PARSONS E&C

Big Sandy Plant, Unit 2 WFGD Project PHASE I REPORT Engineering Services

Report No. AEBS-2-LI-012-0001, Rev. 0

presented to

AEP

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Executive Summary

Parsons E& C was chosen by the American Electric Power Services Corporation (AEPSC) to assist in their efforts to retrofit a Wet Flue Gas Desulfurization System at the Kentucky Power Company's Big Sandy Plant, Coal Fired Electric Generating Unit 2.

The overall project will consist of several different phases as defined below:

- Phase I – Conceptual Engineering and Planning
- Phase II – Scope Definition and Project Planning
- Phase III – Project Execution

These are further defined in AEPSC's Specification PE-BS12-TS-0001.

This report has been prepared at the conclusion of Phase I activity to document the work performed. The work elements developed comprise of the following:

- Conceptual Plot Plans (various alternatives including recommended preliminary layout)
- Conceptual System Descriptions
- Conceptual General Arrangements
- Conceptual Onelines
- Conceptual Process Flow Diagrams and Material Balances
- Proposal for Phase IIa (submitted separately)
- Listing of Outstanding Issues and Studies to be resolved / performed during Phase IIa
- Incremental issues associated with the addition of an SCR on Unit 1
- Incremental issues associated with Unit 1 being added to the Unit 2 absorber (two units into one vessel).
- Phase IIa Conceptual Schedule

Throughout this project, we will continuously review all decisions by measuring them based on their effects on safety, reliability, schedule, and cost.

Since Parsons E&C is currently providing similar services for the Mitchell Plant WFGD System, the AEPSC and Parsons E&C Tier II team has been capitalizing on the experience gained from that effort and will continue to build upon it. Many studies and evaluations were performed and we will build upon acquired knowledge as we move forward on this project. Where site-specific issues are concerned, these will be considered and tailored to the project.

In an effort to mitigate the risks that could potentially impede successful completion of the project, the AEPSC and Parsons E&C Tier II team has identified many actions that need to be addressed in the next Phase of the project. A complete listing of these major open issues is included in Section 6. These issues will be addressed during the early part of the next phase and be scheduled logically to sequence activities that ensure a complete, integrated plan as depicted below.

Following is a partial list of the major Phase IIa studies/evaluations to be completed:

- Boiler upgrade engineering scope definition to be included in Parsons E&C's scope of work
- Determination of limestone delivery methodology to be implemented at the plant
- Gypsum disposal options
- Service water source determination and treatment method
- System blowdown options and determination of proper treatment method(s)
- Permitting support for various recent options related to dust generation from trucks and materials handling

- Fixing the stack location once an FGD OEM supplier is determined
- Potential examination of applying an emissions control technology to Big Sandy Unit 1.

2.1 Characteristics of Existing Unit

Big Sandy Unit #2 is a pulverized coal wall fired unit with a dry bottom pressurized boiler. The nominal unit rating, prior to FGD conversion, is 865 MW gross and 800 MW net. The full load firing rate is 8,180 MM Btu/hr and the minimum load firing rate is 3,017 MM Btu/hr. The unit has a Ljungstrom Rotary Tri-Sector air heater, a cold electrostatic precipitator (ESP), and low NO_x burners. Ignition fuel is #2 oil. The unit has been retrofitted with an SCR for additional NO_x control. Booster fans were added as part of the SCR installation. It will be necessary to lower SO_2 emissions to meet the requirements of the AEPSC Fleet SO_2 Compliance Plan.

2.2 Proposed Sulfur Emissions Control

The proposed method to lower SO_2 emissions at Big Sandy Unit #2 is to retrofit a Wet Flue Gas Desulfurization (WFGD) system that will allow burning of Northern Appalachian Basin or Illinois Basin high sulfur coals with a sulfur content of up to 4.5 lb SO_2/MM Btu. The WFGD system will be designed to have an SO_2 removal efficiency of 98% and will utilize 92% active calcium carbonate limestone to produce wallboard grade gypsum.

2.3 Scope of Work

The scope of work includes Phase I conceptual engineering and design for retrofit of a WFGD system at Big Sandy Unit # 2 as part of the AEPSC Fleet SO_2 Compliance Plan.. The overall scope is divided into two packages: the current work package and the follow on work proposal package. The deliverables associated with the current work package are as follows:

- Conceptual Plot Plan including Stack Location
- Conceptual General Arrangement Drawings
- Conceptual Process Flow Diagrams
- Conceptual Mass Balance Diagrams
- Phase I Report addressing cost, schedule, benefits and risks
- Summary of Open Items and Issues
- Discussion of Incremental issues associated with addition of a WFGD System on Unit 1, utilizing a single absorber (both Units 1 and 2 into one system)

- Discussion of Incremental issues associated with installing an SCR system on Unit 1, in addition to the WFGD system

In addition, Phase I work includes the preparation of a summary proposal to progress the Project into Phase IIa. This report defines a schedule and engineering/design costs required to progress the work to approximately 15 % completion and develop an estimate of the overall project cost.

Key criteria for performance of the Phase I work are as follows:

- In general, follow the Mitchell project decisions and design criteria and approach.
- Base the recommended layouts on subjective comparisons/estimates.
  The design will assume the absorber is an open spray tower or tray design.

2.4 Deliverables

The following deliverables have been prepared and issued to fulfill requirements of the scope of work:

- Plot plan drawings 2-5070000A-A, 2-5070000B-A, 2-5070000C-B 2-5070000D-A, 2-5070000E-A, 2-5070001A-A, 12-5070000A-A, 12-5070000B-A, and 12-5070000D-B
- General Arrangement drawings 2-5070002A-A, and 2-5070003A-A, and 2-5070004A-A.
- Process Flow diagrams 2-51070000-B, 2-51070001-A, 2-51070002-A, 2-51070003-A, and 2-51070004-B
- Boiler and FGD Material Balance Estimate Calculation AEBS-2-DC-042-5-001, Rev. 0 which has process data keyed to nodes on the Process Flow Diagrams
- Big Sandy Unit #2 FGD Process Equipment List AEBS-2-LI-022-0001, Rev. 0.
- Proposal for Big Sandy Unit #2 Phase IIa, dated 11/30/04
- Big Sandy Unit #2 Phase I Report AEBS-2-LI-012-0001, Rev. 0, dated 12/30/04.

In addition, deliverables are included which present the conceptual configuration of the electrical distribution system, and a preliminary list of electrical loads to be served by the system:

- Unit 2 FGD Conceptual One Line Diagram AEBS-2-SK-EZ-206-001-A
- Unit 2 FGD Conceptual Electrical Load List AEBS-2-LI-023-0001-B

3.1 Introduction

Big Sandy Unit 2 is located in Lawrence County, Kentucky, approximately 20 miles north of Louisa. The unit consists of a nominal net 800 MWe coal-fired steam turbine power cycle with an operating selective catalytic reduction (SCR) unit. It is proposed that a WFGD process be applied to the unit to mitigate SO_2 emissions. To that end, Parsons E&C has prepared material balances -- with estimated flow rates and temperatures, plot plans and general arrangement drawings showing stack location and real estate requirements, equipment and electric load lists, as well as an electrical one-line diagram. The drawings and results of these efforts will be presented in subsequent sections of this report. The purpose of this section is to summarize the design input that went into generating the results contained within. All of the values discussed or listed in this section are also summarized in Parsons E&C design calculation AEBS-2-DC-042-5-001.

It is assumed that Big Sandy Unit 2 will undergo a pressurized to balanced-draft conversion and that the currently operating booster fans will be replaced by induced draft (ID) fans. ID fans will be required to operate the boiler and overcome the added ductwork and absorber pressure drop. The WFGD process is assumed to utilize either a tray or spray tower-type absorber and generate wallboard quality gypsum product. The reagent is assumed to be 92 percent "available" calcium carbonate ($CaCO_3$).

3.2 As-Fired Coal Composition

It is proposed that Big Sandy Unit 2 will fire a blend of Northern Appalachian Basin or Illinois Basin high sulfur coal up to 4.5 lbs SO_2/MMBtu. The expected as-fired coal proposed in AEP's Specification BS-12-AECE-093004 is shown in Table 3-A.

The coal composition in Table 3-A is shown on both a "wet" and "dry" basis. Both bases are shown because AEP Specification BS-12-AECE-093004 shows the coal composition on a "dry" basis and the input to the material balance (shown in Appendix A) shows the coal on a "wet" basis. The table is convenient for immediate side-by-side comparison.

Another feature of the coal composition shown In Table 3-A is that there is a column taken directly from AEP Specification BS-12-AECE-093004 and a second labeled "Parsons E&C". The coal composition shown under column "Parsons E&C" is the actual coal used in the material balance presented in this report. The coal from AEP Specification BS-12-AECE-

093004 has a sulfur content that generates 4.31 lb SO_2/MMBtu. The coal shown in column "Parsons E&C" of Table 3-A has been modified such that a true value of 4.5 lb SO_2/MM Btu is produced. This was affected by increasing the "wet-basis" sulfur weight percent of coal from 2.69 percent to 2.81 percent. The difference, 0.12, was subtracted out of the coal oxygen content. It should be noted that a similar adjustment was made on chlorine and fluorine. By adjusting the coal to the expected maximum sulfur and chlorine levels a better representation of the WFGD process can be generated.

Table 3-A Big Sandy Design Coal Composition

	AEP BS-12-AECE-093004		Parsons E&C	
	Wet Basis	Dry Basis	Wet Basis	Dry Basis
Fixed Carbon	47.33		47.33	
Volatile Matter	36.15		36.15	
Moisture	6.63		6.63	
Ash	9.89		9.89	
Total	100.00		100	
Sulfur	2.69		2.81	
Heating Value, Btu/lb	12,490		12,490	
lb SO_2/ MM Btu	4.31		4.5	
Carbon	69.33	74.25	69.33	74.25
Hydrogen	4.67	5.00	4.67	5.00
Nitrogen	1.33	1.43	1.33	1.43
Chlorine	0.05	0.05	0.20	0.214
Fluorine	0.00	0.00	0.002	0.002
Moisture	6.63	-	6.63	-
Ash	9.89	10.59	9.89	10.59
Sulfur	2.69	2.88	2.81	3.00
Oxygen	5.41	5.8	5.138	5.514
Total	100.00	100.00	100.00	100.00

3.3 Ambient Conditions

The ambient conditions that were used in the results generated in this report are summarized in Table 3-B. These values are taken directly from AEP Specification BS-12-AECE-093004.

Table 3-B Big Sandy Ambient Conditions

Barometric Pressure	29.3 inches Hg
Inlet Air Temperature	56.1 °F
Relative Humidity	70 %
Vapor Pressure	0.223 psia
Elevation	568 ft above sea level

3.4 Coal Combustion

Accurate portrayal of the gas flow to the absorber is important for absorber sizing, estimating reagent requirements, purge stream composition, and product generation, as well as estimating large electrical loads such as those associated with the ID and absorber recycle pumps. Parsons E&C completed a combustion calculation based on input from AEP specification BS-12-AECE-093004 in order to characterize the flue gas flow to the absorber and estimate ID fan pressure rise and motor requirements. The primary inputs used in the calculation are summarized in Table 3-C.

Table 3-C Combustion Calculation Inputs

MCR Thermal Input	8,180 MMBtu/hr
Fuel HHV – Design Basis Coal	12,490 Btu/lb
Coal Sulfur Content	4.5 lb SO_2/MMBtu
Excess Air	21% Furnace Excess Air 20% Air Heater Leakage / In-Leakage
SCR Pressure Drop	8.5 inches H_2O
ID Fan Pressure Increase	40.5inches H_2O
ID Fan Inlet Temperature	321 °F

3.5 Limestone Composition

The limestone composition used in this study is shown in Table 3-D. This limestone, with an available CaCO3 content of 92 percent, is a premium brand capable of generating wallboard-grade gypsum when utilized by an appropriate WFGD technology.

Table 3-D Limestone Composition

Dry Basis, Percent (%) by weight	Nominal
Calcium Carbonate available, $CaCO_3$	92.0
Total Magnesium Carbonate, $MgCO_3$ *	3.0
Inerts	5.0
Total	100.0
Free Moisture	<5.0%

* Maximum allowable insoluble MgCO3 content of 1.5% (Nominal quality)

3.6 WFGD Absorber

As an FGD OEM has not been chosen at this point, and giving consideration to the gross unit size of the power station, a generic spray/tray FGD absorber module was modeled and sized for this effort. The arrangement of the absorber and stack provides space for the future installation of a wet electrostatic precipitator (SO_3 mitigation). Table 3-E summarizes the absorber process input parameters used to generate the results presented in this report.

Table 3-E Absorber Parameters

Parameter	Value
SO_2 Removed, %	98
SO_3 Removed, %	30
L/G	115
Water Entrainment, grains/SCF	0.01
SO_2 Oxidized in System, %	99.5

Parameter	Value
Reaction Tank Type	Straight
Gas velocity, ft/sec	13
Inlet/Outlet Duct Velocities, ft/sec	50
Maximum Recycle Pump Flow, gpm	75,000
Solids in Reaction Tank, %	20

3.7 Dewatering

Primary dewatering is assumed to be completed by hydroclone clusters. Each cluster is assumed to produce a 50 weight percent solid product. Hydrocyclone overheads flow to a head tank that drains to the reclaim water tank. Blowdown is removed from the hydrocyclone overheads. Secondary dewatering is assumed to be accomplished by vacuum belt filters. The assumed solids recovery for the belt filters is 98 percent. Wallboard grade gypsum, with greater than 93 percent gypsum, $CaSO_4 \bullet 2H_2O$, purity and less than 100 ppm (dry) chlorides, will be produced by the belt filter system. Cake wash, cloth wash, and system make-up water is assumed to have the composition shown in Table 3-F.

Table 3-F River Water Analysis

Parameter	**Value**
SO_4 (ppmv)	53
Ca (ppmv)	60
Cl (ppmv)	19
Na (ppmv)	0
Mg (ppmv)	50

3.8 Electrical

The Conceptual Electrical Load List (AEBS-2-LI-023-0001) and the Conceptual One Line Diagram (AEBS-2-SK-EZ-206-001) are based on the following:

- Big Sandy Unit 2 Process Equipment List FPCS-C1-LI-537498-0001.
- Mitchell FGD/SCR Project Electrical Load List AEPM-12-LI-023-0001 – for non-process load identification and magnitude only.
- Mitchell FGD/SCR Project Key One Line Diagram 12-121001 – for general bus arrangement and drawing content.

3.9 Control Systems

The control system for the FGD and the Balance of Plant (BOP) systems that are required to support the FGD will be an extension of the existing Emerson plant DCS. The I/O output devices will be remote mounted near the source of the inputs in several locations within and near the FGD buildings. The remote I/O will be connected to the existing DCS via redundant fiber optic cables. The logic for the FGD equipment in the FGD vendor's scope will be designed by the FGD vendor with Parsons E&C as the reviewer. Logic for auxiliary BOP systems supporting the FGD will be designed by Parsons E&C.

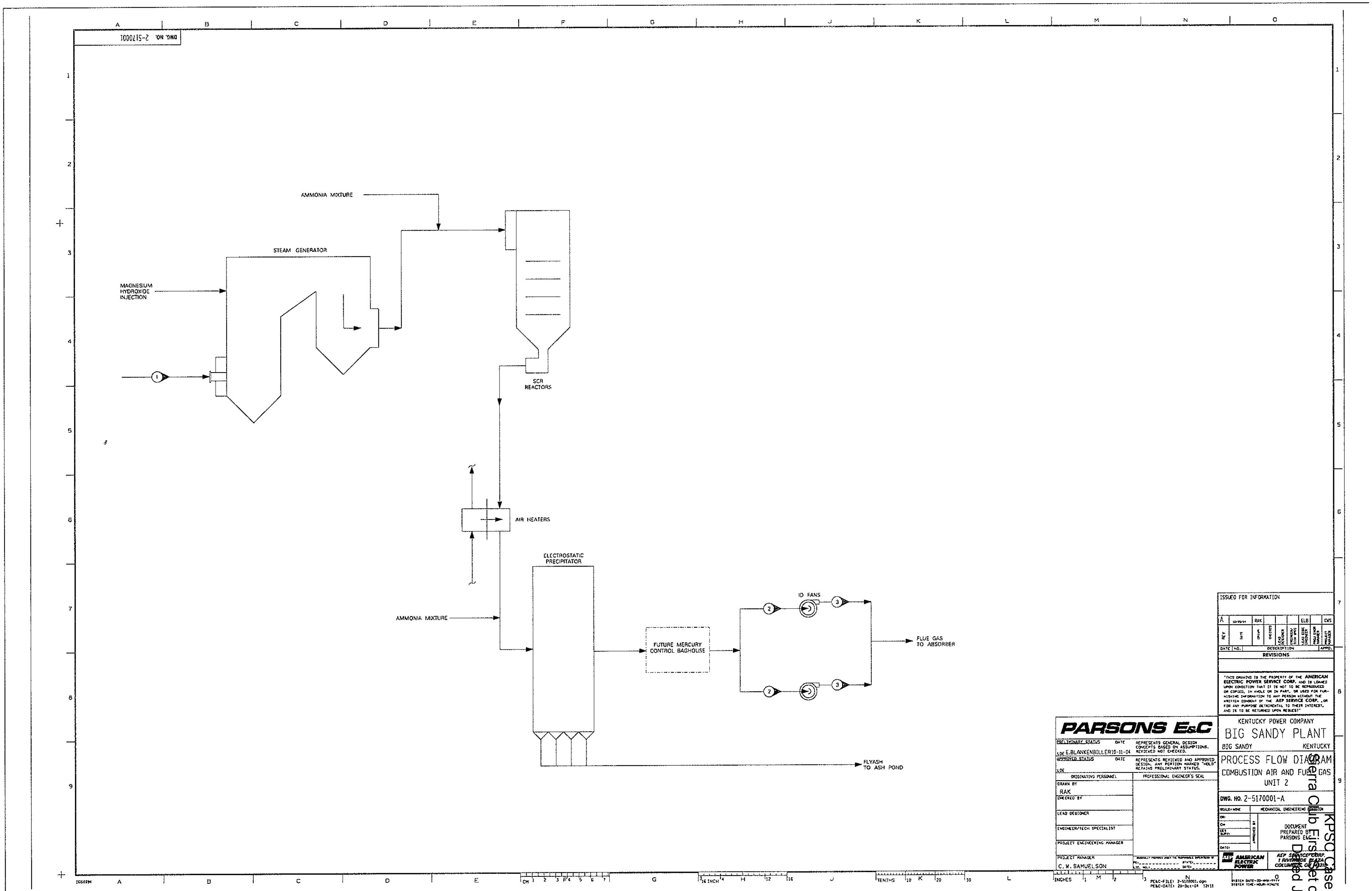
Equipment such as new I/O racks or cards that will be required to support the boiler balanced draft conversion will be placed in the proximity of existing equipment. Suggested logic for the control of the ID fans will be developed by Parsons E&C however final logic and implementation will be by AEP.

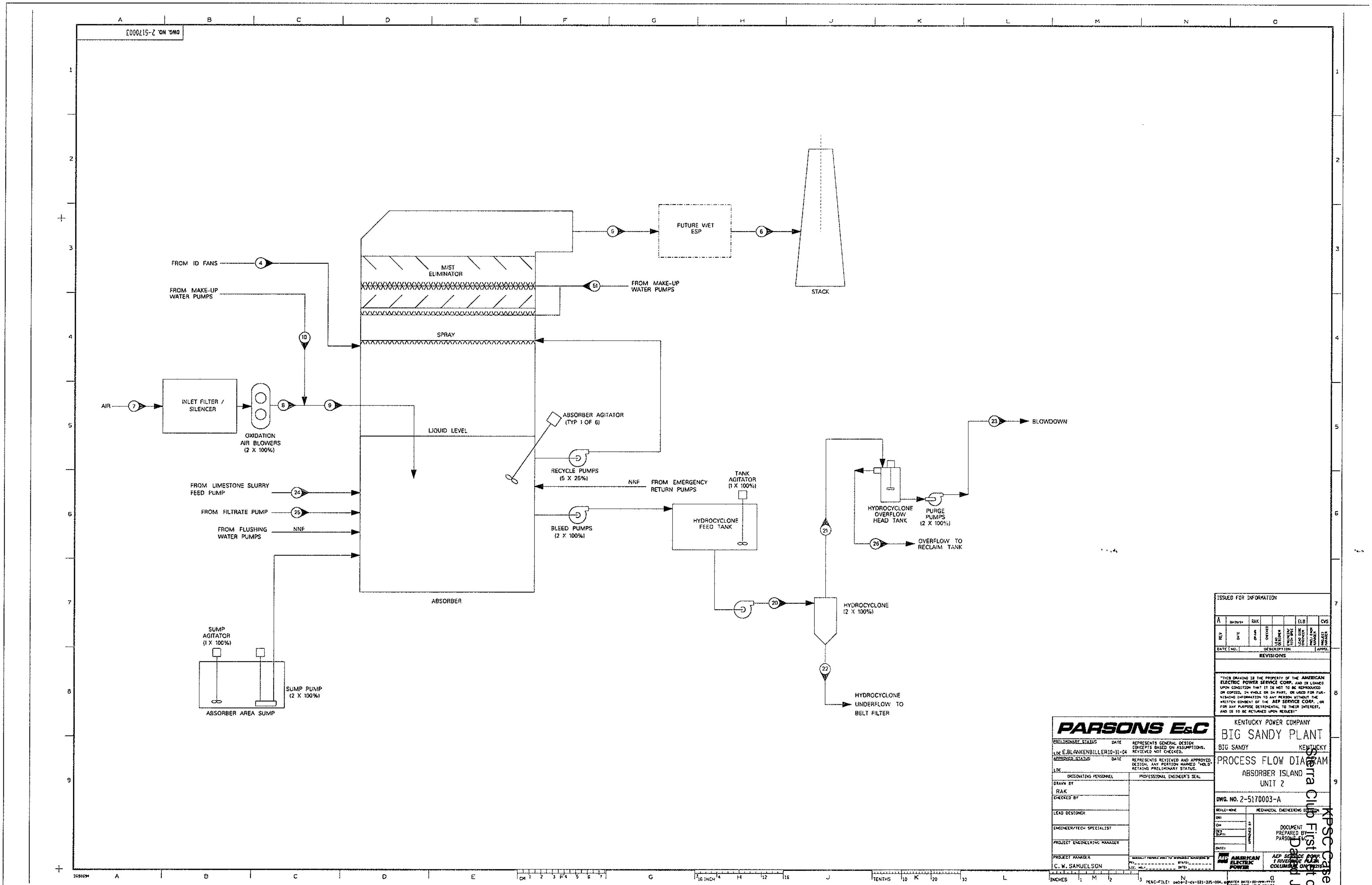
4.1 Process Flow Diagrams and Material Balance

Flue gas generated in the coal-fired Big Sandy Unit 2 boiler will be treated in a WFGD process to mitigate SO_2 emissions. The WFGD system will be designed for an overall SO_2 removal efficiency of 98 %. It is proposed that the unit will fire a blend of Northern Appalachian or Illinois Basin high sulfur coal with up to 4.5 lb SO_2/MMBtu and have a full-load thermal input of 8,180 MMBtu/hr. This section contains a brief system description illustrated by several Process Flow Diagrams (PFDs). The PFDs show a simplified schematic of the principal process system equipment as well as the envisioned equipment redundancy. To support the PFDs, a material balance showing the composition and state points of the primary process streams is presented in Appendix A.

