

**GOVERNMENT OF THE DISTRICT OF COLUMBIA**  
Department of Energy and Environment

**CHAPTER 2 TECHNICAL SUPPORT MEMORANDUM**

TO: Stephen S. Ours, P.E.   
Chief, Permitting

FROM: John Nwoke   
Engineer

SUBJECT: **The George Washington University  
Ross Hall Cogeneration Project  
Permit No. 6618-C-R1 to Construct a Cogeneration Facility**

DATE: February 25, 2016

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**BACKGROUND INFORMATION**

On June 13, 2012, the George Washington University (GW) submitted an air permit application to construct/operate a gas turbine and heat recovery steam generator/duct burner at Ross Hall on GW's Foggy Bottom campus. GW indicated that the proposed equipment would only burn natural gas. GW further indicated that the project would reduce its greenhouse gas footprint, because their electricity consumption would come from the highly efficient and low-emission gas turbine/heat recovery steam generator combo. The power produced by the cogeneration plant would not be for internal consumption and not for sale.

On January 3, 2013, a permit to construct the requested equipment was issued by the Air Quality Division (AQD). This permit had an expiration date of January 2, 2016, though at the time, construction was expected to be completed in 2014. Construction took longer than expected.

On March 27, 2015, GW submitted a request to update the duct burner information because the installed duct burner was not the one originally approved. The installed duct burner has a lower capacity than the permitted unit and potential emissions of the cogeneration system are expected to decrease as a result of the change, except for a slight increase of 0.1 ton per year of carbon monoxide. AQD did not immediately act on this application.

Because of delays in completing the construction of the cogeneration unit, on September 30, 2015, GW requested an extension of the construction permit. At this time it was also identified that the stack design was changed to have dual flues rather than one larger flue. GW sought clarification about the location and duration of stack testing and the inclusion of the duct burner operating modes in the appropriate permit conditions.

GW has not requested that any portions of the application be held confidential.

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### **TECHNICAL INFORMATION**

GW applied for a permit for a minor modification to its existing facility because of a planned project involving the construction of a natural gas fired gas turbine having the capacity to produce 4.6 megawatts (MW) of electrical power. GW plans to install the gas turbine and heat recovery steam generator (HRSG)/duct burner in the central utility plant within Ross Hall on its Foggy Bottom campus. The HRSG/duct burner will produce steam by burning natural gas. The HRSG/duct burner is rated at 15.2 million Btu/hour heat input (net lower heating value (LHV) basis). The HRSG/duct burner steam will be used to meet total demand, while excess steam routed to the existed steam turbine at Ross Hall for generating electric power. Construction for this project is well under way. Construction of the cogeneration facility was delayed, hence GW applied for an extension to the construction permit.

#### Emission Evaluation

GWU analyzed the project as a minor source because the nitrogen oxide emission from the source is 23 tons per year. This is less than the major source threshold of 25 tons per year as shown on the tables below. Note that the tables below reflect the emission rates based on the modified equipment design, and therefore differ from those reflected in the earlier construction permit.

Table 1: Total 12-Month Rolling Emission Limits from Permitted Equipment<sup>1</sup>

<b>Pollutant</b>	<b>12-Month Rolling Emissions Limit (tons/yr)</b>
PM (Total) <sup>2,3</sup>	5.0
SOx	1.1
NOx	21.3
VOC	2.3
CO	21.5
HAPs (Total)	0.38

1. The equipment covered consists of one Solar Centaur 50 gas turbine, and one HRSG/duct burner.

2. Total PM is the sum of the filterable PM and condensable PM.

3. Also all PM is expected to be smaller than 2.5 microns, so PM (Total) equals PM<sub>2.5</sub>

Table 2- Maximum Hourly Emissions (lbs/hr) when Operating Between 50% and 100% Load, Inclusive

<b>Pollutants</b>	<b>Solar Centaur 50 Gas Turbine (CT) and HRSG/Duct Burner (HDB)</b>
PM (Total)	1.1
SOx	0.3
NOx	4.9

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<b>Pollutants</b>	<b>Solar Centaur 50 Gas Turbine (CT) and HRSG/Duct Burner (HDB)</b>
VOC	0.5
CO	4.9

It should also be noted that, while not an emission limit in the permit, total hazardous air pollutant (HAP) emissions are expected to be no more than 0.4 tons per year in total, well below the NSR significance threshold for applicability.

### **REGULATORY REVIEW**

#### **Chapter 2, Section 200: General Permit Requirements**

The provisions of this section are applicable to the boilers as a stationary source of air pollution. A permit is therefore required to operate the boilers pursuant to 20 DCMR 200.1 and 200.2. The permit will be valid for three years. Upon completion of construction and review by the Department confirming that the equipment was constructed as required, a permit to operate will be issued.

#### **Chapter 2, Section 204: Permit Requirements for Sources Affecting Non-Attainment Areas**

The review of the Chapter 2 permit applications indicated that the proposed equipment would emit maximum potential emissions of 21.3 tons of NO<sub>x</sub> per 12-month rolling period as measured at the exhaust stack of the HRSG. The significance threshold to trigger NSR requirements for NO<sub>x</sub> is 25 tons per year per the definition of "significant" in 20 DCMR 299. The proposed project will not generate emission in excess of the significance threshold, and therefore the project would not be considered a new major stationary source or a "major modification" as defined in 20 DCMR 299. Therefore, pursuant to 20 DCMR 204.1, a major non-attainment new source review analysis is not required.

