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west virginia department of environmental protection

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## ENGINEERING EVALUATION / FACT SHEET

### BACKGROUND INFORMATION

Application No.: R13-2558C  
Plant ID No.: 029-00033  
Applicant: C&C Marine Maintenance Company  
Facility Name: Congo Plant  
Location: Newell  
NAISC Code: 325199, 483211, 488310, 488330, and 488390  
Application Type: Modification  
Received Date: June 30, 2011  
Engineer Assigned: Edward Andrews  
Fee Amount: \$2000.00  
Date Received: June 29, 2011  
Completeness Date: July 12, 2011  
Due Date: October 10, 2011  
Newspaper: *The Weirton Daily Times*  
Applicant Ad Date: July 5, 2011  
UTMs: Easting: 530.9 km Northing: 4,495.3 km Zone: 17  
Description: This modification is required as part of the compliance plan in Consent Order CO-R13-E-2011-4 and the installation of additional boiler to the facility.

### DESCRIPTION OF MODIFICATION

The Congo Plant owned and operated by C&C Marine Maintenance Company (C&C Marine), formally owned & operated by DTC, currently operates one 17.4 MMBtu York Shipely fuel oil fired boiler (Boiler #1) to provide 9,000 lb/hr of 150 psig steam to support the marine maintenance activities and process heat for the glycol stills at facility. This unit was covered under Permit R13-2558B. Permit R13-2558B required DTC to conduct compliance testing for PM and SO<sub>2</sub> within 180 days of initial start-up of the facility. This testing was not conducted at

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the maximum heat input rate within this period. Thus, Consent Order CO-R13-E-2011-4 was entered to address this lack of compliance testing and other issues, which are covered under Permit R13-1645. These other issues and corresponding measures to bring the facility into compliance are addressed in Permit Application R13-1645A, which was filed on July 12, 2011.

C&C Marine proposes to add a natural gas fired boiler (Boiler #2) to provide additional steam capacity and backup the other boiler at its Congo Plant, which is located near Newell, WV. The proposed unit will combust natural gas with a maximum design heat input of 20.4 MMBtu/hr. C&C Marine proposes to operate this unit only 8,400 hours per year.

In addition, C&C Marine is requesting various minor revisions and edits to Permit R13-2558B as result of the consent order. C&C Marine acquired the Congo Plant from DTC on April 15, 2011, and subsequently accepted the responsibilities for Permit R13-2558B and the consent order. C&C Marine has complied with Step #5 of the Order for Compliance in the consent order by submitting this modification application.

### SITE INSPECTION

The Congo Plant is an existing non-major (deferred) Title V source. Therefore, the Compliance and Enforcement Section routinely inspects the facility. Mr. Steven Sobutka, P.E., an engineer assigned to the Northern Panhandle Region Office, last inspected the facility on August 18, 2008, and an offsite inspection by Mr. Jesse Adkins on March 1, 2011, which resulted in Consent Order CO-R13-E-2011-4.

Due to conflicting and missing information in the files and lack of a sound explanation why the existing unit is firing at a low rate, the writer with Mr. Steve Sobutka, P.E., an engineer assigned to the Northern Panhandle Regional Office's Compliance and Enforcement Section, conducted a site visit of the facility on August 18, 2011. Mr. Ronald Corigliano, Director of Regulatory Compliance, Mr. Edmund Mile, Environmental Compliance Officer, Mr. Rick Wilson, Acadia Environmental Group, and other key managers and operators of the Congo Plant were present during this visit.

During this visit, C & C Marine provided the following information to the writer:

- Existing boiler is a York Shipley manufactured in 1966 with a rating of 550 boiler horsepower (Bhp). The original burner was replaced with one rated at 450 Bhp, which can handle fuel oils and/or natural gas.
- The exhaust from the existing boiler is being routed to the scrubber instead of the evaporation spray tower. C & C Marine is planning to use the ductwork that housed the evaporation tower as the stack for Boiler #2 (natural gas fired boiler).
- The glycol recovery system permitted in R13-2558 never worked as designed, which was the spray evaporation tower and clay treatment.

