LG&E/KU – Ghent Station

Phase II Air Quality Control Study

Auxiliary Electrical System

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Revision B – Issued For Client Review

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1.0 Introduction

Ghent Units 1-4 are generating facilities owned by LG&E/KU located near Carrolton, Kentucky. Ghent Units 1-4 are coal fired electrical generating stations currently producing 2,107 MW gross. The addition or refurbishment of emissions controls technologies for nitrogen oxide (NO_x) (Units 2), mercury (Hg), hydrogen chloride (HCl) (Unit 2), carbon monoxide (CO), Dioxin/Furan, sulfuric acid (SO_3), and particulate matter (PM) is being evaluated to ensure that there is compliance with the emissions limitations that Unit 1-4 may be required to meet in the future.

The addition of these new emissions control technologies will require installation of new auxiliary electric system equipment to provide power. Each of the potential air quality control equipment alternatives, composed of an SCR for Unit 2, a Pulse Jet Fabric Filter (PJFF) for all units, sorbent injection (Unit 2) and Powdered Activated Carbon (PAC) injection for all units, presents a unique demand upon the auxiliary electric system. This report will identify the expected impact to the auxiliary electric system and propose a method of meeting the demand.

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2.0 System Requirements

2.1 Existing Auxiliary Electrical System

The existing Ghent auxiliary power systems includes two, single-ended 25 kV switchgear fed by one of two 138/25 kV reserve auxiliary transformers. 25 kV switchgear bus A is fed by 138 kV – 25 kV Reserve Auxiliary Transformer (RAT) A, and 25 kV switchgear bus B is fed by 138 kV – 25 kV RAT B. The 25 kV switchgear provides startup/backup power for each unit and the station auxiliary electrical systems. The 25 kV switchgear bus A feeds Unit 1 RAT 1C, Unit 1 and 2 RAT 1 / 2, and station service transformer SST LSA. The 25 kV switchgear bus B feeds Unit 4 RAT 4C, station service transformer SST LSB, Unit 3 and 4 RAT 3 / 4, and Unit 3 RAT 3C. Unit 1 RAT 1C is a three winding transformer that supplies 4.16 kV to the Unit 1 Scrubber bus 1A and 1B. The Unit 1 / 2 reserve auxiliary transformer RAT 1 / 2 is a two winding transformer that supplies Unit 1 4.16 kV switchgear 1A and Unit 2 4.16 kV switchgear 2B. Unit 3 RAT 3C is a two winding transformer that supplies 4.16 kV to the Unit 3 Scrubber bus 3A and 3B. The Unit 3 / 4 reserve auxiliary transformer RAT 3 / 4 is a three winding transformer that supplies Unit 3 and 4 4.16kV switchgear 3A and 3B, and Unit 4 4.16 kV switchgear 3B and 4B.

Units 1 and 2 auxiliary electrical system 4.16 kV switchgear buses are fed from their own respective two-winding main auxiliary transformer that is powered from their respective generator leads. Units 3 and 4 auxiliary electrical system 4.16 kV, and 13.8 kV switchgear bus are fed from their own respective two-winding main auxiliary transformers that are powered from their respective generator leads.

The PJFF additions will require the addition of new booster or ID fans at all units. The existing main auxiliary transformers, reserve auxiliary transformers, 13.8 kV and 4.16 kV switchgear buses were determined to have insufficient spare capacity, short circuit rating, and voltages to power the AQC options that include new technology and booster/ID fan electrical loads.

2.2 New AQC Auxiliary Electrical System

The proposed new AQC auxiliary electrical system is shown on one-line drawings 168908-G1DE-E1001, 168908-G2DE-E1002, 168908-G3DE-E1003, 168908-G4DE-E1004, and 168908-GCDE-E1005, which are referenced in Appendix A. The transformer and switchgear ratings are based upon the load lists referenced in Appendix A. The locations of the new electrical equipment and buildings are shown on site arrangement drawings 168908-GCDS-1001, and 168908-GCDS-1002 referenced in Appendix A. Based on using variable frequency drives for the booster/ID fans, Unit 1

will require one new two-winding 18 kV-4.16 kV AQC main auxiliary transformer (MAT) that will be fed from its respective generator leads; Unit 2 will require one new two-winding 22 kV-4.16 kV AQC main auxiliary transformer (MAT) that will be fed from its respective generator leads; Units 3 and 4 will each require one new two-winding 22 kV-13.8 kV AQC main auxiliary transformer (MAT) that will be fed from its respective generator leads . The secondary windings will power the new AQC 4.16 kV and 13.8 kV switchgear buses for the fans and other various AQC loads. The alternate/backup power for new AQC 4.16 kV and 13.8 kV switchgear buses will be fed from two new AQC 25 kV – 13.8 kV - 4.16 kV three-winding reserve auxiliary transformers (RATs) fed from the existing 25 kV switchgear described above. The existing 25 kV switchgear will need to be modified. Two vertical sections and two breakers will be added to the existing 25 kV switchgear. This will require the extension of the existing bus. The new main and reserve auxiliary transformers will be sized such that one of the two transformers feeding the buses could be taken out of service, with the other transformer supplying the entire load. Further electrical studies (short circuit, motor starting, etc.) will be performed during detailed design to determine the final transformer impedance and MVA ratings.

3.0 Summary

The recommended location of the two new AQC reserve auxiliary transformers that will be connected to the existing outdoor 25 kV switchgear will be in proximity to the tie-in points on the south side of the Units 1 & 2. The recommended locations of each of the four new AQC main auxiliary transformers will be in proximity to each of their respective generator leads. Proposed locations of the new equipment are shown on the site arrangement drawings in Appendix C. Final routing of the ductbank and cable, from the 25 kV switchgear to the reserve auxiliary transformer, will be determined during detailed design. Cable bus, from the reserve auxiliary transformers to the switchgear, will be routed during detailed design. The new electrical AQC buildings would be located in the vicinity of the PJFF equipment as shown in the site arrangement drawings in Appendix C. The buildings will contain the new medium voltage (MV) and low voltage (LV) switchgear, motor control centers (MCCs), and distributed control system (DCS) cabinets. A DC and UPS system will also be included in the electrical buildings to provide control power to the switchgear and DCS system. Motor control centers and DCS I/O cabinets may be installed in a small electrical building adjacent to remote AQC equipment to minimize cable lengths for the equipment in this area.

Appendix A
Reference Drawings, Diagrams and Lists

Site Arrangements

168908-GCDS-1001	Site Arrangement Unit 1 and Unit 2
168908-GCDS-1002	Site Arrangement Unit 3 and Unit 4

Equipment and Load Lists

Unit 1 Load List
Unit 2 Load List
Unit 3 Load List
Unit 4 Load List

One-Line Diagrams

168908-G1DE-E1001	One-Line Diagram, Conceptual Overall – Unit 1 AQCS
168908-G2DE-E1002	One-Line Diagram, Conceptual Overall – Unit 2 AQCS
168908-G3DE-E1003	One-Line Diagram, Conceptual Overall – Unit 3 AQCS
168908-G4DE-E1004	One-Line Diagram, Conceptual Overall – Unit 4 AQCS
168908-GCDE-E1005	One-Line Diagram, Conceptual Overall –AQCS Reserve