, 3 and 4 | $PM_{2.5}$ | 0.055 g/bhp-hr | Operation and maintenance according to manufacture’s written specifications | N/A |

| Operation | Emission | Emission Limit | Compliance Method | Averaging Time |
|---|---|---|---|---|
| Emergency diesel generators/engines Nos. 1, 2, 3 and 4 | GHG | 844 tpy $CO_2e$ | Monthly operating records and Division approved emission factors | 12-month rolling total |
| Emergency diesel generators/engines Nos. 1, 2, 3 and 4 | $SO_2$ | 15 ppm sulfur in fuel | Verification of compliance for each diesel fuel received | N/A |
| Emergency diesel generators/engines Nos. 1, 2, 3 and 4 | $NO_x$ | 4.77 g/bhp-hr | Operation and maintenance according to manufacture's written specifications | N/A |
| Emergency diesel generators/engines Nos. 1, 2, 3 and 4 | CO | 2.6 g/bhp-hr | Operation and maintenance according to manufacture's written specifications | N/A |

2.8 The Permittee shall comply with the provisions of 40 CFR, Part 63, Subpart ZZZZ, "*National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*" for all subject equipment. Each of the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) shall be operated and maintained according to the manufacturer's written specifications/instructions or procedures developed by the Permittee that are approved by the engine manufacturer, over the entire life of the engines.
[40 CFR 52.21 PSD/BACT, 40 CFR 60.4206 & 60.4211(a), 40 CFR 63, Subpart ZZZZ]

2.9 Each of the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) shall be certified for emission standards from new nonroad compression ignition engines specified in 40 CFR 89.112 and 40 CFR 89.113 for the applicable model year and engine rated power.
[40 CFR 52.21 PSD/BACT, 40 CFR 60.4205 subsumed, 60.4211(b)(1) and 60.4211(c)]

2.10 The Permittee shall operate each of the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) using diesel fuel that has a maximum sulfur content of 15 ppm (0.0015% by weight).
[40 CFR 52.21 PSD/BACT subsumes 40 CFR 60.4207 & 60.4207(b)]

2.11 The Permittee shall 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)*".
[40 CFR 63, Subpart B]

2.12 Emissions of hazardous air pollutants (HAPs) shall not exceed the following 112(g) case-by-case MACT emission standards:
[40 CFR 63.40 through 63.44/112(g) case-by-case MACT]

Table 2-3: 112(g) Case-By-Case MACT Emission Limit

| Affected Source | HAP | Emission Limit | Averaging Time | Compliance Method |
|---|---|---|---|---|
| Spray Dryer Nos. 1 & 2 | Methanol | 10.04 tons per 12-rolling months | 12-month rolling total | Mass balance based on methanol-containing additive input records and MSDS |
| Spray Dryer Nos. 3 & 4 | | 10.04 tons per 12-rolling months | | |
| Spray Dryer Nos. 5 & 6 | | 10.04 tons per 12-rolling months | | |
| Spray Dryer Nos. 7 & 8 | | 10.04 tons per 12-rolling months | | |
| Each Calciner | HCl | 1.98 lbs/hr | 3 hours | Method 26 or 26A of 40 CFR Part 60, Appendix A or Method 320 of 40 CFR Part 63, Appendix A |
| | | 8.70 tons per year | 12-month rolling | Calculation based on annual testing result & production records |
| | HF | 8.70 lbs/hr | 3 hours | Method 26 or 26A of 40 CFR Part 60, Appendix A or Method 320 of 40 CFR Part 63, Appendix A |
| | | 37.92 tons per year | 12-month rolling | Calculation based on annual testing result & production records |

2.13 The Permittee shall comply with the provisions of 40 CFR, Part 60, Subpart OOO, *"Standards of Performance for Nonmetallic Mineral Processing Plants"* as amended on April 28, 2009 for all subject equipment. In particular, for sources subject to Subpart OOO that were constructed, modified, or reconstructed on or after April 22, 2008, the Permittee shall comply with the following for each crusher, grinding mill, screening operation, bucket elevator, belt conveyor, bagging operation, storage bin, silo, enclosed truck or railcar loading station or any other affected facilities as defined in 40 CFR 60.670 and 60.671:
[40 CFR 60.672 (a) thru (f)]

The Permittee shall not discharge or cause the discharge into the atmosphere, from each affected facility/source subject to 40 CFR 60 Subpart OOO, any

a. fugitive emissions (including those escaping capture systems) exhibiting greater than 7 percent opacity except for any crusher that does not use a capture system, which shall not exhibit fugitive emissions greater than 12 percent opacity.

b. stack emissions from capture systems feeding a dry control device which contain particulate matter in excess of 0.032 g/dscm (0.014 grains/dscf) except for individually enclosed storage bins.

For any transfer point on a conveyor belt or any other affected facility enclosed in a building, each enclosed affected facility shall comply with the emission limits in paragraphs (a) and (b) of this condition, **or** the building shall comply with the following emission limits:

c. Fugitive emissions from the building openings (except vents with mechanically induced air flow for exhausting PM emissions from the building) shall not exceed 7 percent opacity.

d. PM emissions from any building vent with mechanically induced air flow for exhausting PM emissions shall not contain particulate matter in excess of 0.032 g/dscm (0.014 grains/dscf).

Note:

- Truck dumping of nonmetallic minerals into any screening operation, feed hopper, or crusher is exempt from the requirements of this condition

- Any dry control device that controls emissions from an individually enclosed storage bin is exempt from the stack PM concentration limit (and associated performance testing) in paragraph (b) but shall not exhibit greater than 7 percent stack opacity.

2.14 The accumulated maintenance checks and readiness testing time for each of the stationary emergency diesel generators/engines shall not exceed 100 hours per year. The Permittee may petition the Division for approval of additional hours for maintenance checks and readiness testing, but a petition is not required if the Permittee 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, maintenance checks, and readiness testing is prohibited.
[40 CFR 60.4211(e)]

2.15 Each of the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) and any associated control devices if applicable, shall be installed and configured according to the manufacturer's written instructions.
[40 CFR 60.4211(c)]

2.16 The Permittee shall operate each of the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) 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. It 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.
[40 CFR 63.6590(b)(i)]

2.17 The Permittee shall submit an Initial Notification for each of the stationary emergency diesel generators/engines Nos. 1, 2, 3, and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3, and EDG4) no later than 120 days after the engines become subject to 40 CFR Part 63, Subpart ZZZZ. The notification shall include the information required in 40 CFR 63.9(b)(2)(i) through (v), and a statement that the engine has no additional requirements and explain the basis of the exclusion.
[40 CFR 63.6590(b)(i), 63.6645(f)]

2.18 The Permittee shall operate each of the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) for a maximum of 500 hours per 12 month rolling total.
[40 CFR 52.21 PSD/BACT]

2.19 The Permittee shall comply with the provisions of Georgia Air Quality Control Rule 391-3-1-.02(2)(p), "Particulate Emissions from Kaolin and Fullers Earth Processes". The Permittee shall not discharge, or cause the discharge from any source, particulate matter emissions in total quantities equal to or exceeding the allowable rates specified in the below equations, unless otherwise specified in this Permit.
[391-3-1-.02(2)(p)]

$E = 3.59P^{0.62}$, for equipment with process input weight rate up to and including 30 tons per hour;
$E = 17.31P^{0.16}$, for equipment with process input weight rate above 30 tons per hour.

Where; E = The allowable emission rate is in pounds per hour.
P = The process input weight rate is in tons per hour.

2.20 The Permittee shall not discharge or cause the discharge into the atmosphere from all process equipment any gases which exhibit visible emissions the opacity of which is equal to or greater than 40 percent unless otherwise specified.
[391-3-1-.02(2)(b)1]

2.21 The Permittee shall not discharge or cause the discharge into the atmosphere from Boiler Nos. BLR1, BLR2, BLR3 or BLR4 any gases which exhibit 20% opacity or greater, except for one six-minute period per hour of not more than 27% opacity.
[391-3-1-.02(2)(d)]

2.22 The Permittee shall not cause, let, suffer, permit or allow the emission of fly ash and/or other particulate matter from Boiler Nos. BLR1, BLR2, BLR3 or BLR4 in amounts equal to or exceeding the allowable rate specified in Georgia Rule 391-3-1-.02(2)(d).

2.23 The Permittee shall not burn fuel containing
[391-3-1-.02(2)(g)]

a. more than 2.5 percent sulfur, by weight, in any fuel burning sources rated below 100 million BTU's of heat input per hour;

b. more than 3 percent sulfur, by weight, in any fuel burning sources rated at or above 100 million BTU's of heat input hour.

2.24 The Permittee shall not discharge or cause the discharge into the atmosphere from <u>each</u> Direct-fired rotary calciner (KLN1, KLN2, KLN3, and KLN4) $H_2SO_4$ emissions in excess of 0.39 pounds per hour.
[40 CFR 52.21 – PSD Avoidance]

2.26 The Permittee shall operate all particulate matter controlling baghouses at all times that associated equipment is being operated.
[391-3-1-.03(2)(c)]

2.27 The Permittee shall maintain an adequate inventory of replacement filter bags for all baghouses.
[391-3-1-.03(2)(c)]

2.28 The Permittee shall implement measures, including fencing, sign postings, and routine patrols to restrict public access along the entire Source Boundary utilized in the ambient impact assessment/modeling. Signs shall be posted along the property boundary no further than 100 feet apart, and patrols shall be conducted at least once weekly on boundaries that have public access. The Permittee shall maintain a written plan outlining such measures, and shall be updated as required. The Division reserves the right to require enhancement of the plan.
[40 CFR 52.21-PSD/BACT]

**3.0 Fugitive Emissions**

3.1 The Permittee shall take all reasonable precautions with any operation, process, handling, transportation, or storage facilities to prevent fugitive emissions of air contaminants.

**4.0 Process & Control Equipment**

4.1 Routine maintenance shall be performed on all air pollution control equipment. Maintenance records shall be in a form suitable for inspection or submittal to the Division.

**5.0 Monitoring**

5.1 Any continuous monitoring system required by the Division and installed by the Permittee shall be in continuous operation and data recorded during all periods of operation of the affected facility except for continuous monitoring system breakdowns and repairs. Monitoring system response, relating only to calibration checks and zero and span adjustments, shall be measured and recorded during such periods. Maintenance or repair shall be conducted in the most expedient manner to minimize the period during which the system is out of service.

