Modifications, Interfaces, and Tie-Ins to Existing Equipment and Systems

Common Modifications, Interfaces, and Tie-Ins

41.0804.1.GC01 - AQCS Reserve Power Supply
41.0804.1.GC02 - Grounding
41.0804.1.GC03 - Site Fire Protection
41.0804.1.GC04 - Site

Unit 1 Modifications, Interfaces, and Tie-Ins

41.0804.1.G101 - AQCS Power Supply
41.0804.1.G102 - Communication
41.0804.1.G103 - Control and Monitoring
41.0804.1.G104 - Buildings and Enclosures
41.0804.1.G105 - Ductwork
41.0804.1.G106 - Fly Ash
41.0804.1.G107 - Induced Draft
41.0804.1.G108 - AQCS Compressed Air
41.0804.1.G109 - Service Water

Unit 2 Modifications, Interfaces, and Tie-Ins

41.0804.1.G201 - AQCS Power Supply
41.0804.1.G202 - Communication
41.0804.1.G203 - Control and Monitoring
41.0804.1.G204 - Buildings and Enclosures
41.0804.1.G205 - Ductwork
41.0804.1.G206 - Fly Ash
41.0804.1.G207 - Induced Draft
41.0804.1.G208 - AQCS Compressed Air
41.0804.1.G209 - Service Water
41.0804.1.G210 - Ammonia Supply

Unit 3 Modifications, Interfaces, and Tie-Ins

41.0804.1.G301 - AQCS Power Supply
41.0804.1.G302 - Communication
41.0804.1.G303 - Control and Monitoring
41.0804.1.G304 - Buildings and Enclosures
41.0804.1.G305 - Ductwork
41.0804.1.G306 - Fly Ash
41.0804.1.G307 - Induced Draft
41.0804.1.G308 - AQCS Compressed Air
41.0804.1.G309 - Service Water

Unit 4 Modifications, Interfaces, and Tie-Ins

Modifications, Interfaces, and Tie-Ins Description
Common
AQCS Reserve Power Supply System

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Power Supply System and the new Air Quality Control System (AQCS) Power Supply System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing 25 kV AC power supply system consists of the following equipment:

- Two 138 kV – 26 kV Reserve Auxiliary Supply Transformers A and B with an impedance grounded wye secondary winding .
- Two single ended 25 kV Metal-clad switchgear bus A and B.

2.2 Description of New Infrastructure

The new Common AQCS AC power supply system shall consist of the following equipment:

- Two 25 kV Common AQC Reserve Switchgear, feeding the primary of the Common AQC Reserve Auxiliary Transformers. These two switchgear will be an extension to the existing 25 kV switchgear A and B.
- The feeds from the new 25 kV to the primary of the Common Reserve Transformers will be via 25 kV cable routed through ductbank. The ductbank will run beneath the South road and will require several manholes.
- Two three-winding 25 kV -13.8-4.16kV Common AQC Reserve Auxiliary Transformers.
- 3000A and 2000A cable bus to connect the Common Reserve Auxiliary Transformer secondary's to the Unit 1 and 2, 4160V AQC Switchgear and the Unit 3 and 4, 13.8 kV AQC Switchgear respectively.

3.0 Interface

25 kV cable will be run in the ductbank from the extension of the existing 25 kV switchgear to the Common AQC Reserve Auxiliary Transformers. The ductbank will be run from the 25 kV switchgear located in the substation, beneath the road, to the Common Reserve Transformers, located just South of the Units 1&2, and in proximity to the existing main auxiliary transformers. Cable bus will run from the secondary of the

Common AQC Reserve Aux Transformers to the Unit 1, and Unit 2 4160V switchgear, and to Unit 3, and Unit 4 13.8 kV switchgear .

4.0 Terminal Point List

The AQCS Reserve Power Supply System will have the following terminal points:

- Modification/Connection to the Existing 25 kV Switchgear

Modifications, Interfaces, and Tie-Ins Description
Common
Grounding

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Grounding System and the new Air Quality Control System (AQCS) Grounding System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

Existing infrastructure consists of a grounding grid for the plant.

2.2 Description of New Infrastructure

The Grounding System for AQCS facilities shall provide adequate paths to permit the dissipation of ground fault currents and lightning and switching surges.

3.0 Interface

The ground grid for AQCS facilities shall be connected to the existing plant ground grid through multiple parallel paths.

4.0 Terminal Point List

The Grounding System will have the following terminal points:

- Grounding of the modification of the existing 25 kV switchgear to existing grounding system.
- The manholes shall be grounded and tied into the existing system.
- The Common Reserve Auxiliary Transformers shall have a ground ring and ground rods that shall be tied into the existing ground grid.

Modifications, Interfaces, and Tie-Ins Description
Common
Site Fire Protection

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Fire Protection System and the new Air Quality Control System (AQCS) Fire Protection System. Actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Site Fire Protection System is supplied by two water sources: directly from the service water system drawn from the Ohio River and from the Unit 1 cooling tower basin. The service water system supplies fire protection to the suppression systems, fire hydrants, valve pits, and valve houses. The Unit 1 cooling tower basin has an emergency diesel driven fire pump for backup fire water if the service water system fails.

2.2 Description of New Infrastructure

The AQCS Fire Protection System will be tied to the existing Site Fire Protection System. The underground piping system shall be extended to encompass new fire hydrants near the new AQCS infrastructure. A new loop will be extended from the fire pump discharge header around the new AQCS infrastructure. One 300,000 gallon fire water tank along with a fire pump building containing an electric driven pump and jockey pump will be added south of Unit 1 cooling tower to provide a secondary source of fire water to meet code requirements. Sprinkler systems will be supplied for all four pulse jet fabric filters and the Unit 3 fly ash equipment building. For additional details on the new equipment, refer to the Site Fire Protection System Description (168908.41.0804.3.GC03).

3.0 Interface

New fire hydrants will be tied in to the existing underground main. The new 300,000 gallon fire water tank will tie into the existing loop providing a secondary source of fire water. The tank will also be tied to the existing cooling tower makeup or another acceptable on-site water supply. This tie-in will only be used for initial fill and makeup for the firewater tanks.

4.0 Terminal Point List

The Site Fire Protection System will have the following terminal points:

Underground Piping System:

- New hydrants will be tied in to the existing underground main north of the boiler buildings.
- The new firewater tank will be tied-in to the existing cooling tower makeup supply header.

Aboveground Piping System:

- The line from the firewater tank will be tied-in to the existing diesel fire pump discharge header.

Modifications, Interfaces, and Tie-Ins Description
Common
Site

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent roads, grading, and drainage and the new Air Quality Control System (AQCS) additions. Actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing plant roads to be impacted are primarily to the north of the power block and in the courtyard area between Units 2 and 3. The existing roads are asphalt paved, with the general surrounding grade and the courtyard area gravel surfaced.

The existing plant grading will not be impacted to any significant extent. The Unit 2 PJFF Support Structure will be designed with its northernmost columns located so as to minimize any impact to the existing riverbank slope. All other impacts to existing grade resulting from the new AQCS additions are expected to be immediately local to new structures and minor in nature.

The existing plant drainage will not be impacted to any significant degree except locally in the immediate areas of new structures. Overall storm management and runoff flow directions and characteristics are expected to be changed only minimally.

2.2 Description of New Infrastructure

The existing plant loop road will remain the primary means of accessing new AQCS installations. The north loop road will be re-established in its current location to pass beneath the Unit 2 PJFF support structure. New access roads and driveways from the existing loop road will be established around and to new AQCS installations at Unit 4. Ductwork supports and the west SCR support tower at Unit 2 will be constructed to maintain the existing driveway north of the Unit 2 ESP.

AQCS additions at Unit 3 will not restrict access into the courtyard area but will significantly impact truck turnaround capability. The construction at Unit 3 will eliminate the shop building, requiring its relocation/replacement. All parking lost with the demolished shop will be relocated with the shop. Parking lost due to the installation of new transformers on the north side of the Units will be relocated east of the existing tanks between Units 2 and 3.

Existing driveways and turnoffs from the loop road to access new AQCS structures and buildings will be re-established upon completion of construction. Turnouts and truck unloading lanes will be added to the existing loop road adjacent to new bulk material storage silos to minimize impact on road traffic during deliveries and unloading.

In general new roads will be asphalt paved to match existing roads, although gravel surfacing may be allowed in low or infrequent traffic areas. Access to the existing Unit 3 sorbent silos by semi-trailer truck will be significantly impacted, leading to the recommendation that the silos be relocated or provided with remote unloading capability. Other than the sorbent silos, access to existing equipment will be maintained and reflected in the new road construction.

Existing storm drain inlets and piping may be relocated due to new installations, but their function and service areas are intended to remain generally unaffected. New culverts will be installed under new roads and driveways to maintain existing surface flow paths. The addition of new impervious surfaces such as roofs will impact runoff quantities in the immediate area of new construction but are not expected to be of a magnitude to impact the overall existing site drainage system. Local additions to existing storm drainage piping may be required as determined during detailed design, but drainage in the areas impacted by new construction are expected for the most part to be negligibly changed.

Wastewater drains in the shop area will be displaced by new construction and will be capped and abandoned as appropriate. To the extent practical, interconnecting underground mains, as well are the trenches and sump in the courtyard area, will be left undisturbed, with relocation only as required. If relocated, the function and service of the existing wastewater system component will not be changed.

3.0 Interface

The interface will take place primarily between the loop road as modified or augmented to match new construction and existing intersecting roads. Grading and drainage interfaces will in general be in those same locations along the loop road and in the courtyard.

4.0 Terminal Point List

The Site System will have the following terminal points:

- Existing storm drainage inlets (locations to be determined during detailed design)
- Existing and new road intersections (locations to be determined during detailed design)

Modifications, Interfaces, and Tie-Ins Description
Unit 1
AQCS Power Supply System

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Power Supply System and the new Air Quality Control System (AQCS) Power Supply System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Medium Voltage System does not connect to the Unit 1 AQC Auxiliary Power. The Common AQC Reserve Auxiliary System does tie and is discussed in 41.0804.1.MC01.

There will be a 22kV feed to the primary of the Unit 1 AQC Main Auxiliary transformer. The existing Unit 1 Isolated Phase Bus Duct (IPB) will be tapped to provide the interface from the generator to the auxiliary transformer.