The nominal 800 MW net Unit 2 will be converted from pressurized operation to balanced draft operation. Flue gas will be ducted from the "existing" ESP to "new" induced draft (ID) fans. It is envisioned that two new axial ID fans be used to accommodate the increased furnace gas path pressure drop and overcome the resistance induced by the addition of the WFGD. Provisions have been made, including the consideration of added pressure drop and the allocation of physical space, for a mercury control system that may be added if future conditions warrant. In its present form, the mercury control technology is in the form of in-duct activated carbon injection and baghouse downstream of the existing ESP and prior to the ID fan inlet. The ductwork downstream of each ID fan discharge will converge to a common duct and continue to the WFGD absorber. A schematic illustrating the gas-path ductwork on the suction and discharge of the new ID fans is shown in drawing 2-517001-A

Big Sandy Unit 2 will be provided with a single WFGD absorber. Flue gas discharged from each of the two ID fans will be ducted together and routed to the absorber inlet duct. The PFD for the absorber is shown on drawing 2-5170003-A. The absorber will use ground limestone slurried in water as the SO_2 removal reagent. The absorber will likely be either a tray or spray tower and will utilize absorber recycle pumps to provide an adequate liquid to gas ratio within the absorber tower. Limestone slurry will be fed to replenish the calcium consumed in the desulfurization reactions. Oxidation air blowers will supply low-pressure air to the absorber reaction tank in order to oxidize the calcium sulfite to calcium sulfate (gypsum). Oxidation air will be distributed evenly throughout the reaction area such that high sulfite conversion levels are attained. Bleed pumps transfer a water slurry of gypsum product, unreacted reagent, captured flyash, and inert solid


DWG. NO. 2-5170001
AMMONIA MIXTURE
STEAM GENERATOR
MAGNESIUM HYDROXIDE INJECTION
SCR REACTORS
AIR HEATERS
ELECTROSTATIC PRECIPITATOR
AMMONIA MIXTURE
FUTURE MERCURY CONTROL BAGHOUSE
ID FANS
FLUE GAS TO ABSORBER
FLYASH TO ASH POND
ISSUED FOR INFORMATION
REVISIONS
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
PROCESS FLOW DIAGRAM
COMBUSTION AIR AND FUEL GAS
UNIT 2
DWG. NO. 2-5170001-A
PARSONS E&C
E.BLANKENBILLER 10-11-04
DRAWN BY
RAK
PROJECT MANAGER
C. W. SAMUELSON
DOCUMENT PREPARED BY PARSONS E&C
AMERICAN ELECTRIC POWER

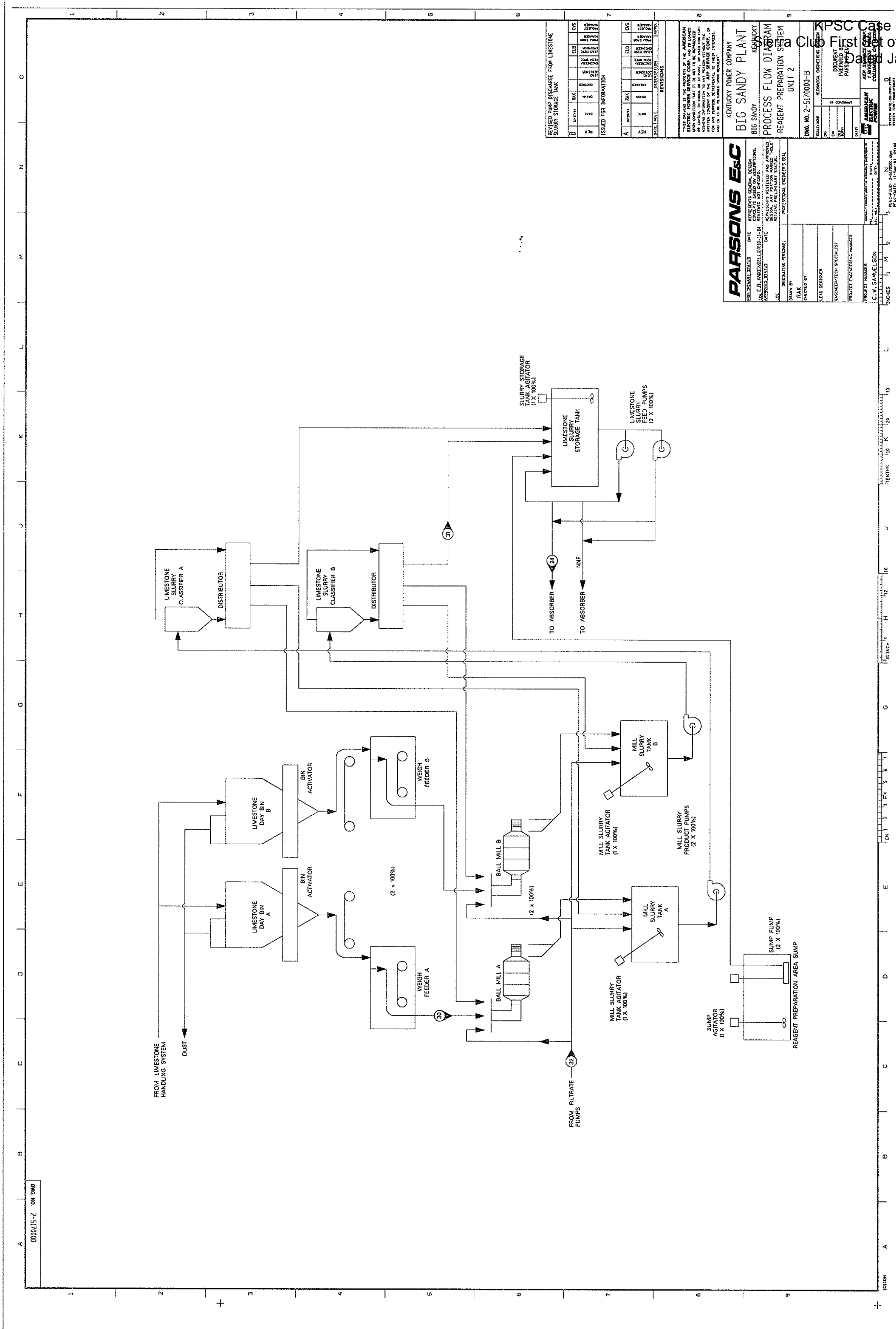

DWG. NO. 2-5170003
FROM ID FANS
FROM MAKE-UP WATER PUMPS
AIR
INLET FILTER / SILENCER
OXIDATION AIR BLOWERS (2 X 100%)
MIST ELIMINATOR
SPRAY
LIQUID LEVEL
ABSORBER
ABSORBER AGITATOR (TYP 1 OF 6)
RECYCLE PUMPS (5 X 25%)
NNF
FROM EMERGENCY RETURN PUMPS
BLEED PUMPS (2 X 100%)
FROM LIMESTONE SLURRY FEED PUMP
FROM FILTRATE PUMP
FROM FLUSHING WATER PUMPS
SUMP AGITATOR (1 X 100%)
SUMP PUMP (2 X 100%)
ABSORBER AREA SUMP
FUTURE WET ESP
STACK
FROM MAKE-UP WATER PUMPS
TANK AGITATOR (1 X 100%)
HYDROCYCLONE FEED TANK
HYDROCYCLONE (2 X 100%)
HYDROCYCLONE UNDERFLOW TO BELT FILTER
HYDROCYCLONE OVERFLOW HEAD TANK
PURGE PUMPS (2 X 100%)
OVERFLOW TO RECLAIM TANK
BLOWDOWN
ISSUED FOR INFORMATION
REVISIONS
PARSONS E&C
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
PROCESS FLOW DIAGRAM
ABSORBER ISLAND
UNIT 2
DWG. NO. 2-5170003-A
E.BLANKENBILLER 10-11-04
RAK
C.W. SAMUELSON
DOCUMENT PREPARED BY PARSONS E&C
AMERICAN ELECTRIC POWER

material to dewatering. A sump area will be provided and will be equipped with sump pumps that return the collected drains to the absorber reaction tanks.

Scrubbed flue gas from the absorber will be ducted to a new chimney. The chimney will have a single flue designed for wet operation. The chimney will be of reinforced concrete construction with a fiberglass reinforced plastic (FRP) flue equipped with liquid collection and drainage systems. Space has been allotted in the system arrangement for the future addition of an elevated, horizontal flow, stand-alone wet ESP (WESP) for fine particulate and SO_3 mist removal downstream of the absorber. The chimney and WESP are shown schematically in drawing number 2-5170003-A.

Full load operation of Unit 2 firing the design coal consumes approximately 775 tons of 92 % "active" calcium carbonate ($CaCO_3$) limestone per day. Limestone will be fed from a storage pile to silos located within the limestone preparation building. Two wet grinding ball mill systems will be installed. The mill systems will be located in the reagent preparation building. The mills produce limestone ground to 95% passing 325 mesh. The ground limestone will be slurried with water that is either reclaimed from the dewatering process or with make-up water from the service water tank. The reagent slurry feed pumps forward the reagent slurry to the absorbers through a double pipe loop (independent) feed system. The reagent preparation building will be provided with an area sump for collection of slurry from process drains. The sump will be provided with two sump pumps that return the collected slurry to the limestone slurry storage tanks. The reagent preparation system is illustrated in drawing number 2-5170000-B.

Gypsum dewatering will consist of two stages: primary and secondary. Primary dewatering will be achieved by hydrocyclone classification. Secondary dewatering will be accomplished with horizontal belt vacuum filters. A hydrocyclone cluster will be mounted above each vacuum belt filter. Hydrocyclone feed pumps will feed slurry from the feed tanks to the hydrocyclone classifiers. Overflow from the hydrocyclones will discharge through a common manifold to one overflow head tank. The head tank will overflow to a reclaim water tank. The reclaimed water will be returned to the absorber and/or the limestone grinding system to maximize the utilization of water and unreacted limestone contained in the hydroclone overflow. Underflow from each hydrocyclone classifier will be delivered to its associated belt filter. A simplified system arrangement for the


KENTUCKY POWER COMPANY
BIG SANDY PLANT
PROCESS FLOW DIAGRAM
REAGENT PREPARATION SYSTEM
UNIT 2
DWG. NO. 2-5170000-B
PARSONS E&C
REVISED PUMP DISCHARGE FROM LIMESTONE SLURRY STORAGE TANK
ISSUED FOR INFORMATION
REVISIONS
C. W. SAMUELSON
LIMESTONE SLURRY STORAGE TANK
SLURRY STORAGE TANK AGITATOR (1 X 100%)
LIMESTONE SLURRY FEED PUMPS (2 X 100%)
TO ABSORBER
NNF
DISTRIBUTOR
LIMESTONE SLURRY CLASSIFIER A
LIMESTONE SLURRY CLASSIFIER B
LIMESTONE DAY BIN A
LIMESTONE DAY BIN B
BIN ACTIVATOR
WEIGH FEEDER A
WEIGH FEEDER B
(2 x 100%)
BALL MILL A
BALL MILL B
MILL SLURRY TANK A
MILL SLURRY TANK B
MILL SLURRY TANK AGITATOR (1 X 100%)
MILL SLURRY PRODUCT PUMPS (2 X 100%)
SUMP PUMP (2 X 100%)
SUMP AGITATOR (1 X 100%)
REAGENT PREPARATION AREA SUMP
FROM LIMESTONE HANDLING SYSTEM
DUST
FROM FILTRATE PUMPS
DWG. NO. 2-5170000

hydrocyclones and overflow tank is shown in Drawing 2-5170003-A along with the absorber configuration.

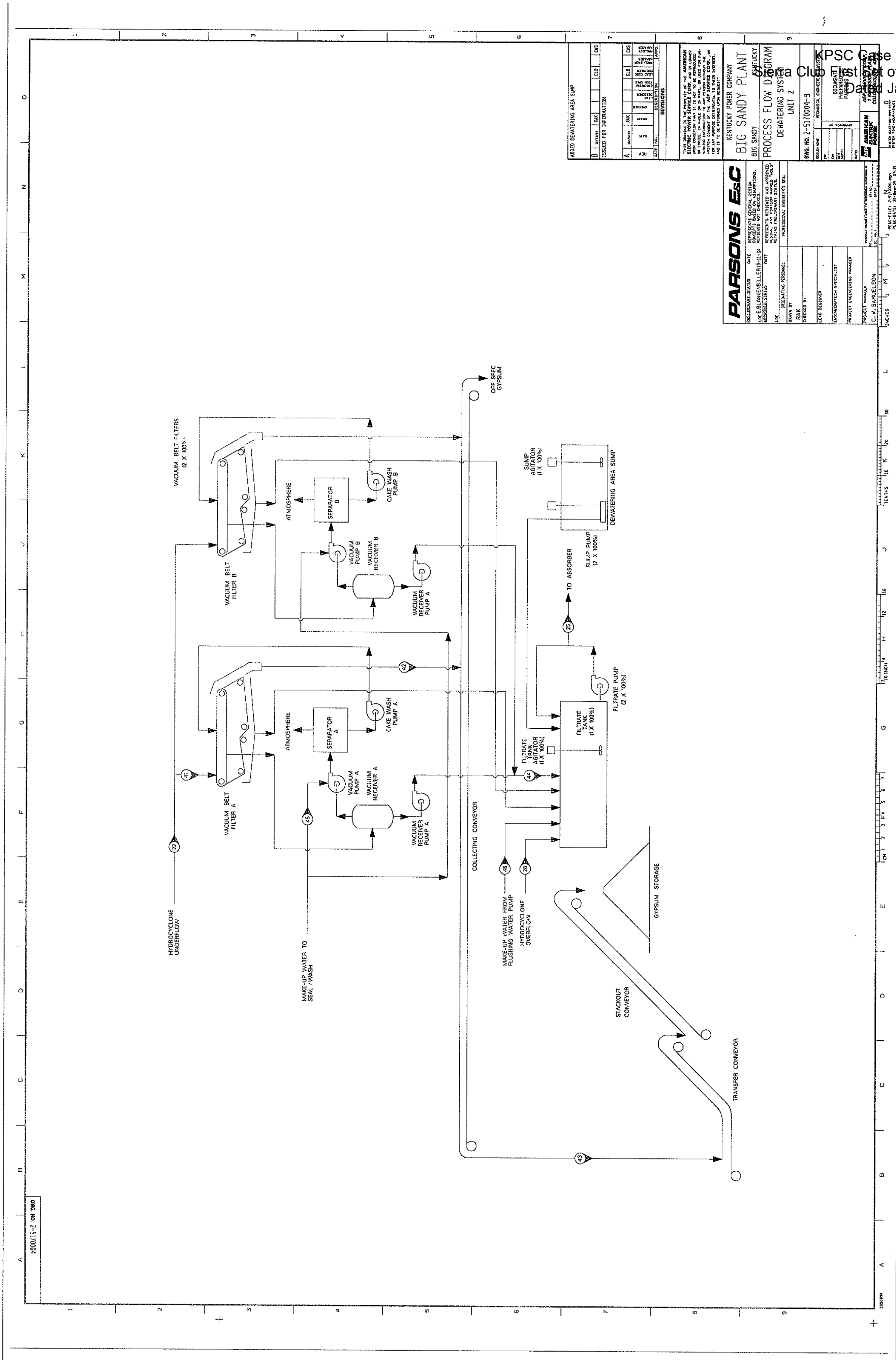
Vacuum belt filters will be used to dewater hydrocyclone underflow to produce gypsum containing less than 10 percent moisture. The gypsum product will be conveyed to a storage pile at a rate up to 56 tph. Fresh makeup water, filtered and biologically treated river water, will be provided as seal water to the vacuum pumps and for washing the gypsum filter cake. Vacuum filter filtrate will be collected together with hydroclone overflow in the reclaim water tanks, and returned to the absorber reaction tank and/or ball mill grinding system by the two reclaim water pumps. The basic configuration of the vacuum belt filter system is shown on drawing 2-5170004-B. Sump pumps will be provided in the vacuum belt filter area to return collected liquids to the reclaim water tanks.

The concentration of chlorides, and/or solid fines material, in the absorber reaction tank will be controlled by an FGD blowdown or purge stream. The blowdown stream may or may not be treated prior to being routed to its ultimate destination, which may be a dedicated pond or the bottom ash pond. The source of the FGD blowdown stream will be the hydroclone overflow head tanks as shown on drawing 2-5170003-A.

The FGD system requires significant quantities of makeup water to compensate for: water lost through evaporation in the FGD absorber, water lost with the FGD gypsum filter cake, and that purged from the system (blowdown) to control the concentration of chlorides and/or fines in the absorber. Strained, biologically treated, filtered water from the Big Sandy River, will be stored in the makeup service water tank from where it will be pumped to the various fresh water users. A schematic of the service water tank in shown in Figure 2-5170002-A. FGD service water pumps will provide fresh water to the absorber mist eliminator and oxidation air quench. The balance-of-plant service water pumps provide water to limestone grinding, vacuum pump seal water, water for slurry piping system flush out, for makeup (initial fill) of the absorbers, and for make-up to the reclaim tank.

4.2 Process Equipment List

The process flow diagrams, described above, and conceptual design criteria, presented in Section 3, were used to generate mass balances (Appendix A) of the conceptual combustion and WFGD systems. The process equipment list is shown in Appendix C. The equipment list is for reference only and not the product of detailed design. The equipment list in


VACUUM BELT FILTERS (2 X 100%)
VACUUM BELT FILTER A
VACUUM BELT FILTER B
ATMOSPHERE
SEPARATOR A
SEPARATOR B
CAKE WASH PUMP A
CAKE WASH PUMP B
VACUUM PUMP A
VACUUM PUMP B
VACUUM RECEIVER A
VACUUM RECEIVER B
VACUUM RECEIVER PUMP A
OFF SPEC GYPSUM
SUMP AGITATOR (1 X 100%)
DEWATERING AREA SUMP
SUMP PUMP (2 X 100%)
TO ABSORBER
FILTRATE PUMP (2 X 100%)
FILTRATE TANK (1 X 100%)
FILTRATE TANK AGITATOR (1 X 100%)
COLLECTING CONVEYOR
HYDROCYCLONE UNDERFLOW
MAKE-UP WATER TO SEAL/WASH
MAKE-UP WATER FROM FLUSHING WATER PUMP
HYDROCYCLONE OVERFLOW
GYPSUM STORAGE
STACKOUT CONVEYOR
TRANSFER CONVEYOR
22
41
42
43
44
25
26
45
46
ADDED DEWATERING AREA SUMP
ISSUED FOR INFORMATION
REVISIONS
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
PROCESS FLOW DIAGRAM
DEWATERING SYSTEM
UNIT 2
DWG. NO. 2-5170004-B
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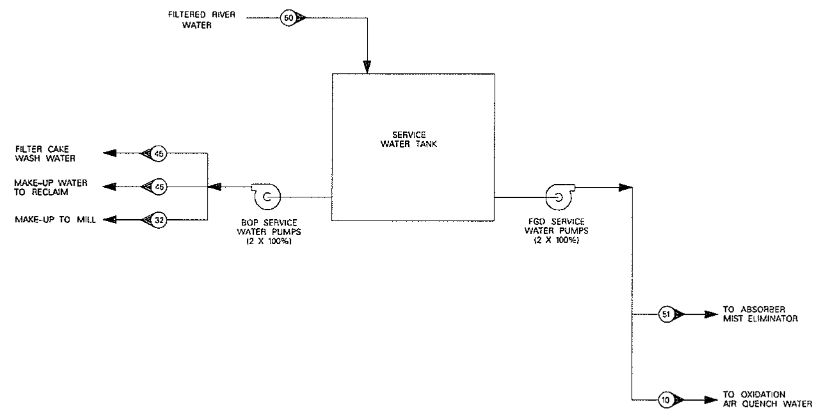

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KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
PROCESS FLOW DIAGRAM
MAKE-UP WATER SYSTEM
UNIT 2

DWG. NO. 2-5170002-A

MECHANICAL ENGINEERING DIVISION

DOCUMENT PREPARED BY PARSONS E&C

AEP AMERICAN ELECTRIC POWER

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Appendix C merely shows gross dimensions and equipment sizes and will change with refinements in design, margin application, and FGD OEM technology choice.

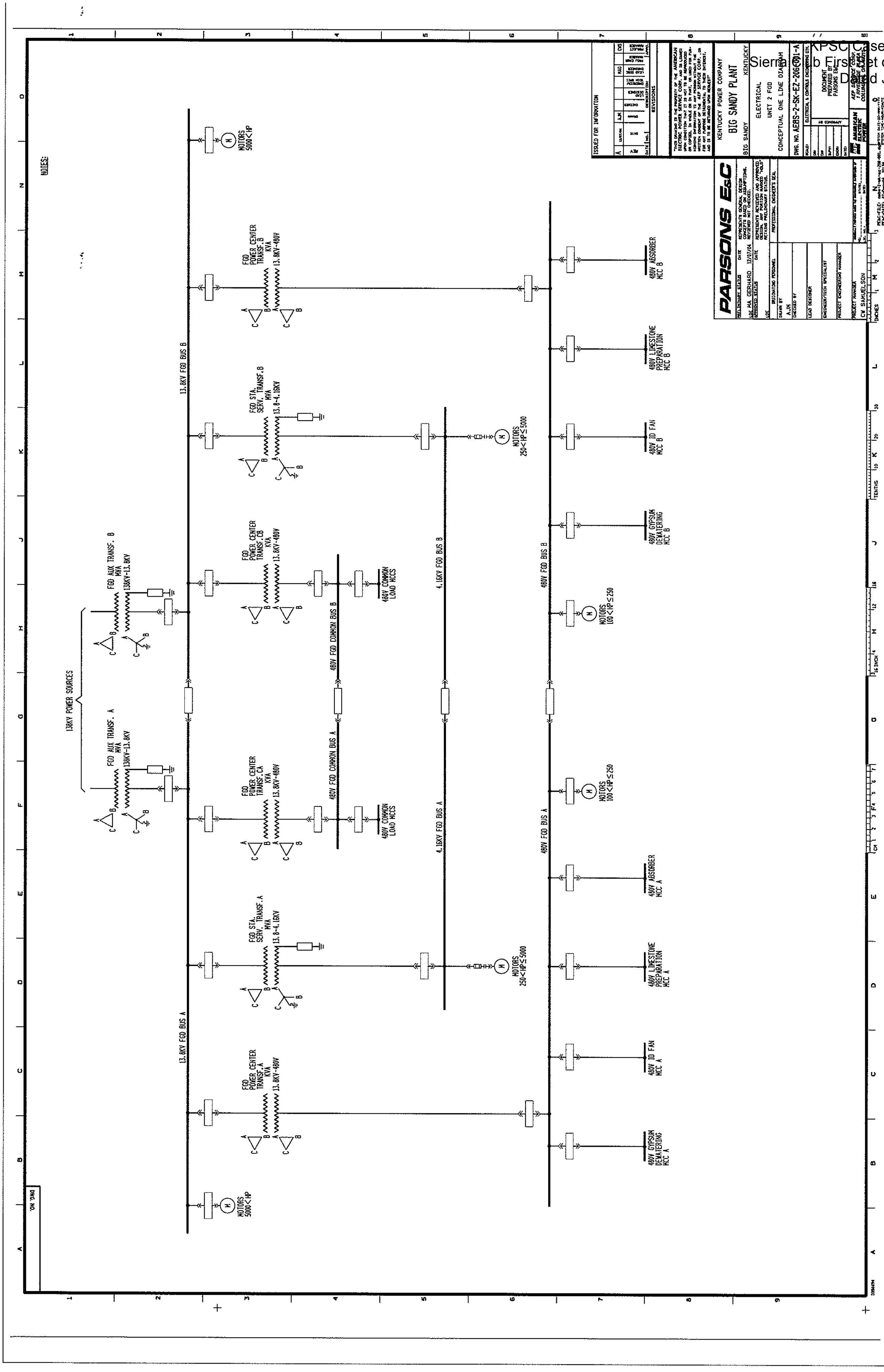
4.3 Conceptual Electrical Load List

The conceptual list of equipment to be powered by the Big Sandy Unit 2 FGD Electrical Distribution System is presented in Appendix D as List AEBS-2-LI-023-0001. Loads to be served by this system include those identified in the Process Equipment List (Appendix C), as well as projected non-process loads associated with FGD facilities lighting and HVAC systems, the new chimney, the new outdoor FGD substation, etc. The Appendix D list assigns process loads to electrical distribution system buses based on anticipated load power ratings, and on the desire to power redundant process loads from separate power sources. This latter approach will minimize process down time in the event of electrical equipment outages. The non-process loads are all envisioned to be 480V and are generally assigned to Common Load motor control centers to be located in load concentration areas.

