



BIG STONE PLANT

SO₂, NO_x, AND MERCURY REDUCTION STUDY
CONCEPTUAL ENGINEERING DESIGN REPORT

SL-010408

Draft Report

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[TRADE SECRET DATA BEGINS

- centrifugal fans with variable-frequency drive (VFD).
- centrifugal fans with VFDs or axial fans with variable-pitch blades.

Inlet dampers and variable inlet vane flow controls were not considered with the centrifugal fans due to their rapid fall-off in operating efficiency when volume flows are reduced below 85% of the normal full load flow. The results of the study concluded that OTP should install centrifugal fans with VFDs based on installation, operating and maintenance advantages. [TRADE SECRET DATA ENDS]

3.11.2 Design Summary

Table 3-9 identifies the major design parameters for the Big Stone ID fans.

Table 3-9. ID Fan Design Summary

| Parameter | Performance |
|-------------------------------|---|
| Percent of total flow per fan | [TRADE SECRET DATA BEGINS |
| Number of fans | TRADE SECRET DATA ENDS] |
| Fan type | Centrifugal with variable frequency drives |
| Test block condition: | |
| Flow | 2,052,000 acfm |
| Static pressure | 50" w.g. (static rise for test block flow plus 10%) |
| Motor size | 12,000 horsepower (hp) |

3.12 DUCTWORK

3.12.1 Description

The ductwork system is generally categorized in two ways – hot-side and cold-side, based on the location in the flue gas route and the operating temperature to which it is subjected. In addition to discussions of standard hot- and cold-side ductwork arrangements, the study also considered the use of SCR reactor boxes in relation to those arrangements, as discussed below.



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3.12.1.1 Hot-Side Ductwork [TRADE SECRET DATA BEGINS

The first part of ductwork in the flue gas route is from economizer outlet to SCR reactor inlet and from the SCR reactor outlet to air heater inlet. This section consists of isolated parallel routes from each economizer to the SCR reactor and back to air heater. It is subjected to high operating temperature of about 750°F. As a result, material, which has a better strength under the elevated temperature than standard carbon steel, is typically utilized for the plates, stiffeners, and other internal structural elements, such as internal trusses, in the hot-side ductwork.

It is desirable from performance and economical standpoints for this section of duct to be as short as possible. Locating the SCR immediately west of boiler building will offer the shortest distance. The duct starts from the economizer outlet and travels horizontally straight west out of boiler building. Because the coal tripper room is running north-south at the west end of boiler building, the ducts to and from SCR would have to straddle vertically above and below the tripper room. Several air heater support steels on column row J2 and boiler building steels on column row K may have to be reconfigured to provide the necessary clearance to the new duct route. After exiting the boiler building, the ducts turn vertically and rise to the top of the SCR reactors. The ammonia injection grid (AIG) typically is located in the lower portion of this vertical duct. Downstream of the AIG, or levels of static mixers will provide for even mix and distribution of flue gas and ammonia injection over the cross-section of ducts. This is important in maximizing SCR performance when the flue gas passes through the catalyst in the reactors. In SCR outlet ducts, hoppers maybe installed at the horizontal runs if the ash drop-out is determined to be excessive. This section of ductwork will end at the existing expansion joints, just above the air heaters.

TRADE SECRET DATA ENDS]

3.12.1.2 Cold-Side Ductwork

The second part of ductwork includes the flue gas route from the air heater outlet to SDA inlet, from the SDA outlet to the baghouse inlet, from the baghouse outlet to the ID fan inlet, and from the ID fan outlet to the chimney breechings. The 300°F operating temperature of this section is much lower than the hot-side, and could drop to about 160°F after the SDA. Special care must be taken in controlling the flue gas temperature and maintaining good insulation to safeguard the risk of duct corrosion due to below-dew-point condensation. Carbon steel material is typically used in the cold-side ductwork.



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[TRADE SECRET DATA BEGINS]

It is recommended to run the existing air heater outlet ducts inside the forced draft (FD) fan enclosure in order to avoid modifying the enclosure structure. The tie-in for bringing the flue gas to the new SDA will then be west of FD fan enclosure. Ducts from two air heaters will first be joined together as a combined header running to the south and then split just before each SDA. SDA inlets typically rise vertically, depending on the requirements of SDA supplier. Since the SDA and baghouse are supplied by the same manufacturer and are close-coupled together physically, the SDA outlet and baghouse inlet duct could be a short, straight piece, designed and supplied as part of SDA with baghouse scope of work to ensure a performance guarantee. Exiting the baghouse, the baghouse outlet will drop vertically directly into ID fan inlet pant-legs. ID fans are located such that the ID fan outlets are aligned with the chimney breechings to avoid ductwork kinks. of the ID fan outlets, however, does have to loop around the backside of chimney in order to enter from the north breeching. TRADE SECRET DATA ENDS]

3.12.1.3 SCR Reactor Boxes [TRADE SECRET DATA BEGINS]

reactor boxes are elevated to the west of existing boiler building. Similar to hot-side ductwork, the reactor boxes are subjected to high temperature and the same pressure conditions. Therefore, the same material and design allowable and overstress considerations will apply. The major differences between the reactor box design and the standard duct are the weight of the catalyst and its required support scheme. Typically, a box consists of external skin and internal catalyst support frames. The external skin has plate girders at the bent line to carry the entire reactor loads to the surrounding support steel structure. Large collector beams will be used above the plate girders for the upper levels. Together, the collector beams and plate girders provide the supports to the internal catalyst support frame. Plating and internal stiffeners will finish up the remaining of skin construction. The internal catalyst support frame at each level typically consists of a number of W24 to W30 parallel beams spanning from one side of box to the other for supporting the catalyst modules. The beam spacing will match approximately to the length of catalyst modules. Gratings thick will be used on top of the internal frame at each catalyst level. This grating floor will allow for pallet-truck traffic during the catalyst replacement, thus, eliminating the need for trolleys and hoists and associated headroom at each level. Baffle plates will be provided at the edge of boxes and between the modules to guide the flue gas through the catalyst and to prevent ash accumulation in the corners. Often, baffle plates are also used under the catalyst support beams to mitigate flow turbulence.

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A hopper will be attached to the bottom of reactor box and will guide the exiting flue gas to the air heater inlet ducts. The hopper design will follow standard ductwork construction with stiffeners being located outside of duct plates.

3.12.2 Design Summary

The function of ductwork is to form a flue gas path from the boiler to the chimney. Unlike regular structural elements, which are typically subjected to ambient temperature only, the ductwork design must address the thermal effect, which includes the reduced material strength under the elevated temperature, thermal expansion and contraction, thermal friction forces, and creep rupture for progressive long-term deformation. Two levels of design temperatures should be considered, i.e., operating and excursion cases. Under the operating case, the ductwork should not exceed code-allowed stresses from both short-term yielding and long-term creep rupture perspectives. Under the excursion case, since this typically occurs in a relatively short duration before the creep rupture can develop, the long-term creep rupture effect does not need to be considered. Associated with elevated temperatures, the ductwork will have to be designed for the accompanying pressures. Different allowable stresses and overstress factors should be used for operating and excursion cases.

[TRADE SECRET DATA BEGINS

The entire ductwork system includes structural and non-structural elements. Structural elements should form a determinate system to avoid arching effects and the uncertainty of load distribution, especially under elevated temperatures. The elements typically consist of plate work, stiffeners, internal trusses, balancing struts, stub columns, sliding-plate assemblies, hold-down details, and lateral restraints. Structural elements are designed for bending and squashing effects, and for unbalanced forces due to internal pressure, self weight of duct, ash accumulation, and wind or seismic lateral transient forces. Typically, a truss will develop from the plates and stiffeners to carry the self weight, ash loads and wind or seismic forces to the supports. Non-structural elements include flow devices, turning vanes, splitter plates, dampers, expansion joints, access doors, and external insulations and laggings. TRADE SECRET DATA ENDS]

The duct route typically divides into to many segments separated by expansion joints. The size of each segment should be carefully selected to minimize the unbalanced forces and to facilitate fabrication and installation. In general, a single duct segment should not exceed 60-80' in length due to transportation limitations and construction crane size consideration.

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3.13 CHIMNEY

Big Stone has a 498-foot-tall concrete chimney. The liner is made of carbon steel with the top 40 feet lined with stainless steel. With the addition of dry FGD, and operation of the flue at 30°F above saturation, the top one diameter of the inside of the liner needs to be coated to negate any potential impact of sulfurous acid condensation. Condensation can occur if cool ambient air is pulled down into the top of the liner under certain atmospheric conditions. However, because top one diameter of the Big Stone chimney is stainless steel, this coating will not be required and is not been included in the cost estimate.

3.14 WATER TREATMENT

3.14.1 Description [TRADE SECRET DATA BEGINS

Big Stone currently operates a brine concentrator (BC) to treat water from the cooling pond. The treated water is used in the Big Stone demineralizers and is sent to the ethanol facility. Due to high operating costs to run the BC, OTP requested S&L to review options for future operation of Big Stone without the BC. The installation of the dry FGD system could allow the BC to be taken out of service; however another treatment process would be needed to supply water to the demineralizers and ethanol facility. Appendix D (SL-010348) provides a summary report discussing all the options that were analyzed. The report identified that the most cost-effective solution for Big Stone is replacement of the BC with a new reverse osmosis (RO) system that would supply water to the Big Stone demineralizers only (Case 6). The ethanol facility would need to install additional RO system capacity and would have to obtain more water from the cooling pond and discharge more reject to the dry FGD system. A portion of the existing cold-lime softener (CLS) effluent will be the source of makeup for the new water treatment system. The treated water (permeate) will become the source of makeup to the existing Big Stone demineralizer and will also be used for lime slaking after blending with service water. The RO waste stream (reject) will be used as a source of makeup to the recycle solids dilution system. [TRADE SECRET DATA ENDS]

The water treatment building is located in the area of the existing baghouse. The existing baghouse will have to be demolished in order to make room for this building. However, note that the water treatment system does not necessarily have to be operational when the dry FGD and SCR come on line. OTP could still rely on the BC and install the new water treatment system later.



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3.14.2 Design Summary

Table 3-10 identifies the major design parameters for the Big Stone RO system.

Table 3-10. Reverse Osmosis Design Summary

| Parameter | Performance |
|--|---|
| Feed to RO system | Existing CLS plant effluent |
| Ultra filtration system | [TRADE SECRET DATA BEGINS] |
| Filtered water storage tank | |
| First-pass RO system, including booster pumps | |
| Second-pass RO system, including booster pumps | |
| Chemical dosing systems | |
| Control system | PLC |
| Water treatment building | TRADE SECRET DATA ENDS] |
| Treated water | 300 gpm used as makeup to Big Stone demineralizer and dry FGD lime slaker (after blending with service water) |
| RO reject water plus ultra filtration backwash | 50 gpm used as makeup to dry FGD recycle solids dilution system |
| Routing of treated water and waste streams | See interconnect diagram in Appendix Q |

3.15 MECHANICAL BOP

Conceptual locations for process piping and piping extensions for interconnection with existing plant services are based on the arrangement of equipment illustrated on the GA drawings in Appendix A. An interconnect diagram displaying all the various air, water, steam, slurry, ammonia, etc., is provided as Appendix Q.

3.15.1 Pipe Racks and Corridors

The active ash and service water lines routed to the exiting fly ash silo will be relocated to facilitate construction of the new FGD system. The new lines will be located along the planned north-south pipe corridor separating the SDA

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modules and baghouse casings. During construction of the FGD system, a pipe rack will be installed along this corridor. This pipe rack will support the SDA lime and recycle slurry piping, baghouse-collected solid waste piping, FGD area steam heating piping, SCR ammonia piping, and service and instrument air pipe headers. FGD area service water and sump discharge lines will be located either underground along this same corridor or above ground supported on the pipe rack.

