Big Sandy Plant Unit 2

# ORDER-OF-MAGNITUDE FGD COST ESTIMATE

Prepared for:
Kentucky Power Company (Owner)
and American Electric Power Service Corporation

Project No. 12721-000
September 29, 2010

Report for WFGD, DFGD, IAQCS
and NID Technologies

Volume 1 – Summary Report

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| Revision Number | Date | Purpose | Prepared By | Reviewed By | Approved By | Pages Affected |
|---|---|---|---|---|---|---|
| 0 | 9/29/10 | Use | D. Anderson<br>J. Hughes<br>K. Nomanbhoy<br>M. Ozan<br>C. Woods | D. F. Franczak<br>W. J. Staehlin<br>P. Fisher | S. R. Bertheau | All |

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## EXECUTIVE SUMMARY

The purpose of this study was to establish the Order-of-Magnitude FGD Cost Estimate to assist American Electric Power (AEP) with the selection of an FGD technology for Big Sandy Plant Unit 2.

Order-of-Magnitude FGD Cost Estimates were prepared for the following four FGD Technologies:

- **Wet (WFGD):** Wet FGD Spray Tower and Integrated Wet ESP
- **Dry (DFGD):** Dry FGD Spray Dryer Absorber (SDA) and Fabric Filter (FF)
- **IAQCS:** Integrated Air Quality Control System (IAQCS) Dry SDA/FF and Wet FGD Spray Tower
- **NID:** Dry FGD NID and Fabric Filter

For each technology, capital cost estimates were prepared for fuel specifications with sulfur content of 1.7, 3.0, 4.5 and 7.5 lb $SO_2$/MMbtu. A base fuel was selected for each technology and a capital cost estimate was prepared for each assuming an Engineer, Procure, Construct (EPC) contracting approach. Adjustments were then made to the base cost estimate to develop the remaining fuel estimates for that specific technology. The cost estimates also considered both the existing ESP in and removed from service for the Dry, IAQCS and NID technologies. The ESP is required to remain in service for the WFGD technology for protection from erosion and wear of the ID fans and FGD system components (pumps, piping, nozzles, etc.).

The estimates were based upon the AEP Order of Magnitude/Relative Capital Installed Cost Estimate Specification (BS2-FGDSCE-052010, Rev. 1) which provided design basis and performance requirements and conceptual design deliverables prepared by S&L for each technology. The conceptual deliverables, consisting of project general arrangements, process flow diagrams, mass balances, water balances and single lines, formed the basis for development of preliminary major equipment sizes and commodity estimates. Attention was focused on the significant elements that changed from one fuel to another, such as storage, handling and disposal of reagent and byproduct materials. The OEM equipment costs were taken from recent vendor quotes and adjusted for Big Sandy specifications, schedule and unit size.

The IAQCS system was evaluated assuming a phased implementation in order to make it more competitive at lower sulfur fuel cases. The DFGD portion would be installed initially and for estimate purposes the WFGD followed 5 years later for the 1.7 lb and 3.0 lb $SO_2$/MMbtu fuels. For the higher sulfur fuels both systems would be constructed to meet the earlier completion date.

The results of the capital cost estimates prepared for the WFGD, DFGD, IAQCS and NID technologies were tabulated in the following tables. Costs were tabulated without (Table ES-1) and with (Table ES-2) escalation and contingency. These total costs included costs provided by AEP for the wet and dry chimney installation and CEM equipment. The estimates exclude AEP costs for associated project work (new landfill, haul road, coal blending equipment etc.) which are typically not included in FGD cost estimates.

**Table ES-1**

**TECHNOLOGY CAPITAL COST ESTIMATE COMPARISON SUMMARY**
**(EXCLUDES ESCALATION AND CONTINGENCY)**

| Technology | Existing ESP Option | 1.7 lb $SO_2$/MMbtu | 3.0 lb $SO_2$/MMbtu | 4.5 lb $SO_2$/MMbtu | 7.5 lb $SO_2$/MMbtu |
|---|---|---|---|---|---|
| WFGD w/Wet ESP | ESP | $612,739,700 | $621,057,300 | $627,957,500 | $635,448,800 |
| DFGD | ESP | $436,769,600 | $447,850,900 | N/A | N/A |
| | N/ESP | $424,009,600 | $433,972,100 | N/A | N/A |
| IAQCS* | ESP | $841,518,600 | $861,236,900 | $827,065,000 | $836,203,800 |
| | N/ESP | $829,868,200 | $848,326,300 | $816,591,700 | $825,635,300 |
| NID | ESP | $387,275,700 | $395,733,500 | $410,431,400 | $451,965,500 |
| | N/ESP | $377,471,800 | $385,834,400 | $399,816,400 | $442,864,600 |

**ESP = ESP In-Service N/ESP = ESP Out-of-Service**
* - IAQCS 1.7 lb and 3.0 lb coals assumed Phased approach; 4.5 lb and 7.5 lb assumed Non-Phased approach.

**Table ES-2**

**TECHNOLOGY CAPITAL COST ESTIMATE COMPARISON SUMMARY**
**(INCLUDES ESCALATION AND CONTINGENCY)**

| Technology | Existing ESP Option | 1.7 lb $SO_2$/MMbtu | 3.0 lb $SO_2$/MMbtu | 4.5 lb $SO_2$/MMbtu | 7.5 lb $SO_2$/MMbtu |
|---|---|---|---|---|---|
| WFGD w/Wet ESP | ESP | $778,311,400 | $787,784,000 | $797,818,300 | $805,756,700 |
| DFGD | ESP | $557,236,000 | $570,556,459 | N/A | N/A |
| | N/ESP | $541,054,622 | $552,811,800 | N/A | N/A |
| IAQCS* | ESP | $1,131,613,500 | $1,203,904,400 | $1,045,532,000 | $1,056,431,500 |
| | N/ESP | $1,115,881,700 | $1,141,541,400 | $1,031,087,300 | $1,043,406,900 |
| NID | ESP | $490,743,400 | $501,447,900 | $520,125,700 | $573,065,000 |
| | N/ESP | $478,765,000 | $489,693,500 | $506,897,900 | $562,254,200 |

**ESP = ESP In-Service N/ESP = ESP Out-of-Service**
* - IAQCS 1.7 lb and 3.0 lb coals assumed Phased approach; 4.5 lb and 7.5 lb assumed Non-Phased approach.

Variable and fixed O&M costs were determined for each technology and fuel specification in accordance with the economic basis agreed to with AEP. These costs were tabulated in Table ES-3. See Exhibit 1-7 for a breakdown of these costs including auxiliary power values.

**Table ES-3**

**FIXED & VARIABLE O&M COST COMPARISON SUMMARY (2010 Dollars)**

| Technology | Fuel lb $SO_2$/MMbtu | Existing ESP Option | Total Cost Fixed O&M ($/year) | Total Cost Variable O&M ($/year) |
|---|---|---|---|---|
| WFGD | 1.7 | ESP | $5,268,000 | $4,808,000 |
| | 3.0 | ESP | $5,565,000 | $8,076,000 |
| | 4.5 | ESP | $5,853,000 | $10,871,000 |
| | 7.5 | ESP | $6,165,000 | $15,986,000 |
| DFGD | 1.7 | N/ESP | $4,292,000 | $16,253,000 |
| | 3.0 | N/ESP | $4,392,000 | $28,708,000 |
| | 1.7 | ESP | $4,292,000 | $15,099,000 |
| | 3.0 | ESP | $4,392,000 | $30,474,000 |
| IAQCS (Phase 1 - DFGD Only) | 1.7 | N/ESP | $4,292,000 | $16,253,000 |
| | 3.0 | N/ESP | $4,392,000 | $28,708,000 |
| | 4.5 | N/ESP | N/A | N/A |
| | 7.5 | N/ESP | N/A | N/A |
| | 1.7 | ESP | $4,292,000 | $15,099,000 |
| | 3.0 | ESP | $4,392,000 | $30,474,000 |
| | 4.5 | ESP | N/A | N/A |
| | 7.5 | ESP | N/A | N/A |

| Technology | Fuel lb $SO_2$/MMbtu | Existing ESP Option | Total Cost Fixed O&M ($/year) | Total Cost Variable O&M ($/year) |
|---|---|---|---|---|
| IAQCS (DFGD + WFGD and Non-Phased) | 1.7 | N/ESP | $8,916,000 | $8,381,000 |
| | 3.0 | N/ESP | $9,045,000 | $12,164,000 |
| | 4.5 | N/ESP | $9,170,000 | $15,467,000 |
| | 7.5 | N/ESP | $9,305,000 | $21,587,000 |
| | 1.7 | ESP | $8,916,000 | $5,787,000 |
| | 3.0 | ESP | $9,045,000 | $9,814,000 |
| | 4.5 | ESP | $9,170,000 | $13,299,000 |
| | 7.5 | ESP | $9,305,000 | $19,295,000 |
| NID | 1.7 | N/ESP | $4,846,000 | $18,139,000 |
| | 3.0 | N/ESP | $4,956,000 | $29,864,000 |
| | 4.5 | N/ESP | $5,066,000 | $40,961,000 |
| | 7.5 | N/ESP | $5,286,000 | $58,143,000 |
| | 1.7 | ESP | $4,846,000 | $15,565,000 |
| | 3.0 | ESP | $4,956,000 | $27,593,000 |
| | 4.5 | ESP | $5,066,000 | $38,926,000 |
| | 7.5 | ESP | $5,286,000 | $56,066,000 |

**ESP = ESP In-Service N/ESP = ESP Out-of-Service**

O&M costs were based upon defined inputs from AEP and results of mass balance calculations. O&M fixed costs include maintenance material costs and operating and maintenance labor costs. Labor staffing is an assumed minimum level for comparative purposes. Variable O&M costs were developed on a yearly basis in 2010 dollars and include costs for reagent, activated carbon, makeup water, byproduct disposal, wastewater treatment chemicals and fabric filter bag and cage replacement. For further details see Attachments 2-14, 3-14, 4-22 and 5-22 for WFGD, DFGD, IAQCS and NID technologies, respectively.

One EPC project schedule was developed for each technology, with exception of the IAQCS which has two due to both phased and non-phased options being considered. Level 2 project schedules are provided in the report. Using the results of the capital cost estimates and the EPC project schedules a preliminary project monthly cash flow was developed for each technology. The schedule and cost information is summarized

in Tables ES-4, ES-5, ES-6, ES-7 and ES-8, which provide key milestone dates and annual cash flow data. Two tables are provided for the IAQCS technology to clearly define the phased and non-phased approaches.

**Table ES-4**
**WFGD MILESTONE SCHEDULE AND CASH FLOW SUMMARY**

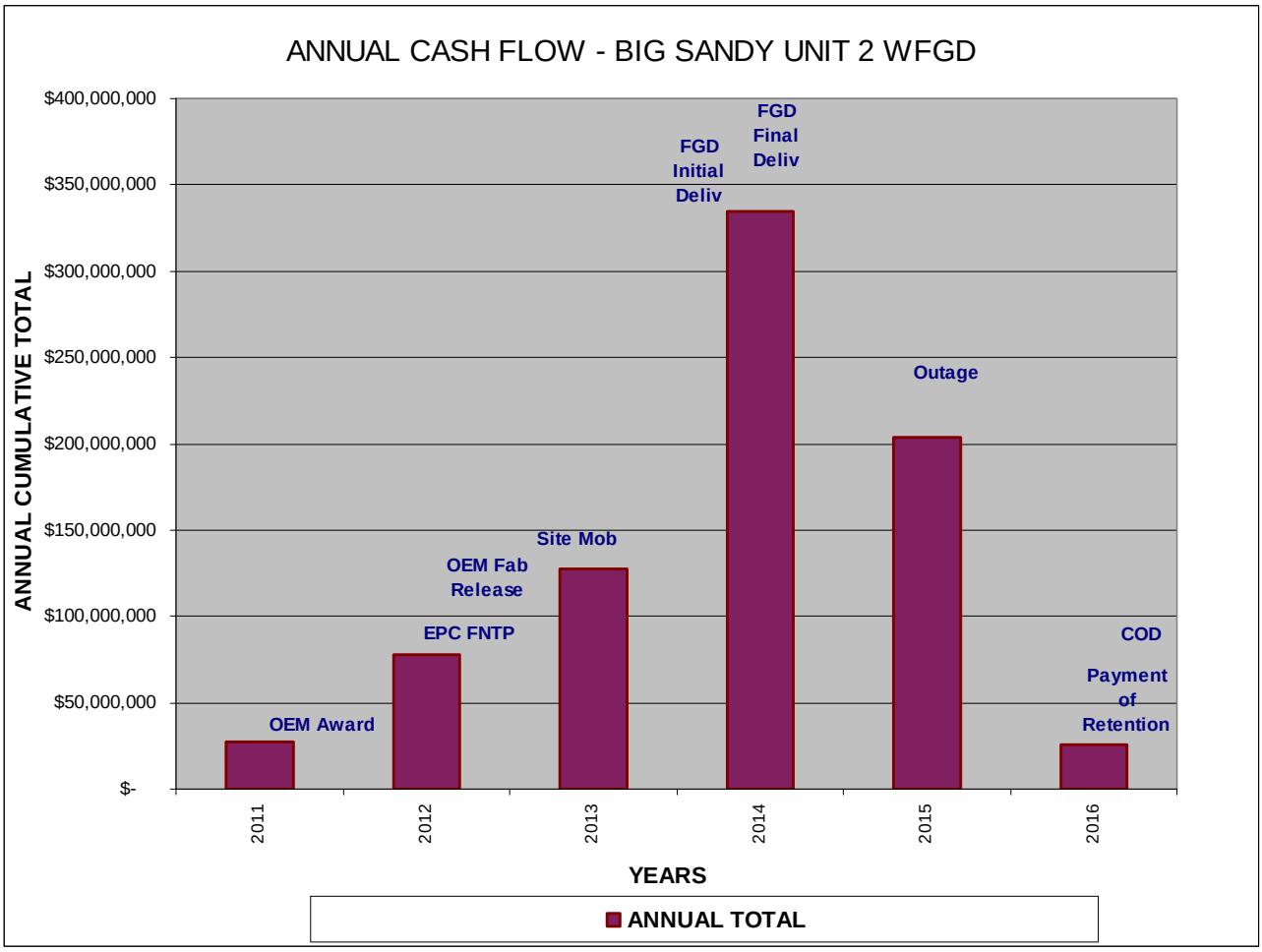


**Table ES-5**
**DFGD MILESTONE SCHEDULE AND CASH FLOW SUMMARY**

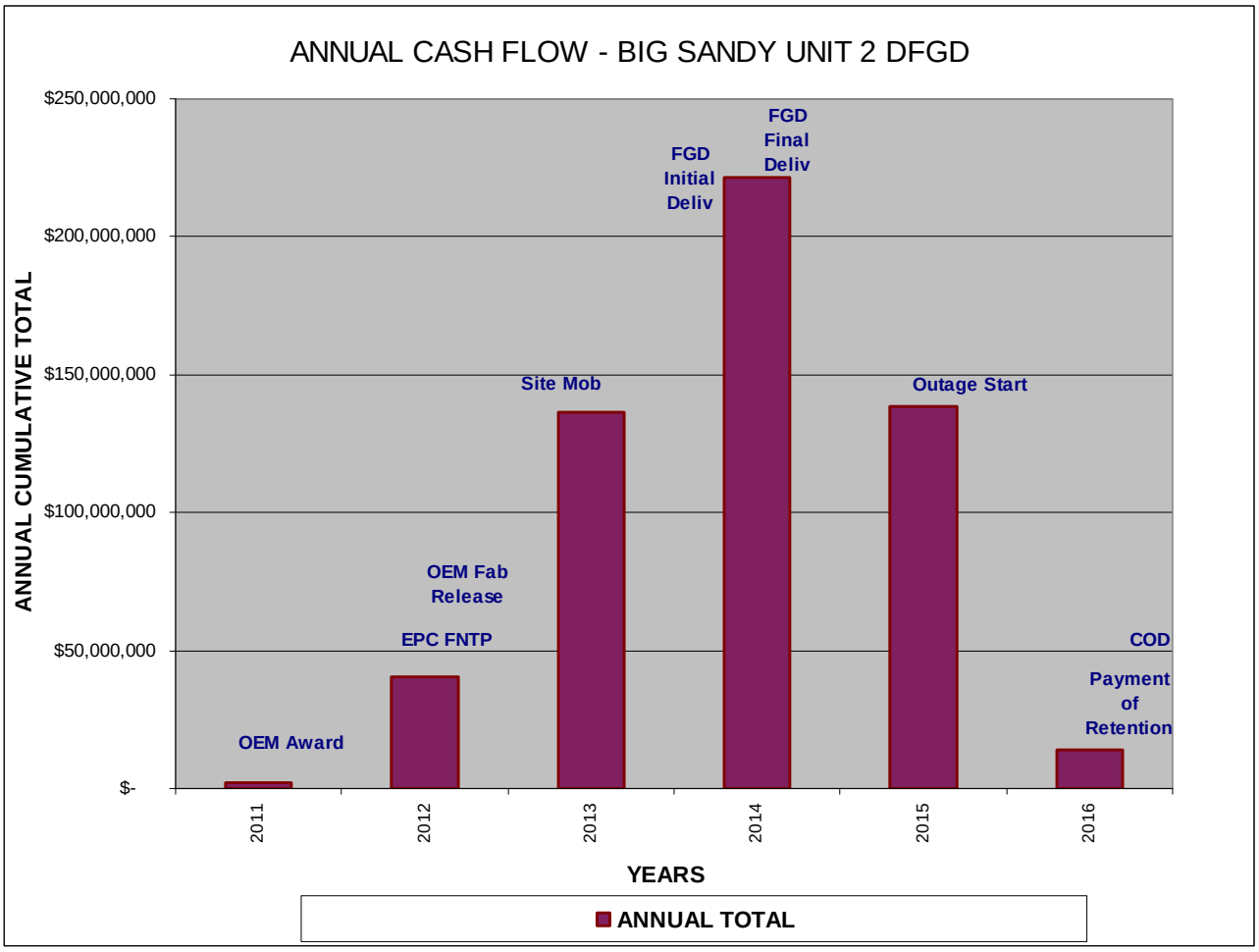


**Table ES-6**

**IAQCS (PHASED) MILESTONE SCHEDULE AND CASH FLOW SUMMARY**

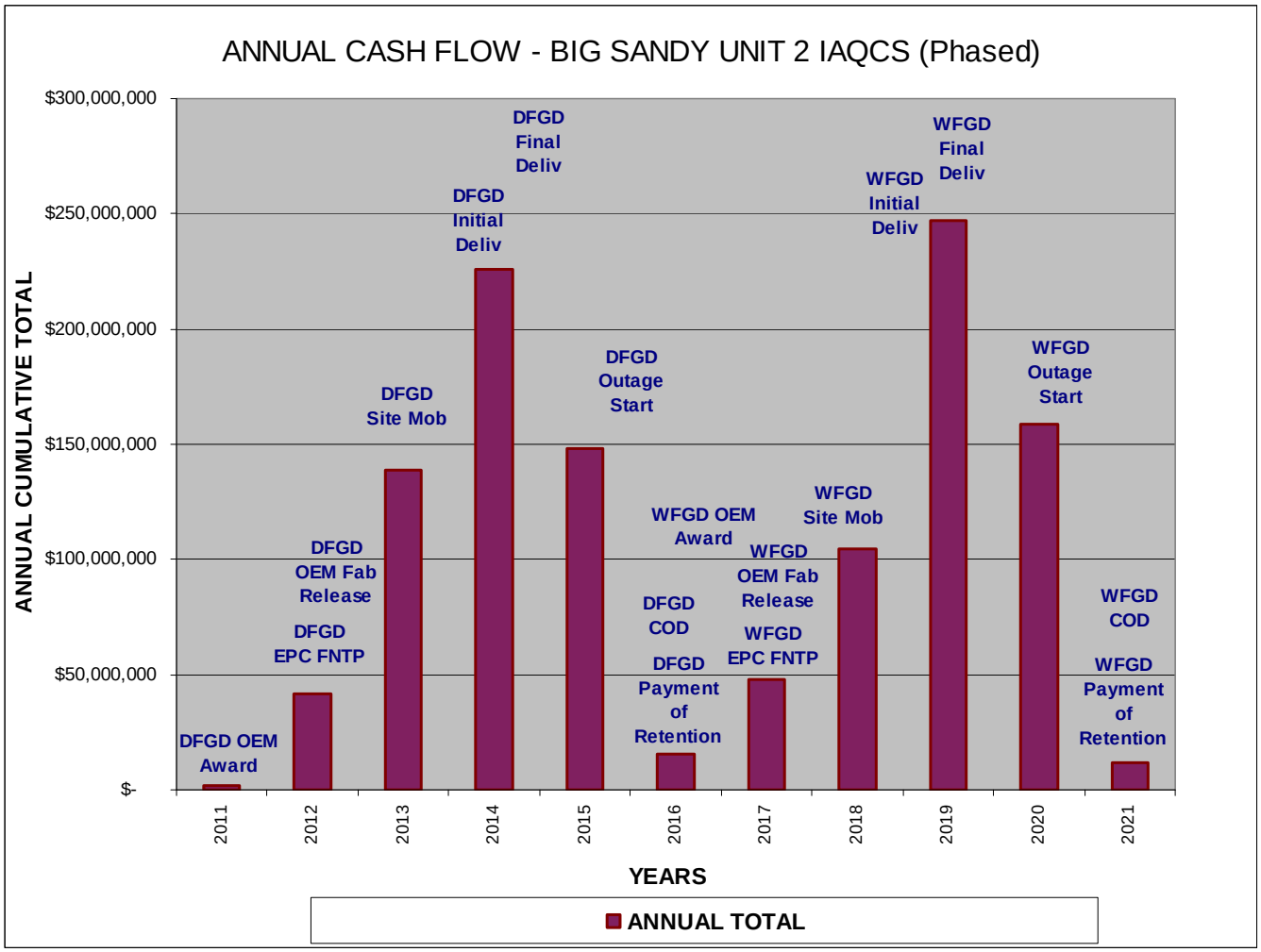


**Table ES-7**
**IAQCS (NON-PHASED) MILESTONE SCHEDULE AND CASH FLOW SUMMARY**

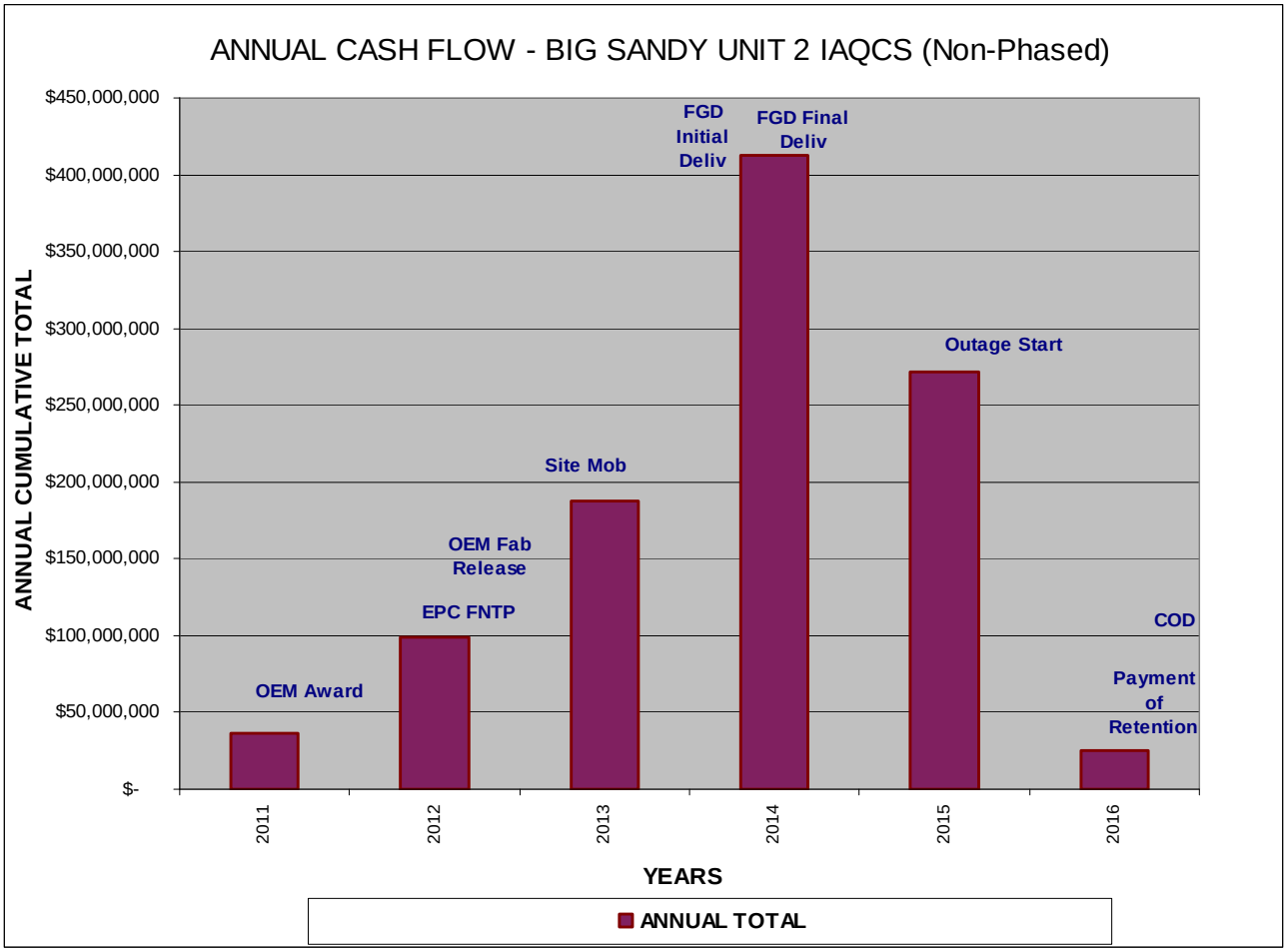
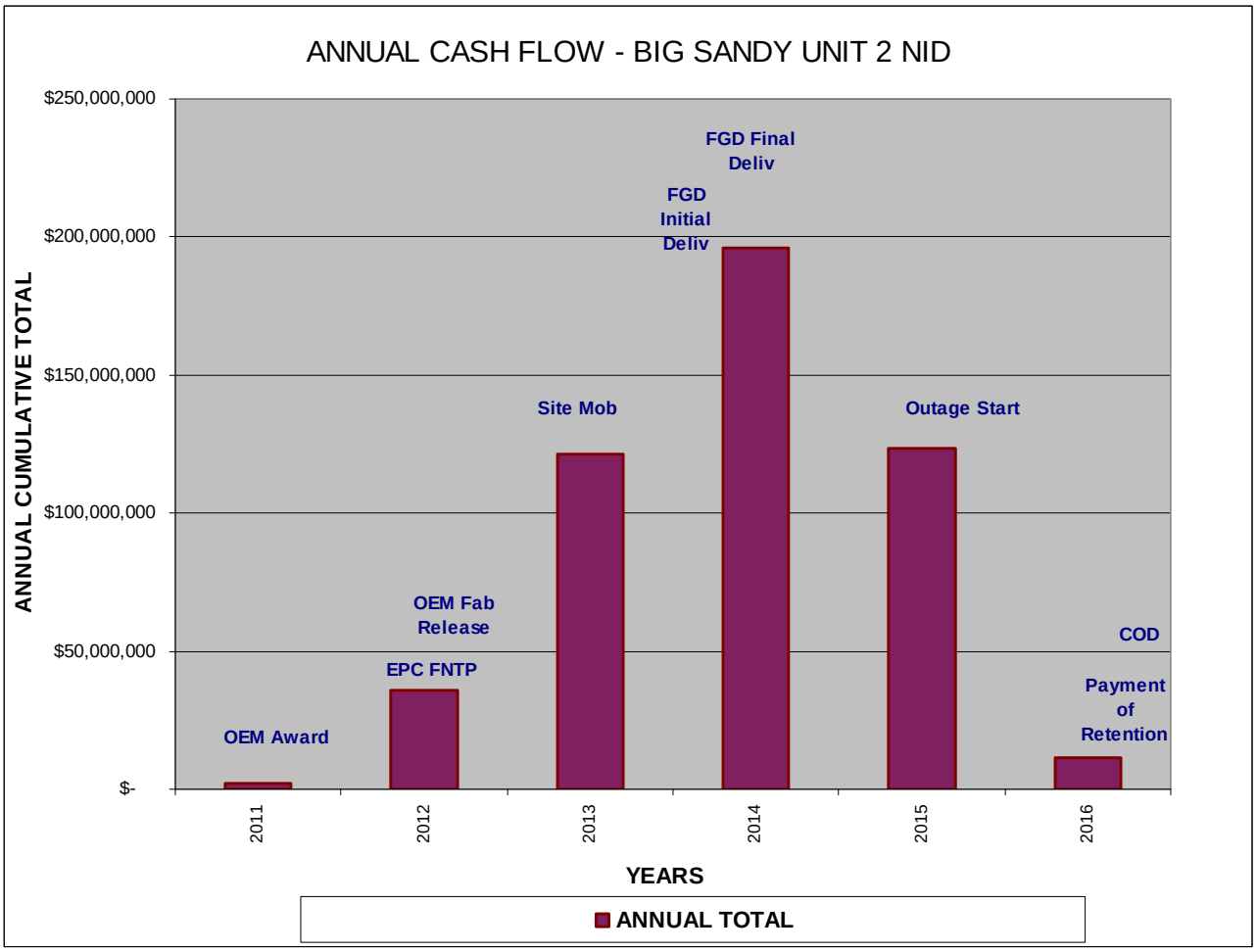


**Table ES-8**
**NID MILESTONE SCHEDULE AND CASH FLOW SUMMARY**




The technical and commercial basis to develop the capital and O&M cost estimates is defined in the following report.

## 1.0 INTRODUCTION

The purpose of this document is to establish the Basis of the Order-of-Magnitude FGD Cost Estimate to assist American Electric Power (AEP) with the selection of an FGD technology for Big Sandy Plant Unit 2. It is also intended to organize and present the deliverables for each technology that were used to develop the Order-of-Magnitude FGD Cost Estimates. This document defines the project scope of work for each technology, the organization of the capital cost estimate structure and the technical and commercial basis used to develop the Capital and O&M Cost Estimates. It also defines the assumptions used in preparing the cost estimates.

The Order-of-Magnitude FGD Cost Estimate Report is comprised of five (5) volumes as follows:

| Volume | Description |
|---|---|
| 1 | Summary Report |
| 2 | WFGD Technology |
| 3 | DFGD Technology |
| 4 | IAQCS Technology |
| 5 | NID Technology |

Order-of-Magnitude FGD Cost Estimates were prepared for the following four FGD Technologies:

- **Wet (WFGD):** Wet FGD Spray Tower and Integrated Wet ESP
- **Dry (DFGD):** Dry FGD Spray Dryer Absorber (SDA) and Fabric Filter (FF)
- **IAQCS:** Integrated Air Quality Control System (IAQCS) Dry SDA/FF and Wet FGD Spray Tower
- **NID:** Dry FGD NID and Fabric Filter

For each technology, cost estimates were prepared considering fuel specifications with sulfur content of 1.7, 3.0, 4.5 and 7.5 lb $SO_2$/MMbtu (as applicable). A base fuel was selected for each technology and a capital cost estimate was prepared for each assuming an Engineer, Procure, Construct (EPC) contracting

approach. Adjustments were then made to the base cost estimate to develop the remaining fuel estimates for that specific technology. The cost estimates also consider both the existing ESP in and removed from service for the Dry, IAQCS and NID technologies. The ESP is required to remain in service for the WFGD technology for protection from erosion and wear of the ID fans and FGD system components (pumps, piping, nozzles, etc.).

The estimates were based upon conceptual design deliverables prepared by S&L for each technology and the AEP Order of Magnitude/Relative Capital Installed Cost Estimate Specification (BS2-FGDSCE-052010, Rev. 2) which provided design basis and performance requirements. The conceptual deliverables, consisting of project general arrangements, process flow diagrams, mass balances, water balances and single lines, formed the basis for development of preliminary major equipment sizes and commodity estimates. Attention was focused on the significant elements that changed from one fuel to another, such as storage, handling and disposal of reagent and byproduct materials. The OEM equipment costs were taken from recent vendor quotes and adjusted for Big Sandy specifications, unit capacity, and escalated to 2010 dollars.

The IAQCS system was evaluated assuming a phased implementation in order to make it more competitive at lower sulfur fuel cases. The DFGD portion would be installed initially and for estimate purposes the WFGD followed 5 years later for the 1.7 lb and 3.0 lb $SO_2$/MMbtu fuels. For the non-phased higher sulfur fuels both systems would be constructed to meet the earlier completion date. In the phased approach the future WFGD infrastructure was considered in the site layout and estimate development for the DFGD Phase. For example, costs for the limestone rail hopper foundation installation were included in the DFGD Phase in order to avoid impacting lime delivery during the WFGD installation in Phase II. The non-phased site layout was optimized to reduce ductwork costs by swapping the chimney and WFGD absorber locations. In addition to higher ductwork costs the phased approach also has significantly higher escalation costs due to the staggered schedule.

Table 1-1 illustrates the total of twenty four (24) cost estimates that were prepared.

**Table 1-1**

**EPC COST ESTIMATES**

| Technology | 1.7 lb $SO_2$/MMbtu | 3.0 lb $SO_2$/MMbtu | 4.5 lb $SO_2$/MMbtu | 7.5 lb $SO_2$/MMbtu |
|---|---|---|---|---|
| **Wet** | Wet Est-2 | Wet Est-3 | Wet Base Est-1 | Wet Est-4 |
| **Dry (ESP)** | Dry Est-2A | Dry Base Est-1A | N/A | N/A |
| **Dry (N/ESP)** | Dry Est-2B | Dry Base Est-1B | N/A | N/A |
| **IAQCS (ESP)** | IAQCS Est-2A | IAQCS Est-3A | IAQCS Base Est-1A | IAQCS Est-4A |
| **IAQCS (N/ESP)** | IAQCS Est-2B | IAQCS Est-3B | IAQCS Base Est-1B | IACCS Est-4B |
| **NID (ESP)** | NID Est-2A | NID Base Est-1A | NID Est-3A | NID Est-4A |
| **NID (N/ESP)** | NID Est-2B | NID Base Est-1B | NID Est-3B | NID Est-4B |

**ESP= ESP In Service** **N/ESP = ESP Out of Service**

## 2.0 TECHNICAL BASIS

The Design Basis used to establish the project scope of work was fully defined in the AEP Specification BS2-FGDSCE-052010 Revision 2, titled Order of Magnitude/Relative Capital Installed Cost Estimate Specification (Exhibit 1-1). Additional Design Basis documents were provided by AEP for use in establishing the design and scope and are not attached to this report. Table 2-1 identifies the AEP Design Basis documents utilized in this study.

**Table 2-1**
**DESIGN BASIS DOCUMENTS**

| SPECIFICATION | DESCRIPTION |
|---|---|
| BS2-FGDSCE-052010 | Order of Magnitude/Relative Capital Installed Cost Estimate Specification |
| GESP-06-004 | Civil Design Criteria |
| SES-7018 | Structural Design Criteria for Fossil Fuel Project |
| DC-NGDE-002 | Architectural Design Criteria |
| DC-MECH-001 | Mechanical Design Criteria |
| DC-ELEC-001-00 | Fleet Plant Electrical Design Criteria |
| DC-FGD/SCR-004-03 | Fleet FGD/SCR Control and Instrumentation Design Criteria |
| ---------- | Engineering Services Technically Approved Suppliers List (3/2/10) |

The Order-of-Magnitude FGD Cost Estimates were also based on the Big Sandy Plant Unit 2 FGD Retrofit Project conceptual design developed during the course of the study. These conceptual design deliverables are tabulated in the Project Deliverable Index within each technology volume and described below.

## 2.1 FGD Technology Process Flow Diagrams

Conceptual Process Flow Diagrams were prepared for each technology to identify the major components of the specific FGD system and the supporting systems, such as material handling, wastewater treatment systems, service water systems, etc. These documents were developed early in the estimating process to define the basic scope of each technology. They were utilized to develop the general arrangements, preliminary equipment lists and sparing philosophy. The Process Flow Diagrams for the Wet, Dry, IAQCS and NID Technologies are included as Attachments 2-1, 3-1, 4-1 and 5-1 respectively.

## 2.2 Site Plan and General Arrangement Drawings

Conceptual Site Plan and General Arrangement Drawings for each technology were prepared to identify the general arrangement and layout of the specific FGD system at the Big Sandy Plant. These drawings conceptually show the arrangement of the FGD Island and supporting systems/equipment. The General Arrangements were a critical part of the commodity development for the cost estimates. The Site Plan and General Arrangement Drawings for the Wet, Dry, IAQCS and NID Technologies are included as Attachments 2-2, 3-2, 4-2 and 5-2 respectively.

## 2.3 Mass Balances

Mass Balances were prepared for each technology and considered three separate variables; flue gas, solids and water. The Mass Balances also considered the existing cold-side ESP in-service and out of service (as applicable). The Mass Balances were utilized in the development of equipment sizing and O&M costs. The Mass Balances for the Wet, Dry, IAQCS and NID Technologies are included as Attachments 2-3, 3-3, 4-3 and 5-3 respectively.

### 2.4 Water Balances

Water Balances were prepared for each technology to show the source of FGD system make-up water. The Water Balances also considered the existing cold-side ESP in-service and out of service (as applicable). The Water Balances, similar to the Mass Balances, were utilized in the development of equipment sizing and O&M costs. The Water Balances for the Wet, Dry, IAQCS and NID Technologies are included as Attachments 2-4, 3-4, 4-4 and 5-4 respectively.

### 2.5 Electrical One-Lines

The existing electrical one-lines and switchyard one-lines were reviewed to establish options for the auxiliary power required for each technology. Conceptual load lists were prepared for each technology based on in-house data from other projects. The electrical one-lines were utilized to define the basic scope of the electrical system. Electrical equipment sizing and associated costs were then determined for the estimates. The Electrical One-Lines for the Wet, Dry, IAQCS and NID Technologies are included as Attachments 2-5, 3-5, 4-5 and 5-5 respectively.

## 3.0 COMMERCIAL BASIS

### 3.1 Capital Cost Estimate Outline

The Capital Cost Estimates prepared for the Big Sandy Plant FGD Project were organized by Area/Equipment. The cost estimate structure was defined in the Capital Cost Estimate Outline, which can be found in Exhibit 1-2.

### 3.2 Capital Cost Estimate Accuracy Range

#### 3.2.1 Cost Estimate Classification

The capital cost estimate prepared for the Big Sandy Plant FGD Project was classified in accordance with AACE International Recommended Practice No. 18R-97 dated February 2, 2005 (refer to Exhibit 3-2). As a recommended practice of AACE International, the Cost Estimate Classification

System provided guidelines for applying the general principles of estimate classification to project cost estimates.

Based on the current level of project definition for the Big Sandy Plant FGD Project, (1% to 15% of full project definition), the capital cost estimate was categorized as a Class 4 estimate in accordance with the AACE International Recommended Practice No. 18R-97. Therefore, the expected accuracy range of the cost estimate typically varies in the low and high ranges as follows:

| | |
|---|---|
| Low: | -15% to -30% |
| High: | +20% to +50% |

The Estimate Input Checklist (Figure 2B of AACE International 18R-97) and Maturity Matrix (Figure 4 of AACE International 18R-97) were utilized to further justify the estimate Class 4 determination.

### 3.2.2 Contingency Analysis

The capital cost estimate contingency was determined using the range estimating process and Monte Carlo analysis. The Palisade Corporation @RISK software program was used to perform the risk analysis using Monte Carlo simulation. Range estimating (1) determined the probability of having a cost overrun, (2) identified how large the overrun can be, and (3) identified how much contingency to add to the cost estimate to reduce the residual risk to an acceptable level. Range estimates were determined for each of the cost elements in the cost estimate reflecting the confidence in the cost estimate. Risk drivers included OEM costs, BOP quantities, relocation/reinforcement costs. Refer to Exhibit 1-4 for the Contingency Analysis summary and other reports that established the contingency used.

## 3.3 Equipment/Material Cost

**3.3.1** The OEM equipment pricing for the WFGD, DFGD and NID Technologies were from a 2009 Alstom bid for a confidential client. The bid was an "engineer and furnish only" proposal for a project in which S&L was involved. The costs were adjusted to meet the Big Sandy project specifications. For example the WFGD vessel costs were increased to account for the C-276 materials specified in the design basis specification. The installation labor costs were developed as a percentage of the OEM equipment costs based upon cost data previously furnished by various equipment manufacturers which once again was adjusted to meet the Big Sandy specifications and location. The OEM equipment pricing was then benchmarked on a $/kW basis against other S&L FGD projects over the last 4 years. Note that the NID benchmarking was done through comparison to similar Circulating Dry Scrubber (CDS) projects. The IAQCS FGD was estimated as a combination of wet and dry systems with adjustments in lime consumption for the non-phased installation. The other equipment and material costs included in the capital cost estimate (for S&L estimated items) was based on recent vendor proposals, S&L's in-house cost database, vendor catalogs or published estimating manuals and adjusted, as required, for capacity, size, or material type.

## 3.4 Construction Labor Wage

Crew labor rates (Crew Hourly Rate) for the cost estimate were from the TriState Union Wage Rates from Huntington, West Virginia as provided by AEP. State specific Workman Comp % Rates were provided by AEP. The craft rates were incorporated into work crews appropriate for the activities by adding allowances for small tools, construction equipment, insurance, and site overheads to arrive at crew rates detailed in the cost estimate (See Exhibit 3-4: Union Labor Rate Summary). A 1.10 regional labor productivity multiplier was included based on Compass International Global Construction Yearbook, 2010 Edition plus and additional 5% for safety related issues for a total productivity multiplier of 1.15.

### 3.4.1 Labor Work Schedule and Incentives

The estimate assumed a 5x10 work week.

A productivity penalty of +8% (in hours) and premium time cost (1-1/2 times the base rate) between the 40 single and 50 single shift was included.

Per-diem subsistence was excluded for craft labor.

### 3.4.2 Base Craft Rates

The base labor crafts used for the capital cost estimate were defined in the Union Labor Rate Summary found on page 1 of Exhibit 1-5.

### 3.4.3 Labor Crews

The construction/erection labor cost was based on the use of applicable construction crews required for the scope of work of this project.

### 3.4.4 Crew Mixes

Major crew mixes used in the cost estimates were defined in the Union Labor Rate Summary found on page 2 of Exhibit 1-5.

### 3.4.5 Quantity Sources

Quantities of pieces of equipment and/or bulk material commodities used in this cost estimate were intended to be reasonable and representative of projects of this type. Material quantities were estimated from the site plan and general arrangement drawings, sketches and past project data provided by the S&L Engineers. Equipment quantities were defined in the AEP estimate specification and the conceptual process flow diagrams.

### 3.4.6 Construction Indirects

Allowances were included in the cost estimate as direct costs as noted for the following:

- Freight: 5% of the total equipment and material costs.

- Additional Crane Allowance: Costs for heavy construction equipment and large cranes were based upon 9 to 20 months of heavy crane usage with a crane crew of 4 persons full time for this duration. Refer to account 99 of the individual estimates for details. Cost of small cranes and machinery were included in the wage rates.
- Mobilization and Demobilization: included in labor wage rates as 3.52% of total payroll wages + other + construction equipment (refer to Union Labor Rate Summary – Exhibit 1-5)
- Scaffolding: 5% of total material and labor costs.
- Consumables: 0.5% of total material and labor cost
- Loss of Productivity due to working 5-10's for extended periods and Premium Time Pay was included as noted in 3.4.1 above
- Per Diem Costs: Excluded from the estimate as noted in 3.4.1 above.
- General and Administrative Costs and Profit: Included in the estimate at 15% per AEP direction.

Contractor allowance percentages noted above were base estimating percentages used for this type of major construction project on an Order-of-Magnitude estimate. These percentages were applied across the entire estimate and were not intended to be representative of individual estimate work areas. However, it should be noted that costs provided by AEP for the chimney and hazardous material abatement were single all inclusive costs. A material, equipment and labor account breakdown was not provided and therefore these costs were not included in the material and labor cost total used to derive the above allowance percentages.

### 3.4.7 Engineering/Design/Procurement Services

Sargent & Lundy has included estimated costs for Engineering, Design, Procurement Services and Project Management and Administrative Services. These costs were based upon S&L experience with EPC projects, recent FGD projects and other projects performed for AEP. In addition costs for Training Services (operator & technician training), and Outside Contractors (noise consultant, ductwork consultant, etc.) were included as separate line items.

### 3.4.8 Construction Management/Field Engineering

Construction Management/Field Engineering was estimated at 3% of total direct and construction indirect costs. Services include on-site construction management, field coordinators and engineering office technical field assistance.

### 3.4.9 Start-Up Commissioning

Start-Up/Commissioning was estimated at 1% of total direct and construction indirect costs. Services include on-site start-up/commissioning management, start-up coordinators and engineering office support.

### 3.4.10 Craft Startup Support

A fixed allowance for Craft Startup Support was included.

### 3.4.11 Initial Fills

Initial Fills were estimated at 0.3% of total direct and construction indirect costs.

### 3.4.12 Spare Parts

Spare parts were included as capitalized spares at 0.9% of total equipment costs and spares for first year of operation at 0.6% of total equipment costs.

### 3.4.13 Owners Costs

Owner costs were not included and will be provided by AEP for the following:

- Project Engineering
- Project Administration
- Owner Construction Management
- Owner Startup & Commissioning
- Permits & Fees

- Air Modeling
- Legal Fees

### 3.4.14 Sales/Use Tax

Sales/Use Tax was not included in the cost estimate.

### 3.4.15 Escalation

S&L has monitored over 200 U.S. indices from nine sources to track past escalation. These included indices for various pieces of equipment, various types of material, labor by city, and other items relevant to power plants. Some of the equipment included heat exchangers, pumps, and transformers. Some of the material types tracked included structural steel, pipe, and conduit.

Data for up to the last ten years was used to calculate past escalation. Then using the most current data as a base the average annual escalation was calculated over various time periods from the last six months, last one year, last two years, last three years, etc., up to the last ten years. We then used that past escalation to help predict future escalation while realizing that past escalation is not an indication of future escalation; but it is an appropriate benchmark along with knowledge of the current market to make predictions. Since anything can occur in a short time frame it was not uncommon to see wide escalation fluctuations for the data of less than about three years. After about three years the data was usually more stable and started to show a long term trend. Also since three years was a reasonable time frame for purchases to be made on many projects this data point was usually used as the starting point for making predictions before current market conditions were factored in. Since using only one data source was very risky, multiple indices from various sources were evaluated and their average was used in the calculation of past escalation.

The average escalation for the last three years was used as the starting point for making predictions before current market conditions were factored in. In addition to this the average escalation for the last five years was used to make escalation predictions after three years in the future before current market

conditions were factored in. Based upon this evaluation along with input from AEP we have used the following escalation percentages:

Equipment: 4.0%/yr of equipment cost (2011-2020).
Material: 2.0%/yr of material cost (2011-2020)
Labor: 2.5%/yr of labor cost (2011-2020)
Indirects: 2.5%/yr of indirect cost (2011-2020).

Escalation was calculated for each of the FGD technologies based upon time of performance. The escalation percentages noted above were applied to estimated monthly expenditures for each estimate component; equipment, material, labor and indirects. The monthly expenditures were determined from cash flows developed for each of the technologies. These cash flows were based upon estimating curves and past project data and can be found in Exhibits 2-6 (WFGD), 3-6 (DFGD), 4-6 (IAQCS) and 5-6 (NID). In order to properly capture the costs of staggering the construction schedule for the IAQCS phased approach, two sets of cash flow curves were developed for the IAQCS estimates, one for the phased approach and one for the non-phased approach. The escalation component costs provided in each of the technology cost estimates was the summation of each of the monthly escalation costs for each component.

### 3.4.16 Contingency

After completion of the cost estimate a Risk Analysis was performed to develop the contingency to be applied to the cost estimates. Cost categories were defined for establishing target, maximum and minimum values depending on the confidence of achieving the target costs. For each category a range (minimum and maximum values) was determined based on level of design, equipment pricing, material / commodity pricing, labor pricing, and volatility in equipment, material, and labor pricing. These ranges were then entered into a software program utilizing Monte Carlo Simulation to determine an overall contingency for the project. The Monte Carlo Simulation is based on running 10,000 iterations where

the inputs are randomly generated from probability distribution curves to simulate the process of sampling. The output was a curve where a point on the curve gives % confidence factor and corresponding overall dollar amount for the project to meet that confidence factor. The software program also provided an output listing contingency % in terms of total direct and indirect costs. For this project a 95% confidence factor was used to determine contingency dollars. Commercially available "@Risk" program was used to perform the risk analysis. Refer to Exhibit 1-4 for the contingency analysis summary.

### 3.4.17 AFUDC

Costs associated with AFUDC were not included.

### 3.4.18 Scope Excluded

The following additional scope items were not included.

- New landfill
- By-product disposal at landfill
- Private haul road to landfill (includes bridge)
- New coal handling equipment required for coal blending
- New coal storage/reclaim system
- Boiler modifications
- Balanced draft conversion
- Controls modernization

Table 3-1
INDIRECTS COMPARISON – BASE CASE TECHNOLOGIES

| Item Description | WFGD BASE EST-1 4.5 LB $SO_2$/MMBTU | DFGD BASE EST - 1B (N/ESP) 3.0 LB $SO_2$/MMBTU | IAQCS BASE EST - 1B (N/ESP) 4.5 LB $SO_2$/MMBTU | NID BASE EST-1B (N/ESP) 3.0 LB $SO_2$/MMBTU |
|---|---|---|---|---|
| TOTAL LABOR COSTS FOR 50 HR WEEK | $231,024,403 | $155,856,625 | $309,412,388 | $135,345,966 |
| TOTAL LABOR COSTS FOR 40 HR WEEK | $196,009,600 | $134,192,300 | $264,512,600 | $116,652,900 |
| HEAVY CRANE ALLOWANCE | $1,337,400 | $2,333,520 | $3,670,920 | $1,337,400 |

| Item Description | WFGD BASE EST-1 4.5 LB $SO_2$/MMBTU | DFGD BASE EST - 1B (N/ESP) 3.0 LB $SO_2$/MMBTU | IAQCS BASE EST - 1B (N/ESP) 4.5 LB $SO_2$/MMBTU | NID BASE EST-1B (N/ESP) 3.0 LB $SO_2$/MMBTU |
|---|---|---|---|---|
| COST DUE TO OVERTIME INEFFICIENCY - 8% | $17,077,000 | $10,515,000 | $21,847,000 | $9,091,000 |
| COST DUE TO OVERTIME PAY @1.5 TIMES OVERTIME PAY RATE - 10% ADDITIONAL HOURS PAID ON ACTUAL HOURS WORKED | $17,937,803 | $11,149,325 | $23,052,788 | $9,602,066 |
| CONSUMABLES - 0.5% of ACCT NO. 90 | $1,381,306 | $900,800 | $1,829,351 | $802,551 |
| FREIGHT ON MATERIAL - 5% of ACCT NO. 90 | $4,028,080 | $2,313,885 | $5,083,375 | $2,208,360 |
| FREIGHT ON EQUIPMENT - 5% of ACCT NO. 90 | $7,280,280 | $5,554,020 | $9,258,770 | $4,706,295 |
| SCAFFOLDING - 5% OF ACCT NO. 90 | $13,813,060 | $9,008,000 | $18,293,505 | $8,025,505 |
| CONTRACTOR'S GENERAL AND ADMINISTRATION EXPENSE & PROFIT - 15% of ACCT NO. 90 | $46,590,180 | $30,355,500 | $60,031,515 | $27,408,015 |
| ENGINEERING, PROCUREMENT, & PROJECT SERVICES | $30,000,000 | $25,000,000 | $45,000,000 | $25,000,000 |
| CONSTRUCTION MANAGEMENT | $16,969,600 | $11,567,400 | $21,850,400 | $10,200,800 |
| S-U / COMMISSIONING | $5,656,500 | $3,855,800 | $7,283,500 | $3,400,300 |
| CRAFT START-UP SUPPORT | $2,310,200 | $1,581,200 | $3,117,400 | $1,374,500 |
| INITIAL FILLS | $1,697,000 | $1,156,700 | $2,185,000 | $1,020,100 |
| CONTINGENCY | $91,254,300 | $63,953,800 | $113,200,600 | $55,124,800 |
| ESCALATION | $78,606,500 | $54,885,900 | $101,295,000 | $48,734,300 |

Note: Acct. 90 is the Total Direct and Construction Indirect Costs

## 3.5 Assumptions

**3.5.1** All utilities such as electricity and water, required for the construction of this project, will be furnished by the owner and made available for use by the installation contractors. The installation contractor will be responsible for construction of the infrastructure needed for utilization of the utility, i.e. construction power distribution system, etc.

**3.5.2** All fuel required for construction equipment will be the responsibility of the installation contractors. This cost is included in the estimate wage rates.

**3.5.3** Initial fills for testing and startup will be furnished by the owner and include the following:

- Lime
- Limestone
- Service Water

**3.5.4** Consumables were included as a line item in the estimates totaling 0.5% of Total Direct and Construction Indirect Costs and are comprised of the following:

- Welding Rods
- Solder and Flux
- Tapes of all Types
- Splicing Materials
- Cable-Pulling Compounds
- Sealing Compounds
- Cleaning Fluids

**3.5.5** Expendables were included in the labor rates and are comprised of the following:

- Sandpapers
- Emery Cloth
- Rags
- Twine

## 3.6 Capital Cost Estimate Summary

Refer to the following Exhibits for the summaries.

- Wet FGD Base Case Capital Cost Estimate Summary (Exhibit 1-6.1)
- Dry FGD Base Case w/o ESP Capital Cost Estimate Summary (Exhibit 1-6.2)
- IAQCS FGD Base Case w/o ESP Capital Cost Estimate Summary (Exhibit 1-6.3)
- NID FGD Base Case w/o ESP Capital Cost Estimate Summary (Exhibit 1-6.4)

For detailed capital cost estimates see the individual technology volumes 2 through 5.

### 3.7 Capital Cost Estimate Comparison

The cost estimates prepared for each technology were summarized in a roll-up of individual accounts for comparison purposes. The cost differences between fuels were noted and technical items which account for the differences in cost between the options are tabulated. See Exhibits 1-8 (WFGD), 1-9 (DFGD), 1-10 (IAQCS) and 1-11 (NID).

## 4.0 O&M COST ESTIMATES

The O&M Cost Estimate Summary for the WFGD, DFGD, IAQCS and NID Technologies was provided in Exhibit 1-7. The detailed O&M Cost Estimates for the WFGD, DFGD, IAQCS and NID Technologies were provided in the individual technology volumes in Attachments 2-5, 3-5, 4-5 and 5-5, respectively. A comparative summary of fixed and variable O&M costs was also provided in the executive summary table ES-3.

## 5.0 PROJECT SCHEDULE

An EPC Project Schedule was developed for each base case technology. For Technologies with two base cases only the ESP out of service base case schedule was prepared since the differences between the ESP in service and out of service are negligible. For the IAQCS technology separate project schedules were prepared for the phased and non-phased options. The level 2 project schedules were

provided in the individual technology volumes. See Attachments 2-15 (WFGD), 3-15 (DFGD), 4-23 (IAQCS Non-Phased), 4-24 (IAQCS Phased) and 5-23 (NID).

Based on the capital cost estimate and the EPC project schedule a cash flow was developed for each technology (Base cost estimate ESP out of service case only). A summary page for each technology containing key milestone dates and an annual cash flow were provided in Tables ES-4 through ES-8. The monthly project cash flows were included in the individual technology volumes. (Refer to Exhibits 2-6 (WFGD), 3-6 (DFGD), 4-6 (IAQCS) and 5-6 (NID).

## 6.0 REFERENCES

6.1 Order of Magnitude/Relative Capital Installed Cost Estimate Specification, BS2-FGDSCE-052010, Rev. 2, Dated September 24, 2010. Attached as Exhibit 1-1

6.2 AACE INTERNATIONAL Recommended Practice No. 18R-97 (February 2, 2005): Cost Estimate Classification System – As Applied In Engineering, Procurement, And Construction For The Process Industries. Attached as Exhibit 1-3

# EXHIBIT 1-1
# Order of Magnitude/Relative Capital Installed Cost Estimate Specification

AMERICAN® ELECTRIC POWER

SPECIFICATION COVER SHEET

**TITLE: Order of Magnitude/Relative Capital Installed Cost Estimate Specification**

**SPECIFICATION NUMBER: BS2-FGDSCE-052010**

| | |
|---|---|
| PROJECT: | Big Sandy 2 – FGD Technology Selection |
| REVISION: | 2 |
| DATE: | September 24, 2010 |

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INTERNAL APPROVAL SIGNATURES

| | Original Issue | Rev. 1 | Rev. 2 |
|---|---|---|---|
| AUTHOR: L. A. Hicks | L. A. Hicks 5/20/2010 | L. A. Hicks 6/21/2010 | Larry A. Hicks 9/24/2010 |
| REVIEW: G. M. Gibbs | G. M. Gibbs 5/20/2010 | G. M. Gibbs 6/21/2010 | G. M. Gibbs 9/24/2010 |
| APPROVAL: T. L. Hart | T. L. Hart 5/20/2010 | T. L. Hart 6/21/2010 | T. L. Hart 9/24/2010 |

# REVISION HISTORY

| REV. | SCOPE OF REVISION | APPROVAL |
|---|---|---|
| 0 | Initial Release | TLH 5/20/2010 |
| 1 | - Added information for IAQCS and NID throughout document<br>- Added miscellaneous clarifications and corrections throughout document<br>- Revised Table of Contents and added sections 2.1.21, 2.1.22, 2.1.23, 2.1.23.1, 2.1.23.2, 2.1.23.3, 2.1.23.4<br>- Added Tables 2.1.2C and 2.1.2D for IAQCS and NID SO2 removal efficiency; pg 6<br>- Added Fuel Analysis for 1.7, 3.0, 4.5, and 7.5 lb/MMBtu coal; pg 9-12<br>- Added Dry FGD NID reagent properties for crushed lime; pg 17<br>- Added Table 2.1.17C and 2.1.17D for IAQCS and NID equipment design basis; pg 23-24<br>- Revised Table 2.1.8A Wet FGD spray tower estimated landfill capacity ash values to match fuel analysis; pg 25<br>- Revised Table 2.1.8B Dry FGD SDA estimated landfill capacity ash values to match fuel analysis and correct sulfite/sulfate values for stoichiometry; pg 25<br>- Added Tables 2.1.18C and 2.1.18D for IAQCS and NID landfill handling; pg 26<br>- Added sections 2.1.21, 2.1.22, 2.1.23, 2.1.23.1, 2.1.23.2, 2.1.23.3, 2.1.23.4; pg 26-29<br>- Added Figure 2.1.21 for Wet FGD spray tower chloride purge stream WWTP flowchart; pg 27<br>- Added Table 2.1.23 for FGD reagent consumption on all technologies; pg 29-30<br>- Added Table 3.0C and 3.0D for IAQCS and NID cost drivers; pg 44-45 | TLH 6/21/2010 |
| 2 | - Revised Table 2.1.2A and Table 2.1.2D controlled SO2 emission from 0.3 to 0.4 lb/MMBtu for the 1.7 lb/MMBtu uncontrolled SO2 case on Wet FGD and NID, added note to clarify revision; pg 6-7<br>- Added clarification for powdered activated carbon requirement on IAQCS phased installation only in section 2.1.3.2; pg 8<br>- Added clarification for flue gas conditions without existing dry side ESP in section 2.1.11; pg 14<br>- Added clarification for IAQCS phased approach design to include diesel operated emergency quench system to protect the FRP flue gas stack liner in section 2.1.14.3; pg 20<br>- Revised Seller to Consultant in section 2.1.15; pg 21<br>- Revised Table 2.1.17A: added storm water pond, service water pumps, river water booster pumps, hydrocyclone feed pumps, WWT wastewater sump, WWT wastewater sump pumps, gypsum stackout conveyor; deleted radial stacker conveyor, emergency stackout conveyor; clarified ball mill hydrocyclone w/ 125% capacity; pg 22<br>- Revised Table 2.1.17B & 2.1.17C: added recycle byproduct premix tank, recycle byproduct makeup tank, lime slurry feed loops & pumps, lime slurry transfer pumps, rotary atomizer spare with holding stand; clarified FF pulse air compressor w/ dryers, pebble lime rotary valve & feeder, lime slaker w/ ventilation and grit screen, spray dryer absorbers to 3 x 33%; pg 23-24 | 9/24/10 |



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| | | |
|---|---|---|
| | - Revised Table 2.1.17C added storm water pond, service water pumps, river water booster pumps, hydrocyclone feed pumps, gypsum stackout conveyor; deleted radial stacker conveyor, emergency stackout conveyor; clarified ball mill hydrocyclone w/ 125% capacity; pg 24<br>- Revised fly ash and Dry FGD byproduct conditioning water % moisture from 5% to 30% in section 2.1.18; pg 26<br>- Revised Table 2.1.18B, C, D estimated landfill capacity for 30% moisture content; pg 26-27<br>- Added requirement for all valves will be remotely operated or accessible from platforms in section 2.1.20; pg 27<br>- Added clarification for Wet FGD WWTP design basis of 12,000 ppm chlorides based on 0.19% chlorine content in section 2.1.21; pg 27<br>- Added clarification for IAQCS gypsum pile runoff to be collected and pumped to dewatering hydroclone feed tank; pg 30<br>- Revised Table 2.1.23 to clarify average cars unloaded per day based on 5 days per week; pg 30<br>- Deleted “and associated landfill” from last bullet in section 2.2.2.1; pg 35<br>- Revised boiler modification requirement from above 3.0 lb/MMBtu SO2 to above 1.7 lb/MMBtu SO2; pg 36<br>- Revised reference from Seller to Consultant in section 2.3; pg 41<br>- Revised Table 3.0A, B, C, D; deleted maintenance outages and changed equipment maintenance to maintenance material and equipment; pg 43-46<br>- Added editorial comments in the following sections: 2.1.2, 2.1.3.1, 2.1.3.3, 2.1.4, 2.1.14.1 | |
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## 1.0 PURPOSE

The purpose of this specification is to provide the high level design basis requirements for the Big Sandy Unit 2 FGD technology selection process, such that a 3rd party consultant can develop order of magnitude cost estimates for the following four technologies:

1) Wet FGD – Spray Tower & Wet Electrostatic Precipitator (ESP)
2) Dry FGD – Spray Dryer Absorber (SDA) & Fabric Filter (FF)
3) Integrated Air Quality Control System (IAQCS) – SDA/FF & Wet FGD Spray Tower
4) Dry FGD – NID & Fabric Filter

As consideration for the cost estimates, it is the Owner's intent to install a FGD system that will meet the required performance specifications, operate with a high degree of availability and reliability, provide ease of access for maintenance, and require low maintenance during all modes of operation throughout the life of the facility.

## 2.0 TECHNICAL REQUIREMENTS

This section of the specification covers the high level design basis and performance requirements, as well as conceptual equipment arrangements for each technology and required unit operating conditions.

### 2.1 DESIGN BASIS & PERFORMANCE REQUIREMENTS

The following items establish the high level design basis requirements and performance requirements for the FGD technologies being considered.

#### 2.1.1 DESIGN LIFE

It is the intention of the Owner to obtain a FGD System that shall operate safely, reliably and without excessive maintenance for a design life of 25 years.

#### 2.1.2 SO2 REMOVAL EFFICIENCY

The following tables define the required percent (%) removal of sulfur dioxide (SO2) in the flue gas produced by the steam generator during all periods of operation from full load to minimum load. In the following four tables, each FGD technology of interest is assigned a specific sulfur range.