2.2 Description of New Infrastructure

The new AQCS AC power supply system shall consist of the following equipment:

- 4.16 kV Switchgear,
- Main Auxiliary Transformer.
- 4.16 kV ID Fan motor soft motor starters,
- 480 volt transformers,
- switchgear, and motor control centers; and
- DC and Uninterruptible Power Supply (UPS) systems to provide DC power to switchgear and UPS power to the Distributed Control System (DCS).

Cable bus will provide the connections from the main auxiliary transformer to the switchgear. Cable connections will connect all other electrical loads.

3.0 Interface

A new IPB tap will have to be installed. This IPB tap will terminate at the Main Auxiliary Transformer.

4.0 Terminal Point List

The AQCS Power Supply System will have the following terminal points:

- 22kV IPB tap at the existing IPB to furnish power to the primary side of the Main Auxiliary Transformer.

Modifications, Interfaces, and Tie-Ins Description
Unit 1
Communication

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Communication systems and the new Air Quality Control System (AQCS) Communication Systems; detailed interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing public address system is a multi-channel Gai-Tronics system.

2.2 Description of New Infrastructure

The Communication System shall include a page/party public address system compatible with Gai-Tronics equipment.

3.0 Interface

The AQCS page party system shall connect to the existing Gai-Tronics system equipment.

4.0 Terminal Point List

The Communication System will have the following terminal points:

- Interface of new system to existing.
- 120VAC power.

Modifications, Interfaces, and Tie-Ins Description
Unit 1
Control and Monitoring

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Control and Monitoring System and the new Air Quality Control System (AQCS) Control and Monitoring; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing DCS is an Emerson Ovation system.

2.2 Description of New Infrastructure

The AQCS DCS shall provide a means to manually and automatically control AQCS plant components individually and as a coordinated plant system. The system will be an extension of the existing system.

3.0 Interface

The new redundant processors and associated I/O modules will be connected to the existing redundant network primary and secondary switches.

4.0 Terminal Point List

The AQCS Control and Monitoring System will have the following terminal points:

- Existing Unit 1 Distributed Control System (DCS)
- Existing Unit 1 DCS Operating Work Stations
- AQCS Main 120 VAC UPS panel board
- AQCS General 208/120 VAC panel board
- AQCS Grounding System
- AQCS Equipment
- Booster Fans and Variable Frequency Drives
- AQCS Auxiliary Electrical System

Modifications, Interfaces, and Tie-Ins Description
Unit 1
Buildings and Enclosures

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Buildings and the new Air Quality Control System (AQCS) Buildings and Enclosures. Actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

Numerous buildings used for various purposes exist as part of the Unit 1 facility. The buildings, in general, are composed of both "stick-built" (individually-designed-and-constructed specialty structures) and pre-engineered metal buildings. The buildings consist of a metal panel exterior on a steel frame supported by a concrete foundation. Details, arrangement, and degree of finish depend on the building's intended function, but all structures protect and provide the necessary environmental control for the functions they enclose.

2.2 Description of New Infrastructure

The miscellaneous buildings and structures for the Unit 1 AQCS modifications will be designed similarly to those existing and will reflect the function and arrangement of the systems they enclose or support. Disregarding the "non-building" equipment which simply require foundations, the new buildings and structures proposed for Unit 1 are identified as follows:

- Unit 1 Pulse Jet Fabric Filter (PJFF) Support Structure
- Unit 1 AQCS Electrical Building
- Unit 1 Booster Fans Variable Frequency Drive (VFD) Enclosure.

Pre-engineered metal buildings, because of their lower capital cost and versatility, will be used where practical and are proposed for the Unit 1 AQCS Electrical Building. This building will consist of a fabricated steel frame of a "standard" size and arrangement enclosed by metal panel wall and roof systems. The building will be insulated, include utilities but no plumbing, have an unfinished interior, and include only heating and ventilation, except where air conditioning is required by the system(s) enclosed.

Where practical and cost effective, small buildings housing one or two related functions provided by a single equipment vendor will be prefabricated with the equipment already installed. This type of structure is proposed for the Unit 1 Booster Fan VFD Enclosure. Prefabricated enclosures usually result in a higher capital cost but a significant savings in

onsite installation labor. These relatively small structures will be delivered complete for installation on a constructed foundation with any outside utilities or services required to be connected to a prefabricated terminal point on the structure. These enclosures are expected to consist of a steel frame with metal panel enclosure. Where prefabricated construction turns out to be impractical or not cost effective, the structures usually revert to pre-engineered buildings.

The PJFF Support Structure is not an enclosure per se and is required primarily as a support for the Unit 1 PJFF assembly. As such it is a very specialized structure and must be designed and constructed as a stick-built installation. The PJFF Support Structure will allow the new PJFF to be erected above the exhaust ductwork downstream of the Unit 1 ID fans. The unenclosed structure will consist of a structural steel superstructure with an elevated slab serving as the "floor" for the PJFF above. The PJFF above the support structure will be supported on its own structural steel framing mounted on that elevated floor. The area above the elevated floor will contain the ash collection hoppers and associated equipment provided with the PJFF and this area will be enclosed and provided with lighting and ventilation.

All new Unit 1 buildings, of whatever type, will be supported on cast-in-place concrete foundations. To minimize the foundation footprint, and thus the potential impact to existing underground utilities in the area, all foundations are expected to be supported on drilled piers rather than larger-footprint shallow footings. Further, in areas of extreme congestion where large drill rigs are unable to access, the foundations will be supported on micropiles which can be installed used in areas of limited access. The location of the AQCS Electrical Building and the Fan VFD Building may allow their foundations to be integrated with the foundation of the PJFF Support Structure, minimizing the extent of piling operations.

None of the new structures at Unit 1 are expected to be continuously manned. That, together with the close proximity of existing facilities, allows plumbing and sanitary utilities, interior finishes, and interior space conditioning for personnel comfort to be eliminated. However, the structures will be provided with appropriate personnel, vehicle, and equipment maintenance access, and a Life Safety review of egress will be completed for each structure.

3.0 Interface

The AQCS Electrical Building and ID Fan VFD Enclosure will be physically and functionally separate from with little or no intended interface to existing structures. The PJFF Support Structure is specifically intended to avoid any interface, to the extent practical, with any existing structure, including the Unit 2 Cooling Tower Electrical Building, over which it will be constructed. Methods of construction for these buildings, especially installation of the new foundations, will be evaluated to minimize any impact of the new structure on those existing. Depending on the service required, the new structures may receive drainage, power, or other services from existing site systems and will interface with those systems accordingly.

4.0 Terminal Point List

Specific terminal points for each of the new Unit 1 buildings and structures will be identified during detailed design.

Modifications, Interfaces, and Tie-Ins Description
Unit 1
Ductwork

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Plant Flue Gas Exhaust System and the new Air Quality Control System (AQCS) Ductwork System. The actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing flue gas exhaust system downstream of the Unit 1 economizer outlet consists of an electrostatic precipitator (ESP), two parallel air heaters, an SCR, sorbent injection system, and two parallel ID fans, with ductwork downstream of the ID fans combined upstream of the inlet to the wet scrubber. Ductwork downstream of the ID fans is elevated and supported by exposed above-grade steel framing and individual concrete foundations. Ductwork is provided with expansion joints to maintain gas tight structural support throughout the equipment operating system flow and temperature range.

2.2 Description of New Infrastructure

The major equipment proposed in the Phase II AQC modifications include the addition of powdered activated carbon (PAC) injection systems, addition of two 50% pulse jet fabric filters (PJFF), and the addition of two parallel booster fans. The scope of Phase II work begins at the discharge of the existing ID fans and ends at the combined ductwork leading to the existing scrubber inlet. New ductwork will be installed to interconnect all new components to the outlet flanges of the ID fans and will terminate at new flanges installed in the existing downstream ductwork.

3.0 Interface

Two new interfaces in each parallel run of ductwork downstream of the ID fans will be established between existing and new equipment. The individual interfaces are described as follows.

- The ductwork connecting to the outlet flange of each ID fans will be removed and replaced with new duct routed to the corresponding PJFF. PAC injection will occur in this length of ductwork, which will terminate at the inlet to the PJFF.
- The outlet from each PJFF will be ducted to the inlet of the corresponding booster fan. The outlet of the booster fan will be ducted to the underside of the existing exhaust ductwork upstream of the scrubber inlet. Two new inlet flanges

will be installed in the existing ductwork to allow the new duct to interface with the existing. The two parallel runs of treated exhaust gas will combine into one flow within the existing ductwork.

All ductwork excluding the common duct to the scrubber as described above will be new, and supported independently where existing ductwork supports cannot be incorporated. Ductwork will be of carbon steel construction and unlined, since temperatures and conditions upstream of the wet scrubber will not require corrosion-resistant liners. Expansion joints, slide plates, and anchor points will be provided where required to ensure gastight operation under all operating temperatures without inducing unacceptable stresses into the interfacing equipment.

4.0 Terminal Point List

The Unit 1 Ductwork terminal points list is summarized as follows, pending final confirmation at time of detailed design:

- ID fan outlet (two required)
- PJFF inlet (two required), interface with PAC injection systems occurs upstream of this terminal point
- PJFF outlet (two required)
- Booster fan inlet (two required)
- Booster fan outlet (two required)
- Existing duct inlet (two required, combine into existing common ductwork).

Modifications, Interfaces, and Tie-Ins Description
Unit 1
Fly Ash

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Ash Systems and the new Air Quality Control System (AQCS) Fly Ash System. Actual interfaces will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

At time of this report, design of a new Common Fly Ash Handling Facility serving both Units 1 and 2 is underway under separate contract. It is assumed for purposes of this report that the new ash facility will be completed and in operation at the time Unit 1 AQCS modifications are made.

The "existing" Fly Ash System consists of pneumatic conveyed lines that draw ash from the economizer hoppers, air heaters, and precipitator hoppers. A vacuum conveying system sequentially removes ash from these collection points and transfers it to a filter/separator located north of Unit 2. The ash is subsequently transported by a pressurized pneumatic blower system to the ash storage and loadout silos at the coal combustion residue (CCR) facility south of Highway 42. At the CCR facility ash would be either unloaded from the silos to trucks for transfer to beneficial reuse or deposited on conveyors for landfilling operations.

