

LG&E/KU – Mill Creek Station

Phase II Air Quality Control Study

Constructability Review

March 3, 2011

Revision B – Issued For Client Review

B&V File Number 41.0813



Table of Contents

1.0	Introduction.....	1-1
2.0	Summary	2-1
2.1	General.....	2-1
2.2	Summary of Findings.....	2-1
2.3	Recommendations.....	2-2
3.0	Constructability Analysis.....	3-1
3.1	Project Identification.....	3-1
3.2	Construction Execution.....	3-1
3.2.1	Construction Contracts	3-1
3.3	Plant Access	3-3
3.4	Craft Manpower	3-4
3.5	Construction Facilities, Utilities and Services	3-6
3.5.1	Parking.....	3-6
3.5.2	Construction Trailers	3-6
3.5.3	Lay-down Area.....	3-7
3.5.4	Fabrication Area	3-7
3.5.5	Construction Utilities.....	3-8
3.5.6	Construction Services.....	3-9
3.6	Site Preparation Activities	3-10
3.7	Plant Site Roadways	3-12
3.8	Mobile Crane Access	3-12
3.9	Construction Execution Plan.....	3-13
3.9.1	Unit 1 Arrangement.....	3-13
3.9.2	Unit 2 Arrangement.....	3-14
3.9.3	Units 3 and 4 Arrangement.....	3-16

Appendix A Reference Drawings

1.0 Introduction

Black & Veatch (B&V) was retained by Louisville Gas & Electric/Kentucky Utilities (LG&E/KU) to provide a technical evaluation and system analysis of Units 1 through 4 at the Mill Creek Generating Station, which is located in Jefferson County southwest of Louisville, Kentucky. Mill Creek is a four unit, coal fired electrical generating station with a combined gross generating capacity of 1,608 megawatts (MW). The addition of air quality control (AQC) technologies is being evaluated to ensure compliance with the emissions limitations the Mill Creek generating site may be required to meet in the future.

This constructability review is intended to identify site-specific construction requirements for the proposed modifications to Mill Creek Units 1 through 4 and ensure their cost is incorporated into the overall project cost estimate. The drawings listed in Appendix A, in combination with the technical documentation gathered during the phase II study and the construction execution plan presented in this review form the basis of the cost estimate for the project.

2.0 Summary

2.1 General

This constructability review proposes methods for establishing essential construction facilities, services, and utilities necessary to support project execution; identifies modifications that should be completed at the site prior to major project mobilization; and identifies the critical work activities associated with the proposed project work scope. It is intended to help define the general construction requirements for the AQC upgrades and ensures the costs associated with them are included in the project cost estimate.

The review is based on information obtained from walkdowns conducted at the plant site, drawings and aerial plan views of the plant site, interviews with plant operations personnel, General Arrangement Drawings 168908-MCDS-1000A, -1000B, -1001, -1002A, -1002B and -1003, listed in Appendix A, and conclusions drawn from the initial technology study.

2.2 Summary of Findings

The following is a summary of the key findings from the review:

- The existing land areas available for the EPC Contractor to develop construction facilities such as construction office trailers, construction parking and material lay-down/fabrication are adequate for the AQC project scope but not ideally located.
- The schedule proposed for the project may cause it to compete with other LG&E/KU projects and planned major capital projects in the region for craft manpower. It may be necessary to offer enhancements to the prevailing wage rate for longevity, performance, or cost of living expenses to obtain and maintain an adequate workforce.
- Existing site facilities, such as Unit 1/2 345 KV transmission line, Unit 1 & 2 Auxiliary Boiler building, Units 1 & 2 ESPs, Unit 3 Scrubber, and a portion of the outer (westernmost) coal rail loop adjacent to Unit 3 interfere with new construction and must be relocated. In addition for Arrangement A, the Unit 3/4 345 KV transmission line, the ammonia storage facility, and thickener base interfere with new construction and need to be relocated or demolished. In contrast for Arrangement B, the Unit 4 Auxiliary Boiler building, the Annex and the Sample Lab interfere with new construction and need to be relocated or demolished. It may be

desirable to relocate interfering site facilities critical to plant operation via a site preparation contract prior to mobilization of the EPC Contractor.

- Crane access to new construction will be congested and require detailed planning. Access to Units 1 and 2 for ESP demolition and SCR construction will be especially challenging.
- The project work scope is interdependent with associated projects to rebuild Units 1, 2, and 4 scrubber facilities and refurbish the structural steel framework around them.
- Construction utilities, such as sewer, potable water, service water, electrical power, telephone, and data communications, are available to the EPC Contractor in sufficient quantities to perform the project and the contractual parties responsible for supplying these utilities (EPC Contractor or Owner) can be clearly defined.
- Access routes can be established to supply manpower and material to the plant site over existing roadway and railway systems.

2.3 Recommendations

B&V recommends LG&E/KU develop the plant site for project construction as shown on the drawings listed in Appendix A. The drawings locate and define approximate footprints for various AQC technologies on the Mill Creek plant site. The project work scope should include relocation of critical existing plant facilities via a site preparation contract performed in advance of EPC Contractor mobilization. Areas suitable for construction and approved for use by plant operations can be offered to the EPC Contractor, as shown on the referenced drawings. The EPC Contractor will be expected to determine the best use of these areas in support of its construction execution plan and to obtain additional facilities and areas that may be required.