The FGD area pipe rack will extend to the SCR structural support steel. Ammonia supply piping for the SCR, steam piping to the FGD area, and a small lime slurry line to the CLS will be routed on this section of the pipe rack.

3.15.2 Air Supply System [TRADE SECRET DATA BEGINS

Each baghouse will be furnished with _____-capacity air-cooled compressors to provide baghouse cleaning air and the balance of instrument and service air to the FGD system equipment. An air receiver will be provided along with _____-capacity air dryers at each baghouse. Service and instrument air for the water treatment building and SCR will be extended from the existing station air systems. Air receivers will be located in the water treatment building and at the SCR reactors to accommodate short-term, peak air demand.

[TRADE SECRET DATA ENDS]

The existing station compressed air system will be extended to provide service and instrument air to the SCR area and the new water treatment building. SCR sonic horns will require instrument air at about 70-80 psig.

3.15.3 Water Supply System

3.15.3.1 FGD Process Water

FGD system process water is required for lime slaking and lime slurry production, recycle solids slurry production, pump seals, and slurry line flushing. The source of process water for lime slaking, lime slurry production, and pump seals will be effluent from the BC or RO system permeate once the new water treatment system is operational.

[TRADE SECRET DATA BEGINS

There will be multiple sources for water for the production of recycle solids slurry. Initially, water from the blowdown holding pond and _____ facility RO reject line will be routed separately to the recycle process water storage tank. Blowdown holding pond water will be routed through a new pipe connected to _____ RW-9-APC

[TRADE SECRET DATA ENDS]



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located at the BC. It may be possible to use some or all of the existing, unused brine waste line routed between the sludge pond area and the fly ash silo.

Later, RO reject from the new Big Stone water treatment system will be routed to the recycle process water storage tank replacing the blowdown hold pond as the primary source of recycle process water. When the Big Stone unit is off line, RO reject will be routed to the BC sludge pond.

3.15.3.2 Service Water [TRADE SECRET DATA BEGINS

Service water to FGD area hose stations and pump seals will be provided through the relocated high-pressure service water line to the existing fly ash silo. This line, which originates in the vicinity of the north and south slag tanks, will be enlarged from to at the time of relocation to provide increased capacity for the new hose stations and new solid waste silo. TRADE SECRET DATA ENDS]

Service water to the water treatment building will be extended from an existing service water line in that area.

3.15.3.3 Domestic (Potable) Water

Domestic water for lavatory facilities and eyewash and safety shower stations located at the FGD system, ammonia storage area, and SCR ammonia vaporization skids will be extended from the existing station domestic water system.

3.15.4 Wastewater System

FGD area washdown and backflush wastewater, pump seal water, and miscellaneous drains will be collected in trenches and routed to sumps located at each SDA, in the lime slurry preparation building, and in the recycle ash preparation building. Sump pumps will transfer the wastewater to the slurry sump basin, where solids will settle out. Water in the slurry sump basin will be pumped back to the recycle process water storage tank. Periodically, solids will be removed from the slurry sump basin and hauled by truck to the dry waste disposal area.



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3.15.5 Steam System [TRADE SECRET DATA BEGINS

Steam service will be provided for anhydrous ammonia vaporization, slaker and recycle solids slurry water preheating, sootblowers on the first layer of catalyst, and space heating for the FGD area process buildings and water treatment building. The source of steam will be the auxiliary steam header located in the vicinity of the auxiliary boiler.

3.15.6 Fire Protection

The existing underground fire protection header system will be extended to provide fire protection service to the FGD system and ACI silo and to the suppression spray water system at the anhydrous ammonia storage tanks.

3.15.7 SCR Ash Hopper Sluice System

Flow modeling may demonstrate that an ash hopper is required in the horizontal length of each SCR reactor outlet duct. If these hoppers are required, ash would be removed by extending the economizer sluice water supply piping to each hopper and returning the SCR ash hopper discharge sluice lines to the existing economizer ash discharge sluice lines. Isolation knife gate valves would be installed in each extended sluice water line and in each SCR ash hopper discharge sluice line. [TRADE SECRET DATA ENDS]

3.16 CIVIL BOP

3.16.1 Description

Throughout the project construction, several civil features will be disturbed or will need to be reconfigured. Areas affected are not limited to the locations of final AQCS equipment. Civil scope should also cover construction laydown areas, trailers, contractor parking, ground assembling, staging, crane setting, etc.

The civil work would include construction sedimentation and erosion control; topsoil striping and rough grading; excavation and gravel surfacing; surface storm water drainage, including adding slopes, ditches, and culverts, oily water waste sewer and sanitary sewer installation; fence and gates; road work reconfiguration and surface pavement; and final grading.



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3.16.2 Design Summary

3.16.2.1 Sedimentation and Erosion Control

A construction permit is typically required to outline the installation procedure and maintenance schedule for site protection. The program will span from the beginning of construction through completion.

3.16.2.2 Top-Soil Striping and Rough Grading [TRADE SECRET DATA BEGINS

Removal of to of top soil and vegetation and leveling of the areas to suitable elevation for the foundation installation and for construction activities such as trailers, contractor parking, laydown, ground assembling, staging and crane setting. This initial site work should also include laying down the gravel sub-base and base course of roadwork required to support the traffic and transportation of equipment during the construction.

TRADE SECRET DATA ENDS]

3.16.2.3 Surface Storm Water Drainage

The site is currently using a surface drainage system to dispose the storm water runoff. New storm water management should include proper surface slopes, ditches, and culverts across the roadwork for the construction and for the permanent operating.

3.16.2.4 Oily Water Waste Sewer and Sanitary Sewer Installation

Additional underground oily water waste sewers and man-holes must be installed to connect the new potential oil sources to the existing oil water separator. The potential oil sources include transformers, motors, and pumps where cooling oil or lube oil exists. A sanitary sewer should also be added to connect the new toilet facility to the existing sanitary discharge. Further study is required to identify the tie-in point of existing sanitary discharge, septic tank, or drain field.

3.16.2.5 Fence and Gates

Aside from final installation of permanent fence and gates, temporary fence and gates are required to define the construction zone, and isolate it from the plant operation area. Temporary fence and gates will also provide authorized access to the construction zone and safeguard the construction materials and equipment.



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3.16.2.6 Road Work Reconfiguration and Pavement Surfacing

Throughout the construction, gravel road sub-base and base courses will need to be maintained. In the final stage, permanent roadwork will receive the surface asphalt pavement based on the new design configuration.

3.16.2.7 Final Site Grading

Prior to the completion of construction, the site must be re-graded to repair any damage caused by the construction. Typically, gravel will be added adjacent to the equipment installation and sod is applied on the balance of disturbed area outside of the loop road.

3.17 STRUCTURAL

3.17.1 Foundation [TRADE SECRET DATA BEGINS

A soil investigation report was prepared for the original plant construction that concluded that either shallow mats or deep friction piles could be used for the main power block foundations, which have very substantial magnitude of load and are generally in the same area as the new AQCS equipment. The mat foundations have an ultimate bearing capacity of , while a group of forty-five -long piles could provide an ultimate bearing capacity of . Since the original plant design adopted the shallow foundation approach, a similar type of foundation will be suggested for the new AQCS equipment. Using shallow foundations also eliminates the risk of impacting the operating unit and the need of high head room typically associated with a pile installation. However, because the original soil investigation was focused on the different area, it is recommended that a new soil investigation program be developed specifically for the location and loads of the new AQCS equipment.

Preliminary assessment shows that using an ultimate bearing capacity of with a conservative factor of safety of , the shallow foundation approach is still a feasible scheme. This basic assumption is reflected in the budgetary cost estimate. The frost depth of about observed in the region must be reached for a shallow foundation construction to avoid frost heave. This thick concrete block will also provide large stiffness, thus reducing the differential settlement between the adjacent support points. [TRADE SECRET DATA ENDS]



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3.17.2 Support Steel

There are several support steel structures required for new AQCS project. Some of the steel structures will be under the equipment contractor scope of design and supply. This includes the SDA support steel and baghouse support steel. The balance of support steel and structures consists of a pipe rack connecting from the south of the existing baghouse to the existing ash silo; ductwork support steel from west of the boiler building to the SDA and from the baghouse to the ID fans and chimney breechings; SCR support steel; recycle ash and lime preparation building; and electrical cable rack connecting the main AQCS electrical building to various electrical buildings and AQCS equipment.

3.17.2.1 Pipe Rack and Electrical Cable Rack

The pipe rack will serve as the main artery for the routes of ash, slurry, water and air supply, lime slurry, electrical cable trays or conduits, and instrumentation and controls (I&C) interconnections between various AQCS equipment. It must be designed and installed to allow the existing ash pipe be rerouted on it, thus providing space for SDA construction. The pipe rack will have a minimum of 20' clear head room to allow ash, lime, and ammonia trucks to pass under. Multiple levels are expected to be needed to carry all the above piping and cables. Cable bus racks are required when there are no adjacent steel structures available. The width and size of cable racks are much smaller in comparison to the pipe rack.

3.17.2.2 Ductwork Support Steel

New support steel structures will be the concentrated, braced frame-type. Differential settlements at the duct support points must be minimized. Typically, tie beams are used to balance the thermal loads at the duct support level. Modification to the existing air heater and boiler building steels are required to provide the necessary clearance to ducts between the economizer and SCR system and between the SCR system and air heater. New vertical bracing members should also be added to span the tripper room over the removed columns. Because the existing structures will be significantly modified and altered, it is expected that the existing air heater and boiler building structures will need to be checked for current code compliance.



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3.17.2.3 SCR Support Steel [TRADE SECRET DATA BEGINS]

SCR support steel typically supports the reactors, inlet riser ducts, inlet horizontal ducts over the reactors, and the surrounding platforms for catalyst replacement. SCR support steel will also provide support for sonic horn, sootblower, and AIG access and O&M. Because the SCR reactors are situated high above the existing baghouse inlet ducts, a baseline approach is to erect two supporting tower outside of existing baghouse and allow the baghouse to continue to operate until the tie-in outage. A span space truss will be used to bridge over the supporting towers. A possible alternative would be to add columns in the middle of truss span. However, these internal columns will attract a significant amount of loads. The feasibility of constructing a suitably size foundation in the congested courtyard will have to be further studied in the detailed design stage. If adding internal columns is feasible, the truss span will be reduced by about half, thus decreasing the size of trusses and the tonnage of steel.

3.17.2.4 Recycle Ash Slurry and Lime Preparation Building

This building will support or house the recycle ash silo, premix tanks, slurry storage tanks, and associated pumps for processing the recycle ash, lime, and slurry.

Aside from several major steel structures mentioned above, cable bus supports from the unit auxiliary transformer (UAT) or reserve auxiliary transformer (RAT) to the main AQCS electrical building is assumed to be within the scope of work of cable bus supply contract.

3.17.3 Galleries

Several galleries are proposed for the AQCS project to provide access to areas for O&M. The galleries proposed are summarized below.

3.17.3.1 SCR Catalyst Platforms

The catalyst platforms are on the outboard side of SCR reactors. Hoist and trolleys are devices used to lift the new catalysts up to the change-out level and to lower the old catalysts down to trucks waiting on the ground. Once lifted to the change-out level, pallet trucks will move the catalyst to the reactor through the change-out doors located on the outboard face of reactors. To facilitate pallet-truck traffic, the entire platforms will be covered with gratings.

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3.17.3.2 SCR soot blower and sonic horn platforms [TRADE SECRET DATA BEGINS]

Soot blowers are installed on the west face of _____ level only. Sonic horns are installed on the north and south face of _____ levels of each reactor. This platform is an integral part of platform system surrounding the SCR.

3.17.3.3 AIG platform

AIG platform is located to the east of SCR inlet duct. It provides the access to AIG piping and valves.

3.17.3.4 Sky bridges

sky bridges connecting the boiler building and SCR platforms are provided. The existing boiler building elevator could then be used to gain access to the SCR through the sky bridges.

