PSD AIR CONSTRUCTION PERMIT APPLICATION

ADDENDUM – PARTICULATE MATTER BACT ANALYSIS

Riverton Facility

Unit 12 Conversion to Combined Cycle Project

B&V PROJECT NO. 176883

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PREPARED FOR

Empire District Electric Company

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Acronym List

BACT	Best Available Control Technology
BHP	Break horsepower
CAA	Clean Air Act Amendments of 1990
CCCT	Combined cycle combustion turbine
Empire District	Empire District Electric Company
HRSG	Heat recovery steam generator
KDHE	Kansas Department of Health and Environment
kW	Kilowatt
LSFO	Low Sulfur Fuel Oil
NSPS	New Source Performance Standard
PSD	Prevention of Significant Deterioration
RBLC	RACT/BACT/LAER Clearinghouse

1.0 Introduction

On January 25, 2013, Empire District Electric Company (Empire District) submitted the Riverton Unit 12 Conversion to Combined Cycle Project Prevention of Significant Deterioration (PSD) Air Permit Application to the Kansas Department of Health and Environment (KDHE). That application document indicated the conversion of Unit 12 from simple cycle to combined cycle operation would trigger PSD permitting for $PM/PM_{10}/PM_{2.5}$ and CO_{2e}. Accordingly, these pollutants are subject to full PSD review including the requirements to address Best Available Control Technology (BACT), impacts upon ambient air quality, as well as impacts upon area growth, soils, vegetation, and visibility. As such, Empire District is submitting this Addendum to the PSD Air Permit Application to address BACT for $PM/PM_{10}/PM_{2.5}$. Additional addendums will address the remaining PSD elements mentioned above.

2.0 PM/PM_{10}/$PM_{2.5}$ BACT

The Clean Air Act Amendments of 1990 (CAA) established revised conditions for the approval of pre-construction permit applications under the PSD program. One of these requirements is that BACT be installed to control all pollutants regulated under the Act that are emitted in significant amounts from new major sources or major modifications. BACT need not necessarily result in an emissions control device. Rather, BACT is an emission limitation made on a case-by-case basis accounting for several project-specific factors. However, in no case is BACT allowed to be less stringent than the emissions limits established by an applicable New Source Performance Standard (NSPS).

The following sections present the PM/PM_{10}/$PM_{2.5}$ BACT analyses conducted for the converted combined cycle combustion turbine (CCCT), auxiliary boiler, emergency diesel generator, and mechanical draft cooling tower.

2.1 COMBINED CYCLE COMBUSTION TURBINE

The CCCT includes the combustion turbine and supplemental firing from duct burners in the heat recovery steam generator (HRSG). PM/PM_{10}/$PM_{2.5}$ emissions generally are a result of incomplete combustion and noncombustible particulate parameters present in the fuel. The CCCT will exclusively fire natural gas which contains only trace quantities of this noncombustible material helping to keep particulate matter emissions inherently low. Following manufacturer recommendations for operating the unit will subsequently help minimize particulate matter formed as a result of incomplete combustion.

The RACT/BACT/LAER Clearinghouse (RBLC) documents do not list any post-combustion particulate control technologies being used on combustion turbines (either simple or combined cycle). Rather, the control for particulate matter found in the RBLC is good combustion practices. Therefore, and consistent with previous determinations made by KDHE for similar projects, the use of good combustion controls and clean burning natural gas (low sulfur fuel) is considered BACT for PM/PM_{10}/$PM_{2.5}$ and is proposed for the CCCT.

Emissions information for the CCCT comes from data provided by the vendor for the CCCT. This data indicates that, via the use of good combustion practices and natural gas, the proposed BACT emission rate for PM/PM_{10}/$PM_{2.5}$ (filterable + condensable) is 30.2 lb/hr (combined operation of the combustion turbine and duct burners). Since the NSPS for CCCT (40 CFR Part 60, Subpart KKKK) does not establish a particulate emission limit, the emission rate given above should be considered BACT.

2.2 AUXILIARY BOILER

The 18.6 MMBtu/hr auxiliary boiler will be fired exclusively on natural gas. Much like the evaluation provided above for the CCCT, emissions from the auxiliary boiler will be inherently low due to the use of clean burning natural gas which contains only trace amounts of noncombustible material. As such, the use of post-combustion controls to further minimize particulate matter

would be costly, especially given that the auxiliary boiler is anticipated to operate infrequently during startup (and possibly shutdown) of the CCCT. An evaluation of the RBLC demonstrates that this is the case for other natural gas fired boilers as well. The database indicates that natural gas fired boilers of all sizes (e.g., those subject to 40 CFR Part 60, Subparts Da, Db, and Dc) utilize good combustion practices to minimize particulate emissions and none of them employ add-on post-combustion controls. Therefore, the use of good combustion practices and natural gas are proposed as BACT for the auxiliary boiler.