3.0 Constructability Analysis

3.1 Project Identification

This project will be executed within the plant boundaries of Mill Creek plant site. The project site consists of approximately 509 acres, which contain four coal fired electrical generating units and associated support facilities.

The construction work scope is depicted on Site Arrangement Drawings 168908-MCDS-1001A, -1001B, -1001, -1002A, -1002B, and -1003, referenced in Appendix A. Work will include installation of Selective Catalytic Reduction (SCR) technology on Units 1 and 2; installation of pulse jet fabric filter (PJFF) technology with sorbent and powder activated carbon (PAC) injection on Units 1, 2, 3, and 4; new ID fans on Units 1 and 2 and new boosters fans on Units 3 and 4; and installation of Wet Flue Gas Desulfurization (WFGD) technology and chimney on Unit 4. These technologies provide the desired emissions control and will also include flue gas ductwork, air compressors, ash handling equipment, addition of new auxiliary electrical equipment, modifications to existing auxiliary electrical equipment and additions to the existing Distributed Controls System (DCS), ammonia injection equipment, and all other associated equipment necessary to achieve the proposed emissions limits while burning high sulfur Western Kentucky bituminous coal.

3.2 Construction Execution

For the purpose of this evaluation, it is assumed that project construction for all four units will be performed as a single project by a selected EPC Contractor under a lump sum, firm price, contracting arrangement. A “Best Value” composite labor rate has been utilized in the cost estimate to account for the use of either union or open shop craft labor. The construction execution plan presented in this report assumes work scope associated with refurbishment of the existing Unit 1, 2 and 4 scrubbers and adjacent structural steel framing is excluded from, but interdependent with the EPC Contract work scope. In addition, some work scope necessary to prepare the plant site for base project construction may be performed by LG&E/KU, or by a separate site preparation contractor prior to EPC Contractor mobilization.

3.2.1 Construction Contracts

It is anticipated that the EPC Contractor will divide the construction work scope into the following major work packages:

- **Piling**--This package would cover the installation of piling to support the heavily loaded foundations.

- **Civil Construction**--This package would cover all work associated with preparation of the site to elevations required for placement of foundations for permanent equipment, buildings, and tanks; demolition, or partial demolition of building and equipment foundations; installation and paving of necessary roadways and preparation of material lay-down areas and fencing; installation of foundations for permanent buildings, tanks, and plant equipment; installation of underground piping, duct bank, buried conduit and grounding; and erection of miscellaneous buildings, structures, and enclosures.
- **Superstructures Construction**--This package would cover furnishing and installing process-related ductwork, metal decking, and structural steel, including erection of any permanent cranes and hoists. It would also include placement of concrete equipment bases and elevated concrete slabs; and the installation of wall panel, roofing, interior walls, HVAC (heating, ventilating, and air conditioning) systems, and all interior finishes.
- **Chimney Construction**--This package will cover all work related to furnishing and installing the Unit 4 chimney, including the concrete wind shell and roof deck, FRP breaching and liners, chimney drains, platforms and ladders, vertical lift service car, hoisting equipment and associated electrical equipment.
- **Field Erected Tanks**--This package would cover the furnishing and installing of field erected tanks.
- **Mechanical Construction**--This package would cover furnishing and installing mechanical systems, including setting, aligning, leveling, and grouting of equipment such as skids, compressors, fans, absorber vessels, and pumps. This contract would also include installation of all above ground large and small bore piping, including the associated valves and supports and calibration and installation of all instrumentation. This package would include responsibility for startup and commissioning of all mechanical systems.
- **Wet Flue Gas Desulfurization**--This package would cover furnishing and installing the selected WFGD equipment and its auxiliaries.
- **Pulse Jet Fabric Filter (PJFF)**--This package would cover furnishing and installing the selected particulate matter emissions control equipment and auxiliaries.

- **Selective Catalytic Reduction (SCR)**—This package would cover furnishing and installing the selected SCR reactor box, ammonia injection equipment, ductwork and catalyst modules, control equipment and auxiliaries.
- **Fire Protection**--This package would cover furnishing and installing the required fire protection equipment and piping by a licensed fire protection contractor.
- **Electrical Construction**--This package would cover all work related to the installation of medium and low voltage electrical equipment, modification to existing switchgear, lighting, heat tracing, cable, ductbank, aboveground raceway, above grade grounding, and instrumentation and controls. This subcontractor would also be responsible for making modifications and additions to the Distributed Control System (DCS). This package would include the responsibility for startup and commissioning of all electrical/control systems, including furnishing manpower and technical assistance for the startup of mechanical systems.
- **Painting**--This package would cover furnishing and installing field applied protective coatings on all new permanent plant facilities and equipment that require a finish coat, installing chemical-resistant coatings, labeling of piping and equipment, and installing signs.
- **Insulation and Lagging**--This package would cover the work associated with furnishing and installing all freeze protection system work that will be executed at the project site. This includes insulation and lagging for permanent equipment, piping, and ductwork.
- **Site Finishing**--This package would cover removal of construction facilities, final grading, landscaping, and final paving.
- **Testing Services**--This package would cover performance testing of the WFGD and SCR equipment to ensure that it meets the performance criteria specified in the contract. This work scope would be contracted to a third party unaffiliated with the EPC Contractor to ensure unbiased test results.