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- The spray evaporation tower process was replaced with a batch vacuum distillation unit. This vacuum distillation process was proposed on February 10, 2005 under PD05-014 and issued a no-permit required letter on April 5, 2005. The vacuum distillation process is currently used at the Congo Plant to recover saturated glycol.
- To improve or enhance the color of the glycol, the facility adds hydrogen peroxide as needed to the glycol to meet their customers' requirements.
- Water distilled from the vacuum distillation unit is used as make-up water for the cooling tower. This cooling tower rejects the heat from the condensers on the distillation units.

The facility is located adjacent to Ergon's Newell Plant and one resident. The Ohio River and an in-land lagoon define the rest of the facility.

### ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

The applicant used pollutant specific emissions factors from Chapters 1.3 and 1.4 of AP-42 to estimate emissions from these two boilers. C & C Marine proposes to limit Boiler #1 to 55 gallons of fuel per hour and hours of operation to 8,400 hours per year, which equates to a heat input of 7.1 MMBtu/hr. There is no real reason for limiting this unit to the proposed limits. Thus, the writer recalculated the potential emission from Boiler #1 with a maximum heat input rate of 8 MMBtu/hr (which equates to 61.8 gallon per hour) and no limitation on hours of operation. The hourly fuel restriction equates to 541,267 gallons per year.

Table # 1 – Emissions from Boiler #1			
Pollutant	Fuel Oil Fired		
	Emission Factor	Hourly Rate lb/hr	Annual Rate (TPY)
Particulate Matter (PM)/PM <sub>10</sub> /PM <sub>2.5</sub> Filterable	7 lb/M gal	0.43	1.89
PM Condensable Fraction	1.5 lb/M gal	0.09	0.41
Sulfur Dioxide (SO <sub>2</sub> )	0.5 % of S	5.02	21.98*
Oxides of Nitrogen (NO <sub>x</sub> )	20 lb/M gal	1.24	5.41
Carbon Monoxide (CO)	5 lb/M gal	0.31	1.35
Volatile Organic Compounds (VOCs)	0.2 lb/M gal	0.01	0.05
Total HAPs		0.01	0.04

\* SO<sub>2</sub> – Emissions are before controls.

C & C Marine plans on only firing Boiler #2 with natural gas. This unit has maximum design heat input rate of 20.4 MMBtu/hr, which equates to a natural gas firing rate of 20.4 Mscf per hour. The annual emissions were estimated based on the maximum operating schedule of 8,760 hours per year.

Table #2 – Emissions from Boiler #2			
Pollutant	Natural Gas Firing		
	Emission Factor	Hourly Rate (lb/hr)	Annual Rate (TPY)
PM/PM <sub>10</sub> /PM <sub>2.5</sub> Filterable	1.9 lb/MMcf	0.039	0.17
PM Condensable Faction	5.7 lb/MMcf	0.12	0.51
SO <sub>2</sub>	0.6 lb/MMcf	0.01	0.05
NO <sub>x</sub>	100 lb/MMcf	2.04	8.94
CO	84 lb/MMcf	1.71	7.51
VOCs	5.5 lb/MMcf	0.11	0.49
Total HAPs		0.04	0.17

Boiler #1 was originally permitted to operate at 8,568 hours per year. In addition, this unit was permitted with a wet scrubber for controlling CO, NO<sub>x</sub>, SO<sub>2</sub> and VOC from this unit. It is the writer's understanding of this type of control device that only SO<sub>2</sub> emissions would be effectively controlled. However, this particular scrubber is not capable of removing sulfur dioxide at the efficiency level as listed in the permit, which was 99.8%. Thus, the permitted emission limits in R13-2558B are not appropriate for Boiler #1. The following table lists the existing limits and the proposed limits with the net difference in emission by pollutant.