2.2 Description of New Infrastructure

A new PJFF system, including PAC injection, will be installed at Unit 1 as part of the Phase II construction. This will result in additional fly ash pickup points at the PJFF hoppers. Because the additional ash flow rate introduced by the Unit 1 PJFF represents a relatively small increase in design flow rates, the anticipated combined total flow rates have been used in the design of the "existing" dry ash conversion system design. Thus, the in-place systems will be capable of handling the expected additional loading if the system and piping is configured to include the new PJFF. The ash collected in the PJFF will be transported to the Unit 1 and 2 Common Fly Ash Handling Facility and from there to the CCR Facility. The Unit 1 vacuum piping system would simply be extended to the new pickup points at the bottom of new PJFF hoppers, using the existing mechanical exhausters to maintain the vacuum.

3.0 Interface

The system proposed as part of the Phase II modifications would interface with the "existing" system at appropriate locations in the piping to the ESP hoppers. The extended vacuum piping would be designed to allow collection of all fly ash to be collected by the PJFF should the ESP eventually be removed from service.

4.0 Terminal Points List

The Unit 1 Fly Ash System will have the following terminal points:

- Lines running from the PJFF will tie in at appropriate pipeline connection points in the ESP hopper headers.

Modifications, Interfaces, and Tie-Ins Description
Unit 1
Induced Draft

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Induced Draft System and the new Induced Draft System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Induced Draft System consists of two induced draft (ID) fans to maintain furnace draft pressure and to overcome the draft system resistance. The ID fans are driven by 9,000 hp, 900 rpm motors and a variable frequency drive (VFD) system that allows variable speed operation. The existing draft system consists of the boiler, selective catalytic reduction (SCR) system, air heaters, cold-side electrostatic precipitator (CS-ESP) system, ID fans, wet flue gas desulfurization (WFGD) system, and associated ductwork, dampers, and other supporting equipment.

2.2 Description of New Infrastructure

The new Induced Draft System shall consist of two new booster fans designed to support the existing ID fans in maintaining furnace draft pressure and to overcome the resistance of the new draft system. The new booster fans would be driven by approximately 7,100 hp motors with a VFD system for variable speed control. The new draft system would consist of the existing boiler, existing SCR system, existing air heaters, existing CS-ESP system, existing ID fans, a new pulse jet fabric filter (PJFF) system, new booster fans, the existing WFGD system, and associated new and existing ductwork, dampers, and other supporting equipment.

3.0 Interface

The new booster fans shall be connected to the new ductwork at the outlet of the new PJFF system and the new ductwork entering the existing WFGD system. The new VFD system for the booster fans shall be supplied with new power feeds and connections to the existing DCS to allow control of the duct pressure between the existing ID fans and new PJFF system. The booster fan dampers, lube oil skid, and other accessories will required low voltage power feeds and connection to the existing DCS as well. The new VFD system and new lube oil skids for the booster fans would be cooled by ambient air.

4.0 Terminal Point List

The Unit 1 Induced Draft System terminal points list is summarized as follows, pending final confirmation at time of detailed design:

- Ductwork outlet of the new PJFF system
- Ductwork inlet of the existing WFGD system
- New booster fan DCS controls to VFD system and inlet damper actuators
- New booster fan medium voltage power feeds to VFD system
- New booster fan low voltage power feeds to VFD system, lube oil skids, damper actuators, and other accessories

Modifications, Interfaces, and Tie-Ins Description
Unit 1
AQCS Compressed Air

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Air Systems and the new Air Quality Control System (AQCS) Compressed Air System. Actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing air systems provide station air and instrument air to the existing plant infrastructure.

2.2 Description of New Infrastructure

The AQCS Compressed Air Systems will provide the clean, dry, oil free compressed air at an adequate pressure and adequate capacity for the pulse jet fabric filter, actuators, controls, instrumentation, and other air users in the AQCS addition.

3.0 Interface

A cross tie will be provided between the existing air systems and the new AQCS Compressed Air Systems. A cross-tie with the existing Station Air System will be provided by tying in before the new air filter/dryer skid. In addition, a cross tie with the existing Control Air System will be provided by tying in after the AQCS compressed air receiver. Each cross-tie will be furnished with manual isolation valve.

4.0 Terminal Point List

The AQCS Compressed Air System will have the following terminal points:

- The AQCS Compressed Air System will tie in to the Station Air system near the existing emergency cross-tie with the Control Air System.
- The AQCS Compressed Air System will tie in to the Control Air system near the existing emergency cross-tie with Station Air System.

Modifications, Interfaces, and Tie-Ins Description
Unit 1
Service Water

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Service Water System and the new Air Quality Control System (AQCS) Service Water System. Actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Service Water System withdraws river water from the Ohio River through the screenhouse intake structure and provides cooling, wash, makeup, back-up fire protection, quench, seal, and sluicing water to all Ghent station users. The screenhouse intake structure includes low pressure and high pressure service water pumps and traveling water screens.

2.2 Description of New Infrastructure

The Service Water System will extend existing service water systems for hose stations, makeup, and seal water for equipment in the AQCS areas. Existing service water quality will be sufficient to protect the AQCS systems.

3.0 Interface

A service water connection shall be supplied between existing Service Water System and AQCS Service Water System.

4.0 Terminal Point List

The AQCS Service Water System will have the following terminal points:

- The AQCS Service Water for Unit 1 will tie in at an appropriate pipeline connection point on the existing low pressure service water header or main branch.

Modifications, Interfaces, and Tie-Ins Description
Unit 2
AQCS Power Supply System

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Power Supply System and the new Air Quality Control System (AQCS) Power Supply System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Medium Voltage System does not connect to the Unit 2 AQC Auxiliary Power. The Common AQC Reserve Auxiliary System does tie and is discussed in 41.0804.1.MC01.

There will be a 22kV feed to the primary of the Unit 2 AQC Main Auxiliary transformer. The existing Unit 2 Isolated Phase Bus Duct (IPB) will be tapped to provide the interface from the generator to the auxiliary transformer.

2.2 Description of New Infrastructure

The new AQCS AC power supply system shall consist of the following equipment:

- 4.16 kV Switchgear,
- Main Auxiliary Transformer.
- 4.16 kV ID Fan motor soft motor starters,
- 480 volt transformers, switchgear, and motor control centers; and
- DC and Uninterruptible Power Supply (UPS) systems to provide DC power to switchgear and UPS power to the Distributed Control System (DCS).

Cable bus will provide the connections from the main auxiliary transformer to the switchgear. Cable connections will connect all other electrical loads.

3.0 Interface

A new IPB tap will have to be installed. This IPB tap will terminate at the Main Auxiliary Transformer.

4.0 Terminal Point List

The AQCS Power Supply System will have the following terminal points:

- 22kV IPB tap at the existing IPB to furnish power to the primary side of the Main Auxiliary Transformer.

Modifications, Interfaces, and Tie-Ins Description
Unit 2
Communication

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Communication systems and the new Air Quality Control System (AQCS) Communication Systems; detailed interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing public address system is a multi-channel Gai-Tronics system.

2.2 Description of New Infrastructure

The Communication System shall include a page/party public address system compatible with Gai-Tronics equipment.

3.0 Interface

The AQCS page party system shall connect to the existing Gai-Tronics system equipment.

4.0 Terminal Point List

The Communication System will have the following terminal points:

- Interface of new system to existing.
- 120VAC power.

Modifications, Interfaces, and Tie-Ins Description
Unit 2
Control and Monitoring

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Control and Monitoring System and the new Air Quality Control System (AQCS) Control and Monitoring; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing DCS is an Emerson Ovation system.

2.2 Description of New Infrastructure

The AQCS DCS shall provide a means to manually and automatically control AQCS plant components individually and as a coordinated plant system. The system will be an extension of the existing system.

3.0 Interface

The new redundant processors and associated I/O modules will be connected to the existing redundant network primary and secondary switches.

4.0 Terminal Point List

The AQCS Control and Monitoring System will have the following terminal points:

- Existing Unit 2 Distributed Control System (DCS)
- Existing Unit 2 DCS Operating Work Stations
- AQCS Main 120 VAC UPS panel board
- AQCS General 208/120 VAC panel board
- AQCS Grounding System
- AQCS Equipment
- Economizer gas-side bypass ductwork damper modulating drives
- Economizer gas-side outlet ductwork damper modulating drives
- Booster Fans and Variable Frequency Drives
- AQCS Auxiliary Electrical System

Modifications, Interfaces, and Tie-Ins Description
Unit 2
Buildings and Enclosures

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Buildings and the new Air Quality Control System (AQCS) Buildings and Enclosures. Actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

Numerous buildings used for various purposes exist as part of the Unit 2 facility. The buildings, in general, are composed of both "stick-built" (individually-designed-and-constructed specialty structures) and pre-engineered metal buildings. The buildings consist of a metal panel exterior on a steel frame supported by a concrete foundation. Details, arrangement, and degree of finish depend on the building's intended function, but all structures protect and provide the necessary environmental control for the functions they enclose. The exterior of the buildings are to some extent coordinated for a pleasing aesthetic appearance throughout the site.

The existing Unit 3/Unit 4 coal conveyor runs overhead along the north side of Unit 2, over the area in which some new Unit 2 structures will be constructed.

At time of this report, design of a new Common Fly Ash Handling Facility serving both Units 1 and 2 is underway under a separate task assignment. It is assumed for purposes of this report that the new ash facility will be completed and in operation at the time Unit 2 AQCS modifications are made.

2.2 Description of New Infrastructure

The miscellaneous buildings and structures for the Unit 2 AQCS modifications will be designed similarly to those existing and will reflect the function and arrangement of the systems they enclose or support. Disregarding the "non-building" equipment which simply require foundations, the new buildings and structures proposed for Unit 2 are identified as follows:

- Unit 2 AQCS Electrical Building
- Unit 2 Booster Fans Variable Frequency Drive (VFD) Enclosure
- Unit 2 Selective Catalytic Reduction (SCR) Module Support Structures
- Unit 2 SCR Power Distribution Centers (PDC)

Pre-engineered metal buildings, because of their lower capital cost and versatility, will be used where practical and are proposed for the Unit 2 AQCS Electrical Building. These buildings consist of a fabricated steel frame of a "standard" size and arrangement enclosed by metal panel wall and roof systems. The buildings will be insulated, include utilities but no plumbing, have an unfinished interior, and include only heating and ventilation, except where air conditioning is required by the system(s) enclosed.

Where practical and cost effective, small buildings housing one or two related functions provided by a single equipment vendor will be prefabricated with the equipment already installed. This type of structure is proposed for the Unit 2 Booster Fan VFD Enclosure and the Unit 2 PDC Enclosures. Prefabricated enclosures usually result in a higher capital cost but a significant savings in onsite installation labor. These relatively small structures will be delivered complete for installation on a constructed foundation or support structure with any outside utilities or services required to be connected to a prefabricated terminal point on the structure. The enclosures are expected to consist of steel frames with metal panel enclosures. Where prefabricated construction turns out to be impractical or not cost effective, the structures usually revert to pre-engineered buildings.