**Specific Monitoring Requirements**

5.2 By the deadlines specified in the table below, the Permittee shall install, calibrate, maintain, and operate a system to continuously monitor and record the indicated emissions or parameters on the following equipment listed. Each system shall meet the applicable performance specification(s) of the Division's monitoring requirements and be operated in a manner sufficient to demonstrate continuous compliance with the applicable emission standards in this permit.
[391-3-1-.02(6)(b)1, 40 CFR 60.735(b)]

**Table 5-1: Monitoring Requirements and Deadlines**

| Emission Unit | Emission Unit ID | Emissions or Parameters | Deadline to Install | Continuous Monitoring System Installation Location |
|---|---|---|---|---|
| Calciner No. 1 | KLN1 | Scrubber Pressure Drop | Upon startup | Wet Scrubber SC01 |
| Calciner No. 1 | KLN1 | Scrubber Flow rate | Upon startup | Wet Scrubber SC01 |
| Calciner No. 1 | KLN1 | Scrubber pH | Upon startup | Wet Scrubber SC01 |
| Calciner No. 2 | KLN2 | Scrubber Pressure Drop | Upon startup | Wet Scrubber SC02 |
| Calciner No. 2 | KLN2 | Scrubber Flow rate | Upon startup | Wet Scrubber SC02 |
| Calciner No. 2 | KLN2 | Scrubber pH | Upon startup | Wet Scrubber SC02 |
| Calciner No. 3 | KLN3 | Scrubber Pressure Drop | Upon startup | Wet Scrubber SC03 |
| Calciner No. 3 | KLN3 | Scrubber Flow rate | Upon startup | Wet Scrubber SC03 |
| Calciner No. 3 | KLN3 | Scrubber pH | Upon startup | Wet Scrubber SC03 |
| Calciner No. 4 | KLN4 | Scrubber Pressure Drop | Upon startup | Wet Scrubber SC04 |

| Emission Unit | Emission Unit ID | Emissions or Parameters | Deadline to Install | Continuous Monitoring System Installation Location |
|---|---|---|---|---|
| Calciner No. 4 | KLN4 | Scrubber Flow rate | Upon startup | Wet Scrubber SC04 |
| Calciner No. 4 | KLN4 | Scrubber pH | Upon startup | Wet Scrubber SC04 |
| Spray Dryer No. 1 | SD01 | Opacity (COMS) | Upon startup | Outlet of the Spray Dryer No. 1 Baghouses (SB01, SB02, SB03 and SB04)/Stack S002 |
| Spray Dryer No. 2 | SD02 | Opacity (COMS) | Upon startup | Outlet of the Spray Dryer No. 2 Baghouses (SB05, SB06, SB07 and SB08)/Stack S003 |
| Spray Dryer No. 3 | SD03 | Visible (COMS) | Upon startup | Outlet of the Spray Dryer No. 3 Baghouses (SB09, SB10, SB11 and SB12)/Stack S010 |
| Spray Dryer No. 4 | SD04 | Visible (COMS) | Upon startup | Outlet of the Spray Dryer No. 4 Baghouses (SB13, SB14, SB15 and SB16)/Stack S011 |
| Spray Dryer No. 5 | SD05 | Visible (COMS) | Upon startup | Outlet of the Spray Dryer No. 5 Baghouses (SB17, SB18, SB19 and SB20)/Stack S017 |
| Spray Dryer No. 6 | SD06 | Visible (COMS) | Upon startup | Outlet of the Spray Dryer No. 6 Baghouses (SB21, SB22, SB23 and SB24)/Stack S018 |
| Spray Dryer No. 7 | SD07 | Visible (COMS) | Upon startup | Outlet of the Spray Dryer No. 7 Baghouses (SB25, SB26, SB27 and SB28)/Stack S024 |
| Spray Dryer No. 8 | SD08 | Visible (COMS) | Upon startup | Outlet of the Spray Dryer No. 8 Baghouses (SB29, SB30, SB31 and SB32)/Stack S025 |

5.3 The Permittee shall install a device to continuously monitor the temperature at the inlet of each baghouse that receive gases at a temperature higher than ambient air, and record the time and date of each incident when the temperature exceeds the filter bag design temperature. In lieu of monitoring temperature at the baghouse inlet, the Permittee may monitor a surrogate temperature (e.g., clay temperature or calciner/dryer outlet temperature). For each baghouse monitored by a surrogate temperature, the Permittee shall determine the equivalent filter bag design temperature and record each incident when the surrogate temperature exceeds the equivalent filter bag design temperature. The Permittee shall record the filter bag design temperature or the equivalent filter bag design temperature for each baghouse listed. Such records and any supporting calculations shall be made available for inspection.
[391-3-1-.02(6)(b)1]

5.4 The Permittee shall perform a check of visible emissions from all baghouses (including process baghouses) controlling emissions from sources listed in Appendix 1 of this permit amendment, and from sources added or replaced in accordance with this permit and Rule 391-3-1-.03. Emission units monitored using COMS and emission units controlled by a wet-process control device (such as a wet scrubber) are exempt from this condition. Additionally, baghouses controlling emissions from silos with dedicated bin vents, wet screening operations, bucket elevators, screw conveyors, bagging operations, and pneumatic conveyors are exempt from this condition. The Permittee shall retain a record in a daily visible emissions (VE) log suitable for inspection or submittal. The check shall be conducted at least once for each day or portion of each day of operation using procedures a through d below except when atmospheric conditions or sun positioning prevents any opportunity to perform the daily VE check. The Permittee shall schedule a daily VE check only when an emission unit is in operation.
[391-3-1-.02(6)(b)1]

a. Determine, in accordance with the procedures specified in paragraph d of this condition, if visible emissions are present at the discharge point to the atmosphere from each of the sources and record the results in the daily VE log. For sources that exhibit visible emissions, the Permittee shall comply with paragraph b or c of this condition.

b. For each source determined to be emitting visible emissions, the Permittee shall determine whether the emissions equal or exceed the opacity action level using the procedure specified in paragraph d of this condition, except that the person performing the determination shall have received additional training acceptable to the Division to recognize the appropriate opacity level and the determination shall cover a period of 3 minutes. The opacity action level is 5 percent. The results shall be recorded in the daily VE log. For sources that exhibit visible emissions of greater than or equal to the opacity action level, the Permittee shall comply with paragraph c of this condition.

c. For each source that requires action in accordance with paragraphs a or b of this condition, the Permittee shall determine the cause of the visible emissions and correct the problem in the most expedient manner possible. The Permittee shall note the cause of the visible emissions, the pressure drop, any other pertinent operating parameters, and the corrective action taken in the maintenance log.

d. The person performing the determination shall stand at a distance of at least 15 feet which is sufficient to provide a clear view of the plume against a contrasting background with the sun in the 140° sector at his/her back. Consistent with this requirement, the determination shall be made from a position such that the line of vision is approximately perpendicular to the plume direction. Only one plume shall be in the line of sight at any time when multiple stacks are in proximity to each other.

e. When a quarterly 30-minute visible emissions inspection required by Condition 5.9 has been conducted on any affected baghouse during the day, no daily VE check on the same baghouse is necessary for that day.

5.5 The Permittee shall develop and implement a Preventive Maintenance Program for the baghouses specified in Condition 5.4. The program shall be subject to review and modification by the Division and shall include the pressure drop ranges that indicate proper operation for each baghouse. At a minimum, the following operation and maintenance checks shall be made on at least a weekly basis, and a record of the findings and corrective actions taken shall be kept in a maintenance log.
[391-3-1-.02(6)(b)1]

a. Record the pressure drop across each baghouse and ensure that it is within the appropriate range.

b. For baghouses equipped with compressed air cleaning systems, check the system for proper operation. This may include checking for low pressure, leaks, proper lubrication, and proper operation of timer and valves.

c. For baghouses equipped with reverse air cleaning systems, check the system for proper operation. This may include checking damper, bypass, and isolation valves for proper operation.

d. For baghouses equipped with shaker cleaning systems, check the system for proper operation. This may include checking shaker mechanism for loose or worn bearings, drive components, mountings, proper operation of outlet/isolation valves, and proper lubrication.

e. Check dust collector hoppers and conveying systems for proper operation.

5.6 Once each day or portion of each day of operation, the Permittee shall inspect all stack emission points from the emission units listed in Appendix 1 for which no air pollution control device (APCD) is utilized. Boilers, wet processes, stationary engines, and emission units monitored in accordance with conditions 5.2 or 5.4 are exempt from this condition. The inspection shall be conducted by performing a walkthrough of the facility and noting the occurrence of the following in a daily VE log:

a. Any visible emissions.

b. Any mechanical failure or malfunction that results in increased air emissions.

For each emission point noted with visible emissions, mechanical problems or malfunctions, the Permittee shall take corrective action in the most expedient manner possible and re-inspect the unit within 24 hours to verify that no visible emissions exist. Failure to eliminate the visible emissions or to correct the mechanical failure or

malfunction specified in paragraph a. and paragraph b within 24 hours shall constitute an excursion.
[391-3-1-.02(6)(b)1]

5.7 When controlling fugitive dust via weekly cleaning, the use of a vacuum street sweeper(s) or a truck washing station(s) as specified in Condition 2.4, the Permittee shall keep operation records of the control equipment involved. Description of inspection, maintenance, malfunction and corrections taken shall be included with the records.
[391-3-1-.02(6)(b)1]

5.8 <u>Each</u> of the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) shall 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. The Permittee shall record the time of operation and the reason the engine/generator was in operation during that time.
[40 CFR 60.4209(c), 60.4214(b) and 40 CFR 52.21]

5.9 The Permittee shall conduct quarterly 30-minute visible emissions inspections using EPA Method 22 for any affected facility that is subject to 40 CFR Part 60, Subpart OOO, constructed, modified, or reconstructed on or after April 22, 2008, and uses a baghouse to control emissions. The Method 22 test shall be conducted while the baghouse is operating. The test is successful if no visible emissions are observed. If any visible emissions are observed, the Permittee shall initiate corrective action within 24 hours to return the baghouse to normal operation. The Permittee shall record each Method 22 test, including the date and any corrective actions taken, in the logbook required under 40 CFR 60.676(b).