Table # 3 – Changes in Permitted Limits for Boiler #1			
Pollutant	Current Limits (TPY)	Proposed (TPY)	Net Difference (TPY)
PM/PM <sub>10</sub> /PM <sub>2.5</sub> Filterable	2.60	1.89	- 0.71
PM Condensable Faction	0	0.37	0.41
SO <sub>2</sub>	0.29	6.59*	5.62
NO <sub>x</sub>	0.29	5.41	5.12
CO	0.01	1.35	1.34
VOCs	0.01	0.05	0.04
Total HAPs		0.04	0.04

\* With controls applied.

The facility operates two vacuum distillation reactors to distill spent ethylene and propylene glycol solutions. Permit R13-2558B allowed the facility to re-claim glycol with a spray evaporator. This process did not work as expected. Thus, DTC elected to switch to the vacuum distillation process. Based on the information in Permit Determination PD05-014, it was assumed by DTC and DAQ, the VOCs from the new process would be the same as permitted under R13-2558B.

Permit R13-2558B established a VOC limit of 0.1 pounds per hour and annual limit of 0.01 tons per year. Based on the C & C Marine's reported Toxic Release Inventory for 2010, the facility discharged 3,002 pounds (1.5 tons) of ethylene glycol (VOC) in 2010. However, this reported discharge of ethylene glycol includes some propylene glycol. C&C Marine receives a solution or mixture of multiple glycols and ships the finished product as a mixture of multiple glycols in a more concentrated solution. Thus, tracking just ethylene glycol is not practicable at this time.

Looking at the process again, there are two potential discharge points of VOC (glycols) emissions from the vacuum distillation system. One point is the discharge side of the vacuum pump and the other point is the distilled water discharged from the condenser. The discharge side of the vacuum is going straight to atmosphere. This distilled water may have trace amount of glycol mixed in with it. The distilled water is usually added to the cooling water for the condenser. As the cooling water is circulated, a portion is evaporated, which is where the VOCs (glycol) is discharged to the atmosphere.

In a perfect situation, ethylene glycol should not boil out of the reactor with a boiling point of 388<sup>0</sup>F and the maximum temperature of the packed column at 300<sup>0</sup>F. However, ethylene glycol has a strong affinity for water. This affinity is why most glycol re-claiming processes use a vacuum to lower the boiling point of the solution. Thus, less heat energy is required in the reactor to bring the solution to a boil.

This distillation process is a batch process. C & C Marine is dependent on market availability of spent glycol as well as the supply demand for glycol. The facility receives spent glycol with a concentration of 20 – 50% glycol. C & C Marine's process has the capability to re-claim it up 99% glycol.

As result of the writer questioning the VOC and Ethylene Glycol emission from the recovery process, C & C Marine contracted Chemstress Consultant Co. of Akron, OH to model the glycol recovery and predict the VOC and Ethylene Glycol emissions from the process vent and cooling tower. The results of this process modeling analysis yielded that the VOC peak hourly rate from the outlet of the process vent was 1.64 pounds per hour, which was process processing propylene glycol during the summer months. For the Ethylene Glycol, the reactor would have to be processing performance fiber ethylene glycol during the summer months, which would be 0.86 pounds per hour of ethylene glycol. The maximum peek VOC emissions was predicted to be 37.7 pounds per hour, during the summer months with the cooling water at 95<sup>0</sup> F with an organic concentration of 50%. Ethylene Glycol emission from the cooling tower was predicted to peek at 22.8 pounds per hour, during the summer months with the cooling water at 95<sup>0</sup> F with an ethylene glycol concentration of 50%.

These hourly rates are peek rates predicted with specific inputs and operating conditions. Annual emissions were based on 155 batches producing four different products. The time for each batch depends on the specific grade of glycol product being reclaim which ranges from 33 hours up to 144 hours. The maximum annual emissions from the total process was predicted to be less than 16 tons of VOCs. Of these VOCs, 9.2 tons would be ethylene glycol.