**Table 2.1.2A. Wet FGD Spray Tower and Wet ESP Sulfur Dioxide Removal Efficiency.***

| Flue Gas Emission | | | | | |
|---|---|---|---|---|---|
| Uncontrolled SO2 | lb/MMBtu | 1.7 | 3.0 | 4.5 | 7.5 |
| | ton/year | 51,772 | 91,362 | 137,044 | 228,406 |
| SO2 removal efficiency | % | 97.7 | 98 | 98 | 98 |
| Controlled SO2 | lb/MMBtu SO2 | 0.04 | 0.06 | 0.09 | 0.15 |
| | ton/year | 1,217 | 1,827 | 2,741 | 4,568 |
| SO2 Removed | ton/year | 50,555 | 89,535 | 134,303 | 223,838 |


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**Table 2.1.2B. Dry FGD SDA and FF Sulfur Dioxide Removal Efficiency.**

| Flue Gas Emission | | | |
|---|---|---|---|
| Uncontrolled SO2 | lb/MMBtu | 1.7 | 3.0 |
| | ton/year | 51,772 | 91,362 |
| SO2 removal efficiency | % | 95 | 95 |
| Controlled SO2 | lb/MMBtu SO2 | 0.09 | 0.15 |
| | ton/year | 2,589 | 4,568 |
| SO2 Removed | ton/year | 49,183 | 86,794 |

**Table 2.1.2C. IAQCS Sulfur Dioxide Removal Efficiency.**

| Flue Gas Emission | | | | | |
|---|---|---|---|---|---|
| Uncontrolled SO2 | lb/MMBtu | 1.7 | 3.0 | 4.5 | 7.5 |
| | ton/year | 51,772 | 91,362 | 137,044 | 228,406 |
| SO2 removal efficiency | % | 95 | 95 | 98 | 98 |
| Controlled SO2 | lb/MMBtu SO2 | 0.09 | 0.15 | 0.09 | 0.15 |
| | ton/year | 2,589 | 4,568 | 2,741 | 4,568 |
| SO2 Removed | ton/year | 49,183 | 86,794 | 134,303 | 223,838 |

**Table 2.1.2D. Dry FGD NID and FF Sulfur Dioxide Removal Efficiency.***

| Flue Gas Emission | | | | | |
|---|---|---|---|---|---|
| Uncontrolled SO2 | lb/MMBtu | 1.7 | 3.0 | 4.5 | 7.5 |
| | ton/year | 51,772 | 91,362 | 137,044 | 228,406 |
| SO2 removal efficiency | % | 97.7 | 98 | 98 | 96 |
| Controlled SO2 | lb/MMBtu SO2 | 0.04 | 0.06 | 0.09 | 0.30 |
| | ton/year | 1,217 | 1,827 | 2,741 | 9,136 |
| SO2 Removed | ton/year | 50,555 | 89,535 | 134,303 | 219,270 |

Note*: The minimum SO2 emission guarantee from OEM's is typically down to 0.04 lb/MMBtu SO2, which affects the 1.7 lb/MMBtu SO2 case on Wet FGD and NID.

The ton/year values are based on an 85% capacity factor.

### 2.1.3 OTHER FLUE GAS EMISSIONS

The FGD technology must be able to remove flue gas emissions other than sulfur dioxide, such as sulfur trioxide, mercury, hydrochloric acid and hydrofluoric acid. For removal of these non-SO2 compounds, a Fabric Filter on a Dry FGD or a Wet ESP on a Wet FGD are considered to be equivalent or same relative order of magnitude for removal of these flue gas constituents.

#### 2.1.3.1 SULFUR TRIOXIDE

Sulfur trioxide (SO3) removal in a Wet FGD Spray Tower and Wet ESP combination is expected to have a total SO3 removal efficiency of 89%. The spray tower can remove SO3 by absorption into water droplets and is expected to be 30% removal. The Wet ESP can remove 85% of the SO3 which is in the aerosol or acid mist form from the saturated flue gas. (Reference B&W Steam Book, 41st Edition, page 35-19).

Sulfur trioxide (SO3) removal in a Dry FGD Spray Dryer Absorber (SDA) and Fabric Filter combination is expected to have a SO3 removal efficiency of 93%. Lime slurry is contacted with flue gas to remove SO2 in the SDA resulting in a decrease of the flue gas temperature below the SO3 acid dew point, promoting the formation of SO3 aerosol. The SO3 is absorbed and neutralized by the lime in the SDA. Also in the fabric filter, dry unreacted lime and SO3 come in contact in the cake on the cloth, where the SO3 is neutralized.


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Sulfur trioxide (SO3) removal in the IAQCS is expected to have an overall SO3 removal efficiency of 95%. This is accomplished in a series of steps.

- First, the SDA operates below the SO3 dew point. In the SDA, SO3 is absorbed into the lime slurry where it is neutralized.

- Next in the fabric filter, unreacted lime and SO3 come in contact in the cake on the cloth, where the SO3 is neutralized.

- Finally, the wet spray tower can remove SO3 by absorption into water droplets.

Therefore, the SDA/FF SO3 removal efficiency is 93% and with 30% removal in the spray tower results in an effective 95% total SO3 removal efficiency.

Sulfur trioxide (SO3) removal in a Dry FGD NID and Fabric Filter is expected to have a SO3 removal efficiency of 93%. Fresh lime and recycle solids from the fabric filter are independently hydrated with water and introduced into the flue gas at a high solids rate to remove SO2 in the NID J-reactor. The temperature of the flue gas in the J-reactor decreases below the acid dew point which promotes the formation of the SO3 aerosol. The SO3 is neutralized by the lime in the flue gas and active lime within the cake on the fabric filter surface.

#### 2.1.3.2 MERCURY

There are three forms of mercury that are present in the flue gas (Reference Alstom Clean Combustion Technologies, 5th Edition, page 5-102):

Hg° - Elemental Mercury
$Hg^{2+}$ - Oxidized Mercury
Hg-P - Attached to unburned carbon (UBC) or other components of the fly ash

Oxidized mercury ($Hg^{2+}$) is easily removed as it attaches to fly ash or a sorbent which can then be removed by a particulate collection device. In addition, $Hg^{2+}$ is also captured in a Wet FGD system as it is highly soluble in water. Elemental mercury (Hg°) is insoluble and most difficult to capture. However Hg° may attach to fly ash or a sorbent which can then be removed in a particulate collection device.

All FGD technologies are expected to achieve high levels of mercury capture based on the following technology arrangements:

- Wet FGD Spray Tower and Wet ESP combination.
- Dry FGD SDA/FF combined w/ powdered activated carbon injection upstream of SDA.
- IAQCS SDA/FF/Spray Tower combined w/ powdered activated carbon injection upstream of SDA for phased installation only. Activated carbon injection is not required for non-phased installation.
- Dry FGD NID/FF combined w/ powdered activated carbon injection upstream of NID.

#### 2.1.3.3 HYDROCHLORIC AND HYDROFLUORIC ACIDS

Both wet and dry FGD technologies are capable of achieving low outlet emission rates for hydrofluoric acid (HF) and hydrochloric acid (HCl). (Reference Carmeuse Natural Chemicals FGD FAQs).


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Dry FGD technologies rely on a neutralization reaction between the lime and HF or HCl to form solid products that are captured in the fabric filter. The Wet FGD relies on the solubility of HF and HCl and its absorption for removal in the spray tower.

### 2.1.4 SYSTEM PRESSURE DROP

The FGD System across the entire vendor supplied equipment shall be designed in such a way to minimize the flue gas pressure drop. Component design such as flow straightening devices, turning vanes, and rounded ductwork corners shall be utilized.

### 2.1.5 EQUIPMENT MODULARIZATION

In order to minimize field construction costs and on-site storage requirements, the FGD System shall be engineered to maximize the extent of off-site equipment fabrication and component modularization. Owner desires overall least-cost project that includes material/equipment, erection labor and professional services.

### 2.1.6 STANDARIZED EQUIPMENT

The Consultant shall consider to the greatest extent possible, standard sized equipment and arrangements (pumps, fans, motors, instruments, agitators, etc.) that gives the Owner the capability for interchangeable equipment and spare parts.

### 2.1.7 ACCEPTED EQUIPMENT VENDORS

The Owner has standardized on the equipment suppliers that are listed in the attached Engineering Services Technically Approved Suppliers List dated 3/2/2010 (see Attachment 1). Note the following changes to the Approved Suppliers List pending the next revision:

- ABB is being removed from the list for medium voltage switchgear.
- The Materials Handling section of the list is considered incomplete. Consult AEP Engineering Services for approval of suppliers for equipment/systems not addressed by the list.

### 2.1.8 ACCEPTABLE PROCESS CHEMISTRY

The WFGD System, as it applies to technologies 1 and 3 per section 1.0, shall be designed based on a limestone reagent, forced oxidation process chemistry that allows the capability to produce landfill grade gypsum. The design shall be based upon no additives to achieve $SO_2$ removal.

The DFGD System, as it applies to technologies 2, 3, and 4 per section 1.0, shall be designed based on lime reagent process chemistry. The design shall be based upon no additives to achieve $SO_2$ removal.

### 2.1.9 FUEL DATA

The Unit 2 fuel consideration is divided into four categories; existing, low, medium, and high sulfur coal. The existing sulfur coal is defined as a 1.7 lb/MMBtu SO2, which is currently being burned pursuant to compliance purposes. The low sulfur coal is defined as a 3.0 lb/MMBtu SO2, which is upper limit of the Dry FGD SDA & FF technology. The medium sulfur coal is defined as 4.5 lb/MMBtu SO2 and is considered the installed equipment basis fuel. The high sulfur coal is defined as 7.5 lb/MMBtu SO2 and is considered the design basis fuel. The system is to be designed such that additional equipment or modifications will achieve performance on this higher level sulfur coal.


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**Table 2.1.9A. Big Sandy Unit 2 Fuel Analysis – 1.7 lb/MMBtu SO2.**

# 1.7 lb SO2/mmBTU

# 100% Central Appalachian Coal

**Mine Name:** Harris #1

**Mine Location:** Boone County, W. Va.

**Seam Name:** Eagle

| **Proximate Data:** | **As Received:** | **Dry Basis:** (Calc) | **Ultimate:** | **Dry Basis:** | **As Rcvd:** (Calc) |
|---|---|---|---|---|---|
| **% Moisture:** | 6.20% | | **% Carbon:** | 74.00% | 69.41% |
| **% Ash :** | 11.60% | 12.37% | **% Hydrogen:** | 5.00% | 4.69% |
| **% Volatile Matter:** | 30.20% | 32.20% | **% Nitrogen:** | 1.40% | 1.31% |
| **% Fixed Carbon:** | 52.00% | 55.44% | **% Chlorine:** | 0.20% | 0.19% |
| **Total Proximate:** | 100.00% | 100.00% | % Moisture: | | 6.20% |
| **% Sulfur:** | 0.94% | 1.00% | % Ash: | 12.37% | 11.60% |
| **BTU/#:** | 12,242 | 13,521 | % Sulfur: | 1.00% | 0.94% |
| **Moist.-Ash-Free BTU/#:** | 14893 | **Ultimate subtotal:** | | 94.34% | |
| **Grindability:** | 45 | | **% Oxygen by Diff.:** | 6.03% | 5.66% |
| | | | **% Total:** | 100.00% | 100.00% |

**# SO2/mmBTU: 1.48**

| **Mineral Ash Data:** | **Dry Basis** | | **SO3 Free Basis** |
|---|---|---|---|
| **% $SiO_2$:** | 56.50% | | 56.90% |
| **% $Al_2O_3$:** | 28.40% | | 28.60% |
| **% $TiO_2$:** | 1.30% | 86.20% | 1.31% |
| **% $Fe_2O_3$:** | 6.50% | | 6.55% |
| **% CaO:** | 0.80% | | 0.81% |
| **% MgO:** | 1.30% | | 1.31% |
| **% $K_2O$:** | 3.78% | | 3.81% |
| **% $Na_2O$:** | 0.47% | 12.85% | 0.47% |
| **% $SO_3$:** | 0.70% | | |
| **% $P_2O_5$:** | 0.10% | | 0.10% |
| **% SrO:** | 0.05% | | 0.05% |
| **% BaO:** | 0.08% | | 0.08% |
| **% $MnO_2$:** | 0.02% | | 0.02% |
| **% Undetermined:** | 0.00% | | |

| **Ash Fusion Temperature Data:** | |
|---|---|
| **Reducing Temperatures:** | |
| **Initial Deformation (ID):** | 2680 |
| **Softening (H=W):** | 2700 |
| **Hemispherical (H=1/2W):** | 2700 |
| **Fluid (Fl):** | 2700 |
| **Oxidizing Temperatures:** | |
| **Initial Deformation (ID):** | 2700 |
| **Softening (H=W):** | 2700 |
| **Hemispherical (H=1/2W):** | 2700 |
| **Fluid (Fl):** | 2700 |
| **Other Data:** | |
| **T250 Temperature:** | 2880 |
| **Free Swelling Index:** | 7.50 |
| **Sulfur Forms:** | |
| **% Pyritic:** | 0.20 |
| **% Sulfate:** | 0.01 |
| **% Organic:** | 0.70 |
| **Equilibrium Moisture %:** | 1.80 |



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**Table 2.1.9B. Big Sandy Unit 2 Fuel Analysis – 3.0 lb/MMBtu SO2.**

# 3.0 lb SO2/mmBTU

# 63% Central Appalachian Coal / 37% Illinois Blend

**Mine Name:** 63% Harris #1 / 37% Radio Hill

| **Proximate Data:** | **As Received:** | **Dry Basis:** (Calc) | **Ultimate:** | **Dry Basis:** | **As Rcvd:** (Calc) |
|---|---|---|---|---|---|
| **% Moisture:** | 8.35 | | **% Carbon:** | 73.15% | 67.04% |
| **% Ash :** | 10.31% | 11.25% | **% Hydrogen:** | 4.98% | 4.56% |
| **% Volatile Matter:** | 33.30% | 36.33% | **% Nitrogen:** | 1.44% | 1.32% |
| **% Fixed Carbon:** | 48.04% | 52.41% | **% Chlorine:** | 0.13% | 0.12% |
| **Total Proximate:** | 100.00% | 100.00% | % Moisture: | | 8.35% |
| **% Sulfur:** | 1.81% | 1.97% | % Ash: | 11.25% | 10.31% |
| **BTU/#:** | 12007 | 13101 | % Sulfur: | 1.97% | 1.81% |
| **Moist.-Ash-Free BTU/#:** | 14,762 | **Ultimate subtotal:** | | 90.82% | |
| **Grindability:** | 47 | | **% Oxygen by Diff.:** | 7.08% | 6.49% |
| | | | **% Total:** | 100.00% | 100.00% |

**# SO2/mmBTU: 3.01**

| **Mineral Ash Data:** | **Dry Basis** | | **SO3 Free Basis** |
|---|---|---|---|
| **% $SiO_2$:** | 52.99% | | 53.37% |
| **% $Al_2O_3$:** | 25.96% | | 26.14% |
| **% $TiO_2$:** | 1.24% | 80.19% | 1.25% |
| **% $Fe_2O_3$:** | 12.73% | | 12.82% |
| **% CaO:** | 1.15% | | 1.15% |
| **% MgO:** | 1.11% | | 1.11% |
| **% $K_2O$:** | 3.28% | | 3.31% |
| **% $Na_2O$:** | 0.41% | 18.67% | 0.41% |
| **% $SO_3$:** | 0.16% | | |
| **% $P_2O_5$:** | 0.09% | | 0.09% |
| **% SrO:** | 0.% | | 0.% |
| **% BaO:** | 0.% | | 0.% |
| **% $MnO_2$:** | 0.% | | 0.% |

| **Ash Fusion Temperature Data:** | |
|---|---|
| **Reducing Temperatures:** | |
| **Initial Deformation (ID):** | 2473 |
| **Softening (H=W):** | 2496 |
| **Hemispherical (H=1/2W):** | 2540 |
| **Fluid (Fl):** | 2589 |
| **Other Data:** | |
| **T250 Temperature:** | 2681 |



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**Table 2.1.9C. Big Sandy Unit 2 Fuel Analysis – 4.5 lb/MMBtu SO2.**

# 4.5 lb SO2/mmBTU

## 45% Central Appalachian Coal / 55% Northern Appalachian Blend

**Mine Name:** 45% Harris #1 / 55% McElroy

| **Proximate Data:** | **As Received:** | **Dry Basis:** (Calc) | **Ultimate:** | **Dry Basis:** | **As Rcvd:** (Calc) |
|---|---|---|---|---|---|
| **% Moisture:** | 6.63% | | **% Carbon:** | 74.25% | 69.33% |
| **% Ash :** | 9.89% | 10.59% | **% Hydrogen:** | 5.00% | 4.67% |
| **% Volatile Matter:** | 36.15% | 38.72% | **% Nitrogen:** | 1.43% | 1.34% |
| **% Fixed Carbon:** | 47.33% | 50.69% | **% Chlorine:** | 0.05% | 0.05% |
| **Total Proximate:** | 100.00% | 100.00% | % Moisture: | | 6.63% |
| **% Sulfur:** | 2.69% | 2.88% | % Ash: | 10.59% | 9.89% |
| **BTU/#:** | 12,490 | 13,376 | % Sulfur: | 2.88% | 2.69% |
| **Moist.-Ash-Free BTU/#:** | 14,962 | | **Ultimate subtotal:** | | 94.59% |
| **Grindability:** | 49 | | **% Oxygen by Diff.:** | 5.80% | 5.41% |
| | | | **% Total:** | 100.00% | 100.00% |

**# SO2/mmBTU: 4.31 #**

| **Mineral Ash Data:** | **Dry Basis** | | **SO3 Free Basis** |
|---|---|---|---|
| **% $SiO_2$:** | 40.59% | | 41.55% |
| **% $Al_2O_3$:** | 20.76% | | 21.25% |
| **% $TiO_2$:** | 0.93% | 62.28% | 0.95% |
| **% $Fe_2O_3$:** | 28.56% | | 29.24% |
| **% CaO:** | 2.72% | | 2.78% |
| **% MgO:** | 0.72% | | 0.74% |
| **% $K_2O$:** | 1.67% | | 1.71% |
| **% $Na_2O$:** | 0.46% | 34.13% | 0.47% |
| **% $SO_3$:** | 2.32% | | |
| **% $P_2O_5$:** | 0.46% | | 0.47% |
| **% SrO:** | 0.00% | | 0.00% |
| **% BaO:** | 0.00% | | 0.00% |
| **% $MnO_2$:** | 0.00% | | 0.00% |
| **% Undetermined:** | 0.81% | | |

| **Ash Fusion Temperature Data:** | |
|---|---|
| **Reducing Temperatures:** | |
| **Initial Deformation (ID):** | 2265 |
| **Softening (H=W):** | 2310 |
| **Hemispherical (H=1/2W):** | 2395 |
| **Fluid (Fl):** | 2484 |
| **Other Data:** | |
| **T250 Temperature:** | 2285 |


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**Table 2.1.9D. Big Sandy Unit 2 Fuel Analysis – 7.5 lb/MMBtu SO2.**

# 7.5 lb SO2/mmBTU

# 100% Northern Appalachian Coal

**Coal Company:** Consolidated Energy

**Region:** Northern Appalachian

**Mine Name:** McElroy

**Seam Name:** Pittsburgh #8

| **Proximate Data:** | **As Received:** | **Dry Basis:** (Calc) | **Ultimate:** | **Dry Basis:** | **As Rcvd:** (Calc) |
|---|---|---|---|---|---|
| **% Moisture:** | 6.73% | | **% Carbon:** | 72.00% | 67.15% |
| **% Ash :** | 10.40% | 11.15% | **% Hydrogen:** | 5.10% | 4.76% |
| **% Volatile Matter:** | 37.10% | 39.78% | **% Nitrogen:** | 1.24% | 1.16% |
| **% Fixed Carbon:** | 46.59% | 49.95% | **% Chlorine:** | 0.05% | 0.05% |
| **Total Proximate:** | 100.82% | 100.88% | % Moisture: | | 6.73% |
| **% Sulfur:** | 4.02% | 4.31% | % Ash: | 11.15% | 10.40% |
| **BTU/#:** | 12,390 | 13,284 | % Sulfur: | 4.31% | 4.02% |
| **Moist.-Ash-Free BTU/#:** | 14,951 | **Ultimate subtotal:** | | 94.26% | |
| **Grindability:** | 50 | | **% Oxygen by Diff.:** | 6.15% | 5.74% |
| | | | **% Total:** | 100.00% | 100.00% |

**# SO2/mmBTU: 6.49**

| **Mineral Ash Data:** | **Dry Basis** | | **SO3 Free Basis** |
|---|---|---|---|
| **% $SiO_2$:** | 42.17% | | 42.41% |
| **% $Al_2O_3$:** | 17.61% | | 17.71% |
| **% $TiO_2$:** | 0.84% | 60.62% | 0.84% |
| **% $Fe_2O_3$:** | 28.63% | | 28.79% |
| **% CaO:** | 4.17% | | 4.19% |
| **% MgO:** | 0.65% | | 0.65% |
| **% $K_2O$:** | 1.51% | | 1.52% |
| **% $Na_2O$:** | 0.48% | 35.44% | 0.48% |
| **% $SO_3$:** | 0.56% | | |
| **% $P_2O_5$:** | 0.75% | | 0.75% |
| **% SrO:** | 0.00% | | 0.00% |
| **% BaO:** | 0.00% | | 0.00% |
| **% $MnO_2$:** | 0.00% | | 0.00% |
| **% Undetermined:** | 2.63% | | |

| **Ash Fusion Temperature Data:** | |
|---|---|
| **Reducing Temperatures:** | |
| **Initial Deformation (ID):** | 2010 |
| **Softening (H=W):** | 2050 |
| **Hemispherical (H=1/2W):** | 2175 |
| **Fluid (Fl):** | 2340 |
| **Oxidizing Temperatures:** | |
| **Initial Deformation (ID):** | 2490 |
| **Softening (H=W):** | 2530 |
| **Hemispherical (H=1/2W):** | 2550 |
| **Fluid (Fl):** | 2575 |
| **Other Data:** | |
| **T250 Temperature:** | 2270 |
| **Free Swelling Index:** | 0.00 |
| **Sulfur Forms:** | |
| **% Pyritic:** | 0.00 |
| **% Sulfate:** | 0.00 |
| **% Organic:** | 0.00 |
| **Equilibrium Moisture %:** | 0.00 |



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### 2.1.10 GENERATING UNIT / STEAM GENERATOR INFORMATION

Big Sandy Plant is located in Louisa, Kentucky along the Big Sandy River. The physical address is 23000 Highway 23, Louisa, KY 41230.

Road Access: Entrance to the plant is from U.S. Route 23.
Rail Access: CSX Transportation
Barge Access: No; however barge access is available less than 10 miles away from the plant for construction purposes.

**Big Sandy Unit 2**

| | |
|---|---|
| Full Load Firing Rate | 8,180 million BTU/hr |
| Nominal Unit Rating (Gross / Net) | 865 / 800 MW |
| Full Load Net Unit Heat Rate | 10,225 BTU/kW-hr |
| Boiler Type | Pressurized Dry Bottom |
| Firing Method | Wall fired |
| Plant Capacity Factor | 85% |
| Annual Starts (Hot / Cold) | 6 / 4 |
| Minimum Load (Net) | 295 MW |
| Minimum Load Firing Rate | 3,089 million BTU/hr |
| Minimum Load Net Unit Heat Rate | 10,472 BTU/kW-hr |
| Unit Ramp Rate (SCR in/out of service) | 5 / 10 MW/min |
| Air Heater Type | Ljungstrom Rotary Tri-Sector |
| Ignition Fuel | #2 Fuel Oil |
| Particulate Control Device | ESP (cold) |
| Combustion Control Devices | Low $NO_x$ Burner |
| Other Emission Control Devices | SCR (High Dust, 2003) |
| Nominal Flue Gas $O_2$ @ Economizer Outlet | 3.5 % (by volume – wet) |
| Max (upset) Flue Gas $O_2$ @ Economizer Outlet | 4.5 % (by volume – wet) |

The Big Sandy Unit 2 circulating water system is a closed loop system. Therefore, the circulating water is recycled and reused in the steam turbine condensers. The heat transferred to the circulating water in the condenser is rejected to the atmosphere by the evaporation process in the cooling tower.

The river water makeup intake structure at Big Sandy consists of two river intake systems: normal and backup.

The normal system has three vertical double suction type river water makeup pumps that are each rated for 10,000 gpm at 130' TDH and are driven by 400 HP, 1800 rpm, 550V motors. Normally two pumps operate to provide all the water needed for the plant and both cooling tower makeups.

The backup system has two vertical turbine type river water makeup pumps that are each rated for 6,750 gpm at 135' TDH and are driven by 200 HP, 1180 rpm, 550V motors. These backup pumps are used when dirty river conditions cause pluggage to the normal system intake strainers and prevent normal flow of water.

### 2.1.11 FLUE GAS CONDITIONS

The FGD System shall be designed to treat the expected nominal inlet flue gas conditions downstream of the existing dry side ESP at full load. The flue gas conditions without the existing dry side ESP will be the same with the exception of the particulate loading. See Table 2.1.11 for flue gas particulate loading without the existing dry side ESP.


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**Big Sandy Unit 2**

| | |
|---|---|
| Volumetric Flow Rate | 3,248,000 acfm (at 350ºF & 11" $H_2O$ static pressure) |
| Average Flue Gas Temperature | 350 $^{o}$ F |
| Flue Gas Particulate Loading | 0.236 lb/MMBtu with existing Dry Side ESP |
| Percent of Flue Gas Treated | 100 % |

* Note: Calculated gas flow rates are based upon operating the steam generator at 21% excess air and an assumed air in-leakage rate of 20 % to account for air heater leakage and any additional leakage due to conversion to balanced draft operation.

**Table 2.1.11. Flue Gas Conditions without the existing Dry ESP.**

| Flue Gas Conditions - Fly Ash Loading without Dry ESP. | | | | | |
|---|---|---|---|---|---|
| Sulfur | lb/MMBtu | 1.7 | 3.0 | 4.5 | 7.5 |
| High Heating Value | Btu/lb | 12,242 | 12,007 | 12,490 | 12,390 |
| Ash | % wt | 11.6 | 10.3 | 9.9 | 10.4 |
| Fly Ash | lb/MMBtu | 7.58 | 6.87 | 6.33 | 6.72 |

## 2.1.12 REAGENT DATA

The FGD System shall be designed to operate as specified with a limestone reagent (Wet FGD technology – as it applies to technologies 1 and 3 per Section 1.0) or lime reagent (Dry FGD technology – as it applies to technologies 2, 3, and 4 per Section 1.0) whose properties are defined by the ranges stated in the below table. The worse case of the range values listed is to be used for material balance calculations.


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## Wet FGD Spray Tower Reagent Properties

Limestone

**Product 1 - Landfill Gypsum Product**

| | Buyer's Minimum Acceptable Standards | Seller's Guaranteed Quality Level (Min or Max) | Test Method |
|---|---|---|---|
| Total $CaCO_3$ (dry wt. %) | 89.0 | Minimum | ASTM C1301 or ASTM C1271. Reference method ASTM C25, Section 17. |
| Total $MgCO_3$ (dry wt. %) | 4.0 | Maximum | ASTM C1301 or ASTM C1271. Reference method ASTM C25, Section 18. |
| Total Insoluble Matter* | 11.0 | Maximum | ASTM C25, Section 8 |
| $SiO_2$ (dry wt. %) | 5.0 | Maximum | ASTM C1301 or ASTM C1271. Reference method ASTM C25, Section 10 |
| Total Mn (dry wt. %) | 0.015 | Maximum | ASTM C1301 or ASTM C1271. Reference method ASTM C25, Section 10 |
| Free Moisture (wt. %) | 5.0 | Maximum | ASTM C25, Section 20. |
| Bond Work Index (kWh/ST) | 12.0 | Maximum | EPRI Method B6 |
| Size (inches) (excluding Cardinal Plant) Summer Months (Apr-Nov) | ¾ x 0, not to exceed 35% passing 8 mesh screen | | ASTM D422 |
| Size (inches) (excluding Cardinal Plant) Winter Months (Dec-Mar) | ¾ x 0, not to exceed 20% passing 8 mesh screen | | ASTM D422 |
| Size (inches) Cardinal Plant only | 1-1/2 x 0, not to exceed 25% passing 8 mesh screen | | ASTM D422 |

*This value will include any insoluble calcium content.

Notes

1) All limestone shipments shall be prequalified to meet these specifications prior to shipment unless the recipient rescinds this requirement.

2) Barge shipments shall be prequalified on a three consecutive barge rolling average prior to shipment.



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## Dry FGD SDA Reagent

Pebble Lime

**Pebble Lime Reagent Properties**

| Proximate Analysis, Dry Basis | Units | Nominal | Range |
|---|---|---|---|
| Total Calcium Oxide, CaO | % by wt | 93 | 88 to 97 |
| Total Magnesium Oxide, MgO | % by wt | 2.8 | 2 to 4 |
| Inerts | % by wt | 2.5 | 0 to 4 |
| CO2 | % by wt | .80 | .10 to 2 |

**Pebble Lime Reactivity Analysis**

| Lime Analysis, Reactivity Average | Average | Min | Max |
|---|---|---|---|
| 3 Min Temp. Rise (°C) | N/A | 40 | N/A |
| Slaking Rate (°C/min) | 6 | 5 | N/A |
| Slaking Residue (% retained on 20 mesh) | 3.0 | N/A | 6.0 |

**Pebble Lime Physical Analysis**

| Lime Analysis, Physical Analysis |
|---|
| **Size:** Nominal ¾" x 0" |
| **Screen Size:** Less then 40% passing a 10 Mesh |
| **Bulk Density: 45 lb/ft3 loose – 60 lb/ft3 packed** |
| **Angle of Repose: 50 – 55** |
| **Abrasiveness : Moderately Abrasive** |


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## Dry FGD NID Reagent

Crushed Lime

**Crushed Lime Reagent Properties**

| Proximate Analysis, Dry Basis | Units | Range |
|---|---|---|
| Total Calcium Oxide, CaO | % by wt | 90 to 97 |
| Total Magnesium Oxide, MgO | % by wt | 2 to 4 |
| Inerts | % by wt | 0 to 4 |
| $CO_2$ | % by wt | 0.10 to 2 |

**Crushed Lime Reactivity Analysis**

| Lime Analysis, Reactivity Average | Average | Min | Max |
|---|---|---|---|
| 3 Min Temp. Rise (°C) | N/A | 40 | N/A |
| Slaking Rate (°C/minute) | 6.0 | 5.0 | N/A |
| Slaking Residue (% remaining on 20 mesh) | 3.0 | N/A | 6.0 |

**Crushed Lime Physical Analysis**

| Lime Analysis, Physical Analysis |
|---|
| **Size:** Nominal 1/8" x 0" |
| **Screen Size:** 85% passing 20 Mesh |
| **Bulk Density:** 45 lb/ft3 loose – 60 lb/ft3 packed |
| **Angle of Repose:** 50 – 55 |
| **Abrasiveness :** Moderately Abrasive |

## Integrated AQCS Reagent

Limestone - See Wet FGD Spray Tower Reagent Properties

Pebble Lime – See Dry FGD SDA Reagent Properties

### 2.1.13 WATER BALANCE AND SUPPLY

The Wet FGD Spray Tower and Wet ESP technology system shall be designed to operate with the only water losses permitted being by evaporation, chloride purge stream and that leaving with the WFGD by-product. The water balance shall be designed in such a manner that the requirements for fresh makeup water are minimized.

The Dry FGD SDA and NID technology system shall be designed to operate with the only water losses permitted being by evaporation and that leaving with the DFGD byproduct. The water


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balance shall be designed in such as manner that the requirements for fresh makeup water are minimized.

The IAQCS technology system shall be designed to operate with the only water losses permitted being by evaporation, Wet FGD chloride purge stream to the Dry FGD SDA/FF, and that leaving with the Wet FGD by-product. The water balance shall be designed in such a manner that the requirements for fresh makeup water are minimized.

The normal water supply for process water to the FGD System shall be strained Big Sandy River water as defined by the ranges stated in the following tabulated data.

**Table 2.1.13. Big Sandy River Water Analysis.**

| | Average | Range |
|---|---|---|
| Iron, Fe (mg/L) | 1.00 | 0.5-5.39 |
| Copper, Cu (ug/L) | 5.43 | 2-10 |
| Sulfate, SO4 (mg/L) | 53.33 | 32-183 |
| Total Hardness, as CaCO3 (mg/L) | 153.14 | 96-260 |
| Chloride, Cl (mg/L) | 18.69 | 7.7-24 |
| Conductivity @ 25 °C (umho) | 450.53 | 210-697 |
| TSS (mg/L) | 178.81 | 6-1300 |
| PH @ 25 °C | 7.66 | 6-8.1 |
| Aluminum | 1.7 | 0.69-4.97 |
| Manganese (mg/L) | 0.11 | 0.08-0.22 |
| Magnesium (mg/L) | 48.82 | 15-83 |

## 2.1.14 TRANSIENT CONDITIONS

### 2.1.14.1 WET FGD SPRAY TOWER AND WET ESP

The Wet FGD Spray Tower and Wet ESP system shall be designed to handle process temperature and pressure transient excursions of an accumulative duration of 100 hours over the design life of the system without causing damage to the system. The system shall be designed for each transient condition acting separately, not collectively. The following transient pressure conditions are assuming balanced draft operation.

The Wet FGD Spray Tower and Wet ESP system shall be designed for the following transient conditions downstream of the ID Fan:

- Positive Pressure + 20 inches of water at 350 °F
- Negative Pressure - 10 inches of water at 350 °F
- Abnormal Absorber Inlet Temperatures up to 515 °F

The Wet FGD Spray Tower and Wet ESP system shall be designed for the following transient conditions upstream of the ID Fan:

- Positive Pressure + 20 inches of water at 350°F
- Negative Pressure - 50 inches of water at 350°F
- Abnormal Absorber Inlet Temperatures up to 515 °F

The Wet FGD Spray Tower and Wet ESP system shall be designed to include provisions (diesel operated emergency quench system) to ensure that an upset condition does not cause failure to any system equipment, its components, or the FRP flue gas stack liner.


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Potential failures include loss of a single air heater and black plant scenario. The flue gas transient condition for loss of a single air heater is an abnormal absorber inlet temperature excursion to approximately 515°F for periods of up to 30 minutes in order to reduce load on the unit. The flue gas transient condition for a black plant scenario is a constant gas flow rate of 6.5% of MCR for a duration of 10 hours, at a constant temperature of 400°F. The temperature will then drop linearly from 400°F to 200°F over the next 5 hours. The total event duration is 15 hours.

**2.1.14.2 <u>DRY FGD SDA AND FF</u>**

The Dry FGD SDA and FF system shall be designed to handle process temperature and pressure transient excursions of an accumulative duration of 100 hours over the design life of the system without causing damage to the system. The system shall be designed for each transient condition acting separately, not collectively.

The Dry FGD SDA and FF system shall be designed for the following transient conditions:

- Positive Pressure + 20 inches of water at 350°F
- Negative Pressure - 85 inches of water at 350°F
- Abnormal Absorber Inlet Temperatures up to 515°F

The Dry FGD SDA and FF system shall be designed to include provisions to ensure that an upset condition does not cause failure to any pulse jet fabric filter system equipment or its components. Potential failures include a black plant scenario or air heater failure as previously defined.

**2.1.14.3 <u>IAQCS</u>**

The IAQCS (SDA/FF/Spray Tower) system shall be designed to handle process temperature and pressure transient excursions of an accumulative duration of 100 hours over the design life of the system without causing damage to the system. The system shall be designed for each transient condition acting separately, not collectively.

The IAQCS SDA and FF system shall be designed for the following transient conditions upstream of the ID Fan:

- Positive Pressure + 20 inches of water at 350°F
- Negative Pressure - 85 inches of water at 350°F
- Abnormal Absorber Inlet Temperatures up to 515°F

The IAQCS Spray Tower system shall be designed for the following transient conditions downstream of the ID Fan:

- Positive Pressure + 20 inches of water at 350 °F
- Negative Pressure - 10 inches of water at 350 °F
- Abnormal Absorber Inlet Temperatures up to 515°F

The Dry FGD SDA and FF system shall be designed with emergency bypass to ensure that an upset condition does not cause failure to any pulse jet fabric filter system equipment or its components, thus ensuring compliance on return to service. The Wet FGD Spray Tower system shall be designed to include provisions (diesel operated emergency quench system) to ensure that an upset condition does not cause failure to any system equipment, its components, or the FRP flue gas stack liner. Potential failures include a black plant scenario or air heater failure as previously defined in Section 2.1.14.1. The IAQCS phased approach shall be designed to include provisions (diesel operated emergency quench system) to ensure that an upset condition does not cause failure to the FRP flue gas stack liner.


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#### 2.1.14.4 DRY FGD NID AND FF

The Dry FGD NID and FF system shall be designed to handle process temperature and pressure transient excursions of an accumulative duration of 100 hours over the design life of the system without causing damage to the system. The system shall be designed for each transient condition acting separately, not collectively.

The Dry FGD NID and FF system shall be designed for the following transient conditions upstream of the ID Fan:

- Positive Pressure + 20 inches of water at 350°F
- Negative Pressure - 85 inches of water at 350°F
- Abnormal Absorber Inlet Temperatures up to 515°F

The Dry FGD NID and FF system shall be designed with emergency bypass to ensure that an upset condition does not cause failure to any pulse jet fabric filter system equipment or its components, thus ensuring compliance on return to service. Potential failures include a black plant scenario or air heater failure as previously defined in Section 2.1.14.1.

### 2.1.15 APPLICABLE SPECIFICATIONS AND DESIGN CRITERIA

Consultant shall utilize the Owner's discipline specific design criteria in the development of the cost estimates. For areas where these provided design criteria do not clearly address specific specifications and design criteria required to develop the cost estimates, the Owner intends to also utilize the Consultant's standard specifications and design criteria. Consultant's specifications and design criteria are expected to conform to typical Utility Industrial specifications and practices.

Listed below are the Owner provided discipline specific design criteria:

- Mechanical Design Criteria - DC-MECH-001 (see Attachment 2)
- Electrical Design Criteria - DC-ELEC-001 (see Attachment 3)
- Control & Instrumentation Design Criteria - DC-FGD/SCR-004 (see Attachment 4)
- Civil Design Criteria - GESP-06-004 (see Attachment 5)
- Architectural Design Criteria - DC-NGDE-002 (see Attachment 6)
- Structural Design Criteria - SES-7018 (see Attachment 7)

### 2.1.16 AMBIENT NOISE EMISSIONS

Near field noise level from operating equipment shall not exceed 85 dBA (when measured 3 ft in the horizontal plane, and 5 feet above grade or personnel platform) whether from the single or surrounding area operating equipment. Far field noise shall not exceed the current preexisting noise level at the property fence line.

### 2.1.17 EQUIPMENT REDUNDANCY

Redundant equipment shall require that a stand-by installed spare is always available for service with equipment in normal operation and maintenance requirements. For example: 1) if two pumps are required to be in service at all times, a third installed pump is required to be a spare; 2) if two pumps are required to be in service at all times, but periodic/frequent removal of one pump for maintenance is required, then four pumps are required (2 operating, 1 in routine maintenance, 1 installed ready for service)

The following tables have been developed to communicate the Owner's equipment redundancy requirements for use in the development of the cost estimates.


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**Table 2.1.17A. Wet FGD Spray Tower and Wet ESP Equipment Design Basis.**

| Process Area | Description | Design Basis | Capacity |
|---|---|---|---|
| | | | % |
| Absorber | Absorber Module w/ agitator | 1 | 100 |
| | ID Fan w/ dampers | 2 | 50 |
| | Recycle Pump | 4 | 33 |
| | Mist Eliminator Pump | 2 | 100 |
| | Bleed Pump | 2 | 100 |
| | Oxidation Air Blower | 2 | 100 |
| | Wet ESP | 1 | 100 |
| | Wet Stack Shell and Liner | 1 | 100 |
| | Maintenance Storage Tank | 1 | 100 |
| | Storm Water Pond | 1 | 100 |
| | | | |
| Reagent Preparation | Limestone Unloading (Rail & Truck) | 1 | 100 |
| | Limestone Reclaim | 1 | 100 |
| | Limestone Emergency Reclaim | 1 | 100 |
| | Limestone Conveyor | 2 | 100 |
| | Limestone Silo w/ feeders | 2 | 100 |
| | Ball Mill w/ Product Tank | 2 | 100 |
| | Ball Mill Product Tank Pump | 2 per Ball Mill | 100 |
| | Ball Mill Hydrocyclone | 1 per Ball Mill | 125 |
| | Limestone Slurry Tank | 2 | 100 |
| | Reagent Feed Pump | 2 | 100 |
| | Limestone Slurry Loop | 2 | 100 |
| | Service Water Tank | 2 | 100 |
| | Service Water Pumps | 2 | 100 |
| | River Water Booster Pumps | 2 | 100 |
| | | | |
| Dewatering | Hydrocyclone Feed Tank | 2 | 75 |
| | Hydrocyclone | 2 | 100 |
| | Hydrocyclone Feed Pumps | 2 | 100 |
| | Vacuum Belt with accessories | 2 | 100 |
| | Gypsum Conveyor | 2 | 100 |
| | Gypsum Stackout Conveyor | 2 | 100 |
| | Reclaim Water Tank | 2 | 100 |
| | Reclaim Water Pump | 2 | 100 |
| | | | |
| FGD WWT | Equalization Tank | 2 | 75 |
| | Desaturation Tank | 2 | 75 |
| | Primary Clarifier | 2 | 75 |
| | Coagulation Tank | 2 | 75 |
| | Secondary Clarifier | 2 | 75 |
| | Clearwater Sump | 1 | 100 |
| | Clearwater Sump Pumps | 2 | 100 |
| | Sludge Holding Tank | 2 | 75 |
| | Filter Press | 2 | 75 |
| | Transfer Pumps (typical all) | 1 per train w/ installed common | 100 |
| | Wastewater Sump | 1 | 100 |
| | Wastewater Sump Pumps | 2 | 100 |
| | | | |
| Sumps and Sump pumps | Absorber Sump | 1 | 100 |
| | Absorber Sump Pump | 2 | 100 |
| | Dewatering Area Sump | 1 | 100 |
| | Dewatering Ares Sump Pump | 2 | 100 |
| | Reagent Area Sump | 1 | 100 |
| | Reagent Area Sump Pumps | 2 | 100 |
| | | | |
| Emergency Quench | Diesel Pump | 1 | 100 |
| | Alternative - Fire Protection Tie | n/a | n/a |
| | | | |
| H&V | Reagent Preparation Building | n/a | n/a |
| | Absorber Building | n/a | n/a |
| | Dewatering Building | n/a | n/a |
| | FGD WWT Building | n/a | n/a |
| | FGD Maintenance Shop | n/a | n/a |
| | | | |
| HVAC | Electrical Building - MCC | n/a | n/a |
| | Electrical Building - Ovation | n/a | n/a |
| | FGD Operations Building | n/a | n/a |
| | FGD Lab | n/a | n/a |
| | FGD Control Room | n/a | n/a |
| | | | |


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**Table 2.1.17B. Dry FGD SDA and FF Equipment Design Basis.**

| Process Area | Description | Design Basis | Capacity |
|---|---|---|---|
| | | | % |
| Absorber | SDA | 3 | 33 |
| | Rotary Atomizers | Req'd # for OEM Design | 100 |
| | Spare Rotary Atomizers including stand | 1 per SDA & 1 common | n/a |
| | Rotary Atomizer Lube System | Req'd # for OEM Design | 100 |
| | Fabric Filter | 1 (with n-1* compartment capacity) | 100 |
| | ID Fan | 2 | 50 |
| | Recycle Byproduct Silo | 1 | 100 |
| | Dry Stack Shell and Liner (new) | 1 | 100 |
| | Byproduct Recycle Silo Fluidizing Air blower | 2 | 100 |
| | Byproduct Recycle Silo Conveying Blower | 2 | 100 |
| | Byproduct Silo Fluidizing Blower | 2 | 100 |
| | Byproduct Silo Pin Mixer | 2 | 100 |
| | Byproduct Conveying Blower | 2 | 100 |
| | SDA outlet hopper collection system | 1 per SDA | 100 |
| | SDA outlet hopper enclosure | 1 per SDA | 100 |
| | FF pulse air compressor and dryers | 2 | 100 |
| | FF Broken Bag Detectors | 2 per FF Compartment | 100 |
| | Process Water Storage Basin | 1 | 100 |
| | Storm Water Settling Pond | 1 | 100 |
| | Process Water Storage Basin Sump | 1 | 100 |
| | Process Water Storage Basin Sump Pumps | 2 | 100 |
| | Byproduct Waste Silo Area Sump | 1 | 100 |
| | Byproduct Waste Silo Area Sump Pumps | 2 | 100 |
| | Recycle Byproduct Premix Tank | 2 | 100 |
| | Recycle Byproduct Makeup Tank | 2 | 100 |
| | | | |
| Reagent | Pebble Lime Silo | 1 | 30 (day) |
| | Pebble Lime Rotary Valve and Feeder | 2 | 100 |
| | Lime Slaker w/ ventilation and grit screen | 2 | 100 |
| | Lime Slurry Transfer Pumps | 2 | 100 |
| | Lime Slurry Storage Tank | 2 | 100 |
| | Lime Slurry Feed Loops and Pumps | 2 | 100 |
| | SDA Feed Tank | 2 | 100 |
| | SDA Feed Loop and Pumps | 2 | 100 |
| | Recycle Area Sump | 1 | 100 |
| | Recycle Area Sump Pumps | 2 | 100 |
| | Reagent Prep Area Sump | 1 | 100 |
| | Reagent Prep Area Sump Pumps | 2 | 100 |
| | | | |
| H&V | Reagent Preparation Building | n/a | n/a |
| | Fabric Filter | n/a | n/a |
| | FGD Maintenance Shop | n/a | n/a |
| | Byproduct Building | n/a | n/a |
| | Byproduct Rec Silo Blower/Vacuum Building | n/a | n/a |
| | SDA Enclosure | n/a | n/a |
| | Air Compressor Building | n/a | n/a |
| | | | |
| HVAC | Electrical Building - MCC | n/a | n/a |
| | Electrical Building - Ovation | n/a | n/a |
| | FGD Operations Building | n/a | n/a |
| | FGD Control Room | n/a | n/a |
| | FGD Lab | n/a | n/a |
| | Byproduct waste control room | n/a | n/a |
| | Lime unloading control room | n/a | n/a |
| | SDA atomizers | n/a | n/a |
| | | | |

** n = the required number of pieces of equipment to maintain full load operation
* n-1 = the required number of pieces of equipment need to maintain full load operations without derating or impacting SO2 emission with one piece of equipment out of service.


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**Table 2.1.17C. IAQCS Equipment Design Basis.**

| Process Area | Description | Design Basis | Capacity |
|---|---|---|---|
| | | | % |
| Wet FGD Absorber | Absorber Module w/ agitator | 1 | 100 |
| | ID Fan w/ dampers | 2 | 50 |
| | Recycle Pump | 4 | 33 |
| | Mist Eliminator Pump | 2 | 100 |
| | Bleed Pump | 2 | 100 |
| | Oxidation Air Blower | 2 | 100 |
| | Wet ESP | 1 | 100 |
| | Wet Stack Shell and Liner | 1 | 100 |
| | Maintenance Storage Tank | 1 | 100 |
| | Storm Water Pond | 1 | 100 |
| | | | |
| Wet FGD Reagent Preparation | Limestone Unloading (Rail & Truck) | 1 | 100 |
| | Limestone Reclaim | 1 | 100 |
| | Limestone Emergency Reclaim | 1 | 100 |
| | Limestone Conveyor | 2 | 100 |
| | Limestone Silo w/ feeders | 2 | 100 |
| | Ball Mill w/ Product Tank | 2 | 100 |
| | Ball Mill Product Tank Pump | 2 per Ball Mill | 100 |
| | Ball Mill Hydrocyclone | 1 per Ball Mill | 125 |
| | Limestone Slurry Tank | 2 | 100 |
| | Reagent Feed Pump | 2 | 100 |
| | Limestone Slurry Loop | 2 | 100 |
| | Service Water Tank | 2 | 100 |
| | Service Water Pumps | 2 | 100 |
| | River Water Booster Pumps | 2 | 100 |
| | | | |
| Wet FGD Dewatering | Hydrocyclone Feed Tank | 2 | 75 |
| | Hydrocyclone | 2 | 100 |
| | Hydrocyclone Feed Pumps | 2 | 100 |
| | Vacuum Belt with accessories | 2 | 100 |
| | Gypsum Conveyor | 2 | 100 |
| | Gypsum Stackout Conveyor | 2 | 100 |
| | Reclaim Water Tank | 2 | 100 |
| | Reclaim Water Pump | 2 | 100 |
| | | | |
| Dry FGD Absorber | SDA | 3 | 33 |
| | Rotary Atomizers | Req'd # for OEM Design | 100 |
| | Spare Rotary Atomizers including stand | 1 per SDA & 1 common | n/a |
| | Rotary Atomizer Lube System | Req'd # for OEM Design | 100 |
| | Fabric Filter | 1 (with n-1* compartment capacity) | 100 |
| | ID Fan | 2 | 50 |
| | Recycle Byproduct Silo | 1 | 100 |
| | Dry Stack Shell and Liner (new) | 1 | 100 |
| | Byproduct Recycle Silo Fluidizing Air blower | 2 | 100 |
| | Byproduct Recycle Silo Conveying Blower | 2 | 100 |
| | Byproduct Silo Fluidizing Blower | 2 | 100 |
| | Byproduct Silo Pin Mixer | 2 | 100 |
| | Byproduct Conveying Blower | 2 | 100 |
| | SDA outlet hopper collection system | 1 per SDA | 100 |
| | SDA outlet hopper enclosure | 1 per SDA | 100 |
| | FF pulse air compressor and dryers | 2 | 100 |
| | FF Broken Bag Detectors | 2 per FF Compartment | 100 |
| | Process Water Storage Basin | 1 | 100 |
| | Storm Water Settling Pond | 1 | 100 |
| | Process Water Storage Basin Sump | 1 | 100 |
| | Process Water Storage Basin Sump Pumps | 2 | 100 |
| | Byproduct Waste Silo Area Sump | 1 | 100 |
| | Byproduct Waste Silo Area Sump Pumps | 2 | 100 |
| | Recycle Byproduct Premix Tank | 2 | 100 |
| | Recycle Byproduct Makeup Tank | 2 | 100 |
| | | | |
| Dry FGD Reagent | Pebble Lime Silo | 1 | 30 (day) |
| | Pebble Lime Rotary Valve and Feeder | 2 | 100 |
| | Lime Slaker w/ ventilation and grit screen | 2 | 100 |
| | Lime Slurry Transfer Pumps | 2 | 100 |
| | Lime Slurry Storage Tank | 2 | 100 |
| | Lime Slurry Feed Loops and Pumps | 2 | 100 |
| | SDA Feed Tank | 2 | 100 |
| | SDA Feed Loop and Pumps | 2 | 100 |
| | Recycle Area Sump | 1 | 100 |
| | Recycle Area Sump Pumps | 2 | 100 |
| | Reagent Prep Area Sump | 1 | 100 |
| | Reagent Prep Area Sump Pumps | 2 | 100 |
| | | | |
| Wet FGD Sumps/Sump pumps | Absorber Sump | 1 | 100 |
| | Absorber Sump Pump | 2 | 100 |
| | Dewatering Area Sump | 1 | 100 |
| | Dewatering Ares Sump Pump | 2 | 100 |
| | Reagent Area Sump | 1 | 100 |
| | Reagent Area Sump Pumps | 2 | 100 |
| | | | |



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**Table 2.1.17C. Continued.**

| Process Area | Description | Design Basis | Capacity |
|---|---|---|---|
| | | | % |
| | | | |
| Emergency Quench | Diesel Pump | 1 | 100 |
| | Alternative - Fire Protection Tie | n/a | n/a |
| | | | |
| H&V | Reagent Preparation Building | n/a | n/a |
| | Absorber Building | n/a | n/a |
| | Dewatering Building | n/a | n/a |
| | FGD WWT Building | n/a | n/a |
| | FGD Maintenance Shop | n/a | n/a |
| | Fabric Filter | n/a | n/a |
| | Byproduct Building | n/a | n/a |
| | Byproduct Rec Silo Blower/Vacuum Building | n/a | n/a |
| | SDA Enclosure | n/a | n/a |
| | Air Compressor Building | n/a | n/a |
| | | | |
| HVAC | Electrical Building - MCC | n/a | n/a |
| | Electrical Building - Ovation | n/a | n/a |
| | FGD Operations Building | n/a | n/a |
| | FGD Lab | n/a | n/a |
| | FGD Control Room | n/a | n/a |
| | Byproduct waste control room | n/a | n/a |
| | Lime unloading control room | n/a | n/a |
| | SDA atomizers | n/a | n/a |
| | | | |

**Table 2.1.17D. Dry FGD NID and FF Equipment Design Basis**

| Process Area | Description | Design Basis | Capacity |
|---|---|---|---|
| | | | % |
| NID/FF | J Reactor | Req'd # for OEM Design | 100 |
| | Fabric Filter | 1 (with n-1* compartment capacity) | 100 |
| | Fluidizing Trough | Req'd # for OEM Design | 100 |
| | Lime Hydrator | Req'd # for OEM Design | 100 |
| | Lime/Byproduct Mixer | Req'd # for OEM Design | 100 |
| | Crushed Lime Day Silo | Req'd # for OEM Design | 100 |
| | NID Fluidizing Air Blowers & heaters | Req'd # for OEM Design | 100 |
| | ID Fan | 2 | 50 |
| | Dry Stack Shell and Liner (new) | 1 | 100 |
| | Byproduct Waste Silo | 1 | 100 |
| | Byproduct Waste Silo Fluidizing Air Blower & | 2 | 100 |
| | Byproduct Waste Silo Pin Mixer | 2 | 100 |
| | Byproduct Waste Conveying System | 2 | 100 |
| | FF pulse air compressor | 2 | 100 |
| | FF Broken Bag Detectors | 2 per FF Compartment | 100 |
| | Process Water Storage Basin | 1 | 100 |
| | Byproduct Waste Silo Area Sump | 1 | 100 |
| | Byproduct Waste Silo Area Sump Pumps | 2 | 100 |
| | Storm Water Settling Pond | 1 | 100 |
| | | | |
| Reagent | Crushed Lime Silo | 1 | 30 (day) |
| | Crushed Lime Conveying System | 2 | 100 |
| | Reagent Prep Area Sump | 1 | 100 |
| | Reagent Prep Area Sump Pumps | 2 | 100 |
| | | | |
| H&V | NID Enclosure | n/a | n/a |
| | Fabric Filter | n/a | n/a |
| | FGD Maintenance Shop | n/a | n/a |
| | Byproduct Building | n/a | n/a |
| | Air Compressor Building | n/a | n/a |
| | | | |
| HVAC | Electrical Building - MCC | n/a | n/a |
| | Electrical Building - Ovation | n/a | n/a |
| | FGD Operations Building | n/a | n/a |
| | FGD Control Room | n/a | n/a |
| | FGD Lab | n/a | n/a |
| | Byproduct waste control room | n/a | n/a |
| | Lime unloading control room | n/a | n/a |
| | | | |

** n = the required number of pieces of equipment to maintain full load operation

* n-1 = the required number of pieces of equipment needed to maintain full load operations without derating or impacting SO2 emission with one piece of equipment out of service.



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### 2.1.18 BYPRODUCT HANDLING

The following narrative and tables describe what the expected quantities of byproduct are produced by each FGD technology at a 100% capacity factor for the different fuels. The tables include bottom ash, fly ash, FGD byproduct, and chloride purge wastewater treatment solids.

Bottom ash is considered to be 20% of the total ash in the coal with the remaining 80% being fly ash. Although bottom ash is not considered in FGD related handling, it is listed for information purposes only. Fly ash handling is considered for all technologies where fabric filter applications are used in the cases where the existing dry ESP will be removed.

The Wet FGD technology requires only the WFGD byproduct and chloride purge wastewater treatment be moved from the plant site to the landfill. The Wet FGD byproduct is expected to be landfill grade gypsum with 15% moisture content. The wastewater treatment solids are suspended solids from the FGD chloride purge stream with 60% moisture content.

**Table 2.1.18A. Wet FGD Spray Tower and Wet ESP Estimated Landfill Capacity.**

| Landfill Ash and Byproduct | | | | | |
|---|---|---|---|---|---|
| Sulfur | lb/MMBtu | 1.7 | 3.0 | 4.5 | 7.5 |
| Bottom Ash | ton/hr | 7.8 | 7.0 | 6.5 | 6.9 |
| | ton/year | 67,899 | 61,529 | 56,740 | 60,148 |
| Fly Ash | ton/hr | 31.0 | 28.1 | 25.9 | 27.5 |
| | ton/year | 271,596 | 246,117 | 226,961 | 240,591 |
| Gypsum ($CaSO_4 \cdot 2H_2O$) | ton/hr | 21.6 | 38.3 | 57.4 | 95.7 |
| | ton/year | 189,336 | 335,319 | 502,979 | 838,298 |
| WWT Solids | ton/hr | 1.1 | 2.0 | 3.0 | 5.0 |
| | ton/year | 10,000 | 17,500 | 26,200 | 43,800 |

With the ESP removed in the Dry FGD SDA and FF technology, the fly ash and FGD byproduct will require handling from various plant sites to the landfill.

The fly ash and FGD byproduct will be conditioned with water to minimize dusting and 30% moisture is used as a conservative estimate. The Dry FGD byproduct is a mixture of 60% calcium sulfite hemihydrate and 40% calcium sulfate dihydrate (gypsum). The fly ash and Dry FGD byproduct capacity in the following table must be added together to determine the total quantity going to the landfill from the Dry FGD SDA and FF system.

**Table 2.1.18B. Dry FGD SDA and FF Estimated Landfill Capacity.**

| Landfill Ash and Byproduct | | | |
|---|---|---|---|
| Sulfur | lb/MMBtu | 1.7 | 3.0 |
| Bottom Ash | ton/hr | 7.8 | 7.0 |
| | ton/year | 67,899 | 61,529 |
| Fly Ash | ton/hr | 40.3 | 36.5 |
| | ton/year | 353,075 | 319,952 |
| Mixture Calcium Sulfite/Sulfate | ton/hr | 24.2 | 44.2 |
| | ton/year | 212,175 | 386,916 |


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**Table 2.1.18C. IAQCS Estimated Landfill Capacity.**

| Landfill Ash and Byproduct | | | | | |
|---|---|---|---|---|---|
| Sulfur | lb/MMBtu | 1.7 | 3.0 | 4.5 | 7.5 |
| Bottom Ash | ton/hr | 7.8 | 7.0 | 6.5 | 6.9 |
| | ton/year | 67,899 | 61,529 | 56,740 | 60,148 |
| Fly Ash | ton/hr | 40.3 | 36.5 | 33.7 | 35.7 |
| | ton/year | 353,075 | 319,952 | 295,049 | 312,768 |
| Gypsum ($CaSO_4 \cdot 2H_2O$) | ton/hr | n/a | n/a | 56.8 | 94.7 |
| | ton/year | n/a | n/a | 497,949 | 829,915 |
| Mixture Calcium Sulfite/Sulfate | ton/hr | 24.2 | 44.2 | 0.6 | 0.9 |
| | ton/year | 212,175 | 386,916 | 4,926 | 8,210 |

**Table 2.1.18D. Dry FGD NID and FF Estimated Landfill Capacity.**

| Landfill Ash and Byproduct | | | | | |
|---|---|---|---|---|---|
| Sulfur | lb/MMBtu | 1.7 | 3.0 | 4.5 | 7.5 |
| Bottom Ash | ton/hr | 7.8 | 7.0 | 6.5 | 6.9 |
| | ton/year | 67,899 | 61,529 | 56,740 | 60,148 |
| Fly Ash | ton/hr | 40.3 | 36.5 | 33.7 | 35.7 |
| | ton/year | 353,075 | 319,952 | 295,049 | 312,768 |
| Mixture Calcium Sulfite/Sulfate | ton/hr | 24.9 | 45.6 | 70.6 | 115.2 |
| | ton/year | 218,094 | 399,135 | 618,028 | 1,009,025 |

Byproduct material from the FGD shall be loaded into trucks for disposal at a landfill.

## 2.1.19 ACCEPTABLE ABSORBER VESSEL METALLURGY

The Dry FGD SDA, FF, and associated ductwork shall be constructed of A36 carbon steel.

The Wet FGD Spray Tower vessel shall be constructed of solid C276. The wetted portion of the absorber inlet duct plus 20 feet upstream shall be constructed of solid C22. The outlet duct shall be constructed of solid C276 from the absorber to the stack breech duct expansion joint. The ductwork is expected to be FRP from the stack breech duct expansion joint to the liner which will also be constructed of FRP.

## 2.1.20 EQUIPMENT MAINTENANCE ACCESS

Major motors and equipment shall be accessible for maintenance purposes such as platforms. Overhead cranes or monorails will be provided to facilitate removing and installing components. Buildings shall have access hatches in the operating floors to transport equipment up through the floor to the appropriate elevation. All valves will be remotely operated or accessible from platforms.

## 2.1.21 WET FGD WASTEWATER TREATMENT PLANT

It is expected that the Wet FGD Spray Tower and Wet ESP option will require a wastewater treatment plant (WWTP) to remove suspended solids from the chloride purge stream before discharging to an ash pond. The following effluent design basis shall be used to estimate WWTP:

| | |
|---|---|
| Total Suspended Solids: | < 30 mg/L |
| pH: | 6 – 9 S.U. |
| Oil and Grease: | < 6 mg/L |
| Mercury: | < 20 ng/L |

The Wet FGD system shall be designed to maintain an equilibrium chloride concentration of 12,000 ppm. The equipment shall be sized to provide adequate purge flow for the worst case chlorine content, which is 0.19% based on the 1.7 lb/MMBtu SO2 fuel defined in section 2.1.9.


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In the FGD WWTP, two train redundancy is required. The primary and secondary clarifiers are to be sized at a rise rate of < 0.3 gpm/ft$^2$ and < 0.75 gpm/ft$^2$, respectively. Chemical feed systems must have one dedicated pump per train plus a common spare. See Figure 2.1.21 for a process flowchart of the expected FGD WWTP.

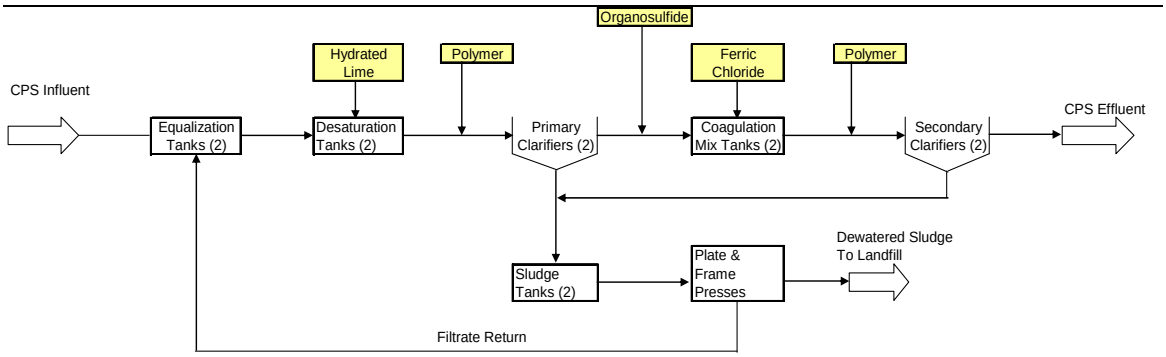


**Figure 2.1.21. Wet FGD Chloride Purge Stream WWTP Flowchart.**

## 2.1.22 STORMWATER RUNOFF CONTROLS

Stormwater shall be collected from all process islands in a stormwater settling pond before discharging to the river. Hard surfaces such as asphalt or concrete will be minimized to only plant roads and work areas (front end loader, operations). All other areas shall be crushed stone. All exposed steel, such as platforms, structural, roofing, etc shall not be galvanized. An inorganic zinc primer with two coats of acrylic paint shall be used.

## 2.1.23 MATERIAL HANDLING DESIGN BASIS

The FGD reagent for the SDA/FF and IAQCS technologies is pebble lime. The FGD reagent for the NID/FF technology is crushed lime. The waste products from these technologies are a byproduct from the scrubber process and fly ash both of which are captured in the fabric filter.

Limestone will be used for the Wet FGD Spray Tower and IAQCS technologies. The waste product from these technologies is landfill grade gypsum.

### 2.1.23.1 PEBBLE AND CRUSHED LIME SYSTEM

The Pebble and Crushed Lime Unloading Systems are designed to unload vacuum pressure pneumatic railcars or positive displacement trailer trucks. The primary delivery mode for these systems will be by rail.

**Major Rail Unloading Equipment:**

- Air Exhauster System
- Filter Separator
- Exhauster Building & Electrical/Controls room
- Transport piping and associated fittings
- Concrete unloading slab
- Rail scale
- Rail sampling system
- Top of railcar access platform(s)
- Rail sidings to store full and empty railcars


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**Major Truck Unloading Equipment**:

- Truck Scale
- Truck sampling system
- Concrete unloading slab

**Pebble and Crushed Lime Storage Silo:**

- One storage silo per unit will be provided to store lime
- The storage silos shall provide a total of 30 days capacity of lime at the normal slaker feedrate.
- Nuclear Level protection
- Bin Vent Filter
- Stair tower/elevator
- Local operator's room
- Silo roof shall be fully enclosed.

### 2.1.23.2 LIMESTONE SYSTEM

The Limestone Unloading System is designed to unload gravity discharge hopper railcars or dump trucks. The primary delivery mode of Limestone will be by rail.

**Major Limestone handling equipment:**

- Under track dump hopper with belt conveyor(s) to feed limestone to the Storage Pile.
- Storage pile to provide a minimum of 30 days of live material storage.
- Vibrating under-pile reclaim hopper to feed limestone to FGD process feed silo via belt conveyor.
- Emergency reclaim hopper, crusher and feeder to breakup frozen lumps of limestone from the storage pile and feed onto the reclaim conveyor.
- Rail sidings for full and empty railcars.
- Belt scale

### 2.1.23.3 WASTE PRODUCT SYSTEM

**Dry FGD SDA, Dry FGD NID and IAQCS Byproduct**

The Waste Byproduct Storage and Loading System are designed to store Waste Reagent and to condition/mix the waste reagent with water for loading into dump trucks for hauling to a waste landfill.