The PJFF Support Structure and the two SCR Module Support Structures are not enclosures per se and are required primarily as supports for the equipment noted. As such all are very specialized structures and must be designed and constructed as a stick-built installation. The PJFF Support Structure will allow the new PJFF to be erected above the Common Unit 1/Unit 2 Fly Ash Handling Facility, plus span the north loop road adjacent to the river. The PJFF will be supported on its own structural steel framing mounted on the elevated floor at the top of the support structure. The area above the elevated floor will contain the ash collection hoppers and associated equipment provided with the PJFF and this area will be enclosed and provided with lighting and ventilation.

The east and west SCR Support Structures will allow installation of the two SCR modules in elevated locations adjacent to the ductwork to which they interface. In addition, the two SCR Support Structures will support the related SCR PDC Enclosures near the equipment each serves. The three unenclosed structures will consist of structural steel superstructure mounted with integral stairwells for access.

All new Unit 2 miscellaneous buildings, of whatever type, will be supported on cast-in-place concrete foundations. To minimize the foundation footprint, and thus the potential impact to existing underground utilities in the area, all foundations are expected to be supported on drilled piers rather than larger-footprint shallow footings. Further, in areas of extreme congestion where large drill rigs are unable to access, the foundations will be supported on micropiles which can be installed used in areas of limited access. The location of the AQCS Electrical Building and the Fan VFD Building may allow their foundations to be integrated with the foundation of the PJFF Support Structure, minimizing the extent of piling operations.

None of the new structures at Unit 2 are expected to be continuously manned. That, together with the close proximity of existing facilities, allows plumbing and sanitary utilities, interior finishes, and the interior space conditioning for personnel comfort to be eliminated. However, the structures will be provided with appropriate personnel, vehicle, and equipment maintenance access, and a Life Safety review of egress will be completed for each structure. To the extent practical, the exteriors of the Unit 2 miscellaneous buildings will be coordinated to complement and match the appearances and colors of the existing site buildings.

3.0 Interface

The Unit 2 AQCS Electrical Building, Unit 2 SCR PDC Enclosures, and Unit 2 Booster Fan VFD Enclosure will be physically and functionally separate with little or no intended direct interface to existing buildings, except as noted below. Methods of construction, especially installation of the new foundations, will be evaluated to minimize any impact of the new structure on those existing. Depending on the service required, the new structures may receive drainage, power, or other services from existing site systems and will interface with those systems accordingly.

The extremely congested areas to receive the PJFF and SCR Support Structures will require careful and coordinated design to minimize impact to the existing structures. To the extent practical, new structures will be designed as separate and independent structures with no interaction between new construction and existing. A possible exception to be considered is the east SCR Support Structure. This structure will straddle the existing west tower of the structure supporting the Unit 1 SCR. If sufficient excess capacity remains in the existing structure, new construction could be integrated with existing to result in a lower capital cost composite structure. In all cases, the interface between existing and new structures will be complex and will be defined during detailed design.

The west Unit 2 SCR Support Structure will be located directly beneath the existing coal conveyor. It is intended that the structure be erected without impacting the conveyor, significantly complicating crane access to the new structure. Selected modularization and or ground prefabrication of support structure components should be considered to simplify crane use around the conveyor. Again, this interface is dependent on the final size and support configuration required for the SCR and will be defined during detailed design.

4.0 Terminal Point List

Specific terminal points for each of the new Unit 2 buildings and structures will be identified during detailed design.

Modifications, Interfaces, and Tie-Ins Description
Unit 2
Ductwork

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Plant Flue Gas Exhaust System and the new Air Quality Control System (AQCS) Ductwork System. The actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing flue gas exhaust system downstream of the Unit 2 economizer outlet consists of an electrostatic precipitator (ESP) system, air heaters, and ID fans, with ductwork downstream of the ID fans combined upstream of the inlet to the wet scrubbers. Ductwork downstream of the ID fans is elevated and supported by exposed above-grade steel framing and individual concrete foundations. Ductwork is provided with expansion joints to maintain gas tight structural support throughout the equipment operating system flow and temperature range.

2.2 Description of New Infrastructure

The major equipment proposed in the Phase II AQC modifications include the addition of two 50% SCRs, sorbent and powdered activated carbon (PAC) injection systems, two 50% pulse jet fabric filters (PJFF), and two parallel booster fans. The scope of Phase II work begins at the boiler back pass where a gas-side economizer bypass system would be installed. The economizer bypass ductwork would reconnect with the main gas path at the ESP system inlet ducts. In the ductwork between the ESPs and the air heaters the SCRs would be installed. The Phase II work scope would end in the combined ductwork leading to the existing scrubber inlets, in which the new PJFFs and booster fans would be installed. New ductwork will be installed to interconnect all new components to new flanges installed in the existing ductwork.

3.0 Interface

Several new interfaces in each parallel run of ductwork downstream of the economizer will be established between existing and new equipment. The individual interfaces are described as follows.

- Penetrations will be created in the boiler back pass upstream of the economizer section for economizer bypass ductwork. This ductwork will be routed to the inlet ductwork of the existing ESP system.

- The ductwork downstream of each ESP will be flanged and new ductwork routed to the inlet of a new SCR, making the first interface in the exhaust path.
- The outlet from the SCR will be ducted to a new flange installed in the ductwork upstream of the air heater, resulting in the second interface.
- A flange will be installed in the combined ductwork downstream of the two ID fans outlets to allow connection of new ductwork routed to the PJFFs.
- The new common ductwork will bifurcate and connect to the inlets of both PJFFs. Sorbent injection and PAC injection will be introduced to the common duct in this area.
- Two parallel runs of ductwork will connect the outlet of a PJFF with the inlet of its respective booster fan.
- Ductwork from the outlet of each new booster fan will be combined into a single common duct, which will be routed to a new flange installed in the existing common ductwork upstream of the scrubbers.

All new ductwork will be supported independently or on other new structures where existing ductwork supports cannot be incorporated. All ductwork other than the economizer bypass will be of carbon steel construction and unlined, since temperatures and conditions upstream of the wet scrubber will not require corrosion-resistant liners. Economizer bypass ductwork and other associated components may require higher temperature materials than carbon steel. Expansion joints, slide plates, and anchor points will be provided where required to ensure gastight operation under all operating temperatures without inducing unacceptable stresses into the interfacing equipment.

4.0 Terminal Point List

The Unit 2 Ductwork terminal points list is summarized as follows, pending final confirmation at time of detailed design:

- Penetrations in the boiler back pass upstream of the economizer section (minimum two required)
- Flange in the economizer bypass ductwork upstream of the ESP (minimum two required)
- Flange in ductwork downstream of the ESP (two required)
- SCR inlet (two required)
- SCR outlet (two required)
- Flange in the ductwork upstream of the air heater (two required)
- Flange in the common duct downstream of the existing ID fans (one required)
- PJFF inlet (two required), interface with sorbent and PAC injection systems occurs upstream of this location.
- PJFF outlet (two required)
- Booster fan inlets (two required)
- Booster fan outlets (two required)
- Flange upstream of the wet scrubber modules inlets (one required).

Modifications, Interfaces, and Tie-Ins Description
Unit 2
Fly Ash

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Ash Systems and the new Air Quality Control System (AQCS) Fly Ash System. Actual interfaces will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

At time of this report, design of a new Common Fly Ash Handling Facility serving both Units 1 and 2 is underway under separate contract. It is assumed for purposes of this report that the new ash facility will be completed and in operation at the time Unit 2 AQCS modifications are made.

The "existing" Fly Ash System consists of pneumatic conveyed lines that draw ash from the economizer hoppers, air heaters, and precipitator hoppers. A vacuum conveying system sequentially removes ash from these collection points and transfers it to a filter/separator located north of Unit 2. The ash is subsequently transported by a pressurized pneumatic blower system to the ash storage and loadout silos at the coal combustion residue (CCR) facility south of Highway 42. At the CCR facility ash would be either unloaded from the silos to trucks for transfer to beneficial reuse or deposited on conveyors for landfilling operations.

2.2 Description of New Infrastructure

A new PJFF system, including PAC injection, will be installed at Unit 2 as part of the Phase II construction. This will result in additional fly ash pickup points at the PJFF hoppers. In addition, two new 50% SCR modules will be installed downstream of the hot ESP. The ductwork in and out of the new SCRs may require ash collection points to avoid ash buildup in the ducts. Because the additional ash flow rate introduced by the Unit 2 PJFF and potential pickup points at the SCRs represents a relatively small increase in design flow rates, the anticipated combined total flow rates have been used in the design of the "existing" dry ash conversion system design. Thus, the in-place systems will be capable of handling the expected additional loading if the system and piping is configured to include the new PJFF. The ash collected in the PJFF will be transported to the Unit 1 and 2 Common Fly Ash Handling Facility and from there to the CCR Facility. The Unit 2 vacuum piping system would simply be extended to the new pickup points at the bottom of new PJFF hoppers and ductwork, using the existing mechanical exhausters to maintain the vacuum.

3.0 Interface

The system proposed as part of the Phase II modifications would interface with the "existing" system at appropriate locations in the piping to the ESP hoppers. The extended vacuum piping would be designed to allow collection of all fly ash to be collected by the PJFF should the ESP eventually be removed from service.

4.0 Terminal Points List

The Unit 2 Fly Ash System will have the following terminal points:

- Lines running from the PJFF and other pickup points within the ductwork will tie in at appropriate pipeline connection points in the ESP hopper headers.

Modifications, Interfaces, and Tie-Ins Description
Unit 2
Induced Draft

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Induced Draft System and the new Induced Draft System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Induced Draft System consists of two induced draft (ID) fans to maintain furnace draft pressure and to overcome the draft system resistance. The ID fans are driven by 12,500 hp, 900 rpm motors and a variable frequency drive (VFD) system that allows variable speed operation. The existing draft system consists of the boiler, hot-side electrostatic precipitator (HS-ESP) system, air heaters, ID fans, wet flue gas desulfurization (WFGD) system, and associated ductwork, dampers, and other supporting equipment.