3.17.3.5 SCR Stair Towers and Elevators

stair tower is located at the north of platform near the hoist zone. Another stair tower is located at the south of platform adjacent to the elevator. This south stair tower could also be used to gain access to the SDA penthouse and to the baghouse penthouse. Similarly, the elevator could have multiple stops to serve the SDA, baghouse as well as three levels of SCR platforms.

3.17.3.6 ID Fan and Motor Galleries

Galleries are typically provided around the ID fan and motor.

3.17.3.7 Other Miscellaneous Galleries

Miscellaneous galleries will be provided at the valve station, AIG, top of tanks, silos, and along the pipe rack.

The SCR platforms should be within in a weather enclosure. This includes roof panels above the top level, side panels on all _____ sides of platforms, and checkered plates on grating on the _____ level floor.

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3.18 ELECTRICAL

3.18.1 Description

The new AQCS equipment will require additional auxiliary power. As the mechanical systems are in the conceptual design phase, the proposed electrical power system design will reflect a conservative approach for providing power to the new system loads based on estimated loads as well as proven design concepts that have been successfully implemented on similar AQCS installations. In order to optimize system design, refinements and options will be explored during detailed design as specific vendor design data are developed.

3.18.2 New ID Fans [TRADE SECRET DATA BEGINS

In order to support the new AQCS systems, the four existing 4,000-hp ID fans will be replaced with new larger fans. The fan study (Appendix G, SL-010396) recommends a minimum of approximately for the motors of each new fan. However, experience has been that as detailed design progresses, this preliminary horsepower requirement typically increases. Additional design margins for future ductwork leakage and air heater pluggage can also contribute to this increase.

At this stage of conceptual design, in order to ensure that the electrical system can accommodate worst-case loading conditions, a conservative rating of for each fan will be assumed. The added margin does not change the approach to providing power to the AQCS equipment and fans but includes some margin in the size of the transformers. [TRADE SECRET DATA ENDS]

3.18.3 Existing Plant Auxiliary Power System

If the new AQCS loads, including the new replacement ID fans, were added to the existing auxiliary power system, the net additional load would be approximately .

[TRADE SECRET DATA BEGINS

An examination of the capacity of the existing UAT (normal source) and the interchange transformer (startup and reserve source) was performed. The existing UAT top capacity rating is . Based on historical data and previous system study models, the current UAT maximum loading is . The remaining transformer capacity is . [TRADE SECRET DATA ENDS]



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[TRADE SECRET DATA BEGINS

The existing interchange transformer tertiary winding capacity rating is . Based on historical data and previous system study models, the current transformer maximum loading is . The remaining transformer tertiary winding capacity is .

Compared with the estimated additional loading of , the remaining capacities of the transformers are not adequate to support the new loads. [TRADE SECRET DATA ENDS]

3.18.4 AQCS Auxiliary Power System

As the existing power system is not adequate to provide power to all of the new loads, either replacement of the existing UAT and interchange transformers and their related power equipment or the addition of a new supplemental 13.8-kV system would be required.

Replacement of the existing main and startup/reserve systems would be extensive in that it would require replacement of upstream and downstream connections and equipment. The modifications would also have to be performed as part of an extended outage.

The installation of a separate AQCS system would be performed as a part of the pre-outage activities. The system would be installed, tested, and available for AQCS system pre-outage checkout and subsequent startup and commissioning. Based on the above, it is recommended that a separate new 13.8-kV system be used for this installation. Appendix J shows the new AQCS power system configuration.

The new system would include a new UAT connected to the existing isolated phase bus. A tap for this service near the existing UAT is already in place. For purposes of this conceptual design, a new startup/reserve source would be provided from a new 230-kV breaker in the switchyard connected to a new RAT located near the turbine building area via a 230-kV overhead line.

[TRADE SECRET DATA BEGINS

transformers would be connected to 13.8-kV switchgear main busses similar to the existing plant configuration. The transformers would be connected to the new switchgear via above grade cable bus. The 13.8-kV buses would provide power to double-ended 480-V substations, which would serve the loads for the SDA, SCR, lime preparation, and recycle systems. The new baghouse and associated fly ash loads would be fed from double-ended 480-V substations fed from the existing 13.8-kV baghouse feeds.

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The new ID fans would also be fed from the 13.8-kV buses. As described in the fan study, VFDs will be used for fan speed control. The drives have the added advantage of limiting motor starting current and short circuit contribution to the power system. The drives would be located in prefabricated buildings near the fans.

As confirmed with OTP, a new diesel generator will not be required.

3.18.5 Electrical Power Distribution [TRADE SECRET DATA BEGINS

The new electrical equipment would be housed in prefabricated electrical power distribution buildings strategically located near the new loads. They consist of a main electrical power distribution building, a lime preparation and recycle electrical building, and a baghouse electrical building. The locations are shown on the GA drawing in Appendix A. TRADE SECRET DATA ENDS]

The main AQCS electrical power distribution building would include a new 125-VDC control battery and uninterruptible power supply (UPS) and would house the new 13.8-kV switchgear lineups.

Cabling between the electrical buildings and the loads would be routed in above grade cable tray supported on new pipe racks or other structures as required. Once the cables were in the vicinity of buildings, the cables would enter the bottom of the building for ease of construction and maintenance.

3.19 CONTROLS

3.19.1 Description

The new AQCS systems will require additional controls for the new equipment and subsystems. The following describes the recommended conceptual design covering the control philosophy and strategy to incorporate the required controls.

3.19.2 DCS and Control Philosophy [TRADE SECRET DATA BEGINS

The new dry FGD, baghouse/SCR systems, and all BOP systems, including the electrical auxiliary power system, would be controlled and monitored in the DCS. The existing plant DCS would be extended with new controllers and inputs/outputs (I/O) to be provided for the dry FGD, baghouse, SCR, and other systems. They TRADE SECRET DATA ENDS]

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[TRADE SECRET DATA BEGINS

would be located remotely in the three new electrical equipment buildings. The exact number of new controllers will be determined after actual I/O count is finalized. The estimated I/O count for the project is approximately . It is recommended that a maximum of hardwired I/O be dedicated to each controller. The new DCS remote controllers and I/O would communicate with the plant main control room over redundant fiber optic data highways. TRADE SECRET DATA ENDS]

The new ID fans and associated equipment would be controlled from the existing unit furnace draft DCS controller with new remote I/O located near the fans in the baghouse area electrical building. The furnace draft controls logic will be upgraded to protect the gas path from implosion.

Human-machine interface (HMI) for the new dry FGD, baghouse, and all BOP systems would be from the existing operator consoles in the plant control room. New display/control screens and logic would be developed and installed in the DCS. New operator consoles would be added if needed dependent upon available space.

3.19.3 Instrumentation Philosophy

Wherever possible, transmitters would be used instead of switches. In general, transmitters would be the smart-type, two-wire design with National Electrical Manufacturers Association (NEMA) 4X enclosures.

Temperature instruments would be either thermocouples or resistance temperature detectors (RTDs) directly wired to the DCS without intermediate transducers. Thermocouples would be either Type E or Type K. RTDs would be 100 ohm.

Redundant instruments would be provided for critical services. As an example, triple-redundant transmitters for measuring ID fan outlet duct pressure for inlet vane control would be implemented.

[TRADE SECRET DATA BEGINS

Pneumatic modulating control valves would be provided with smart-type positioners, e.g., with outputs capable of directly communicating with the DCS. TRADE SECRET DATA ENDS]

3.20 DEMOLITION AND RELOCATION ACTIVITIES

The demolition and relocation activities anticipated to be performed throughout construction of the project are summarized below.

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3.20.1 Demolition of Existing Baghouse and ID Fans [TRADE SECRET DATA BEGINS

The existing baghouse is required to remain active until the tie-in outage in . After the new baghouse is successfully brought in service, the existing baghouse and ID fans should be demolished as a post-outage activity to provide space for installing water treatment facilities. The demolition of the baghouse should include all inlet and outlet ductwork, walkways, galleries, and platforms supported off the baghouse structure.

TRADE SECRET DATA ENDS]

3.20.2 Demolition of Transformers East of Baghouse and Jamestown Boiler

The mentioned transformers and boiler should be removed if internal SCR support columns are to be installed.

3.20.3 Rerouting of Ash Pipe from Existing Baghouse to Ash Silo

The relocation of ash pipe onto the new pipe rack should be completed as an early activity to provide space for installing SDA foundations.

3.20.4 Modification and Extension of Existing Auxiliary Boiler Stack

The exhaust stack of existing auxiliary boiler will have to be kinked north to clear the SCR and extended above the top SCR platform level for safety reasons.

3.20.5 Demolition of Existing Breeching Ducts

Breeching openings of existing chimney will continue to be used for the new flue gas route. As a result, the existing breeching piece will have to be reconfigured as part of new ductwork.

3.20.6 Modification of Air Heater and Boiler Building Steel

As mentioned above in subsection 3.17.2, the existing structure would have to be modified for stability and for space clearance requirement.



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3.21 CONSTRUCTIBILITY

3.21.1 Description

The constructibility review process should be continued through the detailed design process and through the bidding process to contract award. Any subsequent design changes should then be evaluated from a constructibility standpoint. Note that all directions noted below are grid (plant) directions.

Constructibility of a new SDA, SCR, and baghouse, along with demolition of the existing baghouse is enhanced by:

- Open areas where the new FGD, baghouse and support equipment are to be located.
- Open areas adjacent to each side of the boiler building to use as cranes operations and pick areas.

A challenging issue will be coordination of outage work in the area just north of boiler building column row K. A detailed plan will need to be developed for outage work, including equipment handling sequences for baghouse demolition, SCR ductwork connection, and boiler modifications. With boiler modification work and other outage work planned in parallel with SCR ductwork connection, it is advisable to establish a single point of contact as the person to ensure that as overhead loads are secured, others are notified that they can resume work. This will minimize the risk of outage delays due to inefficient communications.

3.21.2 Site Access

Due to the 48th Avenue railroad above the road, equipment delivery traffic will be from the east on 144th St. Route 109 bridge load capacity should be checked by the General Work Contractor when planning special permit heavy loads.

[TRADE SECRET DATA BEGINS]

Rail access is also available with a separate “spur siding” that can be dedicated for staging new plant equipment prior to off-loading. The off-loading flexibility due to this isolated spur siding should be of value for the installation contractors. The condition of the spur siding should be determined and a cost estimate made for any refurbishment required. During the bidding process for the installation work, the bidders should indicate the value of the spur siding in order to provide cost savings input into the decision to refurbish the track. The capital cost estimate assumes that equipment and material will be delivered to the site via truck. There could be cost savings between deliveries via truck versus rail (); however, this can be reviewed further in detail engineering.

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Onsite roadways are in good condition. Grades and turning radii are suitable for heavy hauling and large-piece transport.

3.21.3 Construction Facilities [TRADE SECRET DATA BEGINS

Construction facilities, including laydown and staging areas, are depicted on the mark-up of the aerial photograph provided as Appendix O. The basic intent is to keep construction work force, estimated to peak at _____, on the south side of the plant, with the only exception being the demolition scrap material salvage area at the northeast corner of the site. [TRADE SECRET DATA ENDS]

3.21.4 Crane Sizing and Selection

To increase efficiency and reduce cost, current AQCS demolition and installation trends involve the development of detailed, engineered lift plans for removal and installation of equipment and ductwork in large pieces. Each large piece lift would be approximately 15-20 tons at a boom radius in excess of 200 feet. The demolition and/or installation contractor will select its own equipment to perform the work and should be required by contract to identify and locate buried utilities and equipment to protect from crane ground bearing pressures. Appendix P shows crane operations and equipment staging areas from an equipment GA plan view.