3.3 Plant Access

The Mill Creek plant site is located on the east bank of the Ohio River, approximately 10.5 miles southwest of downtown Louisville, Kentucky. The Ohio River impedes material and manpower access to the plant from the west. There are no vehicle bridge crossings or suitable barge unloading sites on the river in the immediate vicinity of the plant site. The town of Meadowlawn and ash ponds are located to the north and

northeast of the plant site, the Ohio River to its west, ponds and the landfill are on its south and southwest sides, and a railroad coal loop on its east side which is used to supply coal to the four generating facilities on the site.

The existing interstate, federal, state, and county roadway systems provide the primary route for transporting material and personnel to the Mill Creek project site. Interstate 64 (I-64), a divided, multi-lane paved roadway, runs east to west through the City of Louisville, Kentucky approximately 20 miles northeast of the plant site. Interstate 65 (I-65), a divided, multi-lane paved roadway, runs north to south through the City of Louisville, Kentucky approximately 16 miles east of the plant site. The most direct route to the site from Louisville uses US highway 60 (Dixie Road). This paved, four lane roadway is crossed by both major Louisville by-pass loops (I-264 and I-265) as it passes through the business and residential areas of Louisville directly to Lee Driveway, the entrance road into the plant site.

The closest large commercial airport terminal to the Mill Creek plant is the Louisville International Airport (SDF), which is located approximately 16 miles northeast of the plant site.

The site is also served by the P&L railroad. The site railway system is used primarily for delivering coal, but could be made suitable for transporting heavy construction materials such as transformers and equipment skids to the project site

The existing plant roads, parking areas, and vacant land at the north and east ends of the plant site are suitable for use in staging and evacuating construction personnel during medical or site emergencies.

3.4 Craft Manpower

The labor force in the area is made up of both union and non-union forces with an average unemployment rate of 11% and a 25 – 30% unemployment rate among the building trades. The project could be executed using either union or open shop craft labor. The closest labor pools of significant size are located in Louisville, Kentucky (10.5 miles northeast of the jobsite); Lexington, Kentucky (90 miles east of the jobsite); and Cincinnati, Ohio (120 miles northeast of the jobsite).

Current research indicates there will be multiple construction projects within 150 miles of the Mill Creek plant site that will compete for the available craft workforce during the proposed project schedule. Continuous craft demand numbers could average 350 – 400 individuals annually from 2012 -2015 due to external projects alone. In addition, the proposed projects on LG&E/KU assets (Mill Creek Station, Ghent Station and E.W. Brown Station) could increase average continuous craft demand by another 1000 individuals over this same time period. If a majority of the construction work scope

projected between 2012 and 2015 is executed, it is anticipated craft demand will quickly exceed available local union manpower. Projects will likely use a hybrid labor mix of union and non-union craft personnel to satisfy their manpower needs. This work force may contain a high number of traveling craft. Due to the large demands on labor it may become necessary to offer enhancements to the prevailing wage rate for longevity, performance, or cost of living expenses to attract and maintain the appropriate level of skilled craft.

The preliminary construction schedule for the Mill Creek work scope is based on a 60 month construction schedule. This should help to stabilize the project workforce by attracting and retaining local craftsmen looking for long-term job stability. It is anticipated that the project as outlined in the schedules referenced in Appendix A will utilize a peak workforce of approximately 600 field craft.

The EPC Contractor should be able to perform most work scope on a normal 40 hour workweek schedule. However, 50 hour workweeks may be necessary to attract and retain an adequate work force and to maintain the schedule for critical path activities. It is anticipated that all plant outage-related work activities that are critical to support the plant's outage schedule will be performed on an overtime basis or will use extra shifts as necessary to complete the work on time.

The City of Louisville and the numerous small to medium size communities located within 30 miles of the jobsite should be able to offer ample temporary housing to the traveling workforce. It should not be necessary to establish RV areas or other housing options if it becomes necessary to augment the local labor pool with a large constituent of craft travelers.

Detailed manpower surveys need to be conducted during the next phase of development of the project as well as in the months just prior to start of construction. The availability of a stable, quality workforce represents a real risk to the success of the project and this uncertainty has been monetarily quantified and included in the cost estimate. The craft labor portion of the Mill Creek project cost estimate uses a composite labor rate that accounts for the use of union and non-union labor. Use of a composite labor mix will require site access changes to the facility as outlined in section 3.6 "Access Requirements." In addition, the project cost estimate it has been adjusted to include increased craft incentives that may be necessary to attract and maintain skilled labor. It is based on executing the work with a 50 hour work week for the entire duration of the project to account for a high number of traveling craft in the work force.

3.5 Construction Facilities, Utilities and Services

The EPC Contractor will require a majority of the available open area around the Mill Creek plant site to establish the support facilities required to execute the project. These will include craft parking, office trailers, craft break areas, medical facilities, material warehousing and lay-down, fabrication areas, crane lift positions, material staging, and equipment/tool storage. The available area within the plant proper is limited, and in some cases, inadequate to accommodate the need. The EPC Contractor will likely utilize additional open land area on the south end of the plant site; along the western north/south plant road bordering the river; and land area within the coal loop to obtain the necessary construction footprint. The main construction facility requirements are discussed as follows.