The Electrical Load List is meant to account for all loads requiring electrical service; it is not the intent of the list to be used for the determination and optimization of bus demand loadings. Those analyses will be performed as part of the Phase II electrical system voltage studies. This Electrical Load List is envisioned to be a living document, to be expanded and updated as the Big Sandy FGD Project evolves.

4.4 Conceptual Electrical One Line Diagram

The conceptual One Line Diagram of the Big Sandy Unit 2 Electrical Distribution System is included in Appendix D as Sketch AEBS-2-SK-EZ-206-001. The distribution system configuration, which is an abbreviated version of the Mitchell Units 1 and 2 FGD electrical system, provides sufficient redundancy of electrical equipment to allow for full FGD (process) operations under most credible electrical equipment failure scenarios. In addition, a Common Load switchgear lineup is included in the configuration for powering non-process loads. This concept of separating process and non-process load buses evolved in the Mitchell FGD Project due to the high magnitude of the combined process and non-process loads and the resultant adverse impact on the distribution system steady state voltage.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ELECTRICAL
UNIT 2 FGD
CONCEPTUAL ONE LINE DIAGRAM
MA GERHARD 12/07/04
AJM
CM SAMUELSON
AMERICAN ELECTRIC POWER
13.8KV FGD BUS B
13.8KV FGD BUS A
138KV POWER SOURCES
FGD AUX TRANSF. B
FGD AUX TRANSF. A
MVA
138KV-13.8KV
FGD POWER CENTER TRANSF. B
FGD POWER CENTER TRANSF. CB
FGD POWER CENTER TRANSF. CA
FGD POWER CENTER TRANSF. A
KVA
13.8KV-480V
FGD STA. SERV. TRANSF. B
FGD STA. SERV. TRANSF. A
13.8-4.16KV
480V FGD COMMON BUS B
480V FGD COMMON BUS A
4.16KV FGD BUS B
4.16KV FGD BUS A
480V FGD BUS B
480V FGD BUS A
480V COMMON LOAD MCCS
MOTORS 5000<HP
MOTORS 250<HP≤5000
MOTORS 100<HP≤250
480V ABSORBER MCC B
480V LIMESTONE PREPARATION MCC B
480V ID FAN MCC B
480V GYPSUM DEWATERING MCC B
480V ABSORBER MCC A
480V LIMESTONE PREPARATION MCC A
480V ID FAN MCC A
480V GYPSUM DEWATERING MCC A

The double-ended switchgear lineups depicted are operated with their tie breakers normally open, with each bus section receiving power from its incoming transformer and main breaker. In order to maintain continuity of service to all loads during an outage of any individual transformer supply, all transformers and buses will be rated to allow any single transformer in a double-ended switchgear arrangement to carry all load on a double-ended lineup. This will be achieved via manual or automatic closing of the lineup tie breaker in accordance with the control philosophy to be developed for the project.

Incoming power to the Big Sandy FGD Electrical Distribution System will likely be developed via modifications to the existing Big Sandy main 138kV switchyard – it is this method that is implied on the conceptual one line. Another option of FGD power supply would be to modify the existing Unit 2 SCR electrical distribution system, including 138-13.8kV transformers. This approach will be reviewed at the onset of Phase IIa; if adopted, the one line diagram will be revised accordingly. In any event, this one line will evolve, during Phase II, into the Big Sandy FGD Key One Line Diagram, complete with equipment identifiers and ratings.

The Appendix D conceptual One Line assumes that the new ID fans, intended for connection to 13.8kV Buses A and B, will be able to start and run satisfactorily with this connection without unacceptable degradation of system voltages. Should the horsepowers of the fan motors become too high for this configuration – resulting in unacceptable voltages during motor starting or steady state operation – connection of the motors in a different fashion will need to be investigated.

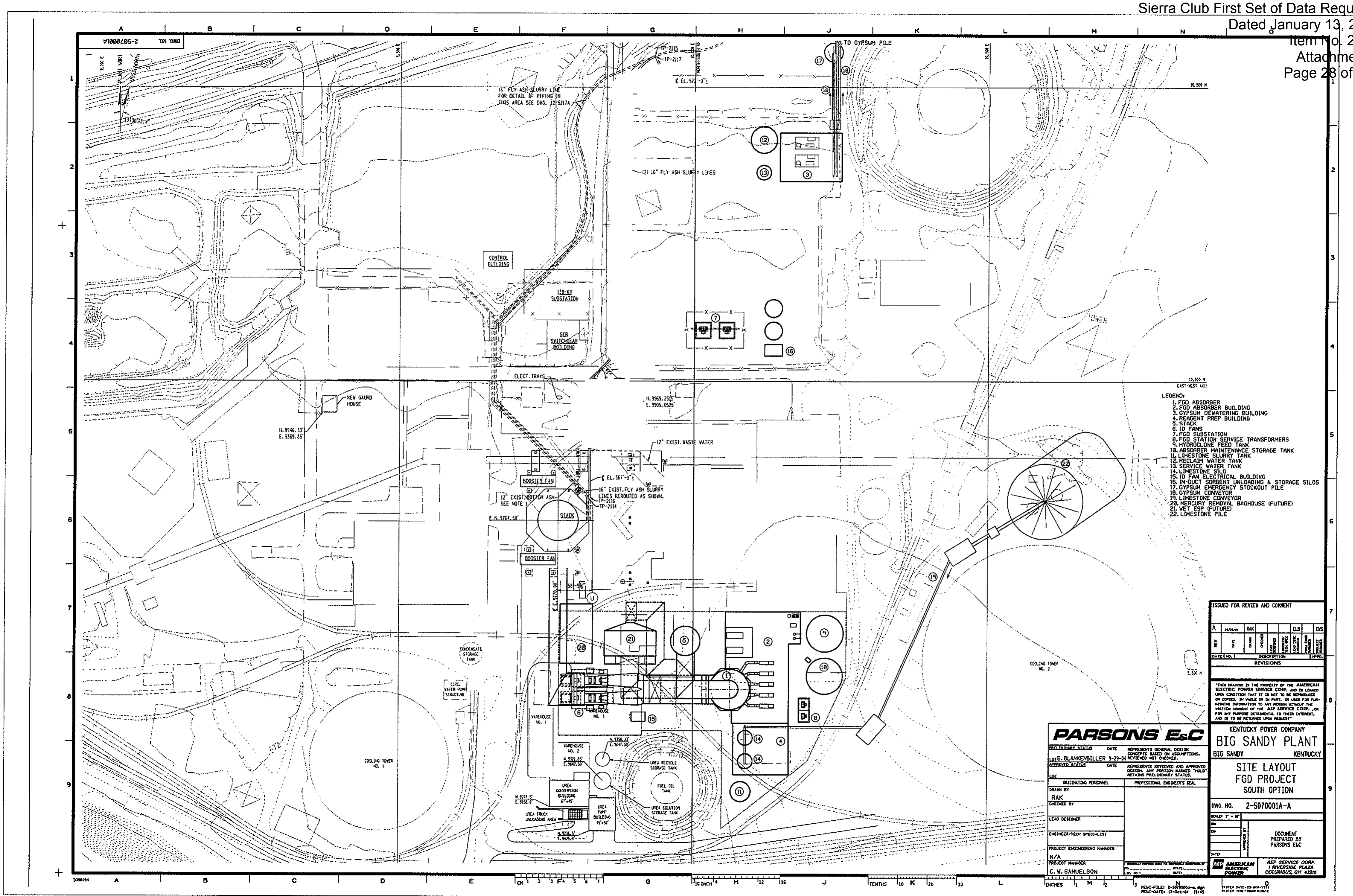
5.1 Summary

Two areas at the Big Sandy Site were considered for placement of the WFGD equipment and buildings. These are the areas north and south of Unit #2. In comparison to the north area, the south area is much smaller, has more existing underground utilities, would require relocation of warehouses and the Unit #2 Service Building, and would result in tight access to the south side of the Unit #2 boiler. One plot plan was considered for the south area. This is shown on drawing 2-507001A. Due to the disadvantages identified for the South arrangement, it is the least desirable of the areas considered.

The north area requires minimum utility relocation. The existing warehouse on the north side would not require relocation for the WFGD system. This warehouse may require relocation if a WESP is added in the future for SO_3 control. Extension of the existing 138 kV switchyard will require modification to the two 12" HDPE ash slurry lines that run north/south on the east side of the switchyard to the ash ponds across the highway. This relocation will be required regardless of the location of the WFGD equipment and buildings. It became apparent that the north area had many advantages over the south area, at which point emphasis was placed on the north area. Two plot plans were considered for this area: Option 1 and Option 2 as shown on drawings 2-5070000B and 2-5070000C, respectively. These plot plans were developed based on a tray tower type absorber. Arrangements for North Options 1 and 2, using an open tower type absorber, were also developed. An open tower absorber would increase the number of Absorber Recycle Pumps from five to eight, requiring a larger FGD Building. The drawings for the open spray tower arrangements are titled North Option – 1/8 and North Option – 2/8 and are shown on drawings 2-5070000E and 2-5070000D, respectively.

5.2 Recommended Plot Plan

The recommended plot plan for the WFGD buildings and equipment at Big Sandy Unit #2 is the North Option 2 arrangement, shown on drawing 2-5070000C for the tray tower type absorber and 2-5070000D for the open tower type absorber. These arrangements are similar to the North Option 1 arrangement with the following exception. The flue gas duct from the SCR outlet through the ID fans to the WFGD absorber inlet is oriented at a 35° angle from the east-west centerline of the existing stack, resulting in a lower pressure drop than the right angle arrangement in the North Option 1 design. Option 2 also moves the FGD buildings further to the east, in


TO GYPSUM PILE
16" FLY ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
(2) 16" FLY ASH SLURRY LINES
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
ELECT. TRAYS
NEW GAURD HOUSE
12" EXIST. WASTE WATER
BOOSTER FAN
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
12" EXIST. BOTTOM ASH SEE NOTE 1
STACK
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA CONVERSION BUILDING
UREA PUMP BUILDING
UREA SOLUTION STORAGE TANK
UREA TRUCK UNLOADING AREA
COOLING TOWER NO. 1
COOLING TOWER NO. 2
10,000 N
EAST-WEST AXIS
LEGEND:
1. FGD ABSORBER
2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
15. ID FAN ELECTRICAL BUILDING
16. IN-DUCT SORBENT UNLOADING & STORAGE SILOS
17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. LIMESTONE PILE
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BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
SOUTH OPTION
DWG. NO. 2-5070001A-A
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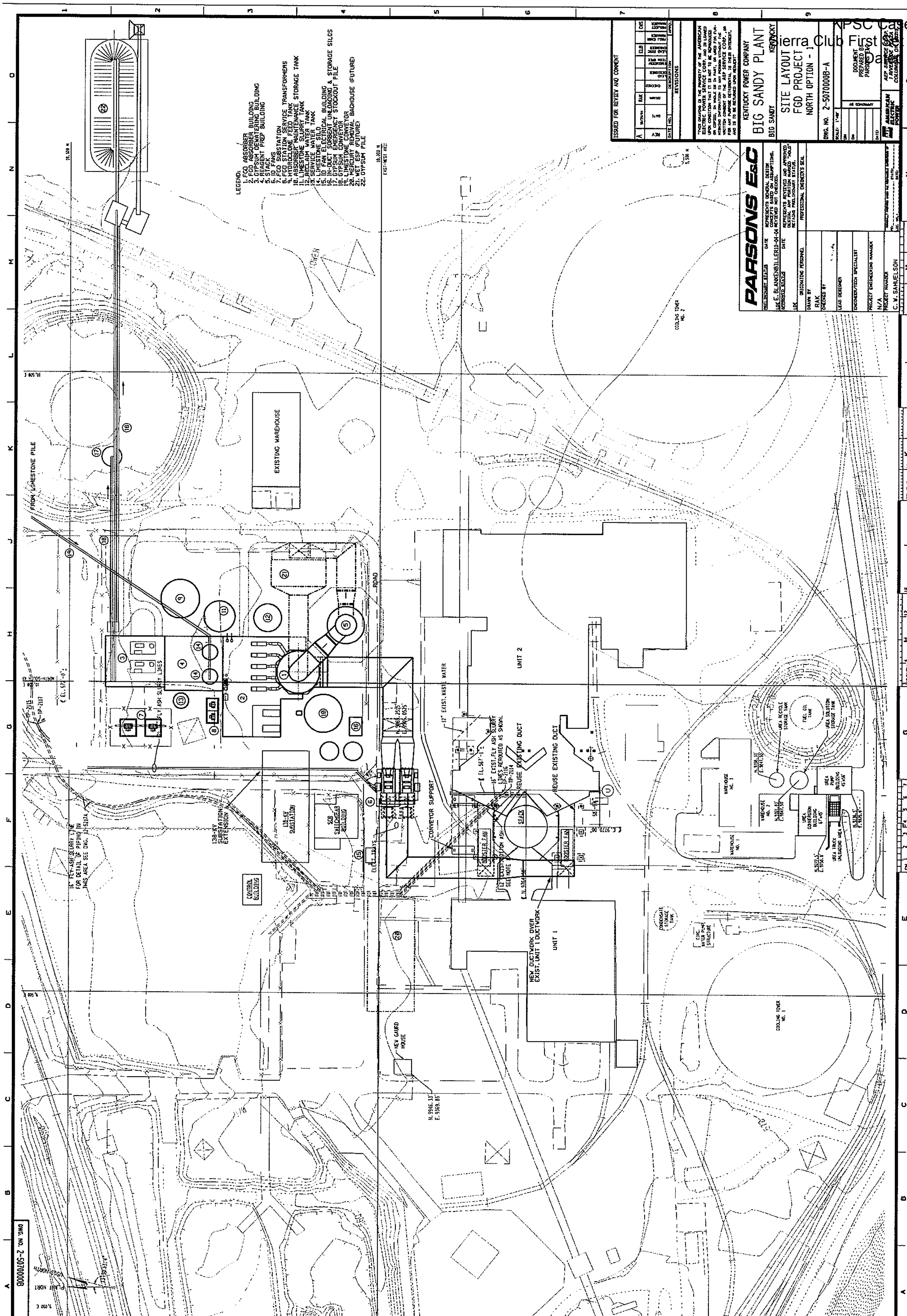
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3. GYPSUM DEWATERING BUILDING
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7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
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12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
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17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
EXISTING WAREHOUSE
FROM LIMESTONE PILE
UNIT 2
UNIT 1
COOLING TOWER NO. 2
COOLING TOWER NO. 1
CONVEYOR SUPPORT
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
NEW GUARD HOUSE
BOOSTER FAN
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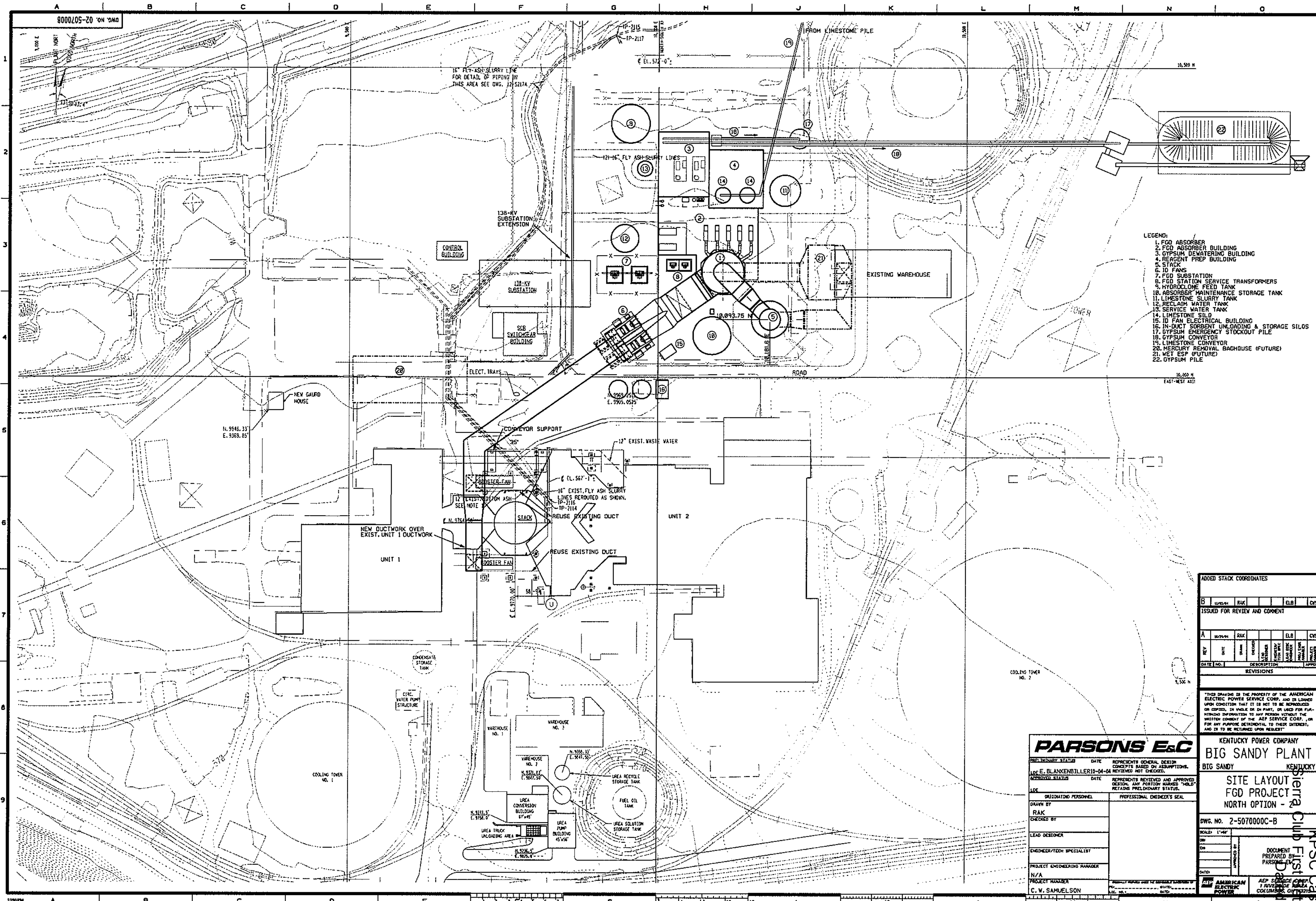
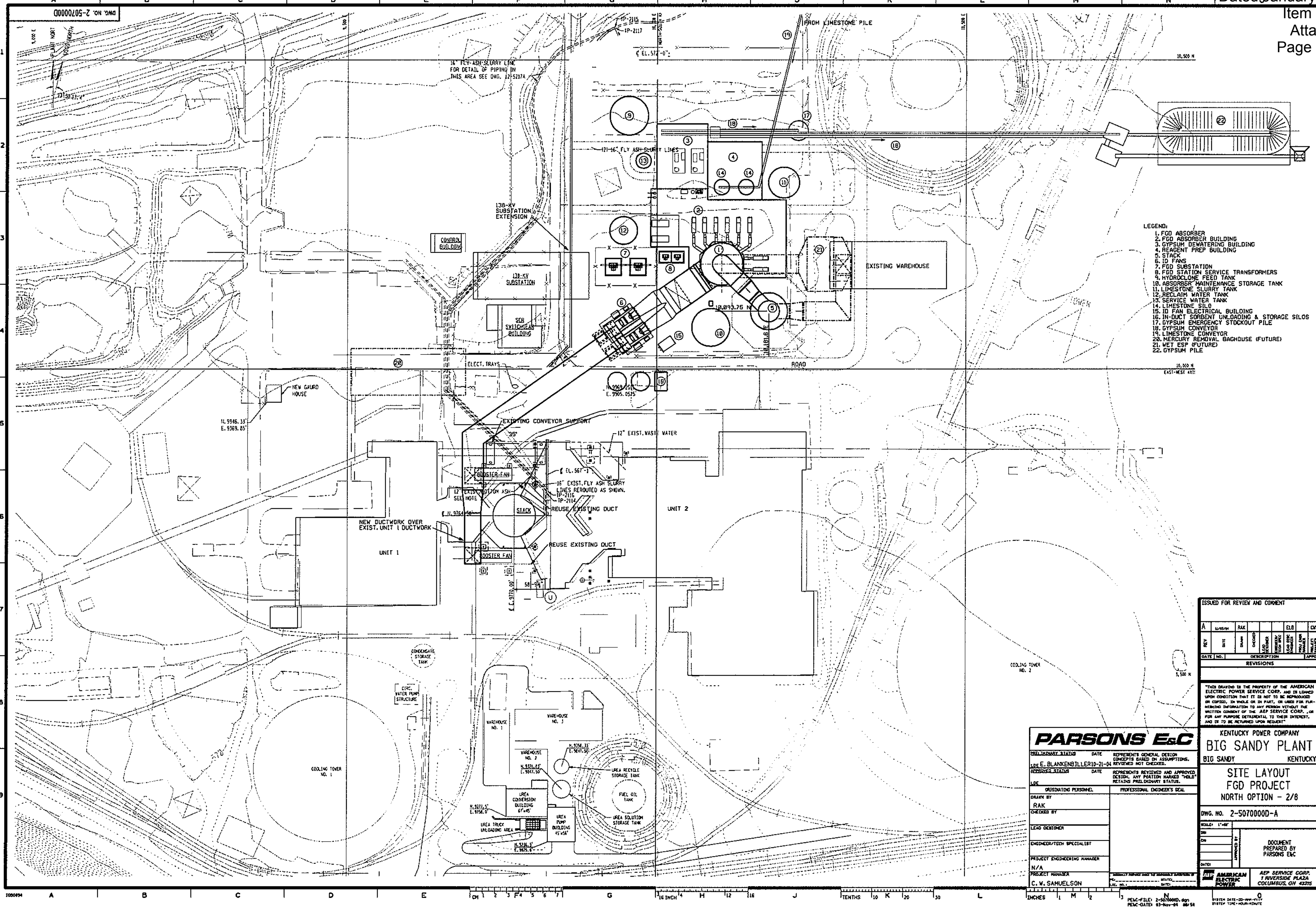
BIG SANDY PLANT
SITE LAYOUT
FGD PROJECT
NORTH OPTION - 1
C. V. SAMUELSON

KPSC Case No. 2011-00401
Sierra Club First Set of Data Requests
Dated January 13, 2012
Item No. 27(a)
Attachment 1
Page 30 of 113