2.2 Description of New Infrastructure

The new Induced Draft System shall consist of two new booster fans designed to support the existing ID fans in maintaining furnace draft pressure and to overcome the resistance of the new draft system. The new booster fans would be driven by approximately 7,100 hp motors with a VFD system for variable speed control. The new draft system would consist of the existing boiler, a new economizer bypass, the existing HS-ESP system, a new selective catalytic reduction (SCR) system, the existing air heaters, the existing ID fans, a new pulse jet fabric filter (PJFF) system, new booster fans, the existing WFGD system, and associated new and existing ductwork, dampers, and other supporting equipment.

3.0 Interface

The inlet of the economizer bypass shall be connected to the existing boiler back pass above the economizer section inlet. The outlet shall be connected to the inlet duct to the HS-ESP system. The drives for the modulating dampers in the economizer bypass ducts would require new power feeds and connections to the existing distributed control system (DCS) to allow control of the flue gas temperature entering the new SCR system. Modulating dampers in the main gas path at the economizer outlet may also be required to aid in controlling SCR gas inlet temperatures. The drives for these dampers would also require new power feeds and connections to the existing DCS.

The new booster fans shall be connected to the new ductwork at the outlet of the new PJFF system and the new ductwork entering the existing WFGD system. The new VFD system for the booster fans shall be supplied with new power feeds and connections to the existing DCS to allow control of the duct pressure between the existing ID fans and new PJFF system. The new VFD system and new lube oil skids for the booster fans would be cooled by ambient air.

4.0 Terminal Point List

The Unit 2 Induced Draft System terminal points list is summarized as follows, pending final confirmation at time of detailed design:

- Boiler back pass above economizer section inlet
- Ductwork inlet of existing HS-ESP system
- New economizer gas-side bypass damper modulating drives DCS controls
- New economizer gas-side bypass damper modulating drives low voltage power feeds
- New economizer gas-side outlet ductwork damper modulating drives DCS controls
- New economizer gas-side outlet ductwork damper modulating drives low voltage power feeds
- Ductwork outlet of the new PJFF system
- Ductwork inlet of the existing WFGD system
- New booster fan DCS controls to VFD system and inlet damper actuators
- New booster fan medium voltage power feeds to VFD system
- New booster fan low voltage power feeds to VFD system, lube oil skids, damper actuators, and other accessories

Modifications, Interfaces, and Tie-Ins Description
Unit 2
AQCS Compressed Air

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Air Systems and the new Air Quality Control System (AQCS) Compressed Air System. Actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing air systems provide station air and instrument air to the existing plant infrastructure.

2.2 Description of New Infrastructure

The AQCS Compressed Air Systems will provide the clean, dry, oil free compressed air at an adequate pressure and adequate capacity for the pulse jet fabric filter, sonic horns, actuators, controls, instrumentation, and other air users in the AQCS addition.

3.0 Interface

A cross tie will be provided between the existing air systems and the new AQCS Compressed Air Systems. A cross-tie with the existing Station Air System will be provided by tying in before the new air filter/dryer skid. In addition, a cross tie with the existing Control Air System will be provided by tying in after the AQCS compressed air receiver. Each cross-tie will be furnished with manual isolation valves.

4.0 Terminal Point List

The AQCS Compressed Air System will have the following terminal points:

- The AQCS Compressed Air System will tie in to the Station Air system near the existing emergency cross-tie with the Control Air System.
- The AQCS Compressed Air System will tie in to the Control Air system near the existing emergency cross-tie with Station Air System.

Modifications, Interfaces, and Tie-Ins Description
Unit 2
Service Water

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Service Water System and the new Air Quality Control System (AQCS) Service Water System. Actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Service Water System withdraws river water from the Ohio River through the screenhouse intake structure and provides cooling, wash, makeup, back-up fire protection, quench, seal, and sluicing water to all Ghent station users. The screenhouse intake structure includes low pressure and high pressure service water pumps and traveling water screens.

2.2 Description of New Infrastructure

The Service Water System will extend existing service water systems for hose stations, makeup, and seal water for equipment in the AQCS areas. Existing service water quality will be sufficient to protect the AQCS systems.

3.0 Interface

A service water connection shall be supplied between existing Service Water System and AQCS Service Water System.

4.0 Terminal Point List

The AQCS Service Water System will have the following terminal points:

- The AQCS Service Water for Unit 2 will tie in at an appropriate pipeline connection point on the existing low pressure service water header or main branch.

Modifications, Interfaces, and Tie-Ins Description
Unit 2
Ammonia Supply

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent existing Ammonia Storage and Supply System and the new Unit 2 Ammonia Supply System. Actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Ammonia System consists of the following equipment:

- Ammonia tanker truck unloading stations.
- Two 90,000 gallon anhydrous ammonia storage tanks.
- Two full capacity ammonia pumps.
- Existing ammonia supply header to Units 1, 3 and 4 SCRs.
- Ammonia Injection skids and ammonia dilution air equipment located at Unit 1, Unit 3, and Unit 4 SCR areas.

2.2 Description of New Infrastructure

Unit 2 Ammonia Supply System will consist of the following equipment:

- Two ammonia injection skids, each skid includes two full capacity mass flow meters and ammonia flow control valve trains.
- Two ammonia dilution air sets, each set includes two full capacity ammonia dilution air blowers, and two full capacity air pre-heaters.

Unit 2 Ammonia Supply System equipment will be located as follows.

- One ammonia injection skid, two full capacity ammonia dilution air blowers, and two full capacity air pre-heaters will be located at the SCR reactor 2-1 area.
- The other ammonia injection skid, two full capacity ammonia dilution air blowers, and two full capacity air pre-heaters will be located at the SCR reactor 2-2 area.

3.0 Interface

Unit 2 Ammonia Supply System will cross tie with the existing ammonia supply line at the above grade interfaces. The first interface will be at the northwest side of the Unit 2

Boiler and the Unit 2 ammonia supply line will then run above grade to the SCR reactor 2-2. The other interface will be at the northeast side of the Unit 2 Boiler and the Unit 2 ammonia supply line will then run above grade to the SCR reactor 2-1.

The steam supplied to the Unit 2 ammonia dilution air pre-heaters will cross tie with the existing station auxiliary steam header.

4.0 Terminal Point List

The Ammonia Supply System will have the following terminal points:

- Above ground ammonia supply line to SCR reactor 2-1.
- Above ground ammonia supply line to SCR reactor 2-2.
- Above ground auxiliary steam supply header to SCR reactor 2-1.
- Above ground auxiliary steam supply header to SCR reactor 2-2.

Modifications, Interfaces, and Tie-Ins Description
Unit 3
AQCS Power Supply System

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Power Supply System and the new Air Quality Control System (AQCS) Power Supply System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Medium Voltage System does not connect to the Unit 3 AQC Auxiliary Power. The Common AQC Reserve Auxiliary System does tie in and is discussed in 41.0804.1.MC01.

There will be a 22kV feed to the primary of the Unit 3 AQC Main Auxiliary transformer. The existing Unit 3 Isolated Phase Bus Duct (IPB) will be tapped to provide the interface from the generator to the auxiliary transformer.

2.2 Description of New Infrastructure

The new AQCS AC power supply system shall consist of the following equipment:

- 13.8 kV Switchgear,
- Main Auxiliary Transformer.
- 13.8 kV ID Fan motor soft motor starters,
- 480 volt transformers, switchgear, and motor control centers
- DC and Uninterruptible Power Supply (UPS) systems to provide DC power to switchgear and UPS power to the Distributed Control System (DCS).

Cable bus will provide the connections from the main auxiliary transformer to the switchgear. Cable connections will connect all other electrical loads.

3.0 Interface

A new IPB tap will have to be installed. This IPB tap will terminate at the Main Auxiliary Transformer.

4.0 Terminal Point List

The AQCS Power Supply System will have the following terminal points:

- 22kV IPB tap at the existing IPB to furnish power to the primary side of the Main Auxiliary Transformer.

Modifications, Interfaces, and Tie-Ins Description
Unit 3
Communication

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Communication systems and the new Air Quality Control System (AQCS) Communication Systems; detailed interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing public address system is a multi-channel Gai-Tronics system.

2.2 Description of New Infrastructure

The Communication System shall include a page/party public address system compatible with Gai-Tronics equipment.

3.0 Interface

The AQCS page party system shall connect to the existing Gai-Tronics system equipment.

4.0 Terminal Point List

The Communication System will have the following terminal points:

- Interface of new system to existing.
- 120VAC power.

Modifications, Interfaces, and Tie-Ins Description
Unit 3
Control and Monitoring

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Control and Monitoring System and the new Air Quality Control System (AQCS) Control and Monitoring; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing DCS is an Emerson Ovation system.

2.2 Description of New Infrastructure

The AQCS DCS shall provide a means to manually and automatically control AQCS plant components individually and as a coordinated plant system. The system will be an extension of the existing system.

3.0 Interface

The new redundant processors and associated I/O modules will be connected to the existing redundant network primary and secondary switches.

4.0 Terminal Point List

The AQCS Control and Monitoring System will have the following terminal points:

- Existing Unit 3 Distributed Control System (DCS)
- Existing Unit 3 DCS Operating Work Stations
- AQCS Main 120 VAC UPS panel board
- AQCS General 208/120 VAC panel board
- AQCS Grounding System
- AQCS Equipment
- ID Fans and Variable Frequency Drives
- AQCS Auxiliary Electrical System

Modifications, Interfaces, and Tie-Ins Description
Unit 3
Buildings and Enclosures

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Buildings and the new Air Quality Control System (AQCS) Buildings and Enclosures. Actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

Numerous buildings used for various purposes exist as part of the Unit 3 facility. These buildings, in general, are composed of both "stick-built" (individually-designed-and-constructed specialty structures) and pre-engineered metal buildings. The buildings consist of a metal panel exterior on a steel frame supported by a concrete foundation. Details, arrangement, and degree of finish depend on the building's intended function, but all structures protect and provide the necessary environmental control for the functions they enclose. The exterior of the buildings are to some extent coordinated for a pleasing aesthetic appearance throughout the site.

Based on the recommendations proposed by the Phase II Study, modifications to the existing Unit 3 facility will be concentrated between ductwork at the inlets and outlets of the existing Unit 3 ID fans, ultimately bypassing those fans. All Unit 3 AQC components upstream of the ID fans will remain unmodified and in service upon completion of the AQC modifications proposed in Phase II.

Existing in the area to be occupied by components of the proposed Unit 3 equipment are the ground-level enclosed walkway and utility corridor connecting Units 2 and 3, the elevated walkway ("skywalk") between Units 2 and 3, and the existing shop areas. The existing shop area will be occupied by new structures and the shop building must be relocated or replaced with equivalent new construction outside the courtyard area between Units 2 and 3.