3.5.1 Parking

Presently, plant construction craft parking consists of a dedicated parking area located on the north end of the plant site, behind the existing maintenance shop buildings which has a capacity of approximately 450 vehicles. Additional parking area could be developed at the southeast end of this parking lot, along the southern right of way of Lee Driveway to increase total parking capacity above 650 vehicles. This should be adequate to accommodate the maximum construction parking demand which will occur when peak construction manpower coincides with a plant outage, which is estimated to approach 850 workers.

3.5.2 Construction Trailers

Construction management, EPC Contractor, and subcontractor office trailers need to be located in proximity to the main workforce, for maximum efficiency. It is estimated the EPC Contractor will require a four wide (or equivalent) office complex and sufficient area to accommodate an additional ten single wide office trailers (or equivalent) around the project site. Two potential areas for locating construction trailers are shown on Construction Facilities Plot Plan drawing 168908-MCDS-1003. It is anticipated that LG&E/KU will establish an Owner's trailer in proximity to the construction work area during project execution. The final location of the construction trailer complex will be determined in cooperation with the EPC Contractor after the site general arrangement is developed and approved.

The EPC Contractor will be responsible for the configuration of the construction trailer complex. It should include staff and craft supervision offices, restroom facilities, hand wash areas, craft break areas, craft change areas, and craft "onboarding" facilities. In addition, a conference room trailer should be provided in this area for project meetings with LG&E/KU.

3.5.3 Lay-down Area

It is estimated approximately 20 acres of lay-down/fabrication area will be required to execute the proposed work scope as a single project, using standard procurement and delivery schedules. The power block footprint is nearly fully developed, and areas suitable for lay-down are limited. The largest open land areas in the plant site are located within the plant railroad loop. Approximately 15 acres of area could be developed for long term material lay-down within the rail loop northeast of, and adjacent to the switchyard. This area is not ideal for material storage due to the frequent coal train deliveries which will limit access to the area. An additional area of approximately 6 acres is available on the southwest side of the plant site, adjacent to, and immediately south of the dewatering facility. This triangular shaped section of ground is serviced directly by the westernmost north/south plant road. It could be suitable for fabricating component modules and storing material that must be accessed on a frequent basis, although module height will be limited due to utility rack which crosses the service road between the yard and construction footprint. The areas proposed for material lay-down and described above are shown on Construction Facilities Plot Plan Drawing 168908-MCDS-1003.

The EPC Contractor is expected to supply, transport, and store all material that is required to execute the project. This includes determining the procurement strategy used to supply the project, acquiring additional offsite lay-down/fabrication area if necessary and developing storage facilities for environmentally sensitive material.

3.5.4 Fabrication Area

The areas available to fabricate and assemble large modular components or subassemblies, e.g., inlet and exhaust ductwork, fabric filter compartments, chimney flue segments, and absorber vessel segments, is largely limited to the 6 acre land parcel described in Section 3.5.3, and small linear parcels of land located along the west side of the western-most north/south plant road. These areas are shown on Construction Facilities Plot Plan Drawing 168908-MCDS-1003. They should be sufficient for fabricating modular components; however, their use will be limited by low overhead restrictions when transporting fabricated material across the plant site.

Limited areas exist around and within each of new major equipment footprints to establish small craft fabrication areas for “field run” items such as small bore piping, conduit, and miscellaneous structural platforms. These areas can follow and be relocated according to the adopted construction execution sequence. However, the EPC Contractor must closely coordinate use of the available area to ensure that fabrication activities do

not affect the work of other subcontractor's and plant operations. The EPC Contractor is expected to obtain and develop additional remote fabrication sites, if required to properly execute the work scope.

3.5.5 Construction Utilities

The EPC Contractor's construction trailer complex and miscellaneous site support trailers will require various temporary utility services, including phone/data lines, potable water, electrical, and sanitary facilities. The EPC Contractor will be responsible for providing all utilities to these trailers, unless otherwise directed by LG&E/KU.

For the purposes of this report, it is expected that construction utilities will be established and routed generally as discussed in the following subsections.

Potable Water and Service Water

LG&E/KU will provide potable water to the project in amounts sufficient to supply drinking water to the EPC Contractor's personnel. The EPC Contractor will be responsible for distributing potable water from the designated connection point(s) near the Mill Creek units to the point of need. Alternately, the EPC Contractor may choose to establish a contract with a local bottled water supplier to provide and distribute potable water for consumption and sanitary needs.

LG&E/KU will also provide a source of service water within the jobsite for the EPC Contractor's use. The EPC Contractor will be responsible for installing freeze protection on all water services, both temporary and permanent, under its control.

Construction Power

LG&E/KU will supply electrical power for all construction activities. It will be offered to the contractor as 480 volt, three-phase power via construction panel boards located at various locations within the Mill Creek plant footprint. The EPC Contractor will be responsible for connecting to the panel boards and distributing the power to its work locations. The EPC Contractor will also be responsible for distributing and connecting the 120 volt power in the trailer area to each trailer.