3.21.4.1 West Side Crane [TRADE SECRET DATA BEGINS

The area due west of the boiler building is a key area for a crane operations and picking loads not only during the non-outage time period but also during the SDA and SCR tie-in outage. In support of large-piece non-outage and outage work plans, an 800-ton-class crane would be located in this area in order to build the SDA units and the SCR non-outage and would be critical for duct piece handling during the tie-in outage. A typical crane of this size used today is a _____ with a _____ counterweight attachment (illustrated in Figure 3-2). A crane operations area is depicted in the marked up GA drawing. [TRADE SECRET DATA ENDS]



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Figure 3-2. with Counterweight Attachment



3.21.4.2 East Side Crane

The aisle way due east of the boiler building is an area that can be used for non-outage SCR installation on the east side and would be essential to support tie-in outage activities by easing the burden of the west side crane. A 250-ton-class crane, such as a , would be used. The crane operations area will be limited by the narrow aisle way created by the existing makeup water tank and the new stairway gallery for the new SCR. If the duct tie-in work is critical path for the outage (not the boiler modification work), a larger crane would be required (such as a) to handle large duct segments on the east side and to reduce outage time. The installation of the SCR stairway gallery can be postponed and the makeup water tank could be temporarily (or permanently) relocated in order to increase the width of the aisle way for crane operations. The crane will impede maintenance shop access and FD fan room access at times but those impediments can be scheduled.

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3.21.4.3 SDA and SCR Support Process Areas

Smaller-size lattice boom cranes or hydraulic truck cranes would be used to erect the various SDA and SCR support equipment.

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3.21.5 Tie-In Outage

The final tie-in outage will involve four major activities:

- Existing baghouse ductwork, ID fan, and ID fan ductwork demolition and removal
- New SDA tie-in ductwork installation
- New SCR tie-in ductwork installation
- Boiler modifications

Cranes on each side of the boiler building would be shared for equipment handling for all of the outage activities. Openings in the boiler building north wall for SCR duct connections would be installed pre-outage. Any construction openings required in the north wall for boiler modification work would also be made pre-outage. The outage is discussed in more detail in Section 4 of this report.

Figure 3-3. Boiler Building Wall Openings



It is assumed at this time that the installing contractor would prefer north side boiler building access above the economizer discharge for movement and replacement of boiler modification equipment and components (boiler tubing panels). Due to the number and duration of outage activities required to install the SCR connecting ductwork



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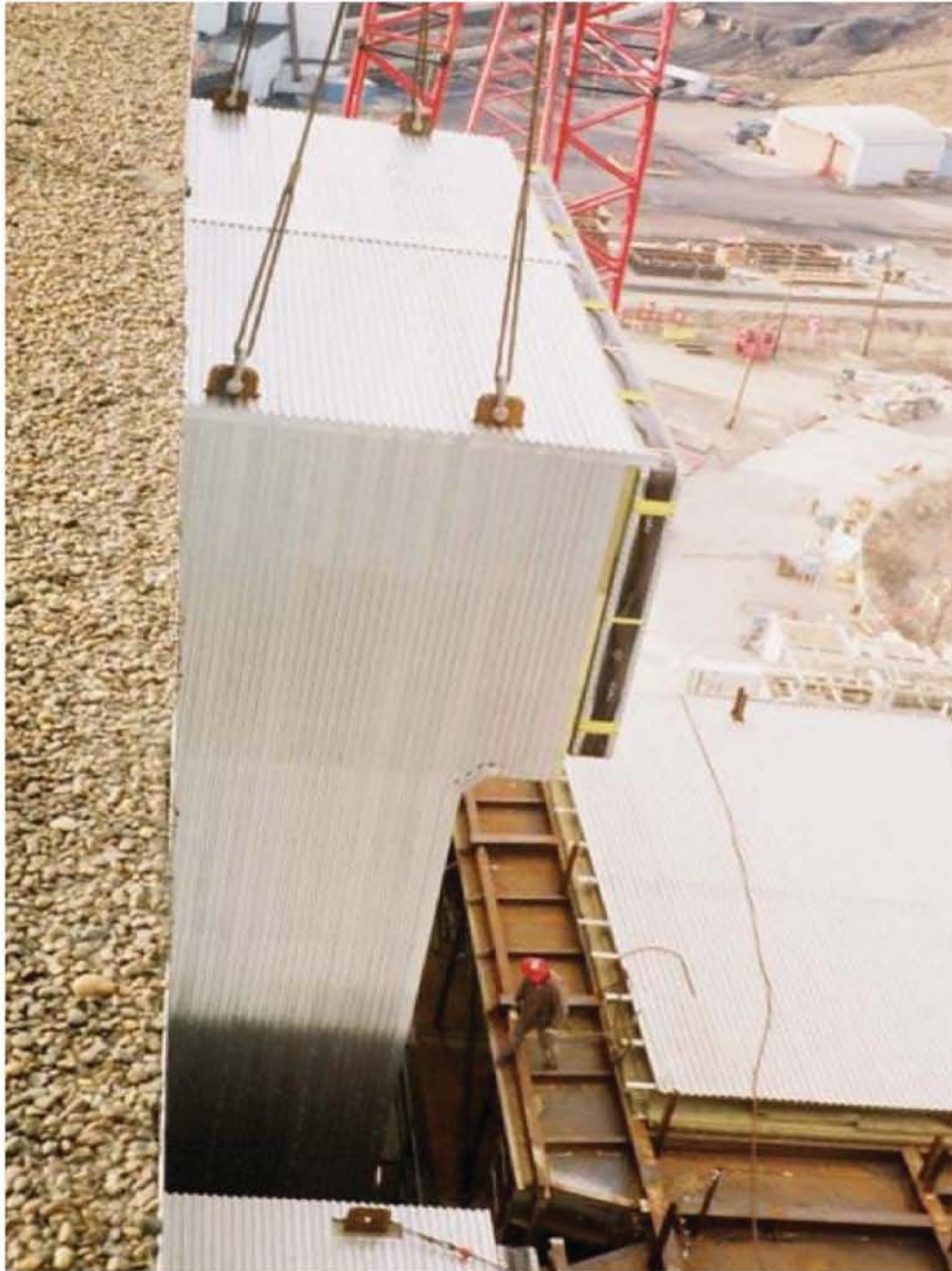
in this area, consideration should be given to loading and removing boiler modification equipment and components into the east and west sides of the boiler building. Weld-out time to secure SCR duct connection pieces in order to release the crane may cause delays in moving boiler modification equipment and components.

Figure 3-4. Example of SCR Inlet Duct Installation During Plant Outage





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CONCEPTUAL ENGINEERING DESIGN REPORT**Figure 3-5. Example of SCR Inlet Duct Lowering Into Position**

If boiler modification work has to be performed from the north side in parallel with existing baghouse duct demolition and SCR ductwork connection during the outage, it would be advisable to establish a single point of

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contact as the person to ensure that as overhead loads are secured, others are notified that they can resume work. This will increase efficiency in work suspension required when overhead loads are suspended on a crane hook.

The tie-in outage sequence for the AQCS equipment is basically to:

- Remove the existing baghouse ductwork and ID fan outlet ducts.
- Install the new SDA and new ID fans tie-in ductwork.
- Install the new SCR discharge (lower) tie-in ductwork.
- Install the new SCR inlet (upper) tie-in ductwork.

Duct weld-out activities will be performed in parallel to the extent possible during periods when live loads are not suspended overhead.

With detailed advance planning, proper coordination of all outage activities in the congested area north of column row K, along with inclement winter weather protection, the outage work scope should be completed within the currently proposed schedule.



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4. SCHEDULE

4.1 SCR AND FGD INSTALLED FOR SAME OUTAGE

The Level I implementation schedule shown in Appendix K is based on one major tie-in outage. This conceptual schedule was developed using the following input as a minimum: [TRADE SECRET DATA BEGINS

- Milestones provided by OTP during the June 8-9, 2010 kickoff meeting at the site.
- S&L in-house data and vendor input on current equipment procurement durations.
- The engineering study report provided in Appendix F.

The Level I implementation schedule (Appendix K) currently shows when engineering activities need to begin in order to support the award of the major equipment and installation procurements. These engineering activities will continue as necessary in order to complete the BOP engineering, procure remaining equipment, perform vendor drawing reviews, and support construction/startup and commissioning activities.

Only the major critical equipment and installation procurements were included in the schedule. For the AQCS project, a total of contracts will be developed. As shown in the Level I implementation schedule, procurement of the SCR catalyst and the dry FGD system, including baghouse equipment, need to start in . The SCR catalyst will be awarded with a limited notice to proceed to initiate the flow model scope of work and in order to hold all major expenditures of the project until after . Design input from these two contracts is required for the BOP engineering and to support the General Work Contract (GWC) specification bid issue in .

The schedule shows an award of one GWC Contract in early to allow the major underground and foundation work to be performed starting in through . The contracting strategy for the GWC Contract is currently planned to be a “ .” Based on a review of the Level I implementation schedule, the civil and structural scope of work required for the project will be well-defined and site-specific. The mechanical and electrical scope of work will be based on the best available information and estimated material quantities. As the project progresses into the design and a more detailed level 3 schedule is developed, splitting the installation

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into GWC Contracts (e.g., underground and above ground) may be economically justified along with the contracting strategy. Issuing an above ground GWC specification for bids to months later than the underground GWC specification would allow the mechanical and electrical scope of work to be more complete and better defined.

The critical path for the outage construction is the boiler and air heater modifications, which are expected to take from the Contractor's access to the work. The schedule currently shows the maximum duration of weeks for this work (line item in the schedule). As a result, the finish date of the outage needs to move out into . The plant is loaded in and and the earliest the plant outage can start is in

For startup and commissioning, approximately months is required after the unit goes back on line. Therefore, the earliest commercial operation date expected is in , which allows approximately months of float from the date mandated by law to have the AQCS in operation, . TRADE SECRET DATA ENDS]

4.2 FGD INSTALLATION FOLLOWED BY SCR INSTALLATION

[TRADE SECRET DATA BEGINS

During the screening study review, the feasibility of tie-in outages was discussed. Phasing the dry FGD system, including the baghouse system and ID fans with VFDs, into operation prior to the installation of the SCR system would be worth pursuing if capital costs could be reduced. At that time, the extent of the boiler modifications was unknown and more conceptual work needed to be performed. Based on further review of the Level I implementation schedule for one tie-in outage, a more detailed structural evaluation, and the length of the outage required for the boiler modifications, minimal capital cost savings, if any, are anticipated. Therefore, this option was not pursued further. TRADE SECRET DATA ENDS]

4.3 CASH FLOW

Appendix K to this report includes OTP's Level I implementation schedule for the project. The Big Stone Plant AQCS cash flow was developed based on the duration and sequence of the activities as dictated by the OTP schedule. In addition to the schedule, Appendix K also provides two plots that depict the cash flow and quarterly spending analyses. One scenario excludes allowance for funds used during construction (AFUDC) and the other excludes contingency, escalation, and AFUDC. The Direct and Construction Indirect Costs (Code of Account Line

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Item in the Cost Estimates, Appendix H) were distributed based on a percent per month payment release typical to the contract type. A percentage was allocated for the award through the vendor drawing review and approval process, mobilization, pre-outage construction, and outage construction. Other project costs were distributed based on similar historical project cost distribution and customized for the project based on the OTP-provided dates for critical milestones: first major expenditure, outage durations, and seasonal weather conditions as they affect construction. TRADE SECRET DATA ENDS]

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5. CAPITAL COST EVALUATION [TRADE SECRET DATA BEGINS

S&L estimated the capital cost for retrofitting dry FGD with new baghouse, dry FGD with reuse of the existing baghouse, wet FGD, and SCR. Estimated capital costs include the equipment, material, and labor based on . The underlying assumption is that the contracting arrangement for the project is on a multiple lump sum (not EPC) basis. The capital costs provided herein are based on burning 100% PRB coal and include the following:

- Equipment and material
- Installation labor
- Erection contractor profit
- General and administration
- Freight
- Sales tax
- Startup and commissioning
- Spare parts
- Indirect field costs and BOP engineering
- Contingency
- Owner's Engineer cost
- Escalation
- AFUDC

Costs for license fees and royalties are not included.