- One flat bottomed, concrete storage silo per unit will be provided to store Waste Reagent.
- The storage silo shall provide a minimum of 72 hours of live capacity of Waste Reagent at the design feed rate.
- Volumetric storage sizing shall be based upon the loose Bulk Density of the Waste Reagent material, or a combined Waste Reagent and Fly Ash if commingled without an operating precipitator.
- Pin Mixer/Unloaders will be used to mix the waste with water prior to loading into trucks for disposal.
- A heated fluidizing air system shall be provided to promote the flow of waste reagent out of the silo.
- The silo roof shall be enclosed for equipment protection in cold weather months.
- The truck loading area at the base of the storage silo shall be enclosed with rollup doors, water spray curtains, and a truck wash.


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- Silo to include Bin Vent Filter
- Nuclear High Level Protection
- Stair tower/elevator
- local operator's manbooth
- Truck scale

**Wet FGD and IAQCS Gypsum**

The Gypsum Storage & Loading System is designed to receive belt conveyed waste gypsum from the FGD process and provide 5 days of pile storage. Gypsum will be stored on a concrete pad enclosed on three sides for fugitive dust control. The stored gypsum will be reclaimed for disposal by a mobile front loader into open dump trucks for transport to a waste landfill. The pad will be designed such that any runoff water contacting the waste gypsum will be collected, stored in a surge tank, and processed through the WWTP for the Wet FGD option only. The gypsum pile runoff water for IAQCS will be collected and pumped to the dewatering hydroclone feed tank.

### 2.1.23.4 RAILCAR UNLOADING REQUIREMENTS

Table 2.1.23 indicates the number of railcars that must be unloaded each of the five days per week to supply the week's reagent consumption at design burn rates. This is a first pass document to get a sense of the number of railcars that will have to be handled to support each FGD option. The table 2.1.23 also includes approximate storage pile and storage silo/dome sizing for reference.

**Table 2.1.23. FGD Technology Reagent Consumption.**

| Reagent Consumption vs Fuel Spec vs Technology | | | | | |
|---|---|---|---|---|---|
| **Fuel Sulfur** | 1.7 | 3.0 | 4.5 | 7.5 | lb/MMBTU |
| | | | | | |
| **Wet FGD - Spray Tower and Wet ESP** | | | | | |
| **Limestone (CaCO3)** | 90,000 | 160,000 | 230,000 | 400,000 | Tons/Year |
| | 12.1 | 21.5 | 30.9 | 53.7 | Tons/Hr |
| | 290 | 516 | 742 | 1,272 | Tons/day Max Use |
| | 2,033 | 3,612 | 5,191 | 8,904 | Tons/week Max Use |
| Average Cars Unloaded | **4** | **7** | **10** | **18** | **Cars Unld per day, 5 days per week** |
| Storage Pile Size | **8,700** | **15,500** | **22,300** | **38,200** | Live Tons |
| | | | | | |
| **Dry FGD - Spray Dryer Absorber & Fabric Filter** | | | | | |
| **Pebble lime (CaO)** | 70,000 | 150,000 | N/A | N/A | Tons/Year |
| | 9.4 | 20.1 | N/A | N/A | Tons/Hr |
| | 226 | 482 | N/A | N/A | Tons/day Max Use |
| | 1,579 | 3,377 | N/A | N/A | Tons/week Max Use |
| Average Cars Unloaded | **3** | **7** | N/A | N/A | **Cars Unld per day, 5 days per week** |
| Storage Silo/Dome Total Cap | **6,780** | **14,500** | N/A | N/A | Live Tons |


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**Table 2.1.23. Continued.**

| Reagent Consumption vs Fuel Spec vs Technology | | | | | |
|---|---|---|---|---|---|
| **Fuel Sulfur** | 1.7 | 3.0 | 4.5 | 7.5 | lb/MMBTU |
| | | | | | |
| **Dry FGD - NID & Fabric Filter** | | | | | |
| **Crushed lime (CaO)** | 71,600 | 134,800 | 214,810 | 350,700 | Tons/Year |
| | 9.6 | 18.1 | 28.8 | 47.1 | Tons/Hr |
| | 230 | 434 | 692 | 1,130 | Tons/day Max Use |
| | 1,613 | 3,041 | 4,838 | 7,913 | Tons/week Max Use |
| Average Cars Unloaded | **3** | **6** | **10** | **16** | **Cars Unld per day, 5 days per week** |
| Storage Silo/Dome Total Cap | **6,900** | **13,000** | **20800** | **33900** | Live Tons |
| | | | | | |
| **Integrated Spray Dryer Absorber, Fabric Filter, & Spray Tower** | | | | | |
| **Limestone (CaCO3)** | N/A | N/A | 227,900 | 379,900 | Tons/Year |
| | N/A | N/A | 30.6 | 51.0 | Tons/Hr |
| | N/A | N/A | 734.0 | 1,224.0 | Tons/day Max Use |
| | N/A | N/A | 5,141.0 | 8,568.0 | Tons/week Max Use |
| Average Cars Unloaded | N/A | N/A | **10.2** | **17.1** | **Cars Unld per day, 5 days per week** |
| Storage Pile Size | N/A | N/A | **22,000** | **36,700** | Live Tons |
| **Pebble lime (CaO)** | 70,000 | 150,000 | 12,600 | 21,000 | Tons/Year |
| | 9.4 | 20.1 | 1.7 | 2.8 | Tons/Hr |
| | 226.0 | 482.0 | 41.0 | 67.0 | Tons/day Use |
| | 1,580.0 | 3,377.0 | 286.0 | 470.0 | Tons/week Use |
| Average Cars Unloaded | **3** | **7** | **0.6** | **0.9** | **Cars Unld per day, 5 days per week** |
| Storage Silo/Dome Total Cap | **6,780.0** | **14,500.0** | **1,230.0** | **2,010.0** | Live Tons |
| **Total Integrated Reagent** | 70,000 | 150,000 | 240,500 | 400,900 | Tons/Year |
| | 9.4 | 20.1 | 32.3 | 53.8 | Tons/Hr |
| **Total Average Cars Unloaded** | **3** | **7** | **11** | **18** | **Cars Unld per day, 5 days per week** |

Notes:
1. ton/year numbers are at 85% capacity factor
2. ton/hr numbers are at 100% capacity factor
3. assume 100 tons per rail car capacity


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## 2.2 TECHNOLOGY OVERVIEWS/EQUIPMENT ARRANGEMENTS

The following provides a narrative overview, conceptual process flow chart, and advantages & disadvantages for each FGD technology being considered for Big Sandy Unit 2.

### 2.2.1 SPRAY TOWER AND WET ESP SYSTEM OVERVIEW

The Wet FGD system can be divided into three major operating islands; Reagent Storage & Preparation, Absorber, and Dewatering.

The Absorber Island consists of the flue gas path equipment such as the induced draft (ID) fans, spray tower, absorber reaction tank, flue gas mist eliminators, wet electrostatic precipitator, and stack.

Flue gas from the ID fan enters the middle section of the spray tower. Slurry from the absorber reaction tank is sprayed down as the flue gas passes up through the spray tower. Nozzles attached to a spray header distribute the slurry across the tower. Slurry droplets created by the spray nozzles absorb the SO2 which is then collected in the absorber reaction tank. In the absorber reaction tank, oxidation air is added to the slurry where the reaction between dissolved limestone and the SO2 absorbed in the water form calcium sulfate or gypsum. Limestone slurry is continuously added to maintain the desired pH in the absorber reaction tank. The gypsum is removed from the absorber tank and then dewatered to produce a suitable product for landfill.

In principle, the wet electrostatic precipitator is similar to a dry electrostatic precipitator. Particulate in the flue gas is charged and collected on an oppositely charged surface. However for a wet electrostatic precipitator, water is continually passed over the collection surface to remove particulate and collect it in a sump. The water from the wet electrostatic precipitator will be used as reclaim water for the spray tower. The Wet ESP will be integral with the absorber. Alkali adjustment of the Wet ESP water is required.

The Reagent Preparation & Storage Island consists of the limestone stack out pad, limestone silos, ball mills, limestone slurry hydroclones, limestone slurry storage tanks, and limestone slurry transfer pumps. Limestone is stored in an uncovered pile outside of the reagent preparation building. Limestone is transferred by conveyor from the active pile to the limestone silo located above the ball mill. Limestone is then metered by conveyor from the silo into the ball mill where it is mixed with water and pulverized into smaller particles to produce limestone slurry. The limestone slurry is passed through a hydroclone where the oversized particles in the underflow are returned to the ball mill for pulverizing again and the overflow is stored in the limestone slurry storage tank and fed to the absorber reaction tank.

The Dewatering Island consists of the hydroclone feed tanks, gypsum hydroclones, vacuum belt filters and ancillary equipment, reclaim water tank, and gypsum conveyors. The gypsum slurry is stored in the hydroclone feed tank and fed to the hydroclone to concentrate the gypsum slurry before feeding it to the vacuum belt. The overflow from the hydroclone is reclaim water which is stored in the reclaim tank and reused back in the absorber area to control density and level in the absorber. The underflow from the hydroclone is the gypsum slurry that is dewatered further by the vacuum belt filter to produce gypsum. The filtrate water from the vacuum belt is returned to the reclaim water tank. A portion of the reclaim water is purged from the system to the wastewater treatment plant. The reclaim water purge reduces the concentration of chlorides in the FGD system and protects the metallurgy from chloride attack or corrosion.

Conveyors are used to collect the gypsum off the vacuum belt and transport it to a stack out pad. From the stack out pad, the gypsum is loaded into trucks and transported to the landfill. The stack out pad shall have walls on 3 sides to control fugitive dust.


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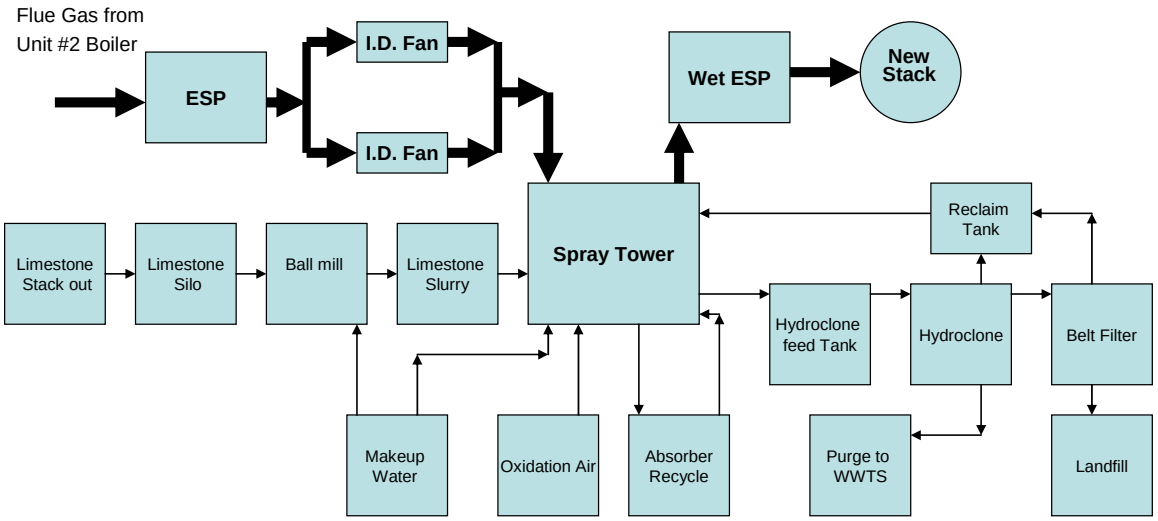


**Figure 2.2A. Wet FGD – Spray Tower & Wet ESP Process Flow Chart.**

### 2.2.1.1 SPRAY TOWER & WET ESP ADVANTAGES

- Wet FGD spray towers can achieve 98% SO2 removal burning coals up to 7.5 lb/MMBtu SO2 coals.
- Wet ESP can collect particulate, SO3, and some hazardous air pollutants (HAPs).
- The AEP fleet has experience with several Wet FGD spray towers. However, no Wet ESP is installed on the AEP fleet.
- Co-benefit of mercury removal in Wet FGD and Wet ESP when installed downstream of an SCR and no carbon injection required.

### 2.2.1.2 SPRAY TOWER & WET ESP DISADVANTAGES

- Wet FGD uses a large quantity of water and requires a wastewater treatment system to control chloride concentration in the absorber vessel.
- Spray towers are equipped with a mist eliminator which requires a fresh water supply for washing.
- Wet ESP is an additional electrical load that requires power distribution equipment.
- Wet ESP materials of construction are high cost, high alloy materials.
- Very few utility applications of Wet ESP and Big Sandy Unit 2 would be one of the largest Wet ESPs constructed.
- Visibility issues with a wet plume and public perception.
- Increased rail and truck traffic.


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### 2.2.2 SDA & FF SYSTEM OVERVIEW

The Dry FGD gas path equipment consists of the spray dryer absorber, fabric filter, induced draft (ID) fans, and a stack.

Flue gas from the existing electrostatic precipitator enters the spray dryer absorber vessel where it contacts a mixture of lime slurry and recycle solids. This contact and mass transfer is enhanced by a rotary atomizer. The atomizer is a high speed rotating disk with an opening along the circumference that reduces the lime slurry to fine droplets. The very small atomized lime slurry droplets have a large surface area that absorbs the SO2 in the flue gas to form calcium sulfite/sulfate byproducts. A fabric filter located downstream of the spray dryer absorber is used to collect the byproducts and fly ash. A portion of scrubber byproduct, which contains some reactive lime, is recycled back to the spray dryer absorber and the remainder is disposed in a landfill.

The spray dryer absorber vessel and fabric filter operate above the flue gas saturation temperature such that all the water entering the SDA vessel with the lime slurry is evaporated before it leaves the vessel.

The Dry FGD reagent and byproduct major equipment consist of the lime handling, lime slurry preparation and feed, byproduct recycle, and byproduct handling and disposal. Each major equipment component will consist of other equipment to support the main function such as pumps, blowers, and conveyors.

Lime slurry is produced by adding water to pebble lime (CaO, calcium oxide) which reacts chemically to form calcium hydroxide ($Ca(OH)_2$) and is referred to as lime slaking. Lime slurry is stored in the lime slurry storage tank and is fed to the spray dryer feed tank along with the recycle from the fabric filter. The scrubber byproducts and fly ash going to the landfill is stored in a byproduct silo and then transported to the landfill.

The Waste Reagent Disposal Silo should be sized for 72 hours of storage. The storage silo shall be a fluidized flat-bottomed design with two fluidized outlet hoppers to discharge waste reagent at a controlled rate into one of two pin conditioning mixers. The silo will have bin vent filters/or filter separators, level indicator, a High and High-High level alarms, a vacuum/pressure safety relief valve, roof mounted manway, and a side mounted top-hat manway six feet above the bin floor. The silo roof will be enclosed for weather protection.


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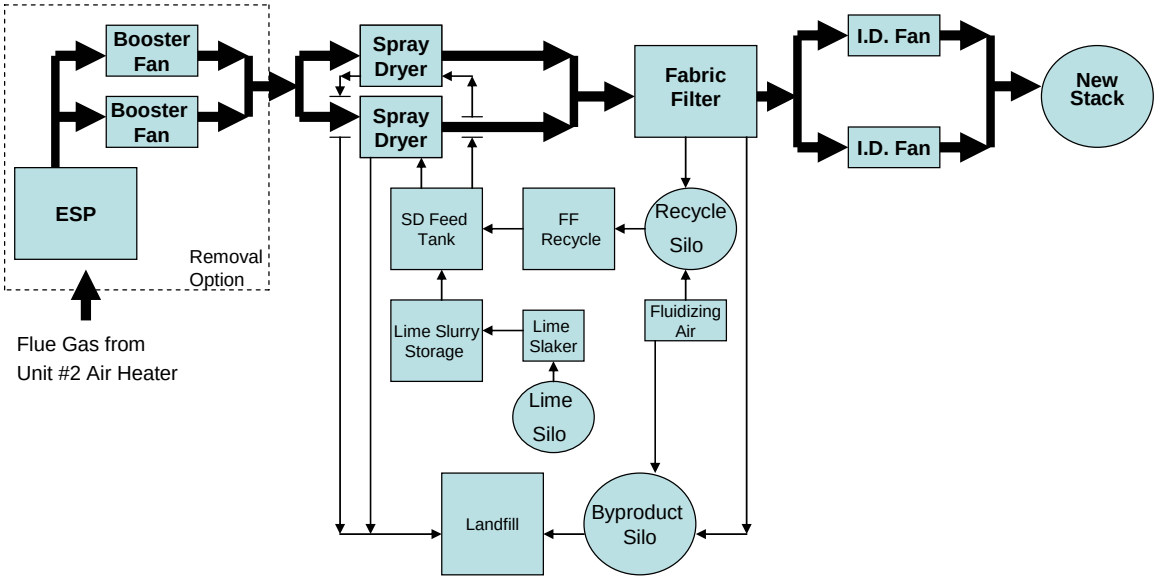


**Figure 2.2B. Dry FGD – SDA & FF Process Flow Chart.**

### 2.2.2.1 SDA & FF ADVANTAGES

- Dry FGD evaporates all the water added to the SDA and collects dry waste material in the fabric filter.
- Since the SDA byproduct is a dry, there is no need for solids dewatering equipment or any subsequent wastewater treatment systems.
- The fabric filter removes particulate, SO3, as well as some hazardous air pollutants (HAPs).
- Fabric filter allows the removal of existing ESP and associated cost such as parasitic load, maintenance, and avoids the need for future dry fly ash handling conversion. This can only be accomplished if the flue gas pressure drop and ID fan pressure rise design can be satisfied without the use of intermediate booster fans.
- Smaller footprint for Dry FGD relative to Wet FGD.

### 2.2.2.2 SDA & FF DISADVANTAGES

- The SDA & FF operate above the flue gas saturation temperature thus limiting the chemical reactions between the atomized lime slurry and sulfur dioxide (SO2). This restricts the effective deployment of an SDA & FF to lower sulfur coals with the maximum at 3.0 lb/MMBtu SO2 at 95% removal.
- The reagent stoichiometry is 1.5 to 1.8, which results in high lime consumption per unit of SO2 removed.
- The high-speed rotary atomizer will require frequent scheduled maintenance, not typical to the power industry equipment.


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- Mercury control requires the addition of powdered activated carbon (PAC) injection systems upstream of the SDA & FF.

- Increased rail and truck traffic.

### 2.2.3 IAQCS SYSTEM OVERVIEW

A major advantage of the IAQCS is the implementation can be phased in over time with the sulfur content of the fuel in order to spread out the total installed capital cost. For example in the case of Big Sandy Unit 2, only the Dry FGD SDA/FF portion can be installed while burning the existing 1.7 lb/MMBtu SO2 fuel, which will avoid other capital cost such as coal pile and boiler modifications. However, future Wet FGD footprint and infrastructure consideration must be planned for in the Dry FGD design basis. For IAQCS consideration, boiler modifications are required above a 1.7 lb/MMBtu fuel and the spray tower installation would occur above a 4.5 lb/MMBtu fuel. The phased implementation of the IAQCS is expected to make this option more competitive at the lower sulfur fuel cases, and should be evaluated phased and non-phased.

The SO2 removal efficiency in the IAQCS is expected to be 98% across the entire range of the sulfur content in the fuel. This is based on SO2 removal in the SDA/FF, as well as the spray tower. At the lower sulfur range, 1.7 to 3.0 lb/MMBtu, the SO2 removal efficiency is expected to be 95% with only the SDA/FF in service. At higher sulfur range, 4.5 to 7.5 lb/MMBtu, the spray tower would be installed and the overall SO2 removal efficiency would be 98% with only 1% removal in the SDA/FF and the remaining in the spray tower. Utilizing the spray tower for the majority of the SO2 removal in the IAQCS is based on limestone having a lower stoichiometry and reagent delivery cost as compared to pebble lime. In addition to the 1% SO2 removal efficiency in the SDA/FF, it will also result in the complete system removing more SO3, HCl, and HF.

The IAQCS system is made up of a dry and wet FGD system in series. The dry FGD system consists of the spray dryer absorber (SDA) and the fabric filter (FF). The wet FGD system consists of the spray tower, which is located downstream of the SDA and FF. Therefore the IAQCS system overview is basically a combination of the dry and wet FGD technologies.

Flue gas from the existing electrostatic precipitator enters the spray dryer absorber vessel where it contacts a mixture of lime slurry and recycle solids. This mass transfer is enhanced by a rotary atomizer. The atomizer is a high speed rotating disk with openings along the circumference that reduces the lime slurry to fine droplets. The very small atomized lime slurry droplets have a large surface area that absorbs the SO2 in the flue gas. In the droplet, the SO2 reacts with dissolved calcium to form calcium sulfite/sulfate byproducts. A fabric filter is located downstream of the spray dryer absorber and is used to collect the byproducts and fly ash. A portion of scrubber byproduct, which contains some reactive lime, is recycled back to the spray dryer absorber and the remainder is disposed in a landfill.

The spray dryer absorber vessel and fabric filter operates approximately 30°F above the flue gas saturation temperature such that all the water entering the SDA vessel with the lime slurry is evaporated before it leaves the vessel.

The Dry FGD reagent and byproduct major equipment consist of a variety of processes. These include: lime handling, lime slurry preparation and storage, byproduct recycle, byproduct handling and disposal.

Lime slurry is produced by adding water to pebble lime (CaO, calcium oxide) which reacts chemically to form calcium hydroxide ($Ca(OH)_2$) and is referred to as lime slaking. Lime slurry is stored in the lime slurry storage tank and is fed to the spray dryer feed tank along with the


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byproduct recycled from the fabric filter. In the IAQCS dry scrubber, the byproducts and fly ash is stored in a byproduct silo and then transported to the landfill.

The Byproduct Silo is sized for 72 hours of storage. The storage silo is a fluidized flat-bottomed design with two fluidized outlet hoppers to discharge waste byproduct at a controlled rate into one of two pin mixers for conditioning purposes. The silo has bin vent filters/or filter separators, level indicator, a High and a High-High level alarms, a vacuum/pressure safety relief valve, roof mounted manway, and a side mounted top-hat manway six feet above the bin floor. The silo roof will be enclosed for weather protection.

The Wet FGD system can be divided into three major operating islands; Reagent Storage & Preparation, Absorber, and Dewatering.

The Absorber Island consists of the flue gas path equipment such as the induced draft (ID) fans, spray tower, absorber reaction tank, flue gas mist eliminators, and stack.

Flue gas from the ID fans, which are located downstream of the Dry SDA/FF, enters the middle section of the spray tower. Slurry from the absorber reaction tank is sprayed down as the flue gas passes up through the spray tower. Nozzles attached to a spray header distribute the slurry across the tower. Slurry droplets created by the spray nozzles absorb the SO2 where neutralization begins and continues in the absorber reaction tank. In the absorber reaction tank, oxidation air is added to the slurry where the reaction between dissolved limestone and the SO2 absorbed forms calcium sulfate or gypsum. Limestone slurry is continuously added to maintain the desired pH in the absorber reaction tank. The gypsum is removed from the absorber tank and then dewatered to produce a suitable product for landfill.

The Reagent Preparation & Storage Island consists of the limestone rail unloading, limestone stack out pad, limestone silos, ball mills, limestone slurry hydroclones, limestone slurry storage tanks, and limestone slurry transfer pumps. Limestone is stored in an uncovered pile outside of the reagent preparation building. Limestone is transferred by conveyor from the active pile to the limestone silo located above the ball mill.

Limestone is then metered by conveyor from the silo into the ball mill where it is mixed with water and pulverized into smaller particles to produce limestone slurry. The limestone slurry is passed through a hydroclone where the oversized particles in the underflow are returned to the ball mill for pulverizing again and the overflow is stored in the limestone slurry storage tank and fed to the absorber reaction tank.

The Dewatering Island consists of the hydroclone feed tanks, gypsum hydroclones, vacuum belt filters and ancillary equipment, reclaim water tank, and gypsum conveyors. The gypsum slurry is stored in the hydroclone feed tank and fed to the hydroclone to concentrate the gypsum slurry before feeding it to the vacuum belt. The overflow from the hydroclone is reclaim water which is stored in the reclaim tank and reused back in the absorber area to control density and level in the absorber.

The underflow from the hydroclone is dewatered further by the vacuum belt filter to separate the gypsum in the final byproduct. The filtrate water from the vacuum belt is returned to the reclaim water tank. A portion of the reclaim water is purged from the system to the Dry FGD SDA. The reclaim water purge reduces the concentration of chlorides in the Wet FGD system and protects the metallurgy from chloride attack or corrosion.

Conveyors are used to collect the gypsum off the vacuum belt and transport it to a stack out pad. From the stack out pad, the gypsum is loaded into trucks and transported to the landfill. The stack out pad shall have walls on 3 sides to control fugitive dust.


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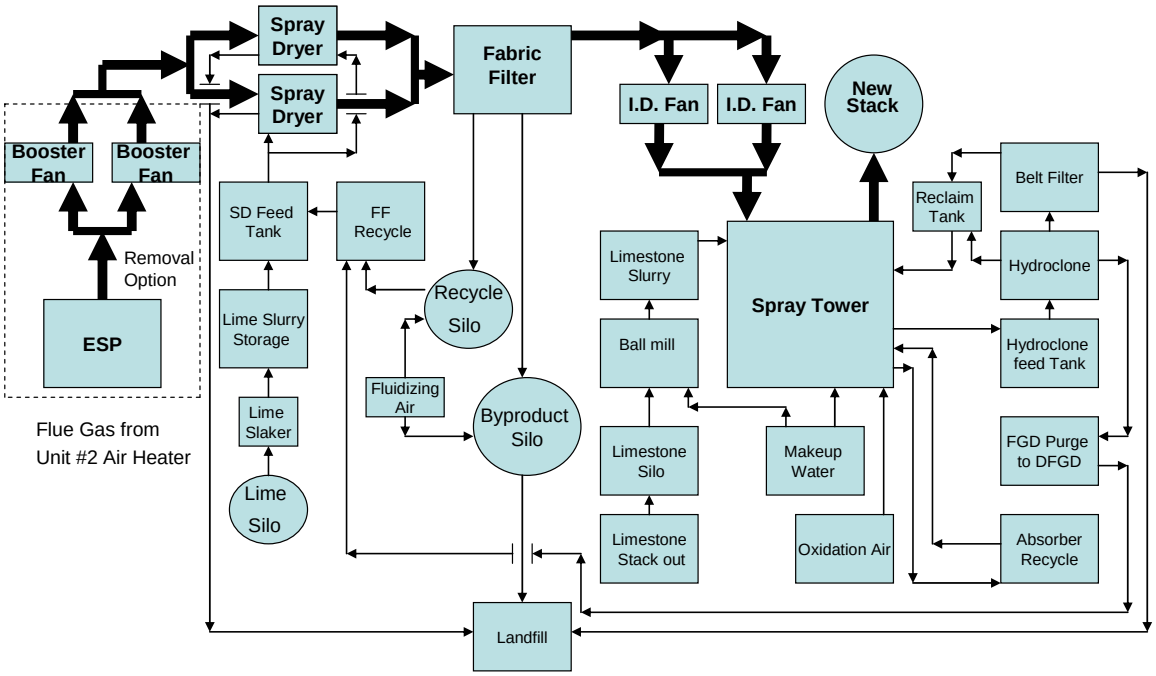


**Figure 2.2C. IAQCS Process Flow Chart.**

### 2.2.3.1 IAQCS ADVANTAGES

- IAQCS can achieve 98% SO2 removal burning coals up to 7.5 lb/MMBtu SO2 coals.
- The IAQCS can be installed in two phases to defer capital investment relative to current low sulfur fuel use. Therefore a dry FGD first for burning current lower sulfur coal and the wet FGD second for burning higher sulfur coal at a later date. However, the equipment arrangement footprint and infrastructure must be designed to accommodate a future spray tower and associated equipment such as reagent storage and preparation, absorber, dewatering and a wet stack.
- There is no waste water treatment plant required. The spray tower chloride purge stream can be used as makeup water in the SDA. This will control solids, chlorides, and metals.
- Fabric filter allows the removal of existing ESP and booster fans and associated cost such as parasitic load, maintenance, and avoids the need for future dry fly ash handling conversion. This can only be accomplished if the flue gas pressure drop and ID fan pressure rise design can be satisfied without the use of intermediate booster fans.
- The fabric filter removes particulate, SO3, as well as some hazardous air pollutants (HAPs).

### 2.2.3.2 IAQCS DISADVANTAGES

- Visibility issues with a wet plume and public perception.
- Increasing rail and truck traffic for lime, limestone, SDA byproduct, and gypsum.


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- Two reagent storage and preparation islands are required; one for lime slurry in the Dry FGD SDA and the other for limestone slurry in the Wet FGD spray tower.

- The high-speed rotary atomizer will require frequent scheduled maintenance, not typical to the power industry equipment.

- Mercury control requires the addition of powdered activated carbon (PAC) injection systems upstream of the SDA & FF.

- IAQCS is a complex cycle relative to combining a Dry and Wet FGD system.

- IAQCS is the largest footprint of all options.

### 2.2.4 NID & FF SYSTEM OVERVIEW

The Dry FGD NID gas path equipment consists of the J-reactor, fabric filter, induced draft (ID) fans, and stack.

Flue gas from the existing electrostatic precipitator and booster fans enters the inlet plenum of the NID where it splits into modules which are comprised of individual J-reactors and fabric filters. Each J-reactor and fabric filter module is equipped with an inlet louver damper and an outlet poppet damper for isolation and maintenance purposes. Modules are placed in and out of service to follow load.

The J-reactor is a vertical duct with a venturi section and elbow near the bottom hence the configuration of the reactor resembles the letter "J" as the name implies. Flue gas passes through the venturi and elbow section of the J-reactor and then up through the vertical section of the reactor. In the vertical section of the reactor, a mixture of lime and byproduct solids from the fabric filter with approximately 5% moisture content is introduced into the duct upstream of a dispersion plate. The lime and byproduct solids are entrained in the flue gas which enhances the absorption of the SO2 to form the calcium sulfite/sulfate byproducts. A screw conveyor is located on the bottom of the J-reactor to remove solids if the module is removed from service without purging the reactor.

A fabric filter located downstream of the J-reactor is used to collect the byproducts and fly ash. A large portion of byproduct and fly ash contains reactive lime similar to a SDA/FF. Some of this reactive lime is available for SO2 and SO3 neutralization. However, much goes unreacted on a single pass so the filter material, including lime, is recycled back to the J-reactor for additional SO2 and SO3 removal. An air slide or fluidized trough is used to transport the byproducts and fly ash from the fabric filter to the NID mixer where it is mixed with lime and sprayed with water. The remainder is disposed in a landfill.

The NID and fabric filter operates above the flue gas saturation temperature such that all the water entering the J-reactor is evaporated before it enters the fabric filter.

The Dry FGD NID reagent and byproduct major equipment consist of lime storage, lime hydrator, and NID mixer, byproduct storage and disposal. Each major equipment component will consist of other equipment to support the main function such as blowers, feeders, and conveyors.

Each J-reactor is equipped with a lime hydrator and NID mixer. Crushed lime stored in the main silo is pneumatically transferred to day silos each dedicated to a pair of J-reactors. The lime is then conveyed to the lime hydrator where it is sprayed with water. The lime is then mixed with byproduct solids and fly ash captured in the fabric filter and again sprayed with water to achieve an overall moisture content of 5%. The mixture of lime and byproducts solids is then introduced into the vertical section of the J-reactor. Lime is added to the mixer to control the SO2 removal


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efficiency. Water is added to the mixer to control the approach to saturation temperature near 25°F.

The Byproduct Disposal Silo should is sized for 72 hours of storage. The storage silo is a fluidized flat-bottomed design with two fluidized outlet hoppers to discharge waste reagent at a controlled rate into one of two pin conditioning mixers. The silo has a bin vent filter, level indicator, a High and a High-High level alarms, a vacuum/pressure safety relief valve, roof mounted manway, and a side mounted top-hat manway six feet above the bin floor. The silo roof is enclosed for weather protection.

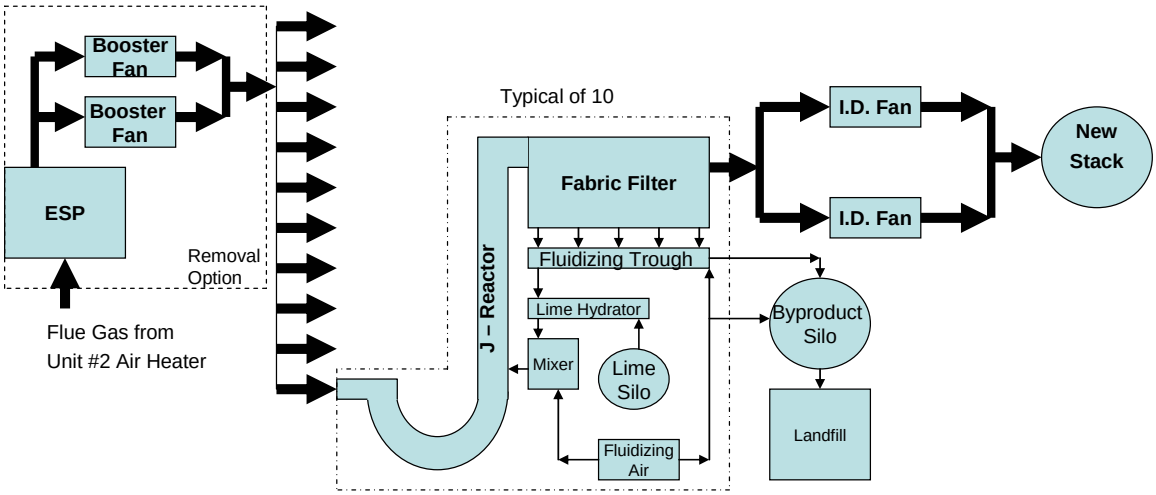


**Figure 2.2D Dry FGD – NID & FF Process Flow Chart.**

### 2.2.4.1 NID & FF ADVANTAGES

- NID can achieve 98% SO2 removal burning coals up to 6.0 lb/MMBtu SO2 coals or 96% SO2 removal burning coals up to 7.5 lb/MMBtu SO2 coals.
- NID evaporates all the water added to the J-reactor and collects dry waste material in the fabric filter.
- NID module design allows on-line scheduled maintenance.
- Since the NID byproduct is dry, there is no need for solids dewatering equipment or any subsequent wastewater treatment systems.
- The fabric filter removes particulate, SO3, as well as some hazardous air pollutants (HAPs).
- Fabric filter allows the removal of existing ESP and booster fans and associated cost such as parasitic load, maintenance, and avoids the need for future dry fly ash handling conversion. This can only be accomplished if the flue gas pressure drop and ID fan pressure rise design can be satisfied without the use of intermediate booster fans.
- NID/FF is the smallest footprint of all options.



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- The NID system uses a lime hydrator and mixer to inject relatively dry lime and byproduct recycle solids in the J-reactor. Therefore, no slurry handling or high speed rotary atomizer is required.

#### 2.2.4.2 NID & FF DISADVANTAGES

- The NID reagent stoichiometry is 1.5 to 1.8, which results in high lime consumption per unit of SO2 removed.

- Mercury control requires the addition of powdered activated carbon (PAC) injection systems upstream of the NID & FF.

- Daily cleaning of water injection nozzles is required in the mixer due to ash build up around the water nozzle.

- Increasing rail and truck traffic.

## 2.3 OPERATING CONDITIONS

The FGD System shall be designed to operate under each of the following conditions without impeding the normal operation of the steam generator while continuously achieving the specified sulfur dioxide ($SO_2$) removal efficiency.

- During all periods of steam generator operation from initial start-up to full load.
- Continuous service at the maximum absorber inlet flue gas conditions.
- Continuous service at minimum load.
- During steam generator load swings from 33 to 100 percent of the maximum inlet flue gas flow rate.
- During extended periods of the steam generator start-up while burning No. 2 Fuel Oil, coal, or any combination thereof.
- Weekly start-up, following any weekend shutdown, which lasts approximately 48 hours.

The Owner anticipates that the following type of operating abnormalities may occur to varying degrees throughout the operating life of the plant. While specific design criteria for all possible conditions cannot be defined herein, the Consultant shall be aware of the Owner's concern and consequently make necessary design provisions to insure that the following potential abnormalities do not cause catastrophic failure to the FGD System equipment or its auxiliary equipment.

- The complete loss of normal on-site power.
- Air heater failure resulting in abnormal absorber inlet temperature excursions to approximately 500 °F for periods up to 30 minutes.
- A loss of any combination of absorber process liquor flows at the normal absorber inlet temperature of 350 °F for periods of up to 30 minutes (WFGD consideration only).

If the FGD system design includes more than one absorber vessel, the system shall be arranged and configured to permit reduced load operation with one absorber vessel removed from service.


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## 2.4 SITE ENVIRONMENTAL CONDITIONS

The table below lists the general Big Sandy Plant site environmental conditions.

**Table 2.4. Big Sandy Plant Site Environmental Conditions.**

| Condition | Value/Range |
|---|---|
| Plant Elevation at Grade | 568 ft above sea level |
| Ambient Temperature Normal Range, °F | -20 to 97 |
| Ambient Relative Humidity Range, % | 25 to 100 |
| | |
| Annual Average Temperature, °F | 56.1 |
| Annual Average Relative Humidity, % | 70 |
| Annual Average Summer Temperature, °F | 74.3 |
| Annual Average Winter Temperature, °F | 37.5 |
| | |
| Average Wind Velocity (mph) | 6.7 |
| Prevailing Wind Direction (Degrees) | 186 |
| Annual Average Precipitation (inches) | 43.06 |

# 3.0 TECHNOLOGY COST DRIVERS

The purpose of this section is to identify some of the expected capital and operating cost drivers for the FGD technologies being considered for Big Sandy Unit 2. The Consultant as part of the cost estimate development for each technology shall identify any other capital and operating cost drivers not listed here.


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**Table 3.0A. Wet FGD Spray Tower and Wet ESP Cost Drivers.**

| Capital Cost Drivers | | 1.7 lb/MMBtu SO2 | 3.0 lb/MMBtu SO2 | 4.5 lb/MMBtu SO2 | 7.5 lb/MMBtu SO2 |
|---|---|---|---|---|---|
| ID Fans | | Yes | Yes | Yes | Yes |
| Wet ESP | | Yes | Yes | Yes | Yes |
| New Stack | | Yes | Yes | Yes | Yes |
| Reagent Preparation Island | | Yes | Yes | Yes | Yes |
| Byproduct dewatering Island | | Yes | Yes | Yes | Yes |
| Absorber Island | | Yes | Yes | Yes | Yes |
| FGD WWT Plant | | Yes | Yes | Yes | Yes |
| Trona System | | No | No | No | No |
| FGD DCS System - Ovation | | Yes | Yes | Yes | Yes |
| Compressed Air (CA) | | Yes | Yes | Yes | Yes |
| Service Water (SW) | | Yes | Yes | Yes | Yes |
| Potable Water (PW) | | Yes | Yes | Yes | Yes |
| CEMS | | Yes | Yes | Yes | Yes |
| Truck and Rail Infrastructure | | Yes | Yes | Yes | Yes |
| Auxiliary Power Distribution | | Yes | Yes | Yes | Yes |
| Capital Replacements | | Yes | Yes | Yes | Yes |
| **Operating Variable Cost Drivers** | | | | | |
| Draft Load | | Yes | Yes | Yes | Yes |
| FGD Equipment Load | | Yes | Yes | Yes | Yes |
| Aux Power Wet ESP | | Yes | Yes | Yes | Yes |
| FGD Reagent (Limestone) | | Yes | Yes | Yes | Yes |
| Make-up Water | | Yes | Yes | Yes | Yes |
| SO3 Mitigation (Trona) | | No | No | No | No |
| FGD WWT Chemicals | | Yes | Yes | Yes | Yes |
| Maintenance Material/Equip | | Yes | Yes | Yes | Yes |
| **Operating Fixed Cost Drivers** | | | | | |
| Operators | | Yes | Yes | Yes | Yes |
| Maintenance Mechanics | | Yes | Yes | Yes | Yes |
| I&C Technicians | | Yes | Yes | Yes | Yes |
| Maintenance Planner | | Yes | Yes | Yes | Yes |
| Supervision | | Yes | Yes | Yes | Yes |
| Overheads | | Yes | Yes | Yes | Yes |


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**Table 3.0B. Dry FGD SDA and FF Cost Drivers.**

| Capital Cost Drivers | | 1.7 lb/MMBtu SO2 | 3.0 lb/MMBtu SO2 |
|---|---|---|---|
| ID Fans | | Yes | Yes |
| Fabric Filter | | Yes | Yes |
| New Stack | | Yes | Yes |
| Reagent Preparation Island | | Yes | Yes |
| Byproduct Dewatering Island | | No | No |
| Absorber Island | | Yes | Yes |
| FGD WWT Plant | | No | No |
| Trona System | | No | No |
| FGD DCS System - Ovation | | Yes | Yes |
| Compressed Air (CA) | | Yes | Yes |
| Service Water (SW) | | Yes | Yes |
| Potable Water (PW) | | Yes | Yes |
| CEMS | | Yes | Yes |
| Activated Carbon Injection | | Yes | Yes |
| Truck and Rail Infrastructure | | Yes | Yes |
| Auxiliary Power Distribution | | Yes | Yes |
| Capital Replacements | | Yes | Yes |
| **Operating Variable Cost Drivers** | | | |
| Draft Load | | Yes | Yes |
| FGD Equipment Load | | Yes | Yes |
| FGD Reagent (Lime) | | Yes | Yes |
| Activiated Carbon | | Yes | Yes |
| Make-up Water | | Yes | Yes |
| SO3 Mitigation (Trona) | | No | No |
| FGD WWT Chemicals | | No | No |
| Maintenance Material/Equip | | Yes | Yes |
| **Operating Fixed Cost Drivers** | | | |
| Operators | | Yes | Yes |
| Maintenance Mechanics | | Yes | Yes |
| I&C Technicians | | Yes | Yes |
| Maintenance Planner | | Yes | Yes |
| Supervision | | Yes | Yes |
| Overheads | | Yes | Yes |


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**Table 3.0C. IAQCS Cost Drivers.**

| Capital Cost Drivers | | 1.7 lb/MMBtu SO2 | 3.0 lb/MMBtu SO2 | 4.5 lb/MMBtu SO2 | 7.5 lb/MMBtu SO2 |
|---|---|---|---|---|---|
| ID Fans | | Yes | Yes | Yes | Yes |
| Wet ESP | | No | No | No | No |
| New Stack | | Yes | Yes | Yes | Yes |
| Absorber Island - Spray Tower | | No | No | Yes | Yes |
| Absorber Island - SDA | | Yes | Yes | Yes | Yes |
| Reagent Preparation - Limestone | | No | No | Yes | Yes |
| Reagent Preparation - Lime | | Yes | Yes | Yes | Yes |
| Byproduct Dewatering - Gypsum | | No | No | Yes | Yes |
| Byproduct Island - SDA & FF | | Yes | Yes | Yes | Yes |
| FGD WWT Plant | | No | No | No | No |
| Trona System | | No | No | No | No |
| Activated Carbon Injection | | Yes | Yes | Yes | Yes |
| FGD DCS System - Ovation | | Yes | Yes | Yes | Yes |
| Compressed Air (CA) | | Yes | Yes | Yes | Yes |
| Service Water (SW) | | Yes | Yes | Yes | Yes |
| Potable Water (PW) | | Yes | Yes | Yes | Yes |
| CEMS | | Yes | Yes | Yes | Yes |
| Truck and Rail Infrastructure | | Yes | Yes | Yes | Yes |
| Auxiliary Power Distribution | | Yes | Yes | Yes | Yes |
| Capital Replacements | | Yes | Yes | Yes | Yes |
| **Operating Variable Cost Drivers** | | | | | |
| Draft Load | | Yes | Yes | Yes | Yes |
| FGD Equipment Load | | Yes | Yes | Yes | Yes |
| Aux Power Wet ESP | | No | No | No | No |
| FGD Reagent (Limestone) | | No | No | Yes | Yes |
| FGD Reagent (Lime) | | Yes | Yes | Yes | Yes |
| Activated Carbon | | Yes | Yes | Yes | Yes |
| Make-up Water | | Yes | Yes | Yes | Yes |
| SO3 Mitigation (Trona) | | No | No | No | No |
| FGD WWT Chemicals | | No | No | No | No |
| Maintenance Material/Equip | | Yes | Yes | Yes | Yes |
| **Operating Fixed Cost Drivers** | | | | | |
| Operators | | Yes | Yes | Yes | Yes |
| Maintenance Mechanics | | Yes | Yes | Yes | Yes |
| I&C Technicians | | Yes | Yes | Yes | Yes |
| Maintenance Planner | | Yes | Yes | Yes | Yes |
| Supervision | | Yes | Yes | Yes | Yes |
| Overheads | | Yes | Yes | Yes | Yes |

* Spray Tower, Limestone, Gypsum Dewatering not required at 1.7 and 3.0 lb/MMBtu fuel because a phased implementation relative to the sulfur content of the fuel is expected.


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**Table 3.0D. Dry FGD NID and Fabric Filter Cost Drivers.**

| Capital Cost Drivers | | 1.7 lb/MMBtu SO2 | 3.0 lb/MMBtu SO2 | 4.5 lb/MMBtu SO2 | 7.5 lb/MMBtu SO2 |
|---|---|---|---|---|---|
| ID Fans | | Yes | Yes | Yes | Yes |
| NID & Fabric Filter | | Yes | Yes | Yes | Yes |
| New Stack | | Yes | Yes | Yes | Yes |
| Reagent Preparation - Lime | | Yes | Yes | Yes | Yes |
| Byproduct Dewatering Island | | No | No | No | No |
| FGD WWT Plant | | No | No | No | No |
| Trona System | | No | No | No | No |
| FGD DCS System - Ovation | | Yes | Yes | Yes | Yes |
| Compressed Air (CA) | | Yes | Yes | Yes | Yes |
| Service Water (SW) | | Yes | Yes | Yes | Yes |
| Potable Water (PW) | | Yes | Yes | Yes | Yes |
| CEMS | | Yes | Yes | Yes | Yes |
| Activated Carbon Injection | | Yes | Yes | Yes | Yes |
| Truck and Rail Infrastructure | | Yes | Yes | Yes | Yes |
| Auxiliary Power Distribution | | Yes | Yes | Yes | Yes |
| Capital Replacements | | Yes | Yes | Yes | Yes |
| **Operating Variable Cost Drivers** | | | | | |
| Draft Load | | Yes | Yes | Yes | Yes |
| FGD Equipment Load | | Yes | Yes | Yes | Yes |
| FGD Reagent (Lime) | | Yes | Yes | Yes | Yes |
| Activated Carbon | | Yes | Yes | Yes | Yes |
| Make-up Water | | Yes | Yes | Yes | Yes |
| SO3 Mitigation (Trona) | | No | No | No | No |
| FGD WWT Chemicals | | No | No | No | No |
| Maintenance Material/Equip | | Yes | Yes | Yes | Yes |
| **Operating Fixed Cost Drivers** | | | | | |
| Operators | | Yes | Yes | Yes | Yes |
| Maintenance Mechanics | | Yes | Yes | Yes | Yes |
| I&C Technicians | | Yes | Yes | Yes | Yes |
| Maintenance Planner | | Yes | Yes | Yes | Yes |
| Supervision | | Yes | Yes | Yes | Yes |
| Overheads | | Yes | Yes | Yes | Yes |


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## 4.0 ATTACHMENTS

1) Engineering Services Technically Approved Suppliers List dated 3/2/2010
2) Mechanical Design Criteria - DC-MECH-001
3) Electrical Design Criteria - DC-ELEC-001
4) Control & Instrumentation Design Criteria - DC-FGD/SCR-004
5) Civil Design Criteria - GESP-06-004
6) Architectural Design Criteria - DC-NGDE-002
7) Structural Design Criteria - SES-7018


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# Technical Specifications Checklist

Project Name: Big Sandy Unit 2 FGD Project - Order of Magnitude Capital Estimate

Originated by: Larry A. Hicks

Checked by: Gregory M. Gibbs Date: 9/24/2010

Description: Revise the specification to include content consistent with the order of magnitude/relative capital installed cost estimates.

*Unique Document ID:* BS2-FGDSCE-052010 Rev 2

| | | Checking Engineer's Initials |
|---|---|---|
| 1. | Purpose of technical specification is identified. | GMG |
| 2. | Technical requirements are identified including: design basis criteria, performance requirements, applicable regulatory, statutory & industrial codes, and ambient environmental conditions. | GMG |
| 3. | Auxiliary services such as power supply (voltage, current, source), air supply (pressure, volume, source), cooling water (pressure, temperature, volume, source), steam (pressure, temperature, volume, source), etc. are identified. | N/A |
| 4. | Off-site fabrication and modular construction requirements are identified. | GMG |
| 5. | Quality, inspection, and testing requirements are identified. This includes testing requirements to determine quality, reliability, or performance of the product are listed and acceptance criteria identified; requirements for bidders to submit documentation of their quality assurance program; requirements for nondestructive examination, including inspections or examinations prior to shipment are identified; and equipment or systems which involve special requirements such as fire protection or special features such as Professional Engineer seals on documents or Underwriter certifications are identified. | N/A |
| 6. | Vendor documentation requirements are identified including: types of documentation required, document submittal requirements, submittal due dates, specific warranty requirements, identify drawings subject to liquidated damages, and document format requirements. | N/A |
| 7. | Shipping and storage requirements are identified including: bill of material requirements, tagging requirements, special shipping & handling requirements, storage requirements such as the use of preservatives and inhibitors, weather protection, etc. are identified. | N/A |
| 8. | Guarantee and guarantee basis are clearly identified. | N/A |
| 9. | Requirements to provide operation and/or maintenance training are identified. | N/A |
| 10. | Requirements for spare parts are identified. | N/A |
| 11. | Requirements to provide field support services such as installation, start up and/or testing assistance are identified. | N/A |

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## Technical Specification Checklist cont.

| | | Checking Engineer's Initials |
|---|---|---|
| 12. | Attachments are included such as: data sheets which contain detail to provide a clear understanding and evaluation of the design parameters (pressure, temperatures, flows, etc.), design features and materials of construction; drawings, industry standards, addenda or other documents, and a list of other documents that form part of the technical specification. | GMG |
| 13. | Verify technical specification cover sheet has a title, a technical specification number, date, and a technical specification revision number. | GMG |
| 14. | Verify revision index includes revision number and description of revision. | GMG |
| 15. | Verify that supporting calculations have been performed and checked. | N/A |
| 16. | Appropriate interdisciplinary review complete. | GMG |
| 17. | The specified materials, parts, equipment, and processes are suitable for the required application. | GMG |
| 18. | The specified materials are compatible with each other and the design environmental conditions to which the material will be exposed. | GMG |
| 19. | Plant specific operating data have been verified and if necessary, incorporated into design basis | GMG |
| List others below as applicable. | | |
| 20. | | |
| 21. | | |

Note: Use N/A to indicate check is not applicable.

| G.M. Gibbs | G.M. Gibbs | 9/24/2010 |
|---|---|---|
| Checked by *(Print name legibly)* | *Checked by (Signature)* | Date |

Engineering completed in accordance with SOP 730.04, Technical Specifications and reviewed by:

| [signature] | HPD&CE | 9/24/10 |
|---|---|---|
| Engineering Manager | Department | Date |

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# EXHIBIT 1-2
# Capital Cost Estimate Outline

# EXHIBIT 1-2
## CAPITAL COST ESTIMATE OUTLINE
## DIRECT COSTS

| PROJECT DIRECT COSTS | | | | | |
|---|---|---|---|---|---|
| ACCT | COST ESTIMATE CATEGORY | EQUIPMENT/MATERIAL COST RESPONSIBILITY | CONSTRUCTION/ERECTION COST RESPONSIBILITY | ESTIMATE BASIS | NOTES |
| | | | | | |
| 1.0 | ID FANS | S&L | S&L | Previous OEM proposals and S&L Estimates | 1 |
| | | | | | |
| 2.0 | WET ESP | S&L | S&L | Previous OEM proposals and S&L Estimates | |
| | | | | | |
| 3.0 | NEW STACK | AEP | AEP | Previous AEP Projects | |
| | | | | | |
| 4.0 | LIMESTONE HANDLING SYSTEM | S&L | S&L | Previous OEM proposals and S&L Estimates | |
| | | | | | |
| 5.0 | REAGENT PREPARATION ISLAND | S&L | S&L | Previous OEM proposals and S&L Estimates | |
| | | | | | |
| 6.0 | BYPRODUCT DEWATERING ISLAND | S&L | S&L | Previous OEM proposals and S&L Estimate | |
| | | | | | |
| 7.0 | ABSORBER ISLAND | S&L | S&L | Previous OEM proposals and S&L Estimates | 1, 2 |
| | | | | | |
| 8.0 | FGD WASTE WATER TREATMENT PLANT | S&L | S&L | Previous OEM proposals and S&L Projects | |
| | | | | | |
| 9.0 | COMPRESSED AIR SYSTEM | S&L | S&L | Past & Current S&L Projects | |
| | | | | | |
| 10.0 | SERVICE WATER SYSTEM | S&L | S&L | Past & Current S&L Projects | |
| | | | | | |
| 11.0 | POTABLE WATER SYSTEM | S&L | S&L | Past & Current S&L Projects | |

# EXHIBIT 1-2
## CAPITAL COST ESTIMATE OUTLINE
## DIRECT COSTS

| PROJECT DIRECT COSTS | | | | | |
|---|---|---|---|---|---|
| **ACCT** | **COST ESTIMATE CATEGORY** | **EQUIPMENT/MATERIAL COST RESPONSIBILITY** | **CONSTRUCTION/ERECTION COST RESPONSIBILITY** | **ESTIMATE BASIS** | **NOTES** |
| | | | | | |
| **12.0** | **FGD SUBSTATION** | S&L | S&L | Past & Current S&L Projects | |
| | | | | | |
| **13.0** | **FGD DCS SYSTEM** | S&L | S&L | Past S&L Projects Adjusted to Meet AEP Design Criteria | |
| | | | | | |
| **14.0** | **CEM SYSTEM** | AEP | AEP | Previous AEP Projects | |
| | | | | | |
| **15.0** | **RAIL INFRASTRUCTURE** | S&L | S&L | Past & Current S&L Projects | |
| | | | | | |
| **16.0** | **SITE IMPROVEMENTS - CIVIL WORK** | S&L | S&L | Past & Current S&L Projects | |
| | | | | | |
| **17.0** | **BOP ITEMS** | S&L | S&L | Past & Current S&L Projects | |
| | | | | | |
| **18.0** | **CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE** | S&L | S&L | Site Plans | |
| | | | | | |
| **19.0** | **ARSENIC, ASBESTOS , LEAD ABATEMENT** | AEP | AEP | Previous AEP Projects | |
| | | | | | |

Notes: 1) Noise Mitigation costs were considered for ID fan insulation and lagging and blower bldg construction.
2) Ductwork costs are based upon general arrangement layouts.

# EXHIBIT 1-2
## CAPITAL COST ESTIMATE OUTLINE
## INDIRECT COSTS

| PROJECT INDIRECT COSTS | | | |
|---|---|---|---|
| **ACCT** | **COST ESTIMATE CATEGORY** | **TOTAL COST RESPONSIBILITY** | **ESTIMATE SOURCE** |
| | | | |
| | **ENGINEERING, PROCUREMENT, & PROJECT SERVICES** | S&L | Past FGD and AEP Projects |
| | | | |
| | **CONSTRUCTION MANAGEMENT** | S&L | Estimating Percentage |
| | | | |
| | **S-U / COMMISSIONING** | S&L | Estimating Percentage |
| | | | |
| | **ESCALATION** | S&L | Material, Equipment and Labor Indices |
| | | | |
| | **CONTINGENCY** | S&L | Range Estimating |
| | | | |
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| | | | |
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# EXHIBIT 1-3
# AACE International
# Recommended Practice No. 18R-97,
# February 2, 2005

AACE International Recommended Practice No. 18R-97

# COST ESTIMATE CLASSIFICATION SYSTEM – AS APPLIED IN ENGINEERING, PROCUREMENT, AND CONSTRUCTION FOR THE PROCESS INDUSTRIES

TCM Framework: 7.3 – Cost Estimating and Budgeting

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AACE International Recommended Practice No. 18R-97

# COST ESTIMATE CLASSIFICATION SYSTEM – AS APPLIED IN ENGINEERING, PROCUREMENT, AND CONSTRUCTION FOR THE PROCESS INDUSTRIES

TCM Framework: 7.3 – Cost Estimating and Budgeting

February 2, 2005

## PURPOSE

As a recommended practice of AACE International, the Cost Estimate Classification System provides guidelines for applying the general principles of estimate classification to project cost estimates (i.e., cost estimates that are used to evaluate, approve, and/or fund projects). The Cost Estimate Classification System maps the phases and stages of project cost estimating together with a generic maturity and quality matrix, which can be applied across a wide variety of industries.

This addendum to the generic recommended practice provides guidelines for applying the principles of estimate classification specifically to project estimates for engineering, procurement, and construction (EPC) work for the process industries. This addendum supplements the generic recommended practice (17R-97) by providing:

- a section that further defines classification concepts as they apply to the process industries;
- charts that compare existing estimate classification practices in the process industry; and
- a chart that maps the extent and maturity of estimate input information (project definition deliverables) against the class of estimate.

As with the generic standard, an intent of this addendum is to improve communications among all of the stakeholders involved with preparing, evaluating, and using project cost estimates specifically for the process industries.

It is understood that each enterprise may have its own project and estimating processes and terminology, and may classify estimates in particular ways. This guideline provides a generic and generally acceptable classification system for process industries that can be used as a basis to compare against. It is hoped that this addendum will allow each user to better assess, define, and communicate their own processes and standards in the light of generally-accepted cost engineering practice.

## INTRODUCTION

For the purposes of this addendum, the term process industries is assumed to include firms involved with the manufacturing and production of chemicals, petrochemicals, and hydrocarbon processing. The common thread among these industries (for the purpose of estimate classification) is their reliance on process flow diagrams (PFDs) and piping and instrument diagrams (P&IDs) as primary scope defining documents. These documents are key deliverables in determining the level of project definition, and thus the extent and maturity of estimate input information.

Estimates for process facilities center on mechanical and chemical process equipment, and they have significant amounts of piping, instrumentation, and process controls involved. As such, this addendum may apply to portions of other industries, such as pharmaceutical, utility, metallurgical, converting, and similar industries. Specific addendums addressing these industries may be developed over time.

This addendum specifically does not address cost estimate classification in nonprocess industries such as commercial building construction, environmental remediation, transportation infrastructure, “dry” processes such as assembly and manufacturing, “soft asset” production such as software development, and similar industries. It also does not specifically address estimates for the exploration, production, or transportation of mining or hydrocarbon materials, although it may apply to some of the intermediate processing steps in these systems.

The cost estimates covered by this addendum are for engineering, procurement, and construction (EPC) work only. It does not cover estimates for the products manufactured by the process facilities, or for research and development work in support of the process industries. This guideline does not cover the

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significant building construction that may be a part of process plants. Building construction will be covered in a separate addendum.

This guideline reflects generally-accepted cost engineering practices. This addendum was based upon the practices of a wide range of companies in the process industries from around the world, as well as published references and standards. Company and public standards were solicited and reviewed by the AACE International Cost Estimating Committee. The practices were found to have significant commonalities that are conveyed in this addendum.

## COST ESTIMATE CLASSIFICATION MATRIX FOR THE PROCESS INDUSTRIES

The five estimate classes are presented in figure 1 in relationship to the identified characteristics. Only the level of project definition determines the estimate class. The other four characteristics are secondary characteristics that are generally correlated with the level of project definition, as discussed in the generic standard. The characteristics are typical for the process industries but may vary from application to application.

This matrix and guideline provide an estimate classification system that is specific to the process industries. Refer to the generic standard for a general matrix that is non-industry specific, or to other addendums for guidelines that will provide more detailed information for application in other specific industries. These will typically provide additional information, such as input deliverable checklists to allow meaningful categorization in those particular industries.

| | ***Primary Characteristic*** | ***Secondary Characteristic*** | | | |
|---|---|---|---|---|---|
| **ESTIMATE CLASS** | **LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition | **END USAGE** Typical purpose of estimate | **METHODOLOGY** Typical estimating method | **EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a] | **PREPARATION EFFORT** Typical degree of effort relative to least cost index of 1 [b] |
| **Class 5** | 0% to 2% | Concept Screening | Capacity Factored, Parametric Models, Judgment, or Analogy | L: -20% to -50%<br>H: +30% to +100% | 1 |
| **Class 4** | 1% to 15% | Study or Feasibility | Equipment Factored or Parametric Models | L: -15% to -30%<br>H: +20% to +50% | 2 to 4 |
| **Class 3** | 10% to 40% | Budget, Authorization, or Control | Semi-Detailed Unit Costs with Assembly Level Line Items | L: -10% to -20%<br>H: +10% to +30% | 3 to 10 |
| **Class 2** | 30% to 70% | Control or Bid/ Tender | Detailed Unit Cost with Forced Detailed Take-Off | L: -5% to -15%<br>H: +5% to +20% | 4 to 20 |
| **Class 1** | 50% to 100% | Check Estimate or Bid/Tender | Detailed Unit Cost with Detailed Take-Off | L: -3% to -10%<br>H: +3% to +15% | 5 to 100 |

Notes: [a] The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

[b] If the range index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

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**Figure 1. – Cost Estimate Classification Matrix for Process Industries**

## CHARACTERISTICS OF THE ESTIMATE CLASSES

The following charts (figures 2a through 2e) provide detailed descriptions of the five estimate classifications as applied in the process industries. They are presented in the order of least-defined estimates to the most-defined estimates. These descriptions include brief discussions of each of the estimate characteristics that define an estimate class.