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20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
FROM LIMESTONE PILE
EXISTING WAREHOUSE
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCB SWITCHGEAR BUILDING
ELECT. TRAYS
ROAD
NEW GAURD HOUSE
EXISTING CONVEYOR SUPPORT
12" EXIST. WASTE WATER
BOOSTER FAN
STACK
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
UNIT 1
UNIT 2
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
WAREHOUSE NO. 1
WAREHOUSE NO. 3
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA CONVERSION BUILDING
UREA PUMP BUILDING
UREA TRUCK UNLOADING AREA
UREA SOLUTION STORAGE TANK
COOLING TOWER NO. 1
COOLING TOWER NO. 2
10,500 N
10,000 N
EAST-WEST AXIS
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BIG SANDY KENTUCKY
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FGD PROJECT
NORTH OPTION - 2/8
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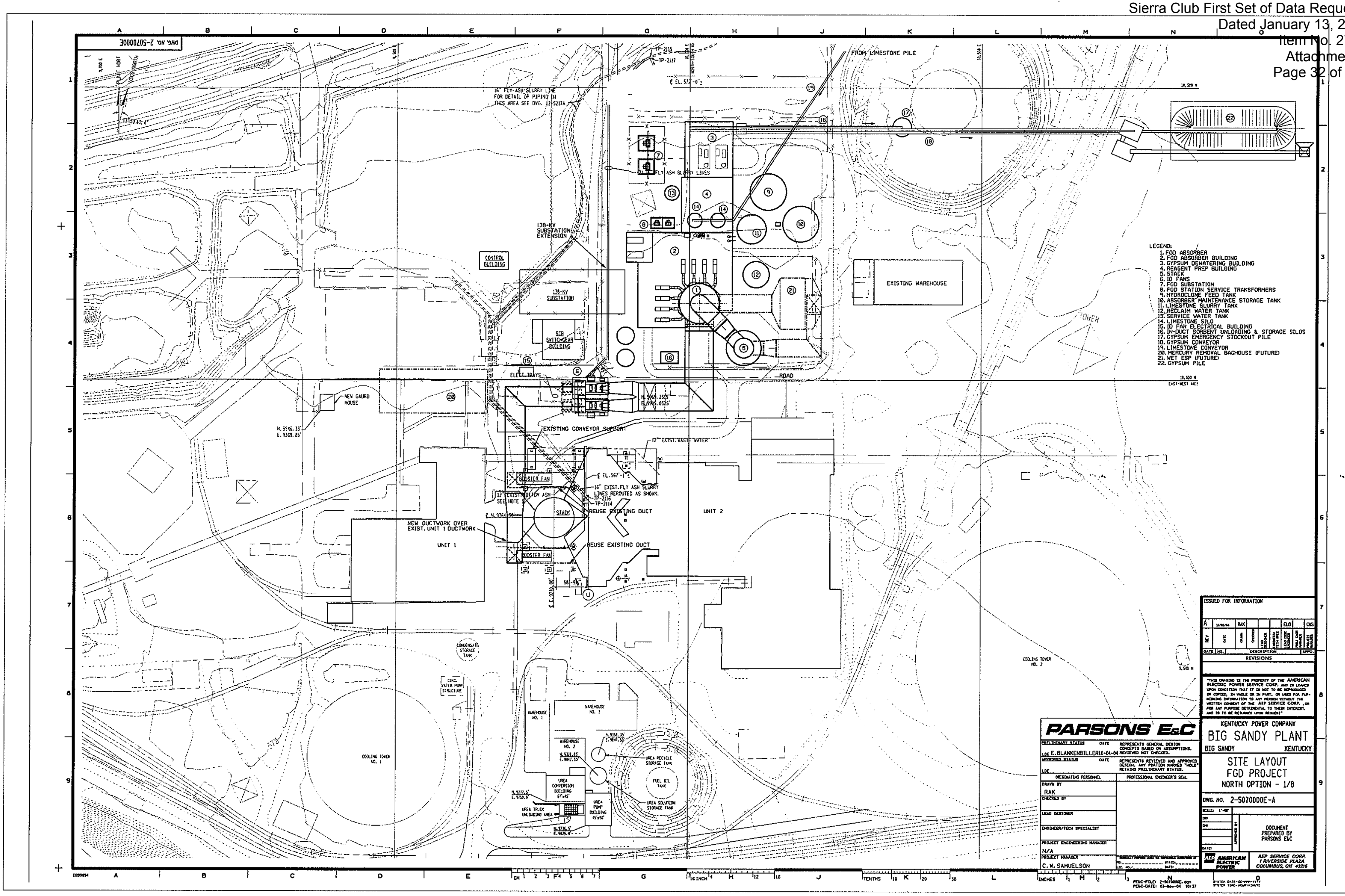
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FROM LIMESTONE PILE
16" FLY ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
FLY ASH SLURRY LINES
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCB SWITCHGEAR BUILDING
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ROAD
NEW GAURD HOUSE
EXISTING CONVEYOR SUPPORT
12" EXIST. WASTE WATER
BOOSTER FAN
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
STACK
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
UNIT 1
UNIT 2
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA CONVERSION BUILDING
UREA TRUCK UNLOADING AREA
UREA PUMP BUILDING
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
LEGEND:
1. FGD ABSORBER
2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
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7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
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21. WET ESP (FUTURE)
22. GYPSUM PILE
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comparison to Option 1, which allows the FGD substation and FGD station service transformers to be located closer to the existing 138 kV Substation. This transformer location is also closer to the FGD Building and the ID Fans, where the largest electrical loads are located. The extension of the existing 138 kV switchyard will be necessary to accommodate switchyard equipment additions for FGD substation bulk power feeds. This arrangement also allows space for efficient location of the field erected tanks so that they are nearest to the primary users, thus minimizing piping runs.

5.3 Plot Plan Development Criteria

In development of the plot plans, the following arrangement criteria have been considered:

- Minimize length of ductwork and pressure drop from the ESP outlet to the FGD absorber inlet.
- Ensure adequate space for operations and maintainability in and around the FGD Buildings and Equipment.
- Minimize the complexity of power transmission from the existing main 138 kV switchyard to the FGD substation, and from the FGD substation to the FGD electrical distribution equipment in the Absorber Building.
- Ensure adequate space for operations and maintainability of all existing Unit#1 and 2 buildings and equipment.
- Ensure adequate duct runs in and out of equipment to provide good flow distribution and minimal pressure drop.
- Provide conveyor access to minimize transfer points and complexity of the limestone and gypsum handling systems.
- Include gypsum dewatering on site even though pumping the slurry across the road to a dewatering pond will be considered in Phase II as an alternative to onsite dewatering.
- Locate the limestone silo bay in the Reagent Prep Building adjacent to the FGD Absorber Building to allow access to the top of the silos from the FGD Building.
- Minimize duct length between absorber and chimney while allowing sufficient space for large underground foundations.

5.4 General Arrangements

General Arrangements for the ground floor of the FGD Building, Reagent Prep Building and the Dewatering Area Building are shown on drawings 2-5070002A, 2-5070003A, and 2-5070004A, respectively. These general arrangements are based on the Mitchell Unit #1 and #2 tray tower design with modifications for single rather than two unit design. Redundancy of equipment is based on the Mitchell Station arrangement and criteria in the AEP Program Buying Guide for Major Process Equipment Sizing.

Mitchell Units #1 and #2 are sister units to Big Sandy Unit #2 with comparable heat input and flue gas flow rate. The Mitchell design is based on burning coal having a maximum sulfur content of 4.5 lb SO_2/MM Btu for the current design with provision for future conversion to allow burning coal having a maximum sulfur content of 7.5 lb SO_2/MM Btu. The current Mitchell design, downsized for a single unit and without provision for future higher sulfur coal capability, is a valid basis for the Big Sandy Unit 2 FGD arrangement.

Some of the equipment used in the Mitchell General Arrangements is oversized for the actual required duty. This is based on determining the required size of the equipment component and then picking the standard equipment size from the AEP Program Buying document that is equal to or larger than the required size. The AEP Program Buying document applies to the ball mills, vacuum belt filters, recycle pumps, oxidation air compressors and ID fans. It may be possible to downsize some of these components for Big Sandy Unit 2, if the Program Buying criteria is not applied and the actual required size equipment is purchased rather than a standard size. For the preliminary general arrangements, the equipment sizes shown are conservative.

Regarding redundancy, the major equipment, based on the Mitchell design, but adjusted in size for one unit at Big Sandy #2, is spared as follows:

- Two ball mills, 1 operating and 1 spare
- Two vacuum belt filters, 1 operating and 1 spare
- Five recycle pumps (based on tray tower absorber), 4 operating and 1 spare
- Two oxidation air compressors, 1 operating and 1 spare

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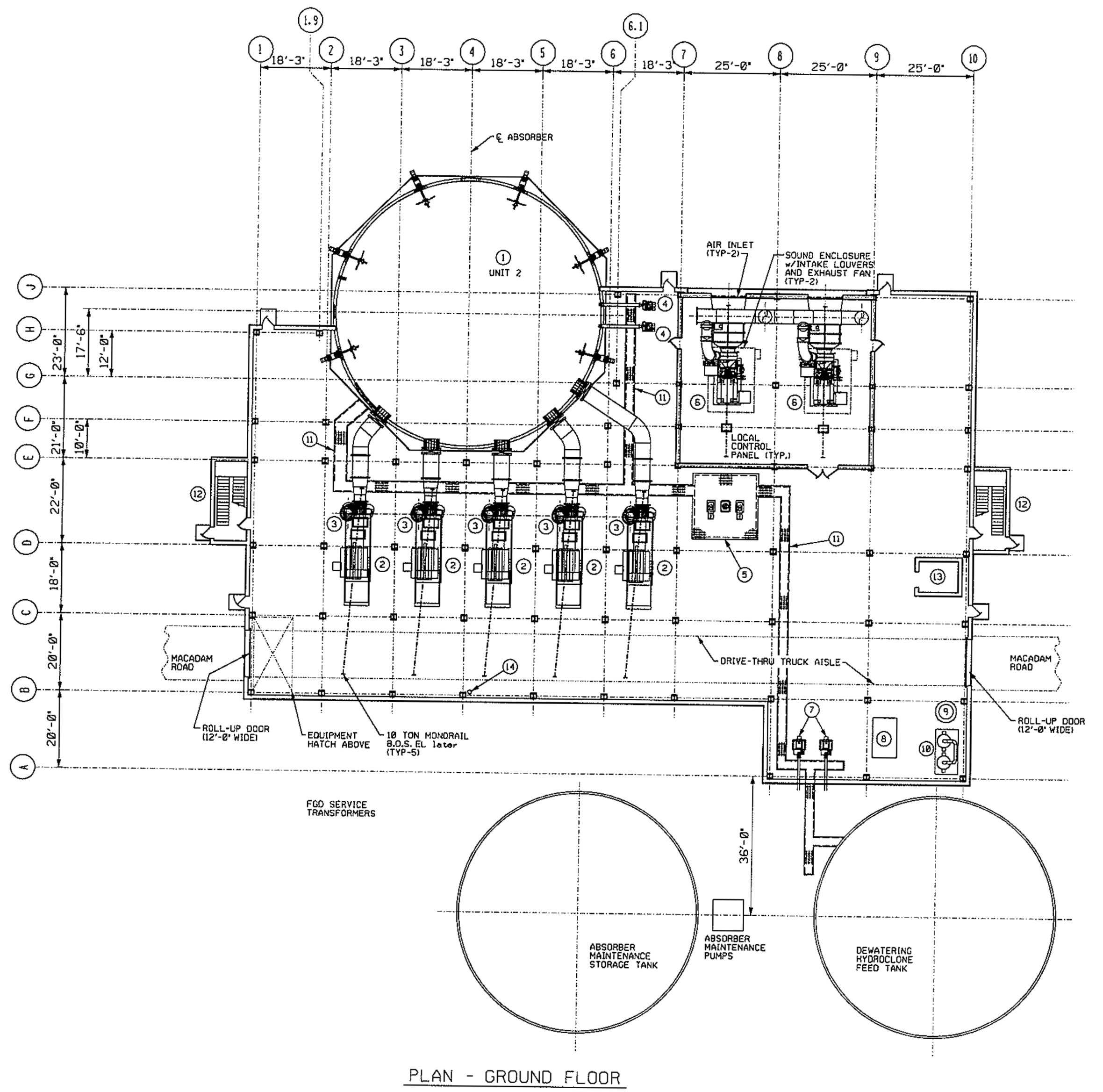

LEGEND:

1 ABSORBER
2 ABSORBER RECYCLE PUMP
3 ABSORBER RECYCLE PUMP DISCHARGE RISER
4 ABSORBER BLEED PUMP
5 ABSORBER AREA SUMP
6 OXIDATION AIR COMPRESSOR
7 HYDROCLONE FEED PUMP
8 AIR COMPRESSOR
9 AIR RECEIVER
10 INSTRUMENT AIR DRYER
11 FLOOR TRENCH
12 STAIRTOWER
13 ELEVATOR
14 EMERGENCY EYE & FACE WASH

PLAN - GROUND FLOOR

10 0 10 30
SCALE IN FEET

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DATE | NO. | DESCRIPTION | APPD.

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ENGINEER/TECH SPECIALIST:
PROJECT ENGINEERING MANAGER: N/A
PROJECT MANAGER: C. W. SAMUELSON

KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY

GENERAL ARRANGEMENT
FGD BUILDING
GROUND FLOOR

DWG. NO. 2-5070002A-A

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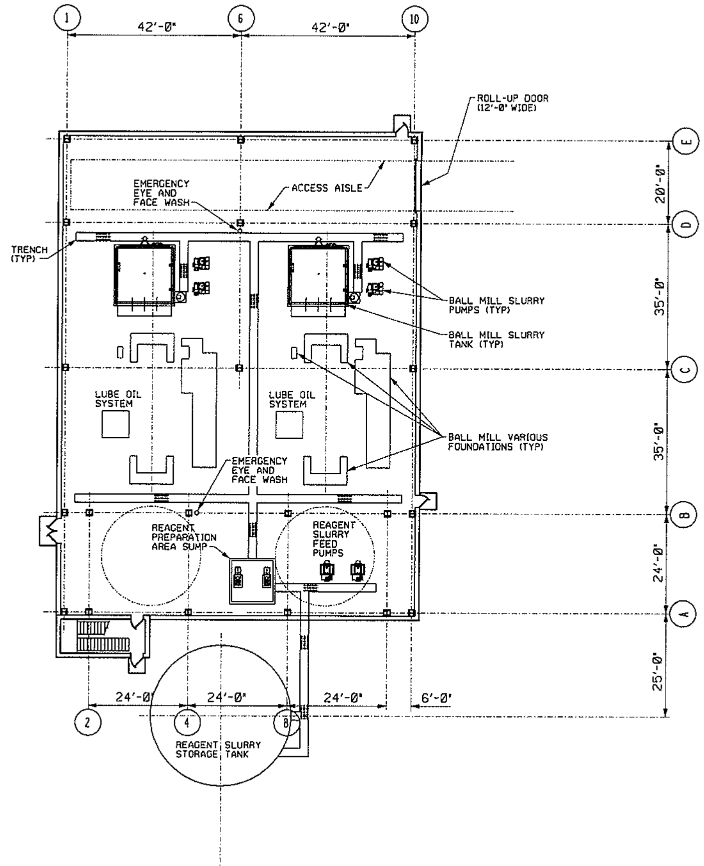

PLAN - GROUND FLOOR
REAGENT PREPARATION AREA

10 0 10 30
SCALE IN FEET

ISSUED FOR REVIEW AND COMMENT

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	09/28/04	RAK				ELB		CVS

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PROJECT ENGINEERING MANAGER: N/A
PROJECT MANAGER: C. W. SAMUELSON

KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY

GENERAL ARRANGEMENT
REAGENT PREP AREA
GROUND FLOOR

DWG. NO. 2-5070003A-A

DOCUMENT PREPARED BY PARSONS E&C

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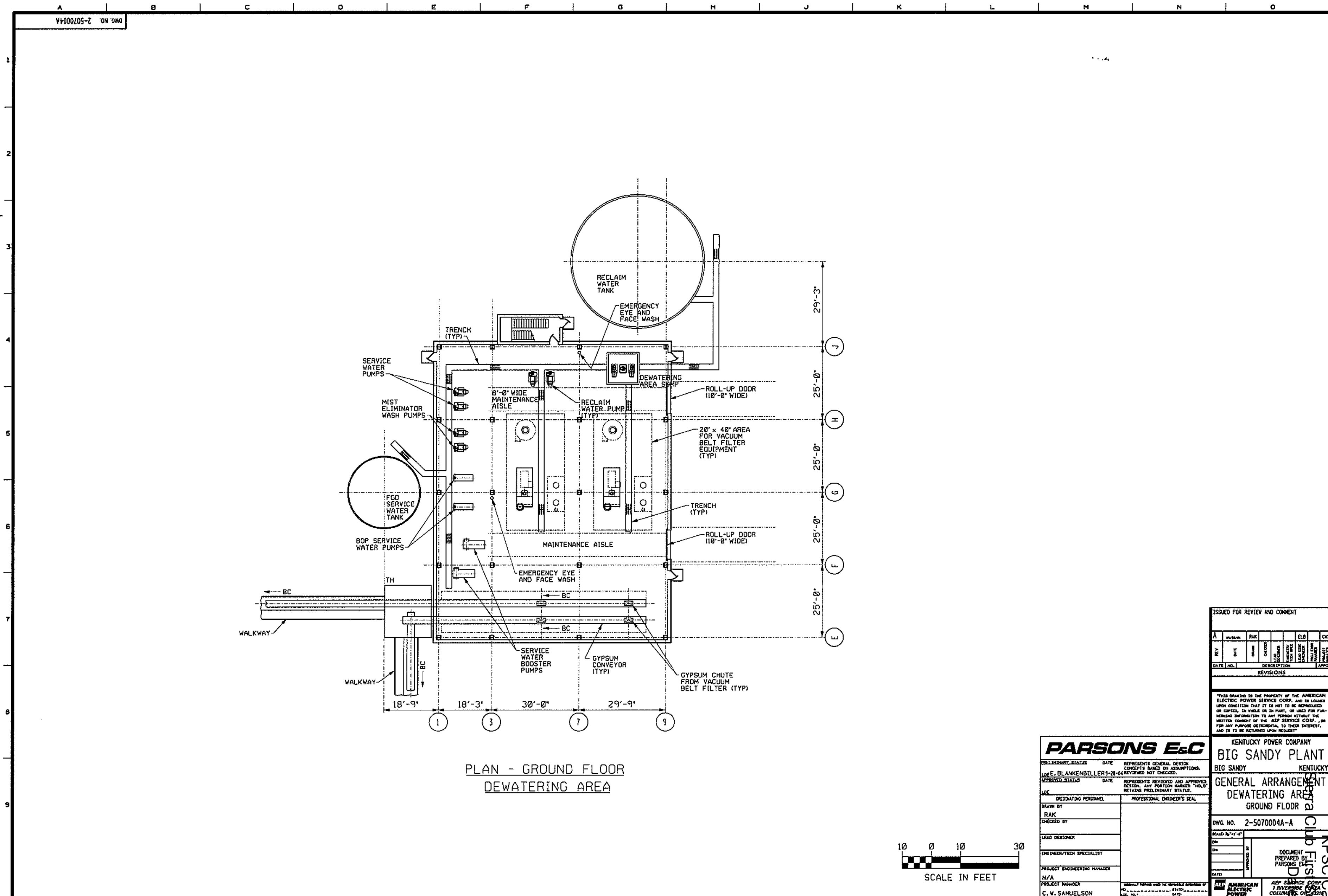
DWG. NO. 2-5070004A
RECLAIM WATER TANK
EMERGENCY EYE AND FACE WASH
TRENCH (TYP)
SERVICE WATER PUMPS
MIST ELIMINATOR WASH PUMPS
8'-0" WIDE MAINTENANCE AISLE
RECLAIM WATER PUMP (TYP)
DEWATERING AREA SUMP
ROLL-UP DOOR (10'-0" WIDE)
20' x 40' AREA FOR VACUUM BELT FILTER EQUIPMENT (TYP)
FGD SERVICE WATER TANK
BOP SERVICE WATER PUMPS
TRENCH (TYP)
ROLL-UP DOOR (10'-0" WIDE)
MAINTENANCE AISLE
EMERGENCY EYE AND FACE WASH
TH
BC
WALKWAY
SERVICE WATER BOOSTER PUMPS
GYPSUM CONVEYOR (TYP)
GYPSUM CHUTE FROM VACUUM BELT FILTER (TYP)
29'-3"
25'-0"
25'-0"
25'-0"
25'-0"
18'-9"
18'-3"
30'-0"
29'-9"
PLAN - GROUND FLOOR
DEWATERING AREA
10 0 10 30
SCALE IN FEET
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RAK
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PROJECT ENGINEERING MANAGER
N/A
PROJECT MANAGER
C. W. SAMUELSON
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CLB
CWS
REVISIONS
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY
KENTUCKY
GENERAL ARRANGEMENT
DEWATERING AREA
GROUND FLOOR
DWG. NO. 2-5070004A-A
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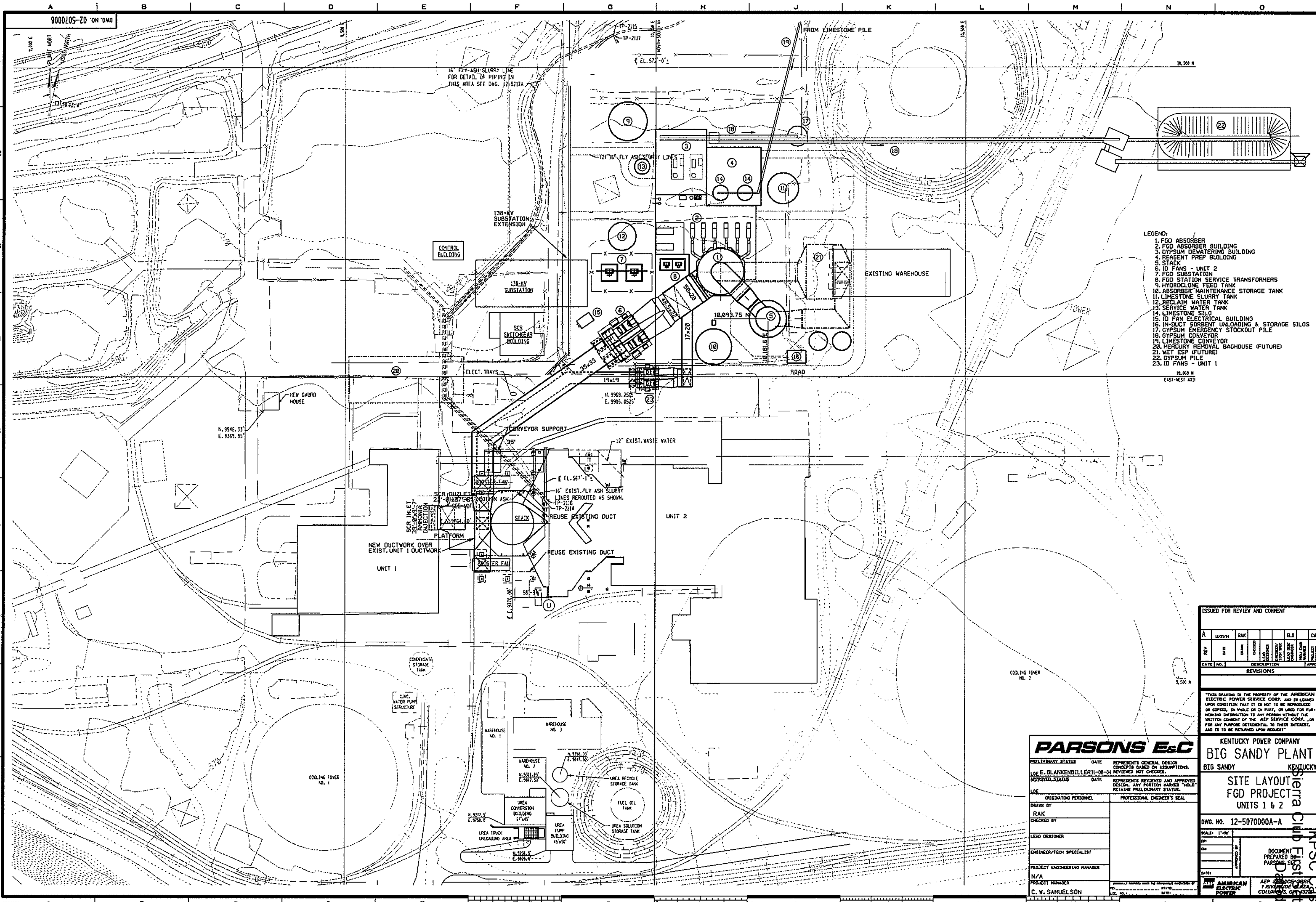
5.5 Stack Location

The plant coordinates of the new FGD stack are shown on Drawing 2-5070000C, the recommended North Option 2 arrangement. This location is based on preliminary equipment and building sizes and can be optimized, as allowed by the permitting schedule, when FGD OEM general arrangements and equipment sizing becomes available.