The installed capital costs are based on S&L in-house cost data from similar projects as well as vendor-supplied budgetary quotations. Based on the conceptual design that has been done, the costs have an accuracy of .

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Two estimates were prepared, one for the SCR and one for the dry FGD with baghouse. The costs are summarized in Table 5-1.



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Table 5-1. Capital Cost Summary

| Parameter | SCR | Dry FGD with New Baghouse |
|--|---------------------|---------------------------|
| Direct and construction indirect cost, | | |
| Indirect cost, | | |
| Contingency @ | | |
| Escalation, | | |
| Owner's cost, | Included in dry FGD | |
| Total project cost, | | |
| Total AQCS Cost, | | |

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Detailed capital cost estimates for installing dry FGD and SCR at Big Stone, including major equipment, site modifications, and material items, are presented in Appendix H.



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6. O&M COST EVALUATION

6.1 FIXED AND VARIABLE OPERATING COSTS [TRADE SECRET DATA BEGINS

The fixed O&M costs determined for this study consist of operating labor, maintenance labor, maintenance material, and administrative labor. The dry FGD will require an estimated additional full-time operators and maintenance personnel. Typical maintenance items for the dry FGD system would include the slakers, changing of atomizers, baghouse air compressors, booster fans, and recycle handling system. The SCR will require part-time operator to check the sonic horns, sootblowers, and ammonia system once per shift.

Annual maintenance material and labor costs shown herein are estimated based on technology operating experience in the U.S. The annual maintenance cost includes maintenance material for various subsystems and the labor required to perform the maintenance. The annual maintenance material and labor for the dry FGD technology is estimated to be of the direct and construction indirect cost. The annual maintenance material and labor for the SCR technology is estimated to be of the direct and construction indirect cost.

6.2 VARIABLE OPERATING COSTS

Variable O&M costs determined for each option include consumables, including reagent (lime and ammonia), byproduct management, bag replacement for the baghouse, catalyst, water, and power requirements. These costs were calculated at a unit capacity factor of . [TRADE SECRET DATA ENDS]

Table 6-1 lists the major economic parameters that were used in the variable O&M costs as well as the economic evaluation. These values were developed both by OTP and S&L.



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Table 6-1. Major Economic Parameters

| Parameter | Value |
|---|-------|
| Amortization life, | |
| Interest rate for discounting, | |
| Capital escalation rate, | |
| O&M escalation rate, | |
| Levelized fixed charge rate, | |
| Capacity factor, | |
| Auxiliary electric power energy charge, | |
| Ash disposal cost (placement only), | |
| Water, | |
| Lime (truck delivery), | |
| Activated carbon (truck delivery), | |
| Anhydrous ammonia (truck delivery), | |

The variable cost for the dry FGD assumes that all generated fly ash solid waste will be land-filled and the current revenue stream for selling fly ash will be lost.

The variable O&M costs, such as reagent consumption, are associated with reducing the inlet sulfur to SO₂/MBtu and reducing the inlet NO_x to _____.

Auxiliary power costs developed reflect the increase in power requirements associated with the new ID fans as well as the estimated power consumption for the SCR, absorber, reagent preparation, and byproduct handling areas.

The fixed and variable O&M costs are summarized in Table 6-2.

Table 6-2. Fixed and Variable O&M Costs

| Parameter | SCR | Dry FGD with New Baghouse |
|----------------------------|-----|---------------------------|
| Fixed O&M, | | |
| Variable O&M, | | |
| Subtotal O&M, | | |
| Total AQCS O&M, | | |

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Detailed fixed and variable O&M costs for installing dry FGD and SCR at Big Stone are presented in Appendix I.

6.3 LEVELIZED COSTS [TRADE SECRET DATA BEGINS]

Table 6-3 provides the annual, levelized cost for the dry FGD and SCR.

Table 6-3. Levelized Cost Summary

| Parameter | SCR | Dry FGD with New Baghouse |
|-----------------------------------|-----|---------------------------|
| Levelized investment, | | |
| Levelized fixed O&M, | | |
| Levelized variable O&M, | | |
| Levelized subtotal cost, | | |
| Levelized Total AQCS Cost, | | |

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7. PERMITTING CONSIDERATIONS

As described herein, OTP has initiated an AQCS retrofit program for Big Stone. The project includes the installation of advanced air pollution control systems, and is being initiated to ensure compliance with the anticipated South Dakota Regional Haze Rule. South Dakota published its Draft Regional Haze State Implementation Plan (SIP) in August 2010. The proposed regional haze regulations are included in the Administrative Rules of South Dakota (ARSD) Article 75:36. The proposed regulations require OTP to control NO_x, SO₂, and PM emissions from Big Stone using Best Available Retrofit Technology (BART).

Air pollution control systems proposed as part of the project include a selective catalytic reduction (SCR) system and separated overfire air (SOFA) for NO_x control, a dry flue gas desulfurization (FGD) system for SO₂ control, and a new fabric filter for PM control. While the existing fabric filter already meets the proposed BART requirements, replacing it as part of the overall AQCS project reduces the total project cost. The plans also incorporate activated carbon injection (ACI) for mercury control, although its installation is contingent upon EPA Maximum Available Control Technology (MACT) rulemaking.

Modifications to an existing stationary emissions source, including the installation of air pollution control systems, can trigger environmental permitting and approval requirements. Permitting requirements can include, but are not necessarily limited to, air, water, storm water, wastewater discharge, and solid waste handling and disposal permitting.

7.1 PERMITTING REQUIREMENTS

A report reviewing the environmental permits that may be required to implement the Big Stone AQCS project is provided in Appendix N to this report. Potential environmental permits include:

- South Dakota Air Construction Permit (ARSD Chapters 74:36:20 and 74:36:21)
- General Permit For Storm Water Discharges Associated With Construction Activities
- Revision to the facility's existing Solid Waste Permit



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7.1.1 Air Permitting Summary

The South Dakota Regional Haze Program (ARSD Chapter 74:36:21) requires submittal of an application for an air permit to construct in accordance with ARSD Chapter 74:36:20. The air permit application will include information describing the air pollution control systems as well as information describing any new emission sources associated with the project (i.e., material handling sources). New emission point sources associated with the proposed material handling system include the:

- Lime storage silo
- Activated carbon storage silo
- FGD recycle solids storage silo
- FGD waste storage silo

Additionally, there will be new fugitive dust emissions associated with truck delivery of lime, anhydrous ammonia, and activated carbon to the plant; as well as truck delivery of FGD solids and fly ash from the storage silo to the landfill. Information describing the new emission points and fugitive dust sources must be included in the air permit application and is included in Appendix N to this report.

7.1.2 Wastewater and Storm Water Permitting Summary

South Dakota administers the National Pollutant Discharge Elimination System (NPDES) permitting requirements. Surface water discharge (SWD) permitting regulations are included in ARSD Chapter 74:52. In South Dakota, no person may directly discharge pollutants from any point source into surface waters of the state without a valid SWD permit (ARSD Chapter 74:52:01:04).

Big Stone is designed and operated as a zero process wastewater discharge facility; thus, an NPDES permit is not required for plant operation. OTP is proposing to install a spray dry absorber (SDA) FGD as part of the AQCS project. There are no liquid wastes generated from an SDA control system, as all water used in the control system is evaporated. Because the AQCS project retains the zero-liquid discharge design and operating criteria, the NPDES permitting requirements in ARSD Chapter 74:52 are not applicable to the project.

However, the NPDES Program also includes provisions for control of storm water discharges from industrial sources and storm water discharges associated with construction activities. In South Dakota, any construction



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activity disturbing one or more acres must have coverage under a storm water permit. On December 31, 2009, the South Dakota DENR reissued a General Permit for Storm Water Discharges Associated with Construction Activity. The storm water general permit includes runoff control requirements and work practices (e.g., grading and drainage requirements, silt fences, and retention ponds) designed to minimize impacts on surface waters associated with storm water runoff during construction activities. OTP will need to file a Notification of Construction Activity and develop a Storm Water Pollution Prevention Plan as required by the General Permit. The facility must complete and submit a Notice of Intent (NOI) prior to commencing construction activities.

All storm water discharges associated with industrial activities, including power generating facilities and chemical processing facilities, that discharge through municipal storm sewer systems or that discharge directly into the waters of the U.S. are required to obtain a NPDES storm water permit. The storm water control and discharge requirements will be included in the facility's NPDES discharge permit, and may require storm water retention, sampling, and analysis prior to discharge. In South Dakota, South Dakota DENR has a General Permit for Storm Water Discharges Associated with Industrial Activity. The permit covers any party meeting the conditions of the general permit. Upon completion of the AQCS project, the facility will be required to submit a Notice of Intent to apply for coverage under the General Permit for Storm Water Discharges Associated with Industrial Activity.

7.1.3 Solid Waste Permitting Summary

South Dakota Codified Law 34A-6 requires that for the purposes of proper, effective, and safe disposal of solid waste, any person intending to dispose of solid waste within South Dakota must comply with the provisions of state law. These provisions require a solid waste permit and establish requirements and procedures for obtaining the permit. The regulations developed to implement the solid waste statutes are found in ARSD Article 73:27. A permit from the South Dakota DENR Solid Waste Management Program is required prior to the construction of a solid waste disposal facility (ARSD Chapter 74:27:08:01). Permits are required before construction of the facility begins. Applications must address requirements listed in Chapter 74:27:09.

Based on information provided by OTP, the facility has an existing solid waste disposal facility permitted to accept coal combustion residues, including gypsum/sludge solids generated as part of the now canceled Big Stone I/Big Stone II common wet FGD system project. A Solid Waste Permit revision will likely be necessary to include reference to semi-dry FGD residue in the plant landfill and to remove references to the Big Stone I/Big Stone II



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common wet FGD system from the permit. It is anticipated that the permit revisions will be made during the scheduled permit renewal process.

7.2 PERMITTING EFFICIENCY AND TIMELINE

The overall goal of the environmental permitting program is to secure all of the permits and approvals needed to commence construction and operation of a proposed new source or modification to an existing source. From a regulatory standpoint, authorities use the permitting process to define legally binding requirements for individual sources to ensure compliance with the applicable environmental rules and regulations. The environmental permitting program should be implemented to support the overall project objectives and implementation schedule. To the extent possible, environmental permitting should not become the critical path or delay construction. Emission limits, discharge limits, environmental controls, and monitoring requirements in the final permit should, to the extent possible, be achievable and support the overall goals of the project. It is important that permit provisions align with technical capabilities of the environmental control systems being proposed (i.e., the technology must be capable of meeting the proposed permit limits). Failure to align permit provisions with control technology capabilities increases the risk of potential future compliance issues.

To minimize permitting risks and potential project delays it is important, as an initial step, to identify all of the environmental permits and approvals required to construct and operate the proposed facility or modification. This step requires the scope of the project to be fully defined and consideration of potential air, water, and solid waste implications of a proposed project. Failure to completely define the scope of the project, including potential impacts to all environmental media, increases the risk of missing a required permit and could lead to significant delays in the permitting process, legal challenges, and jeopardize start of construction and/or operation of the project.

Communication between the project proponent, third-party engineering and environmental consultants, and the permitting agency is also a necessary element of a successful permitting program. It is important to develop a clear division of responsibility and identify the parties responsible for developing the technical and environmental information needed to support the permit application. Environmental permitting regulations are designed to require a transparent review and decision making process, and typically include provisions for review and comment from interested parties. The permitting agency is required to develop a complete administrative record of the permitting process, and to make an informed decision based on the technical/environmental information in the record.



