



---

west virginia department of environmental protection

---

Division of Air Quality  
601 57<sup>th</sup> Street, SE  
Charleston, WV 25304-2345  
Phone: 304-926-0475 Fax: 304-926-0479

Earl Ray Tomblin, Governor  
Randy C. Huffman, Cabinet Secretary  
dep.wv.gov

## ENGINEERING EVALUATION/FACT SHEET

### BACKGROUND INFORMATION

Application No.:	R13-3346
Plant ID No.:	039-00005
Applicant:	Union Carbide Corporation
Facility Name:	Institute Plant
Location:	Institute
NAICS Code:	325199
Application Type:	Construction
Received Date:	October 21, 2016
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	\$2000.00
Date Received:	October 24, 2016
Complete Date:	November 16, 2016
Due Date:	February 14, 2017
Applicant Ad Date:	October 31, 2016
Newspaper:	<i>The Charleston Gazette</i>
UTM's:	Easting: 432.189 km      Northing: 4,248.754 km      Zone: 17
Description:	This application is for the installation of three 99.98 MM Btu/hr, natural gas fired boilers as interim boilers for the replacement of Power House #2.

### DESCRIPTION OF PROCESS

Union Carbide Corporation (UCC) operates several chemical manufacturing units located within the Institute Site (Plant) in Institute, West Virginia, which is a chemical manufacturing complex that has several different companies operating within the complex. Bayer CropScience LP (Bayer) owns and operates the Power House #2 at the Institute Plant. The plant is currently configured with one main steam plant (Power House No. 2). Power House No. 2 has three, 360 MMBtu/hr boilers with a steam output of about 225,000 pounds of steam per hour from each unit (Boilers 10, 11, and 12). This steam is needed to support the chemical manufacturing operation at the site. Due to downturns in the chemical manufacturing operation at the site, the demand for steam has seen a significant decrease over the past couple of years. In 2012, Bayer elected to permanently shut down Power House No. 1, which was configured with three, 180 MMBtu/hr

gas-fired boilers. Once Power House No. 1 was shutdown, the site lost its flexibility to adjust steam output on short notice based on demand.

To resolve the reliability issues with the boilers in Power House No. 2 and prepare to ensure compliance with the Boiler MACT (Subpart DDDDD of Part 63), Bayer had elected to replace the units in Power House No. 2 with three package style boilers (Boiler Nos. 16, 17, and 18) as part of a new steam plant in the Institute Plant. These new boilers will be rated with a heat input of 350 MMBtu/hr for each unit and a steam output of 252,000 pounds per hour at 400 psi and 700<sup>0</sup>F. Each of these units will be fueled solely with natural gas and each one vented to a dedicated stack.

Boilers 16 and 17 were constructed and scheduled to start-up before the end of 2016. However, each boiler experienced a catastrophic failure during the static hydro test of each unit as part of the commission phase for these new boilers. Currently, the Institute Site is receiving its steam from Power House #2. Bayer has committed to shutting down Power House #2 by no later than January 31, 2017, as part of the Bayer's plan to achieve compliance with the Boiler MACT.

Union Carbide Corporation (UCC) currently operates several chemical manufacturing units at the Institute Plant a well. These units require a significant amount of heat energy to operate, which is in the form of steam. To avoid a shutdown of UCC's manufacturing units while Boilers 16 and 17 are being repaired or replaced after Power House #2 ceases operations, UCC has elected to install three 100 MMBtu/hr boilers (one saturated steam boiler and two superheated boilers).

The selected units are manufactured by Victory Energy. Each unit is equipped with a low-NO<sub>x</sub> burner with flue gas recirculation to minimize the formation of thermal oxides of nitrogen (NO<sub>x</sub>) while improving combustion efficiency. To better maintain combustion efficiency while minimize the generation of carbon monoxide (CO), the boilers are equipped with oxygen trim systems that regulates the amount of combustion air that is introduced based on the oxygen level in the exhaust stream in the exhaust stack. To better improve the overall thermal efficiency of the boilers, each unit has an economizer, which is a heat exchanger in the exhaust stack that preheats the boiler feed water prior to been introduced into the boiler.

## SITE INSPECTION

On November 3, 2016, Mr. Todd Shrewsberry, P.E., a Compliance and Enforcement Engineer, and the writer conducted an announced site visit of the Institute Site. The Bayer representatives were Ms. Linda Tennant, Site Environmental Specialist and Mr. Monty Buther, a Project Manager in the Engineering Department. Also, the writer requested UCC representatives to be on hand during this visit as well. UCC representative included Mr. Freddie Sizemore, EHS Regulatory Specialist, Mr. Toby Scholl, P.E. Engineer, and project managers overseeing the

Engineering Evaluation of R13-3346  
Union Carbide Corporation  
Institute Plant  
Non-confidential

installation of these boilers. During this visit, the writer was briefed on the steam capacity and demand at the facility and status of these proposed boilers.

Currently, UCC are operating under Consent Order CO-R13-2016-22 to install and operate the proposed boilers. At the time of the visit, the saturated steam boiler (SAT1) was still been installed. SH1 and SH2 was in the process of being commissioned.

**ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER**

The applicant used pollutant specific emission factors from Chapter 1.4 of AP-42 and manufacturer’s data to estimate emissions from the replacement boilers. The writer reproduced the estimated emissions from one replacement boiler, which are presented in the following table:

<b>Table No. 1 – Emission from One of the New Boilers using Natural Gas</b>			
<b>Pollutant</b>	<b>Emission Factor</b>	<b>Hourly Rate (lb/hr)</b>	<b>Annual Rate<sup>1</sup> (tpy)</b>
PM Filterable/Condensable Fractions	0.0073 lb/MMBtu	0.73	2.64
PM <sub>10</sub> Filterable/Condensable Fractions	0.0073 lb/MMBtu	0.73	2.64
PM <sub>2.5</sub> Filterable/Condensable Fractions	0.0073 lb/MMBtu	0.73	2.64
Sulfur Dioxide (SO <sub>2</sub> )	0.00058 lb/ MMBtu	0.058	0.21
Oxides of Nitrogen (NO <sub>x</sub> )	0.0364 lb/MMBtu	3.64	13.15
Carbon Monoxide (CO)	0.0369 MMBtu	3.69	13.33
Volatile Organic Compounds (VOCs)	0.0054 lb/MMBtu	0.54	1.95
Total Hazardous Air Pollutants (HAPs)	0.0018 lb/MMcf	0.18	0.65
Carbon Dioxide Equivalent* (CO <sub>2e</sub> )	117.098 lb/MMBtu	11,709.80	42,299.90

\* Based on factors and global warming potentials from Tables A-1, C-1, and C-2 of Part 98 published on Federal Register on November 29, 2013.

1 - Annual Rate is based on 7224.7 hours of operation per year, which equates to 722,470.8 MMBtu/year.

<b>Table No. 2 – Annual Emissions from the 3 Boilers</b>	
<b>Pollutant</b>	<b>Annual Potential of 3 proposed boilers (tpy)</b>
PM	7.92
PM <sub>10</sub>	7.92
PM <sub>2.5</sub>	7.92
SO <sub>2</sub>	0.63
NO <sub>x</sub>	39.4
CO	40
VOCs	5.84
HAPs	1.98
CO <sub>2e</sub>	126,899.8

The applicant estimated the potential fugitive emissions associated with the natural gas supply line to these boilers. Applicant identified the components involved with this line would be 31 valves, 148 flanges and 186 connectors. To estimate the emissions, the applicant used the emission factor for the component from the Oil and Gas Industry and the approximate composition of the natural gas by weight by pollutant (VOCs, Hexane (as HAP) and special pollutant - greenhouse gases). The total VOCs from the facility's natural gas supply line would be 860 pounds per year (0.43 tpy). Methane emissions from leaks would be 2,740 pounds (1.37 tpy). Methane emissions are classified as one the six greenhouse gases, which is defined in 40 CFR §86.1818-12(a). To determine the CO<sub>2e</sub> of the methane emissions, the Global warming potential of methane from Table A-1 to Subpart A of Part 98, which is 25 times, is multiplied by the methane emissions. For this case, the supply pipeline has the potential to emit 34.25 tons of CO<sub>2e</sub> per year. Hexane (HAP) emissions would be 0.02 tons per year.

Overall, the emissions represented by this project are presented in the following table.

<b>Table No. 3 –Emissions from the New Powerhouse</b>	
<b>Pollutant</b>	<b>Annual Potential (tpy)</b>
PM	7.92
PM <sub>10</sub>	7.92
PM <sub>2.5</sub>	7.92
SO <sub>2</sub>	0.63
NO <sub>x</sub>	39.4
CO	40
VOCs	6.27
HAPs	2.00
CO <sub>2e</sub>	126,934.1

## REGULATORY APPLICABILITY

The Institute Plant is a major source under Title V (45CSR30) and currently possesses a valid Title V Operating Permit. Under this program, new emission units have 12 months upon start-up to be incorporated in the facility's operating permit. The facility is currently classified as a major source for PM/PM<sub>10</sub>/PM<sub>2.5</sub>, NO<sub>x</sub>, SO<sub>2</sub>, CO, and VOC under Prevention of Significant Deterioration (PSD), Title V and for HAPs.

To avoid a major modification under 45 CSR 14, UCC has elected to limit the potential to emit (PTE) of oxides of nitrogen to 39.4 tons per year, which is just less than the significant threshold value for ozone and oxides of nitrogen. In UCC proposed PTE restriction, UCC proposed to limit the annual actual heat input to each boiler to 722,470.8 MMBtu per year. To monitor compliance with the actual heat input limit, UCC has proposed to install, operate, and maintain gas meters to measure and record the actual volume of natural gas consumed by each boiler. Plus, UCC plans on to sample and analyze to determine the actual higher heating value of the natural gas being consumed by the boilers.

With the proposed heat input limited the annual emissions from these three boilers, the proposed project does not represent a significant emission increase. Therefore, no further review of this proposed with respect to 45 CSR 14 is required.