The Permittee may establish a different baghouse-specific success level for the visible emissions test (other than no visible emissions) by conducting a PM performance test according to Condition 6.6 per 40 CFR 60.675(b) simultaneously with a Method 22 to determine what constitutes normal visible emissions from that affected facility's baghouse when it is in compliance with the applicable PM concentration limit in Condition 2.13 per Table 2 of 40 CFR part 60, Subpart OOO as amended on April 28, 2009. Once established, the revised visible emissions success level shall be incorporated into the permit for the affected facility.

As an alternative to the quarterly Method 22 inspections, the Permittee may use a bag leak detection system that is installed, operated, and maintained according to per 40 CFR 60.674(d).
[40 CFR 60.674(c) and (d)]

5.10 The Permittee shall monitor emissions of nitrogen oxides from the exhaust gases from each direct-fired rotary calciner stack (Stack ID Nos. S005, S016, S026, and S037) for each week or portion of week of operation of each calciner using the following procedures:
[391-3-1-.02(6)(b)1]

a. Within 60 days of the issuance of this permit, the Permittee shall begin to conduct measurements of $NO_x$ and oxygen ($O_2$) concentration in the exhaust gas of each existing calciner. Same measurements shall be conducted on each new calciner within 60 days of the commence of operation of the calciner. The initial measurement period shall consist of three (3) test runs each thirty (30) minutes in duration. Subsequent measurement periods shall consist of one (1) test run thirty minutes in duration.

b. Measurements of $NO_x$ and $O_2$ shall be conducted using the procedures of the American Society for Testing and Materials Standard (ASTM) Test Method for Determination of $NO_x$, Carbon Monoxide (CO), and Oxygen Concentrations in Emissions from Natural Gas-Fired Reciprocating Engines, Combustion Turbines, Boilers, and Process Heaters Using Portable Analyzers, ASTM D 6522; or procedures of Gas Research Institute Method GRI-96/0008, EPA/EMC Conditional Test Method (CTM-30) Determination of Nitrogen Oxides, Carbon Monoxide, and Oxygen Emissions from Natural Gas-Fired Engines, Boilers and Process Heaters Using Portable Analyzers, or Procedures of EPA Reference Methods 7E and 3A, or other methods and procedures as approved by the Division.

c. $NO_x$ emissions rate (pounds per hour) for all emissions units shall be determined using the following equation;

where:

$$\underline{E = K \times C_d \times Q_{std}}$$

E = Mass emissions of nitrogen oxides (lb/hr);

K = Conversion factor for $NO_x$ = $1.194 \times 10^{-7}$ ([lb/scf]/ppm)

$C_d$ = Concentration of $NO_x$ (ppm by volume, dry basis)

$Q_{std}$ = Standard hourly flow rate from Calciner exhaust as measured by Method 2, dscfh

(Note: In lieu of a standard hourly flow rate from the Calciner exhaust measured by Method 2, data from a continuous flow monitor, installed as per

Condition 5.11 of this permit, taken concurrently with the $NO_x$ measurements can be used).

d. Following the initial measurement, the Permittee shall conduct a measurement each calendar week or portion of calendar week for each Calciner. Weekly measurements shall continue until three (3) consecutive weekly measurements are each less 90 lbs/hr. Following three (3) consecutive weekly measurements that are each less than 90 lbs/hr, the measurements may be performed at a frequency of one per calendar quarter (quarters ending March 31, June 30, September 30, and December 31).

e. Following any quarterly measurement that is greater than 90 lbs/hr, the Permittee shall conduct a new measurement within one unit operating day. Following this measurement, subsequent measurements shall be conducted weekly and quarterly measurements may be resumed as prescribed by Condition 5.2(d).

f. A record of $NO_x$ monitoring shall be kept in a form suitable for inspection or submittal for a period of five (5) years. The record shall at a minimum contain the cause and corrective action for all excursions and, for each test run, the mass emission rate and concentration of NOx, the concentration of oxygen, measured stack gas flow rate.

g. A unit operating day shall be defined as any day that the unit is operated for more than 30 minutes between 12:00 midnight and the following midnight.

h. Any measured $NO_x$ emissions exceeding 121 lbs/hr shall be reported to the Division in writing with 15 working days of measurement. The report shall include Calciner exhaust flow rate and Calciner feed rate during the $NO_x$ measurement.

5.11 In lieu of the exhaust flow rate measured by Method 2 for each Calciner as per Condition 5.10, the Permittee may install, calibrate, maintain, and operate according to all applicable performance specifications a flow monitor to continuously measure the exhaust from each Calciner.
[391-3-1-.02(6)(b)1]

## 6.0 Performance Testing

6.1 The Permittee shall cause to be conducted a performance test at any specified emission point when so directed by the Division. The following provisions shall apply with regard to such tests:

a. All tests shall be conducted and data reduced in accordance with applicable procedures and methods specified in the Division's Procedures for Testing and Monitoring Sources of Air Pollutants.

b. All test results shall be submitted to the Division within sixty (60) days of the completion of testing.

c. The Permittee shall provide the Division thirty (30) days prior written notice of the date of any performance test(s) to afford the Division the opportunity to witness and/or audit the test, and shall provide with the notification a test plan in accordance with Division guidelines.

d. All monitoring systems and/or monitoring devices required by the Division shall be installed, calibrated and operational prior to conducting any performance test(s). For any performance test, the Permittee shall, using the monitoring systems and/or monitoring devices, acquire data during each performance test run. All monitoring system and/or monitoring device data acquired during the performance testing shall be submitted with the performance test results.

6.2 Performance and compliance tests shall be conducted and data reduced in accordance with applicable procedures and methods specified in the Division's Procedures for Testing and Monitoring Sources of Air Pollutants. The methods for the determination of compliance with emission limits listed under Section 2.0 which pertain to the emission units listed in Appendix 1 are as follows:

a. Method 6 or 6C for the determination of the concentration of $SO_2$.

b. Method 7 or 7E for the determination of the concentration of $NO_x$.

c. Method 10 for the determination of concentration of CO.

d. Method 5 for the determination of PM emissions.

e. Method 201 or 201 A in conjunction with Method 202 for the determination of $PM_{10}$ and $PM_{2.5}$ emissions.

f. Method 19, when applicable, to convert if necessary PM, CO, $SO_2$ and $NO_x$ concentrations (e.g., gr./dscf for PM, ppm for gaseous pollutants), as determined using other methods specified in this section, to emission rates (e.g., lb/MMBtu).

g. Method 26 or 26A of 40 CFR part 60, Appendix A or Method 320 of 40 CFR Part 63, Appendix A for the determination of HCl and HF emissions.

h. Method 5I for determination of Particulate Matter concentration for sources operating less than 1 hour for sources as allowed by NSPS 40 CFR 60 Subpart OOO.

i. Method 8 for determination of sulfuric acid mist emissions.

Minor changes in methodology may be specified or approved by the Director or his designee when necessitated by process variables, changes in facility design, or improvement or corrections that, in his opinion, render those methods or procedures, or portions thereof, more reliable.
[391-3-1-.02(3)(a)]

**Specific Testing Requirements**

6.3 In accordance with the provisions of 40 CFR 60.8, for any equipment constructed or modified at the facility, the Permittee shall conduct a performance test within 60 days after achieving the maximum production rate at which the equipment will be operated, but no later than 180 days after initial startup, unless the equipment is specifically exempt from testing in the applicable subpart of 40 CFR Part 60. The tests shall be conducted using the test methods and procedures specified in condition 6.2. The specific pollutants, sample volumes, run times, and other testing parameters shall be as specified in the applicable subpart of 40 CFR Part 60.
[40 CFR 60.8]

6.4 Within 60 days after achieving the maximum production rate at which Process Line Nos. 1, 2, 3 and 4 will be operated, but no later than 180 days of the initial startup of the affected source(s), the Permittee shall conduct performance tests as specified in the following table:
[391-3-1-.02(3) and 3-1-3-1-.03(2)(c)]

**Table 6-1: Initial BACT & Case-By-Case MACT Performance Tests**

| Emission Unit | Emission Unit ID | Emissions | Testing Method |
|---|---|---|---|
| Rotary Calciner No. 1<br>Rotary Calciner No. 2<br>Rotary Calciner No. 3<br>Rotary Calciner No. 4 | KLN1<br>KLN2<br>KLN3<br>KLN4 | CO | Method 10 |
| | | $NO_x$ | Method 7 or 7E |
| | | $SO_2$ | Method 6 or 6C |
| | | PM | Method 5 |
| | | $PM_{10}$, $PM_{2.5}$ | Method 201/201A with Method 202 |
| | | HCl, HF | Method 26/26A or Method 320 |
| Spray Dryer No. 1<br>Spray Dryer No. 2<br>Spray Dryer No. 3<br>Spray Dryer No. 4<br>Spray Dryer No. 1<br>Spray Dryer No. 2<br>Spray Dryer No. 3<br>Spray Dryer No. 4 | SD01<br>SD02<br>SD03<br>SD04<br>SD05<br>SD06<br>SD07<br>SD08 | CO | Method 10 |
| | | $NO_x$ | Method 7 or 7E |
| | | PM | Method 5 |
| | | $PM_{10}$, $PM_{2.5}$ | Method 201/201A with Method 202 |
| Stack emission sources excluding calciners, and silos with dedicated bin vents | (refer to Appendix 1) | Visible Emissions | Method 9 or COMS |
| | | PM | Method 5 |
| | | $PM/PM_{10}$ | Method 201/201A with Method 202 |
| Silos with dedicated bin vents | (refer to Appendix 1) | Visible emissions | Method 9 |
| All existing fugitive emission sources | (refer to Appendix 1) | Visible Emissions | Method 22 or Method 9 |

a. Suitable methods shall be used to determine the calciner feed rate for each run.

b. The visible emissions from each spray dryer and calciner during the Method 5 performance tests shall be determined using COMS following the requirements of 40 CFR 60.11(e) or of relevant State rules.

c. The duration of the Method 9 test shall be 3 hours (thirty 6-minute averages), except that the duration of the test for sources subject to 40 CFR Part 60, Subpart OOO as amended on April 28, 2009:

   i. shall be 1 hour (ten 6-minute averages) for stack visible emissions from any baghouse that controls PM emissions only from an individual enclosed storage bin per 40 CFR 60.675(c)(2)(i).