For each chart, the following information is provided:

- **Description:** a short description of the class of estimate, including a brief listing of the expected estimate inputs based on the level of project definition.
- **Level of Project Definition Required:** expressed as a percent of full definition. For the process industries, this correlates with the percent of engineering and design complete.
- **End Usage:** a short discussion of the possible end usage of this class of estimate.
- **Estimating Methods Used:** a listing of the possible estimating methods that may be employed to develop an estimate of this class.
- **Expected Accuracy Range:** typical variation in low and high ranges after the application of contingency (determined at a 50% level of confidence). Typically, this results in a 90% confidence that the actual cost will fall within the bounds of the low and high ranges.
- **Effort to Prepare:** this section provides a typical level of effort (in hours) to produce a complete estimate for a US$20,000,000 plant. Estimate preparation effort is highly dependent on project size, project complexity, estimator skills and knowledge, and on the availability of appropriate estimating cost data and tools.
- **ANSI Standard Reference (1989) Name:** this is a reference to the equivalent estimate class in the existing ANSI standards.
- **Alternate Estimate Names, Terms, Expressions, Synonyms:** this section provides other commonly used names that an estimate of this class might be known by. These alternate names are not endorsed by this Recommended Practice. The user is cautioned that an alternative name may not always be correlated with the class of estimate as identified in the chart.

| CLASS 5 ESTIMATE | |
|---|---|
| **Description:**<br>Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. As such, some companies and organizations have elected to determine that due to the inherent inaccuracies, such estimates cannot be classified in a conventional and systemic manner. Class 5 estimates, due to the requirements of end use, may be prepared within a very limited amount of time and with little effort expended—sometimes requiring less than an hour to prepare. Often, little more than proposed plant type, location, and capacity are known at the time of estimate preparation.<br><br>**Level of Project Definition Required:**<br>0% to 2% of full project definition.<br><br>**End Usage:**<br>Class 5 estimates are prepared for any number of strategic business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, long-range capital planning, etc. | **Estimating Methods Used:**<br>Class 5 estimates virtually always use stochastic estimating methods such as cost/capacity curves and factors, scale of operations factors, Lang factors, Hand factors, Chilton factors, Peters-Timmerhaus factors, Guthrie factors, and other parametric and modeling techniques.<br><br>**Expected Accuracy Range:**<br>Typical accuracy ranges for Class 5 estimates are - 20% to -50% on the low side, and +30% to +100% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.<br><br>**Effort to Prepare (for US$20MM project):**<br>As little as 1 hour or less to perhaps more than 200 hours, depending on the project and the estimating methodology used.<br><br>**ANSI Standard Reference Z94.2-1989 Name:**<br>Order of magnitude estimate (typically -30% to +50%).<br><br>**Alternate Estimate Names, Terms, Expressions, Synonyms:**<br>Ratio, ballpark, blue sky, seat-of-pants, ROM, idea study, prospect estimate, concession license estimate, guesstimate, rule-of-thumb. |

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**Figure 2a. – Class 5 Estimate**

| CLASS 4 ESTIMATE | |
|---|---|
| **Description:**<br>Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 15% complete, and would comprise at a minimum the following: plant capacity, block schematics, indicated layout, process flow diagrams (PFDs) for main process systems, and preliminary engineered process and utility equipment lists.<br><br>**Level of Project Definition Required:**<br>1% to 15% of full project definition.<br><br>**End Usage:**<br>Class 4 estimates are prepared for a number of purposes, such as but not limited to, detailed strategic planning, business development, project screening at more developed stages, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget approval or approval to proceed to next stage. | **Estimating Methods Used:**<br>Class 4 estimates virtually always use stochastic estimating methods such as equipment factors, Lang factors, Hand factors, Chilton factors, Peters-Timmerhaus factors, Guthrie factors, the Miller method, gross unit costs/ratios, and other parametric and modeling techniques.<br><br>**Expected Accuracy Range:**<br>Typical accuracy ranges for Class 4 estimates are -15% to -30% on the low side, and +20% to +50% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.<br><br>**Effort to Prepare (for US$20MM project):**<br>Typically, as little as 20 hours or less to perhaps more than 300 hours, depending on the project and the estimating methodology used.<br><br>**ANSI Standard Reference Z94.2-1989 Name:**<br>Budget estimate (typically -15% to + 30%).<br><br>**Alternate Estimate Names, Terms, Expressions, Synonyms:**<br>Screening, top-down, feasibility, authorization, factored, pre-design, pre-study. |

**Figure 2b. – Class 4 Estimate**

| CLASS 3 ESTIMATE | |
|---|---|
| **Description:**<br>Class 3 estimates are generally prepared to form the basis for budget authorization, appropriation, and/or funding. As such, they typically form the initial control estimate against which all actual costs and resources will be monitored. Typically, engineering is from 10% to 40% complete, and would comprise at a minimum the following: process flow diagrams, utility flow diagrams, preliminary piping and instrument diagrams, plot plan, developed layout drawings, and essentially complete engineered process and utility equipment lists.<br><br>**Level of Project Definition Required:**<br>10% to 40% of full project definition.<br><br>**End Usage:**<br>Class 3 estimates are typically prepared to support full project funding requests, and become the first of the project phase "control estimates" against which all actual costs and resources will be monitored for variations to the budget. They are used as the project budget until replaced by more detailed estimates. In many owner organizations, a Class 3 estimate may be the last estimate required and could well form the only basis for cost/schedule control. | **Estimating Methods Used:**<br>Class 3 estimates usually involve more deterministic estimating methods than stochastic methods. They usually involve a high degree of unit cost line items, although these may be at an assembly level of detail rather than individual components. Factoring and other stochastic methods may be used to estimate less-significant areas of the project.<br><br>**Expected Accuracy Range:**<br>Typical accuracy ranges for Class 3 estimates are -10% to -20% on the low side, and +10% to +30% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.<br><br>**Effort to Prepare (for US$20MM project):**<br>Typically, as little as 150 hours or less to perhaps more than 1,500 hours, depending on the project and the estimating methodology used.<br><br>**ANSI Standard Reference Z94.2-1989 Name:**<br>Budget estimate (typically -15% to + 30%).<br><br>**Alternate Estimate Names, Terms, Expressions, Synonyms:**<br>Budget, scope, sanction, semi-detailed, authorization, preliminary control, concept study, development, basic engineering phase estimate, target estimate. |

**Figure 2c. – Class 3 Estimate**

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| CLASS 2 ESTIMATE | |
|---|---|
| **Description:**<br>Class 2 estimates are generally prepared to form a detailed control baseline against which all project work is monitored in terms of cost and progress control. For contractors, this class of estimate is often used as the "bid" estimate to establish contract value. Typically, engineering is from 30% to 70% complete, and would comprise at a minimum the following: process flow diagrams, utility flow diagrams, piping and instrument diagrams, heat and material balances, final plot plan, final layout drawings, complete engineered process and utility equipment lists, single line diagrams for electrical, electrical equipment and motor schedules, vendor quotations, detailed project execution plans, resourcing and work force plans, etc.<br><br>**Level of Project Definition Required:**<br>30% to 70% of full project definition.<br><br>**End Usage:**<br>Class 2 estimates are typically prepared as the detailed control baseline against which all actual costs and resources will now be monitored for variations to the budget, and form a part of the change/variation control program. | **Estimating Methods Used:**<br>Class 2 estimates always involve a high degree of deterministic estimating methods. Class 2 estimates are prepared in great detail, and often involve tens of thousands of unit cost line items. For those areas of the project still undefined, an assumed level of detail takeoff (forced detail) may be developed to use as line items in the estimate instead of relying on factoring methods.<br><br>**Expected Accuracy Range:**<br>Typical accuracy ranges for Class 2 estimates are -5% to -15% on the low side, and +5% to +20% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.<br><br>**Effort to Prepare (for US$20MM project):**<br>Typically, as little as 300 hours or less to perhaps more than 3,000 hours, depending on the project and the estimating methodology used. Bid estimates typically require more effort than estimates used for funding or control purposes.<br><br>**ANSI Standard Reference Z94.2-1989 Name:**<br>Definitive estimate (typically -5% to + 15%).<br><br>**Alternate Estimate Names, Terms, Expressions, Synonyms:**<br>Detailed control, forced detail, execution phase, master control, engineering, bid, tender, change order estimate. |

**Figure 2d. – Class 2 Estimate**

| CLASS 1 ESTIMATE | |
|---|---|
| **Description:**<br>Class 1 estimates are generally prepared for discrete parts or sections of the total project rather than generating this level of detail for the entire project. The parts of the project estimated at this level of detail will typically be used by subcontractors for bids, or by owners for check estimates. The updated estimate is often referred to as the current control estimate and becomes the new baseline for cost/schedule control of the project. Class 1 estimates may be prepared for parts of the project to comprise a fair price estimate or bid check estimate to compare against a contractor's bid estimate, or to evaluate/dispute claims. Typically, engineering is from 50% to 100% complete, and would comprise virtually all engineering and design documentation of the project, and complete project execution and commissioning plans.<br><br>**Level of Project Definition Required:**<br>50% to 100% of full project definition.<br><br>**End Usage:**<br>Class 1 estimates are typically prepared to form a current control estimate to be used as the final control baseline against which all actual costs and resources will now be monitored for variations to the budget, and form a part of the change/variation control program. They may be used to evaluate bid checking, to support vendor/contractor negotiations, or for claim evaluations and dispute resolution. | **Estimating Methods Used:**<br>Class 1 estimates involve the highest degree of deterministic estimating methods, and require a great amount of effort. Class 1 estimates are prepared in great detail, and thus are usually performed on only the most important or critical areas of the project. All items in the estimate are usually unit cost line items based on actual design quantities.<br><br>**Expected Accuracy Range:**<br>Typical accuracy ranges for Class 1 estimates are -3% to -10% on the low side, and +3% to +15% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.<br><br>**Effort to Prepare (for US$20MM project):**<br>Class 1 estimates require the most effort to create, and as such are generally developed for only selected areas of the project, or for bidding purposes. A complete Class 1 estimate may involve as little as 600 hours or less, to perhaps more than 6,000 hours, depending on the project and the estimating methodology used. Bid estimates typically require more effort than estimates used for funding or control purposes.<br><br>**ANSI Standard Reference Z94.2 Name:**<br>Definitive estimate (typically -5% to + 15%).<br><br>**Alternate Estimate Names, Terms, Expressions, Synonyms:**<br>Full detail, release, fall-out, tender, firm price, bottoms-up, final, detailed control, forced detail, execution phase, master control, fair price, definitive, change order estimate. |

**Figure 2e. – Class 1 Estimate**

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## COMPARISON OF CLASSIFICATION PRACTICES

Figures 3a through 3c provide a comparison of the estimate classification practices of various firms, organizations, and published sources against one another and against the guideline classifications. These tables permits users to benchmark their own classification practices.

INCREASING PROJECT DEFINITION

| AACE Classification Standard | ANSI Standard Z94.0 | AACE Pre-1972 | Association of Cost Engineers (UK) ACostE | Norwegian Project Management Association (NFP) | American Society of Professional Estimators (ASPE) |
|---|---|---|---|---|---|
| **Class 5** | Order of Magnitude Estimate -30/+50 | Order of Magnitude Estimate | Order of Magnitude Estimate Class IV -30/+30 | Concession Estimate<br>Exploration Estimate<br>Feasibility Estimate | Level 1 |
| **Class 4** | Budget Estimate -15/+30 | Study Estimate | Study Estimate Class III -20/+20 | Authorization Estimate | Level 2 |
| **Class 3** | | Preliminary Estimate | Budget Estimate Class II -10/+10 | Master Control Estimate | Level 3 |
| **Class 2** | Definitive Estimate -5/+15 | Definitive Estimate | Definitive Estimate Class I -5/+5 | Current Control Estimate | Level 4 |
| **Class 1** | | Detailed Estimate | | | Level 5<br>Level 6 |

**Figure 3a. – Comparison of Classification Practices**

INCREASING PROJECT DEFINITION

| AACE Classification Standard | Major Consumer Products Company (Confidential) | Major Oil Company (Confidential) | Major Oil Company (Confidential) | Major Oil Company (Confidential) |
|---|---|---|---|---|
| **Class 5** | Class S<br>Strategic Estimate | Class V<br>Order of Magnitude Estimate | Class A<br>Prospect Estimate<br>Class B<br>Evaluation Estimate | Class V |
| **Class 4** | Class 1<br>Conceptual Estimate | Class IV<br>Screening Estimate | Class C<br>Feasibility Estimate<br>Class D<br>Development Estimate | Class IV |
| **Class 3** | Class 2<br>Semi-Detailed Estimate | Class III<br>Primary Control Estimate | Class E<br>Preliminary Estimate | Class III |
| **Class 2** | Class 3<br>Detailed Estimate | Class II<br>Master Control Estimate | Class F<br>Master Control Estimate | Class II |
| **Class 1** | | Class I<br>Current Control Estimate | Current Control Estimate | Class I |

**Figure 3b. – Comparison of Classification Practices**

INCREASING PROJECT DEFINITION

| AACE Classification Standard | J.R. Heizelman, 1988 AACE Transactions [1] | K.T. Yeo, The Cost Engineer, 1989 [2] | Stevens & Davis, 1988 AACE Transactions [3] | P. Behrenbruck, Journal of Petroleum Technology, 1993 [4] |
|---|---|---|---|---|
| **Class 5** | Class V | Class V<br>Order of Magnitude | Class III* | Order of Magnitude |
| **Class 4** | Class IV | Class IV<br>Factor Estimate | Class II | Study Estimate |
| **Class 3** | Class III | Class III<br>Office Estimate | | Budget Estimate |
| **Class 2** | Class II | Class II<br>Definitive Estimate | | |
| **Class 1** | Class I | Class I<br>Final Estimate | Class I | Control Estimate |

[1] John R. Heizelman, ARCO Oil & Gas Co., 1988 AACE Transactions, Paper V3.7
[2] K.T. Yeo, The Cost Engineer, Vol. 27, No. 6, 1989
[3] Stevens & Davis, BP International Ltd., 1988 AACE Transactions, Paper B4.1 (* Class III is inferred)
[4] Peter Behrenbruck, BHP Petroleum Pty., Ltd., article in Petroleum Technology, August 1993

**Figure 3c. – Comparison of Classification Practices**

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## ESTIMATE INPUT CHECKLIST AND MATURITY MATRIX

Figure 4 maps the extent and maturity of estimate input information (deliverables) against the five estimate classification levels. This is a checklist of basic deliverables found in common practice in the process industries. The maturity level is an approximation of the degree of completion of the deliverable. The degree of completion is indicated by the following letters.

- None (blank): development of the deliverable has not begun.
- Started (S): work on the deliverable has begun. Development is typically limited to sketches, rough outlines, or similar levels of early completion.
- Preliminary (P): work on the deliverable is advanced. Interim, cross-functional reviews have usually been conducted. Development may be near completion except for final reviews and approvals.
- Complete (C): the deliverable has been reviewed and approved as appropriate.

| | ESTIMATE CLASSIFICATION | | | | |
|---|---|---|---|---|---|
| **General Project Data:** | **CLASS 5** | **CLASS 4** | **CLASS 3** | **CLASS 2** | **CLASS 1** |
| Project Scope Description | General | Preliminary | Defined | Defined | Defined |
| Plant Production/Facility Capacity | Assumed | Preliminary | Defined | Defined | Defined |
| Plant Location | General | Approximate | Specific | Specific | Specific |
| Soils & Hydrology | None | Preliminary | Defined | Defined | Defined |
| Integrated Project Plan | None | Preliminary | Defined | Defined | Defined |
| Project Master Schedule | None | Preliminary | Defined | Defined | Defined |
| Escalation Strategy | None | Preliminary | Defined | Defined | Defined |
| Work Breakdown Structure | None | Preliminary | Defined | Defined | Defined |
| Project Code of Accounts | None | Preliminary | Defined | Defined | Defined |
| Contracting Strategy | Assumed | Assumed | Preliminary | Defined | Defined |
| **Engineering Deliverables:** | | | | | |
| Block Flow Diagrams | S/P | P/C | C | C | C |
| Plot Plans | | S | P/C | C | C |
| Process Flow Diagrams (PFDs) | | S/P | P/C | C | C |
| Utility Flow Diagrams (UFDs) | | S/P | P/C | C | C |
| Piping & Instrument Diagrams (P&IDs) | | S | P/C | C | C |
| Heat & Material Balances | | S | P/C | C | C |
| Process Equipment List | | S/P | P/C | C | C |
| Utility Equipment List | | S/P | P/C | C | C |
| Electrical One-Line Drawings | | S/P | P/C | C | C |
| Specifications & Datasheets | | S | P/C | C | C |
| General Equipment Arrangement Drawings | | S | P/C | C | C |
| Spare Parts Listings | | | S/P | P | C |
| Mechanical Discipline Drawings | | | S | P | P/C |
| Electrical Discipline Drawings | | | S | P | P/C |
| Instrumentation/Control System Discipline Drawings | | | S | P | P/C |
| Civil/Structural/Site Discipline Drawings | | | S | P | P/C |

**Figure 4. – Estimate Input Checklist and Maturity Matrix**

## REFERENCES

ANSI Standard Z94.2-1989. **Industrial Engineering Terminology: Cost Engineering**.
AACE International Recommended Practice No.17R-97, **Cost Estimate Classification System**.

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# EXHIBIT 1-4
# Contingency Analysis Summary

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE - 4.5 LB/MM/BTU

@RISK
Risk Analysis and Simulation Add-In for Microsoft EXCEL
Version 5.0
Palisade Corporation

# ANALYSIS INPUT

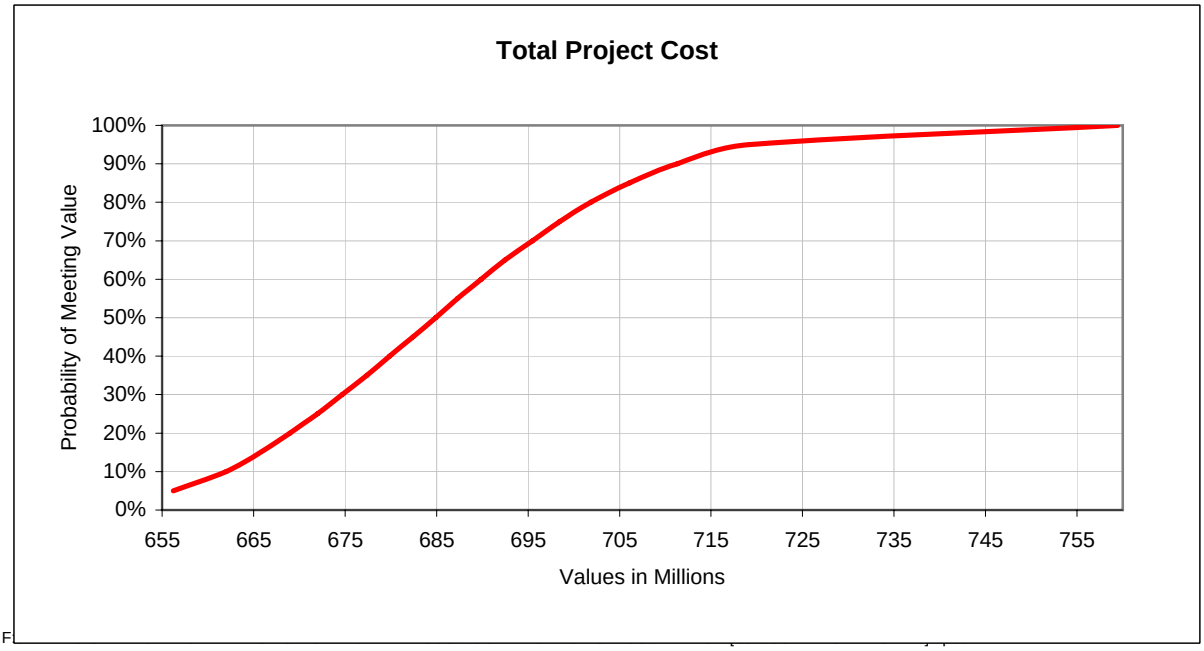
Values in Thousands

| Accnt. No. | Cost Elements | Target Value $k | Minimum | Maximum | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1.0 | ID FANS | $22,698,700 | 95% | 130% | $21,563,765 | $29,508,310 |
| 2.0 | WET ESP | $89,935,300 | 95% | 130% | $85,438,535 | $116,915,890 |
| 3.0 | NEW STACK | $31,480,000 | 95% | 130% | $29,906,000 | $40,924,000 |
| 4.0 | LIMESTONE HANDLING SYSTEM | $23,589,100 | 95% | 125% | $22,409,645 | $29,486,375 |
| 5.0 | REAGENT PREPARATION ISLAND | $40,684,600 | 95% | 130% | $38,650,370 | $52,889,980 |
| 6.0 | BYPRODUCT DEWATERING ISLAND | $34,078,400 | 95% | 130% | $32,374,480 | $44,301,920 |
| 7.0 | ABSORBER ISLAND | $146,652,200 | 95% | 130% | $139,319,590 | $190,647,860 |
| 8.0 | FGD WASTE WATER TREATMENT PLANT | $17,233,200 | 95% | 130% | $16,371,540 | $22,403,160 |
| 9.0 | COMPRESSED AIR SYSTEM | $1,940,700 | 95% | 135% | $1,843,665 | $2,619,945 |
| 10.0 | SERVICE WATER SYSTEM | $5,830,000 | 95% | 135% | $5,538,500 | $7,870,500 |
| 11.1 | POTABLE WATER SYSTEM | $718,500 | 95% | 135% | $682,575 | $969,975 |
| 12.0 | FGD SUBSTATION | $3,060,200 | 95% | 135% | $2,907,190 | $4,131,270 |
| 13.0 | FGD DCS SYSTEM | $6,230,300 | 95% | 135% | $5,918,785 | $8,410,905 |
| 14.0 | CEM SYSTEM | $2,110,000 | 95% | 130% | $2,004,500 | $2,743,000 |
| 15.0 | RAIL INFRASTRUCTURE | $4,340,700 | 95% | 140% | $4,123,665 | $6,076,980 |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | $17,138,100 | 95% | 140% | $16,281,195 | $23,993,340 |
| 17.0 | BOP ITEMS | $4,227,600 | 95% | 160% | $4,016,220 | $6,764,160 |
| 18.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $3,509,200 | 95% | 200% | $3,333,740 | $7,018,400 |
| 19.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | $750,000 | 95% | 150% | $712,500 | $1,125,000 |
| 99.0 | OVERALL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | $109,445,100 | 95% | 140% | $103,972,845 | $153,223,140 |
| | OVERALL PROJECT INDIRECT COSTS | $59,983,300 | 95% | 130% | $56,984,135 | $77,978,290 |
| | SPARE PARTS | $2,322,300 | 95% | 130% | $2,206,185 | $3,018,990 |
| | **Total Base Case** | **$627,957,500** | | | | |

# ANALYSIS OUTPUT

Probability of meeting "Total Base Case" value: 627,957,500 0.0%

| Total Budget Required ($k) | % Confidence Level | Confidence Level Risk | Contingency % of Base |
|---|---|---|---|
| 759,446,830 | 100.0% | 131,489,300 | 20.939% |
| 719,211,777 | 95.0% | 91,254,300 | 14.532% |
| 711,329,081 | 90.0% | 83,371,600 | 13.277% |
| 706,056,693 | 85.0% | 78,099,200 | 12.437% |
| 701,866,390 | 80.0% | 73,908,900 | 11.770% |
| 698,444,985 | 75.0% | 70,487,500 | 11.225% |
| 695,478,897 | 70.0% | 67,521,400 | 10.753% |
| 692,472,969 | 65.0% | 64,515,500 | 10.274% |
| 689,877,826 | 60.0% | 61,920,300 | 9.861% |
| 687,273,165 | 55.0% | 59,315,700 | 9.446% |
| 684,922,000 | 50.0% | 56,964,500 | 9.071% |
| 682,427,571 | 45.0% | 54,470,100 | 8.674% |
| 679,882,467 | 40.0% | 51,925,000 | 8.269% |
| 677,390,981 | 35.0% | 49,433,500 | 7.872% |
| 674,679,607 | 30.0% | 46,722,100 | 7.440% |
| 671,982,596 | 25.0% | 44,025,100 | 7.011% |
| 668,955,253 | 20.0% | 40,997,800 | 6.529% |
| 665,738,849 | 15.0% | 37,781,300 | 6.017% |
| 661,981,064 | 10.0% | 34,023,600 | 5.418% |
| 656,232,312 | 5.0% | 28,274,800 | 4.503% |



SARGENT & LUNDY
DATE: 9/29/2010

AEP
BIG SANDY UNIT 2
FGD PROJECT - DFGD EST (N/ESP)-1B - 3.0 LB/MM/BTU

@RISK
Risk Analysis and Simulation Add-In for Microsoft EXCEL
Version 5.0
Palisade Corporation

# ANALYSIS INPUT

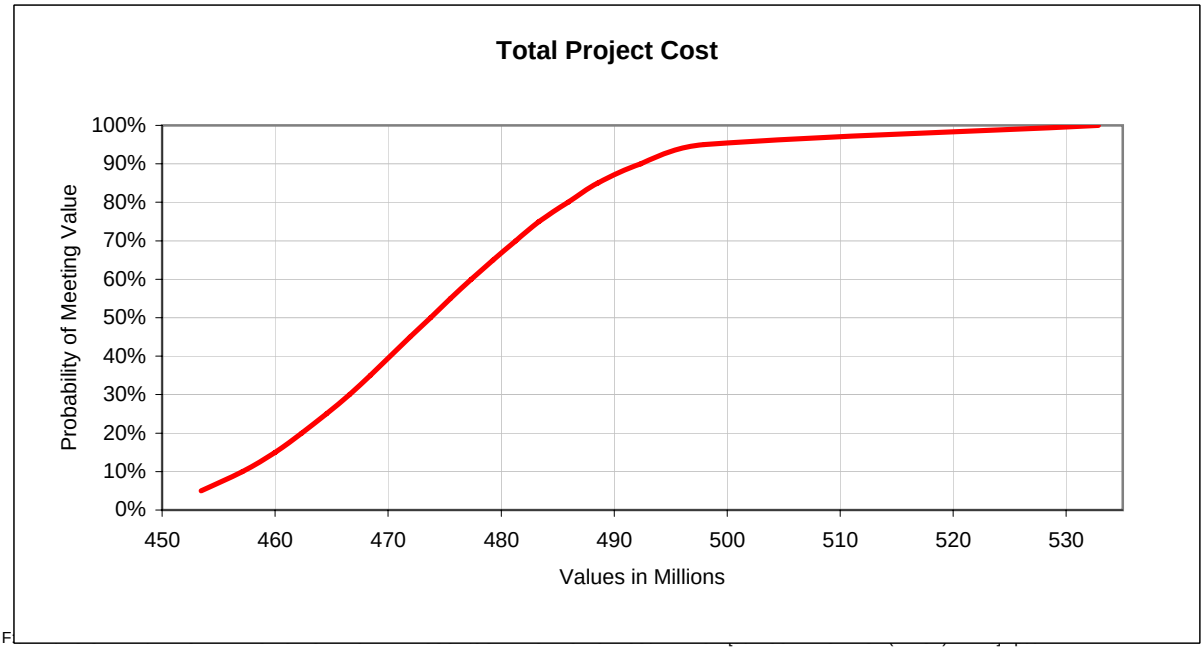
Values in Thousands

| Accnt. No. | Cost Elements | Target Value $k | Minimum | Maximum | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1.0 | ID FANS | $31,775,100 | 95% | 130% | $30,186,345 | $41,307,630 |
| 2.0 | FABRIC FILTERS | $42,992,100 | 95% | 130% | $40,842,495 | $55,889,730 |
| 3.0 | NEW STACK | $19,350,000 | 95% | 130% | $18,382,500 | $25,155,000 |
| 4.0 | LIME HANDLING SYSTEM | $15,896,900 | 95% | 125% | $15,102,055 | $19,871,125 |
| 5.0 | LIME SLAKER BUILDING | $15,968,000 | 95% | 130% | $15,169,600 | $20,758,400 |
| 6.0 | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | $12,869,700 | 95% | 130% | $12,226,215 | $16,730,610 |
| 7.0 | ABSORBER ISLAND | $121,897,500 | 95% | 130% | $115,802,625 | $158,466,750 |
| 8.0 | ACTIVATED CARBON INJECTION SYSTEM | $5,381,600 | 95% | 130% | $5,112,520 | $6,996,080 |
| 9.0 | COMPRESSED AIR SYSTEM | $3,562,300 | 95% | 135% | $3,384,185 | $4,809,105 |
| 10.0 | SERVICE WATER SYSTEM | $3,511,800 | 95% | 135% | $3,336,210 | $4,740,930 |
| 11.1 | POTABLE WATER SYSTEM | $901,900 | 95% | 135% | $856,805 | $1,217,565 |
| 12.0 | FGD SUBSTATION | $7,786,000 | 95% | 135% | $7,396,700 | $10,511,100 |
| 13.0 | FGD DCS SYSTEM | $5,153,600 | 95% | 135% | $4,895,920 | $6,957,360 |
| 14.0 | CEM SYSTEM | $2,110,000 | 95% | 130% | $2,004,500 | $2,743,000 |
| 15.0 | RAIL INFRASTRUCTURE | $4,340,700 | 95% | 140% | $4,123,665 | $6,076,980 |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | $12,459,800 | 95% | 140% | $11,836,810 | $17,443,720 |
| 17.0 | BOP ITEMS | $3,234,100 | 95% | 160% | $3,072,395 | $5,174,560 |
| 18.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $3,509,200 | 95% | 200% | $3,333,740 | $7,018,400 |
| 19.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | $750,000 | 95% | 150% | $712,500 | $1,125,000 |
| 99.0 | OVERALL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | $72,130,000 | 95% | 140% | $68,523,500 | $100,982,000 |
| | OVERALL PROJECT INDIRECT COSTS | $46,611,100 | 95% | 130% | $44,280,545 | $60,594,430 |
| | SPARE PARTS | 1,780,600 | 95% | 130% | $1,691,570 | $2,314,780 |
| | **Total Base Case** | **$433,972,000** | | | | |

# ANALYSIS OUTPUT

Probability of meeting "Total Base Case" value: 433,972,000 0.0%

| Total Budget Required ($k) | % Confidence Level | Confidence Level Risk | Contingency % of Base |
|---|---|---|---|
| 532,858,795 | 100.0% | 98,886,800 | 22.786% |
| 497,925,835 | 95.0% | 63,953,800 | 14.737% |
| 492,356,128 | 90.0% | 58,384,100 | 13.453% |
| 488,563,329 | 85.0% | 54,591,300 | 12.579% |
| 485,940,181 | 80.0% | 51,968,200 | 11.975% |
| 483,312,482 | 75.0% | 49,340,500 | 11.370% |
| 481,286,595 | 70.0% | 47,314,600 | 10.903% |
| 479,267,018 | 65.0% | 45,295,000 | 10.437% |
| 477,349,614 | 60.0% | 43,377,600 | 9.995% |
| 475,525,147 | 55.0% | 41,553,100 | 9.575% |
| 473,747,966 | 50.0% | 39,776,000 | 9.166% |
| 471,944,267 | 45.0% | 37,972,300 | 8.750% |
| 470,196,815 | 40.0% | 36,224,800 | 8.347% |
| 468,432,562 | 35.0% | 34,460,600 | 7.941% |
| 466,583,638 | 30.0% | 32,611,600 | 7.515% |
| 464,555,983 | 25.0% | 30,584,000 | 7.047% |
| 462,332,298 | 20.0% | 28,360,300 | 6.535% |
| 460,002,208 | 15.0% | 26,030,200 | 5.998% |
| 457,106,003 | 10.0% | 23,134,000 | 5.331% |
| 453,450,633 | 5.0% | 19,478,600 | 4.488% |

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AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS - BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON-PHASED

@RISK
Risk Analysis and Simulation Add-In for Microsoft EXCEL
Version 5.0
Palisade Corporation

# ANALYSIS INPUT

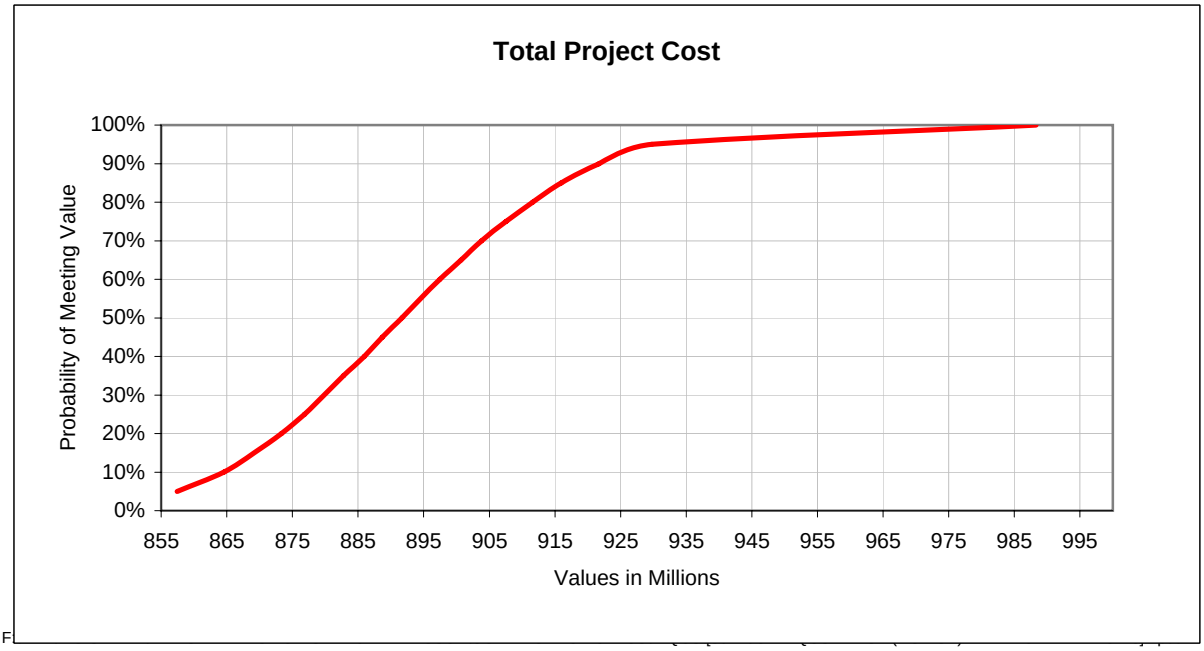
Values in Thousands

| Accnt. No. | Cost Elements | Target Value $k | Minimum | Maximum | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1.0 | ID FANS | $53,014,600 | 95% | 130% | $50,363,870 | $68,918,980 |
| 2.0 | FABRIC FILTERS | $42,992,100 | 95% | 130% | $40,842,495 | $55,889,730 |
| 3.0 | NEW STACK | $31,480,000 | 95% | 130% | $29,906,000 | $40,924,000 |
| 4.0 | LIME HANDLING SYSTEM | $9,166,700 | 95% | 130% | $8,708,365 | $11,916,710 |
| 5.0 | LIME SLAKER BUILDING | $8,514,600 | 95% | 130% | $8,088,870 | $11,068,980 |
| 6.0 | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | $9,851,600 | 95% | 130% | $9,359,020 | $12,807,080 |
| 7.0 | SPRAY DRYER ABSORBER ISLAND | $102,264,200 | 95% | 130% | $97,150,990 | $132,943,460 |
| 9.0 | COMPRESSED AIR SYSTEM | $5,423,700 | 95% | 135% | $5,152,515 | $7,321,995 |
| 10.0 | SERVICE WATER SYSTEM | $8,266,800 | 95% | 135% | $7,853,460 | $11,160,180 |
| 11.1 | POTABLE WATER SYSTEM | $1,143,600 | 95% | 135% | $1,086,420 | $1,543,860 |
| 12.0 | FGD SUBSTATION | $8,692,500 | 95% | 135% | $8,257,875 | $11,734,875 |
| 13.0 | FGD DCS SYSTEM | $11,033,100 | 95% | 135% | $10,481,445 | $14,894,685 |
| 14.0 | CEM SYSTEM | $2,110,000 | 95% | 130% | $2,004,500 | $2,743,000 |
| 15.0 | TRUCK & RAIL INFRASTRUCTURE | $4,340,800 | 95% | 140% | $4,123,760 | $6,077,120 |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | $20,120,900 | 95% | 140% | $19,114,855 | $28,169,260 |
| 17.0 | LIMESTONE HANDLING SYSTEM | $22,661,200 | 95% | 130% | $21,528,140 | $29,459,560 |
| 18.0 | REAGENT (LIMESTONE) PREPARATION ISLAND | $40,693,200 | 95% | 130% | $38,658,540 | $52,901,160 |
| 19.0 | BYPRODUCT DEWATERING ISLAND (INCLUDES REMOTE GYPSUM HANDLING AREA) | $60,616,600 | 95% | 130% | $57,585,770 | $78,801,580 |
| 20.0 | WET FGD ABSORBER ISLAND | $127,317,900 | 95% | 130% | $120,952,005 | $165,513,270 |
| 21.0 | COMPRESSED AIR SYSTEM (BYPRODUCT DEWATERING AREA) | $1,298,800 | 95% | 135% | $1,233,860 | $1,753,380 |
| 23.0 | SCR SUBSTATION UPGRADE | $2,340,000 | 95% | 130% | $2,223,000 | $3,042,000 |
| 26.0 | BOP ITEMS | $6,922,700 | 95% | 160% | $6,576,565 | $11,076,320 |
| 27.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $4,264,900 | 95% | 200% | $4,051,655 | $8,529,800 |
| 28.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | $750,000 | 95% | 150% | $712,500 | $1,125,000 |
| 99.0 | OVERALL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | $143,067,200 | 95% | 140% | $135,913,840 | $200,294,080 |
| | OVERALL PROJECT INDIRECT COSTS | $85,286,300 | 95% | 130% | $81,021,985 | $110,872,190 |
| | SPARE PARTS | $2,957,700 | 95% | 130% | $2,809,815 | $3,845,010 |
| | **Total Base Case** | **$816,591,700** | | | | |

# ANALYSIS OUTPUT

Probability of meeting "Total Base Case" value: 816,591,700 0.0%

| Total Budget Required ($k) | % Confidence Level | Confidence Level Risk | Contingency % of Base |
|---|---|---|---|
| 988,299,655 | 100.0% | 171,708,000 | 21.027% |
| 929,792,275 | 95.0% | 113,200,600 | 13.863% |
| 921,705,744 | 90.0% | 105,114,000 | 12.872% |
| 915,943,694 | 85.0% | 99,352,000 | 12.167% |
| 911,621,709 | 80.0% | 95,030,000 | 11.637% |
| 907,536,476 | 75.0% | 90,944,800 | 11.137% |
| 903,803,935 | 70.0% | 87,212,200 | 10.680% |
| 900,698,387 | 65.0% | 84,106,700 | 10.300% |
| 897,471,189 | 60.0% | 80,879,500 | 9.905% |
| 894,556,818 | 55.0% | 77,965,100 | 9.548% |
| 891,692,497 | 50.0% | 75,100,800 | 9.197% |
| 888,701,193 | 45.0% | 72,109,500 | 8.831% |
| 885,949,244 | 40.0% | 69,357,500 | 8.494% |
| 882,807,375 | 35.0% | 66,215,700 | 8.109% |
| 879,872,853 | 30.0% | 63,281,200 | 7.749% |
| 876,846,033 | 25.0% | 60,254,300 | 7.379% |
| 873,355,330 | 20.0% | 56,763,600 | 6.951% |
| 869,183,077 | 15.0% | 52,591,400 | 6.440% |
| 864,621,128 | 10.0% | 48,029,400 | 5.882% |
| 857,413,557 | 5.0% | 40,821,900 | 4.999% |



AEP
BIG SANDY UNIT 2
FGD PROJECT - NID (N/ESP) - 1B - 3.0 LB/MM BTU

@RISK
Risk Analysis and Simulation Add-In for Microsoft EXCEL
Version 5.0
Palisade Corporation

# ANALYSIS INPUT

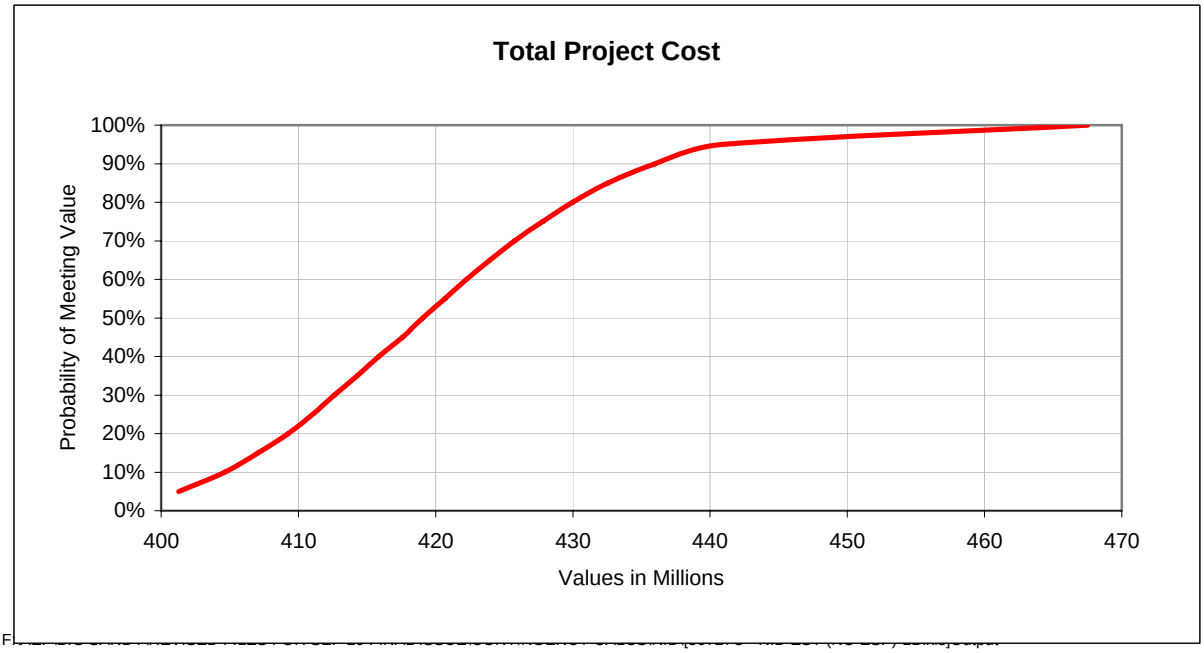
Values in Thousands

| Accnt. No. | Cost Elements | Target Value $k | Minimum | Maximum | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1.0 | ID FANS | $48,130,300 | 95% | 130% | $45,723,785 | $62,569,390 |
| 2.0 | NID MODULES | $124,123,100 | 95% | 125% | $117,916,945 | $155,153,875 |
| 3.0 | STACK | $19,350,000 | 95% | 130% | $18,382,500 | $25,155,000 |
| 4.0 | LIME HANDLING SYSTEM | $21,764,900 | 95% | 125% | $20,676,655 | $27,206,125 |
| 6.0 | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | $10,815,700 | 95% | 130% | $10,274,915 | $14,060,410 |
| 8.0 | ACTIVATED CARBON INJECTION SYSTEM | $5,381,600 | 95% | 130% | $5,112,520 | $6,996,080 |
| 9.0 | COMPRESSED AIR SYSTEM | $3,981,400 | 95% | 135% | $3,782,330 | $5,374,890 |
| 10.0 | SERVICE WATER SYSTEM | $2,907,200 | 95% | 135% | $2,761,840 | $3,924,720 |
| 11.1 | POTABLE WATER SYSTEM | $800,900 | 95% | 135% | $760,855 | $1,081,215 |
| 12.0 | FGD SUBSTATION | $7,795,100 | 95% | 135% | $7,405,345 | $10,523,385 |
| 13.0 | FGD DCS SYSTEM | $5,016,900 | 95% | 135% | $4,766,055 | $6,772,815 |
| 14.0 | CEM SYSTEM | $2,110,000 | 95% | 130% | $2,004,500 | $2,743,000 |
| 15.0 | TRUCK & RAIL INFRASTRUCTURE | $4,340,800 | 95% | 140% | $4,123,760 | $6,077,120 |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | $12,845,200 | 95% | 140% | $12,202,940 | $17,983,280 |
| 17.0 | BOP ITEMS | $3,223,700 | 95% | 160% | $3,062,515 | $5,157,920 |
| 18.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $3,509,200 | 95% | 200% | $3,333,740 | $7,018,400 |
| 19.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | $750,000 | 95% | 150% | $712,500 | $1,125,000 |
| 99.0 | OVERALL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | $63,181,200 | 95% | 140% | $60,022,140 | $88,453,680 |
| | OVERALL PROJECT INDIRECT COSTS | $44,295,700 | 95% | 130% | $42,080,915 | $57,584,410 |
| | SPARE PARTS | $1,511,500 | 95% | 130% | $1,435,925 | $1,964,950 |
| | **Total Base Case** | **$385,834,400** | | | | |

# ANALYSIS OUTPUT

Probability of meeting "Total Base Case" value: 385,834,400 0.0%

| Total Budget Required ($k) | % Confidence Level | Confidence Level Risk | Contingency % of Base |
|---|---|---|---|
| 467,509,494 | 100.0% | 81,675,100 | 21.168% |
| 440,959,174 | 95.0% | 55,124,800 | 14.287% |
| 435,974,828 | 90.0% | 50,140,400 | 12.995% |
| 432,544,320 | 85.0% | 46,709,900 | 12.106% |
| 429,991,125 | 80.0% | 44,156,700 | 11.444% |
| 427,826,341 | 75.0% | 41,991,900 | 10.883% |
| 425,739,782 | 70.0% | 39,905,400 | 10.343% |
| 423,941,739 | 65.0% | 38,107,300 | 9.877% |
| 422,256,411 | 60.0% | 36,422,000 | 9.440% |
| 420,675,831 | 55.0% | 34,841,400 | 9.030% |
| 419,072,899 | 50.0% | 33,238,500 | 8.615% |
| 417,583,544 | 45.0% | 31,749,100 | 8.229% |
| 415,856,426 | 40.0% | 30,022,000 | 7.781% |
| 414,303,527 | 35.0% | 28,469,100 | 7.379% |
| 412,631,000 | 30.0% | 26,796,600 | 6.945% |
| 411,025,258 | 25.0% | 25,190,900 | 6.529% |
| 409,248,043 | 20.0% | 23,413,600 | 6.068% |
| 407,056,070 | 15.0% | 21,221,700 | 5.500% |
| 404,665,373 | 10.0% | 18,831,000 | 4.881% |
| 401,283,783 | 5.0% | 15,449,400 | 4.004% |



# EXHIBIT 1-5
# Union Labor Rate Summary

# Exhibit 1-5
# Union Labor Rate Summary

## 2010 BIG SANDY CRAFTS Union Labor Rates

| Craft Rates | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Craft | Means Title | S&L Title | Base | W. Comp | Fringes | Travel | FICA | Craft Total |
| 1 | Insulation Worker | | 27.00 | 5.53 | 16.34 | 0.00 | 2.60 | 51.47 |
| 2 | Boilermaker | | 31.04 | 6.35 | 18.06 | 0.00 | 2.91 | 58.36 |
| 3 | Bricklayer | | 24.98 | 5.11 | 16.37 | 0.00 | 2.44 | 48.90 |
| 4 | Carpenter | | 26.30 | 5.38 | 14.31 | 0.00 | 2.54 | 48.53 |
| 5 | Cement Finisher | Cement Mason | 25.25 | 5.17 | 15.22 | 0.00 | 2.46 | 48.10 |
| 6 | Electrician | | 28.68 | 5.87 | 19.71 | 0.00 | 2.73 | 56.99 |
| 7 | Elevator Constr | | 26.63 | 5.45 | 18.04 | 0.00 | 2.57 | 52.69 |
| 8 | Glazier | | 26.63 | 5.45 | 18.04 | 0.00 | 2.57 | 52.69 |
| 9 | Structural Steel Worker | Ironworker | 26.63 | 5.45 | 18.04 | 0.00 | 2.57 | 52.69 |
| 10 | Common Bldg Laborer | Laborer, Bulding | 22.90 | 4.69 | 12.37 | 0.00 | 2.28 | 42.24 |
| 11 | Common Bldg Laborer | Laborer, Chimney | 22.90 | 4.69 | 12.37 | 0.00 | 2.28 | 42.24 |
| 12 | Com Bldg Lab, Air Tool | Laborer, Jackhammer | 22.90 | 4.69 | 12.37 | 0.00 | 2.28 | 42.24 |
| 13 | Plasterers Helper | Laborer, Plasterer | 22.90 | 4.69 | 12.37 | 0.00 | 2.28 | 42.24 |
| 14 | Lather | | 22.77 | 4.66 | 11.10 | 0.00 | 2.27 | 40.80 |
| 15 | Equip Oper - Med | Lineman | 24.32 | 4.98 | 13.02 | 0.00 | 2.39 | 44.71 |
| 16 | Mill Wright | | 28.04 | 5.74 | 14.86 | 0.00 | 2.68 | 51.32 |
| 17 | Equip Oper - Light | Oper Engr, Air Comp. | 20.65 | 4.23 | 13.02 | 0.00 | 2.11 | 40.01 |
| 18 | Equip Oper - Oiler | Oper Eng, Oiler | 20.65 | 4.23 | 13.02 | 0.00 | 2.11 | 40.01 |
| 19 | Equip Oper - Heavy | Loader > 2.5 Cu Yds | 25.08 | 5.13 | 13.02 | 0.00 | 2.45 | 45.68 |
| 20 | Equip Oper - Med | Loader < 2.5 Cu Yds | 24.32 | 4.98 | 13.02 | 0.00 | 2.39 | 44.71 |
| 21 | Equip Oper - Heavy | Oper Eng, Crane | 25.08 | 5.13 | 13.02 | 0.00 | 2.45 | 45.68 |
| 22 | Painter, Struct Steel | Painter | 22.77 | 4.66 | 11.10 | 0.00 | 2.27 | 40.80 |
| 23 | Pipefitter | | 24.63 | 5.04 | 19.35 | 0.00 | 2.42 | 51.44 |
| 24 | Plumber | | 24.63 | 5.04 | 19.35 | 0.00 | 2.42 | 51.44 |
| 25 | Roofer, Composition | | 24.30 | 4.97 | 11.18 | 0.00 | 2.39 | 42.84 |
| 26 | Sheet Metal Worker | | 23.18 | 4.74 | 19.37 | 0.00 | 2.31 | 49.60 |
| 27 | Tile Layer | | 24.98 | 5.11 | 16.37 | 0.00 | 2.44 | 48.90 |
| 28 | Truck Driver - Heavy | Teamster | 29.39 | 6.02 | 13.18 | 0.00 | 2.78 | 51.37 |
| 29 | Waterproofer | | 22.77 | 4.66 | 11.10 | 0.00 | 2.27 | 40.80 |
| 30 | Plasterer | | 22.77 | 4.66 | 11.10 | 0.00 | 2.27 | 40.80 |

Average 47.01

# Exhibit 1-5
## Union Labor Rate Summary

**2010 BIG SANDY CRAFTS Union Labor Rates**

| Crew Rates | | | Crew Mix | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crew | Title | Base | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | | Comp | Fringes | Travel | Other | Equipment [1] | FICA | Site OH | Total |
| BAGH | BAGHOUSE | 29.78 | | 0.75 | | 0.02 | | 0.02 | | | 0.07 | 0.03 | | | | | | | | | | | 0.09 | | | | | | | 0.02 | | | 1.00 | 6.09 | 17.29 | 0.00 | 2.98 | 19.56 | 2.81 | 29.83 | 108.34 |
| BCSE | BASE COURSE | 23.85 | | | | | | | | | | 0.30 | | | | | | | | 0.15 | | 0.45 | | | | | | | | 0.10 | | | 1.00 | 4.88 | 12.84 | 0.00 | 2.39 | 30.45 | 2.36 | 29.17 | 105.94 |
| CARP | CARPENTRY | 25.96 | | | | 0.90 | | | | | | 0.10 | | | | | | | | | | | | | | | | | | | | | 1.00 | 5.31 | 14.12 | 0.00 | 2.60 | 1.58 | 2.52 | 19.79 | 71.88 |
| CLHG | COAL HANDLING | 27.08 | | 0.05 | | 0.05 | 0.01 | 0.02 | | | 0.13 | 0.10 | | | | | | 0.50 | | | | | 0.10 | | | | | 0.01 | | 0.03 | | | 1.00 | 5.55 | 15.07 | 0.00 | 2.71 | 14.11 | 2.60 | 25.50 | 92.62 |
| CNDR | CONDENSER | 29.36 | | 0.70 | | 0.07 | | 0.01 | | | | 0.07 | | | | | | 0.02 | | | | | 0.07 | | 0.04 | | | | | 0.02 | | | 1.00 | 6.01 | 16.95 | 0.00 | 2.94 | 9.53 | 2.79 | 25.68 | 93.26 |
| CONB | CONCRETE BUCKET | 24.05 | | | | 0.10 | 0.14 | | | | 0.10 | 0.51 | | | | | | | | 0.05 | | | 0.10 | | | | | | | | | | 1.00 | 4.92 | 13.62 | 0.00 | 2.41 | 14.37 | 2.37 | 23.46 | 85.20 |
| CONC | CONCRETE CHIMNEY | 23.49 | | | | | | | | | 0.10 | 0.15 | 0.55 | | | | | | | 0.05 | | | 0.15 | | | | | | | | | | 1.00 | 4.81 | 13.06 | 0.00 | 2.35 | 9.11 | 2.33 | 20.96 | 76.11 |
| COND | CONCRETE DIRECT | 24.01 | | | | 0.10 | 0.17 | | | | 0.10 | 0.63 | | | | | | | | | | | | | | | | | | | | | 1.00 | 4.92 | 13.61 | 0.00 | 2.40 | 3.44 | 2.37 | 19.29 | 70.04 |
| CONP | CONCRETE PUMP | 23.72 | | | | 0.10 | 0.14 | | | | 0.10 | 0.56 | | | | | | | 0.10 | | | | | | | | | | | | | | 1.00 | 4.86 | 13.59 | 0.00 | 2.37 | 10.83 | 2.34 | 21.93 | 79.64 |
| CTMC | COOL. TWR. CONCRETE | 25.17 | | | | 0.17 | 0.30 | 0.01 | | | 0.10 | 0.26 | | | | | | 0.04 | | | | | 0.10 | | | | | | | 0.02 | | | 1.00 | 5.15 | 14.37 | 0.00 | 2.52 | 14.13 | 2.47 | 24.25 | 88.06 |
| CTMW | COOLING TWR. WOOD | 25.72 | | | | 0.60 | 0.02 | 0.01 | | | | 0.15 | | | | | | 0.05 | | | | | 0.05 | | 0.10 | | | | | 0.02 | | | 1.00 | 5.26 | 14.54 | 0.00 | 2.57 | 14.67 | 2.49 | 24.80 | 90.05 |
| CURB | CURB AND GUTTER | 24.74 | | | | 0.28 | 0.29 | | | | | 0.28 | | | | | | | | | | 0.15 | | | | | | | | | | | 1.00 | 5.07 | 13.83 | 0.00 | 2.47 | 2.50 | 2.42 | 19.39 | 70.42 |
| CYNC | COOLING TWR. NATURAL | 25.15 | | | | 0.22 | 0.30 | 0.01 | | | 0.10 | 0.25 | | | | | | | | | | | 0.10 | | | | | | | 0.02 | | | 1.00 | 5.14 | 14.37 | 0.00 | 2.52 | 8.93 | 2.47 | 22.26 | 80.84 |
| DCKG | DECKING STEEL | 26.47 | | | | | | | | | 0.90 | | | | | | | | | 0.02 | | | 0.06 | | | | | | | 0.02 | | | 1.00 | 5.42 | 17.54 | 0.00 | 2.65 | 3.66 | 2.56 | 22.15 | 80.45 |
| DINS | DUCT THERM. INSUL. | 25.66 | 0.55 | | | | | | | | | 0.10 | | | | | | | | | | | 0.05 | | | | | 0.25 | | 0.05 | | | 1.00 | 5.26 | 16.38 | 0.00 | 2.57 | 6.87 | 2.50 | 22.51 | 81.75 |
| DWTR | DEWATERING | 21.10 | | | | | | | | | | 0.20 | | | | | | | 0.80 | | | | | | | | | | | | | | 1.00 | 4.32 | 12.89 | 0.00 | 2.11 | 5.22 | 2.15 | 18.16 | 65.95 |
| ECND | CONDUITS AND TRAYS | 26.65 | | | | 0.25 | | 0.50 | | | | 0.25 | | | | | | | | | | | | | | | | | | | | | 1.00 | 5.46 | 16.53 | 0.00 | 2.67 | 1.16 | 2.58 | 20.92 | 75.97 |
| EDCO | ELECTRICAL DUCTS | 26.17 | | | | 0.18 | | 0.28 | | | 0.09 | 0.10 | | | | | | | | 0.09 | | | 0.18 | | | | | | | 0.08 | | | 1.00 | 5.35 | 15.52 | 0.00 | 2.62 | 6.45 | 2.53 | 22.28 | 80.92 |
| EDEX | EXCAVATION DUCTRUNS | 25.73 | | | | 0.22 | | | | | 0.11 | 0.12 | | | | | | | | 0.11 | | | 0.22 | | | | | | | 0.22 | | | 1.00 | 5.26 | 13.80 | 0.00 | 2.57 | 4.60 | 2.49 | 20.69 | 75.14 |
| EHEA | ELEC. HEAVY EQ. 1 | 27.26 | | | | | | 0.40 | | | 0.10 | 0.20 | | | | | | 0.20 | | | | | | | | | | | | 0.10 | | | 1.00 | 5.59 | 16.44 | 0.00 | 2.73 | 2.71 | 2.63 | 21.80 | 79.16 |
| EHEB | ELEC. HEAVY EQ. 2&3 | 26.29 | | | | | | 0.30 | | | 0.30 | 0.15 | | | | | | | | 0.05 | | | 0.15 | | | | | | | 0.05 | | | 1.00 | 5.38 | 16.44 | 0.00 | 2.63 | 4.03 | 2.55 | 21.78 | 79.10 |
| EHEC | ELEC. HEAVY EQ. 4 | 26.29 | | | | | | 0.30 | | | 0.30 | 0.15 | | | | | | | | 0.05 | | | 0.15 | | | | | | | 0.05 | | | 1.00 | 5.38 | 16.44 | 0.00 | 2.63 | 5.63 | 2.55 | 22.39 | 81.31 |
| ELEV | ELEVATORS | 26.63 | | | | | | | 1.00 | | | | | | | | | | | | | | | | | | | | | | | | 1.00 | 5.45 | 18.04 | 0.00 | 2.66 | 0.28 | 2.57 | 21.14 | 76.77 |
| ESSW | ELEC. SWITCHYARD | 24.46 | | | | | | | | | 0.38 | 0.39 | | | | | | | | 0.08 | | | 0.15 | | | | | | | | | | 1.00 | 5.01 | 14.67 | 0.00 | 2.45 | 4.03 | 2.41 | 20.15 | 73.18 |
| ETEX | EXCAVATION TRENCHES | 24.40 | | | | | | | | | | 0.30 | | | | | | | | 0.30 | | | 0.10 | | | | | | | 0.30 | | | 1.00 | 5.00 | 12.87 | 0.00 | 2.44 | 9.95 | 2.39 | 21.68 | 78.73 |
| ETRL | TRANSMISSION LINES | 23.72 | | | | | | | | | | 0.25 | | | | | 0.38 | | | 0.12 | 0.25 | | | | | | | | | | | | 1.00 | 4.85 | 12.86 | 0.00 | 2.37 | 6.02 | 2.34 | 19.82 | 71.98 |
| ETWK | EARTHWORK | 24.78 | | | | | | | | | | 0.07 | | | | | | | | 0.15 | | | 0.66 | | | | | | | 0.12 | | | 1.00 | 5.07 | 12.99 | 0.00 | 2.48 | 80.87 | 2.43 | 48.87 | 177.49 |
| EXFD | EXCAVATION | 26.71 | | | | | | | | | | | | | | | | | | 0.12 | | | 0.38 | | | | | | | 0.50 | | | 1.00 | 5.47 | 13.10 | 0.00 | 2.67 | 14.70 | 2.57 | 24.78 | 90.00 |
| FLDU | FLUES AND DUCTS | 29.52 | | 0.72 | | 0.05 | | | | | 0.05 | 0.04 | | | | | | | | | | | 0.12 | | | | | | | 0.02 | | | 1.00 | 6.04 | 16.93 | 0.00 | 2.95 | 19.99 | 2.80 | 29.73 | 107.96 |
| FORM | FORMWORK | 25.37 | | | | 0.65 | | | | | | 0.25 | | | | | | | | 0.02 | | | 0.05 | | | | | | | 0.03 | | | 1.00 | 5.19 | 13.70 | 0.00 | 2.54 | 22.79 | 2.46 | 27.38 | 99.43 |
| GALL | GALLERY WORK | 26.47 | | | | | | | | | 0.90 | | | | | | | | | 0.02 | | | 0.06 | | | | | | | 0.02 | | | 1.00 | 5.42 | 17.54 | 0.00 | 2.65 | 6.67 | 2.56 | 23.30 | 84.61 |
| HVAC | HVAC | 24.32 | 0.10 | | | 0.02 | | 0.06 | | | | 0.06 | | | | | | 0.02 | | | | | | | 0.16 | | | 0.57 | | 0.01 | | | 1.00 | 4.97 | 18.41 | 0.00 | 2.43 | 6.34 | 2.40 | 22.37 | 81.24 |
| INEL | INSTRUMENTATION ELEC | 28.68 | | | | | | 1.00 | | | | | | | | | | | | | | | | | | | | | | | | | 1.00 | 5.87 | 19.71 | 0.00 | 2.87 | 4.22 | 2.73 | 24.35 | 88.43 |
| INPE | PNEUMATIC INSTRUMENT | 24.63 | | | | | | | | | | | | | | | | | | | | | | | 1.00 | | | | | | | | 1.00 | 5.04 | 19.35 | 0.00 | 2.46 | 2.56 | 2.42 | 21.46 | 77.92 |
| INSL | INSULATION | 25.42 | 0.60 | | | | | | | | | 0.20 | | | | | | | | | | | | | | | | 0.20 | | | | | 1.00 | 5.21 | 16.14 | 0.00 | 2.54 | 2.60 | 2.48 | 20.67 | 75.06 |
| LAND | LAND | 22.90 | | | | | | | | | | 1.00 | | | | | | | | | | | | | | | | | | | | | 1.00 | 4.69 | 12.37 | 0.00 | 2.29 | 0.00 | 2.28 | 16.92 | 61.45 |
| MECH | MISC. MECHANICAL EQ. | 26.08 | | 0.05 | | 0.01 | 0.03 | 0.05 | | | | 0.01 | | | | | | 0.24 | | | | | | | 0.59 | | | | | 0.02 | | | 1.00 | 5.34 | 17.86 | 0.00 | 2.61 | 9.98 | 2.54 | 24.48 | 88.89 |
| MSRY | MASONRY | 24.30 | | | 0.67 | | | | | | | 0.33 | | | | | | | | | | | | | | | | | | | | | 1.00 | 4.97 | 15.05 | 0.00 | 2.43 | 4.05 | 2.38 | 20.21 | 73.39 |
| MSTR | SEEDING & MULCHING | 22.90 | | | | | | | | | | 1.00 | | | | | | | | | | | | | | | | | | | | | 1.00 | 4.69 | 12.37 | 0.00 | 2.29 | 13.47 | 2.28 | 22.04 | 80.04 |
| PBIT | PAVING BITUMINOUS | 23.77 | | | | | | | | | | 0.60 | | | | | | | | | 0.40 | | | | | | | | | | | | 1.00 | 4.86 | 12.63 | 0.00 | 2.38 | 19.41 | 2.35 | 24.85 | 90.25 |
| PCON | PAVING CONCRETE | 24.05 | | | | | 0.31 | | | | | 0.50 | | | | | | | | | 0.19 | | | | | | | | | | | | 1.00 | 4.92 | 13.38 | 0.00 | 2.41 | 6.84 | 2.37 | 20.51 | 74.48 |
| PCRF | PRECAST CONCRETE | 24.52 | | | | | 0.15 | | | | 0.30 | 0.32 | | | | | | | | 0.08 | | | 0.15 | | | | | | | | | | 1.00 | 5.03 | 14.64 | 0.00 | 2.45 | 0.50 | 2.41 | 18.83 | 68.38 |
| PILE | SHEET PILING | 23.46 | | | | | | | | | | 0.50 | | | | | | | | 0.12 | | | 0.38 | | | | | | | | | | 1.00 | 4.81 | 12.70 | 0.00 | 2.35 | 38.57 | 2.32 | 32.00 | 116.21 |
| PINS | PIPE INSULATION | 24.29 | 0.23 | | | 0.12 | | | | | | 0.55 | | | | | | | | | | | | | | | | 0.10 | | | | | 1.00 | 4.97 | 14.22 | 0.00 | 2.43 | 2.07 | 2.38 | 19.14 | 69.50 |
| PLAS | PLASTERING | 22.84 | | | | | | | | | | | | | 0.50 | | | | | | | | | | | | | | | | | 0.50 | 1.00 | 4.68 | 11.74 | 0.00 | 2.28 | 1.86 | 2.28 | 17.36 | 63.04 |
| PLMB | PLUMBING | 24.63 | | | | | | | | | | | | | | | | | | | | | | | | 1.00 | | | | | | | 1.00 | 5.04 | 19.35 | 0.00 | 2.46 | 3.65 | 2.42 | 21.87 | 79.42 |
| PNTR | PAINTING | 22.77 | | | | | | | | | | | | | | | | | | | | | | 1.00 | | | | | | | | | 1.00 | 4.66 | 11.10 | 0.00 | 2.28 | 5.27 | 2.27 | 18.37 | 66.72 |
| PREC | PRECIPITATOR | 29.21 | | 0.62 | | 0.04 | | 0.08 | | | 0.05 | 0.04 | | | | | | 0.03 | | | | | 0.07 | | 0.02 | | | 0.03 | | 0.02 | | | 1.00 | 5.98 | 17.33 | 0.00 | 2.92 | 18.58 | 2.77 | 29.18 | 105.97 |
| PUMP | PUMPS AND DRIVES | 25.74 | | | | 0.01 | 0.01 | 0.05 | | | 0.03 | 0.01 | | | | | | 0.21 | | | | | 0.07 | | 0.59 | | | | | 0.02 | | | 1.00 | 5.26 | 17.65 | 0.00 | 2.57 | 9.73 | 2.51 | 24.12 | 87.58 |
| REIN | REINFORCING CADWELDS | 26.63 | | | | | | | | | 1.00 | | | | | | | | | | | | | | | | | | | | | | 1.00 | 5.45 | 18.04 | 0.00 | 2.66 | 1.37 | 2.57 | 21.55 | 78.27 |
| ROOF | ROOFING MEMBRANE | 24.30 | | | | | | | | | | | | | | | | | | | | | | | | | 1.00 | | | | | | 1.00 | 4.97 | 11.18 | 0.00 | 2.43 | 4.82 | 2.39 | 19.03 | 69.12 |
| RRAP | RIP RAP | 23.33 | | | | | | | | | | 0.60 | | | | | | | | 0.10 | | | 0.30 | | | | | | | | | | 1.00 | 4.77 | 12.63 | 0.00 | 2.33 | 6.66 | 2.32 | 19.78 | 71.82 |
| RRTK | RAILROAD TRACK | 24.05 | | | | | | | | | | 0.55 | | | | | | | | 0.08 | | | 0.25 | | | | | | | 0.12 | | | 1.00 | 4.92 | 12.68 | 0.00 | 2.41 | 17.54 | 2.36 | 24.30 | 88.26 |
| SCRB | SCR BACKFIT WORK | 29.52 | | 0.72 | | 0.05 | | | | | 0.05 | 0.04 | | | | | | | | | | | 0.12 | | | | | | | 0.02 | | | 1.00 | 6.04 | 16.93 | 0.00 | 2.95 | 39.99 | 2.80 | 37.33 | 135.56 |
| SDNG | SIDING | 23.18 | | | | | | | | | | | | | | | | | | | | | | | | | | 1.00 | | | | | 1.00 | 4.74 | 19.37 | 0.00 | 2.32 | 15.77 | 2.31 | 25.72 | 93.41 |
| SDWK | SIDEWALK | 23.71 | | | | 0.10 | 0.20 | | | | | 0.70 | | | | | | | | | | | | | | | | | | | | | 1.00 | 4.85 | 13.13 | 0.00 | 2.37 | 2.50 | 2.34 | 18.58 | 67.48 |
| SGEN | STEAM GENERATOR | 28.50 | 0.12 | 0.51 | | 0.02 | | 0.02 | | | 0.05 | 0.02 | | | | | | 0.01 | | | | | 0.10 | | 0.10 | | | 0.03 | | 0.02 | | | 1.00 | 5.82 | 17.23 | 0.00 | 2.85 | 20.75 | 2.72 | 29.59 | 107.46 |
| SPNG | STATION PIPING | 24.92 | | | | 0.07 | | 0.02 | | | | 0.07 | | | | | | | | | | | 0.06 | | 0.74 | | | | | 0.04 | | | 1.00 | 5.11 | 17.89 | 0.00 | 2.49 | 15.56 | 2.44 | 26.00 | 94.41 |
| SSCL | SUSPENSION SYSTEM | 22.77 | | | | | | | | | | | | | | 1.00 | | | | | | | | | | | | | | | | | 1.00 | 4.66 | 11.10 | 0.00 | 2.28 | 2.32 | 2.27 | 17.25 | 62.65 |
| STST | STRUCTURAL STEEL | 25.88 | | | | | | | | | 0.75 | | | | | | | | | 0.08 | | | 0.17 | | | | | | | | | | 1.00 | 5.30 | 16.78 | 0.00 | 2.59 | 23.53 | 2.52 | 29.11 | 105.71 |
| TANK | TANKS | 25.47 | | | | 0.01 | 0.01 | 0.05 | | | | 0.11 | | | | | | 0.21 | | | | | | | 0.59 | | | | | 0.02 | | | 1.00 | 5.21 | 17.44 | 0.00 | 2.55 | 11.45 | 2.49 | 24.55 | 89.16 |
| TILE | TILE CERAMIC | 24.98 | | | | | | | | | | | | | | | | | | | | | | | | | | | 1.00 | | | | 1.00 | 5.11 | 16.37 | 0.00 | 2.50 | 2.06 | 2.44 | 20.31 | 73.77 |
| TKFE | TANKS FIELD ERECTED | 29.32 | | 0.68 | | 0.05 | 0.01 | | | | 0.04 | 0.06 | | | | | | 0.02 | | | | | 0.11 | | | | | | | 0.03 | | | 1.00 | 5.99 | 16.74 | 0.00 | 2.93 | 16.40 | 2.77 | 28.18 | 102.33 |
| TRZO | TERRAZZO | 25.02 | | | | | 0.90 | | | | | 0.10 | | | | | | | | | | | | | | | | | | | | | 1.00 | 5.12 | 14.94 | 0.00 | 2.50 | 7.15 | 2.44 | 21.73 | 78.90 |
| TURB | TURBINE GENERATOR | 26.87 | 0.04 | | | 0.02 | 0.01 | 0.04 | | | 0.08 | 0.02 | | | | | | 0.49 | | | | | 0.08 | | 0.20 | | | | | 0.02 | | | 1.00 | 5.49 | 16.02 | 0.00 | 2.69 | 2.65 | 2.59 | 21.40 | 77.71 |
| WIRE | WIREMEN | 28.14 | | | | | | 0.85 | | | | | | | | | | | | | | | 0.15 | | | | | | | | | | 1.00 | 5.76 | 18.70 | 0.00 | 2.81 | 13.52 | 2.69 | 27.22 | 98.84 |
| WNDW | WINDOWS GLAZED | 26.34 | | | | | | | | 0.45 | 0.45 | | | | | | | | | 0.03 | | | 0.07 | | | | | | | | | | 1.00 | 5.39 | 17.54 | 0.00 | 2.63 | 4.52 | 2.55 | 22.41 | 81.38 |
| WRKG | WRECKING | 24.53 | | | | | | | | | | | | 0.55 | | | | | | 0.05 | | | 0.20 | | | | | | | 0.20 | | | 1.00 | 5.02 | 12.69 | 0.00 | 2.45 | 40.31 | 2.41 | 33.22 | 120.63 |
| WTRP | WATERPROOFING | 22.77 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1.00 | | 1.00 | 4.66 | 11.10 | 0.00 | 2.28 | 5.37 | 2.27 | 18.41 | 66.86 |
| WTRT | WATER TREATMENT | 26.14 | | 0.05 | | 0.01 | 0.03 | 0.14 | | | 0.01 | 0.01 | | | | | | 0.14 | | | | | | | 0.59 | | | | | 0.02 | | | 1.00 | 5.34 | 18.32 | 0.00 | 2.61 | 10.86 | 2.55 | 25.01 | 90.83 |
| YDPP | YARD PIPING | 24.66 | | | | 0.07 | | 0.02 | | | | 0.07 | | | | | | | | 0.06 | | | | | 0.74 | | | | | 0.04 | | | 1.00 | 5.05 | 17.89 | 0.00 | 2.47 | 12.83 | 2.42 | 24.82 | 90.14 |
| YDRN | YARD DRAINAGE | 23.28 | | | | | | | | | | 0.70 | | | | | | | | 0.08 | | 0.17 | | | | | | | | 0.05 | | | 1.00 | 4.77 | 12.57 | 0.00 | 2.33 | 12.21 | 2.32 | 21.84 | 79.32 |

Note 1: Equipment includes small tools and equipment such as air compressors, welding machies, JLG's, forklifts, chain hoists, etc. Heavy cranes and crawlers are not included in the wage rates but are included as separate line items in the cost estimate.

