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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-2911
Plant ID No.:	039-00621
Applicant:	Carbonxt Inc.
Facility Name:	Institute Facility
Location:	Kanawha County
SIC Code:	2895
Application Type:	Construction
Received Date:	December 14, 2011
Engineer Assigned:	Steven R. Pursley, PE
Fee Amount:	$2,000.00
Date Received:	December 15, 2011
Complete Date:	January 12, 2012
Due Date:	April 11, 2012
Applicant Ad Date:	December 15, 2011
Newspaper:	*The Charleston Gazette*
UTM's:	Easting: 431.02 km Northing: 4,248.66 km Zone: 17
Description:	Application for the construction of a 26,200 ton per year activated carbon production facility at the Bayer Crop Science facility.

DESCRIPTION OF PROCESS

The proposed plant will produce activated carbon which has been chemically enhanced to improve its performance as a means for reducing the emission of HAPs from electric power generating plants and other coal burning facilities.

The raw material for the process is stoker sized coal which has been double screened at the mine to produce particles in the range of 1 1/4 inch x 1/4 inch. Delivery trucks will back-into and inside building structure (i.e. delivery room) through an open 12 ft by 30 ft doorway, discharge its coal load onto a grizzly screen which will allow the coal to drop by gravity onto a moving shuttle conveyor that will convey the coal to a bucket elevator and then to one of three storage silos. Control of the emissions will be maintained by producing

a slight negative pressure within the delivery room by means of a blower that will pull air from the room through a pulse jet baghouse.

Coal from the storage silos is recycled back to a surge hopper and then to a crusher. The coal crusher will be a hammer mill type system capable of crushing 20 tons per hour of stoker size coal. The crushed coal is returned to the storage silos. Both the crusher and storage silos are controlled by baghouses.

Crushed coal from the storage silo is fed forward to a surge bin and then to one of two rotary calciners where the coal is indirectly heated to a high temperature (1560°F) in the presence of injected steam to drive off all of the volatile matter contained in the raw coal. The volatile matter and gasification reactions which occur within the rotary calciners amounts to approximately 66% of the weight of the raw coal. The remaining solids (activated carbon) amounts to approximately 34% of the weight of the raw coal.

Each of the two rotary calciners has its own independent control system for processing the gaseous matter produced by the calciners. The gaseous matter from the rotary calciner (RC-600 A) is sent to a thermal oxidizer where it is mixed with injected natural gas and air and burned. The solids (ash) from the thermal oxidizer are sent to a direct water quench cooler, then a venturi scrubber, then to two dual packed bed caustic scrubbers and are then discharged to the atmosphere. The liquids from the venturi scrubber and the dual packed bed scrubbers are collected and sent to filter beds where the solids are removed and sent to a landfill. The liquids from the filter bed are either recycled to the quench cooler or sent to the Bayer waste water treatment facility.

The solids (activated carbon) from the rotary calciner are sent to an indirect cooler and then an activated carbon hopper where the solids are combined with those from the other rotary calciner. Next the activated carbon is dropped onto a belt conveyor where it is mixed with an additive to enhance its performance characteristics. Then the material is sent to a micronization mill where it will be reduced in size to a particle distribution of 95% minimum through 325 mesh. The material is captured by a baghouse from which the final product is pneumatically conveyed to the activated carbon storage bins. The final product is removed from the plant by truck.

SITE INSPECTION

The facility will be installed by Carbonxt in the Bayer CropScience facilities at Institute, WV. No site inspection was performed since the Bayer facility is an established well known facility to DAQ. To get to the facility take I-64 west to exit 50. At the end of the off ramp veer right on Fairlawn Ave./State Route 25. The Bayer facility is on the left and the Carbonxt facility will be on the far west end of the facility.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Emissions from the process can basically be broken down into three parts.