2.2 Description of New Infrastructure

The miscellaneous buildings and structures for Unit 3 will be designed similarly to those existing and will reflect the function and arrangement of the systems they enclose or support. Disregarding the "non-building" equipment which simply require foundations, the new buildings and structures proposed for Unit 3 are identified as follows:

- Unit 3 Pulse Jet Fabric Filter (PJFF) Support Structure
- Unit 3 Fly Ash Handling Building

- Unit 3 AQCS Electrical Building
- Unit 3 ID Fans Variable Frequency Drive (VFD) Enclosure
- Replacement Workshop Building

In addition to the new buildings listed above, two existing structures will be significantly modified during Unit 3 construction, and will be placed back into service in more or less their current location. These structures are:

- Ground Level Walkway between Units 2 and 3
- Skywalk Elevated Walkway between Units 2 and 3

Pre-engineered metal buildings, because of their lower capital cost and versatility, will be used where practical and are proposed for the Unit 3 Fly Ash Handling and AQCS Electrical Buildings, as well as the replacement Workshop Building. These buildings consist of a fabricated steel frame of a "standard" size and arrangement enclosed by metal panel wall and roof systems. The buildings will be insulated, include utilities but no plumbing, have an unfinished interior, and only heating and ventilation, except where air conditioning is required by the system(s) enclosed.

Where practical and cost effective, small buildings housing one or two related functions provided by a single equipment vendor will be prefabricated with the equipment already installed. This type of structure is proposed for the Unit 3 ID Fans VFD Enclosure. Prefabricated enclosures usually result in a higher capital cost but a significant savings in onsite installation labor. This relatively small structure will be delivered complete for installation on a constructed foundation with any outside utilities or services required to be connected to a prefabricated terminal point on the structure. This enclosure is expected to consist of a steel frame with metal panel enclosure. Where prefabricated construction turns out to be impractical or not cost effective, the structures usually revert to pre-engineered buildings.

The PJFF Support Structure is not an enclosure per se and is required primarily as an elevated support for the Unit 3 PJFF assembly. As such it is a very specialized structure and must be designed and constructed as a stick-built installation. The PJFF Support Structure will allow the new PJFF to span across the ground level walkway and utility corridor, as well as allowing ground level access to the east side of the Unit 3 Boiler Building. The elevation of the superstructure will clear the existing piping and utilities enclosed in the ground level walkway to avoid their modification or interruption. In addition the Support Structure will provide a minimum of 16'-6" clear distance between grade and the bottom of steel superstructure above for vehicle access. The remaining area under the support structure will be reserved for the Unit 3 Fly Ash Handling Building and the Fan VFD Enclosure. As an unenclosed structure, no HVAC would be required for the PJFF Support Structure. The PJFF above the support structure will be supported on its own structural steel framing mounted on the elevated floor. The area above the elevated floor will contain the ash collection hoppers and associated equipment provided with the PJFF and this area will be enclosed and provided with lighting and ventilation.

All new Unit 3 buildings, of whatever type, will be supported on cast-in-place concrete foundations. It is expected, due to the weight of most of the structures and the geotechnical conditions onsite, the majority of new foundations will be supported on drilled piers or potentially micropiles where congestions does not allow large piers to be drilled. However, in areas of little existing congestion and for smaller and lighter buildings, shallow foundations (footings and slabs-on-grade) will be used. The location of the AQCS Fly Ash Handling Building and the Fan VFD Building may allow their foundations to be integrated with the foundation of the PJFF Support Structure, minimizing the extent of piling operations.

The new AQCS process structures at Unit 3 are not expected to be continuously manned, but the replacement Workshop Building will be manned on a daily basis. That, together with the close proximity of existing facilities, allows plumbing and sanitary utilities, interior finishes, and the interior space conditioning for personnel comfort to be disregarded for the new process structures. However, the replacement Workshop must be provided with plumbing and personnel utilities normally provided for a manned structure. All new structures will be provided with personnel, vehicle, and equipment maintenance access, and a Life Safety review of egress will be completed for each structure. To the extent practical, the exteriors of the Unit 3 miscellaneous buildings will be coordinated to complement and match the appearances and colors of the existing miscellaneous site buildings.

3.0 Interface

Installation of the PJFF Support Structure will require demolition and/or relocation of the existing shop structures east of Unit 3. It will also require temporary interruption of the skywalk while construction is completed. Impact to the ground level walkway will be minimized to avoid impacting the existing utilities therein, but some modification of the walkway enclosure itself may be required due to new construction. Upon completion of construction, both the ground level walkway and the skywalk will be re-established and continue their function connecting Units 2 and 3. The skywalk may have to be routed around the south end of the PJFF to avoid a significant change in elevation.

Traffic access into the courtyard area between Units 2 and 3 will be maintained, but truck turn-around area will be significantly curtailed. Although vehicle access to the east side of the Unit 3 Boiler Building will be maintained, the difficulty of maneuvering semi-trailer traffic in the area leads to the recommendation that the existing Unit 3 sorbent silos and associated either be relocated or provided with a remote unloading station. Similarly, the loss of courtyard area will significantly restrict placement of portable frac tanks used for Unit 3 boiler cleaning. A substitute permanent frac tank has been located on the site arrangement to make up for the lost area.

In general, the new Unit 3 buildings and structures will be physically and functionally separate with little or no intended direct interface to existing structures other than the skywalk. Methods of construction, especially installation of the new foundations, will be evaluated to minimize any impact of the new structure on the existing facilities other than

those in the courtyard area. Depending on the service required, the new structures may receive drainage, power, or other services from existing site systems and will interface with those systems accordingly.

4.0 Terminal Point List

Specific terminal points for each of the new Unit 3 buildings and structures will be identified during detailed design

Modifications, Interfaces, and Tie-Ins Description
Unit 3
Ductwork

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Plant Flue Gas Exhaust System and the new Air Quality Control System (AQCS) Ductwork System. The actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing flue gas exhaust system downstream of the Unit 3 economizer outlet consists of two parallel electrostatic precipitators (ESP), a selective catalytic reduction (SCR) system, air heaters, a sorbent injection system, and two parallel ID fans, with ductwork downstream of the ID fans combined upstream of the inlet to a single wet scrubber. Ductwork either side of the ID fans is elevated and supported by exposed above-grade steel framing and individual concrete foundations. Ductwork is provided with expansion joints to maintain gas tight structural support throughout the equipment operating system flow and temperature range.

2.2 Description of New Infrastructure

The major equipment proposed in the Phase II AQC modifications include the addition of powdered activated carbon (PAC) injection systems, addition of two 50% pulse jet fabric filters (PJFF), and the addition of four replacement parallel ID fans. The scope of Phase II work begins in the ductwork upstream of the existing ID fans and ends in the combined ductwork between the ID fan discharge and the inlet to the existing scrubber. New ductwork will be installed to interconnect all new components to the existing runs of ductwork, allowing complete bypass of the existing ID fans.

3.0 Interface

Two new interfaces will be established in the ductwork either side of the ID fans between existing and new equipment. The individual interfaces are described as follows.

- An interface flange and elbow will be installed in each of the parallel ductwork connecting to the inlet flange of each existing ID fan. Two new parallel runs of ductwork will be installed routed to the corresponding PJFF. PAC injection will occur in this length of ductwork, which will terminate at the inlet to the PJFF.
- The outlet from each PJFF will be bifurcated and ducted to the inlet of two new ID fans operating in parallel. The outlet of all four ID fans will be ducted together into a single combined duct. A new inlet flange will be installed in the

existing ductwork downstream of the existing ID fans to allow the new duct to interface with the existing. The new combined duct will be routed to this new interface point on the existing combined ductwork.

All new ductwork will be supported independently where existing ductwork supports cannot be incorporated. Ductwork will be of carbon steel construction and unlined, since temperatures and conditions upstream of the wet scrubber will not require corrosion-resistant liners. Expansion joints, slide plates, and anchor points will be provided where required to ensure gastight operation under all operating temperatures without inducing unacceptable stresses into the interfacing equipment.

4.0 Terminal Point List

The Unit 3 Ductwork terminal points list is summarized as follows, pending final confirmation at time of detailed design:

- Existing ductwork interface upstream of the ID fan inlet (two required)
- PJFF inlet (two required), interface with PAC injection systems occurs upstream of this terminal point
- PJFF outlet (two required)
- New ID fan inlet (four required)
- New ID fan outlet (four required, combine into one common duct)
- Existing duct interface downstream of the ID fan outlet (one required).

Modifications, Interfaces, and Tie-Ins Description
Unit 3
Fly Ash

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Ash Systems and the new Air Quality Control System (AQCS) Fly Ash System. Actual interfaces will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

At time of this report, design of a new Common Fly Ash Handling Facility serving both Units 3 and 4 is underway. It is assumed for purposes of this report that the new ash facility will be completed and in operation at the time Unit 3 AQCS modifications are made.

The "existing" Fly Ash System consists of pneumatic conveyed lines that draw ash from the economizer hoppers, air heaters, and precipitator hoppers. A vacuum conveying system sequentially removes ash from these collection points and transfers it to a filter/separator located west of Unit 4. The ash is subsequently transported by a pressurized pneumatic blower system to the ash storage and loadout silos at the coal combustion residue (CCR) facility south of Highway 42. At the CCR facility ash would be either unloaded from the silos to trucks for transfer to beneficial reuse or deposited on conveyors for landfilling operations.

2.2 Description of New Infrastructure

A new PJFF system, including PAC injection, will be installed at Unit 3 as part of the Phase II construction. This will result in additional fly ash pickup points at the PJFF hoppers. The new Unit 3 PJFF is located a substantial distance from the "existing" dry ash conversion system design. It is unlikely that the vacuum system installed for the Units 3 and 4 Common Fly Ash Handling Facility could be extended sufficiently to reach these new pickup points and operate reliably. Thus, a new separate fly ash system will be designed to take the ash collected in the Unit 3 PJFF and transport it via a pressurized system directly to the CCR Facility. The existing vacuum piping system would not be impacted and would continue to collect and transport fly ash from the Unit 3 ESP and upstream pickup points.

3.0 Interface

There is no interface anticipated between the new and "existing" fly ash handling systems at Unit 3. The two systems would remain separate and operate independently.