5.6 Big Sandy Unit1 Layout Considerations

Drawings 12-5070000A , 12-5070000B , and12-5070000D are plot plans showing a wet FGD arrangement that includes retrofit to Unit #1 in conjunction with Unit #2. The three drawings show the same combined Unit#1 and 2 FGD absorber, reagent preparation, and dewatering arrangement. The difference in the three drawings is in the arrangement of the Unit#1 ID fans relative to the Unit #2 ID fans. On drawing 12-5070000D, the Unit #1 ID fans are located under the Unit #2 flue gas duct. The FGD system components have been factored in size for the additional flue gas entering the system from Unit #1 (275 MW gross and 2,602 mm Btu/hr full load firing rate). An additional recycle pump, for a total of six, will be required for the open tray tower design. The quantities of the remaining major mechanical equipment components will not change, but the actual sizing criteria for the equipment will be adjusted to account for the approximate 1/3 increase in flue gas flow to the absorber when Unit 1 flow is combined with the Unit #2 flow.

For a two-unit FGD installation, the FGD substation area would be expected to increase to accommodate a total of four FGD Auxiliary Transformers, and the quantity of station service transformers required would also increase to four. These quantities are consistent with those of the two-unit Mitchell FGD electrical system.


DWG. NO. 02-5070008
LEGEND:
1. FGD ABSORBER
2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS - UNIT 2
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
15. ID FAN ELECTRICAL BUILDING
16. IN-DUCT SORBENT UNLOADING & STORAGE SILOS
17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
23. ID FANS - UNIT 1
FROM LIMESTONE PILE
EXISTING WAREHOUSE
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
16" FLY-ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
NEW GAURD HOUSE
ELECT. TRAYS
ROAD
CONVEYOR SUPPORT
12" EXIST. WASTE WATER
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
PLATFORM
UNIT 1
UNIT 2
STACK
BOOSTER FAN
COOLING TOWER NO. 1
COOLING TOWER NO. 2
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
UREA CONVERSION BUILDING
UREA PUMP BUILDING
UREA TRUCK UNLOADING AREA
EAST-WEST AXIS
ISSUED FOR REVIEW AND COMMENT
A
RAK
ELB
CVS
REV
DATE
DATE
NO.
DESCRIPTION
APPD.
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ORIGINATING PERSONNEL
PROFESSIONAL ENGINEER'S SEAL
DRAWN BY
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ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER
N/A
PROJECT MANAGER
C. W. SAMUELSON
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY
KENTUCKY
SITE LAYOUT
FGD PROJECT
UNITS 1 & 2
DWG. NO. 12-5070000A-A
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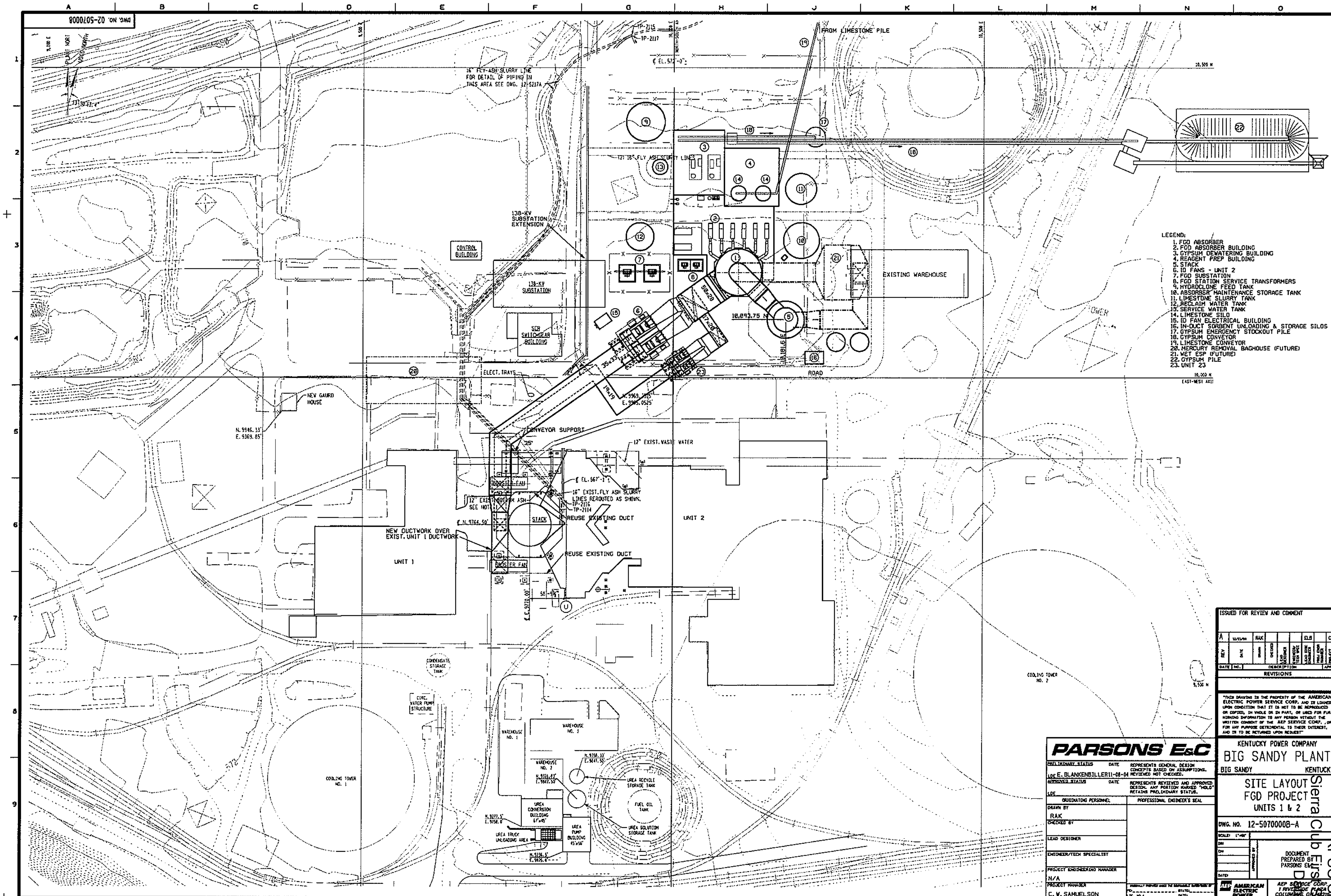
DWG. NO. 02-5070008
FROM LIMESTONE PILE
16" FLY-ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
EXISTING WAREHOUSE
ELECT. TRAYS
ROAD
NEW GAURD HOUSE
CONVEYOR SUPPORT
12" EXIST. WASTE WATER
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
STACK
BOOSTER FAN
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
UNIT 1
UNIT 2
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
UREA CONVERSION BUILDING
UREA TRUCK UNLOADING AREA
UREA PUMP BUILDING
LEGEND:
1. FGD ABSORBER
2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS - UNIT 2
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
15. ID FAN ELECTRICAL BUILDING
16. IN-DUCT SORBENT UNLOADING & STORAGE SILOS
17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
23. UNIT 23
ISSUED FOR REVIEW AND COMMENT
REVISIONS
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KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
UNITS 1 & 2
DWG. NO. 12-5070000B-A
E. BLANKENBILLER 11-08-04
RAK
N/A
C. W. SAMUELSON
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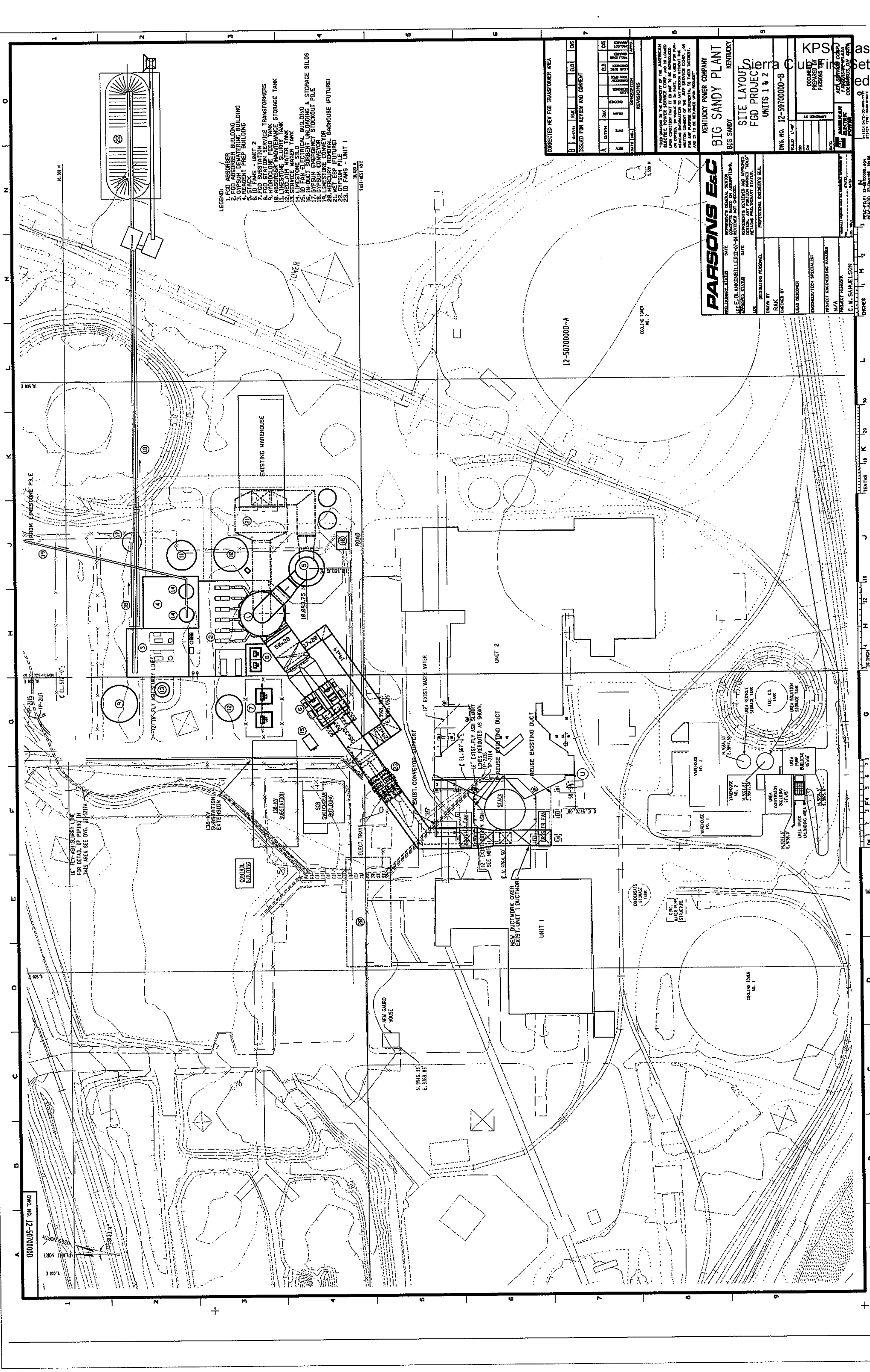
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO


LEGEND:
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3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS - UNIT 2
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
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20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
23. ID FANS - UNIT 1
EXISTING WAREHOUSE
FROM LIMESTONE PILE
UNIT 2
UNIT 1
STACK
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
EXIST. CONVEYOR SUPPORT
12" EXIST. WASTE WATER
138-KV SUBSTATION
CONTROL BUILDING
ELECT. TRAYS
ROAD
NEW GAURD HOUSE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
FUEL OIL TANK
WAREHOUSE NO. 1
WAREHOUSE NO. 2
12-5070000D-A
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
UNITS 1 & 2
DWG. NO. 12-5070000D-B
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AMERICAN ELECTRIC POWER
CORRECTED NEW FGD TRANSFORMER AREA
ISSUED FOR REVIEW AND COMMENT
DWG. NO. 12-5070000D

6.1 Introduction

Phase IIa will involve the integration of planning, conceptual studies and economic assessments, design criteria formulation, site layout design, and primary OEM equipment vendor information for the FGD systems. In Phase IIa, detailed engineering and design efforts will begin in earnest. Because of the schedule necessitating the need for a complete project cost estimate, Phase IIa engineering efforts will be geared toward the formulation of complete project definition to allow proper estimation of the current efforts' equipment sizing, quantities, craft labor, and continued engineering. While the current Phase I work is being completed, efforts involving all of the engineering disciplines for detailed planning of facilities locations and systems design will begin. The initial concentration of engineering will focus primarily on the civil, structural, and mechanical work. The civil work is associated with survey locations, subsurface utility investigations, geotechnical assessments, erosion and sedimentation plans, as well as, storm water system and excavation and fill calculations. The early structural engineering efforts in addition to design criteria development will include preparation of technical specifications, preliminary foundation designs for the absorber and chimney, and lasergrammetry for definition of as-built conditions of tie-in locations and planned duct routing. Foundation design for the chimney and absorber will be finalized after receipt of certified vendor load information. The mechanical work will involve development of ID fan sizing calculations and specification, definition of limestone and gypsum handling systems and specifications, development of balance-of-plant flow diagrams, writing of balance-of-plant equipment specifications, development of piping line specifications, and writing of technical specifications for piping, insulation, and mechanical equipment installation.

The process, electrical, and structural engineering disciplines during this initial period will be finalizing process flow diagrams and one-line diagrams, developing system and equipment sizing calculations, formulating new underground utility systems and grounding grids, beginning preparation of demolition drawings, and interfacing heavily with the FGD OEM vendor in order to obtain the critical system and foundation design information that is essential for the design of their respective foundations. During this initial period, the 3-D PDS model will be developed as the project's basic tool for the integration of the various disciplines' detailed design effort. [The FGD OEM vendor will be required to provide their equipment's 3-D models for use by Parsons E&C in the development of the overall integrated plant 3-D model.]

The conclusion of the Phase IIa efforts will be a complete project estimate that will allow AEPSC to understand the capital commitment necessary to complete this project. It is anticipated that the Design Review Board (DRB) approval of the project will be coincident with the completion of the project cost estimate. The Parsons E&C team is committed to support the AEPSC Big Sandy team during the DRB approval process.

6.2 Major Issues To Be Addressed in Phase IIa

AEPSC and Parsons E&C have jointly developed studies and evaluations that define the known major issues and open actions that will require further effort to completely define the overall project. Following is a listing of these elements with a short description for each, as well as the work to be performed.

Schedule Acceleration Study

Big Sandy Unit 2 WFGD commission date is currently scheduled for November 22, 2009. Parsons E&C will identify what strategic activities need to be initiated and what project milestones need to be completed in order to accelerate this WFGD commissioning date.

Permitting Support

By this activity Parsons E&C will provide AEP with services required, time-to-time, to support on-going issues associated with the air, water, or site permitting processes. These issues would include, but are not confined to, material balances for alternative coals, limestones, or ambient conditions, review of documented state or local emissions/effluent regulations, revised emission or effluent calculations, trace element emissions, and/or supporting calculations.

Design Review Board Support

AEP may request support from Parsons E&C in preparing and/or presenting material to AEP Senior Management. This support may take the form of, but is not limited to, review of presentation material, generating presentation documents, and travel to Columbus, Ohio to support the AEP project team.

Site Safety Study

Parsons E&C will walk the site to see what potential construction hazards exist. The overall study will take the following form: 1) Review access and egress for safe construction operations and minimal conflict with plant operations. 2) Highlight areas for confined space entry permitting. 3) Review worker pedestrian areas for safe site access. 4) Establish preliminary safe work zone boundaries. 5) Evaluate road crossings and recommend special traffic controls for safe construction operations. 6) Review site for "Overhead Power Line" restrictions and recommend appropriate postings for construction clearances. 7) Review existing structures affected by construction for "Tie Off" requirements. 8) Issue a report on existing conditions, analysis of hazards or potential hazards, and recommend corrective actions or accident prevention measures.

Big Sandy Unit 1 Emissions Control Strategy

Parsons E&C may, if directed by AEP, evaluate the application of several emissions control technologies to Big Sandy Unit 1 for the purposes of reducing mercury emissions. The emission controls will focus on deNOx and deSOx technologies, such as SCR and WFGD, as well as commercial mercury removal systems. WFGD control technologies evaluated may or may not include the same WFGD technology applied to Big Sandy Unit 2. The emissions alternatives evaluated will weigh overall results with risk, cost, schedule, and commercial reliability. A study report would be issued for this work.

Big Sandy Unit 1 Alternatives and Risk Assessment

Parsons E&C may, if directed by AEP, identify and evaluate the risks associated with the application of emissions control technology(s) to both Big Sandy Units 1 and 2. Issues to be evaluated may include: the impact of additional ammonia requirements for Unit 1 on the existing urea-to-ammonia plant, affect of Unit 1 technology to the general arrangements and plot plans already developed by Parsons E&C for Unit 2 WFGD, and additional utility requirements for Unit 1 conversion. If the same WFGD control technology is applied to both Units 1 and 2, additional studies will be required. These additional studies may include, but are not limited to, routing flue gas from both Unit 1 (300 MW) and Unit 2 (800 MW) to the same absorber vessel, evaluating induced draft damper configurations required to isolate off-line unit, evaluating affect of "off-line" Unit 2 on location of wet/dry line when Unit 1 "on-line" at part load, and total unit response to master fuel trip (MFT), or other such plant disruption, on either Big Sandy Unit 1 or 2.

Limestone and Gypsum Weather protection

Parsons E&C will make an assessment to determine if raw limestone requires measures for freeze protection and dust control. The same evaluation will be made for the gypsum product. A report will be issued for this study.

Plant Operating Data

Historical plant data summaries will be evaluated by Parsons E&C to determine normal base line and part load operating levels, as well as to determine required turndown requirements and capabilities. Examination of the historical data will also reveal if the unit is a "peaker" or traditional "base loaded" unit. AEP will be interviewed to determine the future disposition of daily operations to make sure they are consistent with historical data. The summarized data will be incorporated into the plant specific design criteria

Plant Operating Philosophy

Parsons E&C will interview the appropriate AEP personnel to determine the preferred schedule for batch operations such as: raw limestone grinding, limestone slurry preparation, and gypsum dewatering. These operations may be confined to two shifts rather than three. Plant preferences will determine storage/surge tank volumes. The summarized results will be incorporated into the plant specific design citeria.

Shared Assets

The potential effects of Unit 2 WFGD conversion to Unit 1 will be evaluated by Parsons E&C. This would include changes in coal feedstock necessitating separate coal deliveries, storage, and handling for Unit 1. Other variables will be identified and investigated such as shared electrical tie-ins, flyash disposal options, and the potential for conversion of Unit 1 for SCR and WFGD.

There are also potential effects of adding WFGD to Unit 2 on existing Unit 2 equipment. These effects need to be identified and quantified. One example of this is if ammonia is chosen for in-duct SO_3 mitigation. The existing urea-to-ammonia facility would have to be examined to ensure that it can provide the required ammonia for both the existing Unit 2 SCR as well as the potentially required ammonia for SO_3 mitigation.

A report will be issued for this study.

Baseline Plant Test

A third party will be contracted by AEP to perform a rigorous and comprehensive survey of plant state points and other data. This data will be reviewed and reconciled by Parsons E&C against historical plant operating data. Plant personnel will be interviewed to assess the accuracy of the baseline test data and to help reconcile any inconsistent information. The results will be reflected in the plant specific design criteria.

High Sulfur Coals

AEP will perform any evaluations required to determine the effect of burning higher sulfur coal on unit operations, including the boiler, air heater and ESP.

Redundancy

Before final plot plans and General Arrangement drawings can be developed, a WFGD equipment redundancy policy must be established. In its simplest form, such a policy requires specifying redundant critical equipment as either: (1) two units sized for full load – one unit operating and one spare, or, (2) three units sized for half load – two units operating and one spare. It is anticipated that redundancy requirements will be mutually resolved by AEP and Parsons E&C during design development.

SO_3 Mitigation Study

SO_3 mitigation method will be determined by AEP. AEP does not want Parsons E&C to perform a study of viable options. Implementation of the mitigation system selected by AEP is in Parsons E&C scope of detailed design.

Limestone Specification

It is essential that we finalize limestone "design" composition and identify likely alternatives. This requires a review of limestone available by railcar and a definition of the gypsum product as either disposable or wallboard quality. Once the design limestone is identified, the trace element analysis for purposes of permitting the unit needs to be verified. The final limestone specification, decision on disposable vs. wallboard quality gypsum, and trace element analysis of the limestone is in AEP scope of work. Parsons E&C will perform the trace element analysis of byproducts and wastewater.

Gypsum Dewatering

A decision by AEP is required on the ultimate disposition of the solids produced in the WFGD process. It must be agreed upon as to whether a salable gypsum product is to be produced or if the WFGD solids are to be disposed of in either a landfill or pond. The choice will allow assessment of the dewatering method and disposal options. The final dewatering option may affect the size of the plot plan, type/size of oxidation blower required, bulk dewatering equipment required, as well as the quality of limestone required.

FGD Supplier

A WFGD OEM must be selected by AEP with input and guidance from Parsons E&C. Choice of technology will affect all other aspects of the plant design and is an important issue that must be evaluated and weighed with cost, risk, reliability, and schedule in mind.

Chimney Studies

Parsons E&C will need to finalize the chimney location. AEP will specify the chimney height and complete turbulence and dispersion tests. Parsons E&C will evaluate potential breeching configurations and determine if the use of FRP ductwork from the absorber hood is feasible or if square/rectangular ductwork is required. The work in Parsons E&C scope is part of design development.

Power Source Study

There are two options for providing redundant sources of power to the Unit 2 WFGD electrical distribution system. One option involves the use of the existing Unit 2 138-13.8kV SCR transformers and SCR 13.8kV switchgear. Modifications and/or partial replacement of this equipment would likely be necessary for this option to be feasible. The other option involves the addition of 138kV breakers in the existing Big Sandy 138kV switchyard, and the extension of new 138kV transmission circuits to a new 138-13.8kV FGD substation located adjacent to the FGD development area. Parsons E&C will perform an assessment of these alternatives and provide a recommendation for AEP's approval.

Rail Delivery or Truck Delivery

A final determination must be made as to whether rail cars or trucks will be used for the delivery of coal, limestone, and perhaps dewatered gypsum.

This decision must be weighed against the risks, cost, and benefits of each alternative. Parsons E&C will perform this study and issue a report.

Make-up Water Supply

Potential water make-up sources will be identified and quantified. Make-up water sources include river water, ash pond run-off, and well water. Make-up water trace element compositions will be evaluated. Pre-treatment alternatives for biological and solids removal will be evaluated. Modifications to the existing river water intakes will be evaluated as necessary. Parsons E&C will perform this study and issue a report.

Coal System Upgrades

Coal feed to Unit 2 will be a blend of high and low sulfur coals. A coal blending system will have to be developed. An approach to maintaining two separate coal piles for Unit 2 will also need to be developed. Parsons E&C will examine rail traffic schedules to determine what impact will be realized through delivery of two separate coal sources. Parsons E&C will perform this study and issue a report.

Blow Down

The ultimate disposition of the WFGD purge stream effluent must be determined and verified. Once the location is determined, a trace element analysis will be required, along with an evaluation of state regulations, as to whether the purge effluent requires additional clarification and/or treatment. This work will be done by Parsons E&C as part of the design development.