   ii. may be reduced to the duration the affected facilities operates (but no less than 30 minutes) for baghouses controlling storage bins or enclosed truck or railcar loading stations that operate for less than 1 hour at a time per 40 CFR 60.675((c)(2)(ii).

   iii. shall be 30 minutes (five 6-minute averages) for fugitive PM emissions from any affected facilities subject to the opacity limit(s) of 40 CFR Part 60, Subpart OOO as amended on April 28, 2009.

d. For the purpose of this condition, calciner operating day means a 24-hour period between 12:00 midnight and the following midnight during which the calciner is operated.

e. Emissions control technologies, procedures and measurements utilized by any source(s) during the performance testing shall be recorded in detail and included with the pertinent test report(s).

f. If a listed source has been tested previously and the testing result(s) has been accepted by the Division, this source is exempt from the testing requirement(s) in this condition for the same pollutants.

g. During the performance tests for $SO_2$ and $PM_{10}$ for Calciners Nos. 1, 2, 3, and 4 (KLN1, KLN2, KLN3, and KLN4), the average pressure drop across the wet scrubbers (SC01, SC02, SC03, and SC04) and the flow rates for the wet scrubbers of the scrubbant shall be continuously monitored in order to develop exceedance thresholds per Condition No. 7.3b.x and 7.3b.xi and the excursion threshold per Condition No. 7.3.c.v.

h. During the performance tests for $SO_2$ for Calciners Nos. 1, 2, 3, and 4 (KLN1, KLN2, KLN3, and KLN4), the overall $SO_2$ control efficiency (OCE) of the wet scrubbers (SC01, SC02, SC03, and SC04) shall be determined for use in Condition No. 7.20.

i. The $SO_2$ test required by Condition 6.4 for Calciners Nos. 1, 2, 3, and 4 (KLN1, KLN2, KLN3, and KLN4) should be conducted with the scrubbant liquid at a minimum pH of 6.0.

6.5 Within 60 days after achieving the maximum production rate at which each of the new spray dryers (Emission Unit ID Nos. SD01 through SD08) and the new calciners (Emission Unit ID Nos. KLN1 through KLN4) will be operated, but no later than 180 days of the initial startup of the sources, the Permittee shall determine compliance with the NSPS Subpart UUU PM and visible emission limits in Condition 2.6 under 40 CFR 60.732 as follows:
[40 CFR 60.736]

a. Method 5 or Method 17 shall be used to determine the PM concentration. The sampling time and volume for each test run shall be at least 2 hours and 1.70 dscm (60 dscf).

b. Method 9 and the procedures in 40 CFR 60.11, including the use of COMS in lieu of Method 9 if preferred, shall be used to determine opacity from stack emissions.

6.6 Within 60 days after achieving the maximum production rate at which Process Line Nos. 1, 2, 3 and 4 will be operated, but no later than 180 days of the initial startup of the affected source(s), the Permittee shall conduct performance tests as required below:
[40 CFR 60.675(a), (b), (c), (d) and (e)]

a. Determining compliance with the NSPS Subpart OOO visible emission standards in Condition 2.13 using Method 9 and the procedures 40 CFR 60.11, with the following additions:

i. The minimum distance between the observer and the emission source shall be 4.57 meters (15 feet).

ii. The observer shall, when possible, select a position that minimizes interference from other fugitive emission sources (e.g., road dust). The required observer position relative to the sun (Method 9, Section 2.1) shall be followed.

iii. When a water mist caused by wet dust suppression/water spray is present, the observation of fugitive emissions is to be made at a point in the plume where the mist is no longer visible.

iv. In determining compliance with the opacity limit for stack emissions from any baghouse that controls emissions only from an individual enclosed storage bin under 40 CFR §60.672(f) using Method 9, the duration of the Method 9 observations shall be 1 hour (ten 6-minute averages).

v. The duration of the Method 9 observations may be reduced to the duration the affected facility operates (but not less than 30 minutes) for baghouses that control storage bins or enclosed truck or railcar loading stations that operate for less than 1 hour at a time.

vi. The duration of the Method 9 observations must be 30 minutes (five 6-minute averages) for fugitive PM emissions from any affected facilities subject to the opacity limit(s) of 40 CFR Part 60, Subpart OOO as amended on April 28, 2009.

b. To demonstrate compliance with the fugitive emission limits for buildings specified in Condition 2.13, the Permittee shall complete the testing specified below. Performance tests must be conducted while all affected facilities inside the building are operating.

i. If the building encloses any affected facility constructed, modified, or reconstructed on or after April 22, 2008, the Permittee shall conduct an initial Method 9 according to this condition and §60.11.

ii. If the building encloses only affected facilities constructed, modified, or reconstructed before April 22, 2008, and the Permittee has previously conducted an initial Method 22 test showing zero visible emissions, then the Permittee has demonstrated compliance with the opacity limit in Condition 2.13. If the Permittee has not conducted an initial performance test for the building before April 22, 2008, then the Permittee shall conduct an initial Method 9 test according to this condition and §60.11 to show compliance with the opacity limit in Condition 2.13c.

c. Subsequent testing shall be performed as required by Table 3 of 40 CFR 60 Subpart OOO as applicable.

6.7 When determining compliance with the fugitive emissions standard for any affected facility described under Conditions 2.13a and 2.13c, the duration of the Method 9 observations shall be 30 minutes (five 6-minute average). Compliance with the applicable fugitive emission limits shall be based on the average of the five 6-minute averages.
[40 CFR 60.675(c)(3)]

6.8 The Permittee may use the following as alternatives to the reference methods and procedures specified in Conditions 6.6 and 6.7:
[40 CFR 60.675(e)]

a. If the fugitive emissions from two or more facilities continuously interfere so that the opacity from an individual affected facility cannot be read, the Permittee may use either the following as alternatives to the reference methods and procedures specified in Conditions 6.6 and 6.7.

i. Use for the combined emission stream the highest fugitive opacity standard applicable to any of the individual affected facilities contributing to the emissions stream.

ii. Separate the emissions so that the opacity of emissions from each affected facility can be read.

b. A single visible emission observer may conduct visible emission observations for up to three fugitive, stack, or vent emission points within a 15-second interval if the following conditions are met:

i. No more than three emission points may be read concurrently.

ii. All three emission points shall be within a 70 degree viewing sector or angle in front of the observer such that the proper sun position can be maintained for all three points.

iii. If an opacity reading for any one of the three emission points equals or exceeds the applicable standard, then the observer shall stop taking readings for the other two points and continue reading just that single point.

c. Method 5I may be used to determine the PM concentration as an alternative to method 5 or method 17 for affected facilities that operate for less than 1 hour at a time such as (but not limited to) storage bins or enclosed truck or railcar loading stations.

d. In case velocities of exhaust gases from building vents may be too low to measure accurately with the type S pitot tube specified in EPA Method 2 [ i.e., velocity head <1.3 mm $H_2O$ (0.05 in. $H_2O$)] and referred to in Method 5, the Permittee may determine the average gas flow rate produced by the power fans ( e.g., from vendor-supplied fan curves) to the building vent. The Permittee may calculate the average gas velocity at the building vent measurement site using the following and use this average velocity in determining and maintaining isokinetic sampling rates.

$$V_e = Q_f/A_e$$

Where:

$V_e$ = average building vent velocity (feet per minute);

$Q_f$ = average fan flow rate (cubic feet per minute); and

$A_e$ = area of building vent and measurement location (square feet).

6.9 For performance tests required in Condition 6.6 involving only Method 9 testing, the Permittee may reduce the 30-day advance notification of performance test to a 7-day advance notification.
[40 CFR 60.675(g)]

6.10 The visible emissions from each spray dryer and calciner during the Method 5 performance tests required by Condition 6.4 shall be determined using COMS following the requirements of 40 CFR 60.11(e) or applicable procedures and methods specified in the Division’s Procedures for Testing and Monitoring Sources of Air Pollutants. The COMS readings from a Division-approved test(s) conducted following the requirements of 40 CFR 60.11(e), as required by Condition 5.2 may be used in lieu of the visible emission determination using Method 9.
[391-3-1-.02(3) and 3-1-3-1-.03(2)(c)]

6.11 After the initial performance test required in Condition No. 6.4, the Permittee shall conduct HCl and HF emission performance tests every third calendar year on each calciner to demonstrate that the calciner is in compliance with the case-by-case MACT emission limits in Condition 2.12.
[391-3-1-.02(3) and 3-1-3-1-.03(2)(c)]

6.12 The CO performance tests required for calciner under Condition 6.4 shall be repeated annually in order to demonstrate compliance with the CO emissions limit in Condition 2.7.
[391-3-1-.02(3) and 3-1-3-1-.03(2)(c)]

6.13 After the initial performance test required in Condition No. 6.4, the Permittee shall conduct $PM/PM_{10}/PM_{2.5}$ emission performance tests every third calendar year on each calciner and on one of the spray dryers on each kaolin clay processing line to demonstrate compliance with the BACT emission limits in Condition 2.7. The spray dryers shall be tested on a rotating schedule. During the performance test for Calciners Nos. 1, 2, 3, and 4 (KLN1, KLN2, KLN3, and KLN4) the average pressure drop across the wet scrubbers (SC01, SC02, SC03, and SC04) and the flow rate for the wet scrubber shall be continuously monitored in order to develop exceedance thresholds per Condition No. 7.3b.x and 7.3b.xi.
[391-3-1-.02(3) and 3-1-3-1-.03(2)(c)]

6.14 After the initial performance test required in Condition No. 6.4, the Permittee shall conduct $NO_x$ and CO emission performance tests every third calendar year on one of the spray dryers on each kaolin clay processing line to demonstrate compliance with the BACT emission limits in Condition 2.7. The spray dryers shall be tested on a rotating schedule.
[391-3-1-.02(3) and 3-1-3-1-.03(2)(c)]

6.15 The $NO_x$ performance test required under Condition No. 6.4 shall be repeated annually on each calciner to demonstrate compliance with the BACT emission limits in Condition 2.7.
[40 CFR 52.21, 391-3-1-.02(3) and 3-1-3-1-.03(2)(c)]

6.16 After the initial performance test required in Condition No. 6.4, the Permittee shall conduct a $SO_2$ emission performance tests every third calendar year on each calciner to demonstrate compliance with its BACT emission limits in Condition No. 2.7. The overall $SO_2$ control efficiency (OCE) of each emission unit's wet scrubber shall be established for use in Condition No. 7.20. During the performance test the average pressure drop across the wet scrubber and the flow rate for the wet scrubber shall be continuously monitored in order to develop exceedance thresholds per Condition No. 7.3b.x and 7.3b.xi.
[40 CFR 52.21, 391-3-1-.02(3) and 3-1-3-1-.03(2)(c)]

6.16 After the initial performance test required in Condition No. 6.4, the Permittee shall conduct a $H_2SO_4$ emission performance tests every third calendar year on each calciner (KLN1, KLN2, KLN3, and KLN4) to demonstrate compliance with Condition 2.25.
[40 CFR 52.21, 391-3-1-.02(3) and 3-1-3-1-.03(2)(c)]

## 7.0 Notification, Reporting and Record Keeping Requirements

7.1 In the event of any malfunction or breakdown of process or emission control equipment for a period of four hours or more which results in increased emissions, the owner or operator shall submit a written report which describes the cause of the breakdown, the corrective actions taken, and the plans to prevent future occurrences. This report must be submitted by means that would insure the Division's receipt of the report by no later than seven days after the occurrence. The information submitted shall be adequate to allow the Division to determine if the increased emissions were due to a sudden and unavoidable breakdown. Such a report shall in no way serve to excuse, otherwise justify or in any manner affect any potential liability or enforcement action.