<b>Pollutant</b>	<b>Annual Potential of 3 proposed boilers (tpy)</b>	<b>PSD Significant Values (tpy)</b>	<b>Is the Project Significant (Yes/No)</b>
PM	7.92	25	No
PM <sub>10</sub>	7.92	15	No
PM <sub>2.5</sub>	7.92	10	No
SO <sub>2</sub>	0.63	40	No
NO <sub>x</sub>	39.4	40	No
CO	40	100	No
VOCs	5.84	40	No

These units are not subject to the New Source Performance Standards of Subpart Db since each unit will have a design heat input rating of less than 100 MMBtu/hr. The units have a maximum design heat input of 99.98 MMBtu/hr, which is greater than 10 MMBtu/hr. Thus, the boilers are subject to Subpart Dc. Under Subpart Dc, natural gas fired units are not subject to any emission standards established in this regulation. Subpart Dc does require fuel records to be maintain, which will be incorporated into the permit.

The facility is currently classified as a major source of HAPs, which means the facility has the potential to emit 10 tons per year of a single HAP or 25 tpy of total HAPs. Within the

Engineering Evaluation of R13-3346  
Union Carbide Corporation  
Institute Plant  
Non-confidential

application, Bayer has not elected to determine if this project would change the facility's major source status for HAPs. Thus, the new boilers are subject to 40 CFR 63, Subpart DDDDD – National Emission Standard for Hazardous Air Pollutants (NESHAP) for Major Sources: Industrial Commercial, and Institutional Boilers and Process Heaters.

This regulation establishes work practices as a means to comply with the emission standards (see Item 3 of Table 3 to Subpart DDDDD of Part 63). Each of the proposed units will be equipped with oxygen trim systems to optimize the combustion air to minimize CO emissions. The rule recognizes this type of combustion control and defers the annual tune-up requirement to be performed once every five years in accordance with 40 CFR §63.7540. These boilers under Subpart DDDDD will be considered as new units. The one-time energy assessment is not required for new units. Therefore, the energy assessment is not applicable for these boilers and will not be included.

UCC prepared and submitted a complete application, paid the filing fee, and published a Class I Legal ad in *The Charleston Gazette* on October 31, 2016. This project requires Notice Level C of 45CSR§13-8.5 be executed because of the proposed restrictions to limit the PTE to avoid triggering permitting requirements under Rule 14, require. A sign must be posted at the facility and a commercial display ad published in conjunction with the Secretary's "notice of intent to approve".

#### TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The new replacement boilers will not emit any pollutants that aren't already being emitted by another emission source at the facility. Therefore, no information about the toxicity of the hazardous air pollutants (HAPs) is presented in this evaluation.

#### AIR QUALITY IMPACT ANALYSIS

An air dispersion modeling study or analysis was not required, because the proposed modification does not meet the definition of a major modification of a major source as defined in 45CSR14.

#### MONITORING OF OPERATIONS

Rules 2 and 10 only require recording of the amount of natural gas consumed each month for natural gas fired boilers. The writer recommends require the actual heat input of each boiler be determine on a monthly basis using the measured fuel rates and calorific values recorded during the corresponding month. UCC and agency agree to an hours of operation limit in Consent Order CO-R13-E-2016-22. The writer believes this limit is reductant and artificially restrictive. The hours of operation limits only count the time the actual unit is operating regards of load or the emissions been generator.

Engineering Evaluation of R13-3346  
Union Carbide Corporation  
Institute Plant  
Non-confidential

To ensure that the applicant maintain the flow monitor, that fuel meter any downtime greater than one hour shall be assumed the unit operate at maximum heat input over the corresponding time period that the monitor was down. The writer believes this provision would sever the same purpose of limiting the hours of operation in limiting the PTE for NO<sub>x</sub> below the PSD significant threshold value.

As noted earlier, these units are subject to the Boiler MACT which requires annual tune-ups for each boiler. The permit will require conducting an initial performance test for CO and conducting a tune-up every 5 years to optimize CO emissions. The permit will require the installation of oxygen trim systems which will minimize CO emissions based on actual oxygen readings at the outlet and trimming the combustion air damper.

### RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates the proposed construction at the facility will meet all the requirements of the applicable rules and regulations when operated in accordance with the permit application. The applicant has proposed these boilers to be temporary units. Under 45 CSR 13, a Temporary Permit only requires the applicant to place a legal ad. However, 45 CSR §13-8.5 requires Notice Level C for any permit to limit physical and operational limits below major source thresholds. To result this conflict, the writer recommends processing this application as a construction application which is allow for maximum opportunity for public participation that is required under 45 CSR 13 and to undergo Public Notice Level C. 45 CSR §13-13. Allows the Director to result this conflict. Therefore, the writer recommends granting Union Carbide Corporation a Rule 13 Construction Permit for their facility located in Institute, WV.

Edward S. Andrews, P.E.  
Engineer

December 9, 2016  
Date

Engineering Evaluation of R13-3346  
Union Carbide Corporation  
Institute Plant  
Non-confidential