1. Emissions from the rotary calciners:

Emissions from the rotary calciners are vented through a thermal oxidizer, then a quench cooler, then a venturi scrubber then a dual pack bed scrubber before being released to the atmosphere. Carbonxt based both controlled and uncontrolled emissions from the two rotary calciners on an engineering estimate. Because little documentation was presented to support this estimate, stacktesting of emission points E6A and E6B will be required by the permit.

2. Emissions from the combustion of natural gas used to supply heat to the rotary calciners:

Emissions from the combustion of natural gas are based on AP-42 Section 1.4.

3. Material Handling Emissions:

Material handling emissions for the handling of coal was performed in the conventional way (i.e. the applicant used a spreadsheet based on the appropriate AP-42 formulas/emission factors). However, material handling emissions for the handling of activated carbon (particularly transfer points) was somewhat different. The applicant could find no existing emission factors for the handling of activated carbon. Therefore, the applicant used an emission factor of 0.0112 pounds per ton which is loosely based on coke. This emission factor is significantly lower than coke but significantly higher than coal. Additionally, the applicant decided to show this emission factor by using the AP-42 batch drop formula and artificially manipulating the material moisture content to arrive at said emission factor. This process seems unnecessarily cumbersome but regardless, the final emission factor does seem reasonable. It should also be noted that emissions from transfer points at this facility are so well controlled that even if an emission factor 10x higher was used it would only increase facility wide emissions from approximately 19 tons per year to 24 tons per year. Specifically, the transfer points and equipment PM emissions will be controlled by a mixture of full enclosures and baghouses. Full enclosures were assigned a control efficiency of 80%. Baghouses with were assigned an overall efficiency of 99.99% when the source was fully enclosed and 99.975% when partially enclosed (only one source, the truck to grizzly screen transfer point, was partially enclosed). Haulroad emissions will be controlled by a water truck which was assigned a control efficiency of 70%.

Controlled emissions from the facility should be as follows:

CALCINER PROCESS EMISSIONS:

Pollutant	Calciner RC-600A		Calciner RC-600B		**Total**	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
PM	1.00	3.99	1.00	3.99	**2.00**	**7.98**
PM_{10}	--	--	--	--	**--**	**--**
$PM_{2.5}$	--	--	--	--	**--**	**--**
SO_2	2.90	11.60	2.90	11.60	**5.80**	**23.2**
NO_x	1.12	4.48	1.12	4.48	**2.24**	**8.96**
CO	8.5	34.01	8.5	34.01	**17.00**	**68.02**
VOC	0.28	1.13	0.28	1.13	**0.56**	**2.26**
Arsenic Sulfide	0.012	0.046	0.012	0.046	**0.023**	**0.091**
Lead Sulfide	0.039	0.155	0.039	0.155	**0.078**	**0.310**
Mercury	0.001	0.001	0.001	0.001	**0.001**	**0.001**
Methane	25	100	25	100	**50**	**200**
CO_2	1,868.3	7,473.2	1,868.3	7,473.2	**3,767**	**14,947**
CO_{2e}	2,393.3	9,573.2	2,393.3	9,573.2	**4,787**	**19,147**

MATERIAL HANDLING EMISSIONS:

	PM		$PM_{10}/PM_{2.5}$	
	lb/hr	tpy	lb/hr	tpy
Crushing	0.01	0.01	0.01	0.01
Transfer Points	0.12	0.51	0.05	0.24
Unpaved Haul Roads	1.91	8.38	0.86	3.77
Bin Loading	0.01	0.03	0.01	0.02
Total	**2.05**	**8.93**	**0.93**	**4.04**