7.2 The Permittee shall submit a written report containing any excess emissions, exceedances, and/or excursions as described in this permit and any monitor malfunctions for each semiannual period ending June 30 and December 31 of each year. All reports shall be postmarked by the 30th day following the end of each reporting period, July 30 and January 30, respectively. In the event that there have not been any excess emissions, exceedances, excursions or malfunctions during a reporting period, the report should so state. Otherwise, the contents of each report shall be as specified by

the Division's Procedures for Testing and Monitoring Sources of Air Pollutants and shall contain the following:
[391-3-1-.02(6)(b)1]

a. A summary report of excess emissions, exceedances and excursions, and monitor downtime, in accordance with Section 1.5(c) and (d) of the above referenced document, including any failure to follow required work practice procedures.

b. Total process operating time during each reporting period.

c. The magnitude of all excess emissions, exceedances and excursions computed in accordance with the applicable definitions as determined by the Director, and any conversion factors used, and the date and time of the commencement and completion of each time period of occurrence.

d. Specific identification of each period of such excess emissions, exceedances, and excursions that occur during startups, shutdowns, or malfunctions of the affected facility. Include the nature and cause of any malfunction (if known), the corrective action taken or preventive measures adopted.

e. The date and time identifying each period during which any required monitoring system or device was inoperative (including periods of malfunction) except for zero and span checks, and the nature of the repairs, adjustments, or replacement. When the monitoring system or device has not been inoperative, repaired, or adjusted, such information shall be stated in the report.

f. Certification by a Responsible Official that, based on information and belief formed after reasonable inquiry, the statements and information in the report are true, accurate, and complete.

7.3 For the purpose of reporting excess emissions, exceedances or excursions in the report required in Condition 7.2, the following excess emissions, exceedances, and excursions shall be reported:
[40 CFR 52.21, 40 CFR 391-3-1-.02(6)(b)1]

a. Excess emissions: (means for the purpose of this Condition and Condition 6.1.4, any condition that is detected by monitoring or record keeping which is specifically defined, or stated to be, excess emissions by an applicable requirement)

None.

b. Exceedances: (means for the purpose of this Condition and Condition 6.1.4, any condition that is detected by monitoring or record keeping that provides data in terms of an emission limitation or standard and that indicates that emissions (or opacity) do not meet the applicable emission limitation or standard consistent with the averaging period specified for averaging the results of the monitoring)

i. Each exceedance of the $SO_2$ emission standard/limit in Condition 2.7 for calciners as determined via Condition 7.20.

ii. Each exceedance of visible emission standard/limit of 10% opacity in Condition 2.7 for calciners and spray dryers, as indicated by COMS required by Condition 5.2.

iii. Firing any of the boilers, spray dryers and calciners with fuel(s) other than natural gas and propane.

iv. Any 12-month rolling total of VOC emissions from the two spray dryers on each process line that equals or exceeds the 13.64 tons limit in Condition 2.2.

v. Any 12-month rolling total of methanol emissions from any of the Process Line No. 1, 2, 3 or 4 that exceeds the 10.04 tons limit in Condition 2.12.

vi. Any 12-month rolling total of HCl emissions from any of the Calciner Nos. 1, 2, 3 or 4 that exceeds the 8.70 tons limit in Condition 2.12.

vii. Any 12-month rolling total of HF emissions from any of the Calciner Nos. 1, 2, 3 or 4 that exceeds the 37.92 tons limit in Condition 2.12.

viii. Any instance of firing any of the stationary emergency diesel generators/engines subject to Condition 2.10 with diesel fuel that:

- Contains more than 0.0015% sulfur by weight; contains either more than 35% by volume of aromatic content **or** has a cetane index of less than 40.

ix. Any instance of operating any of the stationary emergency diesel generators/engines for more than 500 hours during any period of 12 rolling/consecutive months as limited by Condition 2.17 and/or operating the stationary emergency diesel generators for a period greater than 100 hours per 12-month rolling total for periods of maintenance testing and readiness checks as limited per Condition 2.14.

x. Any daily 2-hour average wet scrubber pressure drop recorded per Condition No. 5.2 for each Calciner Nos. 1, 2, 3, and 4 (KLN1, KLN2, KLN3, and KLN4) that is less than 90 percent of the average value determined per Condition Nos. 6.4h.

xi. Any daily 2-hour average wet scrubber liquid flow rate recorded per Condition No. 5.2 for each Calciner Nos. 1, 2, 3, and 4 (KLN1, KLN2, KLN3, and KLN4) that is less than 80 percent or greater than 120 percent of the average value determined per Condition No. 6.4h.

xi. Any 12-month rolling total GHG emissions for any calciner in excess of 36,715 tpy $CO_2$e.

xii. Any 12-month rolling total GHG emissions for any spray dryer in excess of 28,760 tpy $CO_2$e.

xiii. Any 12-month rolling total GHG emissions for any boiler in excess of 5,997 tpy $CO_2$e.

xiv. Any 12-month rolling total GHG emissions for any emergency generator in excess of 844 tpy $CO_2$e.

c. Excursions: (means for the purpose of this Condition and Condition 7.2, any departure from an indicator range or value established for monitoring consistent with any averaging period specified for averaging the results of the monitoring)

i Any 3-hour rolling average temperature at the inlet of any baghouse specified in Condition 5.3 that exceeds the filter bag design temperature or the equivalent filter bag design temperature, as recorded in accordance with Condition 5.3.

ii. For the sources specified in Condition 5.4, any two consecutive required daily determinations of visible emissions from the same source for which visible emissions are equal to or exceed the opacity action level.

iii Any visible emissions or mechanical failure or malfunction discovered by the walk through described in Condition 5.6 that are not eliminated or corrected within 24 hours of first discovering the visible emissions or mechanical failure or malfunction.

iv. Each event that the quarterly 30-minute visible emissions inspection required by Condition 5.9 was not conducted.

v. Any 3-hour period during which the average pH of the scrubbant for the wet scrubbers (APCD ID Nos. SC01, SC02, SC03, and SC04) is below 6.0 standard units.

d. In addition to the excess emissions, exceedances and excursions specified above, the following should also be included with the report required in Condition 7.2:

   i. The results of all $NO_x$ monitoring conducted per Condition 5.10 during the semiannual reporting period.

**Specific Record Keeping and Reporting Requirements**

7.4 The Permittee shall comply with the general provisions of 40 CFR, Part 60, "Standards of Performance for New Stationary Sources (NSPS)." In particular, for sources subject to NSPS, the Permittee shall comply with the reporting and record keeping requirements of 40 CFR, Part 60, Subpart A (unless otherwise directed in another applicable Subpart) and furnish the Division written notification as follows:
[40 CFR 60.7(a)(1) thru (4) & 60.676(g & h)]

a. A notification of the date construction or reconstruction of NSPS equipment is commenced postmarked no later than 30 days after such date.

b. Except for equipment which is subject to 40 CFR, Part 60, Subpart OOO, a notification of the anticipated date of initial startup of NSPS equipment postmarked not more than 60 days nor less than 30 days prior to such date.

c. A notification of the actual date of initial startup of NSPS equipment postmarked within 15 days after such date.

d. A notification of any physical or operational change to an existing NSPS equipment which may increase the emission rate of any air pollutant to which a standard applies, unless that change is specifically exempted in the applicable Subpart of 40 CFR, Part 60. This notice shall be postmarked 60 days or as soon as practicable before the change is commenced and shall include information describing the precise nature of the change, present and proposed emission control systems, productive capacity of the equipment before and after the change, and the expected completion date of the change. The Division may request additional relevant information subsequent to this notice.

7.5 The Permittee shall comply with the detailed reporting and recordkeeping provisions of 40 CFR, Part 60, Subpart OOO, "Standards of Performance for Nonmetallic Mineral Processing Plants" when replacing existing equipment with a new piece of equipment of equal or smaller size that has the same function. The new equipment used to replace the existing equipment is deferred from having to comply with the NSPS emission limits and testing requirements until all of the existing equipment in a production line has been replaced. The Permittee shall submit the following information about the existing equipment being replaced and the replacement piece of equipment:
[40 CFR 60.670(d)]

a. For a crusher, bagging operation, or enclosed truck or railcar loading station:

   i. the rated capacity in tons per hour of the existing equipment being replaced and
   ii. the rated capacity in tons per hour of the replacement equipment.

b. For a screening operation:

   i. the total surface area of the top screen of the existing screening operation being replaced and
   ii. the total surface area of the top screen of the replacement screening operation.

c. For a conveyor belt:

   i. the width of the existing belt being replaced and
   ii. the width of the replacement conveyor belt.

d. For a storage bin:

   i. the rated capacity in tons of the existing storage bin being replaced and
   ii. the rated capacity in tons of replacement storage bin.

e. For all equipment being replaced in accordance with this condition, the Permittee shall provide a certification that the equipment being replaced is existing equipment with a statement of the original construction date for each piece of equipment being replaced. The Permittee shall provide a certification that there is at least one piece of existing equipment in the relevant production line that has not been replaced along with a statement of the oldest piece of existing equipment remaining in that process line.

f. When the last piece of existing equipment in the process line is replaced, the Permittee shall submit a test plan identifying all of the existing equipment within that process line, which has been replaced within 30 days after the final replacement.