4.0 Terminal Points List

The Unit 3 Fly Ash System will have the following terminal points:

- Ash transport lines running from the PJFF will run to the loadout silos at the common CCR.

Modifications, Interfaces, and Tie-Ins Description
Unit 3
Induced Draft

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Induced Draft System and the new Induced Draft System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Induced Draft System consists of two axial induced draft (ID) fans to maintain furnace draft pressure and to overcome the draft system resistance. The axial ID fans are driven by 13,600 hp, 900 rpm single-speed motors. Flow control is accomplished through the use of the variable pitch axial fan blades. The existing draft system consists of the boiler, hot-side electrostatic precipitator (HS-ESP) system selective catalytic reduction (SCR) system, air heaters, axial ID fans, wet flue gas desulfurization (WFGD) system, and associated ductwork, dampers, and other supporting equipment.

2.2 Description of New Infrastructure

The new Induced Draft System shall consist of four new centrifugal ID fans designed to maintain furnace draft pressure and to overcome the resistance of the new draft system. The new ID fans would be driven by approximately 9,500 hp motors with a variable frequency drive (VFD) system for variable speed control. The new draft system would consist of the existing boiler, existing HS-ESP system, existing SCR system, existing air heaters, a new pulse jet fabric filter (PJFF) system, new centrifugal ID fans, the existing WFGD system, and associated new and existing ductwork, dampers, and other supporting equipment.

3.0 Interface

The new ID fans shall be connected to the new ductwork at the outlet of the new PJFF system and the new ductwork entering the existing WFGD system. The new VFD systems for the ID fans shall be supplied with new power feeds and connections to the existing DCS to allow control of furnace draft pressure. The ID fan dampers, lube oil skid, and other accessories will required low voltage power feeds and connection to the existing DCS as well. The new VFD system and new lube oil skids for the booster fans would be cooled by ambient air.

4.0 Terminal Point List

The Unit 3 Induced Draft System terminal points list is summarized as follows, pending final confirmation at time of detailed design:

- Ductwork outlet of the new PJFF system
- Ductwork inlet of the existing WFGD system
- New ID fan DCS controls to VFD system and inlet damper actuators
- New ID fan medium voltage power feeds to VFD system
- New ID fan low voltage power feeds to VFD system, lube oil skids, damper actuators, and other accessories

Modifications, Interfaces, and Tie-Ins Description
Unit 3
AQCS Compressed Air

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Air Systems and the new Air Quality Control System (AQCS) Compressed Air System. Actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing air systems provide station air and instrument air to the existing plant infrastructure.

2.2 Description of New Infrastructure

The AQCS Compressed Air Systems will provide the clean, dry, oil free compressed air at an adequate pressure and adequate capacity for the pulse jet fabric filter, actuators, controls, instrumentation, and other air users in the AQCS addition.

3.0 Interface

A cross tie will be provided between the existing air systems and the new AQCS Compressed Air Systems. A cross-tie with the existing Station Air System will be provided by tying in before the new air filter/dryer skid. In addition, a cross tie with the existing Control Air System will be provided by tying in after the AQCS compressed air receiver. Each cross-tie will be furnished with manual isolation valves.

4.0 Terminal Point List

The AQCS Compressed Air System will have the following terminal points:

- The AQCS Compressed Air System will tie in to the Station Air system near the existing emergency cross-tie with the Control Air System.
- The AQCS Compressed Air System will tie in to the Control Air system near the existing emergency cross-tie with Station Air System.

Modifications, Interfaces, and Tie-Ins Description
Unit 3
Service Water

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Service Water System and the new Air Quality Control System (AQCS) Service Water System. Actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Service Water System withdraws river water from the Ohio River through the screenhouse intake structure and provides cooling, wash, makeup, back-up fire protection, quench, seal, and sluicing water to all Ghent station users. The screenhouse intake structure includes low pressure and high pressure service water pumps and traveling water screens.

2.2 Description of New Infrastructure

The Service Water System will extend existing service water systems for hose stations, makeup, and seal water for equipment in the AQCS areas. Existing service water quality will be sufficient to protect the AQCS systems.

3.0 Interface

A service water connection shall be supplied between existing Service Water System and AQCS Service Water System.

4.0 Terminal Point List

The AQCS Service Water System will have the following terminal points:

- The AQCS Service Water for Unit 3 will tie in at an appropriate pipeline connection point on the existing low pressure service water header or main branch.

Modifications, Interfaces, and Tie-Ins Description
Unit 4
AQCS Power Supply System

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Power Supply System and the new Air Quality Control System (AQCS) Power Supply System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Medium Voltage System does not connect to the Unit 4 AQC Auxiliary Power. The Common AQC Reserve Auxiliary System does tie-in and is discussed in 41.0804.1.MC01.

There will be a 22kV feed to the primary of the Unit 4 AQC Main Auxiliary transformer. The existing Unit 4 Isolated Phase Bus Duct (IPB) will be tapped to provide the interface from the generator to the auxiliary transformer.

2.2 Description of New Infrastructure

The new AQCS AC power supply system shall consist of the following equipment:

- 13.8 kV Switchgear,
- Main Auxiliary Transformer.
- 13.8 kV ID Fan motor soft motor starters,
- 480 volt transformers, switchgear, and motor control centers
- DC and Uninterruptible Power Supply (UPS) systems to provide DC power to switchgear and UPS power to the Distributed Control System (DCS).

Cable bus will provide the connections from the main auxiliary transformer to the switchgear. Cable connections will connect all other electrical loads.

3.0 Interface

A new IPB tap will have to be installed. This IPB tap will terminate at the Main Auxiliary Transformer.

4.0 Terminal Point List

The AQCS Power Supply System will have the following terminal points:

- 22kV IPB tap at the existing IPB to furnish power to the primary side of the Main Auxiliary Transformer.

Modifications, Interfaces, and Tie-Ins Description
Unit 4
Communication

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Communication systems and the new Air Quality Control System (AQCS) Communication Systems; detailed interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing public address system is a multi-channel Gai-Tronics system.

2.2 Description of New Infrastructure

The Communication System shall include a page/party public address system compatible with Gai-Tronics equipment.

3.0 Interface

The AQCS page party system shall connect to the existing Gai-Tronics system equipment.

4.0 Terminal Point List

The Communication System will have the following terminal points:

- Interface of new system to existing.
- 120VAC power.

Modifications, Interfaces, and Tie-Ins Description
Unit 4
Control and Monitoring

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Control and Monitoring System and the new Air Quality Control System (AQCS) Control and Monitoring; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing DCS is an Emerson Ovation system.

2.2 Description of New Infrastructure

The AQCS DCS shall provide a means to manually and automatically control AQCS plant components individually and as a coordinated plant system. The system will be an extension of the existing system.

3.0 Interface

The new redundant processors and associated I/O modules will be connected to the existing redundant network primary and secondary switches.

4.0 Terminal Point List

The AQCS Control and Monitoring System will have the following terminal points:

- Existing Unit 4 Distributed Control System (DCS)
- Existing Unit 4 DCS Operating Work Stations
- AQCS Main 120 VAC UPS panel board
- AQCS General 208/120 VAC panel board
- AQCS Grounding System
- AQCS Equipment
- ID Fan and Variable Frequency Drives
- AQCS Auxiliary Electrical System

Modifications, Interfaces, and Tie-Ins Description
Unit 4
Buildings and Enclosures

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Plant Buildings and the new Air Quality Control System (AQCS) Buildings and Enclosures. Actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

Numerous buildings used for various purposes exist as part of the Unit 4 facility. The buildings, in general, are composed of both "stick-built" (individually-designed-and-constructed specialty structures) and pre-engineered metal buildings. The buildings consist of a metal panel exterior on a steel frame supported by a concrete foundation. Details, arrangement, and degree of finish depend on the building's intended function, but all structures protect and provide the necessary environmental control for the functions they enclose. The exterior of the buildings are to some extent coordinated for a pleasing aesthetic appearance throughout the site.

Based on the recommendations proposed by the Phase II Study, modifications to the existing Unit 4 facility will be concentrated between ductwork at the inlets and outlets of the existing Unit 4 ID fans, ultimately bypassing those fans. All Unit 4 AQC components upstream of the ID fans will remain unmodified and in service upon completion of the AQC modifications proposed in Phase II.

At time of this report, design of a new Common Fly Ash Handling Facility serving both Units 3 and 4 is underway under a separate task assignment. It is assumed for purposes of this report that the new ash facility will be completed and in operation at the time Unit 4 AQCS modifications are made.

2.2 Description of New Infrastructure

The new equipment proposed by Phase II is located west of the existing Unit 4 ESP and immediately south of the Common Fly Ash Facility. The miscellaneous buildings for Unit 4 will be designed similarly to those existing and will reflect the function and arrangement of the systems they enclose or support. Disregarding the "non-building" equipment which simply require foundations, the new buildings and structures proposed for Unit 4 are identified as follows:

- Unit 4 AQCS Electrical Building
- Unit 4 ID Fans Variable Frequency Drive (VFD) Enclosure.

Pre-engineered metal buildings, because of their lower capital cost and versatility, will be used where practical and are proposed for the Unit 4 AQCS Electrical Building. This building consists of a fabricated steel frame of a "standard" size and arrangement enclosed by metal panel wall and roof systems.

Where practical and cost effective, small buildings housing one or two related functions provided by a single equipment vendor will be prefabricated with the equipment already installed. This type of structure is proposed for the Unit 4 ID Fans Variable Frequency Drive Enclosure. This relatively small structure will be delivered complete for installation on a constructed foundation with any outside utilities or services required to be connected to a prefabricated terminal point on the structure. This enclosure is expected to consist of a steel frame with metal panel enclosure. Where prefabricated construction turns out to be impractical or not cost effective, the structures usually revert to pre-engineered buildings.

The Unit 4 pulse jet fabric filter need not be installed at an elevation higher than grade. Accordingly, no separate superstructure beyond that supplied as part of the PJFF itself is required. A concrete foundation supported on drilled piers will be provided for the PJFF similar to any other piece of furnished "equipment" such as the ID fans. The fabric filter is supported on its own steel framing, with the area below the fabric filter body housing the ash collection hoppers and collection equipment. This area above the foundation will be enclosed and provided with lighting and ventilation to protect the hopper area from the elements.

All new Unit 4 buildings, of whatever type, will be supported on cast-in-place concrete foundations. It is expected, due to the weight of most of the structures and the geotechnical conditions onsite, the majority of new foundations will be supported on drilled piers or potentially micropiles where congestions does not allow large piers to be drilled. However, in areas of little existing congestion and for smaller and lighter buildings, shallow foundations (footings and slabs-on-grade) will be used.