Topographic Survey

Parsons E&C will prepare a drawing and specification to procure topographic survey services. The survey will include identification of surface features and will provide existing topographic information for the existing plant necessary for design. The survey will be performed by a professional land surveyor. A Parsons E&C representative will be on site during the surveyor's fieldwork.

Geotechnical Investigations and Report

A subsurface exploration program will be performed at the site. Parsons E&C will review existing geotechnical information, and then propose additional subsurface investigations as warranted. A drawing and specification will be provided by Parsons E&C for AEP to procure these services. The program will likely include standard penetration test (SPT) borings, rock cores, field resistivity testing, shear wave velocity testing, and laboratory testing of soils. A Parsons E&C representative will be on site during the fieldwork. The results of the geotechnical investigation will be provided to Parsons E&C as a data report and Parsons E&C will use this data to generate geotechnical design recommendations.

Underground Utility Investigations and Report

Parsons E&C will review existing utility drawings available for the site and then prepare recommendations for a subsurface utility locating program. Parsons E&C will prepare a drawing and specification for AEP to procure these services. This work will be performed in general accordance with American Society of Civil Engineers (ASCE) 38-02, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data." Most likely the services will consist of Quality Level B geophysical methods for designating utilities in accordance with ASCE 38-02 with some Quality Level A locating on an "as-needed" basis. Quality level C services will be provided as part of the topographic survey. A Parsons E&C representative will be on site during this fieldwork.

River Intake – Bathymetric Study

If required, Parsons E&C will prepare a drawing and specification for AEP to procure bathymetric survey services to obtain river water depths in the area of the proposed river intake. This will only be required if modification to the existing intake is necessary to add pump(s) to meet makeup water requirements of the WFGD system. These services may or may not be performed by the same surveyor who performs the separately listed topographic survey. A professional land surveyor will perform the survey with equipment specifically manufactured to obtain water depth reading or soundings. A Parsons E&C representative will be on site during this fieldwork.

Transient Analysis

A dynamic (time dependant) model maintaining the integrity of the existing plant geometry while incorporating the new absorber gas-path geometry will be developed. This model will be used to investigate gas-path transient responses in order to estimate peak pressures in the flue gas system to determine design pressure of the gas side ductwork and equipment. AEP will perform this work and provide design pressures to Parsons E&C for the ductwork in the AE's scope of design.

Construction Approach

Several approaches to construction for this plant can be used. It is the intent of AEP and Parsons E&C to develop an approach that is consistent with the objectives of a safe working environment, acceptable schedule, and cost-effectiveness. Parsons E&C will evaluate the site specific needs, project schedule, complexity of equipment, and make the most appropriate recommendation while considering the project cost and risk profile for the project.

Noise Study

Parsons E&C will write a specification for use by AEP to procure the services of a noise consultant to perform a survey of existing background noise at the plant boundary lines, determine the allowable noise levels at the boundary lines when the FGD plant is in operation, make recommendations on limits of equipment noise levels and acoustical treatment of outdoor equipment, ductwork, and buildings (louvers, building construction, etc.) to assure that allowable boundary line noise levels are not exceeded, and to perform a noise survey of actual levels at the boundary lines with the FGD plant in operation. Parsons E&C will review the consultant's report and incorporate their recommendations into equipment specifications.

7.1 Incremental Issues with Adding WFGD to Big Sandy Unit 1

The issue to add a WFGD technology to Big Sandy Unit 1 has been raised by AEP. The approach is that the flue gas from Units 1 and 2 would be commonly ducted to a single absorber tower and ultimately to a single wet stack. Reagent preparation and product dewatering would be common. The gas paths from the individual units would remain separate through induced draft fans, dedicated to each unit, and combined, where appropriate, prior to the absorber inlet duct. Three conceptual layouts for the combined FGD system can be found in Section 5 of this report.

Prior to adding WFGD to Big Sandy Unit 1, a life-extension program, that may include furnace conversion from pressurized to balanced-draft, would be required. This is due to the decayed state of the existing furnace and ductwork. This necessary program would extend the life of the power generator by twenty years. For the purposes of this discussion, Parsons E&C is assuming that both a life-extension program and a furnace draft conversion program could be completed without much risk to plant availability and at a known cost.

A design challenge lies in ducting the Unit 1 flue gas to the common absorber inlet duct. The difficulty lies in spatially accommodating the ductwork from the ESPs to the common absorber tower, from both Unit 2 *and* Unit 1. With the two units positioned back-to-back and exhausting into a common stack (existing hot stack), the ductwork egresses from each individual unit will be tight. The existence and/or level of possible interferences will remain unknown until *both* units are evaluated three dimensionally subject to application to a common WFGD tower.

There are other issues that introduce uncertainty and would require evaluation and definition to mitigate risk. These would include but not be limited to: (1) evaluating ID fan damper configurations required to isolate an off-line unit, (2) evaluate effect of "off-line" Unit 2 on location of the absorber wet/dry line when Unit 1 is "on-line" at part load, (3) effect of Unit 1 WFGD on the general arrangements and plot plans already developed by Parsons E&C for Unit 2 WFGD, (4) electrical and other service requirements for additional capacity required to accommodate Unit 1 flue gas flow, and, (5) total unit response to master fuel trip (MFT), or other such plant disruption, on either Big Sandy Unit 1 or 2.

There is a large amount of risk associated with proceeding on Unit 2 WFGD without making a decision over the final disposition of Unit 1. This risk could adversely affect both cost and schedule for Unit 2 WFGD. Comments from plant personnel received by Parsons E&C during the project kick-off meeting indicated a high level of concern in proceeding with WFGD for Unit 2 without planning for and incorporating modifications to Unit 1.

7.2 Incremental Issues with Adding SCR to Big Sandy Unit 1

It has been proposed that if WFGD were applied to Big Sandy Unit 1, a selective catalytic reduction (SCR) system would be concurrently added. This would entail ducting the hot flue gas from the economizer exit to the SCR system and then ducting the flue gas back to the air heater. From the air heater, flue gas would flow through the ESP and ultimately be routed to the common absorber tower.

A typical SCR system consists of an ammonia injection grid (AIG), static mixing of the flue gas and ammonia, and a multiple-bed catalytic reactor. The SCR AIG and reactor must be supported above grade in close proximity to the economizer. Grade-level real estate would have to be located to accommodate the steel. Proper planning would be required to configure the Unit 1 SCR along with the ductwork changes required to route the flue gas to the WFGD absorber tower. Discussion with Big Sandy plant personnel has hinted at the possible relocation of the Unit 1 ESPs. Again, as is the case with the WFGD discussed above, both Units 1 and 2 would have to be evaluated in three dimensions to properly assess and refine this combination. Proceeding without addressing these issues would potentially expose the Unit 2 WFGD design to deficiencies and risk that would undermine the overall project.

Other issues that would have to be evaluated include: general assessment of furnace access for SCR, electrical and other service requirements for SCR addition, impact of additional ammonia requirements for Unit 1 on the existing urea-to-ammonia plant, and the effect of Unit 1 SCR and WFGD on the general arrangements and plot plans already developed by Parsons E&C for Unit 2 WFGD.

7.3 Incremental Issues with Adding Unit 1

One of the possibilities for dealing with mercury control is the installation of an SCR and WFGD for the Big Sandy Unit 1. We have established incremental cost estimates associated with combining the Unit 1 WFGD with the Unit 2 WFGD, vis a vis, Unit 1 and Unit 2 steam generators into one FGD absorber tower. The incremental costs were evaluated by having unitized draft systems up to the absorber vessel. Thus each unit has its own dedicated duct from the ESP outlet to the WFGD absorber including two axial ID Fans.

The incremental costs were determined by using the Mitchell Units 1 and 2 project cost estimates to determine a relative estimate for the Big Sandy Unit 2 overall cost. This was then factored based upon judgment for the incremental increase of the equipment size to incorporate the processes of the 300 MW Unit 1. Following is a tabulation of these incremental costs:

WFGD System Description	Cost (x 1000)
Absorber Island	$11,400
Flue Gas Draft System	$16,150
Limestone Handling and Slurry Preparation System	$5,700
Gypsum Dewatering and Handling System	$5,700
Electrical and I&C Systems	$5,950
Chimney	$4,200
Balance of Plant Equipment	$3,700
Foundation and Site Preparation	$6,400
TOTAL INCREMENTAL COST	$59,200

The above estimated incremental cost breakdown relates to approximately $197/KW and was established by using the same ratio to the total costs as was established for the Mitchell costs. These values include AEPSC's costs, assumed to be in the same proportion as the Mitchell project, but do not include Water Treatment, Coal Blending and SO_3 Mitigation costs.

Regarding the SCR incremental cost, it is Parsons' experience that a ratio of $100 per KW is a relatively accurate cost estimate. Applying this ratio, incremental costs for a Unit 1 SCR would be approximately $30 million. This is based upon it having its own dedicated urea to ammonia conversion system.

8.1 Schedule Basis

To support AEPSC's requirements, this schedule is based on the expected initial operation of Big Sandy Unit 2 WFGD on November 22, 2009. The purpose of this work scope is to advance engineering to a point that will allow the development of a valid overall project cost estimate. See Exhibit 8-1 for the summary schedule for this phase of the work.

During this next phase, a Critical Path Schedule for the entire project, including the development of a target installation schedule that will be adjusted once construction contractors are selected, will be developed.

The concept formulated by Parsons E&C to effectively address this next phase of the project is illustrated in the diagram below:

The cycle for this phase of the project is estimated to take approximately nine (9) months. This time period is required to effectively conclude all aspects of Phase IIa. When conclusions and decision are established for key studies and evaluations, engineering of the project can proceed. A critical point to make here is that it is common to move forward with the engineering of a project too early (i.e., before the foundation for the design has been established). It takes restraint to hold engineering from moving too far forward using assumptions and guesswork instead of firmly established design criteria and fact. Conversely, it is essential to integrate the studies and evaluations phase with engineering to allow overlap and the ability to initiate engineering when appropriate key conclusions have been reached.

A schedule will be developed at the beginning of Phase IIa that logically ties the studies and evaluations to successor activities that will allow the project to flow as shown graphically above.

8.2 Project Critical Path

The critical path through the project lies with the permitting activities. If the permitting activities' schedule can be improved, the critical path in moving forward will then lie with chimney erection and construction of the WFGD absorber. Erection of the chimney shell will essentially prevent other craft activity in the FGD area due to safety requirements. At a minimum, a fifty (50) foot safety exclusion zone (radius) is required around the stack during construction. Therefore, it is important to establish the stack location and mobilize a chimney contractor early in the project. As soon as the chimney shell is erected, construction on the absorber and process buildings can commence.

Related to this string of construction activities at the front end of the schedule is the necessity to complete relocations and foundations in the chimney/FGD island area. Since the chimney erection will impede other FGD area work, the schedule will need to provide for completing the entire FGD island foundations prior to start of the chimney shell. This will permit absorber island building construction immediately after the completion of the chimney shell, which otherwise would be delayed if foundations were not previously installed.

8.3 Engineering Schedule

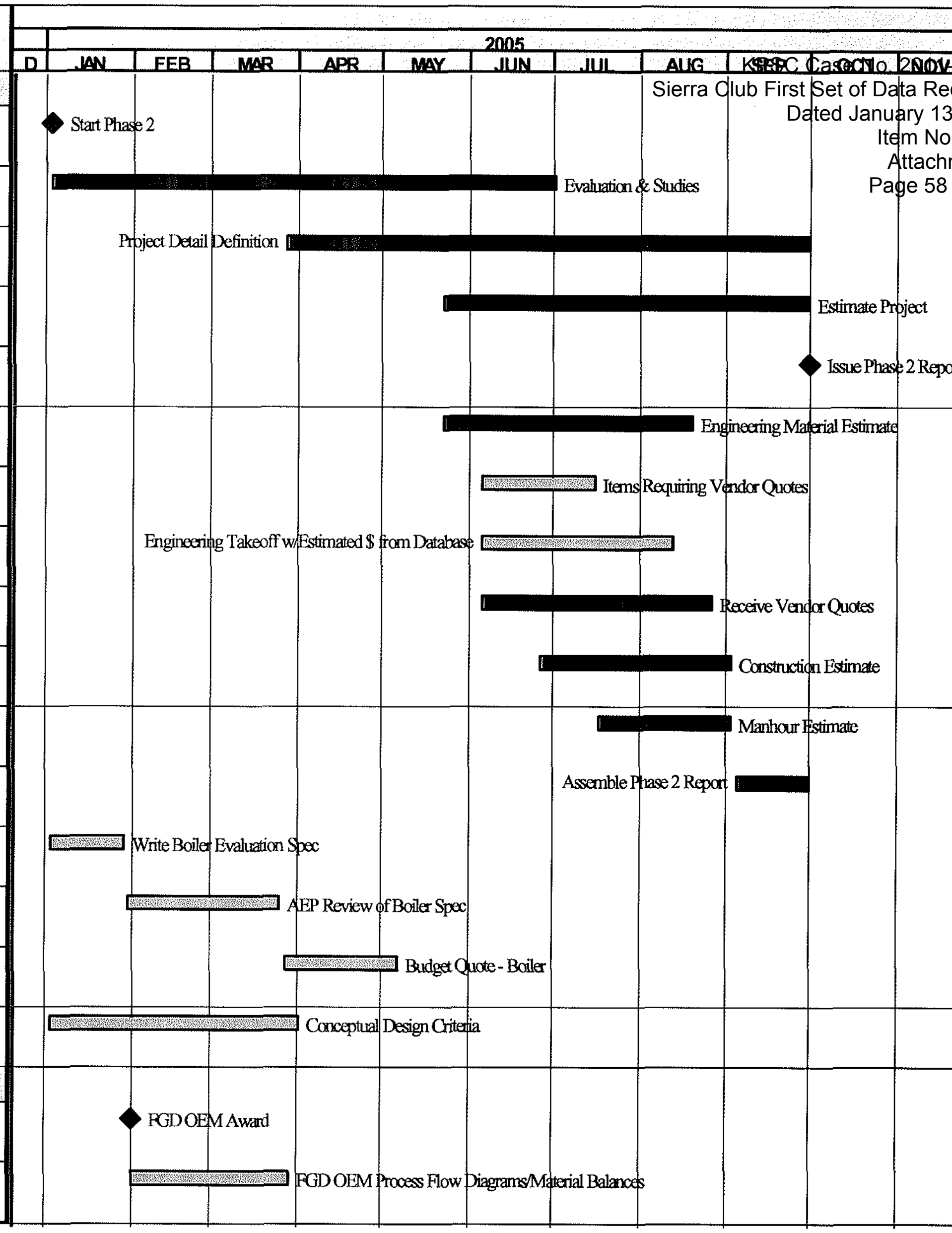
The engineering schedule is dependent upon timely completion of the Phase IIa evaluations and studies that need to be finalized prior to the start of detailed engineering. The major deliverable for this next phase is the project cost estimate. Once the cost estimate is completed, and continued detailed engineering is authorized, the construction and commissioning schedules will be the driving factors to meet the required WFGD startup date. The key to success is the timing of engineering information from the OEMs and vendors to support balance-of-plant engineering and construction. Therefore, it is essential that orders to suppliers be released as required to support the overall schedule, thus preventing undue and unnecessary work schedule conflicts and delays.

8.4 Division of Work

A complete project Division of Work (DOW) was jointly developed by AEPSC and Parsons E&C. The intent of this DOW is to define what company is responsible to perform all the work elements and supply all the materials for the project. This DOW is expected to be a living document, but provides a current baseline for documentation of intended project development. We have included as Exhibit 8.2 this Division of Work.

Exhibit 8-1

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Project Scope & Processes				
1000	Start Phase 2	0	03JAN05*	
1001	Evaluation & Studies	130	03JAN05	01JUL05
1003	Project Detail Definition	135	28MAR05	30SEP05
1006	Estimate Project	95	23MAY05	30SEP05
1008	Issue Phase 2 Report	0		30SEP05
1009	Engineering Material Estimate	65	23MAY05	19AUG05
1012	Items Requiring Vendor Quotes	30	06JUN05	15JUL05
1015	Engineering Takeoff w/Estimated $ from Database	50	06JUN05	12AUG05
1018	Receive Vendor Quotes	60	06JUN05	26AUG05
1021	Construction Estimate	50	27JUN05	02SEP05
1024	Manhour Estimate	35	18JUL05	02SEP05
1027	Assemble Phase 2 Report	20	05SEP05	30SEP05
1046	Write Boiler Evaluation Spec	20	03JAN05	28JAN05
1049	AEP Review of Boiler Spec	40	31JAN05	25MAR05
1051	Budget Quote - Boiler	30	28MAR05	06MAY05
1053	Conceptual Design Criteria	65	03JAN05	01APR05
FGD				
1030	FGD OEM Award	0	01FEB05	
1033	FGD OEM Process Flow Diagrams/Material Balances	40	01FEB05	28MAR05



Start Date 06DEC04 Finish Date 30SEP05 Run Date 29NOV04 09:49	Early Bar Progress Bar Critical Activity	BSP1	American Electric Power Big Sandy 2 Proposal Schedule (1104R1283)	Sheet 1 of 4

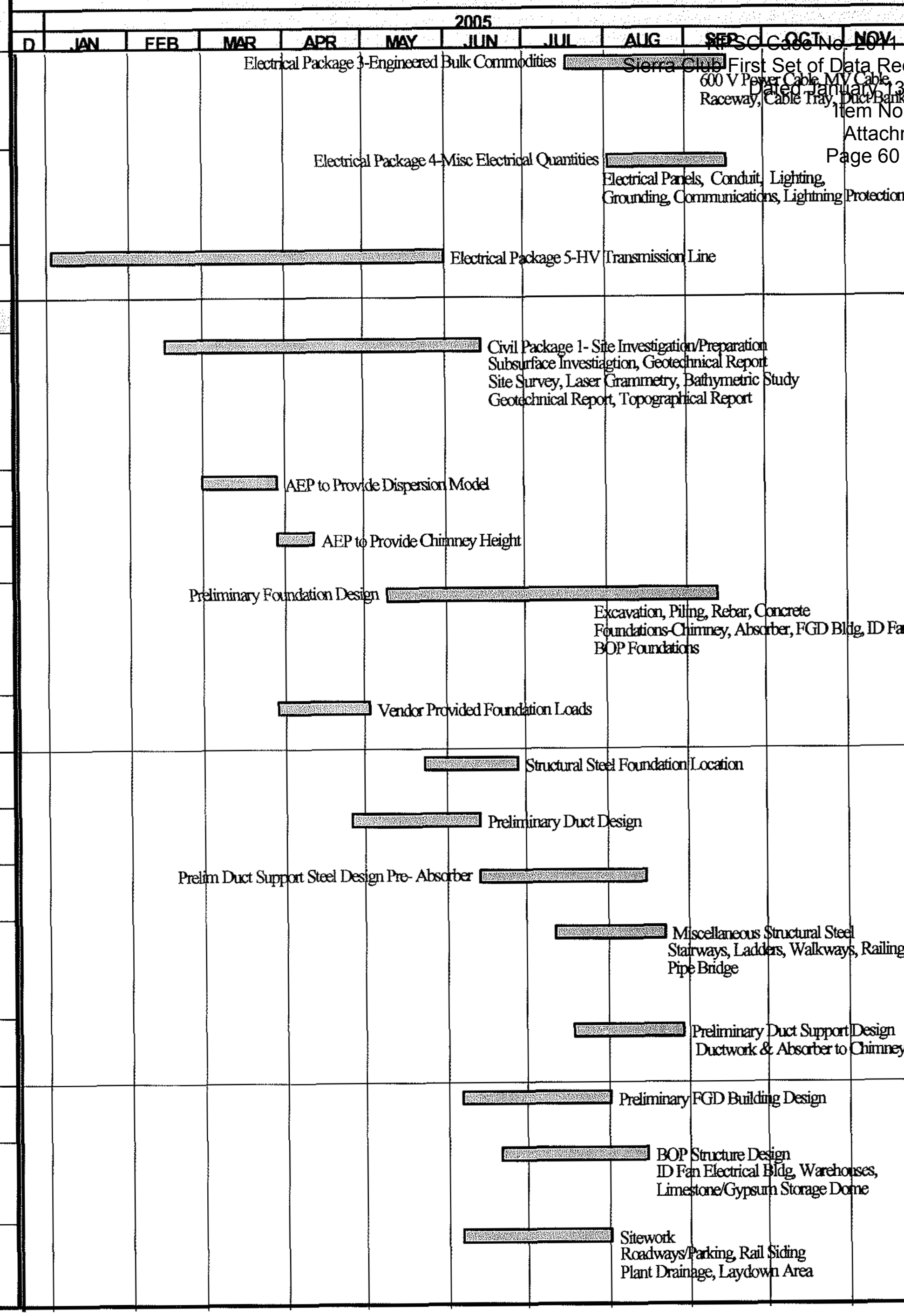
Date	Revision	Checked	Approved

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
1036	FGD OEM General Arrangement Drawings	80	01FEB05	23MAY05
1038	BOP Process Flow Diagrams Special Processes	40	29MAR05	23MAY05
1042	FGD OEM P&ID's	40	29MAR05	23MAY05
1043	BOP General Arrangements	30	24MAY05	04JUL05
1045	BOP P&ID's	80	29MAR05	18JUL05
Instruments & Control				
1054	Valve Process Conditions	10	07JUN05	20JUN05
1057	Instrument Process Conditions	10	07JUN05	20JUN05
1060	DCS I/O Count	10	07JUN05	20JUN05
1063	DCS Architecture Drawing & Data Sheets	10	21JUN05	04JUL05
1066	Budget Quote-DCS	10	05JUL05	18JUL05
1068	Review Vendor Drawings	20	19JUL05	15AUG05
1070	Estimate Control Valves	20	19JUL05	15AUG05
1073	Estimate Instrument	20	19JUL05	15AUG05
1076	Estimate Instrument Racks	15	19JUL05	08AUG05
1079	Estimate Instrument Tubing	10	19JUL05	01AUG05
Electrical				
1107	Typical Schematics	30	06JUN05	15JUL05
1110	Electrical One Lines	195	03JAN05	30SEP05
1113	General Arrangements(Switchyard&Electrical Room)	100	28FEB05	15JUL05
1116	Electrical Package 1-Engineered Electrical Eqpt	45	18JUL05	16SEP05
1119	Electrical Package 2-HV Switchyard Package	45	18JUL05	16SEP05

Transformers, Switchgears,MCC's,UPS,Batteries

Cost to Furnish and Erect

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
1122	Electrical Package 3-Engineered Bulk Commodities	45	18JUL05	16SEP05
1125	Electrical Package 4-Misc Electrical Quantities	33	03AUG05	16SEP05
1128	Electrical Package 5-HV Transmission Line	107	03JAN05	31MAY05
Civil/Structural				
1131	Civil Package 1- Site Investigation/Preparation	86	15FEB05	14JUN05
1137	AEP to Provide Dispersion Model	20	01MAR05	28MAR05
1138	AEP to Provide Chimney Height	10	29MAR05	11APR05
1134	Preliminary Foundation Design	90	10MAY05	12SEP05
1139	Vendor Provided Foundation Loads	25	29MAR05	02MAY05
1142	Structural Steel Foundation Location	25	24MAY05	27JUN05
1140	Preliminary Duct Design	35	26APR05	13JUN05
1143	Prelim Duct Support Steel Design Pre- Absorber	45	14JUN05	15AUG05
1146	Miscellaneous Structural Steel	30	12JUL05	22AUG05
1149	Preliminary Duct Support Design	30	19JUL05	29AUG05
1152	Preliminary FGD Building Design	40	07JUN05	01AUG05
1155	BOP Structure Design	40	21JUN05	15AUG05
1158	Sitework	40	07JUN05	01AUG05



Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Mechanical/Piping				
1170	Mechanical Group 1 -Mechanical Specs	195	03JAN05	30SEP05
1173	Mechanical Group 2 - Lists & Calculations	120	28FEB05	12AUG05
1176	Mechanical Group 3 - Piping Quantities	30	18JUL05	26AUG05
1179	Mechanical Group 4 - Miscellaneous Mechanical	110	28MAR05	26AUG05
1182	Mechanical Group 5 - Constructability Review	30	18JUL05	26AUG05
1185	Mechanical Group 6 - Technical Specs	120	28FEB05	12AUG05

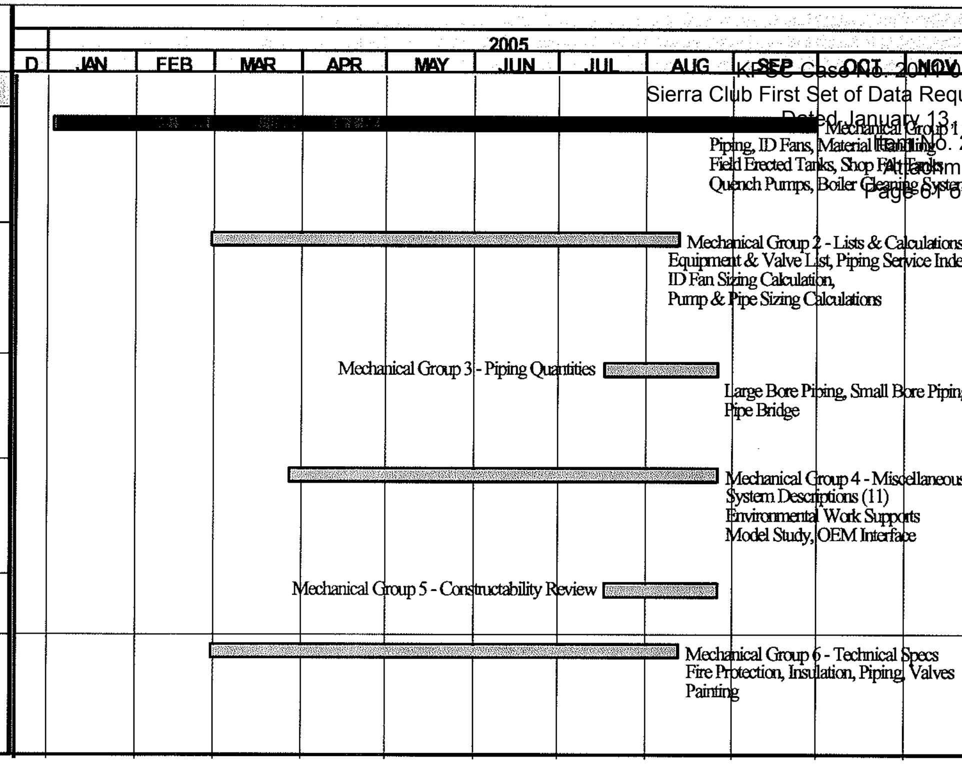


Exhibit 8-2

Project Name: *Big Sandy Plant - Unit 2 WFGD*
Total Project Scope Split
Target Cost Option

Revision Date: *November 17, 2004*
Current Rev #: *Rev 0*

Division of Work (DOW) Legend	
FGD	FGD Supplier
AE	Architect Engineer-PE&C
EC	Erection Contractor
O	Owner-AEP
ESC	Material & Installation by subcontractor managed by AE or EC
SGS	Steam Generator Supplier/OEM
C	Chimney Supplier
TBD	To Be Determined
N/A	Not Applicable for this Project or Task

Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
1	**Special Studies and Investigations**					
2	Fan Study	N/A	N/A	N/A	N/A	
3	Boiler & Draft System Implosion Study & Transient Analysis	AE	AE	AE	N/A	
4	Physical or Computer Flue Gas Model Study (FGD Scope of Supply)	FGD	FGD	FGD	N/A	Flow from Absorber
5	Physical or Computer Flue Gas Model Study (BOP Scope of Supply)	AE	AE	AE	N/A	Flow from ESP outlet to new chimney, excluding Absorber.
6	Geotechnical Study	AE	AE	O	O	
7	Topographical Surveys	AE	AE	O	O	
8	Baseline Testing	N/A	N/A	O	N/A	
9	Traffic Study	AE	AE	AE	N/A	
10	Underground Utility Survey	AE	AE	O	O	
11	Lasergrammetry of Tie-In Points	AE	AE	AE	AE	
12	Chimney Proximity Effect	O	O	O	O	
13	Coal Blending Study	AE	AE	N/A	N/A	
14	Ammonia Bi-Sulphate condensation study and effects	O	O	O	N/A	
15	Sulphuric Acid condensation study and effects	O	O	O	N/A	
16	Preliminary Phase I Studies	N/A	N/A	N/A	N/A	
17	Limestone & Gypsum Supply/ Sales	O	O	O	O	
18	**FGD Process**					
19	Process Design Basis	FGD	FGD	N/A	N/A	
20	Process Flow Diagrams	FGD	FGD	N/A	N/A	
21	Mass Balances	FGD	FGD	N/A	N/A	
22	Process Control Description	FGD	FGD	N/A	N/A	
23	Performance Guarantees/Curves	FGD	FGD	N/A	N/A	
24	Process Data Sheets	FGD	FGD	N/A	N/A	
25	FGD Pressure Drop Calculations	FGD	FGD	N/A	N/A	From absorber inlet to absorber outlet.
26	**BOP Process**					
27	Process Design Basis	AE	AE	N/A	N/A	
28	Process Flow Diagrams	AE	AE	N/A	N/A	
29	Mass Balances	AE	AE	N/A	N/A	
30	Process Control Description	AE	AE	N/A	N/A	
31	Performance Guarantees/Curves	AE	AE	N/A	N/A	
32	Process Data Sheets	AE	AE	N/A	N/A	
33	BOP Design Criteria	AE	AE	N/A	N/A	
34	Pressure Drop Calculations	AE	AE	N/A	N/A	From ESP outlet to stack, excluding Item 19
35	**Struct. Engineering & Plant Layout**					

Project Name: ***Big Sandy Plant - Unit 2 WFGD***
Total Project Scope Split
Target Cost Option

Revision Date: ***November 17, 2004***
Current Rev #: ***Rev 0***

Division of Work (DOW) Legend

FGD	FGD Supplier
AE	Architect Engineer-PE&C
EC	Erection Contractor
O	Owner-AEP
ESC	Material & Installation by subcontractor managed by AE or EC
SGS	Steam Generator Supplier/OEM
C	Chimney Supplier
TBD	To Be Determined
N/A	Not Applicable for this Project or Task

Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
36	Plant General Arrangement Dwgs	AE	AE	N/A	N/A	Input from FGD & BOP Process Suppliers
37	General Arrangements for FGD Process Islands	FGD	FGD	N/A	N/A	
38	Foundations	AE	AE	N/A	N/A	
39	FGD Equipment Loads	FGD	FGD	N/A	N/A	
40	BOP Equipment Loads	AE	AE	N/A	N/A	
41	Site Plan	AE	AE	N/A	N/A	
42	**Support Steel**					
43	FGD Process Building Support Steel	AE	AE	AE	EC	Input from FGD. AE to supply DEA drawings and material takeoffs.
44	FGD Process Equipment Support Steel	FGD	FGD	FGD	EC	
45	Pipe Hangers (Inside FGD Islands)	FGD	FGD	FGD	EC	
46	Pipe Hangers (Outside FGD Islands)	AE	AE	AE	EC	Hangers for FGD-supplied piping to be supplied by FGD. AE to supply DEA drawings and material takeoffs.
47	Pipe Racks / Supports (Inside FGD Islands)	AE	AE	AE	EC	AE to supply DEA drawings and material takeoffs.
48	Pipe Racks / Supports (Outside FGD Islands)	AE	AE	AE	EC	
49	Cable Tray Racks / Supports (Inside FGD Islands)	AE	AE	AE	EC	AE to supply DEA drawings and material takeoffs.
50	Cable Tray Racks / Supports (Outside FGD Islands)	AE	AE	AE	EC	
51	Fluework Support Steel	AE	AE	AE	EC	AE to supply DEA drawings and material takeoffs.
52	Conveyor Support Steel	AE	AE	AE	EC	
53	**Fluework including expansion joints**					
54	Absorber Wet/Dry Interface Flue	FGD	FGD	FGD	EC	Begin scope at Alloy Inlet Duct
55	Absorber Outlet Flue to Chimney	AE	AE	FGD	EC	Gooseneck Support Steel, if required, by FGD. AE to supply DEA drawings and material takeoffs.
56	Absorber Inlet Sample Test Ports	FGD	FGD	FGD	EC	AE to supply DEA drawings and material takeoffs.
57	Absorber Outlet Moisture Carryover Test Ports	FGD	FGD	FGD	EC	
58	Stack Test Sample Ports	O	O	O	O	Chimney Contractor
59	Chimney Breeching	O	O	O	O	Chimney Contractor
60	Modifications to Existing Flue	AE	AE	AE	EC	
61	FGD Supply Flue (from tie to existing flue downstream of ESP Outlet)	AE	AE	AE	EC	AE to supply DEA drawings and material takeoffs.
62	FGD Supply Flue (from ESP outlet)	AE	AE	AE	EC	AE to supply DEA drawings and material takeoffs.

Project Name: ***Big Sandy Plant - Unit 2 WFGD***
Total Project Scope Split
Target Cost Option

Revision Date: ***November 17, 2004***
Current Rev #: ***Rev 0***

Division of Work (DOW) Legend	
FGD	FGD Supplier
AE	Architect Engineer-PE&C
EC	Erection Contractor
O	Owner-AEP
ESC	Material & Installation by subcontractor managed by AE or EC
SGS	Steam Generator Supplier/OEM
C	Chimney Supplier
TBD	To Be Determined
N/A	Not Applicable for this Project or Task

Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
63	Flue located in existing stack	AE	AE	AE	EC	
64	**Platforms/Stairs**					
65	FGD Process Equipment & Components Platforms and Stairs	FGD	AE	AE	EC	
66	BOP Process Equipment & Components Platforms and Stairs	AE	AE	AE	EC	AE to supply DEA drawings and material takeoffs.
67	Chimney Test Platform	O	O	O	O	Chimney Contractor
68	**Limestone Handling System**					
69	Limestone Storage Structure	AE	AE	AE	EC	Limestone Supply by Owner
70	Limestone Reclaim Hopper	AE	AE	AE	EC	
71	Limestone Conveyor System	AE	AE	AE	EC	
72	Limestone Instrumentation & Controls	AE	AE	AE	EC	Conveyor Vendor
73	Trucks Unloading Facility	AE	AE	AE	EC	
74	Trucks Unloading Facility	O	O	O	O	
75	Bulldozers	O	O	O	O	
76	**Limestone Preparation Island & associated equipment**					
77	Limestone Day Silo(s)	FGD	FGD	FGD	EC	Minimum of 2 silos. Total useful storage capacity of all silos combined shall be a minimum of 24 hours based on entire site limestone consumption. AE to supply DEA drawings and material takeoffs.
78	Limestone Day Silo Bin Vibrators	FGD	FGD	FGD	EC	
79	Limestone Silo Isolation Valves	FGD	FGD	FGD	EC	
80	Limestone Silo Dust Collector	FGD	FGD	FGD	EC	
81	Limestone Chutes	FGD	FGD	FGD	EC	
82	Limestone Silo Instrumentation	FGD	FGD	FGD	EC	
83	Limestone Weighing Feeder	FGD	FGD	FGD	EC	
84	Limestone Ball Mill	FGD	FGD	FGD	EC	Minimum of 1 spare ball mill.
85	Ball Mill Motor	FGD	FGD	FGD	EC	
86	Ball Mill Rubber Liners	FGD	FGD	FGD	EC	
87	Ball Charge	FGD	FGD	FGD	EC	
88	Mill Product Tank	FGD	FGD	FGD	EC	Minimum of 1 per mill. B&W to supply design on agitator, lining , nozzles, and loads.
89	Mill Product Tank Agitator	FGD	FGD	FGD	EC	
90	Mill Product Recycle Pumps	FGD	FGD	FGD	EC	Minimum of 1 spare pump per ball mill.
91	Mill Jacking System	FGD	FGD	FGD	EC	
92	Limestone Hydrocyclone Classifiers	FGD	FGD	FGD	EC	Minimum of 1 per mill

Project Name: ***Big Sandy Plant - Unit 2 WFGD***
Total Project Scope Split
Target Cost Option

Revision Date: ***November 17, 2004***
Current Rev #: ***Rev 0***

Division of Work (DOW) Legend	
FGD	FGD Supplier
AE	Architect Engineer-PE&C
EC	Erection Contractor
O	Owner-AEP
ESC	Material & Installation by subcontractor managed by AE or EC
SGS	Steam Generator Supplier/OEM
C	Chimney Supplier
TBD	To Be Determined
N/A	Not Applicable for this Project or Task

Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
93	Limestone Preparation Instrumentation	FGD	FGD	FGD	EC	
94	**Reagent Slurry Feed**					
95	Reagent Slurry Feed Tanks	FGD	FGD	FGD	EC	Mimimum of 2 tanks. Total usable storage capacity of all tanks combined is 12 hours based on entire site slurry consumption. B&W to supply design on agitator, lining , nozzles, and loads
96	Reagent Slurry Feed Tank Agitators	FGD	FGD	FGD	EC	
97	Reagent Slurry Feed Pumps	FGD	FGD	FGD	EC	Mimimum of one spare pump.
98	Reagent Slurry Feed Instrumentation	FGD	FGD	FGD	EC	
99	**Absorbers Island & associated equipment**					
100	**Absorber Vessel (1 x 100% capacity per unit)**					
101	Inlet Flue, Absorber wet/dry interface	FGD	FGD	FGD	EC	
102	Absorber Zone	FGD	FGD	FGD	EC	
103	Outlet Cone & Hood	FGD	FGD	FGD	EC	
104	Absorber Internal Supports	FGD	FGD	FGD	EC	
105	ME Vane Support	FGD	FGD	FGD	EC	
106	Vessel Penetrations, Nozzles, Headers.	FGD	FGD	FGD	EC	
107	Integral recycle tank with agitators	FGD	FGD	FGD	EC	
108	Mist Eliminators & Wash Nozzles	FGD	FGD	FGD	EC	
109	Quench System	FGD/AE	AE	ESC	ESC	FGD to provide quench flow requirements.
110	Quench Logic	AE	AE	N/A	N/A	
111	Quench System Pump	AE	AE	ESC	ESC	
112	Mist Eliminator Wash (Absorber Internal)	FGD	FGD	FGD	EC	
113	**Reaction Tank**					
114	Absorber Reaction Tank Shell	FGD	FGD	FGD	EC	
115	Oxidation Air Distribution System	FGD	FGD	FGD	EC	
116	Reaction Tank Agitators	FGD	FGD	FGD	EC	
117	**Recycle System**					
118	Absorber Recycle Internal Spray Pipe	FGD	FGD	FGD	EC	
119	Absorber Recycle External Spray Pipe	FGD	FGD	FGD	EC	
120	Recycle Piping Supports (internal)	FGD	FGD	FGD	EC	
121	Recycle Piping Supports (external)	AE	AE	AE	EC	AE to supply DEA drawings and material takeoffs.
122	Recycle Pipe Hangers	FGD	FGD	FGD	EC	
123	Recycle Spray Nozzles	FGD	FGD	FGD	EC	

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AE	Architect Engineer-PE&C
EC	Erection Contractor
O	Owner-AEP
ESC	Material & Installation by subcontractor managed by AE or EC
SGS	Steam Generator Supplier/OEM
C	Chimney Supplier
TBD	To Be Determined
N/A	Not Applicable for this Project or Task

Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
124	Recycle Pump	FGD	FGD	FGD	EC	Minimum of one spare pump per absorber.
125	Recycle Pump Gearbox / Accessories	FGD	FGD	FGD	EC	
126	Recycle Pump Motor	FGD	FGD	FGD	EC	
127	**Oxidation Air Supply**					
128	Oxidation Air Blowers	FGD	FGD	FGD	EC	Minimum of one spare blower.
129	Oxidation Air Blower Motors	FGD	FGD	FGD	EC	
130	Oxidation Air Blower Noise Enclosure	FGD	FGD	FGD	EC	
131	Oxidation Air Inlet Filter	FGD	FGD	FGD	EC	
132	Oxidation Air Inlet Filter Silencer	FGD	FGD	FGD	EC	
133	Oxidation Air Control Panel	FGD	FGD	FGD	EC	
134	Oxidation Air Saturation Nozzle	FGD	FGD	FGD	EC	
135	Emergency Storage Tank	FGD	AE	AE	EC	Tank storage capacity to hold contents of one absorber reaction tank. FGD vendor to supply design on agitator, lining , nozzles, and loads.
136	Emergency Storage Tank Agitator(s)	FGD	FGD	FGD	EC	
137	Emergency Storage Tank Return Pumps	FGD	FGD	FGD	EC	One spare per tank.
138	WFGD/Absorber Instrumentation	FGD	FGD	FGD	EC	
139	**Dewatering Island & associated equipment**					
140	**Primary Dewatering**					
141	Absorber Bleed Pump	FGD	FGD	FGD	EC	Minimum of 1 spare pump per absorber. Bleed rate for each pump will be designed to empty Absorber Reaction Tank in 6 hours.
142	Hydrocyclone Classifier Cluster	FGD	FGD	FGD	EC	Located in Dewatering Island. Minimum of 1 cluster per vacuum belt filter.
143	**Secondary Dewatering**					
144	Hydroclone Feed Tank	FGD	FGD	FGD	EC	Mimimum of 2 tanks. Total useful storage capacity of all tanks combined is 8 hours based on entire site absorber bleed rate. FGD vendor to supply design on agitator, lining , nozzles, and loads.
145	Hydroclone Feed Tank Agitator	FGD	FGD	FGD	EC	
146	Hydroclone Feed Pump	FGD	FGD	FGD	EC	Minimum of 1 pump per vacuum belt filter.

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147	Horizontal Vacuum Belt Filter	FGD	FGD	FGD	EC	Minimum of 1 spare vacuum belt filter.
148	**Vacuum Filter Auxiliaries**					
149	Liquid Ring Vacuum Pump	FGD	FGD	FGD	EC	Minimum of 1 per vacuum belt filter.
150	Filtrate Pump	FGD	FGD	FGD	EC	Minimum of 1 per vacuum belt filter.
151	Seal Water Separator	FGD	FGD	FGD	EC	Minimum of 1 per vacuum belt filter.
152	Seal Water Tank	FGD	FGD	FGD	EC	Minimum of 1 per vacuum belt filter.
153	Cake Wash Pump	FGD	FGD	FGD	EC	Minimum of 1 per vacuum belt filter.
154	Cloth Wash Tank	FGD	FGD	FGD	EC	Minimum of 1 per vacuum belt filter.
155	Cloth Wash Pump	FGD	FGD	FGD	EC	Minimum of 1 per vacuum belt filter.
156	**Reclaim Water Storage & Return**					
157	Reclaim Water Tank	FGD	AE	AE	EC	Minimum of 2 tanks. Total useful storage capacity of all tanks combined is 8 hours based on entire site reclaim water rate. FGD vendor to supply design of agitator, lining , nozzles, and loads.
158	Reclaim Water Tank Agitator	FGD	AE	AE	EC	
159	Reclaim Water Pump	FGD	FGD	FGD	EC	Minimum of 1 spare pump.
160	Dewatering System Instrumentation	FGD	FGD	FGD	EC	
161	**Gypsum Handling**					
162	Belt Filter Discharge Conveyor	AE	AE	AE	EC	
163	Cake Transfer Conveyor	AE	AE	AE	EC	
164	**Product Cake Stackout & Storage**					
165	Gypsum Storage Structure	AE	AE	AE	EC	
166	Gypsum Stacker	AE	AE	AE	EC	
167	Gypsum Reclaimer	AE	AE	AE	EC	
168	Gypsum Emergency stackout conveyor	AE	AE	AE	EC	
169	Gypsum Reclaim Conveyor	AE	AE	AE	EC	
170	Truck Loading Facility	AE	AE	AE	EC	
171	Trucks	O	O	O	O	
172	Gypsum Handling Instrumentation	AE	AE	AE	EC	
173	Bulldozers	O	O	O	O	
174	**Water Distribution**					
175	**Make Up Water Storage & Transfer**					

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Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
176	Service Water Tank	FGD	AE	EC	EC	Minimum of one tank per unit. Useful storage capacity for tank shall be a minimum of 1 hour for associated unit + 30 minute emergency quench capacity required for unit. FGD vendor to supply design of agitator, lining , nozzles, and loads.
177	Make Up Water Pump	FGD	FGD	FGD	EC	Single tie point. Minimum of 1 spare pump per Make Up Water Tank.
178	Make Up Water Instrumentation	FGD	FGD	FGD	EC	
179	**Mist Eliminator Wash**					
180	Mist Eliminator Wash Pumps	FGD	FGD	FGD	EC	Single tie point. Minimum of 1 spare pump per Absorber.
181	Mist Eliminator Wash Pump Instrumentation	FGD	FGD	FGD	EC	
182	**Sumps**					
183	**Reagent Preparation Area Sump System**					
184	Reagent Preparation Area Sump	FGD	AE	ESC	ESC	
185	Reagent Preparation Area Trench	FGD	AE	ESC	ESC	
186	Reagent Preparation Area Grating	FGD	AE	ESC	EC	
187	Reagent Preparation Area Sump Agitator	FGD	AE	ESC	EC	
188	Reagent Preparation Area Sump Pump	FGD	AE	ESC	EC	Minimum of 1 spare pump.
189	Reagent Preparation Area Sump Agitator & Pump Supports	FGD	AE	ESC	EC	AE to supply DEA drawings and material takeoffs.
190	Reagent Preparation Area Sump System Instrumentation	FGD	AE	ESC	EC	
191	**Absorber Area Sump System (Absorbers share common sump.)**					
192	Absorber Area Sump	FGD	AE	ESC	ESC	
193	Absorber Area Trench	FGD	AE	ESC	ESC	
194	Absorber Area Grating	FGD	AE	ESC	EC	
195	Absorber Area Sump Agitator	FGD	AE	ESC	EC	
196	Absorber Area Sump Pump	FGD	AE	ESC	EC	Minimum of 1 spare pump.
197	Absorber Area Sump Agitator & Pumps Supports	FGD	AE	ESC	EC	AE to supply DEA drawings and material takeoffs.
198	Absorber Area Sump System Instrumentation	FGD	AE	ESC	EC	
199	**Dewatering Area Sump System**					
200	Dewatering Area Sump	FGD	AE	ESC	ESC	
201	Dewatering Area Trench	FGD	AE	ESC	ESC	
202	Dewatering Area Grating	FGD	AE	ESC	EC	
203	Dewatering Area Sump Agitator	FGD	AE	ESC	EC	
204	Dewatering Area Sump Pump	FGD	AE	ESC	EC	Minimum of 1 spare pump.