For this condition, “existing equipment” is any crusher, grinding mill, screening operation, bucket elevator, belt conveyor bagging operation, storage bin, enclosed truck or railcar loading station constructed on or before August 31, 1983, which has not been modified as described in §60.14 or reconstructed as described in §60.673 and §60.15.

7.6 The Permittee shall maintain a record of all actions taken in accordance with Conditions 2.4 to control fugitive dust from roads, storage piles, or any other source of fugitive dust. Such record shall include, but not to be limited to, the following information if applicable:
[391-3-1-.02(6)(b)1]

a. Inspection and maintenance activities taken;

b. Daily operating log of each of the dust/fugitive control systems;

c. The sources (e.g. sections of the roads) that were controlled;

d. Ambient conditions (dry, wet, precipitation, temperature, etc.).

7.7 To demonstrate compliance with the limitations specified in this permit, the Permittee shall maintain the following records on site:
[40 CFR 52.21 and 391-3-1-.02(6)(b)1]

a. Daily and monthly calciner feed input rates for each of the calciners.

b. Monthly usage rate of additive(s)/chemical(s) containing methanol and/or VOC compounds used for each of the Process Line Nos. 1, 2, 3, and 4. Such records shall also include MSDS, Product Data Certification Sheet or other manufacturer/supplier certified records indicating the methanol and/or VOC content(s) of the additive(s) or chemical(s) used.

c. Daily and monthly operating hours of each process line.

Unless otherwise specified, all records required above shall be recorded in a permanent form suitable for inspection and submission to the Division and to the EPA. The records shall be retained for at least five (5) years following the date of entry.

7.8 The Permittee shall utilize the appropriate records in Condition 7.7 and mass balance to calculate the methanol emission rates for <u>each</u> of the Process Line Nos. 1, 2, 3, and 4 during each calendar month. For the purpose of this condition, 100% of the methanol contained in the chemicals added to the clay slurry is assumed to be emitted into the atmosphere from the spray dryers. The Permittee shall notify the Division in writing if any <u>monthly</u> <u>total</u> methanol emissions exceed the notification level of 0.84 tons, i.e. 1/12 of the annual emission limit in Condition 2.12.

This notification shall be postmarked by the 15th day of the following month and shall include an explanation of how the Permittee intends maintain compliance with the emission limit.
[391-3-1-.02(6)(b)1]

7.9 The Permittee shall use the monthly methanol emission data in Condition 7.8 to calculate the 12-month rolling total of methanol emissions from each of the Process Line Nos. 1, 2, 3, and 4. The Permittee shall notify the Division in writing if any 12-month rolling total exceeds the annual methanol emission limit of 10.04 tons in Condition 2.12. This notification shall be postmarked by the 15th day of the following month and shall include an explanation of how the Permittee intends to attain future compliance with the annual emission limit involved.
[391-3-1-.02(6)(b)1]

7.10 The Permittee shall utilize the appropriate records in Condition 7.7b to calculate the monthly total of VOC emissions from each Process Line (Nos. 1, 2, 3, and 4) during each calendar month. For the purpose of this condition, 100% of the VOC compounds contained in the additive(s) or chemical(s) added to the clay slurry are assumed to be emitted into the atmosphere from the spray dryers. The emission calculation shall sum the VOC emissions from the use of all VOC-containing chemicals and from the fuel combustion. All the emission calculations, including any Division-approved emission factors used, shall be kept as part of the records required in Condition 7.7. The Permittee shall notify the Division in writing if any monthly total exceeds the notification level of 1.14 tons, i.e. 1/12 of the annual emission limit of 13.64 tons in Condition 2.2 for each Process Line. This notification shall be postmarked by the 15th day of the following month and shall include an explanation of how the Permittee intends to maintain compliance with the emission limit specified in Condition 2.2.
[391-3-1-.02(6)(b)1]

7.11 The Permittee shall use the monthly VOC emission data in Condition 7.10 to calculate total VOC emissions from each Process Line (Nos. 1, 2, 3, and 4) for each period of 12 consecutive months. The Permittee shall notify the Division in writing if any 12-month rolling total exceeds any of the annual VOC emission limit(s) in Condition 2.2. This notification shall be postmarked by the 15th day of the following month and shall include an explanation of how the Permittee intends to attain future compliance with the annual emission limit.
[391-3-1-.02(6)(b)1]

7.12 The Permittee shall submit written reports of the results of all performance tests conducted to demonstrate compliance with the applicable NSPS Subpart OOO standards in Condition 2.13 per 40 CFR 60.672, including reports of opacity observations made using Method 9 or Method 22 to demonstrate compliance with Condition 2.13.
[40 CFR 60.676(f)]

7.13 For all the new or modified sources subject to NSPS Subpart OOO, the Permittee shall submit to the Division a written notification of the actual date of initial startup of each affected facility, or a single notification of startup for a combination of affected facilities in a production line that begin actual initial startup on the same day. The notification shall be postmarked within 15 days after such date and shall include a description of each affected facility, equipment manufacturer, and serial number of the equipment, if available.
[40 CFR 60.676(i) and (l)(1)]

7.14 The Permittee shall maintain monthly operating records of each of the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emissions Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) subject to Conditions 2.14 and/or 2.16, including operating hours and reasons of the operation, e.g., emergency power generation and/or fire extinguishing, readiness testing and/or maintenance checks. These records shall be kept available for inspection or submittal for 5 years from the date of record.
[40 CFR 60.4211(e) & 391-3-1-.03(6)(b)11(v)(l)]

7.15 The Permittee shall use monthly operating time records required by Condition 7.14 to calculate the 12 month rolling total of the operating and/or maintenance check and readiness testing time for each generator/engine specified in Condition 7.14 for each calendar month. All the calculations shall be kept as part of the records required in Condition 7.14. The Permittee shall notify the Division in writing if any of the 12 month rolling total of maintenance check and readiness testing time exceeds 100 hours or if total operating time exceeds 500 hours. This notification shall be postmarked by the 15th day of the following month and shall include an explanation of how the Permittee intends to attain future compliance with Condition 2.14 or 2.16.
[40 CFR 60.4211(e) & 391-3-1-.03(6)(b)11(v)(l)]

7.16 The Permittee shall keep records verifying that each shipment of diesel fuel received for firing the stationary emergency diesel generators/engines Nos. 1, 2, 3 and 4 (Emission Unit ID Nos. EDG1, EDG2, EDG3 and EDG4) complies with the applicable requirements in Condition 2.10. Verification shall consist of the diesel fuel receipts and fuel supplier certifications or results of analyses of the diesel fuel conducted by methods of sampling and analysis which have been specified or approved by the EPA or the Division. These records shall be kept available for inspection or submittal for 5 years from the date of record.
[40 CFR 60.4207 and 40 CFR 52.21 – PSD/BACT]

7.17 The Permittee shall 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.
[40 CFR 60.4218]

7.18 The Permittee shall furnish the Division written notification of the date of the initial startup of the Process Line Nos. 1, 2, 3 and 4, including associated boilers and emergency stationary diesel generators within 15 days after such date.
[391-3-1-.03(2)(c)]

7.19 The Permittee shall maintain a record of the operating hours and the daily input rate of calciner feed to each of the calciners (Emission Unit ID No. KLN1, KLN2, KLN3, and KLN4). The Permittee shall obtain a representative sample daily from each kaolin clay slurry tank or each calciner's feed stream feeding any calciner and analyze the sample for the sulfur in percent by weight. The Permittee shall also obtain a respective sample daily from each calciner's output product stream 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 as required by Condition 7.20.
[391-3-I-.02(6)(b)1]

7.20 The Permittee shall use the equation below to determine the hourly $SO_2$ emissions from each calciner:

$$E_{SO_2,i} = \frac{(2)(M_{UCKF,i})(C_{S,i} - C_{SP,i})(2000)}{(100)(Tuc_i)} + \frac{(2)(M_{KF,i})(C_{SF,i} - C_{SP,i})(2000)}{(100)(T_i)} * (1 - \frac{OCE}{100})$$

where:

$E_{SO2,\,i}$ = Daily average $SO_2$ emission rate from the $i^{th}$ calciner, lbs/hr;

2 = Mass conversion constant from sulfur to sulfur dioxide;

$Mkf_{,\,i}$ = Quantity of the kaolin clay slurry or claciner feed processed by the $i^{th}$ calciner during the calendar day, ton/day while the wet scrubber is operating properly;

$Muckf_{,\,i}$ =Quantity of the kaolin clay slurry or claciner feed processed by the $i^{th}$ calciner during the calendar day, ton/day while the wet scrubber is not operating properly as defined per Conditions No. 7.3b.x amd 7.3b.xi;

$C_{S,\,i}$ = Sulfur content of the kaolin slurry or calciner feed processed by the $i^{th}$ calciner during the calendar day, percent by weight;

$C_{SP,\,i}$ = Sulfur content of the calciner product processed by the $i^{th}$ calciner during the calendar day, percent by weight;

2000 = Conversion constant from ton to pound;

100 = Conversion constant from mass percentage to mass ratio;

$T_i$ = Total operating time of the $i^{th}$ calciner during the calendar day, hour. While the wet scrubber is properly operating.

$Tuc_i$ = Total operating time of the $i^{th}$ calciner during the calendar day, hour. While the wet scrubber is not properly operating as defined per Conditions No. 7.3b.x and 7.3b.xi.

OCE = Overall $SO_2$ control efficiency for each Calciner (Emission Unit ID Nos KLN1, KLN2, KLN3, or KLN4) each respective wet scrubber (APCD ID Nos. SC01, SC02, SC03, or SC04) as determined per Condition 6.4h. The control efficiency shall be equal to 95% during the period before which the respective wet scrubber (APCD ID Nos. SC01, SC02, SC03, or SC04) initial performance test has been completed.