Average 85.34

## Sargent & Lundy Labor Rate Make-Up and Calculations

**Indirect Cost Items**

**Total Payroll Wages**

| | | |
|---|---|---|
| **Base Hourly Rate** | | |
| **Payroll Taxes** | | |
| Social Security - FICA | Calculated as a percent of Base | (Set by the Federal Government Annually) |
| State Unemployment - SUI | Calculated as a percent of Base | (Set by each State Government and adjusted periodically) |
| Federal Unemployment - FUI | Calculated as a percent of Base | (Set by the Federal Government and adjusted periodically) |
| **Total Payroll Taxes** | | |
| **Insurance** | | |
| Workmen's Compensation | Calculated as a percent of Base | (Set by each State and adjusted periodically) |
| **Total Insurance Burden** | | |
| **Fringe Benefits** | Calculated as a percent of Base | (Set By Union/Project Agreements) |

**Other**

| | | | |
|---|---|---|---|
| **Other** | | | |
| Expendable/Small Tools | 6.00% | Calculated as a percent of Base | (Set By Contractor) |
| Show-up Time | 2% | Allowance | |
| Working Foreman | 0% | Calculated as a percent of Base | |
| General Liability | 2.35% | Calculated as a percent of Base | (Set by Contractor) |

| | | |
|---|---|---|
| **Construction Equipment** | Fixed | Calculation based on Required Equipment x Rental Rate.<br>Rental rate is based on monthly rate/173 to arrive at an hourly rate |

**Site Overheaeds**

**Overheads** — 38% - This item is strictly all field overheads. (38% of Total Payroll Wages + Other + Construction Equipment)

| **Indirects** | **Percentage breakdown of Site Overhead Factor** |
|---|---|
| Job Supervision-Field Staff | 4.29 |
| Administration-Field Staff | 6.67 |
| Personnel Hiring | 4.29 |
| Craft Superintendents | 12.87 |
| Safety | 4.17 |
| Purchasing/Expediting-Field Staff | 2.98 |
| Material Control-Field Staff | 1.40 |
| Engineering Liaison-Field Staff | 0.53 |
| Project Controls-Field Staff | 6.61 |
| Cost/Schedule Controls-Field Staff | 4.41 |
| Quality Control Inspection-Field Staff | 5.54 |
| Project Office Supplies-Field Staff | 1.10 |
| Computer Expenses | 2.58 |
| Service Trucks/Supplies | 2.57 |
| Field and Shop Mechanics and Supplies | 2.77 |
| Subcontract Administration | 1.63 |
| Warehousing-Field Staff | 1.46 |
| Field Surveying | 2.66 |
| Water & Ice | 0.44 |
| Sanitation and Cleanup | 2.15 |
| Move In/Move Out | 3.52 |
| Detours/Barricades/Flags | 0.22 |
| Security | 3.13 |
| Temp. Utilities/Distr/Hookup | 1.47 |
| Temporary Site Improvement | 0.39 |
| Temporary Facilities/Buildings | 0.80 |
| Utilities Consumption | 2.19 |
| Employee Expenses | 16.31 |
| Legal Expenses/Claims | 0.52 |
| Permits and Fees | 0.07 |
| Timekeeping | 0.26 |
| **Total Indirect Labor Burdened** | 100.00 |

# EXHIBIT 1-6.1
# Capital Cost Estimate Summary
# Wet FGD Base Case

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
COST ESTIMATE SUMMARY

Estimate No.: 30708C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 1.0 | ID FANS | | | | | |
| 1.1 | ID FANS - OEM EQUIPMENT | 2,070,000 ACFM WITH 21,500 HP MOTORS ($825,000 EACH. INCLUDES HYDRAULIC OIL UNITS, SEAL AIR FAN SKIDS, VIBRATION MONITORING EQUIPMENT, FAN STALL EQUIPMENT, FIELD SERVICE REP FOR 140 DAYS | $ 7,544,000 | $ - | $ 1,696,900 | $ 9,240,900 |
| 1.2 | PIPING & SUPPORTS - MECHANICAL | | $ 29,000 | $ 21,400 | $ 95,700 | $ 146,100 |
| 1.3 | DAMPERS | | $ 449,200 | $ - | $ 210,600 | $ 659,800 |
| 1.4 | EXPANSION JOINTS | | $ - | $ 82,800 | $ 73,600 | $ 156,400 |
| 1.5 | DUCTWORK | INCLUDES INTERNAL BRACING AND TURNING VANES | $ - | $ 1,150,500 | $ 2,197,500 | $ 3,348,000 |
| 1.6 | DUCT SUPPORT STEEL | THREE-COAT SHOP PAINT | $ - | $ 513,300 | $ 516,400 | $ 1,029,700 |
| 1.7 | ID FAN INSULATION & LAGGING | TOTAL FOR TWO FANS. PRICE REFLECTS STANDARD ACOUSTICAL INSULATION | $ - | $ 200,000 | $ 258,500 | $ 458,500 |
| 1.8 | DUCTWORK INSULATION & LAGGING | | $ - | $ 289,100 | $ 566,200 | $ 855,300 |
| 1.9 | SUPPORT STEEL - FOUNDATIONS | | $ - | $ 73,600 | $ 151,400 | $ 225,000 |
| 1.10 | ID FAN PDC / CONTROL ROOM - FOUNDATIONS | | $ - | $ 122,100 | $ 206,200 | $ 328,300 |
| 1.11 | ID FAN PDC / CONTROL ROOM - CONCRETE PIERS | 28 PIERS | $ - | $ 20,700 | $ 61,800 | $ 82,500 |
| 1.12 | ID FAN - FOUNDATIONS | TOTAL FOR TWO FANS | $ - | $ 229,300 | $ 415,700 | $ 645,000 |
| 1.13 | SWITCHGEAR | 0.00 | $ 700,000 | $ - | $ 36,400 | $ 736,400 |
| 1.14 | MCC | 0.00 | $ 123,600 | $ - | $ 11,300 | $ 134,900 |
| 1.15 | ID FAN PDC / CONTROL ROOM | 25W X 70' X 13'H | $ 875,000 | $ - | $ 63,800 | $ 938,800 |
| 1.16 | 138 kV PANELS - RELAY | | $ 100,000 | $ - | $ 9,100 | $ 109,100 |
| 1.17 | 2000A, 15KV CABLE BUS & TERMINATIONS | | $ 132,600 | $ 7,200 | $ 127,500 | $ 267,300 |
| 1.18 | MIMIC PANELS | | $ 17,500 | $ - | $ 6,800 | $ 24,300 |
| 1.19 | EMERGENCY POWER SYSTEM | | $ 285,500 | $ - | $ 38,900 | $ 324,400 |
| 1.20 | GROUNDING | | $ 3,800 | $ - | $ 14,800 | $ 18,600 |
| 1.21 | LIGHTING/ TRANSFORMERS & PANELS | | $ 26,000 | $ 30,000 | $ 29,500 | $ 85,500 |
| 1.22 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 390,600 | $ 1,918,600 | $ 2,309,200 |

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU<br>COST ESTIMATE SUMMARY | Estimate No.:<br>Project No.:<br>Date:<br>Preparer:<br>Reviewer:<br>Approver: | 30708C<br>12721-000<br>9/29/2010<br>MNO<br>JMK<br>PEF |
|---|---|---|---|

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 1.23 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL-15KV | $ - | $ 12,500 | $ 35,300 | $ 47,800 |
| 1.24 | LOW VOLTAGE POWER CABLE & TERMINATION | 0.00 | $ - | $ - | $ 112,200 | $ 112,200 |
| 1.25 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 41,000 | $ 114,900 | $ 155,900 |
| 1.26 | DUCT BANK | 37"H X 62.5"W (75'+150'=225') | $ - | $ 73,400 | $ 127,400 | $ 200,800 |
| 1.27 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 1.28 | LIGHTNING PROTECTION | | $ - | $ 7,000 | $ 6,000 | $ 13,000 |
| 1.29 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 10,286,200 | $ 3,289,500 | $ 9,123,000 | $ 22,698,700 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 514,300 | $ 838,800 | $ 3,496,500 | $ 4,849,700 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ID FANS | $ 10,800,500 | $ 4,128,300 | $ 12,619,500 | $ 27,548,400 |
| | | | | | | |
| 2.0 | WET ESP | | | | | |
| 2.1 | MECHANICAL EQUIPMENT | INCLUDES: INTEGRAL ESP WITH THE ABSORBER, ADDITIONAL SUPPORT STRUCTURES FOR INTEGRATED ESP DESIGN, AND ALL ASSOCIATED INTEGRAL PIPING. | $ 41,021,000 | $ - | $ 35,778,200 | $ 76,799,200 |
| 2.2 | ADDITIONAL COST FOR C276 SHELL MATERIAL ABOVE THE PRICE OF A2205 ABSORBER SHELL | INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL<br>41,000 TOTAL SF | $ - | $ 12,628,000 | $ - | $ 12,628,000 |
| 2.3 | PIPING & SUPPORTS - MECHANICAL | | $ 30,200 | $ 115,300 | $ 362,600 | $ 508,100 |
| 2.4 | WET ESP - FOUNDATIONS | INCLUDED WITH ABSORBER FOUNDATIONS | | | | |

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU<br>COST ESTIMATE SUMMARY | Estimate No.:<br>Project No.:<br>Date:<br>Preparer:<br>Reviewer:<br>Approver: | 30708C<br>12721-000<br>9/29/2010<br>MNO<br>JMK<br>PEF |
|---|---|---|---|

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 2.5 | ELECTRICAL | INCLUDED WITH ABSORBER ISLAND SECTION 7.0 | | | | |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 41,051,200 | $ 12,743,300 | $ 36,140,800 | $ 89,935,300 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 2,052,600 | $ 3,249,500 | $ 13,853,000 | $ 19,155,100 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | WET ESP | $ 43,103,800 | $ 15,992,800 | $ 49,993,800 | $ 109,090,400 |
| | | | | | | |
| 3.0 | NEW STACK | | | | | |
| 3.1 | CONCRETE STACK (WET) | PROVIDED BY AEP | $ - | $ - | $ - | $ 31,480,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ - | $ - | $ 31,480,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ 4,722,000 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | NEW STACK | $ - | $ - | $ - | $ 36,202,000 |
| | | | | | | |
| | | | | | | |
| 4.0 | LIMESTONE HANDLING SYSTEM | | | | | |
| 4.1 | MATERIAL HANDLING EQUIPMENT | | $ 4,690,100 | $ 845,000 | $ 3,544,400 | $ 9,079,500 |
| 4.2 | FIRE PROTECTION SYSTEM FOR BELT CONVEYORS | DELUGE SYSTEM, DRY PIPE, SENSORS, ACTIVATION VALVE AND FM APPROVED PANEL - SUBCONTRACT PRICE FOR ALL CONVEYORS INCLUDES LABOR | $ 660,000 | $ - | $ - | $ 660,000 |
| 4.3 | PIPING - MECHANICAL | | $ 4,800 | $ 1,700 | $ 13,200 | $ 19,700 |
| 4.4 | CONVEYOR STRUCTURE SUPPORT STEEL | THREE-COAT SHOP PAINT | $ - | $ 290,000 | $ 291,800 | $ 581,800 |
| 4.5 | CONVEYOR SUPPORT STEEL - FOUNDATIONS | | $ - | $ 16,000 | $ 48,700 | $ 64,700 |
| 4.6 | RAILCAR LIMESTONE UNLOADING HOPPER, CONVEYOR TUNNEL AND ESCAPE TUNNEL - FOUNDATIONS | | $ - | $ 542,000 | $ 1,613,400 | $ 2,155,400 |
| 4.7 | LIMESTONE TRANSFER TOWER - FOUNDATIONS | | $ - | $ 15,400 | $ 30,500 | $ 45,900 |
| 4.8 | LIMESTONE TRANSFER CONVEYOR - FOUNDATIONS | | $ - | $ 62,000 | $ 125,800 | $ 187,800 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
COST ESTIMATE SUMMARY

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Project No.: 12721-000
Date: 9/29/2010
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| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 4.9 | LIMESTONE RECLAIM HOPPER, CONVEYOR TUNNEL AND ESCAPE TUNNEL - FOUNDATIONS | | $ - | $ 542,000 | $ 1,613,400 | $ 2,155,400 |
| 4.10 | LIMESTONE UNLOADING PDC - FOUNDATIONS | | $ - | $ 24,100 | $ 44,800 | $ 68,900 |
| 4.11 | LIMESTONE UNLOADING PDC - CONCRETE PIERS | 10 PIERS | $ - | $ 6,900 | $ 20,600 | $ 27,500 |
| 4.12 | LIMESTONE RECLAIM PDC - FOUNDATIONS | | $ - | $ 16,800 | $ 32,300 | $ 49,100 |
| 4.13 | LIMESTONE RECLAIM PDC - CONCRETE PIERS | 10 PIERS | $ - | $ 6,900 | $ 20,600 | $ 27,500 |
| 4.14 | TRANSFORMERS | LIMESTONE UNLOADING & RECLAIM AREAS | $ 170,000 | $ - | $ 63,700 | $ 233,700 |
| 4.15 | SWITCHGEAR | LIMESTONE UNLOADING & RECLAIM AREAS | $ 156,800 | $ - | $ 14,600 | $ 171,400 |
| 4.16 | LIMESTONE UNLOADING PDC | 18W X 50' X 10'H | $ 450,000 | $ - | $ 32,800 | $ 482,800 |
| 4.17 | LIMESTONE RECLAIM PDC | 15W X 30' X 10'H | $ 225,000 | $ - | $ 16,400 | $ 241,400 |
| 4.18 | MCC | LIMESTONE UNLOADING & RECLAIM AREAS | $ 123,600 | $ - | $ 7,200 | $ 130,800 |
| 4.19 | CABLE BUS DUCT | LIMESTONE UNLOADING & RECLAIM AREAS | $ 134,700 | $ 5,400 | $ 187,900 | $ 328,000 |
| 4.20 | MIMIC PANELS | | $ 17,500 | $ - | $ 4,500 | $ 22,000 |
| 4.21 | EMERGENCY POWER SYSTEM | LIMESTONE UNLOADING & RECLAIM AREAS | $ 216,300 | $ - | $ 49,100 | $ 265,400 |
| 4.22 | LIGHTING/ TRANSFORMERS & PANELS | | $ 26,000 | $ 67,500 | $ 52,200 | $ 145,700 |
| 4.23 | GROUNDING | LIMESTONE UNLOADING & RECLAIM AREAS | $ 24,100 | $ - | $ 62,200 | $ 86,300 |
| 4.24 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 801,100 | $ 3,597,400 | $ 4,398,500 |
| 4.25 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL-15KV | $ - | $ 33,400 | $ 94,100 | $ 127,500 |
| 4.26 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 130,600 | $ 715,400 | $ 846,000 |
| 4.27 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 140,800 | $ 395,100 | $ 535,900 |
| 4.28 | DUCT BANK | DUCT BANK WITH 12-5" CONDUIT, 37"H X 62.5"W (325'+50'=375') | $ - | $ 122,400 | $ 212,300 | $ 334,700 |
| 4.29 | FOUNDATIONS FOR TRANSFORMERS | LIMESTONE UNLOADING & RECLAIM AREAS | $ - | $ 3,500 | $ 10,300 | $ 13,800 |

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AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
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Project No.: 12721-000
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|---|---|---|---|---|---|---|
| 4.30 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 4.31 | LIGHTNING PROTECTION | | $ - | $ 6,500 | $ 5,500 | $ 12,000 |
| 4.32 | SECURITY SYSTEM | | $ - | $ 16,000 | $ 14,000 | $ 30,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 6,898,900 | $ 3,730,000 | $ 12,960,200 | $ 23,589,100 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 344,900 | $ 951,200 | $ 4,967,600 | $ 6,263,700 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | LIMESTONE HANDLING SYSTEM | $ 7,243,800 | $ 4,681,200 | $ 17,927,800 | $ 29,852,800 |
| | | | | | | |
| 5.0 | REAGENT PREPARATION ISLAND | | | | | |
| 5.1 | MECHANICAL EQUIPMENT | INCLUDES LIMESTONE FEEDERS, FROM THE SILOS THROUGH THE SLURRY STORAGE TANKS AND TRANSFER PUMPS WITH INTEGRAL PIPING | $ 15,167,000 | $ - | $ 12,266,800 | $ 27,433,800 |
| 5.2 | REAGENT PREPARATION BUILDING SUMP PUMPS | DUPLEX. INCLUDES CHECK & ISOLATION VALVES | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 5.3 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 5.4 | PIPING - MECHANICAL | | $ 278,900 | $ 205,000 | $ 587,300 | $ 1,071,200 |
| 5.5 | LIMESTONE SLURRY TANKS - FOUNDATIONS | | $ - | $ 166,400 | $ 299,400 | $ 465,800 |
| 5.6 | REAGENT PREPARATION BUILDING - FOUNDATIONS | | $ - | $ 682,000 | $ 1,132,200 | $ 1,814,200 |
| 5.7 | REAGENT PREPARATION BUILDING | 120' L X 130' W X 130' H | $ 269,400 | $ 4,865,000 | $ 4,251,600 | $ 9,386,000 |
| 5.8 | PIPE SUPPORT PAD - REAGENT PREP BUILDING | | $ - | $ 13,800 | $ 27,500 | $ 41,300 |
| 5.9 | LIGHTING/ TRANSFORMERS & PANELS | | $ 52,000 | $ 135,000 | $ 104,500 | $ 291,500 |
| 5.10 | GROUNDING | | $ 2,000 | $ - | $ 7,900 | $ 9,900 |
| 5.11 | ELECTRICAL CABLE AND RACEWAY | INCLUDED IN ABSORBER ISLAND SECTION 7.0 | $ - | $ - | $ - | $ - |
| 5.12 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 5.13 | LIGHTNING PROTECTION | | $ - | $ 23,000 | $ 16,000 | $ 39,000 |

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU<br>COST ESTIMATE SUMMARY | Estimate No.:<br>Project No.:<br>Date:<br>Preparer:<br>Reviewer:<br>Approver: | 30708C<br>12721-000<br>9/29/2010<br>MNO<br>JMK<br>PEF |
|---|---|---|---|

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 5.14 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 15,809,300 | $ 6,132,200 | $ 18,743,100 | $ 40,684,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 790,500 | $ 1,563,700 | $ 7,184,300 | $ 9,538,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | REAGENT PREPARATION ISLAND | $ 16,599,800 | $ 7,695,900 | $ 25,927,400 | $ 50,223,100 |
| | | | | | | |
| 6.0 | BYPRODUCT DEWATERING ISLAND | | | | | |
| 6.1 | MECHANICAL EQUIPMENT | PRIMARY & SECONDARY DEWATERING INCLUDING HYDROCLONES, PUMPS, INTEGRAL PIPING, BELT VACUUM FILTERS, AND DISCHARGE CONVEYORS | $ 8,701,000 | $ - | $ 6,644,500 | $ 15,345,500 |
| 6.2 | PIPING - MECHANICAL | | $ 282,700 | $ 1,202,400 | $ 2,577,100 | $ 4,062,200 |
| 6.3 | MATERIAL HANDLING EQUIPMENT | | $ 724,000 | $ 5,000 | $ 604,400 | $ 1,333,400 |
| 6.4 | FIRE PROTECTION SYSTEM FOR BELT CONVEYORS | DELUGE SYSTEM, DRY PIPE, SENSORS, ACTIVATION VALVE AND FM APPROVED PANEL - SUBCONTRACT PRICE FOR ALL CONVEYORS INCLUDES LABOR | $ 170,000 | $ - | $ - | $ 170,000 |
| 6.5 | BYPRODUCT DEWATERING BUILDING SUMP PUMPS & AGITATORS | | $ 40,000 | $ - | $ 16,900 | $ 56,900 |
| 6.6 | CONVEYOR STRUCTURE SUPPORT STEEL | THREE-COAT SHOP PAINT | $ - | $ 99,000 | $ 99,600 | $ 198,600 |
| 6.7 | BYPRODUCT STACKOUT CONVEYOR - FOUNDATIONS | | $ - | $ 30,100 | $ 65,400 | $ 95,500 |
| 6.8 | BYPRODUCT STACKOUT PILE - FOUNDATIONS | INCLUDES CONTAINMENT AREA SLAB | $ - | $ 1,155,700 | $ 1,872,400 | $ 3,028,100 |
| 6.9 | BYPRODUCT CONTAINMENT WALLS | | $ - | $ 137,300 | $ 235,000 | $ 372,300 |
| 6.10 | INSTALL WIND SCREEN | | $ - | $ 525,000 | $ 192,300 | $ 717,300 |

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|---|---|---|---|---|---|---|
| 6.11 | BYPRODUCT DEWATERING BUILDING - FOUNDATIONS | | $ - | $ 291,400 | $ 482,800 | $ 774,200 |
| 6.12 | BYPRODUCT DEWATERING BUILDING | 120' L X 75' W X 65' H | $ 145,200 | $ 1,595,300 | $ 1,495,900 | $ 3,236,400 |
| 6.13 | PIPE SUPPORT PAD | | $ - | $ 13,800 | $ 27,100 | $ 40,900 |
| 6.14 | TRANSFORMERS | | $ 170,000 | $ - | $ 54,600 | $ 224,600 |
| 6.15 | SWITCHGEAR | 480V LOW VOLATAGE SWITCHGEAR, PRICE PER SECTION | $ 196,000 | $ - | $ 104,700 | $ 300,700 |
| 6.16 | CABLE BUS DUCT | | $ 269,400 | $ 10,800 | $ 375,800 | $ 656,000 |
| 6.17 | MCC | | $ 123,600 | $ - | $ 6,300 | $ 129,900 |
| 6.18 | MIMIC PANELS | | $ 17,500 | $ - | $ 1,600 | $ 19,100 |
| 6.19 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 6.20 | GROUNDING | | $ 5,500 | $ - | $ 18,600 | $ 24,100 |
| 6.21 | LIGHTING/ TRANSFORMERS & PANELS | | $ 52,000 | $ 135,000 | $ 104,500 | $ 291,500 |
| 6.22 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 326,100 | $ 1,393,900 | $ 1,720,000 |
| 6.23 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL-15KV | $ - | $ 13,900 | $ 39,200 | $ 53,100 |
| 6.24 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 73,100 | $ 533,900 | $ 607,000 |
| 6.25 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 99,200 | $ 278,400 | $ 377,600 |
| 6.26 | FOUNDATIONS FOR TRANSFORMERS | | $ - | $ 3,500 | $ 10,300 | $ 13,800 |
| 6.27 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 6.28 | LIGHTNING PROTECTION | | $ - | $ 13,000 | $ 9,000 | $ 22,000 |
| 6.29 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 11,005,200 | $ 5,771,600 | $ 17,301,600 | $ 34,078,400 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 550,300 | $ 1,471,800 | $ 6,631,200 | $ 8,653,200 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | BYPRODUCT DEWATERING ISLAND | $ 11,555,500 | $ 7,243,400 | $ 23,932,800 | $ 42,731,600 |
| | | | | | | |
| 7.0 | ABSORBER ISLAND | | | | | |

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU<br>COST ESTIMATE SUMMARY | Estimate No.:<br>Project No.:<br>Date:<br>Preparer:<br>Reviewer:<br>Approver: | 30708C<br>12721-000<br>9/29/2010<br>MNO<br>JMK<br>PEF |
|---|---|---|---|

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|---|---|---|---|---|---|---|
| 7.1 | MECHANICAL EQUIPMENT | INCLUDES ABSORBER MODULE (A2205) WITH INTERNALS, INLET DUCT ONLY THROUGH WET/DRY INTERFACE, PIPING INSIDE ABSORBER BUILDING TO TERMINAL POINTS, RECYCLE PUMPS, OXIDATION BLOWERS, MIST ELIMINATOR AND WASH PUMPS AND OTHER MISC. EQUIPMENT AND MATERIAL | $ 41,363,000 | $ - | $ 40,889,400 | $ 82,252,400 |
| 7.2 | ADDITIONAL COST FOR C276 ABSORBER SHELL MATERIAL ABOVE THE PRICE OF A2205 ABSORBER SHELL | INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL<br>49,800 TOTAL SF | $ - | $ 15,338,400 | $ - | $ 15,338,400 |
| 7.3 | ABSORBER BUILDING SUMP PUMPS | DUPLEX. INCLUDES CHECK & ISOLATION VALVES | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 7.4 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 7.5 | EMERGENCY DIESEL DRIVEN QUENCH PUMP | WITH FUEL DAY TANK. FOUNDATIONS INCLUDED WITH ABSORBER BUILDING FOUNDATIONS | $ 150,000 | $ - | $ 30,700 | $ 180,700 |
| 7.6 | PIPING - MECHANICAL | ALL PIPING INCLUDED IN OEM EQUIPMENT COST. NO BOP PIPING | $ - | $ - | $ - | $ - |
| 7.7 | ABSORBER VESSEL - FOUNDATIONS | | $ - | $ 366,900 | $ 672,900 | $ 1,039,800 |
| 7.8 | ABSORBER BUILDING - FOUNDATIONS | | $ - | $ 579,500 | $ 961,200 | $ 1,540,700 |
| 7.9 | ABSORBER BUILDING | 150' L X 90' W X 60' H | $ 164,500 | $ 2,622,800 | $ 2,402,700 | $ 5,190,000 |
| 7.10 | PIPE SUPPORT PAD - ABSORBER BUILDING | | $ - | $ 7,700 | $ 16,100 | $ 23,800 |
| 7.11 | OXIDATION AIR BLOWER BUILDING - FOUNDATIONS | | $ - | $ 37,000 | $ 67,300 | $ 104,300 |
| 7.12 | OXIDATION AIR BLOWER BUILDING | 30' L X 30' W X 25' H | $ 33,800 | $ 191,000 | $ 201,400 | $ 426,200 |
| 7.13 | PIPE SUPPORT PAD - OXIDATION BUILDING | | $ - | $ 7,700 | $ 13,700 | $ 21,400 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
COST ESTIMATE SUMMARY

Estimate No.: 30708C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 7.14 | DUCTWORK | INCLUDES INTERNAL BRACING AND TURNING VANES | $ - | $ 3,558,800 | $ 6,797,400 | $ 10,356,200 |
| 7.15 | DUCT SUPPORT STEEL | THREE-COAT SHOP PAINT | $ - | $ 1,586,300 | $ 1,595,900 | $ 3,182,200 |
| 7.16 | DUCTWORK INSULATION & LAGGING | | $ - | $ 1,261,200 | $ 2,470,200 | $ 3,731,400 |
| 7.17 | FOUNDATIONS FOR DUCT SUPPORT STEEL | | $ - | $ 69,000 | $ 143,000 | $ 212,000 |
| 7.18 | TRANSFORMERS | | $ 1,181,000 | $ - | $ 263,900 | $ 1,444,900 |
| 7.19 | SWITCHGEAR | | $ 1,838,400 | $ - | $ 1,118,900 | $ 2,957,300 |
| 7.20 | CABLE BUS & TERMINATIONS | | $ 1,658,300 | $ 46,600 | $ 2,982,700 | $ 4,687,600 |
| 7.21 | MCC | | $ 432,600 | $ - | $ 22,100 | $ 454,700 |
| 7.22 | MIMIC PANELS | | $ 17,500 | $ - | $ 4,000 | $ 21,500 |
| 7.23 | GROUNDING | | $ 16,000 | $ - | $ 46,100 | $ 62,100 |
| 7.24 | LIGHTING/ TRANSFORMERS & PANELS | | $ 164,500 | $ 165,000 | $ 171,300 | $ 500,800 |
| 7.25 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 7.26 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 1,515,700 | $ 5,849,000 | $ 7,364,700 |
| 7.27 | HIGH VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 58,400 | $ 164,700 | $ 223,100 |
| 7.28 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 114,600 | $ 431,700 | $ 546,300 |
| 7.29 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 795,900 | $ 1,500,700 | $ 2,296,600 |
| 7.30 | CONTROL & INSTRUMENT CABLE | | $ - | $ 512,000 | $ 1,436,700 | $ 1,948,700 |
| 7.31 | FOUNDATION FOR TRANSFORMERS | | $ - | $ 59,000 | $ 173,700 | $ 232,700 |
| 7.32 | TRANSFORMER FIRE WALLS | | $ - | $ 3,500 | $ 9,600 | $ 13,100 |
| 7.33 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 7.34 | LIGHTNING PROTECTION | | $ - | $ 19,500 | $ 14,500 | $ 34,000 |
| 7.35 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 47,167,900 | $ 28,958,500 | $ 70,525,800 | $ 146,652,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 3,033,400 | $ 7,384,400 | $ 27,816,500 | $ 38,234,300 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ABSORBER ISLAND | $ 50,201,300 | $ 36,342,900 | $ 98,342,300 | $ 184,886,500 |
| | | | | | | |
| 8.0 | FGD WASTE WATER TREATMENT PLANT | | | | | |
| 8.1 | WWT MECHANICAL EQUIPMENT: | | $ 4,500,000 | $ - | $ 1,073,300 | $ 5,573,300 |
| 8.2 | PIPING - MECHANICAL | | $ 46,800 | $ 281,200 | $ 888,700 | $ 1,216,700 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
COST ESTIMATE SUMMARY

Estimate No.: 30708C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 8.3 | PUMPS | | $ 58,000 | $ 29,300 | $ 74,100 | $ 161,400 |
| 8.4 | TANKS | | $ - | $ 2,385,000 | $ 792,000 | $ 3,177,000 |
| 8.5 | PRIMARY CLARIFIER - FOUNDATIONS | | $ - | $ 23,400 | $ 56,100 | $ 79,500 |
| 8.6 | SECONDARY CLARIFIER - FOUNDATIONS | | $ - | $ 23,400 | $ 56,100 | $ 79,500 |
| 8.7 | RECLAIM WATER TANKS - FOUNDATIONS | TOTAL FOR TWO TANKS | $ - | $ 26,000 | $ 54,000 | $ 80,000 |
| 8.8 | EQUALIZATION TANKS - FOUNDATIONS | TOTAL FOR TWO TANKS | $ - | $ 5,400 | $ 13,200 | $ 18,600 |
| 8.9 | MAINTENANCE STORAGE TANK - FOUNDATIONS | | $ - | $ 100,000 | $ 177,300 | $ 277,300 |
| 8.10 | WWT BUILDING - FOUNDATIONS | | $ - | $ 301,900 | $ 527,400 | $ 829,300 |
| 8.11 | WWT BUILDING | 125' L X 90' W X 25' H | $ 42,000 | $ 885,100 | $ 855,600 | $ 1,782,700 |
| 8.12 | PIPE SUPPORT PAD | | $ - | $ 13,800 | $ 27,100 | $ 40,900 |
| 8.13 | MCC | | $ 61,800 | $ - | $ 3,600 | $ 65,400 |
| 8.14 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 8.15 | GROUNDING | | $ 5,500 | $ - | $ 18,600 | $ 24,100 |
| 8.16 | LIGHTING / TRANSFORMERS & PANELS | | $ 52,000 | $ 60,000 | $ 59,100 | $ 171,100 |
| 8.17 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 536,200 | $ 2,162,700 | $ 2,698,900 |
| 8.18 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 148,000 | $ 184,100 | $ 332,100 |
| 8.19 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 102,400 | $ 287,300 | $ 389,700 |
| 8.20 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 8.21 | LIGHTNING PROTECTION | | $ - | $ 16,000 | $ 12,000 | $ 28,000 |
| 8.22 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 4,874,400 | $ 4,979,100 | $ 7,379,700 | $ 17,233,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 243,700 | $ 1,269,700 | $ 2,828,900 | $ 4,342,300 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FGD WASTE WATER TREATMENT PLANT | $ 5,118,100 | $ 6,248,800 | $ 10,208,600 | $ 21,575,500 |
| | | | | | | |
| 9.0 | COMPRESSED AIR SYSTEM | | | | | |
| 9.1 | AIR COMPRESSOR & AUXILIARIES | 3000 CFM | $ 399,000 | $ - | $ 112,500 | $ 511,500 |
| 9.2 | PIPING - MECHANICAL | | $ 368,700 | $ 200,200 | $ 860,300 | $ 1,429,200 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
COST ESTIMATE SUMMARY

Estimate No.: 30708C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 9.3 | ELECTRICAL | INCLUDED IN REAGENT PREPARATION, SECTION 5.0 | $ - | $ - | $ - | $ - |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 767,700 | $ 200,200 | $ 972,800 | $ 1,940,700 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 38,400 | $ 51,100 | $ 373,300 | $ 462,700 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | COMPRESSED AIR SYSTEM | $ 806,100 | $ 251,300 | $ 1,346,100 | $ 2,403,400 |
| | | | | | | |
| 10.0 | SERVICE WATER SYSTEM | | | | | |
| 10.1 | PUMPS | INCLUDES SELF-CLEANING STRAINERS | $ 204,000 | $ - | $ 90,000 | $ 294,000 |
| 10.2 | PIPING - MECHANICAL | | $ 478,800 | $ 1,205,400 | $ 2,725,900 | $ 4,410,100 |
| 10.3 | PIPING - FIRE PROTECTION SYSTEM | | $ 266,200 | $ 143,400 | $ 537,600 | $ 947,200 |
| 10.4 | TANKS | | $ - | $ 120,000 | $ - | $ 120,000 |
| 10.5 | SERVICE WATER TANK & PUMP - FOUNDATIONS | | $ - | $ 17,300 | $ 41,400 | $ 58,700 |
| 10.6 | ELECTRICAL | INCLUDED IN REAGENT PREPARATION, SECTION 5.0 | $ - | $ - | $ - | $ - |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 949,000 | $ 1,486,100 | $ 3,394,900 | $ 5,830,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 47,500 | $ 379,000 | $ 1,301,000 | $ 1,727,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | SERVICE WATER SYSTEM | $ 996,500 | $ 1,865,100 | $ 4,695,900 | $ 7,557,500 |
| | | | | | | |
| 11.0 | POTABLE WATER SYSTEM | | | | | |
| 11.1 | PUMPS | | $ 30,000 | $ - | $ 18,400 | $ 48,400 |
| 11.2 | PIPING - MECHANICAL | | $ 137,000 | $ 120,800 | $ 389,400 | $ 647,200 |
| 11.3 | TANKS | | $ - | $ 8,500 | $ - | $ 8,500 |
| 11.4 | POTABLE WATER TANK & PUMP - FOUNDATIONS | | $ - | $ 5,200 | $ 9,200 | $ 14,400 |
| 11.5 | ELECTRICAL | INCLUDED IN REAGENT PREPARATION, SECTION 5.0 | $ - | $ - | $ - | $ - |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 167,000 | $ 134,500 | $ 417,000 | $ 718,500 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 8,400 | $ 34,300 | $ 159,600 | $ 202,200 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
COST ESTIMATE SUMMARY

Estimate No.: 30708C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | POTABLE WATER SYSTEM | $ 175,400 | $ 168,800 | $ 576,600 | $ 920,700 |
| | | | | | | |
| 12.0 | FGD SUBSTATION | | | | | |
| 12.1 | 138/13.8 KV STATION SERVICE TRANSFORMERS | | $ 1,390,500 | $ - | $ 218,500 | $ 1,609,000 |
| 12.2 | 138KV MAIN FEEDER & TERMINATIONS | | $ 264,000 | $ - | $ 254,000 | $ 518,000 |
| 12.3 | SWITCHGEAR | | $ 124,200 | $ - | $ 85,200 | $ 209,400 |
| 12.4 | DUCTBANKS | | $ - | $ 108,200 | $ 154,100 | $ 262,300 |
| 12.5 | GROUNDING | | $ 10,100 | $ - | $ 26,800 | $ 36,900 |
| 12.6 | OUTDOOR LIGHTING | | $ 25,000 | $ - | $ 56,800 | $ 81,800 |
| 12.7 | FOUNDATION FOR AUX TRANSFORMER | | $ - | $ 63,200 | $ 194,700 | $ 257,900 |
| 12.8 | FIRE WALL FOR AUX TRANSFORMER | | $ - | $ 21,300 | $ 63,600 | $ 84,900 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,813,800 | $ 192,700 | $ 1,053,700 | $ 3,060,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 90,700 | $ 49,100 | $ 404,254 | $ 544,100 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FGD SUBSTATION | $ 1,904,500 | $ 241,800 | $ 1,458,000 | $ 3,604,300 |
| | | | | | | |
| 13.0 | FGD DCS SYSTEM | | | | | |
| 13.1 | DCS | 4000 I/O POINTS | $ - | $ 3,000,000 | $ 1,016,900 | $ 4,016,900 |
| 13.2 | DCS - VENDOR FIELD SUPPORT | 200 MANDAYS @ $1500/DAY - SHOWN AS SUBCONTRACT COST | $ 300,000 | $ - | $ - | $ 300,000 |
| 13.3 | LOCALLY MOUNTED INSTRUMENTS | | $ - | $ 827,800 | $ 1,085,600 | $ 1,913,400 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 300,000 | $ 3,827,800 | $ 2,102,500 | $ 6,230,300 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 15,000 | $ 976,100 | $ 806,100 | $ 1,797,100 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FGD DCS SYSTEM | $ 315,000 | $ 4,803,900 | $ 2,908,600 | $ 8,027,400 |
| | | | | | | |
| 14.0 | CEM SYSTEM | | | | | |
| 14.1 | CEM | PROVIDED BY AEP | $ 1,260,000 | $ 540,000 | $ 310,000 | $ 2,110,000 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
COST ESTIMATE SUMMARY

Estimate No.: 30708C
Project No.: 12721-000
Date: 9/29/2010
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|---|---|---|---|---|---|---|
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,260,000 | $ 540,000 | $ 310,000 | $ 2,110,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ 316,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | CEM SYSTEM | $ - | $ - | $ - | $ 2,426,500 |
| | | | | | | |
| 15.0 | RAIL INFRASTRUCTURE | | | | | |
| 15.1 | EXISTING RAILROAD IMPROVEMENTS | FOR FULL RAILCAR STORAGE TRACK IMPROVEMENTS - 3250 LF | $ - | $ 660,200 | $ 689,200 | $ 1,349,400 |
| 15.2 | EXISTING RAILROAD IMPROVEMENTS | FOR LOOP TRACK UPGRADE - 5000 LF | $ - | $ 1,008,800 | $ 1,055,600 | $ 2,064,400 |
| 15.3 | NEW RAILROAD TRACK | INCLUDES, 132LB RAIL, 7" TIMBERS, TIE PLATES, SPIKES, BOLTS, 12: SUBBALLAST, 12" BALLAST, 12 OZ/SY GEOTEXTILE MEMBRANE, 12" SUBGRADE PREP | $ - | $ 252,000 | $ 213,100 | $ 465,100 |
| 15.4 | FIELD FABRICATED TURNOUTS | #8 TURNOUT | $ - | $ 90,000 | $ 54,800 | $ 144,800 |
| 15.5 | RAIL SCALE | SUBCONTRACT COST, INCLUDES FOUNDATIONS | $ 212,500 | $ - | $ - | $ 212,500 |
| 15.6 | NEW CONCRETE ENCASEMENT | OVER AND AROUND DUCT BANK CONNECTING THE PLANT TO SWITCHYARD. THIS IS UNDER THE NEW TRACKWORK EXTENSION | $ - | $ 33,100 | $ 71,400 | $ 104,500 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 212,500 | $ 2,044,100 | $ 2,084,100 | $ 4,340,700 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 10,600 | $ 521,200 | $ 798,600 | $ 1,330,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | RAIL INFRASTRUCTURE | $ 223,100 | $ 2,565,300 | $ 2,882,700 | $ 5,671,200 |
| | | | | | | |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | | | | | |
| 16.1 | SITE GRADING | | $ - | $ - | $ 516,000 | $ 516,000 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
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| 16.2 | ROADS & SURFACING | | $ - | $ 605,100 | $ 833,500 | $ 1,438,600 |
| 16.3 | LIMESTONE HANDLING & STORAGE | | $ - | $ 340,100 | $ 541,700 | $ 881,800 |
| 16.4 | GYPSUM HANDLING & STORAGE | | $ - | $ 1,147,200 | $ 1,784,100 | $ 2,931,300 |
| 16.5 | GYPSUM RUNOFF POND | | $ 60,000 | $ 110,400 | $ 312,600 | $ 483,000 |
| 16.6 | BYPRODUCT POND PUMP STRUCTURE - CONCRETE | | $ - | $ 47,000 | $ 105,400 | $ 152,400 |
| 16.7 | NEW CONCRETE ENCASEMENT | 8' X 4' X 40' - FOR EXISTING ASH PIPE HAUL ROAD CROSSING | $ - | $ 15,200 | $ 33,500 | $ 48,700 |
| 16.8 | TRUCK WASH AREA | | $ - | $ 47,300 | $ 83,100 | $ 130,400 |
| 16.9 | TRUCK SCALE & CONCRETE APPROACH | | $ 170,000 | $ 27,300 | $ 92,000 | $ 289,300 |
| 16.10 | STORMWATER DRAINAGE TRENCH | 2' W X 3' DEEP CAST-IN-PLACE CONCRETE TRENCH W/REINFORCING & HS-20 RATED GRATE COVERS | $ - | $ 472,500 | $ 480,800 | $ 953,300 |
| 16.11 | STORMWATER RUNOFF POND | | $ - | $ 15,000 | $ 122,600 | $ 137,600 |
| 16.12 | STORM WATER POND PUMP STRUCTURE - CONCRETE | | $ 90,000 | $ 42,300 | $ 182,200 | $ 314,500 |
| 16.13 | OILY WATER SEWER | | $ 4,500 | $ 80,600 | $ 186,100 | $ 271,200 |
| 16.14 | OIL SEPARATOR | 500 GPM W/ INTEGRAL LIFT STATION | $ 100,000 | $ - | $ 116,100 | $ 216,100 |
| 16.15 | SANITARY SEWER | | $ - | $ 22,200 | $ 96,900 | $ 119,100 |
| 16.16 | SANITARY LIFT STATION | PACKAGED TYPE COMPLETE WITH PUMPS, 100,000 GPD | $ 150,000 | $ - | $ 49,200 | $ 199,200 |
| 16.17 | CONSTRUCTION LAYDOWN AREA | ALLOWANCE FOR 10 ACRES, DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED | $ - | $ 875,000 | $ 1,035,000 | $ 1,910,000 |
| 16.18 | CRAFT PARKING | DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED. ALLOWANCE FOR 20,000 SY INCLUDES: 6" BASE COURSE 10 OZ/SY GEOTEXTILE 12" SUBGRADE PREP | $ - | $ 225,000 | $ 517,800 | $ 742,800 |

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU<br>COST ESTIMATE SUMMARY | Estimate No.:<br>Project No.:<br>Date:<br>Preparer:<br>Reviewer:<br>Approver: | 30708C<br>12721-000<br>9/29/2010<br>MNO<br>JMK<br>PEF |
|---|---|---|---|

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 16.19 | CONTRACTOR OFFICES (AREA) | DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED. ALLOWANCE FOR 5,000 SY AREA (TRAILERS BY CONTRACTORS) INCLUDES: 6" BASE COURSE 10 OZ/SY GEOTEXTILE 12" SUBGRADE PREP | $ - | $ 56,300 | $ 129,400 | $ 185,700 |
| 16.20 | NEW PERMANENT STORAGE | INCLUDES LIGHTING AND H&V. SUBCONTRACT PRICE INCLUDES ELECTRICAL AND H&V | $ 1,700,000 | $ - | $ - | $ 1,700,000 |
| 16.21 | FOUNDATIONS FOR THE NEW WAREHOUSE | | $ - | $ 532,900 | $ 867,800 | $ 1,400,700 |
| 16.22 | NEW TEMPORARY STORAGE | WEATHER TIGHT CANVAS ENCLOSURE. INCLUDES LIGHTING AND H&V. SUBCONTRACT PRICE INCLUDES ELECTRICAL AND H&V | $ 450,000 | $ - | $ - | $ 450,000 |
| 16.23 | FOUNDATIONS FOR TEMPORARY STORAGE | | $ - | $ 99,500 | $ 157,200 | $ 256,700 |
| 16.24 | LABOR BUS SERVICE FROM PARKING LOT TO CONSTRUCTION AREA AND ACCESS CONTROL | ALLOWANCE FOR 36 MONTHS BASED ON 2 BUSES OPERATING CONTINUOUSLY FOR 5X10 WORKWEEK. SUBCONTRACT COST INCLUDES EQUIPMENT, MATERIAL AND LABOR | $ 1,368,000 | $ - | $ - | $ 1,368,000 |
| 16.25 | EROSION & SEDIMENT CONTROL | | $ - | $ 15,800 | $ 25,900 | $ 41,700 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 4,092,500 | $ 4,776,700 | $ 8,268,900 | $ 17,138,100 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 204,600 | $ 1,218,100 | $ 3,169,400 | $ 4,592,100 |

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AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
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| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | SITE IMPROVEMENTS - CIVIL WORK | $ 4,297,100 | $ 5,994,800 | $ 11,438,300 | $ 21,730,200 |
| | | | | | | |
| 17.0 | BOP ITEMS | | | | | |
| 17.1 | PIPE INSULATION | AVERAGE 6" PIPE SIZE | $ - | $ 78,000 | $ 243,100 | $ 321,100 |
| 17.2 | HEAT TRACING | | $ - | $ 332,700 | $ 474,800 | $ 807,500 |
| 17.3 | TOUCH UP PAINT (INCLUDES PAINTING CS PIPE) | | $ - | $ 181,900 | $ 697,600 | $ 879,500 |
| 17.4 | HOISTS & TROLLEYS | | $ 180,000 | $ 210,000 | $ 245,300 | $ 635,300 |
| 17.5 | MISC AUX STEEL FOR PIPE SUPPORTS | FIELD FABRICATED | $ - | $ 140,000 | $ 583,500 | $ 723,500 |
| 17.6 | MISC PIPE SUPPORT FOUNDATIONS | | $ - | $ 10,500 | $ 21,000 | $ 31,500 |
| 17.7 | EYE WASH STATIONS | | $ 30,000 | $ 5,000 | $ 30,700 | $ 65,700 |
| 17.8 | FIRE PROTECTION FOR MISC BUILDINGS & AREAS | | $ - | $ 420,000 | $ 343,500 | $ 763,500 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 210,000 | $ 1,378,100 | $ 2,639,500 | $ 4,227,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 10,500 | $ 351,416 | $ 1,012,192 | $ 1,374,107 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | BOP ITEMS | $ 220,500 | $ 1,729,500 | $ 3,651,700 | $ 5,601,700 |
| | | | | | | |
| 18.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | | | | | |
| 18.1 | RELOCATE HYDROGEN STORAGE TANK | | $ - | $ 15,600 | $ 86,800 | $ 102,400 |
| 18.2 | NEW HYDROGEN LINE TO PLANT | | $ - | $ 62,100 | $ 150,600 | $ 212,700 |
| 18.3 | RELOCATE MISC. UNDERGROUND UTILITIES | ALLOWANCE | $ - | $ 125,000 | $ 170,500 | $ 295,500 |
| 18.4 | OUTAGE TIE-IN DUCTWORK | ALLOWANCE FOR 85 TON DUCTWORK | $ - | $ 276,300 | $ 527,700 | $ 804,000 |
| 18.5 | RELOCATED WAREHOUSE - FOUNDATIONS | | $ - | $ 342,600 | $ 534,900 | $ 877,500 |
| 18.6 | RELOCATE EXISTING WAREHOUSE BUILDING | 150' L X 75' W X 25' H | $ - | $ 95,600 | $ 1,121,500 | $ 1,217,100 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
COST ESTIMATE SUMMARY

Estimate No.: 30708C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ 917,200 | $ 2,592,000 | $ 3,509,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ 233,900 | $ 993,100 | $ 1,227,000 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $ - | $ 1,151,100 | $ 3,585,100 | $ 4,736,200 |
| | | | | | | |
| 19.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | | | | | |
| 19.1 | ARSENIC, ASBESTOS , LEAD ABATEMENT | PROVIDED BY AEP | $ - | $ - | $ - | $ 750,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ - | $ - | $ 750,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ 112,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ARSENIC, ASBESTOS , LEAD ABATEMENT | $ - | $ - | $ - | $ 862,500 |
| | | | | | | |
| 99.0 | OVERALL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 146,865,600 | $ 81,101,600 | $ 196,009,600 | $ 456,206,800 |
| | OVERALL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 7,955,300 | $ 20,624,200 | $ 75,795,600 | $ 109,445,100 |
| | OVERALL TOTAL DIRECT & CONSTRUCTION INDIRECT COST | | $ 154,820,900 | $ 101,725,800 | $ 271,805,200 | $ 565,651,900 |
| | | | | | | |
| | OVERALL PROJECT INDIRECT COSTS | | | | | |
| | ENGINEERING, PROCUREMENT, & PROJECT SERVICES | | | | | $ 30,000,000 |
| | CONSTRUCTION MANAGEMENT | | | | | $ 16,969,600 |
| | S-U / COMMISSIONING | | | | | $ 5,656,500 |
| | CRAFT START-UP SUPPORT | | | | | $ 2,310,200 |
| | INITIAL FILLS | | | | | $ 1,697,000 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU
COST ESTIMATE SUMMARY

Estimate No.: 30708C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | OPERATOR & TRAINING MANUALS | | | | | $ 300,000 |
| | SUBCONTRACTORS (NOISE & DUCTWORK CONSULTANT, GEOTECHNICAL INVESTIGATION) | | | | | $ 400,000 |
| | NOISE ABATEMENT FOR 85 DBA REQUIREMENT | FOR ID FAN, TRANSFORMERS, BOP, DUCTWORK, ACOUSTIC BARRIERS FOR BOUNDARY LIMITS | | | | $ 2,650,000 |
| | SUBTOTAL - INDIRECT COSTS | | | | | $ 59,983,300 |
| | TOTAL PROJECT DIRECT AND INDIRECT COSTS | | | | | $ 625,635,200 |
| | | | | | | |
| | SPARE PARTS: | | | | | $ 2,322,300 |
| | SPARE PARTS - CAPITALIZED | 0.90 | | | | $ 1,393,380 |
| | SPARE PARTS - FIRST YEAR OF OPERATION | 0.60 | | | | $ 928,920 |
| | | | | | | |
| | CONTINGENCY | 14.5 | | | | $ 91,254,300 |
| | | | | | | |
| | ESCALATION | | | | | $ 78,606,500 |
| | EQUIPMENT | | | | | $ 23,797,800 |
| | MATERIAL | | | | | $ 11,195,900 |
| | LABOR | | | | | $ 36,670,100 |
| | INDIRECTS | | | | | $ 6,942,700 |
| | | | | | | |
| | TOTAL PROJECT COST | | | | | $ 797,818,300 |
| | | | | | | |
| | REFERENCE COSTS: | | | | | |
| A | REMOVE BOOSTER AIR FANS | | $ - | $ - | $ 111,000 | $ 111,000 |

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - WFGD BASE EST-1 - 4.5 LB/MMBTU<br>COST ESTIMATE SUMMARY | Estimate No.: 30708C<br>Project No.: 12721-000<br>Date: 9/29/2010<br>Preparer: MNO<br>Reviewer: JMK<br>Approver: PEF |
|---|---|---|

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| B | REMOVAL OF FUEL OIL TANK | LABOR COST IS FOR REMOVAL OF TANK ONLY. ALLOWANCE FOR SOIL REMEDIATION AND DISPOSAL IN AN EPA APPROVED LANDFILL. SUBCONTRACT COST INCLUDES LABOR. USED LOWER END OF THE RANGE $118-355/CY. COST COULD BE LOWER ($59-118/CY) IF SOLD TO A BITUMINOUS CONCRETE BATCH PLANT | $ 1,200,000 | $ 80,000 | $ 469,400 | $ 1,749,400 |

# EXHIBIT 1-6.2
# Capital Cost Estimate Summary
# Dry FGD Base Case w/o ESP

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU<br>COST ESTIMATE SUMMARY | Estimate No.:<br>Project No.:<br>Date:<br>Preparer:<br>Reviewer:<br>Approver: | 30713C<br>12721-000<br>9/29/2010<br>MNO<br>JMK<br>PEF |
|---|---|---|---|

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 1.0 | ID FANS | | | | | |
| 1.1 | ID FANS - OEM EQUIPMENT | 1,870,000 ACFM WITH 19,200 HP MOTORS ($750,000 EACH). INCLUDES HYDRAULIC OIL UNITS, SEAL AIR FAN SKIDS, VIBRATION MONITORING EQUIPMENT, FAN STALL EQUIPMENT, FIELD SERVICE REP FOR 140 DAYS | $ 6,738,000 | $ - | $ 1,635,600 | $ 8,373,600 |
| 1.2 | PIPING & SUPPORTS - MECHANICAL | | $ 21,800 | $ 28,700 | $ 120,500 | $ 171,000 |
| 1.3 | DAMPERS | | $ 781,000 | $ - | $ 352,600 | $ 1,133,600 |
| 1.4 | EXPANSION JOINTS | | $ - | $ 131,100 | $ 116,500 | $ 247,600 |
| 1.5 | DUCTWORK | FABRIC FILTER OUTLET TO ID FANS AND FROM ID FANS TO STACK - INCLUDES INTERNAL BRACING AND TURNING VANES | $ - | $ 2,600,000 | $ 4,966,200 | $ 7,566,200 |
| 1.6 | DUCT SUPPORT STEEL | THREE COAT SHOP PAINT | $ - | $ 1,160,000 | $ 1,167,000 | $ 2,327,000 |
| 1.7 | ID FAN INSULATION & LAGGING | TOTAL FOR TWO FANS. PRICING REFLECTS STANDARD ACOUSTICAL INSULATION | $ - | $ 168,000 | $ 217,200 | $ 385,200 |
| 1.8 | DUCTWORK INSULATION & LAGGING | INCLUDES INSULATION FOR SPRAY DRYER OUTLET DUCT TO FABRIC FILTERS SUPPLIED WITH THE OEM EQUIPMENT | $ - | $ 864,000 | $ 1,692,200 | $ 2,556,200 |
| 1.9 | DUCT SUPPORT STEEL - FOUNDATIONS | | $ - | $ 295,500 | $ 574,000 | $ 869,500 |
| 1.10 | ID FAN FOUNDATIONS INCLUDING ID FAN AUX EQUIPMENT | | $ - | $ 106,000 | $ 198,700 | $ 304,700 |

| Sargent & Lundy, LLC | AEP | Estimate No.: | 30713C |
|---|---|---|---|
| | BIG SANDY UNIT 2 | Project No.: | 12721-000 |
| | FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU | Date: | 9/29/2010 |
| | COST ESTIMATE SUMMARY | Preparer: | MNO |
| | | Reviewer: | JMK |
| | | Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 1.11 | ID FAN DFGD CONTROL ROOM - FOUNDATIONS | | $ - | $ 122,100 | $ 206,200 | $ 328,300 |
| 1.12 | ID FAN DFGD CONTROL ROOM | SUBCONTRACT PRICE INCLUDES LABOR. COMPLETE WITH HVAC, FINISHES AND SANITARY FACILITIES | $ - | $ 2,500,000 | $ - | $ 2,500,000 |
| 1.13 | MCC | | $ 120,000 | $ - | $ 7,200 | $ 127,200 |
| 1.14 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL-15KV - 6600' ID FAN | $ - | $ 61,200 | $ 172,500 | $ 233,700 |
| 1.15 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 121,000 | $ 339,400 | $ 460,400 |
| 1.16 | EMERGENCY POWER SYSTEM | | $ 285,500 | $ - | $ 38,900 | $ 324,400 |
| 1.17 | GROUNDING | | $ 23,300 | $ - | $ 59,100 | $ 82,400 |
| 1.18 | LIGHTING/ TRANSFORMERS & PANELS | | $ 26,000 | $ 30,000 | $ 29,500 | $ 85,500 |
| 1.19 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 352,900 | $ 1,988,800 | $ 2,341,700 |
| 1.20 | LOW VOLTAGE POWER CABLE & TERMINATIONS | | $ - | $ 229,800 | $ 547,600 | $ 777,400 |
| 1.21 | DUCT BANK | | $ - | $ 186,800 | $ 347,700 | $ 534,500 |
| 1.22 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 1.23 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 7,995,600 | $ 8,982,100 | $ 14,797,400 | $ 31,775,100 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 399,800 | $ 2,290,400 | $ 5,329,900 | $ 8,020,100 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ID FANS | $ 8,395,400 | $ 11,272,500 | $ 20,127,300 | $ 39,795,200 |
| | | | | | | |
| 2.0 | FABRIC FILTERS | | | | | |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30713C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 2.1 | MECHANICAL EQUIPMENT | A SINGLE FABRIC FILTER (225' X 130') UNIT INCLUDING ALL INTERNAL FABRIC FILTER ELEMENTS SUCH AS BAGS, CAGES, ASH HOPPERS, 2 BROKEN BAG DETECTORS PER COMPARTMENT | $ 19,761,000 | $ - | $ 12,604,200 | $ 32,365,200 |
| 2.2 | INSULATION FOR FABRIC FILTER | SUBCONTRACT COST INCLUDES LABOR | $ 2,430,000 | $ - | $ - | $ 2,430,000 |
| 2.3 | PENTHOUSE FOR FABRIC FILTER | SUPPORT STEEL AND PURLINS INCLUDED WITH OEM EQUIPMENT | $ 70,200 | $ 787,000 | $ 1,007,600 | $ 1,864,800 |
| 2.4 | BOTTOM ENCLOSURE FOR BAGHOUSE | | $ 60,000 | $ 1,204,000 | $ 1,359,800 | $ 2,623,800 |
| 2.5 | PIPING & SUPPORTS - MECHANICAL | | $ 30,900 | $ 101,400 | $ 209,500 | $ 341,800 |
| 2.6 | FABRIC FILTER - FOUNDATIONS | | $ - | $ 550,700 | $ 1,081,100 | $ 1,631,800 |
| 2.7 | FABRIC FILTER - SUPPORT STEEL AND ACCESS GALLERY | | $ - | $ 360,000 | $ 1,186,700 | $ 1,546,700 |
| 2.8 | RACEWAY, CABLE TRAY, & CONDUIT | INCLUDED IN ABSORBER ISLAND 7.0 | $ - | $ - | $ - | $ - |
| 2.9 | LIGHTING/ TRANSFORMERS & PANELS | | $ 30,000 | $ 75,000 | $ 58,200 | $ 163,200 |
| 2.10 | GROUNDING | | $ 7,300 | $ - | $ 17,500 | $ 24,800 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 22,389,400 | $ 3,078,100 | $ 17,524,600 | $ 42,992,100 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 1,119,500 | $ 784,900 | $ 6,510,000 | $ 8,414,400 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FABRIC FILTERS | $ 23,508,900 | $ 3,863,000 | $ 24,034,600 | $ 51,406,500 |
| | | | | | | |
| 3.0 | NEW STACK | | | | | |
| 3.1 | CONCRETE STACK (DRY) | PROVIDED BY AEP | $ - | $ - | $ - | $ 19,350,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ - | $ - | $ 19,350,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ 2,902,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | NEW STACK | $ - | $ - | $ - | $ 22,252,500 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30713C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | | | | | | |
| 4.0 | LIME HANDLING SYSTEM | | | | | |
| 4.1 | LIME STORAGE SILO | | $ 5,762,000 | $ - | $ - | $ 5,762,000 |
| 4.2 | LIME UNLOADING SYSTEM | INCLUDES PNEUMATIC HANDLING SYSTEM, THREE VACUUM EXHAUSTER, TWO FILTER SEPARATORS | $ 640,000 | $ - | $ 408,900 | $ 1,048,900 |
| 4.3 | PIPING - MECHANICAL | | $ 29,000 | $ 15,600 | $ 77,900 | $ 122,500 |
| 4.4 | LIME STORAGE SILO ACCESS STAIR TOWER | THREE COAT SHOP PAINT | $ - | $ 145,000 | $ 145,900 | $ 290,900 |
| 4.5 | PIPE RACK FOR LIME HANDLING, WASTE ASH HANDLING AND MISC MECHANICAL PIPING | THREE COAT SHOP PAINT | $ - | $ 783,000 | $ 787,800 | $ 1,570,800 |
| 4.6 | RAIL CAR UNLOADING AREA - FOUNDATIONS | 20 X 250 - NO SIDING | $ - | $ 85,300 | $ 180,200 | $ 265,500 |
| 4.7 | LIME UNLOADING BLOWER / ELECTRICAL BUILDING - FOUNDATIONS | | $ - | $ 74,500 | $ 187,800 | $ 262,300 |
| 4.8 | LIME UNLOADING BLOWER / ELECTRICAL BUILDING | 130' L X 30' W X 30' H | $ 75,000 | $ 351,500 | $ 24,400 | $ 450,900 |
| 4.9 | CONCRETE PIT FOR THE ELEVATOR | | $ - | $ 2,300 | $ 6,900 | $ 9,200 |
| 4.10 | LIME STORAGE SILO - FOUNDATIONS | | $ - | $ 469,600 | $ 852,500 | $ 1,322,100 |
| 4.11 | LIME STORAGE SILO ACCESS STAIR TOWER - FOUNDATIONS | | $ - | $ 14,200 | $ 28,600 | $ 42,800 |
| 4.12 | PIPE RACK - FOUNDATIONS | | $ - | $ 94,200 | $ 237,800 | $ 332,000 |
| 4.13 | TRANSFORMERS | SUS TRANSFORMERS: 33F, 33G, 13.8KV-480V | $ 170,000 | $ - | $ 54,600 | $ 224,600 |
| 4.14 | SWITCHGEAR | 480V LOW VOLTAGE (33F/G), SWITCHGEAR | $ 196,000 | $ - | $ 104,700 | $ 300,700 |
| 4.15 | CABLE BUS DUCT | | $ 134,700 | $ 10,800 | $ 200,200 | $ 345,700 |
| 4.16 | MCC | | $ 61,800 | $ - | $ 3,600 | $ 65,400 |
| 4.17 | MIMIC PANELS | | $ 17,500 | $ - | $ 1,400 | $ 18,900 |
| 4.18 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 4.19 | GROUNDING | | $ 13,300 | $ - | $ 41,300 | $ 54,600 |
| 4.20 | LIGHTING/ TRANSFORMERS & PANELS | | $ 52,000 | $ 135,000 | $ 104,500 | $ 291,500 |
| 4.21 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 310,900 | $ 1,537,100 | $ 1,848,000 |
| 4.22 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL-15KV | $ - | $ 50,100 | $ 141,200 | $ 191,300 |
| 4.23 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | 1/C # 350KCMIL-5KV | $ - | $ 66,200 | $ 282,300 | $ 348,500 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