Sanitary Facilities

The EPC Contractor will be responsible for providing adequate temporary toilet facilities for the site workforce employed for this project. Under this scenario, the EPC Contractor is expected to establish a contract with a local service company to supply and maintain chemical toilets for the site workforce. Construction office trailers may use bladder type holding tanks or chemical toilets, as acceptable to the agency having

jurisdiction. The bladder tanks and chemical toilets will be furnished, serviced, and maintained by the EPC Contractor.

Telephone/Data Lines

LG&E/KU will supply telephone and internet connections to the EPC Contractor in sufficient capacity to perform the work scope. This connectivity will be offered at a central hub connection within the existing power block footprint. The EPC Contractor will be responsible for routing phone and data service from the existing hub to its facilities, including subcontractor's trailers and reconfiguring them to suit its needs. Any new data and LAN installations established by the EPC Contractor must be coordinated through LG&E/KU's data security department to ensure they are compatible with the system host.

3.5.6 Construction Services

For the purposes of this evaluation, it is assumed the EPC Contractor will be required to provide the following construction services to support its work activities, unless stated otherwise in its contract:

- Craft break area.
- Craft drinking water stations.
- Restroom facilities.
- Water for hydrostatic tests of tanks and piping systems.
- Housekeeping.
- Security lighting (other than lighting presently installed around the plant site).
- Freeze protection.
- Snow removal (owner will maintain permanent plant roadways).
- Trash removal.
- Hazardous waste storage and disposal.
- Drug testing.
- Small tools.
- Personal protective gear.
- Construction consumables.
- Badging facilities for all construction personnel.
- Security of all facilities and areas under the control of the EPC Contractor.
- Installation of temporary construction signs, fencing, and barriers.

3.6 Site Preparation Activities

Certain work activities required to prepare a “brownfield” site for a major project involve or affect operation of the existing plant; require specific knowledge of existing plant facilities; or involve businesses contractually associated with the owner. In most cases, the owner can accomplish these activities more efficiently and economically than if they were assigned to the EPC Contractor. Performing some elements of site preparation prior to mobilizing the EPC Contractor not only enhances project initiation, but can also allow LG&E/KU to maintain control over those portions of construction execution that can have the most impact on plant operations. Some activities that could be performed by LG&E/KU or by a site development contractor prior to EPC Contractor mobilization are discussed below:

- **Ensure Existing Survey Monuments are Adequate**--The existing plant survey monuments should be visually inspected and validated by survey to ensure that they are in undisturbed, in good repair, accurate, and can be utilized for the proposed work scope. Preferably, monuments should encompass the basic project footprint, with at least two monuments visible while standing at any one monument. This will support the EPC Contractor in establishing horizontal and vertical control points for the project.
- **Raise or Relocate Overhead Obstructions and Widen Pinch Points**-- A 345kV power line is presently routed across the proposed Unit 2 and Unit 4 (Arrangement A) construction footprints, as shown on attached Site Plot Plan Drawings 168908-MCDS-1000A and -1000B. These overhead power lines should be relocated. This relocation should take place prior to the EPC Contractor mobilizing. The routing for the relocated lines needs to be determined and included in the EPC bid documents.
- **Relocate Existing Underground Utilities**-- Existing underground utilities and foundations may require relocation or extensive modification to accommodate new construction. Underground systems critical to the operation of the units should be modified in scheduled plant outages to the extent practical prior to EPC Contractor mobilization.
- **Demolish and Relocate Existing Plant Structures**-- Existing plant facilities critical to plant operation that interfere with new construction should be demolished and relocated prior to EPC Contractor mobilization. These facilities include the Annex building, Sample lab, Unit 4 Auxiliary Boiler building and warehouse building for Unit 4 Arrangement B; the

ammonia storage facility, Flocculent Feed Building, and thickener base for Unit 4 Arrangement A; the Unit 1 & 2 Auxiliary Boiler building for Unit 2; and the Unit 3 scrubber.

- **Develop a Supplemental Parking Area--** Additional parking may need to be developed along the main entrance road (Lee Driveway) to accommodate plant personnel and outage contractors prior to the start of project construction. This activity is discussed above in Subsection 3.5.1.
- **Address Hazardous Materials Abatement--** Mill Creek structures and equipment likely contain asbestos containing materials (ACM) and lead-based protective coatings that are classified as hazardous materials. Tie-in points between the new construction and existing plant must be inspected and these materials, if found, must be abated prior to starting the contract scope of work. The EPC Contractor is expected to locate and identify the areas requiring abatement. LG&E/KU will then abate and dispose of hazardous materials found in the identified areas. It is necessary to establish in the EPC contract a minimum duration for notice of when LG&E/KU will need to perform the abatement.
- **Establish Site Traffic Patterns--** LG&E/KU plant operations and project management personnel should determine the existing site roadways that will be shared with construction vehicles and develop site traffic patterns to re-route existing traffic to isolate plant operations from construction to the extent possible. The affected roadways should be repaired and improved as required to support the plan. The final plant configuration may permanently modify existing plant roads. Affected plant personnel should be trained on the new traffic patterns prior to construction completion.
- **Establish Construction Access--** LG&E/KU plant operations and project management personnel should determine the location(s) that will be offered to the EPC Contractor for developing craft badging and vehicle access facilities. These points should be determined in parallel with establishing site traffic patterns. The number of access points and their configuration will vary, depending on the craft mix (union, non-union, or hybrid) and contracting strategy used to execute the project. These details are typically determined during EPC Contract negotiations, therefore, the project cost estimate does not include costs to modify plant access roads, parking areas, or craft badging facilities. Existing site security procedures should be reviewed and amended to account for the EPC Contractor's

craft plant access points and to ensure construction manpower, material, and traffic are adequately controlled. In addition, existing entry/exit facilities should be improved as necessary to accommodate increased access traffic.