The Permittee shall notify the Division in writing if any of daily averaged hourly $SO_2$ emissions exceeds 34.25 pounds for any calendar day. This notification shall be submitted within 15 working days of the calculation and shall include an plan(s) of how the Permittee intends to attain future compliance with the $SO_2$ emission limit as specified in Condition 2.7.
[40 CFR 52.21-PSD/BACT, 391-3-1-.02(6)(b)1]

7.21 The Permittee shall utilize the monthly calciner feed input rate records (ton per month) in Condition 7.7 and the HCl and HF emission factors (ponds of HCl or HF emitted per ton of calciner feed) established during the most recent Division-approved performance tests to calculate the monthly HCl and HF emission rates for <u>each</u> of the Calciners Nos. 1, 2, 3, and 4 during each calendar month. The Permittee shall 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 Condition 2.12. This notification shall be postmarked by the $15^{th}$ day of the following month and shall include an explanation of how the Permittee intends to attain or maintain compliance with the emission limit.
[391-3-1-.02(6)(b)1]

7.22 The Permittee shall use the monthly HCl and HF emission data in Condition 7.21 to calculate total HCl and HF emissions from each of the Calciner Nos. 1, 2, 3 and 4 during each period of 12 consecutive months. The Permittee shall notify the Division in writing if any 12-month rolling total of the HCl or HF emissions exceed the 8.70 tons or 37.92 tons limit in Condition 2.12. This notification shall be postmarked by the $15^{th}$ day of the following month and shall include an explanation of how the Permittee intends to attain future compliance with the annual HCl or HF emission limit.
[391-3-1-.02(6)(b)1]

7.23 The Permittee shall develop and implement a Dust Suppression Plan in accordance with Condition 2.4 to suppress fugitive dust and roadway particulate sources. The plan shall be subject to review and approval by the Division and shall included records sufficient to show that the plan is followed. In particular, any deviations from the plan, or failure to follow plan procedures, shall be noted.
[40 CFR 52.21 and 391-3-1-.02(6)(b)1]

7.24 In addition to any other reporting requirements of this permit, the Permittee shall report to the Division in writing, within seven (7) days, any deviations from applicable requirements associated with any malfunction or breakdown of process, fuel burning, or emission control equipment for a period of four hours or more which results in excessive emissions. The Permittee shall submit a written report, which shall contain the probable cause of the deviation(s), duration of the deviation(s), and any corrective actions or preventative measures taken.
[391-3-1-.02(6)(b)1(iv)]

7.25 The Permittee shall retain monthly records of natural gas/LPG usage in each calciner, spray dryer, and boiler.
[391-3-1-.02(6)(b)1]

7.26 The Permittee shall use the monthly natural gas/LPG usage records required in Condition 7.25, the monthly operating records of each of the stationary emergency diesel generators/engines required in Condition 7.14, and Division approved emission factors to determine monthly greenhouse gas emissions from the site in terms of $CO_2$e. The Permittee shall notify the Division in writing if any monthly greenhouse gas emission rate exceeds the notification level of one- twelfth (1/12) of the annual greenhouse gas emission limit in terms of $CO_2$e in Condition 2.7. This notification shall be postmarked by the 15$^{th}$ day of the following month and shall include an explanation of how the Permittee intends to maintain compliance with the emission limit. Within 90 days of the commencement of operation of the facility, the Permittee shall submit to the Division greenhouse gas emission factors to be used with respect to this condition.
[391-3-1-.02(6)(b)1]

7.27 The Permittee shall use the monthly records required in Condition 7.25 and Condition 7.26 to calculate total greenhouse gas emissions in terms of $CO_2$e from each calciner, spray dryer, and stationary emergency diesel generators/engines during each period of 12 consecutive months. The Permittee shall notify the Division in writing if any 12-month rolling total of the greenhouse gas emissions in terms of $CO_2$e exceeds the emissions limits in Condition 2.7 for the calciners, spray dryers, and stationary emergency diesel generators/engines. This notification shall be postmarked by the 15$^{th}$ day of the following month and shall include an explanation of how the Permittee intends to attain compliance with the emission limit.
[391-3-1-.02(6)(b)1]

## 8.0 Special Conditions

8.1 At any time that the Division determines that additional control of emissions from the facility may reasonably be needed to provide for the continued protection of public health, safety and welfare, the Division reserves the right to amend the provisions of this Permit pursuant to the Division's authority as established in the Georgia Air Quality Act and the rules adopted pursuant to that Act.

8.2 The Permittee shall calculate and pay an annual Permit Fee to the Division. The amount of the fee shall be determined each year in accordance with the "Procedures for Calculating Air Permit Fees."

8.3 Approval to construct shall become invalid if construction is not commenced within 18 months after receipt of such approval, if construction is discontinued for a period of 18 months or more, or if construction is not completed within a reasonable time. The Director may extend the 18-month period upon satisfactory showing that an extension is justified.
[40 CFR 52.21(r)(2)]

8.4 The Permittee shall prepare and submit an initial Title V Operating Permit Application for the operation of this permitted facility in accordance with 40 CFR 70.5 within 12 months after commencing operation. The Permittee must address 40 CFR 64 "Compliance Assurance Monitoring" applicability in its initial Title V Operating Permit Application.
[40 CFR Part 64 and 40 CFR Part 70]

# APPENDIX 1

## CARBO Ceramics – Millen Plant – Facility Description

| Emission Units | | Air Pollution Control Devices | |
|---|---|---|---|
| **ID No.** | **Description** | **Description** | **ID No.** |
| **Process Line No. 1** | | | |
| SD01 | Spray Dryer No. 1 | Baghouses (Stack S001) | SB01, SB02, SB03, SB04 |
| SD02 | Spray Dryer No. 2 | Baghouses (Stack S002) | SB05, SB06, SB07, SB08 |
| DSB1<br>DUB1<br>DSB2<br>DUB2<br>ABC1<br>OC01<br>GPC1<br>GPT1<br>GPE1<br>GSH1<br>GSC1<br>GSC2<br>GSC3<br>OBC1<br>ORB1<br>UBC1<br>URC1<br>KFE1<br>KFB1<br>KRB1<br>KRE1<br>KFC1 | Spray Dryer No. 1 Feed Bin<br>Spray Dryer No. 1 Unders Bin<br>Spray Dryer No. 2 Feed Bin<br>Spray Dryer No. 2 Unders Bin<br>Accepts Belt Conveyor No. 1<br>Overflow Conveyor No. 1<br>Pellet Collection Conveyor No. 1<br>Pellet Transfer Conveyor No. 1<br>Pellet Bucket Elevator No. 1<br>Screen Surge Hopper No. 1<br>Pellet Screen 1-1<br>Pellet Screen 1-2<br>Pellet Screen 1-3<br>Oversize Collection Belt Conveyor No. 1<br>Oversize Surge Bin No. 1<br>Unders Collection Belt Conveyor No. 1<br>Unders Reversible Belt Conveyor No. 1<br>Calciner No. 1 Feed Bin Bucket Elevator<br>Calciner No. 1 Feed Bin<br>Calciner No. 1 Recycle Feed Bin<br>Calciner No. 1 Rec. Feed Bin Bucket Elevator<br>Calciner No. 1 Feed Conveyor | Baghouse (Stack S003) | GPB1 |
| KLN1 | Direct-Fired Rotary Calciner No.1 and Cooler | Baghouses | KB01, KB02, KB03, KB04, |
| | | Wet Scrubber (Stack S005) | SC01 |

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## CARBO Ceramics – Millen Plant – Facility Description

| Emission Units | | Air Pollution Control Devices | |
|---|---|---|---|
| **ID No.** | **Description** | **Description** | **ID No.** |
| KCE1<br>KPS1<br>KFS1<br>KQC1<br>KQC2<br>KQC3<br>KQC4<br>KCS1<br>KCS2 | Calciner No. 1 Cooler Bucket Elevator<br>Calciner No. 1 Product Screen<br>Calciner No. 1 Fines Screen<br>Calciner No. 1 Product QC Bin A<br>Calciner No. 1 Product QC Bin B<br>Calciner No. 1 Product QC Bin C<br>Calciner No. 1 Product QC Bin D<br>Calciner No. 1 Product Screen DPCS<br>Calciner No. 1 Fines Screen DPCS | Baghouse (Stack S006) | KNB1 |
| BS01 | Bulk Product Silo 1-1 | Bin Vent Filter (Stack S007) | BB01 |
| BS02 | Bulk Product Silo 1-2 | Bin Vent Filter (Stack S008) | BB02 |
| BS03 | Bulk Product Silo 1-3 | Bin Vent Filter (Stack S009) | BB03 |
| BS04 | Bulk Product Silo 1-4 | Bin Vent Filter (Stack S010) | BB04 |
| RRL1 | Railcar Loading Operations No. 1 | Baghouse (Stack S011) | RCB1 |
| EDG1 | Emergency Diesel Generator No. 1 | None (Stack E001) | None |
| BLR1 | Boiler No. 1 | None (Stack B001) | None |
| **Process Line No. 2** | | | |
| SD03 | Spray Dryer No. 3 | Baghouses (Stack S012) | SB09, SB10, SB11, SDB12 |
| SD04 | Spray Dryer No. 4 | Baghouses (Stack S013) | SB13, SB14, SB15, SB16 |

