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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-2578B
Plant ID No.:	069-00083
Applicant:	Touchstone Research Laboratory, LTD
Facility Name:	Triadelphia
Location:	Triadelphia,
SIC Code:	8731
Application Type:	Modification
Received Date:	June 25, 2010
Resubmitted Date:	July 27, 2010
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	\$1000.00
Date Received:	August 10, 2010
Completeness Date:	March 11, 2011
Due Date:	June 9, 2011
Newspaper:	<i>Intelligencer</i>
Applicant Ad Date:	August 3, 2010
UTMs: Easting: 532.2 km	Northing: 4,432.6 km Zone: 17
Description:	This modification is for the addition of a new kiln furnace and autoclave at the facility. Both of these emission units will be vent to its own thermal oxidizer.

DESCRIPTION OF PROCESS

Touchstone Research Laboratory is located in the Millennium Center, a high technology research park in Triadelphia, West Virginia. Touchstone's primary business focus is on the development of advance material for commercialization. Touchstone also serves as a premiere materials testing and characterization facility, with a specialization in metallurgical applications.

Promoting a healthy environment.

Non-confidential

The Triadelphia facility consists of four buildings. In Building #1, material and characterization testing is conducted. Building #2 is dedicated for the MetPreg® process. The CFOAM® pilot production facility is located in Buildings 3 and 4

Touchstone operates a process that converts pulverized coal to rigid carbon foam. This “foaming process involves heating coal under pressure in a primary nitrogen environment. Upon completion of the reaction cycle, volatile organic gases and liquids/sludge are released from the reaction vessel. Touchstone is currently permitted to operate four autoclaves, two kiln furnaces, and a mold filling station. Volatile Organic Compound (VOCs) emissions from autoclaves and kiln furnace are control by a thermal oxidizer.

For this modification application, Touchstone has proposed to install another autoclave (Autoclave #5). This new autoclave will be vented to separate thermal oxidizers. Autoclave #1 has been removed and will be omitted from the permit.

The new Autoclave #5 will be operated in the same manor as the existing ones do. Prior to venting the autoclave, the thermal oxidizer will be started and operated up to a minimum combustion chamber temperature of 760⁰C (1,400⁰F). Once the oxidizer is ready, the effluent for the autoclave will be routed to the oxidizer in a control manor to ensure that the minimum oxidization temperature and oxygen content are maintained during the venting process.

The selected oxidizer will be equipped with natural gas burner system will have a total heat input rating of 9.0 MMBtu/hr. The combustion chamber has a volume of 750 cubic feet. Two Type “K” sensing thermocouples will be used to measure and monitor the combustion chamber temperature continuously during the oxidization process.

Other proposed changes to the process equipment include a change to Furnace #2. Furnace #2 is a shuttle car style kiln. Touchstone has reconfigured the shuttle car in such a way that allows more material to be loaded at single time.

SITE INSPECTION

This facility was last inspected on September 11, 2008, by Mr. Steven j. Sobutka, P.E., a compliance engineer from the Northern Panhandle Regional Office. Mr. Sobutka found the facility to be in compliance. Given that the Touchstone is adding additional equipment of the same type and controlling them in the same manor, a site inspection conducted by this writer is not required for this evaluation.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

9.0 MMBtu/hr thermal oxidizer will be used to oxidize the effient from Autoclave #5. Assuming that the by-products in the coal (volatile matter) is approximately 15% by wt. or 300 lb/ton of coal, Touchstone calculated that 20% of these by-products would be released from the autoclave.

Because these by-products will be vented straight to the thermal oxidizer, the rest of this emission estimate for the new autoclave will focus on the oxidizer. The selected oxidizer is conventional recuperative thermal oxidizer with a manufacturer's destruction efficiency of 99% for volatile organic compounds. Products of incomplete combustion such as PM and CO were based on emission factors from AP-42, Chapter 1.4. and design heat input of the oxidizer.

The annual SO₂ rate is based on emission factor from Table 12.2-16 of AP-42 and the annual processing rate of 940 tons per year. The annual SO₂ was divided by the predicted hourly vent time of the autoclave 2,025 hours per year to determine a hourly sulfur dioxide rate.

In the past, oxidizes of nitrogen were assumed to be generator in similar manor as natural gas fired boiler or heat exchanger. The problem with this assumption is the purpose of the respective device. A boiler is to generator heat energy in a useable from (i.e. steam). To achieve steam at a specific temperature, one will adjust the firing rate of the boiler. An oxidizer is design to create an oxidizing or reducing atmosphere in the combustion chamber, which will reduce the

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undesired effluent in to carbon dioxide and water. Thus, the fundamental difference is the amount of excess air needed for each of these devices. Natural gas boiler are normally fired with 10-25% excess air with yields a exhaust stream with 3% oxygen content. Oxidizer depends on the effluent being oxidized. Some oxidizers can be operating with an oxygen content of near 21% in the exhaust. Touchstone has found the oxygen content in its oxidizers to range from 12 to 14%.