Emissions information for the auxiliary boiler comes from data provided by one potential vendor for the proposed unit. This data indicates that, via the use of good combustion practices and natural gas, the proposed BACT emission rate for $PM/PM_{10}/PM_{2.5}$ is 0.005 lb/MMBtu. The auxiliary boiler proposed for this project is small and will be subject to the NSPS of 40 CFR Part 60, Subpart Dc, *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units* (between 10 and 100 MMBtu/hr, inclusive). However, Subpart Dc contains no numerical emission limitations for units fired solely by natural gas. Since the NSPS for the auxiliary boiler does not establish a particulate emission limit, the emission rate given above should be considered BACT. Furthermore, this emission limit is equal to or better than the vast majority of the values for similar-sized, natural gas fired boilers found in the RBLC.

2.3 EMERGENCY DIESEL GENERATOR

The capacity of the emergency diesel generator has not yet been determined, but for permitting purposes, Empire District will assume the capacity to be 1,102 break horsepower (BHP) or 750 kW electrical output. The generator will emit small quantities of particulates consisting of ash in the fuel and residual carbon and hydrocarbons caused from incomplete combustion. The generator will be limited to no more than 100 hours per year of operation and will be periodically operated for maintenance and readiness testing.

Because of its small size, infrequent operation, and status as emergency equipment, the installation of post-combustion emission controls, while technically feasible, is far from cost-effective as control devices and are, therefore, not practical as BACT control alternatives. A review of the RBLC indicates that good combustion control was the most stringent control permitted for similar units. As such, Empire District has determined that BACT for the emergency diesel generator is limited operation and good combustion practices while firing low sulfur fuel oil (LSFO).

The emergency engine must meet the applicable NSPS found at 40 CFR Part 60, Subpart IIII, *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*. Specifically, emergency generators greater than 560 bkW (750 bhp) and less than or equal to 900 bkW (1,205 bph) are subject to the Tier 2 standards of 0.20 g/kW-hr (0.15 g/bhp-hr) for particulate matter. Empire District proposes the NSPS as BACT for the emergency diesel generator.

2.4 MECHANICAL DRAFT COOLING TOWER

Particulate from cooling towers is generated by the presence of dissolved and suspended solids in the cooling tower circulation water, which is potentially lost as “drift” or moisture droplets

that are suspended in the air moving out of the cooling tower. A portion of the water droplets emitted from the tower exhausts will evaporate, leaving the suspended or dissolved solids in the atmosphere.

Particulate emissions from cooling towers can be controlled by minimizing the amount of water drift that occurs and/or minimizing the amount of dissolved solids in the water. This can be accomplished by using high efficiency drift eliminators, a decreased number of cycles of circulating water concentration, or a combination of both. The number of cycles of water concentration is limited by the amount of water available for use, since lower levels of concentration require increased cooling tower blowdown and more water intake to offset the blowdown.

A review of drift eliminators as particulate control technology for cooling towers concluded that they are technically feasible. There are no significant energy, environmental, or economic impacts that would preclude the use of drift eliminators as particulate control technologies as presented in this evaluation.

The proposed cooling tower BACT for this Project is the use of drift eliminators for particulate control, with a cooling tower design drift rate of 0.0005 percent of inlet flow. There is no corresponding NSPS for the operation of cooling towers.

3.0 Particulate Matter BACT Summary

Table 3-1 summarizes the proposed $PM/PM_{10}/PM_{2.5}$ BACT for each of the new and modified emissions sources associated with the CCCT project.

Table 3-1 $PM/PM_{10}/PM_{2.5}$ BACT Summary

EMISSION UNIT	CONTROL	EMISSION VALUE
Combined Cycle Combustion Turbine (CT+HRSG)	Good Combustion Practices Natural Gas	30.2 lb/hr (front + back half)
Auxiliary Boiler	Good Combustion Practices Natural Gas	0.005 lb/MMBtu
Emergency Diesel Generator	Good Combustion Practices Low sulfur fuel oil	0.15 g/bhp-hr
Mechanical Draft Cooling Tower	High efficiency drift eliminators	0.0005% drift rate