LG&E/KU – E.W. Brown Station

Phase II Air Quality Control Study

Fly Ash and Landfill Waste Disposal

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1.0 Introduction

The E.W. Brown Station is located on Herrington Lake in Mercer County, Kentucky, between Shakertown and Burgin, off of Hwy 33. The station was constructed on the west side of Herrington Lake, the impoundment behind Dix Dam. The plant began commercial operation in 1957. The station includes three pulverized coal fired electric generating units with a total nameplate capacity of 747 MW gross. The electrical power from the E.W. Brown Station units is used to provide both load and voltage support for the 138 kV transmission systems.

The plant site also includes seven simple cycle combustion turbines located on the northwest side of the site.

All three steam generators (boilers) fire high sulfur bituminous coal. Unit 1 has a gross capacity of 110 MW and is equipped with old generation Low NO_x Burners (LNBs) and Cold-side Dry Electrostatic Precipitator (CS-DESP) for nitrogen oxide (NO_x) and particulate matter (PM) control, respectively. Unit 2 has a gross capacity of 180 MW and is equipped with LNBs, Overfire Air (OFA), and CS-DESP for NO_x and PM control. Unit 3 has a gross capacity of 457 MW and is equipped with LNBs, OFA, and CS-DESP for NO_x and PM control. LG&E/KU is in the process of installing a Selective Catalytic Reduction (SCR) module (in-service date, 2012) on Unit 3 to control NO_x. LG&E/KU recently installed a common Wet Flue Gas Desulfurization (WFGD) for sulfur dioxide (SO_2) control for Units 1, 2, and 3. Unit 2 is also equipped with a WFGD bypass system which directs flue gas to the Unit 3 chimney. Lower sulfur coal will be fired in Unit 2 during bypass operation. LG&E/KU is also in the process of installing sorbent injection on Unit 3.

The following Air Quality Control (AQC) technologies were evaluated to ensure that there is compliance with the emissions reductions that are required to meet future regulations:

- Pulse Jet Fabric Filter (PJFF) on Units 1-3.
- Selective Catalytic Reduction (SCR) on Units 1 and 2.
- Sorbent (Trona/Lime) injection on Units 1 and 2.
- Powdered activated carbon (PAC) injection on Units 1-3.

Based on the previously listed AQC technologies, the purpose of this study is to evaluate the physical and chemical composition of the fly ash material removed by the new PJFF on Units 1-3. This study will not discuss any potential impact of disposal of fly ash on the dry landfill currently under construction. The potential impact analysis on the landfill is by others.

2.0 Composition of Fly Ash

Fly ash is one of the solid waste items produced directly from the combustion of coal. The burning of harder, older anthracite and bituminous coals produces fly ash which is pozzolanic in nature, and usually contains less than 10 percent lime (CaO). Fly ash with pozzolanic properties means that it reacts with calcium hydroxide in the presence of water to form compounds possessing cementitious properties at room temperature. Most of the fly ash produced from coal-fired power stations is captured in particulate removal equipment like PJFFs or ESPs and safely disposed off in landfills. This section describes the production and composition of the fly ash removed by PJFFs from Units 1-3.

Additionally, Units 1-3 would utilize a PAC injection system for control of mercury and sorbent injection system (lime or trona) for control of sulfuric acid mist upstream of the PJFF. The byproducts from the PAC and sorbent injection system would be collected in the PJFF and would be removed with the fly ash for disposal in a landfill.

2.1 Unit 1, Unit 2 and Unit 3 Fly Ash

Currently Units 1-3 have an existing cold side electrostatic precipitator (CS-ESP) and the majority of the fly ash is removed by the existing CS-ESP. The existing CS-ESP for each unit would be demolished or abandoned in place. The fly ash and byproducts from PAC and sorbent injection would be collected in a new PJFF, one each for Units 1, 2 and 3. Additionally, lime or trona, which is used as sorbents for removal of sulfuric acid, would be collected as well. It is assumed that LG&E/KU will have the flexibility of using either lime or trona as a sorbent in a new PJFF, one each for Units 1, 2 and 3.