3.7 Plant Site Roadways

Lee Driveway is the primary access used by permanent plant staff and outage contractors to enter and exit the plant site. This roadway leads directly to craft parking areas and main craft entry into the project site. An alternate plant entrance road exits Dixie Highway approximately 270 yards south of Lee Driveway. This entrance traverses the landfill area and could be used to deliver construction material into the proposed lay-down and fabrication yards shown on Construction Facilities Plot Plan drawing 168908-MCDS-1003.

It is anticipated that construction traffic routes inside the plant perimeter fence will largely be confined to the north/south roadway running along the east side of the plant, adjacent to the coal pile and the north/south roadway running along the west side of the plant, adjacent to the limestone handling equipment and settlement ponds. The alternate entrance road running through the landfill area may also be used as the primary material delivery path for incoming construction material, and material traveling between lay-down and the fabrication areas. The EPC Contractor will need to carefully coordinate use of these routes with plant operations to ensure that construction traffic does not impair normal plant operation and maintenance activities. Construction crane activity will frequently interrupt normal plant traffic and may require it to be re-routed when heavy loads are lifted and set in place. The final new construction footprint will likely require existing plant roadways and traffic patterns to be permanently re-routed.

3.8 Mobile Crane Access

Crane access around the existing plant structures and in the new construction area in general will be challenging. Numerous active underground utilities and foundations are located within the new footprint and must be accounted for. The EPC Contractor will be expected to supply and install crane matting and bridging as required to ensure that underground utilities are adequately protected from the ground pressure imposed by construction equipment. The existing 345KV transmission lines in the area of Units 2 and 4 (Arrangement A) must be relocated in order to locate the cranes necessary to construct the AQC systems proposed for these units. Project work scope involving PJFF construction, ESP demolition and SCR construction on Units 1 and 2 will be particularly difficult due to the congestion created by existing facilities. The existing Unit 1 & 2 Auxiliary Boiler building must be demolished in order to establish a corridor for crane

access to Unit 1 and 2 construction footprints. Depending on the size of crane needed, it may be necessary to utilize tower cranes for this portion of the construction.

It is anticipated that the large cranes used to set ductwork, structural steel, vertical vessels, and pre-fabricated equipment modules will be lattice boom type crawler cranes with a capacity of 300 to 400 tons. Cranes used for construction of field erected tanks; pre-engineered buildings, setting of minor equipment, laydown activities, and utility lifting will likely be small, rubber-tired, hydraulic units. The EPC Contractor will be expected to determine actual crane needs based on its final design of the equipment, component size, weight, and the working radius available around the equipment.

3.9 Construction Execution Plan

3.9.1 Unit 1 Arrangement

The proposed Unit 1 AQC arrangement is shown on Site Arrangement Drawing 168908-MCDS-1001. It is assumed the existing Unit 1 scrubber and its associated structural steel framework have been refurbished prior to beginning construction of new AQC equipment.

The proposed construction execution will begin with construction of the PJFF; associated ID fans; and inlet and outlet ductwork. This will be accomplished with Unit 1 in operation. The PJFF is located above the existing SDRS Service Building, supported by a substantial new foundation and structural steel superstructure which spans the existing building. The PJFF location above other new or existing equipment will require substantial work at heights and the resulting complications and inefficiencies. Installation of foundations will be problematic due to the existing congestion and the need to maintain unit operation to the extent practical. Micropiles may be required for many of the foundations in the interior area near the chimney.

New ID fans are located immediately east of Unit 1 scrubber, downstream of the PJFF. After the PJFF and ductwork are erected, the existing ESP, ID fans and booster fans will be by-passed and demolished as required, and exhaust gas flow re-established from the Unit 1 air heater into the new PJFF ductwork, and from the new PJFF outlet ductwork into the existing scrubber inlet ductwork and thence out the existing chimney. The plant will be placed in an extended outage to perform this work. The toggle ductwork between the air heater and the PJFF is routed under the ESP support framework and through the boiler building fan room. The existing ESP, a portion of its structural support frame, and a portion of the fan room roof and steel framing must be demolished in order to provide access to install this ductwork. This demolition will be selective. To the extent practical, the existing foundations and structural steel framework for the ESP will be incorporated into the new SCR support structure. Extensive evaluation of the existing structure and careful implementation of new work will be required to ensure

demolition work maintains the structural integrity of the remaining standing structure. The existing fans and their foundations will only be demolished to the extent required to install new equipment and establish maintenance access around it. Equipment not directly impacting plant operation will be abandoned in place.

Once PJFF tie-in is complete, Unit 1 will be re-started and construction will begin on the SCR and its associated support framework. The new SCR will be constructed in the same area occupied by the ESP. Demolition of the existing ESP and construction of a new SCR in its place will require cranes with substantial reach. The proposed site arrangement provides areas for crane placement south of the Unit 1 scrubber and between the existing Unit RATs and the boiler building for work at Unit 1. These areas may not be adequate to mobilize a lattice boom crawler crane of sufficient size to execute ESP demolition or SCR construction. Tower cranes may need to be utilized to perform this segment of the work scope.