Using 15% as maximum possible oxygen content, a correction factor was developed using the following:

$$CF = \frac{15\%}{(15\% - 3\%)} = 1.25$$

Where:

CF = Correction Factor

Oxides of nitrogen emissions were based on the emission factor from AP-42, Chapter 1.4 multiply be the maximum natural gas flow rate of the oxidizer and the developed correction factor.

VOCs, hydrogen chloride and hydrogen fluoride emissions were calculated on an annual basis using a annual processing rate 940 tons of coal per year. Emission factors from Chapter 12.2 of AP-42 and the annual coal process rate was used to estimate the hydrogen chloride and hydrogen fluoride emissions. VOC emissions were based Touchstone’s predicted organic loses from the coal and a destruction efficiency 99%. These estimates were summarized into the following table.

Table 1 - Controlled Emissions from the Thermal Oxidizer (ID. #6c)		
Pollutant	Controlled Emissions	
	lb/hr	Annual (ton/yr)
PM ₁₀	0.07	0.31
PM	0.07	0.31
SO ₂	6.03	6.10

NO _x	1.13	4.95
CO	0.76	3.33
VOCs	0.03	0.03
HCL		0.01
HF		0.2
Total HAPs		0.21

This writer applied the NO_x correction factor to the existing oxidizers (Thermal Oxidizers #1, and #2). This correction yielded an increase in the NO_x emission rate of 4.6 tons per year from the existing oxidizers.

REGULATORY APPLICABILITY

The following state rules are applicable to the proposed modification

45CSR4 - To Prevent and Control the Discharge of Air Pollutants into the Open Air Which Causes or Contributes to an Objectionable Odor or Odors

The purpose of this rule is to prevent and control the discharge of pollutants into the open air that causes or contributes to an objectionable odor or odors. 45CSR4 states that an objectionable odor is an odor that is deemed objectionable when in the opinion of a duly authorized representative of the Division of Air Quality based on his/her investigations and complaints, such odors is objectionable.

Certain constituents of the by-products (i.e. hydrogen sulfide) are known to cause or contribute to an objectionable odor. Therefore, Touchstone elected to employ oxidization technology to reduce these constituents into odorless products of complete combustion. As of

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this time, Touchstone complies with 45CSR4, as no odors emitted from their facility have been deemed objectionable.

45CSR6 - To Prevent and Control Air Pollutants From Combustion of Refuse

The purpose of this rule is to prevent and control air pollution from the combustion of refuse. Because the vent stream from the process is a un-useable product or material from the manufacturing process, then it is consider a waste stream. Touchstone has elected to oxidize these streams. Thus, the thermal oxidizer is subject to the requirements under this rule.

45CSR§6-4. established the emission standards for incinerators. Under this section, the emissions to be regulated are particulate matter and visible particulate matter.

45CSR§6-4.1. set a particulate matter emission limit based on incinerator capacity that is input in the prescribe formula. Based on information in the application file, the mass of the vent stream is 63.0 pounds per hour, which is less than 15,000 pounds per hour. Using the F factor of 5.43 from row A in Table I of 45CSR§6-4.1, the allowable particulate matter emission rate is calculated to be 0.17 pounds per hour, which is greater than the estimated PM for the new thermal oxidizer, which is 0.07 lb/hr.

45CSR§§6-4.3. & 4.4. establishes visible emission standards for incinerators. The proposed and modified thermal oxidizers will be limited to a 20% opacity limit under this these subsections. Due to the nature of the effluent being incinerated, the selected oxidizer should be more than capable of meeting this visible emissions standard at all time. This prediction was based on the calculated retention time of the effluent is retained in the combustion chamber of the oxidizer.

45CSR7 - To Prevent and Control Particulate Matter Air Pollution from Manufacturing Process Operations

The purpose of this rule is to prevent and control particulate matter air pollution from manufacturing processes and associated operations. However, the manufacturing operations proposed in this application are vented to the oxidizer. The allowable for the autoclave would be 28 pounds of PM per hour, which is more than the allowed under 45CSR6. The oxidizer for this manufacturing processes vent is subject to 45CSR6. For this particular case, the allowable PM standard of 45CSR6 is stricter than 45CSR7. Therefore, 45CSR§7-12.1. and 45CSR§6-11.1 allows the Director to resolve the inconsistency between state rule and use the more stringent provision(s) by incorporating the more stringent allowable into the permit. No further decision of this rule is necessary for this application.

45CSR10 - To Prevent And Control Air Pollution From The Emission of Sulfur Oxides

The purpose of this rule is to prevent and control air pollution from the emissions of sulfur oxides. Under this rule, Touchstone is combusting a process gas stream. Thus, the effluent from the autoclaves and kilns is subject to 45CSR§10-5., which prohibits the combustion of any gas stream with a concentration of hydrogen sulfide greater than 50 grains per 100 cubic feet of carrier gas.