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## REGULATORY APPLICABILITY

### WV STATE RULES

#### **45CSR2 To Prevent and Control Particulate Air Pollution From Combustion of Fuel In Indirect Heat Exchangers**

This rule establishes emission limitations for smoke and particulate matter, which are discharged from combustion of fuel in indirect heat exchangers (boilers and process heaters). The proposed new unit (boiler) is to be only fired with natural gas. The agency recognizes that natural gas is a clean burning fuel and assumes “Type b” fuel burning units to be capable of complying with PM and visible emission limitations of this rule, which is outline in the DAQ’s Rule 13 Guidance for Natural Gas Combustion Source.

Based on the restriction of fuel rate for Boiler #1 to 56 gallons per hour (less than 10 MMBtu/hr), the unit would be exempt from Sections 4, 5,6, 8, and 9 of this rule (45CSR§2-11.1). However, Hancock County is currently classified as non-attainment for PM<sub>2.5</sub>. Thus the writer evaluated this unit’s ability to meet the PM emission limitation of this rule. The existing unit (Boiler #1) burns either fuel oil, used oil, or recovered oil product from the barge cleaning process. Thus, this unit is classified as “Type b” fuel burning unit and is subject to the weight emission standards in 45CSR§2-4.1.b., which sets an allowable PM limit of 0.09 lb. of PM per million (MM) BTUs for Boiler #1. At the maximum design heat input rate of this unit, Boiler #1 has a predicted PM rate of 1.03 pounds per hour which includes the condensable fraction. This PM mass rate equates to 0.06 lb/MMBtu or 67 % of the allowable. C & C Marine uses a packed bed scrubber with caustic soda to control sulfur dioxide emissions. The design control device is known to be very effective in collecting acid gases out of exhaust streams. Acid gases are classified as condensable particulate matter, which this control device will aid or increase the margin of compliance with this rule. Under 45CSR§2-3, visible emissions from this unit would be limited to a visual emission standard of 10% opacity. C&C Marine conducted a performance demonstration on May 10, 2011. This testing included visible emission observations using U.S. EPA Method 9. The result of these observations was that no visible emissions were detected.

#### **45CSR10 To Prevent and Control Air Pollution From Emissions of Sulfur Oxides**

The purpose of this rule is to prevent and control air pollution from the emission of sulfur oxides. The proposed unit is classified as a “Type b” fuel burning unit per 45CSR§10-2.8.b. Therefore, the unit is subject to 45 CSR §10-3.1.e., which set an allowable sulfur dioxide limit of the product of 3.1 and the total design heat input of the unit in terms of million BTU per hour. For this unit, the allowable sulfur dioxide rate would be 24.8 pounds per hour. Boiler #1 has a potential to emit, before controls, of 5.02 pounds of SO<sub>2</sub> per hour. C & C Marine believes the scrubber has a SO<sub>2</sub> collection efficiency of 85%. The writer believes for this case a more conservative collection efficiency of 70% is appropriate for this design and with a fuel that has

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less than half a percent of sulfur. At 70%, the SO<sub>2</sub> rate would be 1.5 pounds per hour, which is less than 6% of the allowable.

It should be noted that Hancock County has is projected to be classified as non-attainment for the 2010 Sulfur Dioxide National Ambient Air Quality Standards. Thus, the writer recommends that the 1.4 lb of SO<sub>2</sub> per hour be established as the limit in the permit rather than set the allowable under this rule as the permitted limit.

#### **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**

The potential to emit from the proposed emission units exceeds the 6 pounds per hour and 10 tons per year for oxides of nitrogen, carbon monoxide and sulfur dioxide before controls, which is the trigger level of a source as defined in 45CSR§13-2.24. Thus, the facility is required to obtain a permit as required in 45CSR-13.5.1.