NATURAL GAS BURNER EMISSIONS

Pollutant	Calciner RC-600A Burner		Calciner RC-600B Burner		Total	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
$PM/PM_{10}/PM_{2.5}$	0.29	1.14	0.29	1.14	**0.57**	**2.28**
SO_2	0.03	0.09	0.03	0.09	**0.05**	**0.18**
NO_x	3.74	14.96	3.74	14.96	**7.48**	**29.91**
CO	3.14	12.56	3.14	12.56	**6.28**	**25.12**
VOC	0.21	0.83	0.21	0.83	**0.42**	**1.65**
Formaldehyde	0.01	0.02	0.01	0.02	**0.01**	**0.03**
Hexane	0.07	0.27	0.07	0.27	**0.14**	**0.54**
Nitrous Oxide	0.09	0.33	0.09	0.33	**0.17**	**0.66**
Methane	0.09	0.35	0.09	0.35	**0.18**	**0.69**
CO_2	4485.6	17942.4	4485.6	17942.4	**8,971**	**35,885**
CO_{2e}	4515.4	18,052	4515.4	18,052	**9,031**	**36,104**

FACILITYWIDE TOTAL

	Pounds Per Hour	Tons Per Year
PM	4.62	19.19
$PM_{10}/PM_{2.5}$	1.50	6.32
SO_2	5.85	23.38
NO_x	9.72	38.87
CO	23.28	93.14
VOC	0.98	3.91
Arsenic Sulfide	0.023	0.091
Lead Sulfide	0.078	0.310

Mercury	0.001	0.001
Formaldehyde	0.01	0.03
Hexane	0.14	0.54
Nitrous Oxide	0.17	0.66
Methane	50.18	200.69
CO_2	12,738	50,832
CO_{2e}	13,818	55,251

REGULATORY APPLICABILITY

The following state and federal regulations apply to the facility:

STATE RULES

45CSR5 To Prevent and Control Air Pollution from the Operation of Coal Preparation Plants and Coal Handling Operations

The facility is subject to the requirements of 45CSR5 because it meets the definition of "Coal Preparation Plant" found in subsection 45CSR5.2.4. The facility should be in compliance with Section 3 (less than 20% opacity) and Section 6 (fugitive dust control system and dust control of the premises and access roads) when the particulate matter control methods and devices proposed within Permit Application R13-2911 (full enclosures, baghouses, and a water truck) are in operation.

It should be noted that, in the writers opinion, the rotary calciners do NOT meet the definition of "thermal dryer" in rule 5. Rule 5 defines "thermal dryer" as a device which reduces the moisture content of coal as its primary purpose. The primary purpose of the rotary calciners is to remove the volatiles from the coal. The fact that this process takes place in an environment where steam is injected further verifies that the primary purpose is not to reduce moisture content.

45CSR6: To Prevent and Control Air pollution From Combustion of Refuse.

45CSR6 limits the particulate matter to be discharged from any incinerator into the open air in excess of the quantity determined by use of the following formula:

Emissions (lb/hr) = F x Incinerator Capacity (tons/hour)

Where, F = 5.43 for an incinerator capacity less than 15,000 lbs/hr or 2.72 for an incinerator capacity of 15,000 lbs/hr or greater. The thermal oxidizers will burn a maximum of 4,903.2 lbs/hr of VOCs each(well under 15,000 lb/hr). Therefore the allowable emissions from each Thermal Oxidizer is:
5.43 x (4903.2/2000) = 13.31 lb/hr.

Particulate Matter emissions from each thermal oxidizer were reported in the application to be 1.0 lb/hr. Therefore the emissions limitations in 45CSR6 should be met by the RTO.

45CSR10 To Prevent and Control Air Pollution From the Emission of Sulfur Oxides.

45CSR10 section 4.1 limits the in stack SO_2 concentration to 2,000 ppm. The only sources of SO_2 emissions from the facility are the calciners/thermal oxidizer and calciner burners. According to information submitted with the applicants emission calculations, exhaust from the calciners will be approximately 56,990 acfm. Temperatures of the exhaust are approximately 190°F. Total SO_2 emissions from the calciners will be limited to 2.9 pounds per hour. This yields an in stack SO_2 concentration of approximately 6.29 ppm. Exhaust from the calciner burners will be approximately 30,100 acfm. Temperatures of the exhaust are approximately 1,560°F. Total SO_2 emissions from the calciner burners will be limited to 0.02 pounds per hour each. This yields an in stack SO_2 concentration of approximately 0.26 ppm.

45CSR13 Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation).