Due to the differing amounts of sorbent usage rates between lime and trona, tables have been created to show the differences. Tables 2-1, 2-2 and 2-3 provide the estimated quantity calculated by B&V (and not provided by LG&E/KU) and composition of fly ash and byproducts removed from the PJFFs for Unit 1, Unit 2 and Unit 3 respectively when trona is used as a sorbent in addition to PAC injection. Tables 2-4, 2-5 and 2-6 provide the estimated quantity calculated by B&V (and not provided by LG&E/KU) and composition of fly ash and byproducts removed from the PJFFs for Unit 1, Unit 2 and Unit 3 when lime is used as a sorbent in addition to PAC injection.

The fly ash from coal combustion and byproducts from PAC and sorbent (lime or trona) injection would all be collected in new PJFF systems for E.W. Brown Units 1-3. The CS-ESP systems on all units would be bypassed. With these draft system arrangements the addition of PAC and sorbent injection would have limited fire hazard or bag blinding impact to the new PJFF systems. Additionally, the ID fans on all units would be located downstream of the new PJFF systems and would not be subject to high particulate loading.

Table 2-1

Unit 1 PJFF - Composition of Fly Ash and Byproduct for Trona Sorbent

Byproduct Composition	**lb/hr**	**Percentage**
Fly ash from coal combustion	8,734	87.72%
Unreacted Trona ($Na_2CO_3.NaHCO_3.2H_2O$)	546	5.48%
Na_2SO_4	399	4.01%
Powdered Activated Carbon	278	2.79%
Total	**9,957**	**100.00%**

Table 2-2

Unit 2 PJFF - Composition of Fly Ash and Byproduct for Trona Sorbent

Byproduct Composition	**lb/hr**	**Percentage**
Fly ash from coal combustion	14,550	88.09%
Unreacted Trona ($Na_2CO_3.NaHCO_3.2H_2O$)	909	5.50%
Na_2SO_4	665	4.03%
Powdered Activated Carbon	394	2.39%
Total	**16,518**	**100.00%**

Table 2-3

Unit 3 PJFF - Composition of Fly Ash and Byproduct for Trona Sorbent

Byproduct Composition	**lb/hr**	**Percentage**
Fly ash from coal combustion	35,996	88.03%
Unreacted Trona ($Na_2CO_3.NaHCO_3.2H_2O$)	2,249	5.50%
Na_2SO_4	1,645	4.02%
Powdered Activated Carbon	1,003	2.45%
Total	**40,892**	**100.00%**

Table 2-4

Unit 1 PJFF - Composition of Fly Ash and Byproduct for Lime Sorbent

Byproduct Composition	**lb/hr**	**Percentage**
Fly ash from coal combustion	8,734	85.22%
Unreacted Lime (CaO)	855	8.34%
$CaSO_4$	383	3.73%
Powdered Activated Carbon	278	2.71%
Total	**10,250**	**100.00%**

Table 2-5

Unit 2 PJFF - Composition of Fly Ash and Byproduct for Lime Sorbent

Byproduct Composition	**lb/hr**	**Percentage**
Fly ash from coal combustion	14,550	85.56%
Unreacted Lime (CaO)	1,424	8.37%
$CaSO_4$	637	3.75%
Powdered Activated Carbon	394	2.32%
Total	**17,005**	**100.00%**

Table 2-6

Unit 3 PJFF - Composition of Fly Ash and Byproduct for Lime Sorbent

Byproduct Composition	**lb/hr**	**Percentage**
Fly ash from coal combustion	35,996	85.51%
Unreacted Lime (CaO)	3,523	8.37%
$CaSO_4$	1,576	3.74%
Powdered Activated Carbon	1,003	2.38%
Total	**42,098**	**100.00%**

3.0 Summary

The information provided in this study may be utilized by LG&E/KU in addressing the transport and final disposal of the byproducts. However, this study does not discuss any potential impact of disposal of fly ash on the landfill currently under construction. Additional review regarding expansions of landfills may also be required to meet the stricter design requirements.

For fly ash containing activated carbon (used for mercury control at power plants), the physical and engineering performance of the material is expected to be similar to that of fly ash without activated carbon. However, it may have some potential handling issues, such as increased dusting. Therefore, the disposal requirements are expected to be the same as fly ash without activated carbon. A detailed landfill study may be required to address the potential impact of disposal of fly ash in existing or new landfill.