The facility has met the applicable requirements of this rule by publishing a Class I Legal Advertisement in *The Weirton Daily Times* on July 5, 2011, paid the \$1000.00 application fee, \$1000.00 NSPS fee, and submitted a complete permit application.

#### **FEDERAL REGULATIONS**

##### **45CSR30 Requirements for Operating Permits**

This rule provides for the establishment of a comprehensive air quality permitting system consistent with the requirements of Title V of the Clean Air Act, and provides for a transition period prior to the implementation of the permitting system. The Congo Plant is an existing Title V deferred source. Boiler #1 was an affected source under 40 CFR 60, Subpart Dc as stated in Permit R13-2558. The writer believes this NSPS applicability determination was not correct since the boiler was manufactured in 1966 (per NSPS) and has not demonstrated that the unit can achieve a heat input greater than 10 MMBtu/hr. The previous owner attempted to conduct performance testing at or near the design maximum heat input of Boiler #1. However, the facility never could get the unit above 8 MMBtu/hr. On May 6, 2011, the facility conducted compliance tests as required in Consent Order CO-R13-E-2011-4 and had the unit operating with an average heat input of 6.40 MMBtu/hr. Thus, the unit should not have been classified as an affected source subject to Subpart Dc, which means the Congo Plant should not have been classified as Title V source.

Regardless, C & C Marine has now proposed to install a natural gas fired boiler with a heat input of greater than 10 MMBtu/hr, which means Boiler #2 is subject to Subpart Dc. Thus, the Congo Plant is a deferred Title V source. The emissions from Boiler #2 and the flare which is under consideration in Permit Application R13-1645A does not change the Congo Plant's status as a minor source, which is listed in the following table.

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Pollutants	Emission Units			Total (TPY)
	Boiler #1 (TPY)	Boiler #2 (TPY)	Flare in R13-1645A (TPY)	
PM <sup>1</sup>	2.30	0.68	0.19	3.17
SO <sub>2</sub>	6.59	0.05	0.01	6.65
NO <sub>x</sub>	5.41	8.94	1.7	16.05
CO	1.35	7.51	9.18	18.04
VOCs	0.05	0.49	5.04	21.38*

\* Assumed 16 tons of VOCs from the glycol recovery process.

1 – Includes the fillable and condensable PM portions.

#### **40 CFR 60, Subpart Dc Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units.**

Boiler # 2 has a heat input of 20.4 MMBtu/hr and manufactured in 1991. Therefore it is subject to 40 CFR 60, Subpart Dc under the applicability requirements of §60.40c(a). C & C Marine proposes to only burn natural gas in this unit.

This unit is only subject to a few portions of the reporting and recordkeeping requirements of this regulation, which are §§60.48c(a) and (g). C & C Marine has noted that it would prefer to comply with the alternative monitoring requirement of §60.48c(g)(2), which is recording the total amount of natural gas combusted each month.

#### **40 CFR 63 National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers Subpart JJJJJ**

This regulation establishes emission limitations for area sources (minor sources of HAPs) that operate at least one boiler. The Congo Plant is a minor source of HAPs and has two boilers on site. Thus, the facility is subject to this regulation.

C & C Marine has elected to only burn natural gas in Boiler #2. Thus, Boiler # 2 is not subject to the emission limitation and/or work practice standards of this regulation (§63.1195(e)). Boiler #1 burns liquid fuel and therefore is an affected source under this regulation.

Boiler #1 will have a maximum heat input of 8 MMBtu/hr and therefore is only subject to the work practices of §63.11223, which requires biennial boiler tune-ups. Because the heat input of Boiler #1 will be limited to less than 10 MMBtu/hr, the facility is not subject to the energy assessment requirements of §63.11214(c). The draft permit will include the boiler tune-up and notification requirements of this regulation.

## TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

As a result of this permit, the emissions sources covered by this permit will not be releasing any new hazardous air pollutants (HAPs). Thus, no additional information on toxicity is presented in this evaluation.