None of the new structures at Unit 4 are expected to be continuously manned and, with existing facilities nearby will require no plumbing or sanitary utilities. None of the buildings will require interior finishes. Space conditioning will be limited to heating and ventilation only, except where air conditioning is required for the equipment enclosed. All buildings will be provided with necessary personnel, vehicle, and equipment maintenance access, and a Life Safety review of egress will be completed for each structure. To the extent practical, the exteriors of the Unit 4 miscellaneous buildings will be coordinated to complement and match the appearances and colors of the existing site buildings.

3.0 Interface

All new structures will be physically and functionally separate from with little or no intended interface to existing structures. Methods of construction for these buildings, especially installation of the new foundations, will be evaluated to minimize any impact of the new structure on those existing. Depending on the service required, the new structures may receive drainage, power, or other services from existing site systems and will interface with those systems accordingly.

4.0 Terminal Point List

Specific terminal points for each of the new Unit 4 buildings and structures will be identified during detailed design once the appropriate arrangement is ultimately selected.

Modifications, Interfaces, and Tie-Ins Description
Unit 4
Ductwork

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Plant Flue Gas Exhaust System and the new Air Quality Control System (AQCS) Ductwork System. The actual interface will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing flue gas exhaust system downstream of the Unit 4 economizer outlet consists of two parallel electrostatic precipitators (ESP), selective catalytic reduction (SCR) system, air heaters, a sorbent injection system, and two parallel ID fans, with ductwork downstream of the ID fans combined upstream of the inlet to a single wet scrubber. Ductwork either side of the ID fans is elevated and supported by exposed above-grade steel framing and individual concrete foundations. Ductwork is provided with expansion joints to maintain gas tight structural support throughout the equipment operating system flow and temperature range.

2.2 Description of New Infrastructure

The major equipment proposed in the Phase II AQC modifications include the addition of powdered activated carbon (PAC) injection systems, addition of two 50% pulse jet fabric filters (PJFF), and the addition of four replacement parallel ID fans. The scope of Phase II work begins in the ductwork upstream of the existing ID fans and ends in the combined ductwork between the ID fan discharge and the inlet to the existing scrubber. New ductwork will be installed to interconnect all new components to the existing runs of ductwork, allowing complete bypass of the existing ID fans.

3.0 Interface

Two new interfaces will be established in the ductwork either side of the ID fans between existing and new equipment. The individual interfaces are described as follows.

- An interface flange and elbow will be installed in each of the parallel ductwork connecting to the inlet flange of each existing ID fan. Two new parallel runs of ductwork will be installed routed to the corresponding PJFF. PAC injection will occur in this length of ductwork, which will terminate at the inlet to the PJFF.
- The outlet from each PJFF will be bifurcated and ducted to the inlet of two new ID fans operating in parallel. The outlet of all four ID fans will be ducted together into a single combined duct. A new inlet flange will be installed in the

existing ductwork downstream of the existing ID fans to allow the new duct to interface with the existing. The new combined duct will be routed to this new interface point on the existing combined ductwork.

All new ductwork will be supported independently where existing ductwork supports cannot be incorporated. Ductwork will be of carbon steel construction and unlined, since temperatures and conditions upstream of the wet scrubber will not require corrosion-resistant liners. Expansion joints, slide plates, and anchor points will be provided where required to ensure gastight operation under all operating temperatures without inducing unacceptable stresses into the interfacing equipment.

4.0 Terminal Point List

The Unit 3 Ductwork terminal points list is summarized as follows, pending final confirmation at time of detailed design:

- Existing ductwork interface upstream of the ID fan inlet (two required)
- PJFF inlet (two required), interface with PAC injection systems occurs upstream of this terminal point
- PJFF outlet (two required)
- New ID fan inlet (four required)
- New ID fan outlet (four required, combine into one common duct)
- Existing duct interface downstream of the ID fan outlet (one required).

Modifications, Interfaces, and Tie-Ins Description
Unit 4
Fly Ash

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Ash Systems and the new Air Quality Control System (AQCS) Fly Ash System. Actual interfaces will be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

At time of this report, design of a new Common Fly Ash Handling Facility serving both Units 3 and 4 is underway. It is assumed for purposes of this report that the new ash facility will be completed and in operation at the time Unit 4 AQCS modifications are made.

The "existing" Fly Ash System consists of pneumatic conveyed lines that draw ash from the economizer hoppers, air heaters, and precipitator hoppers. A vacuum conveying system sequentially removes ash from these collection points and transfers it to a filter/separator located west of Unit 4. The ash is subsequently transported by a pressurized pneumatic blower system to the ash storage and loadout silos at the coal combustion residue (CCR) facility south of Highway 42. At the CCR facility ash would be either unloaded from the silos to trucks for transfer to beneficial reuse or deposited on conveyors for landfilling operations.

2.2 Description of New Infrastructure

A new PJFF system, including PAC injection, will be installed at Unit 4 as part of the Phase II construction. This will result in additional fly ash pickup points at the PJFF hoppers. Because the additional ash flow rate introduced by the Unit 4 PJFF represents a relatively small increase in design flow rates, the anticipated combined total flow rates have been used in the design of the "existing" dry ash conversion system design. Thus, the in-place systems will be capable of handling the expected additional loading if the system and piping is configured to include the new PJFF. The ash collected in the PJFF will be transported to the Unit 3 and 4 Common Fly Ash Handling Facility and from there to the CCR Facility. The Unit 4 vacuum piping system would simply be extended to the new pickup points at the bottom of new PJFF hoppers, using the existing mechanical exhausters to maintain the vacuum.

3.0 Interface

The system proposed as part of the Phase II modifications would interface with the "existing" system at appropriate locations in the piping to the ESP hoppers. The extended vacuum piping would be designed to allow collection of all fly ash to be collected by the PJFF should the ESP eventually be removed from service.

4.0 Terminal Points List

The Unit 4 Fly Ash System will have the following terminal points:

- Lines running from the PJFF will tie in at appropriate pipeline connection points in the ESP hopper headers.

Modifications, Interfaces, and Tie-Ins Description
Unit 4
Induced Draft

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Induced Draft System and the new Induced Draft System; actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Induced Draft System consists of two axial induced draft (ID) fans to maintain furnace draft pressure and to overcome the draft system resistance. The axial ID fans are driven by 13,600 hp, 900 rpm single-speed motors. Flow control is accomplished through the use of the variable pitch axial fan blades. The existing draft system consists of the boiler, hot-side electrostatic precipitator (HS-ESP) system selective catalytic reduction (SCR) system, air heaters, axial ID fans, wet flue gas desulfurization (WFGD) system, and associated ductwork, dampers, and other supporting equipment.

2.2 Description of New Infrastructure

The new Induced Draft System shall consist of four new centrifugal ID fans designed to maintain furnace draft pressure and to overcome the resistance of the new draft system. The new ID fans would be driven by approximately 9,500 hp motors with a variable frequency drive (VFD) system for variable speed control. The new draft system would consist of the existing boiler, existing HS-ESP system, existing SCR system, existing air heaters, a new pulse jet fabric filter (PJFF) system, new centrifugal ID fans, the existing WFGD system, and associated new and existing ductwork, dampers, and other supporting equipment.

3.0 Interface

The new ID fans shall be connected to the new ductwork at the outlet of the new PJFF system and the new ductwork entering the existing WFGD system. The new VFD systems for the ID fans shall be supplied with new power feeds and connections to the existing DCS to allow control of furnace draft pressure. The ID fan dampers, lube oil skid, and other accessories will required low voltage power feeds and connection to the existing DCS as well. The new VFD system and new lube oil skids for the booster fans would be cooled by ambient air.

4.0 Terminal Point List

The Unit 4 Induced Draft System terminal points list is summarized as follows, pending final confirmation at time of detailed design:

- Ductwork outlet of the new PJFF system
- Ductwork inlet of the existing WFGD system
- New ID fan DCS controls to VFD system and inlet damper actuators
- New ID fan medium voltage power feeds to VFD system
- New ID fan low voltage power feeds to VFD system, lube oil skids, damper actuators, and other accessories

Modifications, Interfaces, and Tie-Ins Description
Unit 4
AQCS Compressed Air

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the existing Ghent Air Systems and the new Air Quality Control System (AQCS) Compressed Air System. Actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing air systems provide station air and instrument air to the existing plant infrastructure.

2.2 Description of New Infrastructure

The AQCS Compressed Air Systems will provide the clean, dry, oil free compressed air at an adequate pressure and adequate capacity for the pulse jet fabric filter, actuators, controls, instrumentation, and other air users in the AQCS addition.

3.0 Interface

A cross tie will be provided between the existing air systems and the new AQCS Compressed Air Systems. A cross-tie with the existing Station Air System will be provided by tying in before the new air filter/dryer skid. In addition, a cross tie with the existing Service/Control Air System will be provided by tying in after the AQCS compressed air receiver. Each cross-tie will be furnished with manual isolation valves.

4.0 Terminal Point List

The AQCS Compressed Air System will have the following terminal points:

- The AQCS Compressed Air System will tie in to the Station Air system near the existing emergency cross-tie with the Control Air System.
- The AQCS Compressed Air System will tie in to the Instrument Air system near the existing emergency cross-tie with Control Air System.

Modifications, Interfaces, and Tie-Ins Description
Unit 4
Service Water

1.0 Introduction

The purpose of this description is to describe the conceptual interface between the Ghent Service Water System and the new Air Quality Control System (AQCS) Service Water System. Actual interface shall be determined during detailed design.

2.0 Description

2.1 Description of Existing Infrastructure

The existing Service Water System withdraws river water from the Ohio River through the screenhouse intake structure and provides cooling, wash, makeup, back-up fire protection, quench, seal, and sluicing water to all Ghent station users. The screenhouse intake structure includes low pressure and high pressure service water pumps and traveling water screens.

2.2 Description of New Infrastructure

The Service Water System will extend existing service water systems for hose stations, makeup, and seal water for equipment in the AQCS areas. Existing service water quality will be sufficient to protect the AQCS systems.

3.0 Interface

A service water connection shall be supplied between existing Service Water System and AQCS Service Water System.

4.0 Terminal Point List

The AQCS Service Water System will have the following terminal points:

- The AQCS Service Water for Unit 4 will tie in at an appropriate pipeline connection point on the existing low pressure service water header or main branch.