Touchstone conducted performance testing on December 12, 2006, for the purpose for measuring sulfur dioxide emissions. The measured concentrations ranged from 127 ppm to 0.41 ppm. To evaluated these measured results to the actual emission standard in this rule, the sulfur dioxide concentration must be converted into a hydrogen sulfide concentration. The agency assumed that all of the sulfur in this measured concentration of sulfur dioxide was created by oxidizing hydrogen sulfide. Using the proposed effluent rates from the autoclave and kiln, the hydrogen sulfur concentration would be 0.002 grains per 100 cubic feet of carrier gas for effluent for the autoclave and 1.34 grains per 100 cubic feet of carrier gas from the kiln. Clearly, these

predicted concentrations are less than the 50-grain standard. Thus, these sources operated in the proposed manner should be capable of achieving compliance this rule.

45CSR13 - Permits for Construction, Modification, Relocation, and Operation of Stationary Sources of Air Pollutants, Notifications Requirements, Temporary Permits, General Permits, and Procedures for Evaluation

The purpose of this rule is to set forth the procedures for stationary source reporting, and the criteria for obtaining a permit to construct and operate a new stationary source which is not a major stationary source, to modify a non-major stationary source, to make modifications which are not major modifications to an existing major stationary source and to relocate non-major stationary sources within the State of West Virginia.

45CSR13 applies to this proposed modification that the hourly potential emissions of sulfur dioxide exceeds the regulatory threshold for criteria pollutants of six pounds per hour. Also, 45CSR§6-6.1. required Touchstone to obtain a permit for the proposed and modified thermal oxidizers regardless of the potential emissions.

On October 21, 2005, Touchstone published a class I legal ad in the Intelligencer. Thus, Touchstone for fore filled the public review procedures under §45-13-8. Touchstone paid the filling fee according the fee schedule set forth in 45CSR22, which consisted of a \$1000.00 permit application fee.

45CSR31 - Confidential Information

Touchstone has filed a claim of confidential information to protect specific information being released to the public. The information noted under this claim shall be protected until the Director makes his/her determination that the information does not fall with the definition of confidential information under 45CSR§31-4.

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TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The HAPs present in Touchstone's stream consist of the following: xylenes, phenol, naphthalene, toluene, ethyl benzene, benzene, hydrochloric acid, hydrogen fluoride and total fluorides. Due to the estimated emission rates of these HAPs (below 45CSR30 major source status trigger levels), detailed toxicological information is not included in this evaluation. Touchstone will be limited to the emission rates set forth in Permit R13-2578B. The oxidizer will destroy the HAPs that are volatile organic compounds with a destruction efficiency of at least 99%. Any metal HAPs (i.e. mercury, beryllium, etc.), chlorinated compounds and fluoridated compounds will not be removed or oxidized into products of complete combustion. The chlorinated and fluoridated compounds will be converted into hydrogen chloride and hydrogen fluoride respectively.

AIR QUALITY IMPACTS ANALYSIS

This writer deemed that an air dispersion modeling study or analysis was not necessary, because the proposed modification does not meet the definition of a "major source" as defined in 45CSR14.

MONITORING OF OPERATIONS

The permittee shall be required to monitor and record the amount of bituminous coal processed, operating temperature of the thermal oxidizers and the maintenance and repair activities associated with the control devices.

Previous permit (R13-2578A) required monitoring natural gas usage. This writer review the pass compliance inspection reports which include natural gas usage records. It was noted in

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the compliance report that the recorded natural gas usage include usage from other sources such as heater for conditioning indoor air at the facility. Taking the whole facility into consideration, the production of Touchstone's products is a batch operation and the utilization of the oxidizers (natural gas fired sources) will be used on intermitted based on the actual batch operation. Thus, this writer recommends omitting the natural gas usage limits from the permit as indicator of compliance for this facility.

The focus of ensuring compliance from this facility should center on operating the oxidizers at the correct temperature. The existing permit requires monitoring the temperature combustion chamber of each oxidizer. Currently, the agency has been requiring sources to conduct annual inspection of combustion equipment to ensure proper operation of the source. Because of the very low utilization/production rates, annual inspections may appear to be too frequent. Thus, this writer recommends relying on the manufacturer's maintenance requirements instead on conducting annual inspections.

One other operating parameter that should be monitored and recorded is the actual length of time an autoclave vents to the oxidizer. Having this data available would aid in actually determinate actual annual emissions from the oxidizers.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates Touchstone's research laboratory meets all the requirements of the applicable rules or regulations when all of the proposed control devices are functioning properly. Therefore, impact on the surrounding area should be minimized and it is recommended that the Touchstone's Triadelphia facility should be granted a modification permit under 45CSR13 for the proposed changes.

Edward S. Andrews, P.E.
Engineer

Date: March 16, 2011

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