## AIR QUALITY IMPACTS ANALYSIS

The 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

Both boilers are subject to the visible emission standard of Rule 2. Boiler # 2 will be restricted to burning natural gas, which is understood not to generate particulate matter or visible emissions when combusted. Thus, ensuring compliance with the standard will be done by restricting the fuel type for this unit.

Boiler #1 is not that simple. The exhaust from this source should contain a steam plume due to the caustic scrubber. Thus, Method 22 would not be appropriate since there is no distinguishable difference between visible emissions and a steam plume or the separation of visible emissions out of the steam plume. Typically, oil burning units do not usually exhibit visible emissions. The writer proposes to have C & C Marine conduct a Method 9 observation within 60 days after completing the biennial boiler tune-ups to demonstrate compliance with the standard.

Other monitoring for these two boilers includes the following:

- Fuel usage every month.
- Type of fuel consumed by Boiler #2
- Quarterly analysis of the fuel stored in the waste oil tank to determine the following:
  - Ash
  - Moisture
  - Total Sulfur
  - Higher heating Value (HHV)

The glycol recovery system only had annual crude glycol throughput and waste oil separated limits. Permit R13-2558B did not clearly establish a VOC limit based on the restricted throughput. Second, the process reviewed under Permit R13-2558B was abandoned and replaced with a vacuum distillation process. The writer believes that the annual crude glycol

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limit did not serve any purpose other than limiting the amount of crude glycol the facility could accept in a given year.

The facility accepts or buys crude glycol with a glycol concentration of between 20 to 50%. The Congo Plant basically separates the oil and other contaminants through simple mechanical means. Then, the evaporator boils off the water to concentrate glycol in the final product to meet the customer needs. Thus, the writer could see that the existing limit would not prevent the facility from re-processing the solution until the desired concentration is reached. Thus, the throughput is not representative of the process or emissions from the process.

The writer considered attempting to estimate the emissions from the process. To estimate the emissions would require additional operation information of the process, glycol received and chemical process simulating model. At the end of the day, the results from this would only be representative if the crude glycols originate from a specific source and the operation reclaimed the glycol to a specific concentration.

Reviewing the Glycol Recovery Emission Study, the VOC emission from the cooling tower significant increase when the temperature of cooling water approaches 95<sup>0</sup>F, nearly a 45% increase. It is more significant if the organics in the cooling water is ethylene glycol, which is over 65% increase of Ethylene Glycol emissions when the temperature approaches 95<sup>0</sup>F. Thus, monitoring of this process should focus around the temperature of the cooling water. Thus, the writers propose to monitor the temperature of the cooling water once per operating day during June through September. It was assumed that the cooling water should average 60<sup>0</sup>F or less during the rest of the year. The peak hourly VOC was predicted to be 4.5 pounds per hour or only 12% of the hourly limit. Other information that will need to be recorded is the number of date/time of each batch starts and finishes, amount and concentration of process glycol and final product.

#### CHANGES TO PERMIT R13-2558B

The proposed draft permit was developed using the latest version of the agency's format. Permit R13-2558B establishes limits on hour of operation and annual fuel usage. The writer does not believe there is a need to have both limits for Boiler #1. Thus, the hours of operation limit (Condition A.4.) was omitted. Conditions A.1. through A.3., A.7. and A.8. were combined into Condition 4.1.1. The specific requirements for Boiler #2 and the boiler tune-up requirements were included in Condition 4.1.1. as well. Permit R13-2558B did not define any specification for the used or waste oil. The draft permit incorporates that the used oil must meet the specification of 40 CFR §279.11.

## RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that compliance with all applicable regulations will be achieved. Therefore, the writer recommend that the Director grant a modification permit to C &C Marine Maintenance Company for the boilers and glycol recovery process at the Congo Plant.

Edward S. Andrews, P.E.  
Engineer

Date: March 9, 2012

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