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|---|---|---|---|---|---|---|
| 4.24 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 93,000 | $ 143,200 | $ 236,200 |
| 4.25 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 26,200 | $ 73,600 | $ 99,800 |
| 4.26 | DUCT BANK | DUCT BANK WITH 4-5" & 4-3" CONDUITS, 2.38' H X 3.79' W | $ - | $ 61,100 | $ 116,200 | $ 177,300 |
| 4.27 | FOUNDATIONS FOR TRANSFORMERS | FOR XFMR 33F, 33G, INCLUDES MUD MAT | $ - | $ 3,500 | $ 10,300 | $ 13,800 |
| 4.28 | COMMUNICATIONS | 0.00 | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 4.29 | LIGHTNING PROTECTION | 0.00 | $ - | $ 14,000 | $ 9,000 | $ 23,000 |
| 4.30 | SECURITY SYSTEM | 0.00 | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 7,259,600 | $ 2,831,000 | $ 5,806,300 | $ 15,896,900 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 363,000 | $ 721,900 | $ 2,120,800 | $ 3,205,700 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | LIME HANDLING SYSTEM | $ 7,622,600 | $ 3,552,900 | $ 7,927,100 | $ 19,102,600 |
| | | | | | | |
| 5.0 | LIME SLAKER BUILDING | | | | | |
| 5.1 | MECHANICAL EQUIPMENT | INCLUDES:CHAIN CONVEYOR, SLAKERS THROUGH THE LIME SLURRY PUMPS, PIPING, AND LIME SLURRY STORAGE TANKS. | $ 7,985,000 | $ - | $ 4,942,500 | $ 12,927,500 |
| 5.2 | LIME SLAKER BUILDING SUMP PUMPS | DUPLEX. INCLUDES CHECK & ISOLATION VALVES | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 5.3 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 5.4 | PIPING - MECHANICAL | | $ 117,800 | $ 111,400 | $ 381,100 | $ 610,300 |
| 5.5 | LIME SLURRY TANKS - FOUNDATIONS | | $ - | $ 166,400 | $ 299,400 | $ 465,800 |
| 5.6 | LIME SLAKER BUILDING - FOUNDATIONS | | $ - | $ 119,200 | $ 204,000 | $ 323,200 |
| 5.7 | LIME SLAKER BUILDING | 135' L X 30' W X 50' H | $ 40,500 | $ 803,300 | $ 740,500 | $ 1,584,300 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
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| | |
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|---|---|---|---|---|---|---|
| 5.8 | ELECTRICAL | INCLUDED WITH LIME HANDLING SYSTEM, ACCOUNT 4.0 | $ - | $ - | $ - | $ - |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 8,183,300 | $ 1,200,300 | $ 6,584,400 | $ 15,968,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 409,200 | $ 306,100 | $ 2,456,800 | $ 3,172,000 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | LIME SLAKER BUILDING | $ 8,592,500 | $ 1,506,400 | $ 9,041,200 | $ 19,140,000 |
| | | | | | | |
| 6.0 | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | | | | | |
| 6.1 | BYPRODUCT WASTE ASH HANDLING - MECHANICAL EQUIPMENT | INCLUDES PNEUMATIC HANDLING SYSTEM, THREE PRESSURE BLOWERS, ONE BIN VENT FILTER, ASH UNLOADING SYSTEM | $ 2,047,000 | $ - | $ 1,380,000 | $ 3,427,000 |
| 6.2 | ECONOMIZER ASH HANDLING - MECHANICAL EQUIPMENT | INCLUDES JET PUMPS AND PIPING / SUPPORTS TO THE BOTTOM ASH POND | $ 400,000 | $ - | $ 296,400 | $ 696,400 |
| 6.3 | BUILDING SUMP PUMPS | FOR BUILDINGS - DUPLEX. INCLUDES CHECK & ISOLATION VALVES. | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 6.4 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 6.5 | PIPING - MECHANICAL | | $ 142,800 | $ 240,900 | $ 759,100 | $ 1,142,800 |

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Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 6.6 | BYPRODUCT WASTE SILO | CONCRETE SILO 65' DIA X 111' H - 4700 TONS - SUBCONTRACT COST INCLUDES LABOR | $ 2,630,000 | $ - | $ - | $ 2,630,000 |
| 6.7 | SDA RECYCLE SILO | INCLUDED WITH OEM EQUIPMENT | $ - | $ - | $ - | $ - |
| 6.8 | SDA FLY ASH SILO | NOT REQUIRED - ECONOMIZER FLY ASH SLUICED TO BOTTOM ASH POND | $ - | $ - | $ - | $ - |
| 6.9 | WASTE ASH STORAGE SILO - FOUNDATIONS | | $ - | $ 186,400 | $ 343,900 | $ 530,300 |
| 6.10 | FLY ASH SILO - FOUNDATIONS | NOT REQUIRED | $ - | $ - | $ - | $ - |
| 6.11 | FLY ASH BLOWER AND ELECTRICAL BUILDING - FOUNDATIONS | NOT REQUIRED | $ - | $ - | $ - | $ - |
| 6.12 | FLY ASH BLOWER AND ELECTRICAL BUILDING | NOT REQUIRED | $ - | $ - | $ - | $ - |
| 6.13 | RECYCLE ASH BUILDING - FOUNDATIONS | | $ - | $ 234,300 | $ 393,800 | $ 628,100 |
| 6.14 | RECYCLE ASH BUILDING | 100' L X 65' W X 50' H | $ 58,500 | $ 1,306,700 | $ 1,194,500 | $ 2,559,700 |
| 6.15 | MCC | 480V MCC PER LINE UP | $ 60,000 | $ - | $ 3,600 | $ 63,600 |
| 6.16 | EMERGENCY POWER SYSTEM | | $ 92,800 | $ - | $ 19,900 | $ 112,700 |
| 6.17 | LIGHTING/ TRANSFORMERS & PANELS | | $ 18,500 | $ 60,000 | $ 44,100 | $ 122,600 |
| 6.18 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 32,500 | $ 189,100 | $ 221,600 |
| 6.19 | LOW VOLTAGE POWER CABLE & TERMINATION | #4/0 - #12 AWG-600V | $ - | $ 64,700 | $ 80,500 | $ 145,200 |
| 6.20 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 30,700 | $ 86,200 | $ 116,900 |
| 6.21 | GROUNDING | | $ - | $ 4,500 | $ 10,900 | $ 15,400 |
| 6.22 | DUCT BANK | DUCT BANK WITH 12-5" & 6-3" CONDUITS, 5.2' H X 2.08" W | $ - | $ 111,500 | $ 184,000 | $ 295,500 |
| 6.23 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

Estimate No.: 30713C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 6.24 | LIGHTNING PROTECTION | | $ - | $ 16,000 | $ 14,000 | $ 30,000 |
| 6.25 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 5,489,600 | $ 2,330,200 | $ 5,049,900 | $ 12,869,700 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 274,500 | $ 594,200 | $ 1,883,600 | $ 2,752,300 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | $ 5,764,100 | $ 2,924,400 | $ 6,933,500 | $ 15,622,000 |
| | | | | | | |
| 7.0 | ABSORBER ISLAND | | | | | |
| 7.1 | MECHANICAL EQUIPMENT | INCLUDES: ABSORBER MODULES AND ATOMIZERS WITH LUBE OIL, DUCT WORK FROM THE ABSORBERS TO THE FABRIC FILTER, AND COMPLETE RECYCLE SYSTEM WITH PIPING INSIDE FGD BUILDINGS. | $ 39,438,000 | $ - | $ 24,186,100 | $ 63,624,100 |
| 7.2 | ELEVATOR | MAINTENANCE ELEVATOR - SUBCONTRACT COST INCLUDES LABOR | $ 325,000 | $ - | $ - | $ 325,000 |
| 7.3 | BUILDING SUMP PUMPS | FOR BUILDINGS - DUPLEX. INCLUDES CHECK & ISOLATION VALVES. | $ 28,000 | $ - | $ 12,300 | $ 40,300 |

Sargent & Lundy, LLC

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| 7.4 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 7.5 | PIPING - MECHANICAL | | $ 142,800 | $ 36,900 | $ 227,900 | $ 407,600 |
| 7.6 | SDA SUPERSTRUCTURE | | $ 75,000 | $ 764,900 | $ 1,227,300 | $ 2,067,200 |
| 7.7 | SDA BOTTOM ENCLOSURE - SUPPORT STEEL, GIRTS AND SIDING | TOTAL FOR THREE ABSORBERS | $ - | $ 362,100 | $ 385,200 | $ 747,300 |
| 7.8 | SDA SHELL / ROOF INSULATION | 61,000 SF. SUBCONTRACT COST INCLUDES LABOR | $ 1,830,000 | $ - | $ - | $ 1,830,000 |
| 7.9 | SDA - SUPPORT STEEL & ACCESS GALLERY | | $ - | $ 711,000 | $ 1,884,100 | $ 2,595,100 |
| 7.10 | EXPANSION JOINTS | | $ - | $ 195,500 | $ 173,800 | $ 369,300 |
| 7.11 | DUCTWORK | | $ - | $ 4,797,000 | $ 10,481,700 | $ 15,278,700 |
| 7.12 | DUCT SUPPORT STEEL | THREE COAT SHOP PAINT | $ - | $ 2,140,200 | $ 2,153,200 | $ 4,293,400 |
| 7.13 | DUCTWORK INSULATION & LAGGING | | $ - | $ 1,632,000 | $ 3,196,400 | $ 4,828,400 |
| 7.14 | CONCRETE PIT FOR ELEVATOR | | $ - | $ 2,800 | $ 8,200 | $ 11,000 |
| 7.15 | SPRAY DRYER ABSORBER - FOUNDATIONS | TOTAL FOR THREE TOWERS | $ - | $ 1,678,600 | $ 3,323,400 | $ 5,002,000 |
| 7.16 | SDA PDC - FOUNDATION | | $ - | $ 85,600 | $ 169,000 | $ 254,600 |
| 7.17 | SDA PDC BUILDING | 60' L X 40' W X 13' H. SUBCONTRACT PRICE INCLUDES LABOR | $ - | $ 1,200,000 | $ - | $ 1,200,000 |
| 7.18 | FOUNDATIONS FOR SUPPORT STEEL | | $ - | $ 69,000 | $ 143,000 | $ 212,000 |
| 7.19 | TRANSFORMERS | | $ 770,000 | $ - | $ 145,600 | $ 915,600 |
| 7.20 | SWITCHGEAR | | $ 1,082,000 | $ - | $ 569,000 | $ 1,651,000 |
| 7.21 | CABLE BUS & TERMINATIONS | | $ 1,082,500 | $ 35,800 | $ 1,853,300 | $ 2,971,600 |
| 7.22 | MCC | | $ 185,400 | $ - | $ 8,200 | $ 193,600 |
| 7.23 | MIMIC PANELS | | $ 17,500 | $ - | $ 4,500 | $ 22,000 |
| 7.24 | GROUNDING | | $ - | $ 16,000 | $ 46,100 | $ 62,100 |
| 7.25 | LIGHTING/ TRANSFORMERS & PANELS | | $ 156,000 | $ 150,000 | $ 159,100 | $ 465,100 |
| 7.26 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 7.27 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 1,658,100 | $ 8,154,700 | $ 9,812,800 |
| 7.28 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL- 15KV | $ - | $ 53,300 | $ 150,300 | $ 203,600 |
| 7.29 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 82,500 | $ 243,200 | $ 325,700 |
| 7.30 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 409,900 | $ 537,400 | $ 947,300 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
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COST ESTIMATE SUMMARY

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Project No.: 12721-000
Date: 9/29/2010
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| 7.31 | CONTROL & INSTRUMENT CABLE | | $ - | $ 99,200 | $ 278,400 | $ 377,600 |
| 7.32 | DUCT BANK | | $ - | $ 137,900 | $ 278,600 | $ 416,500 |
| 7.33 | FOUNDATION FOR TRANSFORMERS | | $ - | $ 49,800 | $ 145,800 | $ 195,600 |
| 7.34 | TRANSFORMER FIRE WALLS | FOR 21A & 21B | $ - | $ 3,500 | $ 9,600 | $ 13,100 |
| 7.35 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 7.36 | LIGHTNING PROTECTION | | $ - | $ 25,500 | $ 18,500 | $ 44,000 |
| 7.37 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 45,252,500 | $ 16,422,100 | $ 60,222,900 | $ 121,897,500 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 3,072,600 | $ 4,187,600 | $ 23,578,100 | $ 30,838,300 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ABSORBER ISLAND | $ 48,325,100 | $ 20,609,700 | $ 83,801,000 | $ 152,735,800 |
| | | | | | | |
| 8.0 | ACTIVATED CARBON INJECTION SYSTEM | | | | | |
| 8.1 | ACI MECHANICAL EQUIPMENT: | | $ 3,046,400 | $ - | $ 1,012,000 | $ 4,058,400 |
| 8.2 | PIPING - MECHANICAL | | $ 29,800 | $ 149,800 | $ 377,100 | $ 556,700 |
| 8.3 | ACI SYSTEM - FOUNDATIONS | | $ - | $ 41,500 | $ 88,000 | $ 129,500 |
| 8.4 | MCC | | $ 61,800 | $ - | $ 3,600 | $ 65,400 |
| 8.5 | GROUNDING | | $ 5,500 | $ - | $ 18,600 | $ 24,100 |
| 8.6 | LIGHTING / TRANSFORMERS & PANELS | | $ 26,000 | $ 15,000 | $ 20,400 | $ 61,400 |
| 8.7 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 89,900 | $ 302,900 | $ 392,800 |
| 8.8 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 30,400 | $ 18,000 | $ 32,400 |
| 8.9 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 16,000 | $ 44,900 | $ 60,900 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 3,169,500 | $ 326,600 | $ 1,885,500 | $ 5,381,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 158,500 | $ 83,300 | $ 694,500 | $ 936,300 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ACTIVATED CARBON INJECTION SYSTEM | $ 3,328,000 | $ 409,900 | $ 2,580,000 | $ 6,317,900 |
| | | | | | | |
| 9.0 | COMPRESSED AIR SYSTEM | | | | | |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
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|---|---|---|---|---|---|---|
| 9.1 | AIR COMPRESSOR & AUXILIARIES | | $ 664,000 | $ - | $ 155,400 | $ 819,400 |
| 9.2 | PIPING - MECHANICAL | | $ 320,600 | $ 399,200 | $ 1,096,000 | $ 1,815,800 |
| 9.3 | AIR COMPRESSOR BUILDING - FOUNDATIONS | | $ - | $ 96,100 | $ 194,700 | $ 290,800 |
| 9.4 | AIR COMPRESSOR BUILDING | 100' L X 60' W X 20' H | $ - | $ 510,000 | $ - | $ 510,000 |
| 9.5 | LIGHTING/ TRANSFORMERS & PANELS | | $ 11,000 | $ 10,500 | $ 11,400 | $ 32,900 |
| 9.6 | RACEWAY, CABLE TRAY, & CONDUIT | INCLUDED IN ABSORBER ISLAND 7.0 | $ - | $ - | $ - | $ - |
| 9.7 | GROUNDING | | $ 4,500 | $ - | $ 10,900 | $ 15,400 |
| 9.8 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 9.9 | LIGHTNING PROTECTION | | $ - | $ 10,500 | $ 7,500 | $ 18,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,000,100 | $ 1,060,300 | $ 1,501,900 | $ 3,562,300 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 50,000 | $ 270,400 | $ 551,500 | $ 871,800 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | COMPRESSED AIR SYSTEM | $ 1,050,100 | $ 1,330,700 | $ 2,053,400 | $ 4,434,100 |
| | | | | | | |
| 10.0 | SERVICE WATER SYSTEM | | | | | |
| 10.1 | PUMPS | INCLUDES SELF-CLEANING STRAIINERS | $ 204,000 | $ - | $ 90,000 | $ 294,000 |
| 10.2 | PIPING - MECHANICAL | | $ 183,400 | $ 624,600 | $ 1,092,000 | $ 1,900,000 |
| 10.3 | PIPING - FIRE PROTECTION SYSTEM | | $ 181,200 | $ 284,600 | $ 673,300 | $ 1,139,100 |
| 10.4 | TANKS | | $ - | $ 120,000 | $ - | $ 120,000 |
| 10.5 | SERVICE WATER TANK & PUMP - FOUNDATIONS | | $ - | $ 17,300 | $ 41,400 | $ 58,700 |
| 10.6 | ELECTRICAL | INCLUDED IN ABSORBER ISLAND 7.0 | $ - | $ - | $ - | $ - |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 568,600 | $ 1,046,500 | $ 1,896,700 | $ 3,511,800 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 28,400 | $ 266,900 | $ 690,700 | $ 986,000 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

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| Project No.: | 12721-000 |
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| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | SERVICE WATER SYSTEM | $ 597,000 | $ 1,313,400 | $ 2,587,400 | $ 4,497,800 |
| | | | | | | |
| 11.0 | POTABLE WATER SYSTEM | | | | | |
| 11.1 | PUMPS | | $ 30,000 | $ - | $ 18,400 | $ 48,400 |
| 11.2 | PIPING - MECHANICAL | | $ 99,500 | $ 200,400 | $ 530,700 | $ 830,600 |
| 11.3 | TANKS | | $ - | $ 8,500 | $ - | $ 8,500 |
| 11.4 | POTABLE WATER TANK & PUMP - FOUNDATIONS | | $ - | $ 5,200 | $ 9,200 | $ 14,400 |
| 11.5 | ELECTRICAL | INCLUDED IN ABSORBER ISLAND 7.0 | $ - | $ - | $ - | $ - |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 129,500 | $ 214,100 | $ 558,300 | $ 901,900 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 6,500 | $ 54,600 | $ 203,000 | $ 264,100 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | POTABLE WATER SYSTEM | $ 136,000 | $ 268,700 | $ 761,300 | $ 1,166,000 |
| | | | | | | |
| 12.0 | FGD SUBSTATION | | | | | |
| 12.1 | TRANSFORMERS | | $ 1,560,000 | $ - | $ 273,100 | $ 1,833,100 |
| 12.2 | TRANSFORMER PDC | 15W X 45' X 10'H. SUBCONTRACT PRICE INCLUDES LABOR | $ 202,500 | $ - | $ - | $ 202,500 |
| 12.3 | TRANSFORMER PDC - FOUNDATION | | $ - | $ 73,200 | $ 146,900 | $ 220,100 |
| 12.4 | 138KV MAIN FEEDER & TERMINATIONS | | $ 264,000 | $ - | $ 254,000 | $ 518,000 |
| 12.5 | SWITCHGEAR | | $ 710,000 | $ - | $ 121,600 | $ 831,600 |
| 12.6 | MCC | 480V MCC, PER LINE UP | $ 60,000 | $ - | $ 3,600 | $ 63,600 |
| 12.7 | CABLE BUS | | $ 181,100 | $ 18,000 | $ 290,200 | $ 489,300 |
| 12.8 | PANELS - RELAY | | $ 100,000 | $ - | $ 9,100 | $ 109,100 |
| 12.9 | MIMIC PANELS | | $ 17,500 | $ - | $ 4,500 | $ 22,000 |
| 12.10 | UPS SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 12.11 | GROUNDING | | $ 23,300 | $ - | $ 59,100 | $ 82,400 |
| 12.12 | LIGHTING/ TRANSFORMERS & PANELS | | $ 26,000 | $ 30,000 | $ 29,500 | $ 85,500 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
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| 12.13 | OUTDOOR LIGHTING | NEW AUX YARD LIGHTING - ALLOWANCE | $ 25,000 | $ - | $ 56,800 | $ 81,800 |
| 12.14 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 390,600 | $ 1,918,600 | $ 2,309,200 |
| 12.15 | DUCT BANK | | $ - | $ 26,200 | $ 54,300 | $ 80,500 |
| 12.16 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 112,200 | $ 194,700 | $ 306,900 |
| 12.17 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 21,800 | $ 61,100 | $ 82,900 |
| 12.18 | FOUNDATION FOR AUX TRANSFORMER | | $ - | $ 70,200 | $ 205,400 | $ 275,600 |
| 12.19 | FIREWALL FOR TRANSFORMERS | | $ - | $ 3,000 | $ 5,200 | $ 8,200 |
| 12.20 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 12.21 | LIGHTNING PROTECTION | | $ - | $ 4,000 | $ 2,000 | $ 6,000 |
| 12.22 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 3,277,700 | $ 774,200 | $ 3,734,100 | $ 7,786,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 163,900 | $ 197,400 | $ 1,350,042 | $ 1,711,300 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FGD SUBSTATION | $ 3,441,600 | $ 971,600 | $ 5,084,100 | $ 9,497,300 |
| | | | | | | |
| 13.0 | FGD DCS SYSTEM | | | | | |
| 13.1 | DCS | 3200 I/O POINTS | $ 2,400,000 | $ - | $ 813,600 | $ 3,213,600 |
| 13.2 | DCS - VENDOR FIELD SUPPORT | 200 MANDAYS @ $1500/DAY - SHOWN AS SUBCONTRACT COST | $ 300,000 | $ - | $ - | $ 300,000 |
| 13.3 | LOCALLY MOUNTED INSTRUMENTS | | $ - | $ 709,500 | $ 930,500 | $ 1,640,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 2,700,000 | $ 709,500 | $ 1,744,100 | $ 5,153,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 135,000 | $ 180,900 | $ 650,900 | $ 966,800 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FGD DCS SYSTEM | $ 2,835,000 | $ 890,400 | $ 2,395,000 | $ 6,120,400 |
| | | | | | | |
| 14.0 | CEM SYSTEM | | | | | |

Sargent & Lundy, LLC

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| 14.1 | CEM | PROVIDED BY AEP | $ 1,260,000 | $ 540,000 | $ 310,000 | $ 2,110,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,260,000 | $ 540,000 | $ 310,000 | $ 2,110,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ 316,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | CEM SYSTEM | $ - | $ - | $ - | $ 2,426,500 |
| | | | | | | |
| 15.0 | TRUCK & RAIL INFRASTRUCTURE | | | | | |
| 15.1 | EXISTING RAILROAD IMPROVEMENTS | FOR FULL RAILCAR STORAGE TRACK IMPROVEMENTS - 3250 LF | $ - | $ 660,200 | $ 689,200 | $ 1,349,400 |
| 15.2 | EXISTING RAILROAD IMPROVEMENTS | FOR LOOP TRACK UPGRADE - 5000 LF | $ - | $ 1,008,800 | $ 1,055,600 | $ 2,064,400 |
| 15.3 | NEW RAILROAD TRACK | INCLUDES, 132LB RAIL, 7" TIMBERS, TIE PLATES, SPIKES, BOLTS, 12: SUBBALLAST, 12" BALLAST, 12 OZ/SY GEOTEXTILE MEMBRANE, 12" SUBGRADE PREP | $ - | $ 252,000 | $ 213,100 | $ 465,100 |
| 15.4 | FIELD FABRICATED TURNOUTS | #8 TURNOUT | $ - | $ 90,000 | $ 54,800 | $ 144,800 |
| 15.5 | RAIL SCALE | SUBCONTRACT COST, INCLUDES FOUNDATIONS | $ 212,500 | $ - | $ - | $ 212,500 |
| 15.6 | NEW CONCRETE ENCASEMENT | OVER AND AROUND DUCT BANK CONNECTING THE PLANT TO SWITCHYARD. THIS IS UNDER THE NEW TRACKWORK EXTENSION | $ - | $ 33,200 | $ 71,400 | $ 104,600 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 212,500 | $ 2,044,200 | $ 2,084,100 | $ 4,340,800 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 10,600 | $ 521,300 | $ 779,600 | $ 1,311,500 |

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| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | TRUCK & RAIL INFRASTRUCTURE | $ 223,100 | $ 2,565,500 | $ 2,863,700 | $ 5,652,300 |
| | | | | | | |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | | | | | |
| 16.1 | SITE GRADING | | $ - | $ - | $ 538,800 | $ 538,800 |
| 16.2 | ROADS & SURFACING | | $ - | $ 918,600 | $ 1,237,000 | $ 2,155,600 |
| 16.3 | NEW CONCRETE ENCASEMENT | 16' X 4' X 40' - FOR EXISTING ASH PIPE HAUL ROAD CROSSING | $ - | $ 144,300 | $ 286,600 | $ 430,900 |
| 16.4 | TRUCK WASH AREA | | $ - | $ 47,300 | $ 83,100 | $ 130,400 |
| 16.5 | TRUCK SCALE & CONCRETE APPROACH | | $ 170,000 | $ 27,300 | $ 92,000 | $ 289,300 |
| 16.6 | PROCESS WATER STORAGE BASIN | | $ 60,000 | $ 110,400 | $ 312,600 | $ 483,000 |
| 16.7 | PROCESS WATER STORAGE BASIN PUMP STRUCTURE - CONCRETE | | $ - | $ 47,000 | $ 105,400 | $ 152,400 |
| 16.8 | STORMWATER DRAINAGE TRENCH | 2' W X 3' DEEP CAST-IN-PLACE CONCRETE TRENCH W/REINFORCING & HS-20 RATED GRATE COVERS | $ - | $ 499,500 | $ 508,300 | $ 1,007,800 |
| 16.9 | STORMWATER RUNOFF POND | | $ - | $ 15,000 | $ 122,600 | $ 137,600 |
| 16.10 | STORM WATER POND PUMP STRUCTURE - CONCRETE | | $ 90,000 | $ 42,300 | $ 182,200 | $ 314,500 |
| 16.11 | OILY WATER SEWER | | $ 4,500 | $ 105,000 | $ 223,600 | $ 333,100 |
| 16.12 | OIL SEPARATOR | 500 GPM W/ INTEGRAL LIFT STATION | $ 100,000 | $ - | $ 116,100 | $ 216,100 |
| 16.13 | SANITARY SEWER | | $ - | $ 22,200 | $ 96,900 | $ 119,100 |
| 16.14 | SANITARY LIFT STATION | PACKAGED TYPE COMPLETE WITH PUMPS, 100,000 GPD | $ 150,000 | $ - | $ 49,200 | $ 199,200 |
| 16.15 | CONSTRUCTION LAYDOWN AREA | ALLOWANCE FOR 10 ACRES, DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED | $ - | $ 700,000 | $ 828,000 | $ 1,528,000 |

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU<br>COST ESTIMATE SUMMARY | Estimate No.:<br>Project No.:<br>Date:<br>Preparer:<br>Reviewer:<br>Approver: | 30713C<br>12721-000<br>9/29/2010<br>MNO<br>JMK<br>PEF |
|---|---|---|---|

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 16.16 | CRAFT PARKING | DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED.<br>ALLOWANCE FOR 20,000 SY<br>INCLUDES:<br>6" BASE COURSE<br>10 OZ/SY GEOTEXTILE<br>12" SUBGRADE PREP | $ - | $ 180,000 | $ 414,200 | $ 594,200 |
| 16.17 | CONTRACTOR OFFICES (AREA) | DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED.<br>ALLOWANCE FOR 5,000 SY AREA (TRAILERS BY CONTRACTORS)<br>INCLUDES:<br>6" BASE COURSE<br>10 OZ/SY GEOTEXTILE<br>12" SUBGRADE PREP | $ - | $ 45,000 | $ 103,600 | $ 148,600 |
| 16.18 | NEW PERMANENT STORAGE | INCLUDES LIGHTING AND H&V. SUBCONTRACT | $ 850,000 | $ - | $ - | $ 850,000 |
| 16.19 | FOUNDATIONS FOR THE NEW WAREHOUSE | | $ - | $ 273,500 | $ 450,200 | $ 723,700 |
| 16.20 | NEW TEMPORARY STORAGE | WEATHER TIGHT CANVAS ENCLOSURE. INCLUDES | $ 450,000 | $ - | $ - | $ 450,000 |
| 16.21 | FOUNDATIONS FOR TEMPORARY STORAGE | | $ - | $ 99,500 | $ 157,200 | $ 256,700 |
| 16.22 | LABOR BUS SERVICE FROM PARKING LOT TO CONSTRUCTION AREA AND ACCESS CONTROL | ALLOWANCE FOR 36 MONTHS BASED ON 2 | $ 1,368,000 | $ - | $ - | $ 1,368,000 |
| 16.23 | EROSION & SEDIMENT CONTROL | | $ - | $ 12,400 | $ 20,400 | $ 32,800 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 3,242,500 | $ 3,289,300 | $ 5,928,000 | $ 12,459,800 |

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU<br>COST ESTIMATE SUMMARY | Estimate No.:<br>Project No.:<br>Date:<br>Preparer:<br>Reviewer:<br>Approver: | 30713C<br>12721-000<br>9/29/2010<br>MNO<br>JMK<br>PEF |
|---|---|---|---|

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 162,100 | $ 838,800 | $ 2,156,500 | $ 3,157,400 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | SITE IMPROVEMENTS - CIVIL WORK | $ 3,404,600 | $ 4,128,100 | $ 8,084,500 | $ 15,617,200 |
| | | | | | | |
| 17.0 | BOP ITEMS | | | | | |
| 17.1 | PIPE INSULATION | AVERAGE 6" PIPE SIZE | $ - | $ 34,000 | $ 106,000 | $ 140,000 |
| 17.2 | HEAT TRACING | | $ - | $ 175,600 | $ 248,500 | $ 424,100 |
| 17.3 | TOUCH UP PAINT (INCLUDES PAINTING CS PIPE) | | $ - | $ 134,400 | $ 515,600 | $ 650,000 |
| 17.4 | HOISTS & TROLLEYS | | $ 180,000 | $ 210,000 | $ 245,300 | $ 635,300 |
| 17.5 | MISC AUX STEEL FOR PIPE SUPPORTS | FIELD FABRICATED | $ - | $ 122,500 | $ 510,600 | $ 633,100 |
| 17.6 | MISC PIPE SUPPORT FOUNDATIONS | | $ - | $ 10,500 | $ 21,000 | $ 31,500 |
| 17.7 | EYE WASH STATIONS | | $ 30,000 | $ 5,000 | $ 30,700 | $ 65,700 |
| 17.8 | FIRE PROTECTION FOR MISC BUILDINGS & AREAS | | $ - | $ 360,000 | $ 294,400 | $ 654,400 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 210,000 | $ 1,052,000 | $ 1,972,100 | $ 3,234,100 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 10,500 | $ 268,260 | $ 750,694 | $ 1,029,454 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | BOP ITEMS | $ 220,500 | $ 1,320,300 | $ 2,722,800 | $ 4,263,600 |
| | | | | | | |
| 18.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | | | | | |
| 18.1 | RELOCATE HYDROGEN STORAGE TANK | | $ - | $ 15,600 | $ 86,800 | $ 102,400 |
| 18.2 | NEW HYDROGEN LINE TO PLANT | | $ - | $ 62,100 | $ 150,600 | $ 212,700 |
| 18.3 | RELOCATE MISC. UNDERGROUND UTILITIES | ALLOWANCE | $ - | $ 125,000 | $ 170,500 | $ 295,500 |
| 18.4 | OUTAGE TIE-IN DUCTWORK | ALLOWANCE FOR 85 TON DUCTWORK | $ - | $ 276,300 | $ 527,700 | $ 804,000 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

Estimate No.: 30713C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 18.5 | RELOCATED WAREHOUSE - FOUNDATIONS | | $ - | $ 342,600 | $ 534,900 | $ 877,500 |
| 18.6 | RELOCATE EXISTING WAREHOUSE BUILDING | 150' L X 75' W X 25' H | $ - | $ 95,600 | $ 1,121,500 | $ 1,217,100 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ 917,200 | $ 2,592,000 | $ 3,509,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ 233,900 | $ 927,100 | $ 1,161,000 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $ - | $ 1,151,100 | $ 3,519,100 | $ 4,670,200 |
| | | | | | | |
| 19.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | | | | | |
| 19.1 | ARSENIC, ASBESTOS , LEAD ABATEMENT | PROVIDED BY AEP | $ - | $ - | $ - | $ 750,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ - | $ - | $ 750,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ 112,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ARSENIC, ASBESTOS , LEAD ABATEMENT | $ - | $ - | $ - | $ 862,500 |
| | | | | | | |
| | | | | | | |
| 99.0 | OVERALL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 112,340,400 | $ 46,817,700 | $ 134,192,300 | $ 313,450,400 |
| | OVERALL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 6,364,000 | $ 11,881,800 | $ 50,633,700 | $ 72,130,000 |
| | OVERALL TOTAL DIRECT & CONSTRUCTION INDIRECT COST | | $ 118,704,400 | $ 58,699,500 | $ 184,826,000 | $ 385,580,400 |
| | | | | | | |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30713C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | | | | | | |
| | OVERALL PROJECT INDIRECT COSTS | | | | | |
| | ENGINEERING, PROCUREMENT, & PROJECT SERVICES | | | | | $ 25,000,000 |
| | CONSTRUCTION MANAGEMENT | | | | | $ 11,567,400 |
| | S-U / COMMISSIONING | | | | | $ 3,855,800 |
| | CRAFT START-UP SUPPORT | | | | | $ 1,581,200 |
| | INITIAL FILLS | | | | | $ 1,156,700 |
| | OPERATOR & TRAINING MANUALS | | | | | $ 300,000 |
| | SUBCONTRACTORS (NOISE & DUCTWORK CONSULTANT, GEOTECHNICAL INVESTIGATION) | | | | | $ 400,000 |
| | NOISE ABATEMENT FOR 85 DBA REQUIREMENT | | | | | $ 2,750,000 |
| | SUBTOTAL - INDIRECT COSTS | | | | | $ 46,611,100 |
| | TOTAL PROJECT DIRECT AND INDIRECT COSTS | | | | | $ 432,191,500 |
| | | | | | | |
| | SPARE PARTS: | | | | | $ 1,780,600 |
| | SPARE PARTS - CAPITALIZED | 0.90 | | | | $ 1,068,360 |
| | SPARE PARTS - FIRST YEAR OF OPERATION | 0.60 | | | | $ 712,240 |
| | | | | | | |
| | CONTINGENCY | 14.7 | | | | $ 63,953,800 |
| | | | | | | |
| | ESCALATION | | | | | $ 54,885,900 |
| | EQUIPMENT | | | | | $ 18,902,600 |
| | MATERIAL | | | | | $ 6,044,500 |
| | LABOR | | | | | $ 24,477,200 |
| | INDIRECTS | | | | | $ 5,461,600 |
| | | | | | | |
| | | | | | | |
| | TOTAL PROJECT COST | | | | | $ 552,811,800 |
| | | | | | | |
| | REFERENCE COSTS: | | | | | |
| A | ESP DEMOLITION | ALLOWANCE FOR 1000T STRUCTURE | $ - | $ - | $ 832,300 | $ 832,300 |

| Sargent & Lundy, LLC | AEP<br>BIG SANDY UNIT 2<br>FGD PROJECT - DRY FGD EST BASE (N/ESP)-1B - 3.0 LB/MM BTU<br>COST ESTIMATE SUMMARY | Estimate No.:<br>Project No.:<br>Date:<br>Preparer:<br>Reviewer:<br>Approver: | 30713C<br>12721-000<br>9/29/2010<br>MNO<br>JMK<br>PEF |
|---|---|---|---|

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| B | REMOVE BOOSTER AIR FANS | ALLOWANCE FOR 150 TON FRAMING REINFORCEMENT | $ - | $ - | $ 111,000 | $ 111,000 |
| C | REMOVAL OF FUEL OIL TANK | LABOR COST IS FOR REMOVAL OF TANK ONLY. ALLOWANCE FOR SOIL REMEDIATION AND DISPOSAL IN AN EPA APPROVED LANDFILL. SUBCONTRACT COST INCLUDES LABOR. USED LOWER END OF THE RANGE $118-355/CY. COST COULD BE LOWER ($59-118/CY) IF SOLD TO A BITUMINOUS CONCRETE BATCH PLANT | $ 1,200,000 | $ 80,000 | $ 469,400 | $ 1,749,400 |

# EXHIBIT 1-6.3
# Capital Cost Estimate Summary
# IAQCS FGD Base Case w/o ESP

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 1.0 | ID FANS | | | | | |
| 1.1 | ID FANS - OEM EQUIPMENT | 1,865,000 ACFM WITH 24,500 HP MOTORS ($875,000 EACH). INCLUDES HYDRAULIC OIL UNITS, SEAL AIR FAN SKIDS, VIBRATION MONITORING EQUIPMENT, FAN STALL EQUIPMENT, FIELD SERVICE REP FOR 140 DAYS | $ 7,688,000 | $ - | $ 1,737,800 | $ 9,425,800 |
| 1.2 | PIPING & SUPPORTS - MECHANICAL | | $ 21,800 | $ 28,700 | $ 120,500 | $ 171,000 |
| 1.3 | DAMPERS | | $ 781,000 | $ - | $ 352,600 | $ 1,133,600 |
| 1.4 | EXPANSION JOINTS | | $ - | $ 131,100 | $ 116,500 | $ 247,600 |
| 1.5 | DUCTWORK | FABRIC FILTER OUTLET TO ID FANS AND FROM ID FANS TO STACK - INCLUDES INTERNAL BRACING AND TURNING VANES | $ - | $ 2,860,000 | $ 5,462,800 | $ 8,322,800 |
| 1.6 | DUCT SUPPORT STEEL | THREE COAT SHOP PAINT | $ - | $ 1,276,000 | $ 1,283,700 | $ 2,559,700 |
| 1.7 | ID FAN INSULATION & LAGGING | TOTAL FOR TWO FANS. PRICING REFLECTS STANDARD ACOUSTICAL INSULATION | $ - | $ 200,000 | $ 258,500 | $ 458,500 |
| 1.8 | DUCTWORK INSULATION & LAGGING | INCLUDES INSULATION FOR SPRAY DRYER OUTLET DUCT TO FABRIC FILTERS SUPPLIED WITH THE OEM EQUIPMENT | $ - | $ 1,090,800 | $ 2,136,300 | $ 3,227,100 |
| 1.9 | DUCT SUPPORT STEEL - FOUNDATIONS | | $ - | $ 352,200 | $ 684,000 | $ 1,036,200 |
| 1.10 | ID FAN FOUNDATIONS INCLUDING ID FAN AUX EQUIPMENT | | $ - | $ 229,300 | $ 415,700 | $ 645,000 |
| 1.11 | ID FAN IAQCS CONTROL ROOM - FOUNDATIONS | | $ - | $ 270,100 | $ 508,600 | $ 778,700 |
| 1.12 | ID FAN IAQCS CONTROL ROOM | SUBCONTRACT PRICE INCLUDES LABOR. COMPLETE WITH HVAC, FINISHES AND SANITARY FACILITIES | $ - | $ 3,937,500 | $ - | $ 3,937,500 |
| 1.13 | TRANSFORMERS | | $ 770,000 | $ - | $ 145,600 | $ 915,600 |
| 1.14 | SWITCHGEAR | | $ 1,132,000 | $ - | $ 589,900 | $ 1,721,900 |
| 1.15 | CABLE BUS & TERMINATIONS | | $ 1,129,100 | $ 35,800 | $ 1,930,000 | $ 3,094,900 |
| 1.16 | MCC | | $ 180,000 | $ - | $ 10,900 | $ 190,900 |
| 1.17 | MIMIC PANELS | | $ 17,500 | $ - | $ 4,500 | $ 22,000 |
| 1.18 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 1,664,200 | $ 8,196,600 | $ 9,860,800 |
| 1.19 | HIGH VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 288,500 | $ 666,700 | $ 955,200 |
| 1.20 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 100,200 | $ 427,400 | $ 527,600 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 1.21 | LOW VOLTAGE POWER CABLE & TERMINATIONS | | $ - | $ 229,800 | $ 732,100 | $ 961,900 |
| 1.22 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 361,000 | $ 1,012,900 | $ 1,373,900 |
| 1.23 | EMERGENCY POWER SYSTEM | | $ 285,500 | $ - | $ 38,900 | $ 324,400 |
| 1.24 | GROUNDING | | $ 14,100 | $ - | $ 42,700 | $ 56,800 |
| 1.25 | LIGHTING/ TRANSFORMERS & PANELS | | $ 26,000 | $ 30,000 | $ 29,500 | $ 85,500 |
| 1.26 | DUCT BANK | | $ - | $ 136,000 | $ 192,700 | $ 328,700 |
| 1.27 | FOUNDATION FOR TRANSFORMERS | | $ - | $ 61,900 | $ 162,600 | $ 224,500 |
| 1.28 | FIREWALL FOR TRANSFORMERS | | $ - | $ 3,200 | $ 8,300 | $ 11,500 |
| 1.29 | EARLY COMMISSIONING COSTS TEMPORARY HIGH VOLTAGE | | $ - | $ 139,800 | $ 230,200 | $ 370,000 |
| 1.30 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 1.31 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 12,045,000 | $ 13,451,100 | $ 27,518,500 | $ 53,014,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 602,300 | $ 3,430,000 | $ 9,926,800 | $ 13,959,100 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ID FANS | $ 12,647,300 | $ 16,881,100 | $ 37,445,300 | $ 66,973,700 |
| | | | | | | |
| 2.0 | FABRIC FILTERS | | | | | |
| 2.1 | MECHANICAL EQUIPMENT | A SINGLE FABRIC FILTER (225' X 130') UNIT INCLUDING ALL INTERNAL FABRIC FILTER ELEMENTS SUCH AS BAGS, CAGES, ASH HOPPERS, 2 BROKEN BAG DETECTORS PER COMPARTMENT | $ 19,761,000 | $ - | $ 12,604,200 | $ 32,365,200 |
| 2.2 | INSULATION FOR FABRIC FILTER | SUBCONTRACT COST INCLUDES LABOR | $ 2,430,000 | $ - | $ - | $ 2,430,000 |
| 2.3 | PENTHOUSE FOR FABRIC FILTER | SUPPORT STEEL AND PRLINS INCLUDED WITH OEM EQUIPMENT | $ 70,200 | $ 787,000 | $ 1,007,600 | $ 1,864,800 |
| 2.4 | BOTTOM ENCLOSURE FOR BAGHOUSE | | $ 60,000 | $ 1,204,000 | $ 1,359,800 | $ 2,623,800 |
| 2.5 | PIPING & SUPPORTS - MECHANICAL | | $ 30,900 | $ 101,400 | $ 209,500 | $ 341,800 |
| 2.6 | FABRIC FILTER - FOUNDATIONS | | $ - | $ 550,700 | $ 1,081,100 | $ 1,631,800 |
| 2.7 | FABRIC FILTER - SUPPORT STEEL AND ACCESS GALLERY | | $ - | $ 360,000 | $ 1,186,700 | $ 1,546,700 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 2.8 | ELECTRICAL | DISTRIBUTION, RACEWAY & CABLE INCLUDED IN SECTION 1.0 - ID FANS | $ - | $ - | $ - | $ - |
| 2.9 | LIGHTING/ TRANSFORMERS & PANELS | | $ 30,000 | $ 75,000 | $ 58,200 | $ 163,200 |
| 2.10 | GROUNDING | | $ 7,300 | $ - | $ 17,500 | $ 24,800 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 22,419,400 | $ 3,153,100 | $ 17,524,600 | $ 42,992,100 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 1,121,000 | $ 804,000 | $ 6,510,000 | $ 8,435,100 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FABRIC FILTERS | $ 23,540,400 | $ 3,957,100 | $ 24,034,600 | $ 51,427,200 |
| | | | | | | |
| 3.0 | NEW STACK | | | | | |
| 3.1 | CONCRETE STACK (WET) | PROVIDED BY AEP | $ - | $ - | $ - | $ 31,480,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ - | $ - | $ 31,480,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT | | $ - | $ - | $ - | $ 4,722,000 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | NEW STACK | $ - | $ - | $ - | $ 36,202,000 |
| | | | | | | |
| 4.0 | LIME HANDLING SYSTEM | | | | | |
| 4.1 | LIME STORAGE SILO | | $ 1,020,000 | $ - | $ - | $ 1,020,000 |
| 4.2 | LIME UNLOADING SYSTEM | INCLUDES PNEUMATIC HANDLING SYSTEM, THREE VACUUM EXHAUSTER, TWO FILTER SEPARATORS | $ 350,000 | $ - | $ 281,100 | $ 631,100 |
| 4.3 | PIPING - MECHANICAL | | $ 29,000 | $ 15,600 | $ 77,900 | $ 122,500 |
| 4.4 | LIME STORAGE SILO ACCESS STAIR TOWER | THREE COAT SHOP PAINT | $ - | $ 87,000 | $ 87,500 | $ 174,500 |
| 4.5 | PIPE RACK FOR LIME HANDLING, WASTE HANDLING AND MISC MECHANICAL PIPING | THREE COAT SHOP PAINT | $ - | $ 783,000 | $ 787,800 | $ 1,570,800 |
| 4.6 | RAIL CAR UNLOADING AREA - FOUNDATIONS | 20 X 60 - NO SIDING | $ - | $ 22,600 | $ 49,100 | $ 71,700 |
| 4.7 | LIME UNLOADING BLOWER / ELECTRICAL BUILDING - FOUNDATIONS | | $ - | $ 80,600 | $ 139,600 | $ 220,200 |
| 4.8 | LIME UNLOADING BLOWER / ELECTRICAL BUILDING | 100' L X 30' W X 30' H | $ 75,000 | $ 335,000 | $ 24,400 | $ 434,400 |
| 4.9 | CONCRETE PIT FOR THE ELEVATOR | | $ - | $ 2,300 | $ 6,900 | $ 9,200 |
| 4.10 | LIME STORAGE SILO - FOUNDATIONS | | $ - | $ 75,100 | $ 150,000 | $ 225,100 |
| 4.11 | LIME STORAGE SILO ACCESS STAIR TOWER - FOUNDATIONS | | $ - | $ 10,700 | $ 22,300 | $ 33,000 |
| 4.12 | PIPE RACK - FOUNDATIONS | | $ - | $ 94,200 | $ 237,800 | $ 332,000 |
| 4.13 | TRANSFORMERS: 33F, 33G, | 13.8KV-480V,3PHASE, CAST COIL | $ 170,000 | $ - | $ 54,600 | $ 224,600 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 4.14 | 480V LOW VOLTAGE (33F/G) SWITCHGEAR | PER LINE UP | $ 196,000 | $ - | $ 104,700 | $ 300,700 |
| 4.15 | CABLE BUS DUCT | | $ 134,700 | $ 10,800 | $ 200,200 | $ 345,700 |
| 4.16 | MCC | | $ 61,800 | $ - | $ 3,600 | $ 65,400 |
| 4.17 | MIMIC PANELS | | $ 17,500 | $ - | $ 1,400 | $ 18,900 |
| 4.18 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 4.19 | GROUNDING | | $ 13,300 | $ - | $ 41,300 | $ 54,600 |
| 4.20 | LIGHTING/ TRANSFORMERS & PANELS | | $ 52,000 | $ 135,000 | $ 104,500 | $ 291,500 |
| 4.21 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 310,900 | $ 1,537,100 | $ 1,848,000 |
| 4.22 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL-15KV | $ - | $ 50,100 | $ 141,200 | $ 191,300 |
| 4.23 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | 1/C # 350KCMIL-5KV | $ - | $ 66,200 | $ 282,300 | $ 348,500 |
| 4.24 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 93,000 | $ 143,200 | $ 236,200 |
| 4.25 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 26,200 | $ 73,600 | $ 99,800 |
| 4.26 | DUCT BANK | 6-5" & 6-3" CONDUITS | $ - | $ 26,600 | $ 52,500 | $ 79,100 |
| 4.27 | FOUNDATIONS FOR TRANSFORMERS | | $ - | $ 5,300 | $ 11,900 | $ 17,200 |
| 4.28 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 4.29 | LIGHTNING PROTECTION | | $ - | $ 14,000 | $ 9,000 | $ 23,000 |
| 4.30 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 2,227,600 | $ 2,269,200 | $ 4,669,900 | $ 9,166,700 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 111,400 | $ 578,600 | $ 1,683,700 | $ 2,373,700 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | LIME HANDLING SYSTEM | $ 2,339,000 | $ 2,847,800 | $ 6,353,600 | $ 11,540,400 |
| | | | | | | |
| 5.0 | LIME SLAKER BUILDING | | | | | |
| 5.1 | MECHANICAL EQUIPMENT | INCLUDES:CHAIN CONVEYOR, SLAKERS THROUGH THE LIME SLURRY PUMPS, PIPING, AND LIME SLURRY STORAGE TANKS. | $ 2,663,000 | $ - | $ 2,811,100 | $ 5,474,100 |
| 5.2 | REAGENT AREA SUMP PUMPS | DUPLEX. INCLUDES CHECK & ISOLATION VALVES | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 5.3 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 5.4 | PIPING - MECHANICAL | | $ 117,800 | $ 111,400 | $ 381,100 | $ 610,300 |
| 5.5 | LIME SLURRY TANKS - FOUNDATIONS | | $ - | $ 166,400 | $ 299,400 | $ 465,800 |
| 5.6 | LIME SLAKER BUILDING - FOUNDATIONS | | $ - | $ 119,200 | $ 204,000 | $ 323,200 |
| 5.7 | LIME SLAKER BUILDING | 135' L X 30' W X 50' H | $ 40,500 | $ 803,300 | $ 740,500 | $ 1,584,300 |
| 5.8 | ELECTRICAL | INCLUDED WITH LIME HANDLING SYSTEM, ACCOUNT 4.0 | $ - | $ - | $ - | $ - |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 2,861,300 | $ 1,200,300 | $ 4,453,000 | $ 8,514,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 143,100 | $ 306,100 | $ 1,663,000 | $ 2,112,100 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | LIME SLAKER BUILDING | $ 3,004,400 | $ 1,506,400 | $ 6,116,000 | $ 10,626,700 |
| | | | | | | |
| 6.0 | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | | | | | |
| 6.1 | BYPRODUCT WASTE HANDLING - MECHANICAL EQUIPMENT | INCLUDES PNEUMATIC HANDLING SYSTEM, THREE PRESSURE BLOWERS, ONE BIN VENT FILTER, ASH UNLOADING SYSTEM | $ 1,637,600 | $ - | $ 1,104,000 | $ 2,741,600 |
| 6.2 | ECONOMIZER ASH HANDLING - MECHANICAL EQUIPMENT | INCLUDES JET PUMPS AND PIPING / SUPPORTS TO THE BOTTOM ASH POND | $ 400,000 | $ - | $ 296,400 | $ 696,400 |
| 6.3 | BYPRODUCT WASTE SILO AREA SUMP PUMPS | FOR BUILDINGS - DUPLEX. INCLUDES CHECK & ISOLATION VALVES. | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 6.4 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 6.5 | PIPING - MECHANICAL | | $ 142,800 | $ 240,900 | $ 759,100 | $ 1,142,800 |
| 6.6 | BYPRODUCT WASTE SILO | CONCRETE SILO 35' DIA X 46' H - 782 TONS -SUBCONTRACT COST INCLUDES LABOR | $ 625,500 | $ - | $ - | $ 625,500 |
| 6.7 | SDA RECYCLE SILO | INCLUDED WITH OEM EQUIPMENT | $ - | $ - | $ - | $ - |
| 6.8 | FLY ASH SILO | NOT REQUIRED - ECONOMIZER FLY ASH SLUICD TO BOTTOM ASH POND | $ - | $ - | $ - | $ - |
| 6.9 | BYPRODUCT WASTE SILO - FOUNDATIONS | | $ - | $ 60,200 | $ 122,300 | $ 182,500 |
| 6.10 | FLY ASH SILO - FOUNDATIONS | NOT REQUIRED | $ - | $ - | $ - | $ - |
| 6.11 | FLY ASH BLOWER AND ELECTRICAL BUILDING - FOUNDATIONS | NOT REQUIRED | $ - | $ - | $ - | $ - |
| 6.12 | FLY ASH BLOWER AND ELECTRICAL BUILDING | NOT REQUIRED | $ - | $ - | $ - | $ - |
| 6.13 | RECYCLE ASH BUILDING - FOUNDATIONS | | $ - | $ 234,300 | $ 393,800 | $ 628,100 |
| 6.14 | RECYCLE ASH BUILDING | 100' L X 65' W X 50' H | $ 58,500 | $ 1,306,700 | $ 1,194,500 | $ 2,559,700 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 6.15 | MCC | 480V MCC PER LINE UP | $ 60,000 | $ - | $ 3,600 | $ 63,600 |
| 6.16 | EMERGENCY POWER SYSTEM | | $ 92,800 | $ - | $ 19,900 | $ 112,700 |
| 6.17 | LIGHTING/ TRANSFORMERS & PANELS | | $ 18,500 | $ 60,000 | $ 44,100 | $ 122,600 |
| 6.18 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 32,500 | $ 189,100 | $ 221,600 |
| 6.19 | GROUNDING | | $ - | $ 4,500 | $ 10,900 | $ 15,400 |
| 6.20 | LOW VOLTAGE POWER CABLE & TERMINATION | #4/0 - #12 AWG-600V | $ - | $ 64,700 | $ 80,500 | $ 145,200 |
| 6.21 | CONTROL & INSTRUMENT CABLE | | $ - | $ 30,700 | $ 86,200 | $ 116,900 |
| 6.22 | DUCT BANK | | $ - | $ 109,700 | $ 205,400 | $ 315,100 |
| 6.23 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 6.24 | LIGHTNING PROTECTION | | $ - | $ 16,000 | $ 14,000 | $ 30,000 |
| 6.25 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 3,075,700 | $ 2,202,200 | $ 4,573,700 | $ 9,851,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 153,800 | $ 561,600 | $ 1,702,500 | $ 2,417,900 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | $ 3,229,500 | $ 2,763,800 | $ 6,276,200 | $ 12,269,500 |
| | | | | | | |
| 7.0 | SPRAY DRYER ABSORBER ISLAND | | | | | |
| 7.1 | MECHANICAL EQUIPMENT | INCLUDES: ABSORBER MODULES AND ATOMIZERS WITH LUBE OIL, DUCT WORK FROM THE ABSORBERS TO THE FABRIC FILTER, AND COMPLETE RECYCLE SYSTEM WITH PIPING INSIDE FGD BUILDINGS. | $ 39,438,000 | $ - | $ 24,186,100 | $ 63,624,100 |
| 7.2 | ELEVATOR | MAINTENANCE ELEVATOR - SUBCONTRACT COST INCLUDES LABOR | $ 325,000 | $ - | $ - | $ 325,000 |
| 7.3 | ABSORBER AREA SUMP PUMPS | DUPLEX. INCLUDES CHECK & ISOLATION VALVES. | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 7.4 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 7.5 | PIPING - MECHANICAL | | $ 142,800 | $ 36,900 | $ 227,900 | $ 407,600 |
| 7.6 | SDA SUPERSTRUCTURE | | $ 75,000 | $ 764,900 | $ 1,227,300 | $ 2,067,200 |
| 7.7 | SDA BOTTOM ENCLOSURE - SUPPORT STEEL, GIRTS AND SIDING | TOTAL FOR THREE ABSORBERS | $ - | $ 362,100 | $ 385,200 | $ 747,300 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 7.8 | SDA SHELL / ROOF INSULATION | 61,000 SF. SUBCONTRACT COST INCLUDES LABOR | $ 1,830,000 | $ - | $ - | $ 1,830,000 |
| 7.9 | SDA - SUPPORT STEEL & ACCESS GALLERY | | $ - | $ 711,000 | $ 1,884,100 | $ 2,595,100 |
| 7.10 | EXPANSION JOINTS | | $ - | $ 195,500 | $ 173,800 | $ 369,300 |
| 7.11 | DUCTWORK | | $ - | $ 4,797,000 | $ 10,481,700 | $ 15,278,700 |
| 7.12 | DUCT SUPPORT STEEL | THREE COAT SHOP PAINT | $ - | $ 2,140,200 | $ 2,153,200 | $ 4,293,400 |
| 7.13 | DUCTWORK INSULATION & LAGGING | | $ - | $ 1,632,000 | $ 3,196,400 | $ 4,828,400 |
| 7.14 | CONCRETE PIT FOR ELEVATOR | | $ - | $ 2,800 | $ 8,200 | $ 11,000 |
| 7.15 | SPRAY DRYER ABSORBER - FOUNDATIONS | TOTAL FOR THREE TOWERS | $ - | $ 1,678,600 | $ 3,323,400 | $ 5,002,000 |
| 7.16 | FOUNDATIONS FOR SUPPORT STEEL | | $ - | $ 69,000 | $ 143,000 | $ 212,000 |
| 7.17 | GROUNDING | | $ - | $ 16,000 | $ 46,100 | $ 62,100 |
| 7.18 | LIGHTING/ TRANSFORMERS & PANELS | | $ 156,000 | $ 150,000 | $ 159,100 | $ 465,100 |
| 7.19 | ELECTRICAL | DISTRIBUTION, RACEWAY & CABLE INCLUDED IN SECTION 1.0 - ID FANS | $ - | $ - | $ - | $ - |
| 7.20 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 7.21 | LIGHTNING PROTECTION | | $ - | $ 25,500 | $ 18,500 | $ 44,000 |
| 7.22 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 42,006,800 | $ 12,606,500 | $ 47,650,900 | $ 102,264,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 2,910,300 | $ 3,214,700 | $ 19,057,200 | $ 25,182,200 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | SPRAY DRYER ABSORBER ISLAND | $ 44,917,100 | $ 15,821,200 | $ 66,708,100 | $ 127,446,400 |
| | | | | | | |
| 8.0 | ACTIVATED CARBON INJECTION SYSTEM | NOT REQUIRED WITH NON-PHASED CONSTRUCTION | | | | |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ - | $ - | $ - |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ - |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ACTIVATED CARBON INJECTION SYSTEM | $ - | $ - | $ - | $ - |
| | | | | | | |
| 9.0 | COMPRESSED AIR SYSTEM | | | | | |
| 9.1 | AIR COMPRESSOR & AUXILIARIES | | $ 832,000 | $ - | $ 184,600 | $ 1,016,600 |
| 9.2 | PIPING - MECHANICAL | | $ 543,100 | $ 722,600 | $ 2,151,100 | $ 3,416,800 |
| 9.3 | AIR COMPRESSOR BUILDING - FOUNDATIONS | | $ - | $ 96,100 | $ 194,700 | $ 290,800 |
| 9.4 | AIR COMPRESSOR BUILDING | 100' L X 600' W X 20' H | $ - | $ 510,000 | $ - | $ 510,000 |
| 9.5 | LIGHTING/ TRANSFORMERS & PANELS | | $ 11,000 | $ 10,500 | $ 11,400 | $ 32,900 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 9.6 | ELECTRICAL | DISTRIBUTION, RACEWAY & CABLE ARE INCLUDED IN SECTION 1.0 - ID FANS | $ - | $ - | $ - | $ - |
| 9.7 | GROUNDING | | $ 4,500 | $ - | $ 10,900 | $ 15,400 |
| 9.8 | DUCT BANK | | $ - | $ 19,900 | $ 43,300 | $ 63,200 |
| 9.9 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 9.10 | LIGHTNING PROTECTION | | $ - | $ 10,500 | $ 7,500 | $ 18,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,390,600 | $ 1,403,600 | $ 2,629,500 | $ 5,423,700 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 69,500 | $ 357,900 | $ 963,100 | $ 1,390,600 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | COMPRESSED AIR SYSTEM | $ 1,460,100 | $ 1,761,500 | $ 3,592,600 | $ 6,814,300 |
| | | | | | | |
| 10.0 | SERVICE WATER SYSTEM | | | | | |
| 10.1 | PUMPS | INCLUDES SELF-CLEANING STRAIINERS | $ 260,000 | $ - | $ 110,500 | $ 370,500 |
| 10.2 | PIPING - MECHANICAL | | $ 504,300 | $ 1,813,000 | $ 3,377,200 | $ 5,694,500 |
| 10.3 | PIPING - FIRE PROTECTION SYSTEM | | $ 434,900 | $ 415,600 | $ 1,014,300 | $ 1,864,800 |
| 10.4 | TANKS | | $ - | $ 150,000 | $ - | $ 150,000 |
| 10.5 | SERVICE WATER TANK & PUMP - FOUNDATIONS | | $ - | $ 69,800 | $ 117,200 | $ 187,000 |
| 10.6 | ELECTRICAL | DISTRIBUTION, RACEWAY & CABLE ARE INCLUDED IN SECTION 1.0 - ID FANS | $ - | $ - | $ - | $ - |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,199,200 | $ 2,448,400 | $ 4,619,200 | $ 8,266,800 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 60,000 | $ 624,300 | $ 1,683,200 | $ 2,367,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | SERVICE WATER SYSTEM | $ 1,259,200 | $ 3,072,700 | $ 6,302,400 | $ 10,634,300 |
| | | | | | | |
| 11.0 | POTABLE WATER SYSTEM | | | | | |
| 11.1 | PUMPS | | $ 30,000 | $ - | $ 18,400 | $ 48,400 |
| 11.2 | PIPING - MECHANICAL | | $ 99,500 | $ 258,000 | $ 737,700 | $ 1,095,200 |
| 11.3 | TANKS | | $ - | $ 17,000 | $ - | $ 17,000 |
| 11.4 | POTABLE WATER TANK & PUMP - FOUNDATIONS | | $ - | $ 10,100 | $ 18,600 | $ 28,700 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 11.5 | ELECTRICAL | DISTRIBUTION, RACEWAY & CABLE ARE INCLUDED IN SECTION 1.0 - ID FANS | $ - | $ - | $ - | $ - |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 129,500 | $ 258,000 | $ 756,100 | $ 1,143,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 6,500 | $ 65,800 | $ 275,700 | $ 348,000 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | POTABLE WATER SYSTEM | $ 136,000 | $ 323,800 | $ 1,031,800 | $ 1,491,600 |
| | | | | | | |
| 12.0 | FGD SUBSTATION | | | | | |
| 12.1 | TRANSFORMERS | | $ 1,670,000 | $ - | $ 282,200 | $ 1,952,200 |
| 12.2 | TRANSFORMER PDC | 15W X 45' X 10'H. SUBCONTRACT PRICE INCLUDES LABOR | $ 202,500 | $ - | $ - | $ 202,500 |
| 12.3 | TRANSFORMER PDC - FOUNDATION | | $ - | $ 73,200 | $ 146,900 | $ 220,100 |
| 12.4 | 138KV MAIN FEEDER & TERMINATIONS | | $ 264,000 | $ - | $ 254,000 | $ 518,000 |
| 12.5 | SWITCHGEAR | | $ 870,000 | $ - | $ 36,400 | $ 906,400 |
| 12.6 | MCC | 480V MCC, PER LINE UP | $ 60,000 | $ - | $ 3,600 | $ 63,600 |
| 12.7 | CABLE BUS | | $ 181,100 | $ 18,000 | $ 290,200 | $ 489,300 |
| 12.8 | PANELS - RELAY | | $ 100,000 | $ - | $ 9,100 | $ 109,100 |
| 12.9 | MIMIC PANELS | | $ 17,500 | $ - | $ 4,500 | $ 22,000 |
| 12.10 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 12.11 | GROUNDING | | $ 23,300 | $ - | $ 59,100 | $ 82,400 |
| 12.12 | LIGHTING/ TRANSFORMERS & PANELS | | $ 26,000 | $ 30,000 | $ 29,500 | $ 85,500 |
| 12.13 | OUTDOOR LIGHTING | NEW AUX YARD LIGHTING - ALLOWANCE | $ 25,000 | $ - | $ 56,800 | $ 81,800 |
| 12.14 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 390,600 | $ 1,918,600 | $ 2,309,200 |
| 12.15 | DUCT BANK | | $ - | $ 26,200 | $ 54,300 | $ 80,500 |
| 12.16 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL-15KV | $ - | $ 27,800 | $ 78,400 | $ 106,200 |
| 12.17 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 263,700 | $ 649,600 | $ 913,300 |
| 12.18 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 21,800 | $ 61,100 | $ 82,900 |
| 12.19 | FOUNDATION FOR AUX TRANSFORMER | | $ - | $ 70,200 | $ 205,400 | $ 275,600 |
| 12.20 | FIREWALL FOR TRANSFORMERS | | $ - | $ 3,000 | $ 5,200 | $ 8,200 |
| 12.21 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 12.22 | LIGHTNING PROTECTION | | $ - | $ 4,000 | $ 2,000 | $ 6,000 |
| 12.23 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 3,547,700 | $ 953,500 | $ 4,191,300 | $ 8,692,500 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 177,400 | $ 243,100 | $ 1,513,212 | $ 1,933,700 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FGD SUBSTATION | $ 3,725,100 | $ 1,196,600 | $ 5,704,500 | $ 10,626,200 |
| | | | | | | |
| 13.0 | FGD DCS SYSTEM | DRY AND WET FGD COMBINED | | | | |
| 13.1 | DCS | 7000 I/O POINTS | $ 5,250,000 | $ - | $ 1,779,700 | $ 7,029,700 |
| 13.2 | DCS - VENDOR FIELD SUPPORT | 300 MANDAYS @ $1500/DAY - SHOWN AS SUBCONTRACT COST | $ 450,000 | $ - | $ - | $ 450,000 |
| 13.3 | LOCALLY MOUNTED INSTRUMENTS | 0.0 | $ - | $ 1,537,300 | $ 2,016,100 | $ 3,553,400 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 5,700,000 | $ 1,537,300 | $ 3,795,800 | $ 11,033,100 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 285,000 | $ 392,000 | $ 1,417,400 | $ 2,094,400 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FGD DCS SYSTEM | $ 5,985,000 | $ 1,929,300 | $ 5,213,200 | $ 13,127,500 |
| | | | | | | |
| 14.0 | CEM SYSTEM | | | | | |
| 14.1 | CEM | PROVIDED BY AEP | $ 1,260,000 | $ 540,000 | $ 310,000 | $ 2,110,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,260,000 | $ 540,000 | $ 310,000 | $ 2,110,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT | | $ - | $ - | $ - | $ 316,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | CEM SYSTEM | $ - | $ - | $ - | $ 2,426,500 |
| | | | | | | |
| 15.0 | TRUCK & RAIL INFRASTRUCTURE | | | | | |
| 15.1 | EXISTING RAILROAD IMPROVEMENTS | FOR FULL RAILCAR STORAGE TRACK IMPROVEMENTS - 3250 LF | $ - | $ 660,200 | $ 689,200 | $ 1,349,400 |
| 15.2 | EXISTING RAILROAD IMPROVEMENTS | FOR LOOP TRACK UPGRADE - 5000 LF | $ - | $ 1,008,800 | $ 1,055,600 | $ 2,064,400 |
| 15.3 | NEW RAILROAD TRACK | 1400 LF. INCLUDES, 132LB RAIL, 7" TIMBERS, TIE PLATES, SPIKES, BOLTS, 12: SUBBALLAST, 12" BALLAST, 12 OZ/SY GEOTEXTILE MEMBRANE, 12" SUBGRADE PREP | $ - | $ 252,000 | $ 213,100 | $ 465,100 |
| 15.4 | FIELD FABRICATED TURNOUTS | #8 TURNOUT | $ - | $ 90,000 | $ 54,800 | $ 144,800 |
| 15.5 | RAIL SCALE | SUBCONTRACT COST, INCLUDES FOUNDATIONS | $ 212,500 | $ - | $ - | $ 212,500 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 15.6 | NEW CONCRETE ENCASEMENT | OVER AND AROUND DUCT BANK CONNECTING THE PLANT TO SWITCHYARD. THIS IS UNDER THE NEW TRACKWORK EXTENSION | $ - | $ 33,200 | $ 71,400 | $ 104,600 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 212,500 | $ 2,044,200 | $ 2,084,100 | $ 4,340,800 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 10,600 | $ 521,300 | $ 779,600 | $ 1,311,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | TRUCK & RAIL INFRASTRUCTURE | $ 223,100 | $ 2,565,500 | $ 2,863,700 | $ 5,652,300 |
| | | | | | | |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | | | | | |
| 16.1 | SITE GRADING | | $ - | $ - | $ 676,000 | $ 676,000 |
| 16.2 | ROADS & SURFACING | | $ - | $ 1,811,000 | $ 2,387,200 | $ 4,198,200 |
| 16.3 | RAILROAD CROSSING | 50' WIDE CROSSING THREE TRACKS - CUSTOM BUILT | $ - | $ 120,000 | $ 152,200 | $ 272,200 |
| 16.4 | NEW CONCRETE ENCASEMENT | 16' X 4' X 40' - FOR EXISTING ASH PIPE HAUL ROAD CROSSING | $ - | $ 144,300 | $ 286,600 | $ 430,900 |
| 16.5 | TRUCK WASH AREA - CONCRETE PAD | | $ - | $ 47,300 | $ 83,100 | $ 130,400 |
| 16.6 | TRUCK SCALE & CONCRETE APPROACH | | $ 170,000 | $ 27,300 | $ 92,000 | $ 289,300 |
| 16.7 | PROCESS WATER STORAGE BASIN | | $ 60,000 | $ 110,400 | $ 312,600 | $ 483,000 |
| 16.8 | PROCESS WATER STORAGE BASIN PUMP STRUCTURE - CONCRETE | | $ - | $ 47,000 | $ 105,400 | $ 152,400 |
| 16.9 | STORMWATER DRAINAGE TRENCH | 2' W X 3' DEEP CAST-IN-PLACE CONCRETE TRENCH W/REINFORCING & HS-20 RATED GRATE COVERS | $ - | $ 594,000 | $ 604,500 | $ 1,198,500 |
| 16.10 | STORMWATER RUNOFF POND | | $ - | $ 15,000 | $ 122,600 | $ 137,600 |
| 16.11 | STORM WATER POND PUMP STRUCTURE - CONCRETE | | $ 90,000 | $ 42,300 | $ 182,200 | $ 314,500 |
| 16.12 | OILY WATER SEWER | | $ 7,500 | $ 128,100 | $ 261,600 | $ 397,200 |
| 16.13 | OIL SEPARATOR | 500 GPM W/ INTEGRAL LIFT STATION | $ 100,000 | $ - | $ 116,100 | $ 216,100 |
| 16.14 | SANITARY SEWER | | $ - | $ 37,100 | $ 118,900 | $ 156,000 |
| 16.15 | SANITARY LIFT STATION | PACKAGED TYPE COMPLETE WITH PUMPS, 100,000 GPD | $ 150,000 | $ - | $ 49,200 | $ 199,200 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 16.16 | CONSTRUCTION LAYDOWN AREA | ALLOWANCE FOR 15 ACRES, DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED | $ - | $ 1,050,000 | $ 1,242,000 | $ 2,292,000 |
| 16.17 | CRAFT PARKING | DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED. ALLOWANCE FOR 30,000 SY INCLUDES:<br>6" BASE COURSE<br>10 OZ/SY GEOTEXTILE<br>12" SUBGRADE PREP | $ - | $ 270,000 | $ 621,300 | $ 891,300 |
| 16.18 | CONTRACTOR OFFICES (AREA) | DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED. ALLOWANCE FOR 7,500 SY AREA (TRAILERS BY CONTRACTORS) INCLUDES:<br>6" BASE COURSE<br>10 OZ/SY GEOTEXTILE<br>12" SUBGRADE PREP | $ - | $ 67,500 | $ 155,300 | $ 222,800 |
| 16.19 | NEW PERMANENT STORAGE WAREHOUSE | INCLUDES LIGHTING AND H&V. SUBCONTRACT PRICE INCLUDES ELECTRICAL AND H&V | $ 2,550,000 | $ - | $ - | $ 2,550,000 |
| 16.20 | FOUNDATIONS FOR THE NEW PERMANENT STORAGE | | $ - | $ 803,800 | $ 1,301,600 | $ 2,105,400 |
| 16.21 | NEW TEMPORARY STORAGE | WEATHER TIGHT CANVAS ENCLOSURE. INCLUDES LIGHTING AND H&V. SUBCONTRACT PRICE INCLUDES ELECTRICAL AND H&V | $ 900,000 | $ - | $ - | $ 900,000 |
| 16.22 | FOUNDATIONS FOR TEMPORARY STORAGE | | $ - | $ 197,400 | $ 309,200 | $ 506,600 |
| 16.23 | LABOR BUS SERVICE FROM PARKING LOT TO CONSTRUCTION AREA AND ACCESS CONTROL | ALLOWANCE FOR 36 MONTHS BASED ON 2 BUSES OPERATING CONTINUOUSLY FOR 5X10 WORKWEEK. SUBCONTRACT COST INCLUDES EQUIPMENT, MATERIAL AND LABOR | $ 1,368,000 | $ - | $ - | $ 1,368,000 |
| 16.24 | EROSION & SEDIMENT CONTROL | | $ - | $ 12,600 | $ 20,700 | $ 33,300 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 5,395,500 | $ 5,525,100 | $ 9,200,300 | $ 20,120,900 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 269,800 | $ 1,408,900 | $ 3,329,300 | $ 5,008,000 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | SITE IMPROVEMENTS - CIVIL WORK | $ 5,665,300 | $ 6,934,000 | $ 12,529,600 | $ 25,128,900 |
| | | | | | | |
| 17.0 | LIMESTONE HANDLING SYSTEM | | | | | |
| 17.1 | MATERIAL HANDLING EQUIPMENT | | $ 4,690,100 | $ 845,000 | $ 3,540,600 | $ 9,075,700 |
| 17.2 | FIRE PROTECTION SYSTEM FOR BELT CONVEYORS | DELUGE SYSTEM, DRY PIPE, SENSORS, ACTIVATION VALVE AND FM APPROVED PANEL - SUBCONTRACT PRICE FOR ALL CONVEYORS INCLUDES LABOR | $ 660,000 | $ - | $ - | $ 660,000 |
| 17.3 | PIPING - MECHANICAL | | $ 4,800 | $ 1,700 | $ 13,200 | $ 19,700 |
| 17.4 | CONVEYOR STRUCTURE SUPPORT STEEL | THREE-COAT SHOP PAINT | $ - | $ 290,000 | $ 291,800 | $ 581,800 |
| 17.5 | RAILCAR LIMESTONE UNLOADING HOPPER, CONVEYOR TUNNEL AND ESCAPE TUNNEL - FOUNDATIONS | | $ - | $ 542,000 | $ 1,613,400 | $ 2,155,400 |
| 17.6 | CONVEYOR SUPPORT STEEL - FOUNDATIONS | | $ - | $ 16,000 | $ 48,700 | $ 64,700 |
| 17.7 | LIMESTONE TRANSFER TOWER - FOUNDATIONS | | $ - | $ 15,400 | $ 30,500 | $ 45,900 |
| 17.8 | LIMESTONE TRANSFER CONVEYOR - FOUNDATIONS | | $ - | $ 62,000 | $ 125,800 | $ 187,800 |
| 17.9 | LIMESTONE RECLAIM HOPPER, CONVEYOR TUNNEL AND ESCAPE TUNNEL - FOUNDATIONS | | $ - | $ 542,000 | $ 1,613,400 | $ 2,155,400 |
| 17.10 | LIMESTONE UNLOADING PDC - FOUNDATIONS | | $ - | $ 24,100 | $ 44,800 | $ 68,900 |
| 17.11 | LIMESTONE UNLOADING PDC - CONCRETE PIERS | 10 PIERS | $ - | $ 6,900 | $ 20,600 | $ 27,500 |
| 17.12 | LIMESTONE RECLAIM PDC - FOUNDATIONS | | $ - | $ 16,800 | $ 32,300 | $ 49,100 |
| 17.13 | LIMESTONE RECLAIM PDC - CONCRETE PIERS | 10 PIERS | $ - | $ 6,900 | $ 20,600 | $ 27,500 |
| 17.14 | LIMESTONE UNLOADING PDC | 18W X 50' X 10'H | $ 450,000 | $ - | $ 32,800 | $ 482,800 |
| 17.15 | LIMESTONE RECLAIM PDC | 15W X 30' X 10'H | $ 225,000 | $ - | $ 16,400 | $ 241,400 |
| 17.16 | MCC | LIMESTONE UNLOADING & RECLAIM AREAS | $ 123,600 | $ - | $ 7,200 | $ 130,800 |
| 17.17 | EMERGENCY POWER SYSTEM | LIMESTONE UNLOADING & RECLAIM AREAS | $ 216,300 | $ - | $ 49,100 | $ 265,400 |
| 17.18 | LIGHTING/ TRANSFORMERS & PANELS | | $ 26,000 | $ 67,500 | $ 52,200 | $ 145,700 |
| 17.19 | GROUNDING | LIMESTONE UNLOADING & RECLAIM AREAS | $ 13,000 | $ - | $ 42,400 | $ 55,400 |
| 17.20 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 801,100 | $ 3,597,400 | $ 4,398,500 |
| 17.21 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL-15KV | $ - | $ 33,400 | $ 94,100 | $ 127,500 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 17.22 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 130,600 | $ 715,400 | $ 846,000 |
| 17.23 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 140,800 | $ 395,100 | $ 535,900 |
| 17.24 | DUCT BANK | DUCT BANK WITH 6-5" & 6-3" | $ - | $ 26,600 | $ 183,800 | $ 210,400 |
| 17.25 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 17.26 | LIGHTNING PROTECTION | | $ - | $ 6,500 | $ 5,500 | $ 12,000 |
| 17.27 | SECURITY SYSTEM | | $ - | $ 16,000 | $ 14,000 | $ 30,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 6,408,800 | $ 3,625,300 | $ 12,627,100 | $ 22,661,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 320,400 | $ 924,500 | $ 4,839,900 | $ 6,084,800 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | LIMESTONE HANDLING SYSTEM | $ 6,729,200 | $ 4,549,800 | $ 17,467,000 | $ 28,746,000 |
| | | | | | | |
| 18.0 | REAGENT (LIMESTONE) PREPARATION ISLAND | | | | | |
| 18.1 | MECHANICAL EQUIPMENT | INCLUDES LIMESTONE FEEDERS, FROM THE DAY SILOS THROUGH THE SLURRY STORAGE TANKS AND TRANSFER PUMPS WITH INTEGRAL PIPING | $ 15,167,000 | $ - | $ 12,266,800 | $ 27,433,800 |
| 18.2 | SUMP PUMPS | DUPLEX. INCLUDES CHECK & ISOLATION VALVES | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 18.3 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 18.4 | PIPING - MECHANICAL | | $ 278,900 | $ 205,000 | $ 587,300 | $ 1,071,200 |
| 18.5 | LIMESTONE SLURRY TANKS - FOUNDATIONS | | $ - | $ 166,400 | $ 299,400 | $ 465,800 |
| 18.6 | REAGENT PREPARATION BUILDING - FOUNDATIONS | | $ - | $ 682,000 | $ 1,132,200 | $ 1,814,200 |
| 18.7 | REAGENT PREPARATION BUILDING | 120' L X 130' W X 130' H | $ 269,400 | $ 4,865,000 | $ 4,251,600 | $ 9,386,000 |
| 18.8 | PIPE SUPPORT PAD - REAGENT PREP BUILDING | | $ - | $ 13,800 | $ 27,500 | $ 41,300 |
| 18.9 | LIGHTING/ TRANSFORMERS & PANELS | | $ 52,000 | $ 135,000 | $ 104,500 | $ 291,500 |
| 18.10 | GROUNDING | | $ 5,100 | $ - | $ 13,400 | $ 18,500 |
| 18.11 | ELECTRICAL | DISTRIBUTION, RACEWAY & CABLE ARE INCLUDED IN SECTION 20.0 - ABSORBER ISLAND | $ - | $ - | $ - | $ - |
| 18.12 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 18.13 | LIGHTNING PROTECTION | | $ - | $ 23,000 | $ 16,000 | $ 39,000 |
| 18.14 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 15,812,400 | $ 6,132,200 | $ 18,748,600 | $ 40,693,200 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
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| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 790,600 | $ 1,563,700 | $ 7,186,000 | $ 9,540,300 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | REAGENT (LIMESTONE) PREPARATION ISLAND | $ 16,603,000 | $ 7,695,900 | $ 25,934,600 | $ 50,233,500 |
| | | | | | | |
| 19.0 | BYPRODUCT DEWATERING ISLAND (INCLUDES REMOTE GYPSUM HANDLING AREA) | | | | | |
| 19.1 | MECHANICAL EQUIPMENT | PRIMARY & SECONDARY DEWATERING INCLUDING HYDROCLONE FEED TANKS, HYDROCLONES, PUMPS, INTEGRAL PIPING AND BELT VACUUM FILTERS | $ 8,701,000 | $ - | $ 6,644,500 | $ 15,345,500 |
| 19.2 | PUMPS & AGITATORS | | $ 250,000 | $ - | $ 137,000 | $ 387,000 |
| 19.3 | PIPING - MECHANICAL | | $ 282,700 | $ 3,555,700 | $ 7,786,000 | $ 11,624,400 |
| 19.4 | MATERIAL HANDLING EQUIPMENT | | $ 724,000 | $ 7,500 | $ 614,100 | $ 1,345,600 |
| 19.5 | FIRE PROTECTION SYSTEM FOR BELT CONVEYORS | DELUGE SYSTEM, DRY PIPE, SENSORS, ACTIVATION VALVE AND FM APPROVED PANEL - SUBCONTRACT PRICE FOR ALL CONVEYORS INCLUDES LABOR | $ 170,000 | $ - | $ - | $ 170,000 |
| 19.6 | CONVEYOR STRUCTURE SUPPORT STEEL | THREE-COAT SHOP PAINT | $ - | $ 99,000 | $ 99,600 | $ 198,600 |
| 19.7 | PIPE RACK SUPPORT STEEL | THREE-COAT SHOP PAINT | $ - | $ 197,200 | $ 198,400 | $ 395,600 |
| 19.8 | TANKS | | $ - | $ 3,825,300 | $ 846,700 | $ 4,672,000 |
| 19.9 | RECLAIM WATER TANKS & PUMPS - FOUNDATIONS | | $ - | $ 26,000 | $ 54,000 | $ 80,000 |
| 19.10 | MAINTENANCE STORAGE TANK & PUMPS - FOUNDATIONS | | $ - | $ 100,000 | $ 177,300 | $ 277,300 |
| 19.11 | LANDFILL SERVICE WATER TANKS & PUMP - FOUNDATIONS | | $ - | $ 80,900 | $ 155,100 | $ 236,000 |
| 19.12 | LANDFILL RECLAIM WATER TANKS & PUMPS - FOUNDATIONS | | $ - | $ 26,000 | $ 54,000 | $ 80,000 |
| 19.13 | HYDROCLONE FEED TANKS & BLEED TANKS - FOUNDATIONS | TOTAL FOR HYDROCLONE AND BLEED TANKS | $ - | $ 340,200 | $ 618,900 | $ 959,100 |
| 19.14 | BYPRODUCT STACKOUT CONVEYOR & TRANSFER TOWER - FOUNDATIONS | | $ - | $ 16,100 | $ 34,700 | $ 50,800 |
| 19.15 | BYPRODUCT STACKOUT PILE - FOUNDATIONS | INCLUDES CONTAINMENT AREA SLAB | $ - | $ 891,700 | $ 1,427,400 | $ 2,319,100 |
| 19.16 | PIPE RACK | SUPPORTS AT 15' C/C | $ - | $ 60,800 | $ 149,400 | $ 210,200 |
| 19.17 | BYPRODUCT CONTAINMENT WALLS | | $ - | $ 137,300 | $ 235,000 | $ 372,300 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