Because uncontrolled PM emissions from the facility will exceed 6 pounds per hour and 10 tons per year of PM the facility is required to submit a construction permit under 45CSR13. Additionally, the facility is subject to several substantive rule requirements (as outlined in this section). Because this permit is a synthetic minor for PSD, “notice level C” is required. The facility will be a synthetic minor mainly because the facility would be major without the controls that were proposed in the application and will be required in the permit. Those controls (along with limits on throughput) will also make the facility a minor source under Title V.

45CSR16 Standards of Performance for New Stationary Sources

The facility is subject to 45CSR16 because it is subject to 40 CFR 60 (see below).

45CSR30 Requirements for Operating Permits

In accordance with 45CSR30 Major Source Determination, this facility will be a non-major source which is subject to NSPS Subpart Y. The facility's potential to emit will be less than the 45CSR30 threshold of 100 TPY for any criteria pollutant. Therefore, the facility will continue to be subject to 45CSR30 and classified as a Title V deferred source.

FEDERAL RULES

40 CFR 60 Subpart Y: Standards of Performance for Coal Preparation Plants

Subpart Y contains requirements relating to the performance of coal preparation plants. Pursuant to §60.250, affected facilities under Subpart Y include "[t]hermal dryers, pneumatic coal-cleaning equipment (air tables), coal processing and conveying equipment (including breakers and crushers), coal storage systems, transfer and loading systems, and open storage piles" located at "coal preparation and processing plants" that process greater than 200 tons per day. "Coal preparation and processing plants" is defined as "any facility (excluding underground mining operations) which prepares coal by one or more of the following processes: breaking, crushing, screening, wet or dry cleaning, and thermal drying." Carbonxt has proposed to crush and screen coal at their facility and, therefore, all coal conveying and crushing equipment and open storage piles are subject to the applicable sections of Subpart Y. Additionally, it should be noted that, unlike Rule 5, the calciners DO appear to meet the definition of "thermal dryer" under Subpart Y. This is because Subpart Y does not require the reduction of moisture content to be the **primary** purpose of the unit.

The substantive standards under Subpart Y applicable to the proposed Carbonxt facility are given in §60.252(b) and §60.254(b) and (c):

* The owner or operator must not cause to be discharged into the atmosphere from the thermal dryer any gases that contain PM in excess of 0.023 g/dscm (0.010 grains per dry standard cubic feet (gr/dscf)); and the owner or operator must not cause to be discharged into the atmosphere from the thermal dryer any gases that exhibit 10 percent opacity or greater. Note that since the thermal dryer is fired with natural gas it is exempt from the SO_2, CO and NO_x limits of the rule.

* A 10% opacity limit on all emission points;

* Operation of all coal open storage piles and associated conveying equipment in accordance with a fugitive coal dust emissions control plan.

Carbonxt's proposed use of full enclosures and baghouses on coal conveying and processing equipment (including crushers and screens) and coal transfer and loading systems should allow them to meet the 10% opacity limit.

Carbonxt will be required to submit, prior to startup, a "fugitive coal dust emissions control plan" according to the provisions of 40 CFR §60.254(b).

Carbonxt will be required to comply with all applicable monitoring, testing, reporting, and record-keeping requirements in Subpart Y.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The following Hazardous Air Pollutants will be emitted from the Calciners (all information comes directly from EPA's Air Toxics Website):

Arsenic Sulfide (Arsenic Compounds)

Arsenic, a naturally occurring element, is found throughout the environment; for most people, food is the major source of exposure. Acute (short-term) high-level inhalation exposure to arsenic dust or fumes has resulted in gastrointestinal effects (nausea, diarrhea, abdominal pain); central and peripheral nervous system disorders have occurred in workers acutely exposed to inorganic arsenic. Chronic (long-term) inhalation exposure to inorganic arsenic in humans is associated with irritation of the skin and mucous membranes. Chronic oral exposure has resulted in gastrointestinal effects, anemia, peripheral neuropathy, skin lesions, hyperpigmentation, and liver or kidney damage in humans. Inorganic arsenic exposure in humans, by the inhalation route, has been shown to be strongly associated with lung cancer, while ingestion of inorganic arsenic in humans has been linked to a form of skin cancer and also to bladder, liver, and lung cancer. EPA has classified inorganic arsenic as a Group A, human carcinogen.