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## CARBO Ceramics – Millen Plant – Facility Description

| Emission Units | | Air Pollution Control Devices | |
|---|---|---|---|
| **ID No.** | **Description** | **Description** | **ID No.** |
| DSB3<br>DUB3<br>DSB4<br>DUB4<br>ABC2<br>OC02<br>GPC2<br>GPT2<br>GPE2<br>GSH2<br>GSC4<br>GSC5<br>GSC6<br>OBC2<br>ORB2<br>UBC2<br>URC2<br>KFE2<br>KFB2<br>KRB2<br>KRE2<br>KFC2 | Spray Dryer No. 3 Feed Bin<br>Spray Dryer No. 3 Unders Bin<br>Spray Dryer No. 4 Feed Bin<br>Spray Dryer No. 4 Unders Bin<br>Accepts Belt Conveyor No. 2<br>Overflow Conveyor No. 2<br>Pellet Collection Conveyor No. 2<br>Pellet Transfer Conveyor No. 2<br>Pellet Bucket Elevator No. 2<br>Screen Surge Hopper No. 2<br>Pellet Screen 2-1<br>Pellet Screen 2-2<br>Pellet Screen 2-3<br>Oversize Collection Belt Conveyor No. 2<br>Oversize Surge Bin No. 2<br>Unders Collection Belt Conveyor No. 2<br>Unders Reversible Belt Conveyor No. 2<br>Calciner No. 2 Feed Bin Bucket Elevator<br>Calciner No.2 Feed Bin<br>Calciner No. 2 Recycle Feed Bin<br>Calciner No. 2 Rec. Feed Bin Bucket Elevator<br>Calciner No. 2 Feed Conveyor | Baghouse<br>(Stack S014) | GPB2 |
| KLN2 | Direct-Fired Rotary Calciner No. 2 and Cooler | Baghouses | KB05, KB06, KB07, KB08, |
| | | Wet Scrubber<br>(Stack S016) | SC02 |
| KCE2<br>KPS2<br>KFS2<br>KQC5<br>KQC6<br>KQC7<br>KQC8<br>KCS3<br>KCS4 | Calciner No. 2 Cooler Bucket Elevator<br>Calciner No. 2 Product Screen<br>Calciner No. 2 Fines Screen<br>Calciner No. 2 Product QC Bin A<br>Calciner No. 2 Product QC Bin B<br>Calciner No. 2 Product QC Bin C<br>Calciner No. 2 Product QC Bin D<br>Calciner No. 2 Product Screen DPCS<br>Calciner No. 2 Fines Screen DPCS | Baghouse<br>(Stack S017) | KNB2 |
| BS05 | Bulk Product Silo 2-1 | Bin Vent<br>Filter<br>(Stack S018) | BB05 |

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### CARBO Ceramics – Millen Plant – Facility Description

| Emission Units | | Air Pollution Control Devices | |
|---|---|---|---|
| **ID No.** | **Description** | **Description** | **ID No.** |
| BS06 | Bulk Product Silo 2-2 | Bin Vent Filter (Stack S019) | BB06 |
| BS07 | Bulk Product Silo 2-3 | Bin Vent Filter (Stack S020) | BB07 |
| BS08 | Bulk Product Silo 2-4 | Bin Vent Filter (Stack S021) | BB08 |
| EDG2 | Emergency Diesel Generator No. 2 | N/A (Stack E002) | N/A |
| BLR2 | Boiler No. 2 | None (Stack B002) | None |
| **Process Line No. 3** | | | |
| SD05 | Spray Dryer No. 5 | Spray Dryer No. 5 Baghouses A,B,C,D (Stack S022) | SB17, SB18, SB19, SB20 |
| SD06 | Spray Dryer No. 6 | Spray Dryer No. 6 Baghouses A, B,C,D (Stack S023) | SB21, SB22, SB23, SB24 |
| ABC3 | Accepts Belt Conveyor No. 3 | Pellet Nuisance Baghouse No. 3 (Stack S024) | GPB3 |
| DSB5 | Spray Dryer No. 5 Feed Bin | | |
| DUB5 | Spray Dryer No. 5 Unders Bin | | |
| DSB6 | Spray Dryer No. 6 Feed Bin | | |
| DUB6 | Spray Dryer No. 6 Unders Bin | | |
| OC03 | Overflow Conveyor No. 3 | | |
| GPC3 | Pellet Collection Conveyor No. 3 | | |
| GPT3 | Pellet Transfer Conveyor No. 3 | | |
| GPE3 | Pellet Bucket Elevator No. 3 | | |
| GSH3 | Screen Surge Hopper No. 3 | | |
| GSC7 | Pellet Screen No. 3-1 | | |
| GSC8 | Pellet Screen No. 3-2 | | |
| GSC9 | Pellet Screen No. 3-3 | | |
| OBC3 | Oversize Collection Belt Conveyor No. 3 | | |
| ORB3 | Oversize Surge Bin No. 3 | | |
| UBC3 | Unders Collection Belt Conveyor No. 3 | | |
| URC3 | Unders Reversible Belt Conveyor No. 3 | | |
| KFE3 | Calciner No. 3 Feed Bin | | |
| KFB3 | Calciner No. 3 Feed Bin | | |
| KRE3 | Calciner No. 3 Recycle Feed Bin Bucket Elevator | | |
| KFC3 | Calciner No. 3 Feed Conveyor | | |
| KRB3 | Calciner No. 3 Recycle Feed Bin | | |

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### CARBO Ceramics – Millen Plant – Facility Description

| Emission Units | | Air Pollution Control Devices | |
|---|---|---|---|
| **ID No.** | **Description** | **Description** | **ID No.** |
| KLN3 | Direct-Fired Rotary Calciner No. 3 and Cooler | Calciner No. 3 Baghouses A, B,C,D | KB09, KB10, KB11, KB12 |
| | | Wet Scrubber (Stack S026) | SC03 |
| KCE3 | Calciner No. 3 Cooler Bucket Elevator | Calciner No. 3 Nuisance Baghouse (Stack S027) | KNB3 |
| KPS3 | Calciner No. 3 Product Screen | | |
| KFS3 | Calciner No. 3 Fine Screen | | |
| KQC9 | Calciner No. 3 Product QC Bin A | | |
| KQ10 | Calciner No. 3 Product QC Bin B | | |
| KQ11 | Calciner No. 3 Product QC Bin C | | |
| KQ12 | Calciner No. 3 Product QC Bin D | | |
| KCS5 | Calciner No. 3 Product Screen DPCS | | |
| KCS6 | Calciner No. 3 Product Screen DPCS | | |
| PBC3 | Calciner No. 3 Product Screen belt Conveyor | None | N/A |
| PBE3 | Calciner No. 3 Product Screen Bucket Elevator | | |
| FBC3 | Calciner No. 3 Fines Screen Belt Conveyor | | |
| FBE3 | Calciner No. 3 Fines Screen Bucket Elevator | | |
| BS09 | Bulk Product Silo No. 3-1 | Baghouse (Stack S028) | BB09 |
| BS10 | Bulk Product Silo No. 3-2 | Baghouse (Stack S029) | BB10 |
| BS11 | Bulk Product Silo No. 3-3 | Baghouse (Stack S030) | BB11 |
| BS12 | Bulk Product Silo No. 3-4 | Baghouse (Stack S031) | BB12 |
| RRL2 | Railcar Loading Operations No. 2 | Baghouse (Stack S032) | RCB2 |
| EDG3 | Emergency Diesel Generator No. 3 | N/A (Stack E003) | N/A |
| BLR3 | Boiler No. 3 | None (Stack B003) | N/A |

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## CARBO Ceramics – Millen Plant – Facility Description

| Emission Units | | Air Pollution Control Devices | |
|---|---|---|---|
| **ID No.** | **Description** | **Description** | **ID No.** |
| **Process Line No. 4** | | | |
| SD07 | Spray Dryer No. 7 | Spray Dryer No. 7 Baghouses A,B,C,D (Stack S033) | SB25, SB26, SB27, SB28 |
| SD08 | Spray Dryer No. 8 | Spray Dryer No. 8 Baghouses A,B,C,D (Stack S034) | SB29, SB30, SB31, SB32 |
| ABC4 | Accepts Belt Conveyor No. 4 | Pellet Nuisance Baghouse No. 4 (Stack S035) | GPB4 |
| DSB7 | Spray Dryer No. 7 Feed Bin | | |
| DUB7 | Spray Dryer No. 7 Unders Bin | | |
| DSB8 | Spray Dryer No. 8 Feed Bin | | |
| DUB8 | Spray Dryer No. 8 Unders Bin | | |
| OC04 | Overflow Conveyor No. 4 | | |
| GPC4 | Pellet Collection Conveyor No. 4 | | |
| GPT4 | Pellet Transfer Conveyor No. 4 | | |
| GPE4 | Pellet Bucket Elevator No. 4 | | |
| GSH4 | Screen Surge Hopper No. 4 | | |
| GS10 | Pellet Screen No. 4-1 | | |
| GS11 | Pellet Screen No. 4-2 | | |
| GS12 | Pellet Screen No. 4-3 | | |
| OBC4 | Oversize Collection Belt Conveyor No. 4 | | |
| ORB4 | Oversize Surge Bin No. 4 | | |
| UBC4 | Unders Collection Belt Conveyor No. 4 | | |
| URC4 | Unders Reversible Belt Conveyor No. 4 | | |
| KFE4 | Calciner No. 4 Feed Bin Bucket Elevator | | |
| KFB4 | Calciner No. 4 Feed Bin | | |
| KRE4 | Kin No. 4 Recycle Feed Bucket Elevator | | |
| KFC4 | Calciner No. 4 Feed Conveyor | | |
| KRB4 | Calciner No. 4 Recycle Feed Bin | | |

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## CARBO Ceramics – Millen Plant – Facility Description

| Emission Units | | Air Pollution Control Devices | |
|---|---|---|---|
| **ID No.** | **Description** | **Description** | **ID No.** |
| PB04 | Line 4 Product Belt | None | N/A |
| KLN4 | Direct-Fired Rotary Calciner No. 4 and Cooler | Calciner No. 4 Baghouses A, B, C D | KB13, KB14, KB15, KB16 |
| | | Wet Scrubber (Stack S037) | SC04 |
| KCE4 | Calciner No. 4 Cooler Bucket Elevator | Calciner No. 4 Nuisance Baghouse (Stack S038) | KNB4 |
| KPS4 | Calciner No. 4 Product Screen | | |
| KFS4 | Calciner No. 4 Fine Screen | | |
| KQ13 | Calciner No. 4 Product QC Bin A | | |
| KQ14 | Calciner No. 4 Product QC Bin B | | |
| KQ15 | Calciner No. 4 Product QC Bin C | | |
| KQ16 | Calciner No. 4 Product QC Bin D | | |
| KCS7 | Calciner No. 4 Product Screen 1 DPCS | | |
| KCS8 | Calciner No. 4 Fines Screen 2 DPCS | | |
| BS13 | Bulk Product Silo No. 4-1 | Baghouse (Stack S039) | BB16 |
| BS14 | Bulk Product Silo No. 4-2 | Baghouse (Stack S040) | BB17 |
| BS15 | Bulk Product Silo No. 4-3 | Baghouse (Stack S041) | BB18 |
| BS16 | Bulk Product Silo No. 4-4 | Baghouse (Stack S042) | BB19 |
| EDG4 | Emergency Diesel Generator No. 4 | N/A (Stack E004) | N/A |
| BLR4 | Boiler No. 4 | None (Stack B004) | N/A |

# Volume I, Attachment F –

# Electronic Discs for Volume I