After completion of the SCR, Unit 1 must be placed in outage to make the necessary ductwork modifications to tie the new SCR into the exhaust gas path. The Unit will then be restarted and the SCR tuned.

The expected sequence of construction for installation for the Unit 1 arrangement is as follows and as noted:

- Construct new foundations and any supporting superstructure for the PJFF and ductwork up to tie-in points.
- Install new PJFF and ancillary systems, plus ductwork to tie-in points. Demo existing ESP (*outage*).
- Install by-pass toggle ductwork to air heater (*concurrent with ESP demo outage*).
- Complete tie-in of ductwork to new fans and existing scrubber (*concurrent with ESP demo outage*).
- Start-up new PJFF system.
- Construct new SCR.
- Tie-in SCR.
- Start-up new SCR.

3.9.2 Unit 2 Arrangement

The proposed Unit 2 AQC arrangement is shown on Site Arrangement Drawing 168908-MCDS-1001. It is assumed the following work scope has been completed prior to beginning construction of new AQC equipment: The existing Unit 2 scrubber and its associated structural steel framework have been refurbished; the 345KV high voltage line running around the north side of Unit 2 has been re-located to the north out of the

immediate construction footprint; the Unit 1 & 2 Auxiliary Boiler building has been demolished; and the plant traffic path for maintenance material has been re-routed out of the construction footprint.

The proposed construction execution will begin with construction of the PJFF; associated ID fans; and inlet and outlet ductwork. This will be accomplished with Unit 2 in operation. The PJFF is located in the open area east of the existing water treatment building. A significant grade elevation change exists at northeast corner of the proposed area, which may require additional fill and complicate access. In addition, installation of foundations will be problematic due to the congestion created by existing structures and the need to maintain unit operation to the extent practical. Micropiles may be required for many of the foundations in the interior area near the chimney due to both overhead and underground utility obstructions.

New ID fans are located immediately northwest of Unit 2 scrubber, downstream of the PJFF. After the PJFF and ductwork are erected, the existing ESP, ID fans and booster fans will be by-passed and demolished as required, and exhaust gas flow re-established from the Unit 2 air heater into the new PJFF ductwork, and from the new PJFF outlet ductwork into the existing scrubber inlet ductwork and thence out the existing chimney. The plant will be placed in an extended outage to perform this work. The toggle ductwork between the air heater and the PJFF is routed under the ESP support framework and through the boiler building fan room. The existing ESP, a portion of its structural support frame, and a portion of the fan room roof and steel framing must be demolished in order to provide access to install this ductwork. This demolition will be selective. To the extent practical, the existing foundations and structural steel framework for the ESP will be incorporated into the new SCR support structure. Extensive evaluation of the existing structure and careful implementation of new work will be required to ensure demolition work maintains the structural integrity of the remaining standing structure. The existing fans and their foundations will only be demolished to the extent required to install new equipment and establish maintenance access around it. Equipment not directly impacting plant operation will be abandoned in place.

Once PJFF tie-in is complete, Unit 2 will be re-started and construction will begin on the SCR and its associated support framework. The new SCR will be constructed in the same area occupied by the ESP. Demolition of the existing ESP and construction of a new SCR in its place will require cranes with substantial reach. The proposed site arrangement locates an area for crane placement southwest of the new PJFF in the area vacated by demolition of the Unit 1 & 2 Auxiliary Boiler building. This area may not be adequate to mobilize a lattice boom crawler crane of sufficient size to execute ESP

demolition or SCR construction. Tower cranes may need to be utilized to perform this segment of the work scope.

After completion of the SCR, Unit 2 must be placed in outage to make the necessary ductwork modifications to tie the new SCR into the exhaust gas path. The Unit will then be restarted and the SCR tuned.

The expected sequence of construction for installation for the Unit 2 arrangement is as follows and as noted:

- Construct new foundations and any supporting superstructure for the PJFF and ductwork up to tie-in points.
- Install new PJFF and ancillary systems, plus ductwork to tie-in points.
- Demo existing ESP (*outage*).
- Install by-pass toggle ductwork to air heater (*concurrent with ESP demo outage*).
- Complete tie-in of ductwork to new fans and existing scrubber (*concurrent with ESP demo outage*).
- Start-up new PJFF system.
- Construct new SCR.
- Tie-in SCR (*outage*).
- Start-up new SCR.

3.9.3 Units 3 and 4 Arrangement

Two equipment configurations are presented for Unit 3 and 4 AQC arrangement as shown on Site Arrangement Drawings 168908-MCDS-1002A and -1002B. It is assumed the following work scope has been completed prior to beginning construction of new AQC equipment: The 345KV high voltage line running around the south side of Unit 4 has been re-located to the south out of the immediate construction footprint, the Ammonia Storage facility relocated to the east of the Unit 3 cooling tower, and Thickener base slab has been demolished (arrangement A only); and the Unit 4 Auxiliary Boiler building, Annex building, Sample Lab, and plant warehouse north of Unit 2 have been demolished or relocated (arrangement B only).