Lead Sulfide (Lead Compounds)

Lead is used in the manufacture of batteries, metal products and ammunition. Exposure to lead can occur from breathing contaminated air in or near workplaces that process lead or lead materials, as well as from incidentally ingesting dust or paint chips in houses with lead-based paint. Lead can cause effects on the blood, as well as the nervous, immune, renal and cardiovascular systems. Early childhood and prenatal exposures are associated with slowed cognitive development, learning deficits and other effects.

Exposure to high amounts of lead can cause gastrointestinal symptoms, severely damage the brain and kidneys, and may cause reproductive effects. Large doses of some lead compounds have caused cancer in lab animals.

Mercury

Acute (short-term) exposure to high levels of elemental mercury in humans results in central nervous system (CNS) effects such as tremors, mood changes, and slowed sensory and motor nerve function. Chronic (long-term) exposure to elemental mercury in humans also affects theCNS, with effects such as erethism (increased excitability), irritability, excessive shyness, and tremors. Human studies are inconclusive regarding elemental mercury and cancer.

The following Hazardous Air Pollutants result from the normal combustion of natural gas and are emitted in quantities greater than or equal to 0.01 tons per year (again all information comes directly from EPA's Air Toxics Website):

Formaldehyde

Formaldehyde is used mainly to produce resins used in particleboard products and as an intermediate in the synthesis of other chemicals. Exposure to formaldehyde may occur by breathing contaminated indoor air, tobacco smoke, or ambient urban air. Acute (short-term) and chronic (long-term) inhalation exposure to formaldehyde in humans can result in respiratory symptoms, and eye, nose, and throat irritation. Limited human studies have reported an association between formaldehyde exposure and lung and nasopharyngeal cancer. Animal inhalation studies have reported an increased incidence of nasal squamous cell cancer. EPA considers formaldehyde a probable human carcinogen (Group B1).

Hexane

Hexane is used to extract edible oils from seeds and vegetables, as a special-use solvent, and as a cleaning agent. Acute (short-term) inhalation exposure of humans to high levels of hexane causes mild central nervous system (CNS) effects, including dizziness, giddiness, slight nausea, and headache. Chronic (long-term) exposure to hexane in air is associated with polyneuropathy in humans, with numbness in the extremities, muscular weakness, blurred vision, headache, and fatigue observed. Neurotoxic effects have also been exhibited in rats. No information is available on the carcinogenic effects of hexane in humans or animals. EPA has classified hexane as a Group D, not classifiable as to human carcinogenicity.

AIR QUALITY IMPACT ANALYSIS

Because this is a construction of a minor source no modeling was performed.

MONITORING OF OPERATIONS

The permittee shall maintain certifiable records of the following:

* The amount of coal delivered to the facility on a monthly basis.

* The amount of additive delivered to the facility on a monthly basis.

* The amount of natural gas fired by the calciner burners on a monthly basis.

* The amount of activated carbon produced on a monthly basis.

* The amount of water used by the water truck on a monthly basis.

* The pressure drop across each baghouse at least once per day.

* Liquor flow rate to the dual packed bed scrubbers at least once per day.

* All applicable monitoring required by 40 CFR 60 Subpart Y.

Additionally, an initial performance test will be required on either emission point E6A or E6B to ensure that all emission limits are being met.

RECOMMENDATION TO DIRECTOR

Information supplied in the application indicates that compliance with all applicable regulations will be achieved. Therefore it is the recommendation of the writer that permit R13-2911 for the construction of an activated carbon production plant in Institute, Kanawha County, be granted to Carbonxt Inc.

Steven R. Pursley, PE
Engineer

March 15, 2012