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|---|---|---|---|---|---|---|
| 19.18 | INSTALL WIND SCREEN | | $ - | $ 525,000 | $ 192,300 | $ 717,300 |
| 19.19 | BYPRODUCT DEWATERING BUILDING - FOUNDATIONS | | $ - | $ 291,400 | $ 482,800 | $ 774,200 |
| 19.20 | BYPRODUCT DEWATERING BUILDING | 120' L X 75' W X 65' H | $ 145,200 | $ 1,595,300 | $ 1,495,900 | $ 3,236,400 |
| 19.21 | PIPE SUPPORT PAD | | $ - | $ 18,300 | $ 36,000 | $ 54,300 |
| 19.22 | AUXILIARY PUMPHOUSE BUILDING WITH ELECTRICAL ROOM - FOUNDATIONS | | $ - | $ 32,300 | $ 60,800 | $ 93,100 |
| 19.23 | AUXILIARY PUMPHOUSE BUILDING | 50'L X 35' W X 20'H | $ 101,300 | $ 252,500 | $ 269,800 | $ 623,600 |
| 19.24 | SITE GRADING - GYPSUM HANDLING AREA | | $ - | $ - | $ 587,800 | $ 587,800 |
| 19.25 | ROADS & SURFACING - GYPSUM HANDLING AREA | | $ - | $ 188,000 | $ 427,900 | $ 615,900 |
| 19.26 | GYPSUM HANDLING & STORAGE | | $ - | $ 1,179,900 | $ 1,854,100 | $ 3,034,000 |
| 19.27 | GYPSUM RUNOFF POND | | $ 68,000 | $ 110,400 | $ 315,700 | $ 494,100 |
| 19.28 | GYPSUM RUNOFF POND PUMP STRUCTURE - CONCRETE | | $ - | $ 47,000 | $ 105,400 | $ 152,400 |
| 19.29 | OILY WATER SEWER - GYPSUM HANDLING AREA | | $ 1,500 | $ 9,000 | $ 14,200 | $ 24,700 |
| 19.30 | OIL SEPARATOR - GYPSUM HANDLING AREA | 500 GPM W/ INTEGRAL LIFT STATION | $ 50,000 | $ - | $ 58,100 | $ 108,100 |
| 19.31 | EROSION & SEDIMENT CONTROL - GYPSUM HANDLING AREA | | $ - | $ 18,000 | $ 28,300 | $ 46,300 |
| 19.32 | SITE GRADING - ACCESS ROAD WIDENING & CONTAINMENT DITCH | NORTH OF HWY 23 TO GYPSUM DEWATERING AREA | $ - | $ - | $ 60,400 | $ 60,400 |
| 19.33 | ROADS & SURFACING - GYPSUM DEWATERING AREA | NORTH OF HWY 23 TO GYPSUM DEWATERING AREA | $ - | $ 66,300 | $ 190,800 | $ 257,100 |
| 19.34 | PIPELINE CONTAINMENT & DRAINAGE | NORTH OF HWY 23 TO GYPSUM DEWATERING AREA | $ - | $ 271,600 | $ 429,200 | $ 700,800 |
| 19.35 | CONTAINMENT RUNOFF POND | NORTH OF HWY 23 TO GYPSUM DEWATERING AREA | $ 68,000 | $ 114,300 | $ 344,300 | $ 526,600 |
| 19.36 | CONTAINMENT POND PUMP STRUCTURE - CONCRETE | NORTH OF HWY 23 TO GYPSUM DEWATERING AREA | $ - | $ 47,000 | $ 105,400 | $ 152,400 |
| 19.37 | SITE GRADING - PIPELINE CONTAINMENT & DRAINAGE | SOUTH OF HWY 23 | $ - | $ - | $ 30,200 | $ 30,200 |
| 19.38 | PIPELINE CONTAINMENT & DRAINAGE | SOUTH OF HWY 23 | $ - | $ 169,600 | $ 263,600 | $ 433,200 |
| 19.39 | PIPE BORING PIT | SOUTH OF HWY 23 | $ - | $ 5,300 | $ 50,900 | $ 56,200 |
| 19.40 | PIPE RECEIVING PIT | NORTH OF HWY 23 | $ - | $ 4,900 | $ 43,500 | $ 48,400 |
| 19.41 | DIRECTIONAL BORING FOR BURIED PIPE | BENEATH HWY 23 | $ 28,000 | $ 652,500 | $ 277,000 | $ 957,500 |
| 19.42 | TRANSFORMERS | | $ 470,000 | $ - | $ 136,500 | $ 606,500 |
| 19.43 | SWITCHGEAR | | $ 825,600 | $ - | $ 500,700 | $ 1,326,300 |
| 19.44 | CABLE BUS & TERMINATIONS | | $ 355,500 | $ 39,400 | $ 730,700 | $ 1,125,600 |
| 19.45 | MCC | | $ 123,600 | $ - | $ 6,300 | $ 129,900 |
| 19.46 | MIMIC PANELS | | $ 17,500 | $ - | $ 1,600 | $ 19,100 |
| 19.47 | EMERGENCY POWER SYSTEM | | $ 285,500 | $ - | $ 38,900 | $ 324,400 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

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|---|---|---|---|---|---|---|
| 19.48 | GROUNDING | | $ 9,400 | $ - | $ 25,400 | $ 34,800 |
| 19.49 | LIGHTING/ TRANSFORMERS & PANELS | | $ 52,000 | $ 135,000 | $ 104,500 | $ 291,500 |
| 19.50 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 354,700 | $ 1,514,100 | $ 1,868,800 |
| 19.51 | 13.8 KV OH LINE OPGW | INCLUDES POLES, CONDUCTORS, INSULATORS & GROUNDING | $ - | $ 240,200 | $ 292,400 | $ 532,600 |
| 19.52 | HIGH VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 88,400 | $ 256,600 | $ 345,000 |
| 19.53 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | 1/C # 350KCMIL-5KV | $ - | $ 18,400 | $ 78,400 | $ 96,800 |
| 19.54 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 62,700 | $ 547,400 | $ 610,100 |
| 19.55 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 112,000 | $ 314,300 | $ 426,300 |
| 19.56 | FOUNDATIONS FOR TRANSFORMERS | | $ - | $ 70,200 | $ 205,400 | $ 275,600 |
| 19.57 | FIREWALL FOR TRANSFORMERS | | $ - | $ 3,200 | $ 8,300 | $ 11,500 |
| 19.58 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 19.59 | LIGHTNING PROTECTION | | $ - | $ 13,000 | $ 10,300 | $ 23,300 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 12,728,800 | $ 16,133,500 | $ 31,754,300 | $ 60,616,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 636,400 | $ 4,114,000 | $ 12,171,100 | $ 16,921,600 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | | $ 13,365,200 | $ 20,247,500 | $ 43,925,400 | $ 77,538,200 |
| | | | | | | |
| 20.0 | WET FGD ABSORBER ISLAND | | | | | |
| 20.1 | MECHANICAL EQUIPMENT | | $ 41,363,000 | $ - | $ 40,889,400 | $ 82,252,400 |
| 20.2 | ADDITIONAL COST FOR C276 ABSORBER SHELL MATERIAL ABOVE THE PRICE OF A2205 ABSORBER SHELL | INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL - 49,800 TOTAL SF | $ - | $ 15,338,400 | $ - | $ 15,338,400 |
| 20.3 | SUMP PUMPS | DUPLEX. INCLUDES CHECK & ISOLATION VALVES | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 20.4 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 20.5 | EMERGENCY DIESEL DRIVEN QUENCH PUMP | | $ 150,000 | $ - | $ 30,700 | $ 180,700 |
| 20.6 | PIPING - MECHANICAL | | $ - | $ - | $ - | $ - |
| 20.7 | ABSORBER VESSEL - FOUNDATIONS | | $ - | $ 366,900 | $ 672,900 | $ 1,039,800 |
| 20.8 | ABSORBER BUILDING - FOUNDATIONS | | $ - | $ 579,500 | $ 961,200 | $ 1,540,700 |
| 20.9 | ABSORBER BUILDING | | $ 164,500 | $ 2,622,800 | $ 2,402,700 | $ 5,190,000 |
| 20.10 | PIPE SUPPORT PAD - ABSORBER BUILDING | | $ - | $ 7,700 | $ 16,100 | $ 23,800 |
| 20.11 | OXIDATION AIR BLOWER BUILDING - FOUNDATIONS | | $ - | $ 37,000 | $ 67,300 | $ 104,300 |
| 20.12 | OXIDATION AIR BLOWER BUILDING | | $ 33,800 | $ 191,000 | $ 201,400 | $ 426,200 |
| 20.13 | PIPE SUPPORT PAD - OXIDATION BUILDING | | $ - | $ 7,700 | $ 13,700 | $ 21,400 |
| 20.14 | DUCTWORK | | $ - | $ 373,800 | $ 713,900 | $ 1,087,700 |
| 20.15 | DUCT SUPPORT STEEL | | $ - | $ 168,200 | $ 169,200 | $ 337,400 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 20.16 | DUCTWORK INSULATION & LAGGING | | $ - | $ 132,000 | $ 258,500 | $ 390,500 |
| 20.17 | FOUNDATIONS FOR DUCT SUPPORT STEEL | | $ - | $ 17,700 | $ 35,300 | $ 53,000 |
| 20.18 | TRANSFORMERS | | $ 981,000 | $ - | $ 209,300 | $ 1,190,300 |
| 20.19 | SWITCHGEAR | 13.8KV-4160V, 2 WINDING XFMR | $ 1,162,800 | $ - | $ 673,700 | $ 1,836,500 |
| 20.20 | CABLE BUS & TERMINATIONS | PRICE PER SECTION | $ 867,100 | $ 46,600 | $ 1,634,100 | $ 2,547,800 |
| 20.21 | MCC | CABLE BUS | $ 216,300 | $ - | $ 11,100 | $ 227,400 |
| 20.22 | MIMIC PANELS | PER MCC LINE UP | $ 35,000 | $ - | $ 7,900 | $ 42,900 |
| 20.23 | GROUNDING | 0.00 | $ 16,000 | $ - | $ 46,100 | $ 62,100 |
| 20.24 | LIGHTING/ TRANSFORMERS & PANELS | 3/4" - 20' LONG | $ 164,500 | $ 165,000 | $ 171,300 | $ 500,800 |
| 20.25 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 20.26 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 1,515,700 | $ 5,849,000 | $ 7,364,700 |
| 20.27 | HIGH VOLTAGE POWER CABLE & TERMINATION | INCLUDING SUPPORT & FITTINGS | $ - | $ 58,400 | $ 164,700 | $ 223,100 |
| 20.28 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 114,600 | $ 431,700 | $ 546,300 |
| 20.29 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 795,900 | $ 1,500,700 | $ 2,296,600 |
| 20.30 | CONTROL & INSTRUMENT CABLE | | $ - | $ 512,000 | $ 1,436,700 | $ 1,948,700 |
| 20.31 | FOUNDATION FOR TRANSFORMERS | | $ - | $ 59,000 | $ 173,700 | $ 232,700 |
| 20.32 | TRANSFORMER FIRE WALLS | WITH OIL PIT | $ - | $ 3,500 | $ 9,600 | $ 13,100 |
| 20.33 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 20.34 | LIGHTNING PROTECTION | | $ - | $ 19,500 | $ 14,500 | $ 34,000 |
| 20.35 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 45,302,300 | $ 23,174,900 | $ 58,840,700 | $ 127,317,900 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 2,940,100 | $ 5,909,600 | $ 23,335,900 | $ 32,185,600 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | | $ 48,242,400 | $ 29,084,500 | $ 82,176,600 | $ 159,503,500 |
| | | | | | | |
| 21.0 | COMPRESSED AIR SYSTEM (BYPRODUCT DEWATERING | | | | | |
| 21.1 | AIR COMPRESSOR & AUXILIARIES | | $ 205,200 | $ - | $ 53,200 | $ 258,400 |
| 21.2 | PIPING - MECHANICAL | | $ 241,100 | $ 166,200 | $ 633,100 | $ 1,040,400 |
| 21.3 | ELECTRICAL | DISTRIBUTION, RACEWAY & CABLE ARE INCLUDED IN SECTION 19.0 - BYPRODUCT DEWATERING ISLAND | $ - | $ - | $ - | $ - |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 446,300 | $ 166,200 | $ 686,300 | $ 1,298,800 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT | | $ 22,300 | $ 42,400 | $ 263,400 | $ 328,100 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | COMPRESSED AIR SYSTEM (BYPRODUCT DEWATERING AREA) | $ 468,600 | $ 208,600 | $ 949,700 | $ 1,626,900 |
| | | | | | | |
| 22.0 | POTABLE WATER SYSTEM | INCLUDED WITH ACCOUNT 11.0 | | | | |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | | | | | | |
| 23.0 | SCR SUBSTATION UPGRADE | | | | | |
| 23.1 | TRANSFORMERS | | $ 1,126,000 | $ 150,000 | $ 414,700 | $ 1,690,700 |
| 23.2 | SWITCHGEAR | | $ 250,000 | $ - | $ 136,600 | $ 386,600 |
| 23.3 | 138 KV OH LINE UPGRADE | 6-200FT QUAIL #200 | $ - | $ 10,200 | $ 54,600 | $ 64,800 |
| 23.4 | FOUNDATION FOR AUX TRANSFORMER | | $ - | $ 63,500 | $ 134,400 | $ 197,900 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,376,000 | $ 223,700 | $ 740,300 | $ 2,340,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 68,800 | $ 57,000 | $ 283,381 | $ 409,200 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | | $ 1,444,800 | $ 280,700 | $ 1,023,700 | $ 2,749,200 |
| | | | | | | |
| 24.0 | FGD DCS SYSTEM | INCLUDED WITH ACCOUNT 13.0 | | | | |
| | | | | | | |
| 25.0 | SITE IMPROVEMENTS - CIVIL WORK | INCLUDED WITH ACCOUNT 16.0 | | | | |
| | | | | | | |
| 26.0 | BOP ITEMS | | | | | |
| 26.1 | PIPE INSULATION | AVERAGE 6" PIPE SIZE | $ - | $ 94,000 | $ 293,000 | $ 387,000 |
| 26.2 | HEAT TRACING | | $ - | $ 454,500 | $ 660,200 | $ 1,114,700 |
| 26.3 | TOUCH UP PAINT (INCLUDES PAINTING CS PIPE) | | $ - | $ 301,500 | $ 1,156,700 | $ 1,458,200 |
| 26.4 | HOISTS & TROLLEYS | | $ 330,000 | $ 385,000 | $ 449,800 | $ 1,164,800 |
| 26.5 | MISC AUX STEEL FOR PIPE SUPPORTS | FIELD FABRICATED | $ - | $ 245,000 | $ 1,021,200 | $ 1,266,200 |
| 26.6 | MISC PIPE SUPPORT FOUNDATIONS | | $ - | $ 32,000 | $ 59,700 | $ 91,700 |
| 26.7 | EYE WASH STATIONS | | $ 60,000 | $ 10,000 | $ 61,300 | $ 131,300 |
| 26.8 | FIRE PROTECTION FOR MISC BUILDINGS & AREAS | | $ - | $ 720,000 | $ 588,800 | $ 1,308,800 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 390,000 | $ 2,242,000 | $ 4,290,700 | $ 6,922,700 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 19,500 | $ 571,710 | $ 1,644,510 | $ 2,235,720 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | BOP ITEMS | $ 409,500 | $ 2,813,700 | $ 5,935,200 | $ 9,158,400 |
| | | | | | | |
| 27.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | | | | | |
| 27.1 | RELOCATE HYDROGEN STORAGE TANK | | $ - | $ 15,600 | $ 86,800 | $ 102,400 |
| 27.2 | NEW HYDROGEN LINE TO PLANT | | $ - | $ 62,100 | $ 150,600 | $ 212,700 |
| 27.3 | RELOCATE MISC. UNDERGROUND UTILITIES | ALLOWANCE | $ - | $ 125,000 | $ 170,500 | $ 295,500 |
| 27.4 | REROUTED 138KV LINE . | TWO NEW TOWERS, NEW | $ 500,000 | $ - | $ 255,700 | $ 755,700 |
| 27.5 | OUTAGE TIE-IN DUCTWORK | ALLOWANCE FOR 85 TON | $ - | $ 276,300 | $ 527,700 | $ 804,000 |
| 27.6 | RELOCATED WAREHOUSE - FOUNDATIONS | | $ - | $ 342,600 | $ 534,900 | $ 877,500 |
| 27.7 | RELOCATE EXISTING WAREHOUSE BUILDING | 150' L X 75' W X 25' H | $ - | $ 95,600 | $ 1,121,500 | $ 1,217,100 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 500,000 | $ 917,200 | $ 2,847,700 | $ 4,264,900 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 25,000 | $ 233,900 | $ 1,018,300 | $ 1,277,200 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | | $ 525,000 | $ 1,151,100 | $ 3,866,000 | $ 5,542,100 |
| | | | | | | |
| 28.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | | | | | |
| 28.1 | ARSENIC, ASBESTOS , LEAD ABATEMENT | PROVIDED BY AEP | $ - | $ - | $ - | $ 750,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ - | $ - | $ 750,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT | | $ - | $ - | $ - | $ 112,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ARSENIC, ASBESTOS , LEAD | $ - | $ - | $ - | $ 862,500 |
| | | | | | | |
| 99.0 | OVERALL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 186,435,400 | $ 102,207,500 | $ 264,512,600 | $ 585,280,500 |
| | OVERALL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 10,743,800 | $ 26,006,200 | $ 101,247,200 | $ 143,067,200 |
| | OVERALL TOTAL DIRECT & CONSTRUCTION INDIRECT COST | | $ 197,179,200 | $ 128,213,700 | $ 365,759,800 | $ 728,347,700 |
| | | | | | | |
| | | | | | | |
| | INDIRECT COSTS | | | | | |
| | ENGINEERING, PROCUREMENT, & PROJECT SERVICES | | | | | $ 45,000,000 |
| | CONSTRUCTION MANAGEMENT | | | | | $ 21,850,400 |
| | S-U / COMMISSIONING | | | | | $ 7,283,500 |
| | CRAFT START-UP SUPPORT | | | | | $ 3,117,400 |
| | INITIAL FILLS | | | | | $ 2,185,000 |
| | OPERATOR & TRAINING MANUALS | | | | | $ 600,000 |
| | SUBCONTRACTORS (NOISE & DUCTWORK CONSULTANT, | | | | | $ 750,000 |
| | NOISE ABATEMENT FOR 85 DBA REQUIREMENT | FOR ID FAN, SDA ENCLOSURE, TRANSFORMERS, BOP, DUCTWORK, ACOUSTIC BARRIERS FOR BOUNDARY LIMITS | | | | $ 4,500,000 |
| | SUBTOTAL - INDIRECT COSTS | | | | | $ 85,286,300 |
| | TOTAL DIRECT AND INDIRECT COSTS | | | | | $ 813,634,000 |
| | | | | | | |
| | SPARE PARTS | | | | | $ 2,957,700 |
| | SPARE PARTS - CAPITALIZED | 0.90 | | | | $ 1,774,620 |
| | SPARE PARTS - FIRST YEAR OF OPERATION | 0.60 | | | | $ 1,183,080 |
| | | | | | | |
| | CONTINGENCY | 13.9 | | | | $ 113,200,600 |

INCLUDES MATERIAL AND WELDING ROD COST DIFFERENTIAL+A1

AEP
BIG SANDY UNIT 2
FGD PROJECT - IAQCS BASE (N/ESP)-1B - 4.5 LB/MM BTU - NON PHASED

COST ESTIMATE SUMMARY

Estimate No.: 30720C
Project No.: 12721-000
Date: 9/29/2010

Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | | | | | | |
| | ESCALATION | | | | | $ 101,295,000 |
| | EQUIPMENT | | | | | $ 29,379,300 |
| | MATERIAL | | | | | $ 13,609,300 |
| | LABOR | | | | | $ 48,448,900 |
| | INDIRECTS | | | | | $ 9,857,500 |
| | | | | | | |
| | TOTAL PROJECT COST | | | | | $ 1,031,087,300 |
| | | | | | | |
| | REFERENCE COSTS: | | | | | |
| A | ESP DEMOLITION | ALLOWANCE FOR 1000T STRUCTURE | $ - | $ - | $ 832,300 | $ 832,300 |
| B | REMOVE BOOSTER AIR FANS | | $ - | $ - | $ 111,000 | $ 111,000 |
| C | REMOVAL OF FUEL OIL TANK | LABOR COST IS FOR REMOVAL OF TANK ONLY. ALLOWANCE FOR SOIL REMEDIATION AND DISPOSAL IN AN EPA APPROVED LANDFILL. SUBCONTRACT COST INCLUDES LABOR. USED LOWER END OF THE RANGE $118-355/CY. COST COULD BE LOWER ($59-118/CY) IF SOLD TO A BITUMINOUS CONCRETE BATCH PLANT | $ 1,200,000 | $ 80,000 | $ 469,400 | $ 1,749,400 |

# EXHIBIT 1-6.4
# Capital Cost Estimate Summary
# NID FGD Base Case w/o ESP

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 1.0 | ID FANS | | | | | |
| 1.1 | ID FANS - OEM EQUIPMENT | 1,875,000 ACFM WITH 19,500 HP MOTORS ($750,000 EACH). INCLUDES HYDRAULIC OIL UNITS, SEAL AIR FAN SKIDS, VIBRATION MONITORING EQUIPMENT, FAN STALL EQUIPMENT, FIELD SERVICE REP FOR 140 DAYS | $ 6,920,000 | $ - | $ 1,674,400 | $ 8,594,400 |
| 1.2 | PIPING & SUPPORTS - MECHANICAL | | $ 21,800 | $ 28,700 | $ 120,500 | $ 171,000 |
| 1.3 | DAMPERS | | $ 781,000 | $ - | $ 352,600 | $ 1,133,600 |
| 1.4 | EXPANSION JOINTS | | $ - | $ 131,100 | $ 116,500 | $ 247,600 |
| 1.5 | DUCTWORK | NID MODULE OUTLET TO ID FANS AND FROM ID FANS TO STACK - INCLUDES INTERNAL BRACING AND TURNING VANES | $ - | $ 2,600,000 | $ 4,966,200 | $ 7,566,200 |
| 1.6 | DUCT SUPPORT STEEL | THREE COAT SHOP PAINT | $ - | $ 1,160,000 | $ 1,167,000 | $ 2,327,000 |
| 1.7 | ID FAN INSULATION & LAGGING | TOTAL FOR TWO FANS. PRICING REFLECTS STANDARD ACOUSTICAL INSULATION | $ - | $ 168,000 | $ 217,200 | $ 385,200 |
| 1.8 | DUCTWORK INSULATION & LAGGING | INCLUDES INSULATION FOR SPRAY DRYER OUTLET DUCT TO NID MODULES SUPPLIED WITH THE OEM EQUIPMENT | $ - | $ 864,000 | $ 1,692,200 | $ 2,556,200 |
| 1.9 | DUCT SUPPORT STEEL - FOUNDATIONS | | $ - | $ 295,500 | $ 574,000 | $ 869,500 |
| 1.10 | ID FAN FOUNDATIONS INCLUDING ID FAN AUX EQUIPMENT | | $ - | $ 106,000 | $ 198,700 | $ 304,700 |
| 1.11 | NID CONTROL & SWITCHGEAR BUILDING - FOUNDATIONS | | $ - | $ 273,800 | $ 458,900 | $ 732,700 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
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| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 1.12 | NID CONTROL & SWITCHGEAR BUILDING | SUBCONTRACT PRICE INCLUDES LABOR. COMPLETE WITH HVAC, FINISHES AND SANITARY FACILITIES | $ - | $ 3,937,500 | $ - | $ 3,937,500 |
| 1.13 | TRANSFORMERS | | $ 770,000 | $ - | $ 145,600 | $ 915,600 |
| 1.14 | SWITCHGEAR | | $ 1,082,000 | $ - | $ 569,000 | $ 1,651,000 |
| 1.15 | CABLE BUS & TERMINATIONS | | $ 756,300 | $ 35,800 | $ 1,316,200 | $ 2,108,300 |
| 1.16 | MCC | | $ 120,000 | $ - | $ 7,200 | $ 127,200 |
| 1.17 | MIMIC PANELS | | $ 17,500 | $ - | $ 4,500 | $ 22,000 |
| 1.18 | EMERGENCY POWER SYSTEM | | $ 285,500 | $ - | $ 38,900 | $ 324,400 |
| 1.19 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C 750KCMIL- 13.8KV | $ - | $ 186,300 | $ 283,200 | $ 469,500 |
| 1.20 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 91,600 | $ 393,700 | $ 485,300 |
| 1.21 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 543,000 | $ 794,800 | $ 1,337,800 |
| 1.22 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 345,000 | $ 968,000 | $ 1,313,000 |
| 1.23 | GROUNDING | | $ 11,100 | $ - | $ 37,200 | $ 48,300 |
| 1.24 | LIGHTING/ TRANSFORMERS & PANELS | | $ 26,000 | $ 30,000 | $ 29,500 | $ 85,500 |
| 1.25 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 1,651,700 | $ 8,113,100 | $ 9,764,800 |
| 1.26 | DUCT BANK | | $ - | $ 40,800 | $ 280,000 | $ 320,800 |
| 1.27 | FOUNDATION FOR TRANSFORMERS | | $ - | $ 64,600 | $ 188,900 | $ 253,500 |
| 1.28 | FIREWALL FOR TRANSFORMERS | | $ - | $ 3,200 | $ 8,300 | $ 11,500 |
| 1.29 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 1.30 | LIGHTNING PROTECTION | | $ - | $ 12,000 | $ 9,200 | $ 21,200 |
| 1.31 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 10,791,200 | $ 12,593,600 | $ 24,745,500 | $ 48,130,300 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 539,600 | $ 3,211,400 | $ 8,904,700 | $ 12,655,600 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ID FANS | $ 11,330,800 | $ 15,805,000 | $ 33,650,200 | $ 60,785,900 |
| | | | | | | |
| 2.0 | NID MODULES | | | | | |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
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| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 2.1 | MECHANICAL EQUIPMENT | A 12-MODULE NID SYSTEM (160' X 160') INCLUDING LIME DAY SILOS, HYDRATORS, MIXERS, J-DUCTS, FABRIC FILTER MODULES, ALL INTERNAL ELEMENTS (BAGS, CAGES, ASH HOPPERS, 2 BROKEN BAG DETECTORS / COMPARTMENT), ASH RECYCLE SYSTEM, VACUUM PIPING, AND ALL INTERNAL PIPING & DUCTWORK FOR THE VARIOUS MODULES. | $ 50,231,000 | $ - | $ 32,415,100 | $ 82,646,100 |
| 2.2 | INSULATION FOR NID MODULES | SUBCONTRACT COST INCLUDES LABOR | $ 2,419,200 | $ - | $ - | $ 2,419,200 |
| 2.3 | PENTHOUSE FOR NID MODULES | 14 FT HIGH, 25600 SF | $ 58,100 | $ 1,316,900 | $ 1,747,600 | $ 3,122,600 |
| 2.4 | BOTTOM ENCLOSURE FOR NID MODULES | 40 FT HIGH | $ 92,200 | $ 2,428,900 | $ 2,544,900 | $ 5,066,000 |
| 2.5 | PIPING & SUPPORTS - MECHANICAL | | $ 125,200 | $ 174,500 | $ 385,900 | $ 685,600 |
| 2.6 | DUCTWORK | | $ - | $ 4,797,000 | $ 9,162,600 | $ 13,959,600 |
| 2.7 | DUCT SUPPORT STEEL | THREE COAT SHOP PAINT | $ - | $ 2,140,200 | $ 2,153,200 | $ 4,293,400 |
| 2.8 | DUCTWORK INSULATION & LAGGING | | $ - | $ 1,632,000 | $ 3,196,400 | $ 4,828,400 |
| 2.9 | NID MODULE- FOUNDATIONS | | $ - | $ 1,087,000 | $ 1,778,100 | $ 2,865,100 |
| 2.10 | NID MODULE - SUPPORT STEEL AND ACCESS GALLERY | | $ - | $ 1,152,000 | $ 2,863,700 | $ 4,015,700 |
| 2.11 | GROUNDING | | $ - | $ 16,000 | $ 46,100 | $ 62,100 |
| 2.12 | LIGHTING/ TRANSFORMERS & PANELS | | $ 27,000 | $ 75,000 | $ 57,300 | $ 159,300 |
| 2.13 | RACEWAY, CABLE TRAY, & CONDUIT | INCLUDED IN ID FANS, 1.0 | $ - | $ - | $ - | $ - |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 52,952,700 | $ 14,819,500 | $ 56,350,900 | $ 124,123,100 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 3,322,600 | $ 3,779,000 | $ 21,387,300 | $ 28,488,900 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | NID MODULES | $ 56,275,300 | $ 18,598,500 | $ 77,738,200 | $ 152,612,000 |
| | | | | | | |
| 3.0 | NEW STACK | | | | | |
| 3.1 | CONCRETE STACK (DRY) | PROVIDED BY AEP | $ - | $ - | $ - | $ 19,350,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ - | $ - | $ 19,350,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ 2,902,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | NEW STACK | $ - | $ - | $ - | $ 22,252,500 |
| | | | | | | |
| 4.0 | LIME HANDLING SYSTEM | | | | | |
| 4.1 | LIME STORAGE SILO | | $ 6,770,000 | $ - | $ - | $ 6,770,000 |
| 4.2 | LIME UNLOADING SYSTEM | INCLUDE PNEUMATIC HANDLING SYSTEM, THREE VACUUM EXHAUSTERS, TWO FILTER SEPARATORS | $ 595,000 | $ - | $ 477,900 | $ 1,072,900 |
| 4.3 | LIME TRANSPORT SYSTEM TO DAY BINS | INCLUDE PNEUMATIC HANDLING SYSTEM, THREE VACUUM EXHAUSTERS, TWO FILTER SEPARATORS | $ 1,100,000 | $ - | $ 654,200 | $ 1,754,200 |
| 4.4 | PIPING - MECHANICAL | | $ 88,700 | $ 130,300 | $ 342,600 | $ 561,600 |
| 4.5 | LIME STORAGE SILO ACCESS STAIR TOWER | | $ - | $ 159,500 | $ 160,500 | $ 320,000 |
| 4.6 | PIPE RACK FOR LIME HANDLING, WASTE HANDLING AND MISC MECHANICAL PIPING | THREE COAT SHOP PAINT | $ - | $ 1,885,000 | $ 1,896,400 | $ 3,781,400 |
| 4.7 | RAIL CAR UNLOADING AREA - FOUNDATIONS | 20' X 120' - NO SIDING | $ - | $ 42,700 | $ 90,100 | $ 132,800 |
| 4.8 | LIME UNLOADING BLOWER / ELECTRICAL BUILDING - FOUNDATIONS | | $ - | $ 69,600 | $ 147,600 | $ 217,200 |
| 4.9 | LIME UNLOADING BLOWER / ELECTRICAL BUILDING | 100' L X 30' W X 30' H | $ 75,000 | $ 335,000 | $ 24,400 | $ 434,400 |
| 4.10 | CONCRETE PIT FOR THE ELEVATOR | | $ - | $ 2,300 | $ 6,900 | $ 9,200 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

Estimate No.: 30727C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 4.11 | LIME STORAGE SILO - FOUNDATIONS | INCLUDES FOUNDATIONS FOR LIME TRANSPORT SYSTEM PRESSURE BLOWERS | $ - | $ 368,100 | $ 676,300 | $ 1,044,400 |
| 4.12 | LIME STORAGE SILO ACCESS STAIR TOWER - FOUNDATIONS | | $ - | $ 14,200 | $ 28,600 | $ 42,800 |
| 4.13 | PIPE RACK - FOUNDATIONS | | $ - | $ 239,600 | $ 588,600 | $ 828,200 |
| 4.14 | TRANSFORMERS | SUS TRANSFORMERS: 33F, 33G, 13.8KV-480V,3PHASE, 3 WINDING XFMR | $ 170,000 | $ - | $ 54,600 | $ 224,600 |
| 4.15 | SWITCHGEAR | 480V LOW VOLTAGE (33F/G), SWITCHGEAR | $ 196,000 | $ - | $ 104,700 | $ 300,700 |
| 4.16 | CABLE BUS DUCT | | $ 134,700 | $ 10,800 | $ 200,200 | $ 345,700 |
| 4.17 | MCC | | $ 61,800 | $ - | $ 3,600 | $ 65,400 |
| 4.18 | MIMIC PANELS | | $ 17,500 | $ - | $ 1,400 | $ 18,900 |
| 4.19 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 4.20 | GROUNDING | | $ 13,300 | $ - | $ 41,300 | $ 54,600 |
| 4.21 | LIGHTING/ TRANSFORMERS & PANELS | | $ 52,000 | $ 135,000 | $ 104,500 | $ 291,500 |
| 4.22 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 310,900 | $ 1,537,100 | $ 1,848,000 |
| 4.23 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL- 15KV | $ - | $ 144,600 | $ 407,800 | $ 552,400 |
| 4.24 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | 1/C 350KCMIL-5KV | $ - | $ 66,200 | $ 282,300 | $ 348,500 |
| 4.25 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 93,000 | $ 143,200 | $ 236,200 |
| 4.26 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 26,200 | $ 73,600 | $ 99,800 |
| 4.27 | DUCT BANK | DUCT BANK WITH 4-5" & 4-3" CONDUITS, 2.38' H X 3.79' W | $ - | $ 61,100 | $ 116,200 | $ 177,300 |
| 4.28 | FOUNDATIONS FOR TRANSFORMERS | FOR XFMR 33F, 33G, INCLUDES MUD MAT | $ - | $ 3,500 | $ 10,300 | $ 13,800 |
| 4.29 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 4.30 | LIGHTNING PROTECTION | | $ - | $ 6,000 | $ 4,700 | $ 10,700 |
| 4.31 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 9,382,300 | $ 4,145,600 | $ 8,237,000 | $ 21,764,900 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
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| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
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| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
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| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 469,100 | $ 1,057,100 | $ 2,988,100 | $ 4,514,400 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | LIME HANDLING SYSTEM | $ 9,851,400 | $ 5,202,700 | $ 11,225,100 | $ 26,279,300 |
| | | | | | | |
| 5.0 | LIME SLAKER BUILDING | NOT REQUIRED FOR NID | | | | |
| | | | | | | |
| 6.0 | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | | | | | |
| 6.1 | BYPRODUCT WASTE HANDLING - MECHANICAL EQUIPMENT | INCLUDES PNEUMATIC HANDLING SYSTEM, THREE PRESSURE BLOWERS, ONE BIN VENT FILTER, ASH UNLOADING SYSTEM | $ 2,822,000 | $ - | $ 1,609,000 | $ 4,431,000 |
| 6.2 | ECONOMIZER ASH HANDLING - MECHANICAL EQUIPMENT | INCLUDES JET PUMPS AND PIPING / SUPPORTS TO THE BOTTOM ASH POND | $ 400,000 | $ - | $ 296,400 | $ 696,400 |
| 6.3 | BUILDING SUMP PUMPS | FOR BUILDINGS - DUPLEX. INCLUDES CHECK & ISOLATION VALVES. | $ 28,000 | $ - | $ 12,300 | $ 40,300 |
| 6.4 | AGITATOR FOR SUMP PUMPS | 5 HP | $ 12,000 | $ - | $ 4,600 | $ 16,600 |
| 6.5 | PIPING - MECHANICAL | | $ 142,800 | $ 131,000 | $ 408,700 | $ 682,500 |
| 6.6 | BYPRODUCT WASTE SILO | CONCRETE SILO 65' DIA X 111' H - 4700 TONS -SUBCONTRACT COST INCLUDES LABOR | $ 2,630,000 | $ - | $ - | $ 2,630,000 |
| 6.7 | RECYCLE SILO | NOT REQUIRED FOR NID | $ - | $ - | $ - | $ - |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
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| 6.8 | FLY ASH SILO | NOT REQUIRED - ECONOMIZER FLY ASH SLUICD TO BOTTOM ASH POND | $ - | $ - | $ - | $ - |
| 6.9 | BYPRODUCT WASTE STORAGE SILO - FOUNDATIONS | | $ - | $ 162,400 | $ 301,900 | $ 464,300 |
| 6.10 | FLY ASH SILO - FOUNDATIONS | NOT REQUIRED | $ - | $ - | $ - | $ - |
| 6.11 | BYPRODUCT TRANSPORT BLOWER BUILDING - FOUNDATIONS | | $ - | $ 97,600 | $ 172,100 | $ 269,700 |
| 6.12 | BYPRODUCT TRANSPORT BLOWER BUILDING | 90' L X 30' W X 20' H | $ 40,000 | $ 241,500 | $ 26,200 | $ 307,700 |
| 6.13 | FLY ASH BLOWER AND ELECTRICAL BUILDING - FOUNDATIONS | NOT REQUIRED | $ - | $ - | $ - | $ - |
| 6.14 | FLY ASH BLOWER AND ELECTRICAL BUILDING | NOT REQUIRED | $ - | $ - | $ - | $ - |
| 6.15 | LOAD OUT AREA PDC | SUBCONTRACT PRICE INCLUDES LABOR. COMPLETE WITH HVAC, & FINISHES. | $ - | $ 300,000 | $ - | $ 300,000 |
| 6.16 | MCC | 480V MCC PER LINE UP | $ 60,000 | $ - | $ 3,600 | $ 63,600 |
| 6.17 | EMERGENBCY POWER SYSTEM | | $ 92,800 | $ - | $ 19,900 | $ 112,700 |
| 6.18 | LIGHTING/ TRANSFORMERS & PANELS | | $ 18,500 | $ 60,000 | $ 44,100 | $ 122,600 |
| 6.19 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 32,500 | $ 189,100 | $ 221,600 |
| 6.20 | GROUNDING | | $ - | $ 4,500 | $ 10,900 | $ 15,400 |
| 6.21 | MEDIUM VOLTAGE POWER CABLE & TERMINATION | 1/C # 2/0-5KV | $ - | $ 9,500 | $ 47,900 | $ 57,400 |
| 6.22 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 64,700 | $ 80,500 | $ 145,200 |
| 6.23 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 30,700 | $ 86,200 | $ 116,900 |
| 6.24 | DUCT BANK | | $ - | $ 6,200 | $ 10,600 | $ 16,800 |
| 6.25 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 6.26 | LIGHTNING PROTECTION | | $ - | $ 16,000 | $ 14,000 | $ 30,000 |
| 6.27 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 6,246,100 | $ 1,198,600 | $ 3,371,000 | $ 10,815,700 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 312,300 | $ 305,600 | $ 1,251,300 | $ 1,869,200 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
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Project No.: 12721-000
Date: 9/29/2010
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| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | $ 6,558,400 | $ 1,504,200 | $ 4,622,300 | $ 12,684,900 |
| | | | | | | |
| 7.0 | ABSORBER ISLAND | NOT REQUIRED FOR NID | | | | |
| | | | | | | |
| 8.0 | ACTIVATED CARBON INJECTION SYSTEM | | | | | |
| 8.1 | ACI MECHANICAL EQUIPMENT: | | $ 3,046,400 | $ - | $ 1,012,000 | $ 4,058,400 |
| 8.2 | PIPING - MECHANICAL | | $ 29,800 | $ 149,800 | $ 377,100 | $ 556,700 |
| 8.3 | ACI SYSTEM - FOUNDATIONS | | $ - | $ 41,500 | $ 88,000 | $ 129,500 |
| 8.4 | MCC | | $ 61,800 | $ - | $ 3,600 | $ 65,400 |
| 8.5 | GROUNDING | | $ 5,500 | $ - | $ 18,600 | $ 24,100 |
| 8.6 | LIGHTING / TRANSFORMERS & PANELS | | $ 26,000 | $ 15,000 | $ 20,400 | $ 61,400 |
| 8.7 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 89,900 | $ 302,900 | $ 392,800 |
| 8.8 | LOW VOLTAGE POWER CABLE & TERMINATION | #4/0 - #12 AWG-600V | $ - | $ 14,400 | $ 18,000 | $ 32,400 |
| 8.9 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 16,000 | $ 44,900 | $ 60,900 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 3,169,500 | $ 326,600 | $ 1,885,500 | $ 5,381,600 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 158,500 | $ 83,300 | $ 694,500 | $ 936,300 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ACTIVATED CARBON INJECTION SYSTEM | $ 3,328,000 | $ 409,900 | $ 2,580,000 | $ 6,317,900 |
| | | | | | | |
| 9.0 | COMPRESSED AIR SYSTEM | | | | | |
| 9.1 | AIR COMPRESSOR & AUXILIARIES | | $ 848,000 | $ - | $ 184,600 | $ 1,032,600 |
| 9.2 | PIPING - MECHANICAL | | $ 320,600 | $ 344,800 | $ 875,600 | $ 1,541,000 |
| 9.3 | AIR COMPRESSOR BUILDING - FOUNDATIONS | | $ - | $ 249,800 | $ 419,700 | $ 669,500 |
| 9.4 | AIR COMPRESSOR BUILDING | 120' L X 60' W X 20' H | $ - | $ 612,000 | $ - | $ 612,000 |
| 9.5 | LIGHTING/ TRANSFORMERS & PANELS | | $ 11,000 | $ 10,500 | $ 11,400 | $ 32,900 |
| 9.6 | RACEWAY, CABLE TRAY, & CONDUIT | INCLUDED IN ID FANS, 1.0 | $ - | $ - | $ - | $ - |
| 9.7 | GROUNDING | | $ 4,500 | $ - | $ 10,900 | $ 15,400 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
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| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
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| 9.8 | COMMUNICATIONS | | $ - | $ 34,000 | $ 26,000 | $ 60,000 |
| 9.9 | LIGHTNING PROTECTION | | $ - | $ 10,500 | $ 7,500 | $ 18,000 |
| 90.00 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,184,100 | $ 1,261,600 | $ 1,535,700 | $ 3,981,400 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 59,200 | $ 321,700 | $ 570,900 | $ 951,800 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | COMPRESSED AIR SYSTEM | $ 1,243,300 | $ 1,583,300 | $ 2,106,600 | $ 4,933,200 |
| | | | | | | |
| 10.0 | SERVICE WATER SYSTEM | | | | | |
| 10.1 | PUMPS | INCLUDES SELF-CLEANING STRAIINERS | $ 174,000 | $ - | $ 85,900 | $ 259,900 |
| 10.2 | PIPING - MECHANICAL | | $ 298,400 | $ 342,800 | $ 688,300 | $ 1,329,500 |
| 10.3 | PIPING - FIRE PROTECTION SYSTEM | | $ 181,200 | $ 284,600 | $ 673,300 | $ 1,139,100 |
| 10.4 | TANKS | | $ - | $ 120,000 | $ - | $ 120,000 |
| 10.5 | SERVICE WATER TANK & PUMP - FOUNDATIONS | | $ - | $ 17,300 | $ 41,400 | $ 58,700 |
| 10.6 | ELECTRICAL | INCLUDED IN ID FANS, 1.0 | $ - | $ - | $ - | $ - |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 653,600 | $ 764,700 | $ 1,488,900 | $ 2,907,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 32,700 | $ 195,000 | $ 542,900 | $ 770,600 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | SERVICE WATER SYSTEM | $ 686,300 | $ 959,700 | $ 2,031,800 | $ 3,677,800 |
| | | | | | | |
| 11.0 | POTABLE WATER SYSTEM | | | | | |
| 11.1 | PUMPS | | $ 30,000 | $ - | $ 18,400 | $ 48,400 |
| 11.2 | PIPING - MECHANICAL | | $ 99,500 | $ 181,900 | $ 448,200 | $ 729,600 |
| 11.3 | TANKS | | $ - | $ 8,500 | $ - | $ 8,500 |
| 11.4 | POTABLE WATER TANK & PUMP - FOUNDATIONS | | $ - | $ 5,200 | $ 9,200 | $ 14,400 |
| 11.5 | ELECTRICAL | INCLUDED IN ID FANS, 1.0 | $ - | $ - | $ - | $ - |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
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| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 129,500 | $ 195,600 | $ 475,800 | $ 800,900 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 6,500 | $ 49,900 | $ 173,400 | $ 229,800 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | POTABLE WATER SYSTEM | $ 136,000 | $ 245,500 | $ 649,200 | $ 1,030,700 |
| | | | | | | |
| 12.0 | FGD SUBSTATION | | | | | |
| 12.1 | TRANSFORMERS | | $ 1,560,000 | $ - | $ 273,100 | $ 1,833,100 |
| 12.2 | TRANSFORMER PDC | 15W X 45' X 10'H. SUBCONTRACT PRICE INCLUDES LABOR | $ 202,500 | $ - | $ - | $ 202,500 |
| 12.3 | TRANSFORMER PDC - FOUNDATION | | $ - | $ 73,200 | $ 146,900 | $ 220,100 |
| 12.4 | 138KV MAIN FEEDER & TERMINATIONS | | $ 264,000 | $ - | $ 254,000 | $ 518,000 |
| 12.5 | SWITCHGEAR | | $ 714,200 | $ - | $ 121,600 | $ 835,800 |
| 12.6 | MCC | 480V MCC, PER LINE UP | $ 60,000 | $ - | $ 3,600 | $ 63,600 |
| 12.7 | CABLE BUS | | $ 181,100 | $ 18,000 | $ 290,200 | $ 489,300 |
| 12.8 | PANELS - RELAY | | $ 100,000 | $ - | $ 9,100 | $ 109,100 |
| 12.9 | MIMIC PANELS | | $ 17,500 | $ - | $ 4,500 | $ 22,000 |
| 12.10 | EMERGENCY POWER SYSTEM | | $ 108,300 | $ - | $ 24,400 | $ 132,700 |
| 12.11 | GROUNDING | | $ 23,300 | $ - | $ 59,100 | $ 82,400 |
| 12.12 | LIGHTING/ TRANSFORMERS & PANELS | | $ 26,000 | $ 30,000 | $ 29,500 | $ 85,500 |
| 12.13 | OUTDOOR LIGHTING | NEW AUX YARD LIGHTING - ALLOWANCE | $ 25,000 | $ - | $ 56,800 | $ 81,800 |
| 12.14 | RACEWAY, CABLE TRAY, & CONDUIT | | $ - | $ 390,600 | $ 1,918,600 | $ 2,309,200 |
| 12.15 | DUCT BANK | | $ - | $ 26,200 | $ 54,300 | $ 80,500 |
| 12.16 | HIGH VOLTAGE POWER CABLE & TERMINATION | 1/C # 500KCMIL- 15KV | $ - | $ 16,700 | $ 47,100 | $ 63,800 |
| 12.17 | LOW VOLTAGE POWER CABLE & TERMINATION | | $ - | $ 96,600 | $ 147,700 | $ 244,300 |
| 12.18 | CONTROL & INSTRUMENT CABLE | #14, #16 & PR # 20 & SHLD WIRE | $ - | $ 21,800 | $ 61,100 | $ 82,900 |
| 12.19 | FOUNDATION FOR AUX TRANSFORMER | | $ - | $ 70,200 | $ 205,400 | $ 275,600 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
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| 12.20 | FIREWALL FOR TRANSFORMERS | | $ - | $ 4,300 | $ 7,600 | $ 11,900 |
| 12.21 | COMMUNICATIONS | | $ - | $ 17,000 | $ 13,000 | $ 30,000 |
| 12.22 | LIGHTNING PROTECTION | | $ - | $ 4,000 | $ 2,000 | $ 6,000 |
| 12.23 | SECURITY SYSTEM | | $ - | $ 8,000 | $ 7,000 | $ 15,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 3,281,900 | $ 776,600 | $ 3,736,600 | $ 7,795,100 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 164,100 | $ 198,000 | $ 1,350,783 | $ 1,712,900 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FGD SUBSTATION | $ 3,446,000 | $ 974,600 | $ 5,087,400 | $ 9,508,000 |
| | | | | | | |
| 13.0 | FGD DCS SYSTEM | | | | | |
| 13.1 | DCS | 3200 I/O POINTS | $ 2,400,000 | $ - | $ 813,600 | $ 3,213,600 |
| 13.2 | DCS - VENDOR FIELD SUPPORT | 200 MAN DAYS @ $1500/DAY - | $ 300,000 | $ - | $ - | $ 300,000 |
| 13.3 | LOCALLY MOUNTED INSTRUMENTS | | $ - | $ 650,400 | $ 852,900 | $ 1,503,300 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 2,700,000 | $ 650,400 | $ 1,666,500 | $ 5,016,900 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 135,000 | $ 165,900 | $ 622,300 | $ 923,200 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | FGD DCS SYSTEM | $ 2,835,000 | $ 816,300 | $ 2,288,800 | $ 5,940,100 |
| | | | | | | |
| 14.0 | CEM SYSTEM | | | | | |
| 14.1 | CEM | PROVIDED BY AEP | $ 1,260,000 | $ 540,000 | $ 310,000 | $ 2,110,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 1,260,000 | $ 540,000 | $ 310,000 | $ 2,110,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ 316,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | CEM SYSTEM | $ - | $ - | $ - | $ 2,426,500 |
| | | | | | | |
| 15.0 | TRUCK & RAIL INFRASTRUCTURE | | | | | |