The modifications proposed at Units 3 and 4 are interdependent in that the existing Unit 4 scrubber and chimney will be refurbished and reused in the modified Unit 3 configuration. Accordingly construction of these two units will be considered together. Unit 4 will be the first of the two units to be modified and will be addressed first. Since the Unit 4 scrubber and chimney will be dedicated to Unit 3, a new wet scrubber and chimney will be constructed downstream of the PJFF, with the addition of booster fans to supplement the existing Unit 4 ID fans. Ductwork feeding the downstream Unit 4 AQC

train will be located in the area currently occupied by Unit 4 duct to the scrubber and bypass duct to the chimney.

Phase I work identified a location for new Unit 4 construction in the area of the existing foundation for the demolished thickener, south of the Reagent Prep building. This arrangement “A”, as detailed Site Arrangement drawing 168908-MCDS-1002A, is oriented north to south and allows construction access from the main plant road with relatively easy operational access to the equipment. However, ductwork lengths are significant for this arrangement, plus ductwork must be routed above the existing limestone conveyor and ash pipe rack. In addition, the thickener foundation must be demolished and the existing ammonia storage area relocated. An overhead 345KV high voltage line is routed directly through the area and must be relocated to allow safe construction. Finally, the relatively close location of the Unit 4 cooling tower may cause icing problems on the new AQC equipment and this would have to be considered.

An alternate arrangement “B” is shown for Unit 4 on Site Arrangement Drawing 168908-MCDS-1002B. Instead of continuing to the south, the AQC train is turned along an east-west axis south of Unit 4, with new equipment located between the limestone storage area and Unit 4. The PJFF will be elevated and located above the existing Unit 4 AQC Switchgear Building, whose contents will be modified for reuse on Unit 3. Ash handling equipment and new electrical equipment for Unit 4 will be located in the remaining area under the PJFF. This arrangement will require the existing Annex Building, Sample Lab, and Unit 4 Auxiliary Boiler Building to be demolished or relocated. This arrangement is also somewhat more congested than arrangement “A” and equipment building clearance must be carefully coordinated to maintain access to the Unit 4 Boiler and Turbine Buildings and minimize impact to the limestone storage pile. A retaining wall, either temporary or permanent, will likely be required at the north side of the limestone pile to maximize construction access along the south side of Unit 4.

Construction of Unit 3 will be completed in two parts to minimize outages. Once the new Unit 4 WFGD is on line, the existing Unit 4 scrubber can be refurbished. New ductwork will be extended from the existing Unit 3 ID fans to the Unit 4 scrubber inlets. The new duct will be routed beneath the Unit 4 duct, turn, and rise at a diagonal to the existing scrubber inlet duct. Unit 3 will then be put back into operation using the Unit 4 scrubber and chimney. The existing Unit 3 scrubber, now bypassed, will then be demolished and the area cleared for a new PJFF and two additional booster fans, plus tie-in ductwork. Once new construction is complete, tie-ins will be made to bring the new PJFF into service. The PJFF will be elevated to span across the existing road and allow ash handling equipment to be located beneath in the footprint of the demolished Unit 3 scrubber.

Crane access for construction of Unit 3 and Unit 4 appears relatively good for either arrangement, although access for both units in Arrangement B will be limited to a great extent to one side. Extensive coordination of the installation of new ductwork in the area between the existing ID fans and the existing scrubbers will be required to minimize outage. Demolition of the existing Unit 3 scrubber, especially the foundation and underground portion, will be extensive and consideration should be given to abandoning and backfilling the existing substructure to the extent practical. Reuse of existing ductwork support steel and foundations should also be considered as practical. Access for piling appears acceptable except under existing ductwork, where micropiles may be required.

The expected sequence of construction for installation for the Unit 3 and Unit 4 construction is as follows:

- Demo and/or relocate existing structures in the way of new construction (duration to be determined based on arrangement selected, non-outage).
- Construct Unit 4 AQC Train.
- Tie-in Unit 4 to new AQC Train (*outage*).
- Start-up Unit 4.
- Recondition Existing Unit 4 Scrubber for use by Unit 3 and switch power source for “old” Unit 4 AQC to Unit 3.
- Install new duct from Unit 4 scrubber inlet to tie-in points at Unit 3 ID fans.
- Tie-in Unit 3 to reconditioned Unit 4 scrubber (*outage*).
- Start-up Unit 3.
- Demo Unit 3 Scrubber and all areas needed to facilitate new PJFF and all ancillary equipment.
- Reclaim area demolished and make ready for PJFF construction.
- Erect Unit 3 PJFF.
- Make final tie-in to Unit 3 PJFF (*outage*).
- Start-up Unit 3.

Appendix A Reference Drawings

168908-MCDS-1000A	Site Plot Plan, Arrangement A
168908-MCDS-1000B	Site Plot Plan, Arrangement B
168908-MCDS-1001	Site Arrangement Unit 1 and Unit 2
168908-MCDS-1002A	Site Arrangement Unit 3 and Unit 4, Arrangement A
168908-MCDS-1002B	Site Arrangement Unit 3 and Unit 4, Arrangement B
168908-MCDS-1003	Construction Facilities Plot Plan
Level 1 Project Schedule A	Mill Creek Units 1, 2, 3, & 4 (A) Schedule
Level 1 Project Schedule B	Mill Creek Units 1, 2, 3, & 4 (B) Schedule