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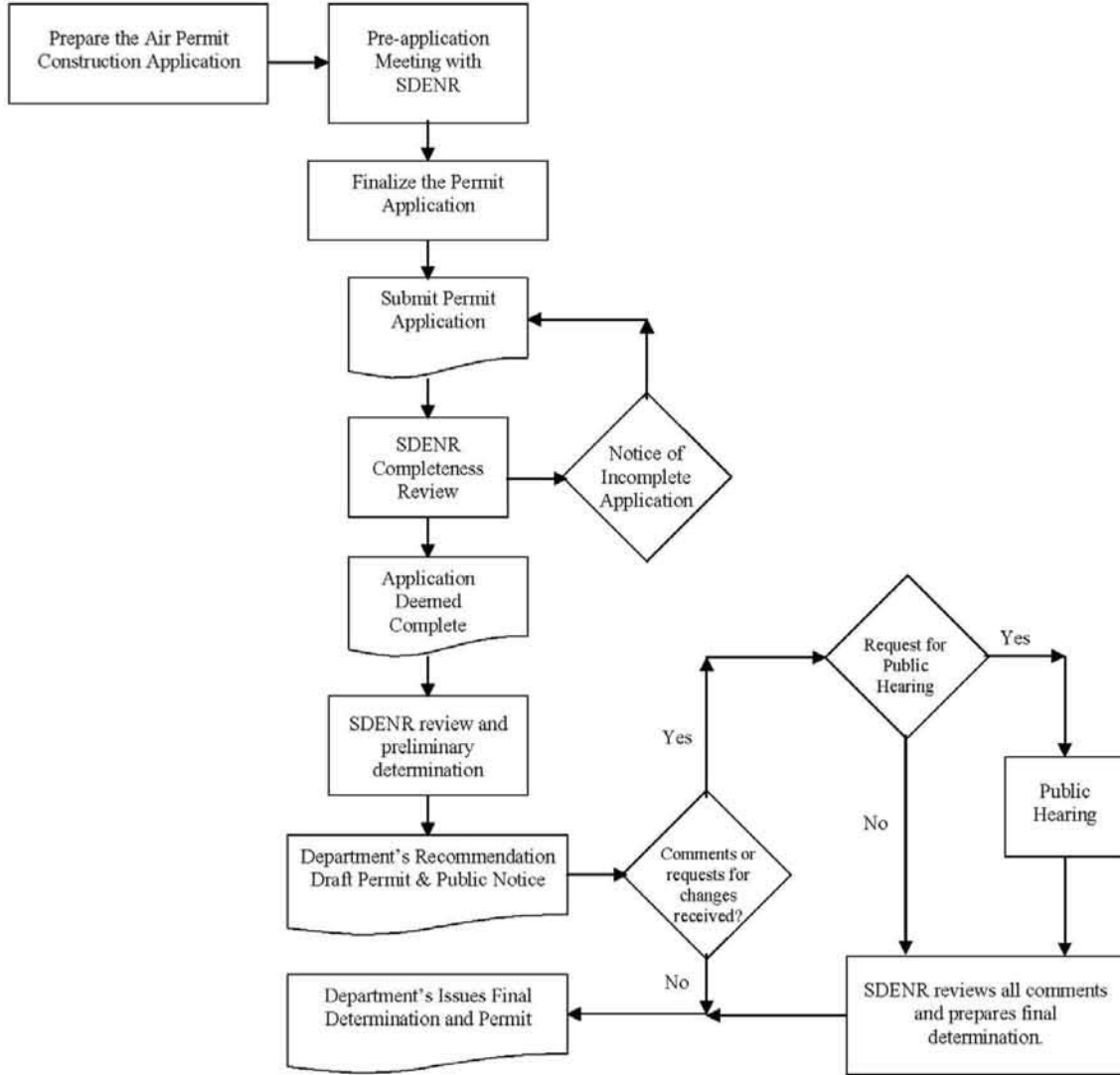
Therefore, it is important to establish clear lines of communications with the agency throughout the permitting process to ensure the agency receives the technical/environmental information needed to support its permit decisions.

Appendix N provides a report reviewing the environmental permits that may be required to implement the Big Stone AQCS retrofit project. Potential environmental permits include:

- South Dakota Air Construction Permit (ARSD Chapters 74:36:20 and 74:36:21)
- General Permit for Storm Water Discharges Associated with Construction Activities
- Revision to the facility's existing Solid Waste Permit

The most significant environmental permit needed for the proposed AQCS project is the Chapter 74:36:20 air construction permit for new sources or modifications; therefore, the remainder of this subsection focuses on preparation and submittal of the air construction permit application. The proposed South Dakota BART regulations require the Owner or operator of any BART-eligible source to submit an application to modify its operation in accordance with Chapter 74:36:20. OTP will be required to submit an application for a permit to construct that must describe the new air pollution control systems, emission limits, and monitoring requirements for Unit 1 and the new material handling emission sources. A construction permit may be issued by the South Dakota ENR only if it has been shown that the operation of the new source, or modification to an existing source, will not prevent or interfere with the attainment or maintenance of an applicable National Ambient Air Quality Standard (NAAQS), and that each new or modified source will comply with all applicable emission limits and other requirements. A simplified flow diagram showing the Chapter 74:36:20 permitting process is provided in Figure 7-1. Timeframes associated with the permit application review process are summarized in Table 7-1.

Figure 7-1. Chapter 74:36:20 Air Construction Permitting Process





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Table 7-1. Chapter 74:36:20 Air Construction Permitting Timeframes

| Process/Chapter | Regulatory Requirement |
|---|---|
| Completeness Review 74:36:20:09 | <p>Within 30 days after submission of an application the department shall notify the applicant in writing whether or not the application is complete or incomplete.</p> <p>If the application is incomplete, the department shall identify the items required to complete the application.</p> <p>The applicant has 20 working days to submit the information, unless an extension beyond the 20 days is approved by the department.</p> <p>The department shall determine the adequacy of the applicant's response to each incomplete item within 15 days after receipt of the response and shall notify the applicant in writing if the application is or is not complete.</p> |
| Department's Recommendation 74:36:20:10 | The department shall recommend issuance or denial of a construction permit within 180 days after the submission of a <u>complete application</u> . |
| Public Participation 74:36:20:11 and 12 | <p>The department shall publish a public notice of the draft permit in a legal newspaper in the county where the source is located, including a statement that a person may submit comments or contest the draft permit within 30 days after the publication of the notice.</p> <p>During the public comment period, any interested person may submit written comments on the draft permit or request a contested hearing case.</p> |
| Final Permit Decision 74:36:20:13 | <p>The department shall make its final permit decision within 30 days of the end of the public comment period on a draft permit. The department shall notify, in writing, the applicant and each person that submitted written comments.</p> <p>A final permit shall be issued within 30 days of the final decision, except under the following conditions:</p> <ol style="list-style-type: none"> (1) A later effective date is specified in the final permit decision; (2) A contested case hearing is requested; or (3) No comments or request for changes in the draft permit were received during the public comment period on the draft permit. In this case, the draft permit automatically becomes the final permit decision and the final permit is issued at the end of the public comment period. |
| Right to Petition for Contested Case Hearing 74:36:20:14 | <p>The applicant or interested person may petition the board and obtain a contested case hearing to dispute the department's draft permit. Such petitions must comply with provisions of Chapter 74:09 and must be received by the department within 30-days after publication of the notice required by Chapter 74:36:20:11.</p> <p>An applicant or an interested person that comments on the draft permit may petition the board for and obtain a contested case hearing to dispute the department's final permit decision. Such petitions must comply with the provisions of Chapter 74:09 and must be received by the department within 30 days after receiving the department's final permit decision.</p> |

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Chapter 74:36:20:06 requires any person who wishes to construct a new source or modify an existing source to submit a complete application to the South Dakota DENR at least 180 days before the estimated date of commencing construction of the new source or modification. Based on the review times summarized in Table 7-1, additional time should be added for the initial completeness review and the public participation process. A preliminary permitting timeline is summarized in Table 7-2.

Table 7-2. Preliminary Permitting Timeline

| Activity | Days | Early Date | Late Date |
|--|-----------|----------------|--------------|
| Start Date | -- | January 2011 | January 2011 |
| Prepare Permit Application | 60 – 90 | | |
| Submit Permit Application | -- | March 2011 | April 2011 |
| Initial Completeness Review | 60 – 90 | | |
| Application Deemed Complete | -- | May 2011 | July 2011 |
| Department Review | 120 – 180 | | |
| Preliminary Determination/Draft Permit | -- | September 2011 | January 2012 |
| Public Participation/Public Hearing | 30 – 60 | | |
| End of Public Review Period | -- | October 2011 | March 2012 |
| Department Review | 30 | | |
| Final Determination | -- | November 2011 | April 2012 |

Because the department is under a regulatory mandate to issue its draft recommendation within 180 days of submission of a complete application, reaching “completeness” is critical to minimizing the overall permitting timeframe. Although the department is required to conduct its initial completeness review within 30 days of receiving an application, the department can return the application to the proponent during this period for additional details and information. Thus, to the extent possible, the applicant should endeavor to submit a thorough and complete application, including all of the technical/environmental information required by the department, to minimize the initial review period and start the 180-day countdown.

To be deemed complete, an air construction permit application submitted pursuant to Chapter 74:36:20 must include the following information:

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- The following general company information:
 - The company name and address or the plant name and address if different from the company name.
 - The Owner's name and agent.
 - The plant site manager or contact.
- A description of the plant and its processes and products.
- The following information on emissions:
 - Identification and description of all emission units.
 - Fuels, fuel use, raw materials, and production rates.
 - Identification and description of air pollution control equipment.
 - Limitations on source operation affecting emissions or any work practice standards, if applicable, for all regulated air pollutants.
 - Other information required by any applicable requirements, including information related to stack height limits, such as the location of emission units, flow rates, building dimensions, and stack parameters, including height, diameter, and plume temperature for all pollutants regulated at the source.
- If available, a copy of any prepared plans and the specifications of any equipment or other facilities that may affect the source, including pollution control devices.
- A signed and notarized certification of applicant form.
- The results of any air dispersion modeling required by the department.
- The results of any stack performance testing required by the department.
- Any other information requested by the department that is relevant to determining compliance with the act or the Clean Air Act.

Finally, the potential for significant public interest in the permitting process must be taken into account when developing a permitting timeline. It is important to ensure that the department meets its public participation mandates, and to work with the department to address comments submitted during the public review process. Failure to assign an appropriate level of importance to public interest in a project can lead to permit application review delays, legal challenges, and jeopardize start of construction.

Chapter 74:36:20 provides two opportunities for interested parties to request a contested case hearing. First, the applicant or interested person may petition the Board of Minerals and Environment and obtain a contested case hearing to dispute the department's draft permit. Such petitions must be received by the department within 30 days

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after publication of the notice required by Chapter 74:36:20:11. Second, an applicant or interested person that comments on the draft permit may petition the Board and obtain a contested case hearing to dispute the department's final permit decision. Such petition must be received by the department within 30 days after receiving the department's final permit decision. Either petition must comply with the provisions of Chapter 74:09. Chapter 74:09 details the contested case hearing procedures, including timeframes for filing petitions, answers, pleading, motions, etc. Although the regulations provide specific timeframes, contested case hearings can add significantly to the overall permitting timeline, and should be considered a possibility in any permit application related to the construction or operation of a coal-fired electric generating unit (EGU).