Sargent & Lundy, LLC

AEP
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|---|---|---|---|---|---|---|
| 15.1 | EXISTING RAILROAD IMPROVEMENTS | FOR FULL RAILCAR STORAGE TRACK IMPROVEMENTS - 3250 LF | $ - | $ 660,200 | $ 689,200 | $ 1,349,400 |
| 15.2 | EXISTING RAILROAD IMPROVEMENTS | FOR LOOP TRACK UPGRADE - 5000 LF | $ - | $ 1,008,800 | $ 1,055,600 | $ 2,064,400 |
| 15.3 | NEW RAILROAD TRACK | INCLUDES, 132LB RAIL, 7" TIMBERS, TIE PLATES, SPIKES, BOLTS, 12: SUB BALLAST, 12" BALLAST, 12 OZ/SY GEOTEXTILE MEMBRANE, 12" SUBGRADE PREP | $ - | $ 252,000 | $ 213,100 | $ 465,100 |
| 15.4 | FIELD FABRICATED TURNOUTS | #8 TURNOUT | $ - | $ 90,000 | $ 54,800 | $ 144,800 |
| 15.5 | RAIL SCALE | SUBCONTRACT COST, INCLUDES FOUNDATIONS | $ 212,500 | $ - | $ - | $ 212,500 |
| 15.6 | NEW CONCRETE ENCASEMENT | OVER AND AROUND DUCT BANK CONNECTING THE PLANT TO SWITCHYARD. THIS IS UNDER THE NEW TRACK WORK EXTENSION | $ - | $ 33,200 | $ 71,400 | $ 104,600 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 212,500 | $ 2,044,200 | $ 2,084,100 | $ 4,340,800 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 10,600 | $ 521,300 | $ 779,600 | $ 1,311,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | TRUCK & RAIL INFRASTRUCTURE | $ 223,100 | $ 2,565,500 | $ 2,863,700 | $ 5,652,300 |
| | | | | | | |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | | | | | |
| 16.1 | SITE GRADING | | $ - | $ - | $ 555,200 | $ 555,200 |
| 16.2 | ROADS & SURFACING | | $ - | $ 1,204,900 | $ 1,667,500 | $ 2,872,400 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 16.3 | NEW CONCRETE ENCASEMENT | 16' X 4' X 40' - FOR EXISTING ASH PIPE HAUL ROAD CROSSING | $ - | $ 36,500 | $ 73,000 | $ 109,500 |
| 16.4 | TRUCK SCALE & CONCRETE APPROACH | | $ 170,000 | $ 27,300 | $ 92,000 | $ 289,300 |
| 16.5 | PROCESS WATER STORAGE BASIN | | $ 60,000 | $ 81,600 | $ 240,300 | $ 381,900 |
| 16.6 | PROCESS WATER STORAGE BASIN PUMP STRUCTURE - CONCRETE | | $ - | $ 47,000 | $ 105,400 | $ 152,400 |
| 16.7 | STORM WATER DRAINAGE TRENCH | 2' W X 3' DEEP CAST-IN-PLACE CONCRETE TRENCH W/REINFORCING & HS-20 RATED GRATE COVERS | $ - | $ 526,500 | $ 535,800 | $ 1,062,300 |
| 16.8 | STORM WATER RUNOFF POND | | $ - | $ 15,000 | $ 122,600 | $ 137,600 |
| 16.9 | STORM WATER RUNOFF POND PUMP STRUCTURE - CONCRETE | | $ 90,000 | $ 42,300 | $ 182,200 | $ 314,500 |
| 16.10 | OILY WATER SEWER | | $ 4,500 | $ 112,600 | $ 236,000 | $ 353,100 |
| 16.11 | OIL SEPARATOR | 500 GPM W/ INTEGRAL LIFT STATION | $ 100,000 | $ - | $ 116,100 | $ 216,100 |
| 16.12 | SANITARY SEWER | | $ - | $ 22,200 | $ 96,900 | $ 119,100 |
| 16.13 | SANITARY LIFT STATION | PACKAGED TYPE COMPLETE WITH PUMPS, 100,000 GPD | $ 150,000 | $ - | $ 49,200 | $ 199,200 |
| 16.14 | CONSTRUCTION LAYDOWN AREA | ALLOWANCE FOR 10 ACRES, DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED | $ - | $ 700,000 | $ 828,000 | $ 1,528,000 |
| 16.15 | CRAFT PARKING | DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED. ALLOWANCE FOR 20,000 SY INCLUDES:<br>6" BASE COURSE<br>10 OZ/SY GEOTEXTILE<br>12" SUBGRADE PREP | $ - | $ 180,000 | $ 414,200 | $ 594,200 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 16.16 | CONTRACTOR OFFICES (AREA) | DOES NOT INCLUDE LAND ACQUISITION, IF REQUIRED. ALLOWANCE FOR 5,000 SY AREA (TRAILERS BY CONTRACTORS) INCLUDES: 6" BASE COURSE 10 OZ/SY GEOTEXTILE 12" SUBGRADE PREP | $ - | $ 45,000 | $ 103,600 | $ 148,600 |
| 16.17 | TRUCK WASH AREA | | $ - | $ 47,300 | $ 83,100 | $ 130,400 |
| 16.18 | NEW PERMANENT STORAGE | INCLUDES LIGHTING AND H&V. SUBCONTRACT PRICE INCLUDES ELECTRICAL AND H&V | $ 850,000 | $ - | $ - | $ 850,000 |
| 16.19 | FOUNDATIONS FOR THE NEW WAREHOUSE | | $ - | $ 273,500 | $ 450,200 | $ 723,700 |
| 16.20 | NEW TEMPORARY STORAGE | WEATHER TIGHT CANVAS ENCLOSURE. INCLUDES LIGHTING AND H&V. SUBCONTRACT PRICE INCLUDES ELECTRICAL AND H&V | $ 450,000 | $ - | $ - | $ 450,000 |
| 16.21 | FOUNDATIONS FOR TEMPORARY STORAGE | | $ - | $ 99,500 | $ 157,200 | $ 256,700 |
| 16.22 | LABOR BUS SERVICE FROM PARKING LOT TO CONSTRUCTION AREA AND ACCESS CONTROL | ALLOWANCE FOR 36 MONTHS BASED ON 2 BUSES OPERATING CONTINUOUSLY FOR 5X10 WORKWEEK. SUBCONTRACT COST INCLUDES EQUIPMENT, MATERIAL AND LABOR | $ 1,368,000 | $ - | $ - | $ 1,368,000 |
| 16.23 | EROSION & SEDIMENT CONTROL | 0 | $ - | $ 12,500 | $ 20,500 | $ 33,000 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

Estimate No.: 30727C
Project No.: 12721-000
Date: 9/29/2010
Preparer: MNO
Reviewer: JMK
Approver: PEF

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 3,242,500 | $ 3,473,700 | $ 6,129,000 | $ 12,845,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 162,100 | $ 885,800 | $ 2,226,600 | $ 3,274,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | SITE IMPROVEMENTS - CIVIL WORK | $ 3,404,600 | $ 4,359,500 | $ 8,355,600 | $ 16,119,700 |
| | | | | | | |
| 17.0 | BOP ITEMS | | | | | |
| 17.1 | PIPE INSULATION | AVERAGE 6" PIPE SIZE | $ - | $ 34,000 | $ 106,000 | $ 140,000 |
| 17.2 | HEAT TRACING | | $ - | $ 175,600 | $ 248,500 | $ 424,100 |
| 17.3 | TOUCH UP PAINT (INCLUDES PAINTING CS PIPE) | | $ - | $ 176,700 | $ 677,900 | $ 854,600 |
| 17.4 | HOISTS & TROLLEYS | | $ 150,000 | $ 175,000 | $ 204,400 | $ 529,400 |
| 17.5 | MISC AUX STEEL FOR PIPE SUPPORTS | FIELD FABRICATED | $ - | $ 122,500 | $ 510,600 | $ 633,100 |
| 17.6 | MISC PIPE SUPPORT FOUNDATIONS | | $ - | $ 10,500 | $ 21,000 | $ 31,500 |
| 17.7 | EYE WASH STATIONS | WITH 50 KW HEATERS | $ 30,000 | $ 5,000 | $ 30,700 | $ 65,700 |
| 17.8 | FIRE PROTECTION FOR MISC BUILDINGS & AREAS | STAND PIPE FOR BUILDINGS | $ - | $ 300,000 | $ 245,300 | $ 545,300 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 180,000 | $ 999,300 | $ 2,044,400 | $ 3,223,700 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 9,000 | $ 254,822 | $ 786,346 | $ 1,050,167 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | BOP ITEMS | $ 189,000 | $ 1,254,100 | $ 2,830,700 | $ 4,273,900 |
| | | | | | | |
| 18.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | | | | | |
| 18.1 | RELOCATE HYDROGEN STORAGE TANK | | $ - | $ 15,600 | $ 86,800 | $ 102,400 |
| 18.2 | NEW HYDROGEN LINE TO PLANT | | $ - | $ 62,100 | $ 150,600 | $ 212,700 |
| 18.3 | RELOCATE MISC. UNDERGROUND UTILITIES | ALLOWANCE | $ - | $ 125,000 | $ 170,500 | $ 295,500 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| 18.4 | OUTAGE TIE-IN DUCTWORK | ALLOWANCE FOR 85 TON DUCTWORK | $ - | $ 276,300 | $ 527,700 | $ 804,000 |
| 18.5 | RELOCATED WAREHOUSE - FOUNDATIONS | | $ - | $ 342,600 | $ 534,900 | $ 877,500 |
| 18.6 | RELOCATE EXISTING WAREHOUSE BUILDING | 150' L X 75' W X 25' H | $ - | $ 95,600 | $ 1,121,500 | $ 1,217,100 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ 917,200 | $ 2,592,000 | $ 3,509,200 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ 233,900 | $ 927,100 | $ 1,161,000 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $ - | $ 1,151,100 | $ 3,519,100 | $ 4,670,200 |
| | | | | | | |
| 19.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | | | | | |
| 19.1 | ARSENIC, ASBESTOS , LEAD ABATEMENT | PROVIDED BY AEP | $ - | $ - | $ - | $ 750,000 |
| 90.0 | SUBTOTAL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ - | $ - | $ - | $ 750,000 |
| | SUBTOTAL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ - | $ - | $ - | $ 112,500 |
| | TOTAL DIRECT & CONSTRUCTION INDIRECT COST | ARSENIC, ASBESTOS , LEAD ABATEMENT | $ - | $ - | $ - | $ 862,500 |
| | | | | | | |
| 99.0 | OVERALL - EQUIPMENT, MATERIAL AND LABOR COSTS | | $ 95,385,900 | $ 44,707,200 | $ 116,652,900 | $ 276,846,000 |
| | OVERALL - OTHER DIRECT & CONSTRUCTION INDIRECT COSTS | | $ 5,381,300 | $ 11,343,600 | $ 43,205,800 | $ 63,181,200 |
| | OVERALL TOTAL DIRECT & CONSTRUCTION INDIRECT COST | | $ 100,767,200 | $ 56,050,800 | $ 159,858,700 | $ 340,027,200 |
| | | | | | | |
| | OVERALL PROJECT INDIRECT COSTS | | | | | |
| | ENGINEERING, PROCUREMENT, & PROJECT SERVICES | | | | | $ 25,000,000 |
| | CONSTRUCTION MANAGEMENT | | | | | $ 10,200,800 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| | S-U / COMMISSIONING | | | | | $ 3,400,300 |
| | CRAFT START-UP SUPPORT | | | | | $ 1,374,500 |
| | INITIAL FILLS | | | | | $ 1,020,100 |
| | OPERATOR & TRAINING MANUALS | | | | | $ 300,000 |
| | SUBCONTRACTORS (NOISE & DUCTWORK CONSULTANT, GEOTECHNICAL INVESTIGATION) | | | | | $ 400,000 |
| | NOISE ABATEMENT FOR 85 DBA REQUIREMENT | FOR ID FAN, NID MODULES, TRANSFORMERS, BOP, DUCTWORK, ACOUSTIC BARRIERS FOR BOUNDARY LIMITS | | | | $ 2,600,000 |
| | SUBTOTAL - INDIRECT COSTS | | | | | $ 44,295,700 |
| | TOTAL PROJECT DIRECT AND INDIRECT COSTS | | | | | $ 384,322,900 |
| | | | | | | |
| | SPARE PARTS: | | | | | $ 1,511,500 |
| | SPARE PARTS - CAPITALIZED | 0.90 | | | | $ 906,900 |
| | SPARE PARTS - FIRST YEAR OF OPERATION | 0.60 | | | | $ 604,600 |
| | | | | | | |
| | CONTINGENCY | 14.287 | | | | $ 55,124,800 |
| | | | | | | |
| | ESCALATION | | | | | $ 48,734,300 |
| | EQUIPMENT | | | | | $ 16,011,200 |
| | MATERIAL | | | | | $ 5,863,300 |
| | LABOR | | | | | $ 21,653,900 |
| | INDIRECTS | | | | | $ 5,205,900 |
| | | | | | | |
| | TOTAL PROJECT COST | | | | | $ 489,693,500 |
| | | | | | | |
| | REFERENCE COSTS: | | | | | |
| A | ESP DEMOLITION | | | | | $ 832,300 |
| B | REMOVE BOOSTER AIR FANS | | | | | $ 111,000 |

Sargent & Lundy, LLC

AEP
BIG SANDY UNIT 2
FGD PROJECT - NID BASE EST (N/ESP)-1B - 3.0 LB/MM BTU
COST ESTIMATE SUMMARY

| | |
|---|---|
| Estimate No.: | 30727C |
| Project No.: | 12721-000 |
| Date: | 9/29/2010 |
| Preparer: | MNO |
| Reviewer: | JMK |
| Approver: | PEF |

| Account No. | Item Description | Scope Definition | Total Equipment Cost | Total Material Cost | Total Construction & Erection Cost | Total Projected Cost |
|---|---|---|---|---|---|---|
| C | REMOVAL OF FUEL OIL TANK | | $ 1,200,000 | $ 80,000 | $ 469,400 | $ 1,749,400 |

# EXHIBIT 1-7
# O&M Cost Estimate Summary

## Exhibit 1-7. O&M Cost Estimate Summary (2010 dollars)

| Fuel | WFGD | | | | DFGD | | | |
|---|---|---|---|---|---|---|---|---|
| | 1.7 | 3.0 | 4.5 | 7.5 | 1.7 w/o ESP | 3.0 w/o ESP | 1.7 w/ ESP | 3.0 w/ ESP |
| **Fixed O&M ($/year)** | | | | | | | | |
| Operating Labor | 1,248,000 | 1,248,000 | 1,248,000 | 1,248,000 | 832,000 | 832,000 | 832,000 | 832,000 |
| Maintenance Material | 2,412,000 | 2,590,000 | 2,763,000 | 2,950,000 | 2,076,000 | 2,136,000 | 2,076,000 | 2,136,000 |
| Maintenance Labor | 1,608,000 | 1,727,000 | 1,842,000 | 1,967,000 | 1,384,000 | 1,424,000 | 1,384,000 | 1,424,000 |
| **Total Fixed O&M ($/year)** | **5,268,000** | **5,565,000** | **5,853,000** | **6,165,000** | **4,292,000** | **4,392,000** | **4,292,000** | **4,392,000** |
| **Variable O&M ($/year)** | | | | | | | | |
| Reagent Cost | 2,534,000 | 4,729,000 | 6,618,000 | 9,940,000 | 8,601,000 | 19,605,000 | 9,924,000 | 23,281,000 |
| Activated Carbon | NA | NA | NA | NA | 2,344,000 | 2,319,000 | 2,267,000 | 2,243,000 |
| FGD Byproduct Disposal Cost | 1,290,000 | 2,528,000 | 3,604,000 | 5,408,000 | 4,148,000 | 5,612,000 | 1,793,000 | 3,817,000 |
| Makeup Water Cost | 685,000 | 650,000 | 618,000 | 626,000 | 509,000 | 521,000 | 464,000 | 482,000 |
| Wastewater Treatment Chemicals | 299,000 | 169,000 | 31,000 | 12,000 | NA | NA | NA | NA |
| Bags and Cages Replacement | NA | NA | NA | NA | 651,000 | 651,000 | 651,000 | 651,000 |
| **Total Variable O&M excluding Auxiliary Power ($/year)** | **4,808,000** | **8,076,000** | **10,871,000** | **15,986,000** | **16,253,000** | **28,708,000** | **15,099,000** | **30,474,000** |
| **Auxiliary Power at Full Load (MW)** | | | | | | | | |
| Overall Draft [in WC] | 26 [52] | 26 [52] | 26 [52] | 26 [52] | 23 [49] | 23 [49] | 17 [39] | 17 [39] |
| FGD Draft Only [in WC] | 8 [14] | 8 [15] | 9 [16] | 10 [17] | 8 [16] | 8 [16] | 8 [16] | 8 [16] |
| FGD Equipment Load | 7 | 10 | 11 | 18 | 4 | 5 | 4 | 5 |
| Existing Booster Fans | -10 | -10 | -10 | -10 | -10 | -10 | 0 | 0 |
| Existing ESP | 0 | 0 | 0 | 0 | -4 | -4 | 0 | 0 |
| WESP | 3 | 3 | 3 | 3 | NA | NA | NA | NA |
| **Total Auxiliary Power at Full Load (MW)** | **26** | **29** | **30** | **37** | **13** | **14** | **21** | **22** |

Note: NA = Not Applicable for the technology

## Exhibit 1-7. O&M Cost Estimate Summary (2010 dollars)

| Fuel | IAQCS (Phased – DFGD Only) | | IAQCS (Non-Phased – DFGD and WFGD) | | | |
|---|---|---|---|---|---|---|
| | 1.7 w/o ESP | 3.0 w/o ESP | 1.7 w/o ESP | 3.0 w/o ESP | 4.5 w/o ESP | 7.5 w/o ESP |
| **Fixed O&M ($/year)** | | | | | | |
| Operating Labor | 832,000 | 832,000 | 2,184,000 | 2,184,000 | 2,184,000 | 2,184,000 |
| Maintenance Material | 2,076,000 | 2,136,000 | 4,039,000 | 4,117,000 | 4,191,000 | 4,272,000 |
| Maintenance Labor | 1,384,000 | 1,424,000 | 2,693,000 | 2,744,000 | 2,795,000 | 2,849,000 |
| **Total Fixed O&M ($/year)** | **4,292,000** | **4,392,000** | **8,916,000** | **9,045,000** | **9,170,000** | **9,305,000** |
| **Variable O&M ($/year)** | | | | | | |
| Limestone Reagent Cost | NA | NA | 2,376,000 | 4,558,000 | 6,442,000 | 9,685,000 |
| Lime Reagent Cost | 8,601,000 | 19,605,000 | 661,000 | 1,225,000 | 1,713,000 | 2,574,000 |
| Activated Carbon | 2,344,000 | 2,319,000 | NA | NA | NA | NA |
| WFGD Byproduct Disposal Cost | NA | NA | 1,215,000 | 2,425,000 | 3,472,000 | 5,227,000 |
| DFGD Byproduct Disposal Cost | 4,148,000 | 5,612,000 | 2,732,000 | 2,553,000 | 2,426,000 | 2,670,000 |
| Total Makeup Water Cost | 509,000 | 521,000 | 746,000 | 752,000 | 763,000 | 780,000 |
| Wastewater Treatment Chemicals | NA | NA | NA | NA | NA | NA |
| Bags and Cages Replacement | 651,000 | 651,000 | 651,000 | 651,000 | 651,000 | 651,000 |
| **Total Variable O&M excluding Auxiliary Power ($/year)** | **16,253,000** | **28,708,000** | **8,381,000** | **12,164,000** | **15,467,000** | **21,587,000** |
| **Auxiliary Power at Full Load (MW)** | | | | | | |
| Overall Draft [in WC] | 23 [49] | 23 [49] | 29 [66] | 29 [66] | 29 [66] | 29 [66] |
| FGD Draft Only [in WC] | 8 [16] | 8 [16] | 14 [28] | 14 [29] | 15 [30] | 16 [31] |
| FGD Equipment Load | 4 | 5 | 11 | 15 | 17 | 24 |
| Existing Booster Fans | -10 | -10 | -10 | -10 | -10 | -10 |
| Existing ESP | -4 | -4 | -4 | -4 | -4 | -4 |
| WESP | NA | NA | NA | NA | NA | NA |
| **Total Auxiliary Power at Full Load (MW)** | **13** | **14** | **26** | **30** | **32** | **39** |

Note: NA = Not Applicable for the technology

## Exhibit 1-7. O&M Cost Estimate Summary (2010 dollars)

| Fuel | IAQCS (Phased – DFGD Only) | | IAQCS (Non-Phased – DFGD and WFGD) | | | |
|---|---|---|---|---|---|---|
| | **1.7 w/ ESP** | **3.0 w/ ESP** | **1.7 w/ ESP** | **3.0 w/ ESP** | **4.5 w/ ESP** | **7.5 w/ ESP** |
| **Fixed O&M ($/year)** | | | | | | |
| Operating Labor | 832,000 | 832,000 | 2,184,000 | 2,184,000 | 2,184,000 | 2,184,000 |
| Maintenance Material | 2,076,000 | 2,136,000 | 4,039,000 | 4,117,000 | 4,191,000 | 4,272,000 |
| Maintenance Labor | 1,384,000 | 1,424,000 | 2,693,000 | 2,744,000 | 2,795,000 | 2,849,000 |
| **Total Fixed O&M ($/year)** | **4,292,000** | **4,392,000** | **8,916,000** | **9,045,000** | **9,170,000** | **9,305,000** |
| **Variable O&M ($/year)** | | | | | | |
| Limestone Reagent Cost | NA | NA | 2,376,000 | 4,558,000 | 6,442,000 | 9,685,000 |
| Lime Reagent Cost | 9,924,000 | 23,281,000 | 661,000 | 1,225,000 | 1,713,000 | 2,574,000 |
| Activated Carbon | 2,267,000 | 2,243,000 | NA | NA | NA | NA |
| WFGD Byproduct Disposal Cost | NA | NA | 1,216,000 | 2,426,000 | 3,472,000 | 5,228,000 |
| DFGD Byproduct Disposal Cost | 1,793,000 | 3,817,000 | 182,000 | 245,000 | 300,000 | 420,000 |
| Total Makeup Water Cost | 464,000 | 482,000 | 701,000 | 709,000 | 721,000 | 737,000 |
| Wastewater Treatment Chemicals | NA | NA | NA | NA | NA | NA |
| Bags and Cages Replacement | 651,000 | 651,000 | 651,000 | 651,000 | 651,000 | 651,000 |
| **Total Variable O&M excluding Auxiliary Power ($/year)** | **15,099,000** | **30,474,000** | **5,787,000** | **9,814,000** | **13,299,000** | **19,295,000** |
| **Auxiliary Power at Full Load (MW)** | | | | | | |
| Overall Draft [in WC] | 17 [39] | 17 [39] | 24 [54] | 24 [54] | 24 [54] | 24 [54] |
| FGD Draft Only [in WC] | 8 [16] | 8 [16] | 14 [28] | 14 [29] | 15 [30] | 16 [31] |
| FGD Equipment Load | 4 | 5 | 11 | 15 | 17 | 24 |
| Existing Booster Fans | 0 | 0 | 0 | 0 | 0 | 0 |
| Existing ESP | 0 | 0 | 0 | 0 | 0 | 0 |
| WESP | NA | NA | NA | NA | NA | NA |
| **Total Auxiliary Power at Full Load (MW)** | **21** | **22** | **35** | **39** | **41** | **48** |

Note: NA = Not Applicable for the technology

## Exhibit 1-7. O&M Cost Estimate Summary (2010 dollars)

| Fuel | NID | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **1.7 w/o ESP** | **3.0 w/o ESP** | **4.5 w/o ESP** | **7.5 w/o ESP** | **1.7 w/ ESP** | **3.0 w/ ESP** | **4.5 w/ ESP** | **7.5 w/ ESP** |
| **Fixed O&M ($/year)** | | | | | | | | |
| Operating Labor | 1,040,000 | 1,040,000 | 1,040,000 | 1,040,000 | 1,040,000 | 1,040,000 | 1,040,000 | 1,040,000 |
| Maintenance Material | 2,284,000 | 2,350,000 | 2,416,000 | 2,548,000 | 2,284,000 | 2,350,000 | 2,416,000 | 2,548,000 |
| Maintenance Labor | 1,522,000 | 1,566,000 | 1,610,000 | 1,698,000 | 1,522,000 | 1,566,000 | 1,610,000 | 1,698,000 |
| **Total Fixed O&M ($/year)** | **4,846,000** | **4,956,000** | **5,066,000** | **5,286,000** | **4,846,000** | **4,956,000** | **5,066,000** | **5,286,000** |
| **Variable O&M ($/year)** | | | | | | | | |
| Reagent Cost | 10,189,000 | 20,462,000 | 30,160,000 | 44,782,000 | 10,189,000 | 20,462,000 | 30,160,000 | 44,782,000 |
| Activated Carbon | 2,344,000 | 2,319,000 | 2,315,000 | 2,293,000 | 2,267,000 | 2,243,000 | 2,239,000 | 2,218,000 |
| FGD Byproduct Disposal Cost | 4,393,000 | 5,860,000 | 7,246,000 | 9,806,000 | 1,902,000 | 3,668,000 | 5,290,000 | 7,806,000 |
| Makeup Water Cost | 523,000 | 533,000 | 550,000 | 572,000 | 517,000 | 530,000 | 547,000 | 570,000 |
| Wastewater Treatment Chemicals | NA | NA | NA | NA | NA | NA | NA | NA |
| Bags and Cages Replacement | 690,000 | 690,000 | 690,000 | 690,000 | 690,000 | 690,000 | 690,000 | 690,000 |
| **Total Variable O&M excluding Auxiliary Power ($/year)** | **18,139,000** | **29,864,000** | **40,961,000** | **58,143,000** | **15,565,000** | **27,593,000** | **38,926,000** | **56,066,000** |
| **Auxiliary Power at Full Load (MW)** | | | | | | | | |
| Overall Draft [in WC] | 23 [52] | 23 [52] | 23 [52] | 23 [52] | 17 [40] | 17 [40] | 17 [40] | 17 [40] |
| FGD Draft Only [in WC] | 10 [18] | 10 [18] | 10 [18] | 10 [18] | 10 [18] | 10 [18] | 10 [18] | 10 [18] |
| FGD Equipment Load | 4 | 5 | 6 | 6 | 4 | 5 | 6 | 6 |
| Existing Booster Fans | -10 | -10 | -10 | -10 | 0 | 0 | 0 | 0 |
| Existing ESP | -4 | -4 | -4 | -4 | 0 | 0 | 0 | 0 |
| WESP | NA | NA | NA | NA | NA | NA | NA | NA |
| **Total Auxiliary Power at Full Load (MW)** | **13** | **14** | **15** | **15** | **21** | **22** | **23** | **23** |

Note: NA = Not Applicable for the technology

# EXHIBIT 1-8
# WFGD Technology Comparison

# EXHIBIT 1-8
# WFGD TECHNOLOGY COMPARISON

| WFGD | | Estimate 2 1.7 lb $SO_2$/Mmbtu | Estimate 3 3.0 lb $SO_2$/Mmbtu | Base Estimate 1 4.5 lb $SO_2$/Mmbtu | Estimate 4 7.5 lb $SO_2$/Mmbtu | |
|---|---|---|---|---|---|---|
| Acct. No. | Item Description | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Remarks |
| 1.0 | ID FANS | $ 27,548,400 | $ 27,548,400 | $ 27,548,400 | $ 27,548,400 | |
| 2.0 | WET ESP | $ 109,090,400 | $ 109,090,400 | $ 109,090,400 | $ 109,090,400 | |
| 3.0 | NEW STACK | $ 36,202,000 | $ 36,202,000 | $ 36,202,000 | $ 36,202,000 | |
| 4.0 | LIMESTONE HANDLING SYSTEM | $ 29,852,800 | $ 29,852,800 | $ 29,852,800 | $ 29,852,800 | Limestone handling system costs are the same for all fuels because the equipment is assumed the same and operating durations will be adjusted as required. |
| 5.0 | REAGENT PREPARATION ISLAND | $ 43,096,600 | $ 47,065,400 | $ 50,223,100 | $ 53,587,300 | As fuel sulfur content increases more limestone is required and more byproduct is produced, therefore the reagent prep island costs and byproduct handling costs are increased |
| 6.0 | BYPRODUCT DEWATERING ISLAND | $ 37,301,700 | $ 40,230,400 | $ 42,731,600 | $ 45,506,500 | |
| 7.0 | ABSORBER ISLAND | $ 183,015,000 | $ 184,116,600 | $ 184,886,500 | $ 185,851,700 | As the fuel sulfur content increases the liquid-to-gas ratio increases thereby increasing the size of the recirculation system and slightly increasing the Absorber Island costs. |
| 8.0 | FGD WASTE WATER TREATMENT PLANT | $ 21,575,500 | $ 21,575,500 | $ 21,575,500 | $ 21,575,500 | |
| 9.0 | COMPRESSED AIR SYSTEM | $ 2,403,400 | $ 2,403,400 | $ 2,403,400 | $ 2,403,400 | |
| 10.0 | SERVICE WATER SYSTEM | $ 7,557,500 | $ 7,557,500 | $ 7,557,500 | $ 7,557,500 | |
| 11.0 | POTABLE WATER SYSTEM | $ 920,700 | $ 920,700 | $ 920,700 | $ 920,700 | |
| 12.0 | FGD SUBSTATION | $ 3,604,300 | $ 3,604,300 | $ 3,604,300 | $ 3,604,300 | |
| 13.0 | FGD DCS SYSTEM | $ 8,027,400 | $ 8,027,400 | $ 8,027,400 | $ 8,027,400 | |
| 14.0 | CEM SYSTEM | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | |
| 15.0 | RAIL INFRASTRUCTURE | $ 5,671,200 | $ 5,671,200 | $ 5,671,200 | $ 5,671,200 | |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | $ 21,730,200 | $ 21,730,200 | $ 21,730,200 | $ 21,730,200 | |
| 17.0 | BOP ITEMS | $ 5,601,700 | $ 5,601,700 | $ 5,601,700 | $ 5,601,700 | |
| 18.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $ 4,736,200 | $ 4,736,200 | $ 4,736,200 | $ 4,736,200 | |
| 19.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | $ 862,500 | $ 862,500 | $ 862,500 | $ 862,500 | |
| | | | | | | |
| 99.0 | PROJECT INDIRECT COSTS | | | | | |
| | ENGINEERING, PROCUREMENT, & PROJECT SERVICES | $ 30,000,000 | $ 30,000,000 | $ 30,000,000 | $ 30,000,000 | |
| | CONSTRUCTION MANAGEMENT | $ 16,536,700 | $ 16,773,300 | $ 16,969,600 | $ 17,182,700 | |
| | S-U / COMMISSIONING | $ 5,512,200 | $ 5,591,100 | $ 5,656,500 | $ 5,727,600 | |
| | CRAFT START-UP SUPPORT | $ 2,259,400 | $ 2,288,300 | $ 2,310,200 | $ 2,334,400 | |
| | INITIAL FILLS | $ 1,653,700 | $ 1,677,300 | $ 1,697,000 | $ 1,718,300 | |
| | OPERATOR & TRAINING MANUALS | $ 300,000 | $ 300,000 | $ 300,000 | $ 300,000 | |

# EXHIBIT 1-8
# WFGD TECHNOLOGY COMPARISON

| WFGD | | Estimate 2 1.7 lb $SO_2$/Mmbtu | Estimate 3 3.0 lb $SO_2$/Mmbtu | Base Estimate 1 4.5 lb $SO_2$/Mmbtu | Estimate 4 7.5 lb $SO_2$/Mmbtu | |
|---|---|---|---|---|---|---|
| Acct. No. | Item Description | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Remarks |
| | SUBCONTRACTORS (NOISE & DUCTWORK CONSULTANT, GEOTECHNICAL INVESTIGATION) | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | |
| | NOISE ABATEMENT FOR 85 DBA REQUIREMENT | $ 2,650,000 | $ 2,650,000 | $ 2,650,000 | $ 2,650,000 | |
| | SUBTOTAL - INDIRECT COSTS | $ 59,312,000 | $ 59,680,000 | $ 59,983,300 | $ 60,313,000 | |
| | SUBTOTAL - CONTRACTOR'S G&A AND PROFIT | $ 45,876,600 | $ 46,179,735 | $ 46,590,180 | $ 46,950,825 | Subtotal of Contractor's G&A and Profit, which is included in accounts 1 through 19 above. |
| | SPARE PARTS | $ 2,203,700 | $ 2,266,800 | $ 2,322,300 | $ 2,379,600 | |
| | CONTINGENCY | $ 89,062,900 | $ 89,075,700 | $ 91,254,300 | $ 90,676,000 | |
| | ESCALATION | $ 76,508,800 | $ 77,651,000 | $ 78,606,500 | $ 79,631,900 | |
| | TOTAL PROJECT COST | $ 778,311,400 | $ 787,784,000 | $ 797,818,300 | $ 805,756,700 | |
| | | | | | | |
| | REFERENCE COSTS: | | | | | |
| A | REMOVE BOOSTER AIR FANS | $ 111,000 | $ 111,000 | $ 111,000 | $ 111,000 | |
| B | REMOVAL OF FUEL OIL TANK | $ 1,749,400 | $ 1,749,400 | $ 1,749,400 | $ 1,749,400 | |

# EXHIBIT 1-9
# DFGD Technology Comparison

# EXHIBIT 1-9
# DFGD TECHNOLOGY COMPARISON

| DFGD | | Estimate 1A ESP 3.0 lb $SO_2$/Mmbtu | Estimate 1B ESP 1.7 lb $SO_2$/Mmbtu | Estimate 2A N/ESP 3.0 lb $SO_2$/Mmbtu | Estimate 2B N/ESP 1.7 lb $SO_2$/Mmbtu | |
|---|---|---|---|---|---|---|
| Acct. No. | Item Description | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Remarks |
| 1.0 | ID FANS | $ 39,266,900 | $ 39,266,900 | $ 39,795,200 | $ 39,795,200 | The ID Fans without the ESP are larger (i.e. cost more) because they replace the existing Booster Fans. |
| 2.0 | FABRIC FILTERS | $ 50,644,800 | $ 50,854,400 | $ 51,406,500 | $ 51,747,900 | The Fabric Filter equipment costs are slightly larger at the lower coal sulfur levels because there is more actual flow rate i.e. there is more bag area in the same footprint. |
| 3.0 | NEW STACK | $ 22,252,500 | $ 22,252,500 | $ 22,252,500 | $ 22,252,500 | |
| 4.0 | LIME HANDLING SYSTEM | $ 20,516,100 | $ 14,705,000 | $ 19,102,600 | $ 14,270,500 | The lime consumption rate is almost double for 3.0 vs. 1.7 with ESP. There is also a difference in lime consumptions between ESP and No ESP. Without the ESP the approach to saturation temperature is reduced which improves the lime utilization thereby leading to slightly less lime consumption. The lime equipment (blowers etc.) is the same regardless. The main delta is the storage equipment (i.e. Storage silo) |
| 5.0 | LIME SLAKER BUILDING | $ 20,115,400 | $ 15,849,400 | $ 19,140,000 | $ 15,267,900 | The lime consumption rate is almost double for 3.0 vs. 1.7 with ESP. There is also a difference in lime consumptions between ESP and No ESP. Without the ESP the approach to saturation temperature is reduced which improves the lime utilization thereby leading to slightly less lime consumption. The lime equipment (blowers etc.) is the same regardless. The main delta is the storage equipment (i.e. Storage silo) |
| 6.0 | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | $ 19,469,700 | $ 18,728,800 | $ 15,622,000 | $ 14,548,500 | With the ESP in service additional Fly Ash equipment is required including a silo for blending the fly ash with the byproduct. The silo sizes with the ESP in service are significantly smaller than without the ESP. This results from the fly ash being removed prior the waste being sent to the silo. |
| 7.0 | ABSORBER ISLAND | $ 161,224,700 | $ 161,224,700 | $ 152,735,800 | $ 152,735,800 | The absorber itself is sized on the actual flue gas flow rates which are roughly equivalent. |
| 8.0 | ACTIVATED CARBON INJECTION SYSTEM | $ 6,317,900 | $ 6,317,900 | $ 6,317,900 | $ 6,317,900 | |
| 9.0 | COMPRESSED AIR SYSTEM | $ 4,434,100 | $ 4,434,100 | $ 4,434,100 | $ 4,434,100 | |
| 10.0 | SERVICE WATER SYSTEM | $ 4,497,800 | $ 4,497,800 | $ 4,497,800 | $ 4,497,800 | |
| 11.0 | POTABLE WATER SYSTEM | $ 1,166,000 | $ 1,166,000 | $ 1,166,000 | $ 1,166,000 | |
| 12.0 | FGD SUBSTATION | $ 9,387,700 | $ 9,387,700 | $ 9,497,300 | $ 9,497,300 | |
| 13.0 | FGD DCS SYSTEM | $ 6,120,400 | $ 6,120,400 | $ 6,120,400 | $ 6,120,400 | |
| 14.0 | CEM SYSTEM | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | |
| 15.0 | TRUCK & RAIL INFRASTRUCTURE | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | $ 15,617,200 | $ 15,617,200 | $ 15,617,200 | $ 15,617,200 | |
| 17.0 | BOP ITEMS | $ 4,263,600 | $ 4,263,600 | $ 4,263,600 | $ 4,263,600 | |
| 18.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $ 4,670,200 | $ 4,670,200 | $ 4,670,200 | $ 4,670,200 | |
| 19.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | $ 862,500 | $ 862,500 | $ 862,500 | $ 862,500 | |

# EXHIBIT 1-9
# DFGD TECHNOLOGY COMPARISON

| DFGD | | Estimate 1A ESP 3.0 lb $SO_2$/Mmbtu | Estimate 1B ESP 1.7 lb $SO_2$/Mmbtu | Estimate 2A N/ESP 3.0 lb $SO_2$/Mmbtu | Estimate 2B N/ESP 1.7 lb $SO_2$/Mmbtu | |
|---|---|---|---|---|---|---|
| Acct. No. | Item Description | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Remarks |
| 99.0 | PROJECT INDIRECT COSTS | | | | | |
| | ENGINEERING, PROCUREMENT, & PROJECT SERVICES | $ 25,000,000 | $ 25,000,000 | $ 25,000,000 | $ 25,000,000 | |
| | CONSTRUCTION MANAGEMENT | $ 11,963,800 | $ 11,648,900 | $ 11,567,400 | $ 11,284,300 | |
| | S-U / COMMISSIONING | $ 3,987,900 | $ 3,883,000 | $ 3,855,800 | $ 3,761,400 | |
| | CRAFT START-UP SUPPORT | $ 1,647,500 | $ 1,625,300 | $ 1,581,200 | $ 1,561,800 | |
| | INITIAL FILLS | $ 1,196,400 | $ 1,164,900 | $ 1,156,700 | $ 1,128,400 | |
| | OPERATOR & TRAINING MANUALS | $ 300,000 | $ 300,000 | $ 300,000 | $ 300,000 | |
| | SUBCONTRACTORS (NOISE & DUCTWORK CONSULTANT, GEOTECHNICAL INVESTIGATION) | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | |
| | NOISE ABATEMENT FOR 85 DBA REQUIREMENT | $ 2,750,000 | $ 2,750,000 | $ 2,750,000 | $ 2,750,000 | |
| | SUBTOTAL - INDIRECT COSTS | $ 47,245,600 | $ 46,772,100 | $ 46,611,100 | $ 46,185,900 | |
| | SUBTOTAL - CONTRACTOR'S G&A AND PROFIT | $ 31,518,180 | $ 30,355,500 | $ 31,282,470 | $ 30,056,325 | Subtotal of Contractor's G&A and Profit, which is included in accounts 1 through 19 above. |
| | SPARE PARTS: | $ 1,811,700 | $ 1,699,800 | $ 1,780,600 | $ 1,679,600 | |
| | CONTINGENCY | $ 66,341,200 | $ 65,104,400 | $ 63,953,800 | $ 63,192,400 | |
| | ESCALATION | $ 56,364,359 | $ 55,362,000 | $ 54,885,900 | $ 53,852,622 | |
| | TOTAL PROJECT COST | $ 570,556,459 | $ 557,236,000 | $ 552,811,800 | $ 541,054,622 | |
| | | | | | | |
| | REFERENCE COSTS: | | | | | |
| A | ESP DEMOLITION | $ 1,749,400 | $ 1,749,400 | $ 832,300 | $ 832,300 | |
| B | REMOVE BOOSTER AIR FANS | | | $ 111,000 | $ 111,000 | |
| C | REMOVAL OF FUEL OIL TANK | | | $ 1,749,400 | $ 1,749,400 | |

# EXHIBIT 1-10
# IAQCS Technology Comparison

# EXHIBIT 1-10
# IAQCS - NON PHASED TECHNOLOGY COMPARISON

| IAQCS - NON PHASED | | Estimate 1A ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4A ESP 7.5 lb $SO_2$/Mmbtu | Estimate 1B N/ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4B N/ESP 7.5 lb $SO_2$/Mmbtu | |
|---|---|---|---|---|---|---|
| Acct. No. | Item Description | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Remarks |
| 1.0 | ID FANS | $ 65,527,000 | $ 65,527,000 | $ 66,973,700 | $ 66,973,700 | The ID Fans without the ESP are larger (i.e. cost more) because they replace the existing Booster Fans. |
| 2.0 | FABRIC FILTERS | $ 50,619,200 | $ 50,409,500 | $ 51,427,200 | $ 51,172,300 | The Fabric Filter equipment costs are slightly larger at the lower coal sulfur levels because there is more actual flow rate i.e. there is more bag area in the same footprint. |
| 3.0 | NEW STACK | $ 36,202,000 | $ 36,202,000 | $ 36,202,000 | $ 36,202,000 | |
| 4.0 | LIME HANDLING SYSTEM | $ 11,540,400 | $ 11,973,300 | $ 11,540,400 | $ 11,973,300 | The lime consumption rate is almost double for 3.0 vs. 1.7 with ESP. There is also a difference in lime consumptions between ESP and No ESP. Without the ESP the approach to saturation temperature is reduced which improves the lime utilization thereby leading to slightly less lime consumption. The lime equipment (blowers etc.) is the same regardless. The main delta is the storage equipment (i.e. Storage silo) |
| 5.0 | LIME SLAKER BUILDING | $ 10,626,700 | $ 11,889,300 | $ 10,626,700 | $ 11,889,300 | The lime consumption rate is almost double for 3.0 vs. 1.7 with ESP. There is also a difference in lime consumptions between ESP and No ESP. Without the ESP the approach to saturation temperature is reduced which improves the lime utilization thereby leading to slightly less lime consumption. The lime equipment (blowers etc.) is the same regardless. The main delta is the storage equipment (i.e. Storage silo) |
| 6.0 | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | | $ 16,637,200 | $ 12,269,500 | $ 12,295,200 | With the ESP in service additional Fly Ash equipment is required including a silo for blending the fly ash with the byproduct. The silo sizes with the ESP in service are significantly smaller than without the ESP. This results from the fly ash being removed prior the waste being sent to the silo. |
| 7.0 | SPRAY DRYER ABSORBER ISLAND | $ 135,935,200 | $ 135,935,200 | $ 127,446,400 | $ 127,446,400 | The absorber itself is sized on the actual flue gas flow rates which are roughly equivalent. |
| 8.0 | ACTIVATED CARBON INJECTION SYSTEM | $ - | $ - | $ - | $ - | |
| 9.0 | COMPRESSED AIR SYSTEM | $ 6,814,300 | $ 6,814,300 | $ 6,814,300 | $ 6,814,300 | |
| 10.0 | SERVICE WATER SYSTEM | $ 10,634,300 | $ 10,634,300 | $ 10,634,300 | $ 10,634,300 | |
| 11.0 | POTABLE WATER SYSTEM | $ 1,491,600 | $ 1,491,600 | $ 1,491,600 | $ 1,491,600 | |
| 12.0 | FGD SUBSTATION | $ 10,319,400 | $ 10,319,400 | $ 10,626,200 | $ 10,626,200 | |
| 13.0 | FGD DCS SYSTEM | $ 13,127,500 | $ 13,127,500 | $ 13,127,500 | $ 13,127,500 | |
| 14.0 | CEM SYSTEM | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | |
| 15.0 | TRUCK & RAIL INFRASTRUCTURE | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK (DFGD + WFGD AREAS) | $ 25,128,900 | $ 25,128,900 | $ 25,128,900 | $ 25,128,900 | |
| 17.0 | LIMESTONE HANDLING SYSTEM | $ 28,746,000 | $ 28,746,000 | $ 28,746,000 | $ 28,746,000 | Limestone handling system costs are the same for all fuels because the equipment is assumed the same and operating |
| 18.0 | REAGENT (LIMESTONE) PREPARATION ISLAND | $ 50,233,500 | $ 53,610,500 | $ 50,233,500 | $ 53,610,500 | As fuel sulfur content increases more limestone is required and more byproduct is produced, therefore the reagent prep island costs and byproduct handling costs are increased |
| 19.0 | BYPRODUCT DEWATERING ISLAND (INCLUDES REMOTE GYPSUM HANDLING AREA) | $ 77,538,200 | $ 80,304,800 | $ 77,538,200 | $ 80,304,800 | |
| 20.0 | WET FGD ABSORBER ISLAND | $ 159,503,500 | $ 160,469,200 | $ 159,503,500 | $ 160,469,200 | As the fuel sulfur content increases the liquid-to-gas ratio increases thereby increasing the size of the recirculation system and slightly increasing the Absorber Island costs. |
| 21.0 | COMPRESSED AIR SYSTEM (BYPRODUCT DEWATERING AREA) | $ 1,626,900 | $ 1,626,900 | $ 1,626,900 | $ 1,626,900 | |
| 22.0 | POTABLE WATER SYSTEM | $ - | $ - | $ - | $ - | |

# EXHIBIT 1-10
# IAQCS - NON PHASED TECHNOLOGY COMPARISON

| IAQCS - NON PHASED | | Estimate 1A ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4A ESP 7.5 lb $SO_2$/Mmbtu | Estimate 1B N/ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4B N/ESP 7.5 lb $SO_2$/Mmbtu | |
|---|---|---|---|---|---|---|
| Acct. No. | Item Description | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Remarks |
| 23.0 | SCR SUBSTATION UPGRADE | $ 2,749,200 | $ 2,749,200 | $ 2,749,200 | $ 2,749,200 | |
| 24.0 | FGD DCS SYSTEM | | | | | |
| 25.0 | SITE IMPROVEMENTS - CIVIL WORK | $ - | $ - | $ - | $ - | |
| 26.0 | BOP ITEMS | $ 9,158,400 | $ 9,158,400 | $ 9,158,400 | $ 9,158,400 | |
| 27.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $ 5,542,100 | $ 5,542,100 | $ 5,542,100 | $ 5,542,100 | |
| 28.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | $ 862,500 | $ 862,500 | $ 862,500 | $ 862,500 | |
| | | | | | | |
| 99.0 | INDIRECT COSTS | | | | | |
| | ENGINEERING, | $ 45,000,000 | $ 45,000,000 | $ 45,000,000 | $ 45,000,000 | |
| | CONSTRUCTION | $ 22,157,100 | $ 22,417,100 | $ 21,850,400 | $ 22,107,700 | |
| | S-U / COMMISSIONING | $ 7,385,700 | $ 7,472,400 | $ 7,283,500 | $ 7,369,200 | |
| | CRAFT START-UP SUPPORT | $ 3,177,400 | $ 3,207,500 | $ 3,117,400 | $ 3,147,300 | |
| | INITIAL FILLS | $ 2,215,700 | $ 2,241,700 | $ 2,185,000 | $ 2,210,800 | |
| | OPERATOR & TRAINING | $ 600,000 | $ 600,000 | $ 600,000 | $ 600,000 | |
| | SUBCONTRACTORS (NOISE & | $ 500,000 | $ 500,000 | $ 750,000 | $ 750,000 | |
| | NOISE ABATEMENT FOR 85 | $ 4,500,000 | $ 4,500,000 | $ 4,500,000 | $ 4,500,000 | |
| | SUBTOTAL - INDIRECT COSTS | $ 85,535,900 | $ 85,938,700 | $ 85,286,300 | $ 85,685,000 | |
| | SUBTOTAL - CONTRACTOR'S G&A AND PROFIT | | | | | Subtotal of Contractor's G&A and Profit, which is included in accounts 1 through 28 above. |
| | SPARE PARTS | $ 2,957,500 | $ 3,027,200 | $ 2,957,700 | $ 3,026,900 | |
| | CONTINGENCY | $ 115,966,200 | $ 116,497,100 | $ 113,200,600 | $ 115,259,100 | |
| | ESCALATION | $ 102,500,800 | $ 103,730,600 | $ 101,295,000 | $ 102,512,500 | |
| | TOTAL PROJECT COST | $ 1,045,532,000 | $ 1,056,431,500 | $ 1,031,087,300 | $ 1,043,406,900 | |
| | | | | | | |
| | REFERENCE COSTS: | | | | | |
| A | ESP DEMOLITION | | | $ 832,300 | $ 832,300 | |
| B | REMOVE BOOSTER AIR FANS | | | $ 111,000 | $ 111,000 | |
| C | REMOVAL OF FUEL OIL TANK | $ 1,749,400 | $ 1,749,400 | $ 1,749,400 | $ 1,749,400 | |

# EXHIBIT 1-11
# NID Technology Comparison

# EXHIBIT 1-11
# NID
# TECHNOLOGY COMPARISON

| NID | | Estimate 2A ESP 1.7 lb $SO_2$/Mmbtu | Estimate 1A ESP 3.0 lb $SO_2$/Mmbtu | Estimate 3A ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4A ESP 7.5 lb $SO_2$/Mmbtu | Estimate 2B N/ESP 1.7 lb $SO_2$/Mmbtu | Estimate 1B N/ESP 3.0 lb $SO_2$/Mmbtu | Estimate 3B N/ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4B N/ESP 7.5 lb $SO_2$/Mmbtu | |
|---|---|---|---|---|---|---|---|---|---|---|
| Acct. No. | Item Description | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Remarks |
| 1.0 | ID FANS | $ 60,012,400 | $ 60,012,400 | $ 60,012,400 | $ 60,012,400 | $ 60,785,900 | $ 60,785,900 | $ 60,785,900 | $ 60,785,900 | The ID Fans without the ESP are larger (i.e. cost more) because they replace the existing Booster Fans. The main difference in ID Fan account cost between the DFGD and NID is due to GA differences and the allocation of electrical equipment to particular areas. |
| 2.0 | NID MODULES | $ 158,198,600 | $ 159,363,000 | $ 166,153,900 | $ 196,128,800 | $ 151,332,800 | $ 152,612,000 | $ 158,505,300 | $ 189,835,500 | NID Module costs increase with sulpher based on larger mixers and hydraters until the 7.5lb coal at which point two additional modules are required. The ductwork costs for ESP Out are less as a result of shorter ductwork lengths. There is a closer tie-in location. |
| 3.0 | NEW STACK | $ 22,252,500 | $ 22,252,500 | $ 22,252,500 | $ 22,252,500 | $ 22,252,500 | $ 22,252,500 | $ 22,252,500 | $ 22,252,500 | |
| 4.0 | LIME HANDLING SYSTEM | $ 21,292,500 | $ 26,279,300 | $ 33,056,800 | $ 40,325,500 | $ 21,292,500 | $ 26,279,300 | $ 33,056,800 | $ 40,325,500 | As fuel sulfur levels increase more lime is required therefore the lime handling system costs are |
| 5.0 | LIME SLAKER BUILDING | | | | | | | | | |
| 6.0 | BYPRODUCT WASTE & FLY ASH HANDLING SYSTEMS | $ 14,407,200 | $ 16,263,300 | $ 16,620,800 | $ 18,679,400 | $ 11,034,200 | $ 12,684,900 | $ 13,257,300 | $ 15,399,900 | With the ESP in service fly ash must be pulled from a cell for blending with FGD byproduct. Significant additional equipment and a silo will be added for fly ash blending. In fact even though the byproduct quantities are increased in the no ESP case, the costs for the ESP options are higher due to this equipment addition.The silo sizes with the ESP in service are significantly smaller than without the ESP. This is a result of the fly ash being removed in the ESP prior to the FF. |
| 7.0 | ABSORBER ISLAND | | | | | | | | | |
| 8.0 | ACTIVATED CARBON INJECTION SYSTEM | $ 6,317,900 | $ 6,317,900 | $ 6,317,900 | $ 6,317,900 | $ 6,317,900 | $ 6,317,900 | $ 6,317,900 | $ 6,317,900 | |
| 9.0 | COMPRESSED AIR SYSTEM | $ 4,933,200 | $ 4,933,200 | $ 4,933,200 | $ 4,933,200 | $ 4,933,200 | $ 4,933,200 | $ 4,933,200 | $ 4,933,200 | |
| 10.0 | SERVICE WATER SYSTEM | $ 3,677,800 | $ 3,677,800 | $ 3,677,800 | $ 3,677,800 | $ 3,677,800 | $ 3,677,800 | $ 3,677,800 | $ 3,677,800 | |
| 11.0 | POTABLE WATER SYSTEM | $ 1,030,700 | $ 1,030,700 | $ 1,030,700 | $ 1,030,700 | $ 1,030,700 | $ 1,030,700 | $ 1,030,700 | $ 1,030,700 | |
| 12.0 | FGD SUBSTATION | $ 9,398,300 | $ 9,398,300 | $ 9,398,300 | $ 9,398,300 | $ 9,508,000 | $ 9,508,000 | $ 9,508,000 | $ 9,508,000 | Larger auxiliary transformers are required for the ESP Out case due to the ID Fan's increase in size. A larger switchgear is required for the ESP in case due to the increased number of required feeder breakers to accommodate the relocated feeds to the existing booster fans. The net difference results in a higher ESP out cost. |

# EXHIBIT 1-11
# NID
# TECHNOLOGY COMPARISON

| NID | | Estimate 2A ESP 1.7 lb $SO_2$/Mmbtu | Estimate 1A ESP 3.0 lb $SO_2$/Mmbtu | Estimate 3A ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4A ESP 7.5 lb $SO_2$/Mmbtu | Estimate 2B N/ESP 1.7 lb $SO_2$/Mmbtu | Estimate 1B N/ESP 3.0 lb $SO_2$/Mmbtu | Estimate 3B N/ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4B N/ESP 7.5 lb $SO_2$/Mmbtu | |
|---|---|---|---|---|---|---|---|---|---|---|
| Acct. No. | Item Description | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Remarks |
| 13.0 | FGD DCS SYSTEM | | | | | | | | | |
| 14.0 | CEM SYSTEM | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | $ 2,426,500 | |
| 15.0 | TRUCK & RAIL INFRASTRUCTURE | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | $ 5,652,300 | |
| 16.0 | SITE IMPROVEMENTS - CIVIL WORK | $ 16,119,700 | $ 16,119,700 | $ 16,119,700 | $ 16,119,700 | $ 16,119,700 | $ 16,119,700 | $ 16,119,700 | $ 16,119,700 | |
| 17.0 | BOP ITEMS | $ 4,273,900 | $ 4,273,900 | $ 4,273,900 | $ 4,350,800 | $ 4,273,900 | $ 4,273,900 | $ 4,273,900 | $ 4,350,800 | |
| 18.0 | CAPITAL REPLACEMENTS - REMOVAL AND RELOCATION OF EXISTING EQUIPMENT AND INFRASTRUCTURE | $ 4,670,200 | $ 4,670,200 | $ 4,670,200 | $ 4,670,200 | $ 4,670,200 | $ 4,670,200 | $ 4,670,200 | $ 4,670,200 | |
| 19.0 | ARSENIC, ASBESTOS , LEAD ABATEMENT | $ 862,500 | $ 862,500 | $ 862,500 | $ 862,500 | $ 862,500 | $ 862,500 | $ 862,500 | $ 862,500 | |
| | | | | | | | | | | |
| 99.0 | OVERALL PROJECT INDIRECT COSTS | | | | | | | | | |
| | ENGINEERING, PROCUREMENT, & PROJECT SERVICES | $ 25,000,000 | $ 25,000,000 | $ 25,000,000 | $ 25,000,000 | $ 25,000,000 | $ 25,000,000 | $ 25,000,000 | $ 25,000,000 | |
| | CONSTRUCTION MANAGEMENT | $ 10,244,000 | $ 10,484,200 | $ 10,902,000 | $ 12,083,400 | $ 9,963,300 | $ 10,200,800 | $ 10,598,100 | $ 11,822,700 | |
| | S-U / COMMISSIONING | $ 3,414,700 | $ 3,494,700 | $ 3,634,000 | $ 4,027,800 | $ 3,321,100 | $ 3,400,300 | $ 3,532,700 | $ 3,940,900 | |
| | CRAFT START-UP SUPPORT | $ 1,417,000 | $ 1,431,100 | $ 1,472,400 | $ 1,614,200 | $ 1,361,300 | $ 1,374,500 | $ 1,407,900 | $ 1,560,400 | |
| | INITIAL FILLS | $ 1,024,400 | $ 1,048,400 | $ 1,090,200 | $ 1,208,300 | $ 996,300 | $ 1,020,100 | $ 1,059,800 | $ 1,182,300 | |
| | OPERATOR & TRAINING MANUALS | $ 300,000 | $ 300,000 | $ 300,000 | $ 300,000 | $ 300,000 | $ 300,000 | $ 300,000 | $ 300,000 | |
| | SUBCONTRACTORS (NOISE & DUCTWORK CONSULTANT, GEOTECHNICAL INVESTIGATION) | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | |
| | NOISE ABATEMENT FOR 85 DBA REQUIREMENT | $ 2,600,000 | $ 2,600,000 | $ 2,600,000 | $ 2,600,000 | $ 2,600,000 | $ 2,600,000 | $ 2,600,000 | $ 2,600,000 | |
| | SUBTOTAL - INDIRECT COSTS | $ 44,400,100 | $ 44,758,400 | $ 45,398,600 | $ 47,233,700 | $ 43,942,000 | $ 44,295,700 | $ 44,898,500 | $ 46,806,300 | |
| | SUBTOTAL - CONTRACTOR'S G&A AND PROFIT | $ 28,358,895 | $ 28,565,520 | $ 29,122,080 | $ 31,110,540 | $ 27,213,315 | $ 27,408,015 | $ 27,866,310 | $ 29,997,600 | |
| | SPARE PARTS: | $ 1,409,400 | $ 1,501,700 | $ 1,633,500 | $ 1,953,300 | $ 1,419,200 | $ 1,511,500 | $ 1,647,500 | $ 1,969,400 | |
| | CONTINGENCY | $ 54,896,800 | $ 55,898,200 | $ 57,769,600 | $ 63,352,700 | $ 53,792,000 | $ 55,124,800 | $ 56,319,300 | $ 62,612,800 | |
| | ESCALATION | $ 48,570,900 | $ 49,816,200 | $ 51,924,700 | $ 57,746,800 | $ 47,501,200 | $ 48,734,300 | $ 50,762,200 | $ 56,776,800 | |

# EXHIBIT 1-11
# NID
# TECHNOLOGY COMPARISON

| NID | | Estimate 2A ESP 1.7 lb $SO_2$/Mmbtu | Estimate 1A ESP 3.0 lb $SO_2$/Mmbtu | Estimate 3A ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4A ESP 7.5 lb $SO_2$/Mmbtu | Estimate 2B N/ESP 1.7 lb $SO_2$/Mmbtu | Estimate 1B N/ESP 3.0 lb $SO_2$/Mmbtu | Estimate 3B N/ESP 4.5 lb $SO_2$/Mmbtu | Estimate 4B N/ESP 7.5 lb $SO_2$/Mmbtu | |
|---|---|---|---|---|---|---|---|---|---|---|
| Acct. No. | Item Description | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Total Projected Cost | Remarks |
| | TOTAL PROJECT COST | $ 490,743,400 | $ 501,447,900 | $ 520,125,700 | $ 573,065,000 | $ 478,765,000 | $ 489,693,500 | $ 506,897,900 | $ 562,254,200 | |
| | | | | | | | | | | |
| | REFERENCE COSTS: | | | | | | | | | |
| A | ESP DEMOLITION | $ 1,749,400 | $ 1,749,400 | $ 1,749,400 | $ 1,749,400 | $ 832,300 | $ 832,300 | $ 832,300 | $ 832,300 | |
| B | REMOVE BOOSTER AIR FANS | | | | | $ 111,000 | $ 111,000 | $ 111,000 | $ 111,000 | |
| C | REMOVAL OF FUEL OIL TANK | | | | | $ 1,749,400 | $ 1,749,400 | $ 1,749,400 | $ 1,749,400 | |