#### **Prevention of Significant Deterioration (PSD) (Federal program)**

The project will have a potential to emit (PTE) of less than 250 tpy for all pollutants, except greenhouse gases, which is also below the applicable threshold, and so this project is not subject to the PSD program (implemented by EPA). The potential emissions of greenhouse gases is 35,300 metric tonnes per year on a CO<sub>2e</sub> basis.

#### **Chapter 2, Section 205: New Source Performance Standards**

Subsection 205.1 of 20 DCMR adopts the federal New Source Performance Standards (NSPS) as in effect on September 30, 1997. Additionally, in order to be sufficiently protective of public health pursuant to 20 DCMR 201, the Department places all current NSPS standards into all Chapter 2 permits issued.

The gas turbine and HRSG/duct burner will be subject to the NSPS that applies to stationary gas turbines, HRSGs and duct burner (40 CFR Part 60, Subpart KKKK). The NSPS NO<sub>x</sub> limit for the proposed modification is 25 ppm at 15% O<sub>2</sub>. The NSPS also limits sulfur dioxide (SO<sub>2</sub>)

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emissions to 0.060 lbs/MMBtu of heat input. 40 CFR 60 does not apply to the boilers because they are below the size thresholds for applicability of New Source Performance Standards.

#### **Chapter 3: Operating Permits and Acid Rain Programs**

The project is not subject to the Acid Rain Program. However, the equipment will be part of a larger facility subject to the major source operating permit program of 20 DCMR Chapter 3. As such, pursuant to 20 DCMR 301.1(a)(2), the facility must apply for the requirements of this permit to be placed into its existing Title V operating permit. This requirement is contained in Condition I(j) of the proposed permit.

#### **Chapter 5: Testing, Monitoring and Record keeping Requirements**

Testing, monitoring and record keeping requirements pursuant to 20 DCMR 500.8 and 502 have been included in the permit documents under Condition III(a)(3) and (4), and Condition III(b)(3) and (4). These requirements are also based on 20 DCMR 200.7. Permit Conditions III.a.3 and III.a.3.E have been updated as appropriate to accommodate the changes requested in the September 30, 2015 GW application/letter. In summary:

1. The applicant's request to perform certain quarterly testing with supplemental duct burner firing during the fall and winter months, but without the supplemental duct burner firing during the spring and summer months was granted;
2. The applicant's request to alternate quarterly testing between the dual stack flues rather than testing in both identical flues each quarter was granted; and
3. It was clarified that both flues must be represented during all stack testing, but whenever three test runs are required, two may be performed in one flue while the third is performed in the second flue rather than splitting runs between flues or performing full tests for each flue.

#### **Chapter 6: Particulates**

20 DCMR 600.1 is applicable to the equipment, thus its requirements have been included. Additionally, the gas turbine and HRSG/duct burners could emit visible emissions during any period of equipment startup, operation or shutdown and as such 20 DCMR 606.1 is applicable. This requirement is also contained in the proposed permit.

#### **Chapter 8: Asbestos, Sulfur, Nitrogen Oxides, and Lead**

The fuel sulfur provisions of 20 DCMR 801 are not applicable because the unit will not use fuel oil. The NOx RACT provisions of 20 DCMR 805 are not applicable because the combustion turbine is rated below 100 MMBTU/hr. The requirements of 20 DCMR 800, covering asbestos abatement are addressed in Condition I(i) in case construction will result in the disturbance of asbestos containing materials.

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### Chapter 9, Section 903: Odorous or Other Nuisance Air Pollutants

The gas turbine and HRSG/duct burners could emit emissions during any period of equipment startup, operation or shutdown and as such 20 DCMR 903.1 is applicable. This requirement is contained in the proposed permit.

### Other Regulations

#### Maximum Achievable Control Technology (MACT) Standards for Gas Turbines

40 CFR 63 Subpart YYY for gas turbines regulates/monitors Hazardous Air Pollutants (HAPs) such as acetaldehyde, acrolein, benzene, toluene, xylene, cadmium, chromium, lead, etc, through surrogate compounds such as formaldehyde, carbon monoxide (CO) and/or volatile organic compounds (VOCs).

A facility that emits or has the potential to emit 10 tons/year of any single HAP or 25 tons/year of any combination of HAPs, is considered a major source. The proposed project will produce emissions of HAP that are under the major source threshold. The facility as a whole is also a minor source of HAPs. Therefore the gas turbine is not subject to this MACT standard.

#### Compliance Assurance Monitoring (CAM) (40 CFR 64)

The project is not subject to this Part because the pre-control emissions of pollutants for all sources are less than 25 tpy for VOC and 100 tpy for ammonia (NH<sub>3</sub>) and hydrogen sulfide (H<sub>2</sub>S), respectively.

## **RECOMMENDATIONS**

The draft renewal permit will be published in the D.C. Register and on the Department's website on March 4, 2016 for a thirty-day public comment period.

The proposed project and attached permit comply with all applicable federal and District air pollution control laws and regulations. I recommend that the attached permit document be issued if no comments are received following the completion of the public review period.

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