7.3 FUTURE ENVIRONMENTAL REGULATIONS/LEGISLATION

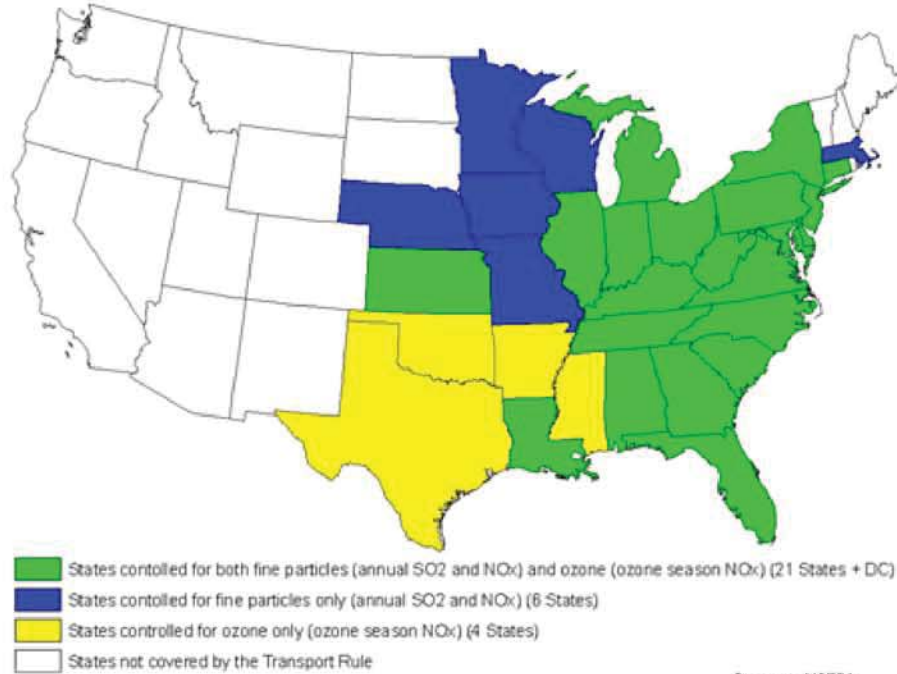
U.S.EPA is actively working on a number of environmental regulatory initiatives that may affect emissions from coal-fired electricity generating units such as Big Stone. This section of the report provides a summary of the future regulatory initiatives, and evaluates potential impacts to the AQCS project and operation of Big Stone.

7.3.1 Transport Rule

On July 6, 2010 EPA proposed the Transport Rule. The proposed rule would replace EPA's 2005 Clean Air Interstate Rule (CAIR). Both rules are intended to implement the Clean Air Act requirements concerning the transport of air pollutants across state boundaries, and assist downwind states to attain and maintain the NAAQS for ozone and fine particulate matter (PM_{2.5}). On July 11, 2008, the U.S. Court of Appeals for the D.C. Circuit vacated the 2005 CAIR in its entirety; however, after a rehearing of the case, the Court, on December 23, 2008, reinstated CAIR and directed the EPA to conduct further proceedings consistent with the Court's opinion in the case. As a result, CAIR went into effect in its entirety on January 1, 2009, and will remain in effect until the EPA re-writes the rule to address the flaws identified by the Court. The proposed Transport Rule responds to the court's concerns.

Specifically, the Transport Rule would require 31 states and the District of Columbia to reduce SO₂ and NO_x emissions from power plants that cross state lines and contribute to ozone and PM_{2.5} NAAQS non-attainment in downwind states. Figure 7-2 shows the 31 states affected by the Transport Rule. Power plants located in South Dakota are not covered by the Transport Rule; therefore, the Transport Rule should have no impact on Big Stone operations.

Figure 7-2. States Affected by Transport Rule



7.3.2 Utility MACT

On December 14, 2000, EPA published a finding that the regulation of hazardous air pollutant (HAP) emissions from coal- and oil-fired utility steam electric generating units (EGUs) was appropriate and necessary, effectively adding coal- and oil-fired EGUs to the list of source categories under §112(c)(5) of the Clean Air Act.¹ On January 30, 2004 EPA published two alternative rules regulating mercury emissions from coal-fired EGUs.² The first proposal set mercury emission standards based on the maximum achieve control technology (MACT) developed pursuant to §112 of the Act (the “Proposed MACT Rule”). The alternative rule proposed revising EPA’s December 20, 2000 regulatory finding, removing coal- and oil-fired EGUs from the list of source categories, and setting mercury emission standards for coal-fired EGUs pursuant to §111 of the Act. On March 29, 2005, EPA

¹ See, 65 FR 79825. Historically, electric utility steam generating units (EGUs) like Big Stone Unit have been excluded from the 40 CFR 63 Subpart B maximum achievable control technology (MACT) requirements. The regulations state that “[t]he requirements of [40 CFR Part 63 Subpart B] do not apply to electric utility steam generating units unless and until such time as these units are added to the source category list pursuant to section 112(c)(5) of the Act.” (40 CFR 63.40(a)). The December 2000 finding effectively added EGUs to the list of source categories.



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published a final rule revising its December 2000 finding, concluding that it was neither appropriate nor necessary to regulate coal- and oil-fired EGUs pursuant to §112 (the “Revision Rule”).³ Based on this revised finding, EPA removed coal-fired utility units from the §112(c) list of source categories.

A final rule regulating mercury emissions from coal-fired EGUs was published on May 18, 2005.⁴ The Clean Air Mercury Rule (CAMR) established standards of performance for mercury emissions from both new and existing coal-fired utility units. Rather than regulating mercury pursuant to §112, CAMR was based on §111 of the Act. CAMR included a New Source Performance Standard (NSPS) for mercury emissions from new coal-fired units, and established a nationwide mercury cap-and-trade program applicable to both new and existing coal-fire units.

However, on February 8, 2008, the U.S. Court of Appeals for the District of Columbia Circuit issued a decision vacating CAMR as well as EPA’s Revision Rule.⁵ The Court’s ruling effectively vacated the CAMR regulations for both new and existing EGUs, and restored EPA’s previous finding, published December 20, 2000, that the regulation of HAP emissions from coal- and oil-fired EGUs was appropriate and necessary. The Court’s vacatur effectively reestablished coal- and oil-fired EGUs as a §112(c) source category of HAP emissions.

EPA is currently working on rewriting the Utility MACT Rule to address the Court’s ruling. As part of this effort, EPA initiated an Information Collection Request (ICR), including a request that several existing coal fired EGUs conduct stack testing for a variety of HAP compounds. The ICR effort will provide EPA with the emissions data needed to establish the MACT emission limits, and will help EPA identify the MACT control technology requirements for new and existing coal-fired sources.⁶ A proposed Utility MACT Rule is expected to be published by March 16, 2011, and a final Utility MACT rule is expected by November 16, 2011. The rule will include HAP emission standards for new and existing coal-fired EGUs, such as Big Stone.

It is not known how EPA will propose to regulate HAP emissions from coal-fired EGUs. However, based a review of the February 2008 Court of Appeals decision, it appears unlikely that the new rule would include an emissions trading program. Based on a review of the 2004 proposed Utility MACT Rule (69 FR 4652, January 2004), judicial

² 60 FR 4652 (January 30, 2004)

³ 70 FR 15994, March 29, 2005),

⁴ 70 FR 28606 (May 18, 2005)

⁵ See, *State of New Jersey v. Environmental Protection Agency*, 517 F.3d 574 (D.C. Cir. 2008).

⁶ More information on the Utility MACT ICR can be found at: <http://utilitymacticr.rti.org/>



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decisions addressing MACT rules,⁷ and the recently published proposed Industrial Boiler MACT rule (57 FR 32006, June 2010), it is likely that the new Utility MACT rule would include the following provisions:

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Although it is anticipated that that the Utility MACT rule will regulate a number of HAPs and HAP categories, and that the rule will likely include stringent MACT emission limits, it does not appear that the rule will trigger additional air pollution controls for Big Stone (beyond those proposed for the AQCS project).

are captured in air pollution control systems designed to control SO₂ emissions. The proposed SDA with baghouse should provide the most effective , and should represent MACT for existing sources firing sub-bituminous coal. are effectively captured in particulate control systems, and the

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proposed fabric filter baghouse should represent MACT for . The SDA with baghouse coupled with the proposed ACI control system should represent MACT for mercury control. Finally, combustion controls should represent MACT for the . There is some concern that combustion systems designed for low-NO_x operation may not be able to simultaneously achieve . OTP should closely follow the Utility MACT rulemaking process to ascertain whether EPA will propose to limit emissions as a surrogate for , and determine whether any proposed limit is achievable with low-NO_x combustion.

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7.3.3 National Ambient Air Quality Standards

EPA has recently proposed and finalized several NAAQS revisions. The NAAQS revisions will likely increase the number of non-attainment areas in the U.S. The following subsections highlight NAAQS revisions that could impact OTP's pollution control strategy.

7.3.3.1 PM_{2.5} NAAQS

In 1997, EPA revised the NAAQS for PM to add new standards for fine particles, using PM_{2.5} as the indicator. EPA established primary annual and 24-hour standards for PM_{2.5} of 15 µg/m³ and 65 µg/m³, respectively. On October 17, 2006, EPA revised the primary and secondary NAAQS for PM_{2.5}. In that rulemaking, EPA reduced the 24-hour NAAQS for PM_{2.5} to 35 µg/m³, and retained the existing annual PM_{2.5} NAAQS of 15 µg/m³. On February 24, 2009, the U.S. Court of Appeals for the District of Columbia issued rulings on litigation involving the 2007 PM_{2.5} NAAQS.⁸ Among other things, the Court remanded the annual primary PM_{2.5} standard of 15 µg/m³ to EPA because the agency failed to explain adequately why this level is "requisite to protect the public health." In response to the Court's decision, EPA is considering lowering the annual PM_{2.5} NAAQS to 12 - 14 µg/m³. EPA is expected to issue a Notice of Proposed Rulemaking (NPRM) by the end of 2010.

Currently, all areas of South Dakota are in attainment with the 1997 and 2006 PM_{2.5} NAAQS. If EPA proposes an annual standard that changes the status of areas in South Dakota to non-attainment, the state of South Dakota would be required to modify its State Implementation Plan (SIP) and could require OTP to install control equipment to

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reduce emissions of primary and secondary PM_{2.5} (e.g., SO₂ and NO_x). However, even if EPA lowers the PM_{2.5} NAAQS, it appears unlikely that any counties in South Dakota would be designated non-attainment, or that compliance with the more stringent NAAQS would require emission reductions from Big Stone beyond those required by BART. Assuming EPA revises the PM_{2.5} NAAQS, a potential timeline could be as follows: (1) EPA issues the NPRM by the end of 2010; (2) EPA publishes a final rule by the end of 2011; (3) EPA issues final area designations by 2013; (4) EPA approves South Dakota's final SIP in 2016 (if any areas in South Dakota were designated non-attainment); and (5) emission controls on affected units would have to be installed in the 2019 timeframe.

7.3.3.2 Ozone NAAQS

In 2008, EPA reduced the 8-hour ozone NAAQS from 80-75 ppb. Final area designations are expected by March 2011. In a letter dated March 6, 2009, South Dakota's Secretary of DENR sent a letter to U.S. EPA with recommendations for designation of areas of the state for the 2008 revised 8-hour ozone NAAQS. In that letter, the Secretary proposed that all counties in South Dakota be designated in attainment with the 2008 8-hour ozone NAAQS.

On January 19, 2010, EPA proposed lowering the 8-hour ozone standard even further to 60-70 ppb. A lower 8-hour ozone standard would be expected to result in more non-attainment areas. A more stringent NAAQS would require the South Dakota to re-elevate the attainment status of areas within the state. However, based on the ambient ozone data included in South Dakota's March 6, 2009 letter to EPA, it appears that most of the state would be in attainment with the more stringent NAAQS. EPA intends to complete reconsideration of the 8-hour ozone NAAQS before the end of 2010. Even if EPA lowers the 8-hour ozone NAAQS, it appears unlikely that compliance with the more stringent NAAQS would require emission reductions from Big Stone beyond those required by BART.

7.3.3.3 Nitrogen Dioxide NAAQS

On February 9, 2010, EPA published its final nitrogen dioxide (NO₂) NAAQS rule, setting a new 1-hour NO₂ standard of 100 ppb, and retaining the current annual NO₂ standard of 53 ppb. The effective date of the new standard was April 12, 2010. All areas of South Dakota are currently in attainment with the annual NO₂ NAAQS; however, the State will be required to designate areas as attainment/non-attainment with the new 1-hour standard.



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EPA expects to designate areas as attainment or non-attainment by January 2012 based on the existing community-wide ambient air quality monitoring network. In the event areas within South Dakota are designated non-attainment, the State would be required to modify its SIP and could require OTP to install control equipment to reduce emissions of NO_x. However, it appears unlikely that compliance with the more stringent NAAQS would require emission reductions from Big Stone beyond those required by BART. If EPA designates areas of South Dakota as non-attainment, EPA would be expected to approve the final South Dakota SIP by 2015 to 2016, and could require control technologies to be installed in the 2018 timeframe.

7.3.3.4 SO₂ NAAQS

On June 2, 2010 EPA published a final revision to the NAAQS for SO₂. In the final rule EPA revised the primary SO₂ standard by establishing a new 1-hour standard at a level of 75 ppb. EPA also revoked the two existing primary standards of 140 ppb (24 hours) and 30 ppb (annual) because it was determined that they would not add additional public health protection beyond that provided by the new 1-hour standard.

All areas of South Dakota were in attainment with the 24-hour and annual SO₂ NAAQS. South Dakota will be required to re-visit its designations for compliance with the new 1-hour standard. Unlike other NAAQS implementation rules, EPA plans to use refined dispersion modeling to determine if areas with sources that have the potential to cause or contribute to a violation of the new standard can comply with the standard. EPA intends to complete designations by June 2012, and anticipates designating areas based on 2008-2010 ambient air quality monitoring data and/or refined dispersion modeling results.

In the event areas of South Dakota are designated as non-attainment, the state would need to submit its revised SIP in 2014. SIP revisions would describe the actions that South Dakota would take to come into compliance with the new standard, and could require OTP to install control equipment to reduce emissions of SO₂. However, it appears unlikely that compliance with the more stringent NAAQS would require emission reductions from Big Stone beyond those required by BART. EPA would be expected to approve the final South Dakota SIP by 2015 to 2017, and could require control technologies to be installed in the 2018–2019 timeframe.



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7.3.4 Status of Potential Future Greenhouse Gas Regulations

7.3.4.1 Greenhouse Gas Legislation

Over the past couple of years, several legislative initiatives have been introduced in Congress addressing greenhouse gas (GHG) emissions, clean energy technologies, climate change, and energy efficiency. To become law, any GHG legislation must be approved independently by both the House of Representatives and the Senate, coming together in conference committee to reconcile any differences. This process must be completed during the same two-year congressional session. The current congressional session ends December 2010.

In June 2009, the House of Representatives passed the American Clean Energy and Security Act of 2009 (H.R. 2454). The bill included a GHG cap-and-trade program that encompassed most large industrial sectors (including power plants), and included emission caps that would reduce aggregate GHG emissions to 3% below their 2005 levels in 2012; 17% below 2005 levels by 2020; 42% below 2005 levels by 2030, and 83% below 2005 levels by 2050. The bill also included provisions related to a federal renewable electricity and efficiency standard, carbon capture and storage technology development, performance standards for new coal-fired power plants, R&D support for electric vehicles, and support for deployment of smart grid advancement. The Senate has not, however, produced a companion bill. Several senate bills were considered in 2010, including the American Clean Energy Leadership Act (S.1462) and the American Power Act (S.1733). The American Clean Energy Leadership Act (sponsored by Senator Bingaman) sought to accelerate the introduction of new clean energy technologies and increase energy efficiency, but did not set a price on carbon and did not have quantifiable reductions in GHG emissions. The American Power Act (sponsored by Senators Kerry and Lieberman) sought to achieve aggregate GHG emission reductions of 20% below 2005 levels by 2020 and by 83% by 2050 through a nationwide cap-and-trade program. The bill also included provisions encouraging investments in clean energy technology and the creation of green jobs.

At present, it appears unlikely that Congress will pass GHG legislation during this congressional session. If the Senate does not act in the remaining months of 2010, both chambers must start the process from the beginning to pass new bills during the next session that begins January 2011.



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7.3.4.2 Greenhouse Gas Regulations

Unless legal challenges or opposition in Congress succeed in stripping EPA of its authority to regulate GHG emissions under the Clean Air Act, EPA is expected to require major stationary sources to account for GHG emissions by early 2011. On May 13, 2010, U.S.EPA released a final rule intended to clarify how CAA permitting requirements, including the PSD program, will be applied to GHG emissions from power plants and other stationary facilities. The rule is commonly known as the “Tailoring Rule” because it adjusts the PSD threshold requirements applicable to other NSR-regulated pollutants to make them appropriate for GHG emissions.

The Tailoring Rule applies to six GHGs: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Because some GHGs have greater potential to effect global warming than others, the rule expresses GHG emission thresholds in “carbon dioxide equivalents” or “CO₂e.” The CO₂e metric translates emissions of gases other than CO₂ into the CO₂ equivalent based on the climate change potential of each gas. Total GHG emissions are calculated by summing the CO₂e emissions of all six regulated GHGs.

The Tailoring Rule establishes two initial steps for phasing in regulation of GHGs:

- Step 1 (January 2, 2011, through June 30, 2011):
 - GHGs must be addressed in PSD preconstruction permits for new or modified facilities that require a PSD permit based on their emissions of other regulated pollutants (SO₂, PM, etc.) and that increase net GHG emissions by at least 75,000 tons per year CO₂e.
 - GHGs must be addressed in Title V operating permits for all facilities that require a Title V permit based on their emissions of other regulated pollutants.
- Step 2 (July 1, 2011, through June 30, 2013):
 - GHGs must be addressed in PSD preconstruction permits for new facilities that have the potential to emit at least 100,000 tons per year CO₂e, even if they would not require a PSD permit based on their emissions of other regulated pollutants.
 - GHGs must be addressed in PSD preconstruction permits for modifications of existing facilities that increase net GHG emissions by at least 75,000 tons per year CO₂e, even if they would not require a PSD permit based on their emissions of other regulated pollutants.
 - GHGs must be addressed in Title V operating permits for all facilities that have the potential to emit at least 100,000 tons per year CO₂e, even if they would not require a Title V permit based on their emissions of other regulated pollutants.



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Most power plants are already required to have a Title V Operating Permit based on emissions of other regulated pollutants, and have the potential to emit considerably more than 100,000 tons per year CO₂e. Therefore, the facility will need to modify its existing Title V Operating Permit to address GHG emissions; however, this regulatory requirement is not part of the AQCS project.

7.3.5 Coal Combustion Residue Regulations

On May 4, 2010, the U.S. EPA proposed alternative approaches to regulate the disposal of coal combustion residuals (CCRs), including both ash and flue gas desulfurization wastes, generated by electric utilities and independent power producers. Beneficial use of CCRs in products such as concrete or wallboard would be not regulated under the proposal. Placement of CCRs as fill in quarries or gravel pits would be considered disposal and would be regulated, but placement in coal mine voids would not.

The proposal requests comments on two primary alternatives: one would regulate CCRs as “special wastes” under the hazardous waste provisions of Subtitle C of the Resource Conservation and Recovery Act (RCRA); the other would regulate CCRs under the non-hazardous waste provisions of RCRA Subtitle D. An important difference between the two is that the Subtitle C approach would regulate CCRs from the point of generation through the point of final disposal. This would include stringent requirements for facilities that generate, transport, store, treat, and dispose of CCRs. The Subtitle D approach, in contrast, would regulate only the disposal of CCRs. However, the disposal requirements of the two approaches have many similarities, including standards for siting, liners, groundwater monitoring, corrective action for releases, closure of disposal units, and post-closure care.

Other significant differences and similarities are summarized below:

- **Effective Dates:** Under Subtitle C, the effective date of the requirements would be variable, because each state would have to develop and promulgate its own implementing regulations. According to EPA, this process could take two years or more. Under Subtitle D, the proposed federal standards would take effect within 180 days after promulgation of the final rule.
- **Enforcement:** Subtitle C would allow for enforcement by EPA and state agencies, while Subtitle D would not be enforced by EPA. States could enforce their Subtitle D regulations, and citizens could file lawsuits against offending facilities.
- **Permitting:** Under Subtitle C, regulated facilities would be required to obtain permits for the units in which CCRs are disposed, treated, and stored. Under Subtitle D, there would be no federal permitting requirements, but states would be free to require permits under their own regulations.



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- Existing Surface Impoundments: Under Subtitle C, surface impoundments constructed before the rule is finalized must either remove solids and retrofit the impoundment with a composite liner within five years of the effective date, or stop receiving CCRs within five years and then close the unit within two years thereafter. Under Subtitle D, existing surface impoundments must remove solids and retrofit with a composite liner, or stop receiving CCRs and close the unit within five years of the effective date.
- Existing Landfills: Under either Subtitle C or Subtitle D, landfills built before the rule is finalized are not required to retrofit with a new liner or leachate collection system. However, under either approach, an existing landfill must comply with groundwater monitoring requirements.
- New Surface Impoundments: Under either Subtitle C or Subtitle D, surface impoundments constructed after the rule is finalized are required to meet a new set of technological requirements specific to CCRs. These requirements include a composite liner and a leachate collection and removal system. Additionally, under Subtitle C, CCRs are subject to treatment requirements that EPA has stated are intended to phase out the use of new surface impoundments.
- New Landfills: Under either Subtitle C or Subtitle D, new landfills and lateral expansions of existing landfills must meet technological requirements that include composite liners, leachate collection and removal systems, and groundwater monitoring.

As stated above, the proposal does not intend to regulate the beneficial use of CCRs. However, industry representatives have raised concerns that the Subtitle C approach could have a detrimental effect on beneficial use, because of the permitting and technical requirements that might apply to the storage and transportation of CCRs before they are used. Additionally, the proposal requests comments on possible changes to the definition of beneficial use, intended to clarify when the use of CCRs constitutes an exempt beneficial use. Specifically, EPA has proposed to consider the following factors in deciding whether a use is beneficial: 1) the CCR used must provide a functional benefit; 2) the CCR used must substitute for the use of a natural material, thereby conserving a natural resource; and 3) CCRs would be expected to meet any applicable product specifications, regulatory standards, or relevant agricultural standards. EPA has not published an expected date for finalizing the rule after comments are considered.

As discussed above, the facility has an existing solid waste disposal system permitted to accept CCRs. Based on a review of the proposed CCR regulations, it does not appear that the proposed regulations would have a significant impact on the design or operation of the existing solid waste disposal facility if EPA chooses to regulate CCRs under the non-hazardous waste provisions of RCRA Subtitle D. However, regulating CCR as "special wastes" under the hazardous waste provisions of Subtitle C of RCRA could have a significant impact on the design and operation of the facility. OTP should continue to monitor the EPA's CCR rulemaking efforts.



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8. NEXT STEPS

Items recommended as the next steps prior to detailed design are summarized below.

Development of a detailed procurement plan is an important next step. This plan will identify the contracting approach, number of contracts, long lead time equipment, and the division of responsibility for each contract. Additionally, the schedule can be developed in more detail and the cash flow formalized.

Conceptual engineering on the AQCS retrofit project should be initiated to refine items from the study and reduce risk on the cost estimate. This conceptual engineering should be initiated in 2010 and 2011 and should include:

- Evaluate a more typical heat input for equipment sizing.
- Evaluate cost-adder to operate the SCR up to 830°F versus boiler retrofits. [TRADE SECRET DATA BEGINS
- Revisit SCR reagent study based on SCR inlet NO_x. TRADE SECRET DATA ENDS]
- Federal, state, and local permit evaluations.
- Construction tie-in plans with diagrams, crane positions, and detailed outage schedules.
- Conceptual engineering of the auxiliary power supply system, including refinement of the single line, detailed evaluation of the auxiliary power supply system, and others.
- Investigations of the underground utilities and subsurface investigation.
- Flow model using mathematical model for the air preheater outlet duct and other areas.
- Layout and utility relocations.
- Piping and instrumentation diagrams to be prepared to define interconnections with existing plant systems.