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205	Dewatering Area Sump Agitator & Pumps Supports	FGD	AE	ESC	EC	AE to supply DEA drawings and material takeoffs.
206	Dewatering Area Sump System Instrumentation	FGD	FGD	FGD	EC	
207	**Maintenance Tank Area Sump System**					
208	Maintenance Tank Area Sump	FGD	AE	ESC	ESC	
209	Maintenance Tank Area Trench	FGD	AE	ESC	ESC	
210	Maintenance Tank Area Grating	FGD	AE	ESC	EC	
211	Maintenance Tank Area Sump Agitator	FGD	AE	ESC	EC	
212	Maintenance Tank Area Sump Pump	FGD	AE	ESC	EC	Minimum of 1 spare pump.
213	Maintenance Tank Area Sump Agitator & Pumps Supports	FGD	AE	ESC	EC	AE to supply DEA drawings and material takeoffs.
214	Maintenance Tank Area Sump System Instrumentation	FGD	FGD	FGD	EC	
215	**Air & Flue Gas Equipment**					
216	ID Fans	AE	AE	AE	EC	
217	ID Fans Motors	AE	AE	AE	EC	
218	Fan Isolation Dampers	AE	AE	AE	EC	
219	Instrumentation	AE	AE	AE	EC	
220	**WFGD Waste Water**					
221	**WFGD Waste Water Treatment System**	AE	AE	AE	EC	
222	**Heating, Ventilation and Air Conditioning (HVAC)**					
223	FGD Process Equipment	FGD	FGD	FGD	EC	For FGD-Supplied Enclosures
224	FGD Process Island Buildings	AE	AE	ESC	ESC	
225	BOP Process Equipment	AE	AE	AE	EC	
226	**Dust Collection**					
227	FGD Process Equipment	FGD	FGD	FGD	EC	
228	BOP Process Equipment	AE	AE	AE	EC	
229	**Lifting & Handling Equipment**					
230	Monorail (for FGD Process Equipment)	FGD	AE	AE	EC	AE to supply DEA drawings and material takeoffs.
231	Hoists / Trolleys (for FGD Process Equipment)	FGD	AE	AE	EC	AE to supply DEA drawings and material takeoffs.
232	Monorail (for ID fans)	AE	AE	AE	EC	
233	Hoists / Trolleys (for ID fans)	AE	AE	AE	EC	
234	Monorail (for BOP Process Equipment)	AE	AE	AE	EC	
235	Hoists / Trolleys (for BOP Process Equipment)	AE	AE	AE	EC	
236	**Stacks**					
237	Stacks	O	O	O	O	
238	Continuous Emissions Monitoring System (CEMS)	O	O	O	EC	
239	**Piping, Valves & Operators, Paint & Insul, Lagging, Supports, Expansion Joints**					

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TBD	To Be Determined
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240	**Interconnecting piping & accessories (Within FGD Islands)**					
241	FGD Process Piping	FGD	FGD	FGD	EC	Small bore (2" & under) field run piping supplied by FGD. Site erection by EC.
242	Seal Water	FGD	FGD	FGD	EC	Single Supply Point by AE. Small bore (2" & under) field run piping supplied by FGD. Site erection by EC.
243	Limestone Prep Area Sump Transfer	FGD	FGD	FGD	EC	
244	Absorber Area Sump Transfer	FGD	FGD	FGD	EC	
245	Dewatering Area Sump Transfer	FGD	FGD	FGD	EC	
246	Flush Water	FGD	FGD	FGD	EC	Single Supply Point by AE
247	Firewater loop mods, hydrants, hose stations	AE	AE	ESC	ESC	AE to supply DEA drawings and material takeoffs.
248	Potable Water	AE	AE	ESC	ESC	AE to supply DEA drawings and material takeoffs.
249	Sanitary Water	AE	AE	ESC	ESC	AE to supply DEA drawings and material takeoffs.
250	Process Drain and Vents (in FGD Island)	FGD	FGD	FGD	EC	Small bore (2" & under) field run piping supplied by FGD. Site erection by EC.
251	Process Drain and Vents (in BOP)	AE	ESC	ESC	ESC	
252	Service & Instrument Air (Within Islands)	FGD	FGD	FGD	EC	Single Supply Point by AE. Small bore (2" & under) field run piping supplied by FGD. Site erection by EC.
253	Closed Cycle Cooling Water (Within Island)	N/A	N/A	N/A	N/A	
254	FGD Process Piping (Outside of Island)	FGD	AE	AE	EC	Small bore (2" & under) field run piping supplied by FGD. Site erection by EC.
255	BOP Process Piping (Outside of Island)	AE	AE	ESC	ESC	AE to supply DEA drawings and material takeoffs.
256	Stack Water Collection Piping to Absorber Island	AE	AE	ESC	ESC	FGD OEM responsible for piping to Absorber located inside island.
257	**Mech. Eng. Technical Data**					
258	FGD Coating/Paint Spec	FGD	FGD	N/A	N/A	
259	FGD Piping and Instrument Diagrams	FGD	FGD	N/A	N/A	
260	FGD Piping Isometric Drawings	FGD	FGD	N/A	N/A	
261	FGD Equipment List	FGD	FGD	N/A	N/A	
262	FGD Piping Line List	FGD	FGD	N/A	N/A	
263	FGD Valve List	FGD	FGD	N/A	N/A	

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264	FGD Piping Spec	FGD	FGD	N/A	N/A	
265	FGD Equipment Insulation	FGD	FGD	FGD	N/A	As Required on skid mounted equipment
266	BOP Coating/Paint Spec	AE	AE	N/A	N/A	
267	BOP Piping and Instrument Diagrams	AE	AE	N/A	N/A	
268	BOP Piping Isometric Drawings	AE	AE	N/A	N/A	
269	BOP Equipment List	AE	AE	N/A	N/A	
270	BOP Piping Line List	AE	AE	N/A	N/A	
271	BOP Valve List	AE	AE	N/A	N/A	
272	BOP Piping Spec	AE	AE	N/A	N/A	
273	**Insulation & Lagging Material**					
274	FGD Equipment Insulation	FGD	FGD	ESC	ESC	If required
275	Fluework Insulation including booster fans	AE	AE	ESC	ESC	AE to supply DEA drawings and material takeoffs.
276	FGD Piping Insulation	FGD	FGD	ESC	ESC	If required
277	FGD Buildings & Enclosures Insulation	AE	AE	ESC	ESC	
278	BOP Equipment Insulation	AE	AE	ESC	ESC	
279	BOP Piping Insulation	AE	AE	ESC	ESC	
280	BOP Buildings & Enclosures Insulation	AE	AE	ESC	ESC	
281	**I & C Drawings & Documents**					
282	FGD Analog Logic Diagrams	FGD	FGD	N/A	N/A	
283	FGD Digital Logic Diagrams	FGD	FGD	N/A	N/A	
284	FGD Instrument Data Sheets	FGD	FGD	N/A	N/A	
285	FGD Instrument Equipment Specifications	FGD	FGD	N/A	N/A	
286	FGD Instrument Installation Specification	FGD	FGD	N/A	N/A	
287	FGD Instrument Location Drawings	FGD	FGD	N/A	N/A	
288	FGD Instrument Installation Details	FGD	FGD	N/A	N/A	
289	FGD Instrument and DCS I/O Lists	FGD	FGD	N/A	N/A	
290	BOP Analog Logic Diagrams	AE	AE	N/A	N/A	
291	BOP Digital Logic Diagrams	AE	AE	N/A	N/A	
292	BOP Instrument Data Sheets	AE	AE	N/A	N/A	
293	BOP Instrument Equipment Specifications	AE	AE	N/A	N/A	
294	BOP Instrument Installation Specification	AE	AE	N/A	N/A	
295	BOP Instrument Location Drawings	AE	AE	N/A	N/A	
296	BOP Instrument Installation Details	AE	AE	N/A	N/A	
297	BOP Instrument and DCS I/O Lists	AE	AE	N/A	N/A	
298	**I & C Control Systems**					
299	Balance Draft Boiler Logic Change	O	O	N/A	N/A	
300	ID Fan & Ductwork Protection Logic	AE	AE	N/A	N/A	

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Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
301	FGD System Descriptions	FGD	FGD	N/A	N/A	
302	BOP System Descriptions	AE	AE	N/A	N/A	
303	DCS System Hardware	AE/O	AE/O	O	EC	
304	DCS (Logics)	AE/O	AE/O	O	N/A	
305	DCS Factory Acceptance Testing	O	O	O	N/A	Require FGD OEM to be present
306	Instrument Installation Materials	FGD/AE	FGD/AE	ESC	ESC	
307	**Electrical Design Drawings & Documents**					
308	Single Line Diagrams	AE	AE	N/A	N/A	
309	Elementary Diagrams	AE	AE	N/A	N/A	
310	Interconnection Diagrams	AE	AE	N/A	N/A	
311	Electrical/Electronics Room Layout	AE	AE	N/A	N/A	
312	Electrical Load List	AE	AE	N/A	N/A	Input from FGD OEM.
313	Power System Studies (SKM)	AE	AE	N/A	N/A	
314	**Power Distribution Equipment**					
315	Unit Aux Transformer	AE	AE	AE	EC	
316	Iso-Phase Bus & Modifications	AE	AE	AE	EC	
317	Non-Seg Bus and Modifications	AE	AE	AE	EC	
318	Medium Voltage Cable Bus	AE	AE	AE	EC	
319	Substation / Load Center	AE	AE	AE	EC	
320	Transformers	AE	AE	AE	EC	
321	Switchgear	AE	AE	AE	EC	
322	Motor Control Centers (MCC)	AE	AE	AE	EC	
323	Bus Ducts	AE	AE	AE	EC	
324	Power Distribution Panels	AE	AE	ESC	ESC	
325	FGD Process Equipment Variable Frequency Drives (480V)	FGD	FGD	FGD	EC	Supplied with Equipment
326	BOP Process Equipment Variable Frequency Drives (480V)	AE	AE	AE	EC	Supplied with Equipment
327	**Transmission of Bulk Power to FGD Substation**					
328	Existing substation modifications	AE	AE	O	O	
329	New Transmission Line	AE	AE	AE/O	EC/O	If overhead: owner responsible for supply & erection
330	New FGD Substation HV	AE	EC	EC	EC	
331	**Power Sources Equipment**					
332	U P S	AE	AE	AE	EC	
333	Batteries	AE	AE	AE	EC	
334	**Motors (Provided with Equipment)**					
335	FGD Process Equipment Motors <5 HP (Use Industry Standard Voltage)	FGD	FGD	FGD	EC	Supplied with Equipment
336	FGD Process Equipment Low Voltage Motors 5 to 250 HP (480V)	FGD	FGD	FGD	EC	Supplied with Equipment
337	FGD Process Equipment Medium Voltage Motors from > 250 HP to < 5000 HP (4.16kV)	FGD	FGD	FGD	EC	Supplied with Equipment
338	FGD Process Equipment Motors >5000 HP	FGD	FGD	FGD	EC	

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N/A	Not Applicable for this Project or Task

Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
339	BOP Process Equipment Motors <5 HP (Use Industry Standard Voltage)	AE	AE	AE	EC	Supplied with Equipment
340	BOP Process Equipment Low Voltage Motors 5 to 250 HP (480V)	AE	AE	AE	EC	Supplied with Equipment
341	BOP Process Equipment Medium Voltage Motors > 250 HP to 5000 HP (4.16kV)	AE	AE	AE	EC	Supplied with Equipment
342	BOP Equipment Motors >5000 HP	AE	AE	AE	EC	
343	**Electrical Miscellaneous**					
344	Junction Boxes integral to FGD Skid Mounted Equipment	FGD	FGD	FGD	N/A	
345	Junction Boxes integral to BOP Skid Mounted Equipment	AE	AE	AE	N/A	
346	Junction Boxes (Balance of Plant)	AE	AE	ESC	ESC	
347	Local Control Stations (FGD Process)	FGD	FGD	FGD	EC	Requirements need to be defined
348	Local Control Stations (BOP Process)	AE	AE	ESC	ESC	Requirements need to be defined
349	**Electrical Installation (within Absorber/Limestone Prep Areas)**					
350	Electrical Install Spec/Scope of Work Doc.	AE	AE	AE	N/A	
351	Lighting	AE	AE	ESC	ESC	
352	Communications	AE	AE	ESC	ESC	
353	Fire Detection	AE	AE	ESC	ESC	
354	Heat Tracing (FGD Process)	FGD	AE	ESC	ESC	
355	Heat Tracing (BOP Process)	AE	AE	ESC	ESC	
356	Raceways to Junction Boxes integral to FGD Process Equipment Skid Mounted	FGD	FGD	FGD	N/A	
357	Raceways to Junction Boxes integral to BOP Process Equipment Skid Mounted	AE	AE	AE	N/A	
358	Raceways	AE	AE	ESC	ESC	
359	Cable / Wiring to Junction Boxes integral to FGD Process Equipment Skid Mounted	FGD	FGD	FGD	N/A	
360	Cable / Wiring to Junction Boxes integral to BOP Process Equipment Skid Mounted	AE	AE	AE	N/A	
361	Cable / Wiring	AE	AE	ESC	ESC	
362	Grounding	AE	AE	ESC	ESC	
363	Lightning Protection	AE	AE	ESC	ESC	
364	Cathodic Protection	AE	AE	ESC	ESC	
365	Welding / Maint Recept	AE	AE	ESC	ESC	
366	**Permits**					Reference to insurance removed
367	Environmental (Air, Water, Disposal)	O	O	O	O	
368	Corp of Engineers	O	O	O	O	
369	Building Permit	N/A	N/A	EC/O	N/A	
370	**Civil**					
371	Excavation	AE/ESC	AE/ESC	ESC	ESC	Excavation by ESC typically. But, if required excavation by AE
372	Foundations	AE	AE	ESC	ESC	
373	Piping and Electrical Underground	AE	AE	ESC	ESC	
374	Slabs & Pads, Elevated (Within FGD Islands)	FGD/AE	AE	ESC	ESC	
375	Slabs & Pads, Elevated (Outside FGD Islands)	AE	AE	ESC	ESC	
376	Grading & Drainage	AE	AE	ESC	ESC	

Project Name: ***Big Sandy Plant - Unit 2 WFGD***
Total Project Scope Split
Target Cost Option

Revision Date: ***November 17, 2004***
Current Rev #: ***Rev 0***

Division of Work (DOW) Legend

FGD	FGD Supplier
AE	Architect Engineer-PE&C
EC	Erection Contractor
O	Owner-AEP
ESC	Material & Installation by subcontractor managed by AE or EC
SGS	Steam Generator Supplier/OEM
C	Chimney Supplier
TBD	To Be Determined
N/A	Not Applicable for this Project or Task

Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
377	Paving	AE	AE	ESC	ESC	
378	Fencing	AE	AE	ESC	ESC	
379	**Site Construction Services**					
380	Site Supervision	N/A	N/A	EC	N/A	
381	Site Technical Supervision	N/A	N/A	EC	N/A	
382	Construction Advisor (Site)	N/A	N/A	FGD/AE	N/A	Each his own
383	Safety Supervision (Site)	N/A	N/A	O/EC	N/A	Each his own
384	Construction Coordination (HO)	N/A	N/A	EC	N/A	
385	Engineering Support (HO)	N/A	N/A	FGD/AE	N/A	Each his own
386	Site Support Services (Site)	N/A	N/A	FGD/AE	N/A	Each his own
387	Temporary Utilities & Services	AE	AE	O	O	
388	Unloading and Site Storage	AE	AE	EC/ESC	EC/ESC	
389	Craneage / Lifting Equipment	AE/EC	AE/EC	EC	EC	
390	Office Trailers	N/A	N/A	EC	EC	
391	Office Equipment	N/A	N/A	EC	EC	
392	Vehicles	N/A	N/A	FGD/AE/EC	N/A	Each his own
393	Safety Equipment	NA	N/A	FGD/AE/EC	N/A	Each his own
394	Site Computer Services	N/A	N/A	FGD/O/EC	FGD/O/EC	Each his own
395	Mobilization/Demobilization Costs	N/A	N/A	EC	N/A	
396	Site Construction Services Subcontractor	N/A	N/A	AE/EC/O	N/A	Each his own
397	**Buildings & Structures**					
398	FGD Process Island Buildings (Architectural)	AE	AE	ESC	ESC	GA & Equip loading data from suppliers
399	Miscellaneous Buildings (Pre-engineered)	AE	AE	ESC	ESC	
400	Warehouse/shops	AE	AE	ESC	ESC	
401	**Commissioning/Startup**					
402	Commissioning FGD Technical Support	N/A	N/A	FGD	N/A	
403	Commissioning BOP Technical Support	N/A	N/A	AE	N/A	Quoted as an option.
404	Commissioning & Startup Standby Labor	N/A	N/A	EC/O	N/A	Each his own.
405	Commissioning Coordination	N/A	N/A	FGD/AE/O	N/A	
406	**Training**					
407	FGD System Training Program Delivery	N/A	N/A	FGD	N/A	Based on providing training including FGD subvendors to 4 groups. Each group will be trained for a minimum of 10 days. The training will be provided in 4 separate calander periods (1 group per period).
408	BOP System Training Program	N/A	N/A	O	N/A	
409	**Performance Testing**					
410	Performance Testing Site Support	N/A	N/A	FGD/AE	N/A	Each his own

Project Name: *Big Sandy Plant - Unit 2 WFGD*
Total Project Scope Split
Target Cost Option

Revision Date: *November 17, 2004*
Current Rev #: *Rev 0*

Division of Work (DOW) Legend

FGD	FGD Supplier
AE	Architect Engineer-PE&C
EC	Erection Contractor
O	Owner-AEP
ESC	Material & Installation by subcontractor managed by AE or EC
SGS	Steam Generator Supplier/OEM
C	Chimney Supplier
TBD	To Be Determined
N/A	Not Applicable for this Project or Task

Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
411	Performance Testing	N/A	N/A	O	N/A	
412	**Warranty**					
413	Performance Guarantees for FGD Process Equipment	N/A	N/A	FGD	N/A	As expressly stated in the proposal.
414	Extended	N/A	N/A	N/A	N/A	
415	Material & Workmanship	N/A	N/A	FGD/AE/EC	N/A	Warranty on BOP equipment will be a pass through to Owner.
416	**Freight**					
417	Freight	N/A	N/A	FGD/AE	N/A	By BOP equipment supplier.
418	Postage/Express Delivery	N/A	N/A	FGD/AE	N/A	
419	Customs Fees / Duties	N/A	N/A	FGD/AE	N/A	If required. By BOP equipment supplier.
420	Packing	N/A	N/A	FGD/AE	N/A	By BOP equipment supplier.
421	**Travel & Relocation Associated with Construction**					
422	Project Related Travel	N/A	N/A	FGD/AE	N/A	
423	Personnel Relocation	N/A	N/A	FGD/AE	N/A	
424	Interim Living Expenses	N/A	N/A	FGD/AE	N/A	
425	**Turnover Documentation**					
426	O&M Manual	FGD/AE	FGD/AE	FGD/AE	N/A	Each his own.
427	Lubrication Manuals	FGD/AE	FGD/AE	FGD/AE	N/A	Each his own.
428	As-Built Dwgs	FGD/AE	FGD/AE	FGD/AE	N/A	Each his own.
429	Training Manual for FGD Process Equipment	FGD	FGD	FGD	N/A	
430	Spare Parts List	FGD/AE	FGD/AE	FGD/AE	N/A	Each his own.
431	Commissioning Manual	FGD/AE	FGD/AE	FGD/AE	N/A	Each his own. Quoted as an option for BOP.
432	**Taxes**					
433	Sales Taxes	N/A	N/A	O	EC/ESC	Owner to pay sales tax & other taxes.
434	Other Taxes (Example: Payroll Taxes)	N/A	N/A	FGD/AE/O	N/A	Each his own
435	**Schedule**					
436	Top Level/Milestones Schedule	O	O/AE	O	N/A	
437	Detailed Schedule	O/AE	O/AE	AE	N/A	
438						
439	**Coal Handling System Modifications for Coal Blending**					
440	TBD	TBD	TBD	TBD	TBD	
441	TBD	TBD	TBD	TBD	TBD	
442	TBD	TBD	TBD	TBD	TBD	
443	TBD	TBD	TBD	TBD	TBD	
444	TBD	TBD	TBD	TBD	TBD	
445	TBD	TBD	TBD	TBD	TBD	

Project Name: ***Big Sandy Plant - Unit 2 WFGD***
Total Project Scope Split
Target Cost Option

Revision Date: ***November 17, 2004***
Current Rev #: ***Rev 0***

Division of Work (DOW) Legend	
FGD	FGD Supplier
AE	Architect Engineer-PE&C
EC	Erection Contractor
O	Owner-AEP
ESC	Material & Installation by subcontractor managed by AE or EC
SGS	Steam Generator Supplier/OEM
C	Chimney Supplier
TBD	To Be Determined
N/A	Not Applicable for this Project or Task

Item	Description	Functional Design	Detail Design	Supply	Site Erection	Comments
446						
447	**BALANCED DRAFT CONVERSION (BDC)**					
448	Steam Generator Reinforcement	O	O	O	EC	
449	Air Pre-Heater reinforcement	O	O	O	EC	
450	Flues Between Air Pre-Heater Outlet to ESP Inlet Reinforcement	O	O	O	EC	
451	Electrostatic Precipitator (ESP) Reinforcement	O	O	O	EC	
452	Insulation & Lagging	O	O	EC	EC	
453	Induced Draft Fan	AE	AE	TBD	EC	
454	Induced Draft Fan Motors	AE	AE	TBD	EC	
455	FD Fan Modifications	AE	AE	TBD	EC	
456	Electrical upgrades for ID Fans	AE	AE	TBD	EC	
457						
458	**COAL BURNING FLEXIBILITY (CBF)**					
459	Install "Nose" on Furnace Rear Wall	O	O	O	EC	
460	Water Cannons and Water Lances	AE	AE	AE	EC	
461	Sootblowers	AE	AE	AE	EC	
462	Thermal Imaging Systems	AE	AE	AE	EC	
463	Piping Systems	AE	AE	AE	EC	
464	Electrical Systems	AE	AE	AE	EC	
465	Furnace Wall Tubing Overlay	O/AE	AE	EC	EC	

Appendix A

WFGD Material Balance Tables and Process Flow Diagrams

Big Sandy Unit 2

PARSONS E&C CALCULATION SHEET			Revision:	A	0	1	2	3	JOB NUMBER:
	CLIENT NAME:	AEP							53762301
	PROJECT NAME:	Big Sandy Unit 2	Originator:	Jay White	Jay White				
	SUBJECT:	Boiler and FGD Material Balance Estimate	Reviewer:	B. Graeffe	B. Graeffe				CALCULATION NUMBER:
	WORKSHEET:	Material Balance Report Sheets	Date:	10/19/2004	12/6/2004				AEBS-2-DC-042-5-001

Big Sandy Unit 2 - WFGD Gas Path Material Balance - 100% MCR Load Condition

Stream	1	2		3		4		5		6		7		8		9		10	
Component Lb/hr	Coal Input	ID Fan Suction		ID Fan Discharge		Flue Gas to FGD Absorber		Flue Gas Entering WESP		Flue Gas Entering Stack		Oxidation Air Inlet		Oxidation Air Blower Outlet		Sat'd Ox Air with Quench Water		Oxidation Air Quench Water	
	Mass	Mass	Mole	Mass	Mole	Mass	Mole	Mass	Mole	Mass	Mole	Mass	Mole	Mass	Mole	Mass	Mole	Mass	Mole
Ar		58,747	1,471	58,747	1,471	117,493	2,941	118,487	2,966	118,487	2,966	994	25	994	25	994	25	0	0
CO2		826,412	18,778	826,412	18,778	1,652,824	37,556	1,678,098	38,130	1,678,098	38,130	0	0	0	0	0	0	0	0
HCL		674	18	674	18	1,347	37	0	0	0	0	0	0	0	0	0	0	0	0
HF		7	0	7	0	14	1	0	0	0	0	0	0	0	0	0	0	0	0
H2O		191,426	10,626	191,426	10,626	382,853	21,251	961,672	53,381	961,672	53,381	523	29	523	29	2,918	162	2,395	133
N2		3,426,208	122,306	3,426,208	122,306	6,852,417	244,612	6,910,291	246,678	6,910,291	246,678	57,874	2,066	57,874	2,066	57,874	2,066	0	0
NH3		4	0	4	0	9	1	9	1	9	1	0	0	0	0	0	0	0	0
NO		228	8	228	8	456	15	456	15	456	15	0	0	0	0	0	0	0	0
NO2		18	0	18	0	37	1	37	1	37	1	0	0	0	0	0	0	0	0
O2		335,798	10,494	335,798	10,494	671,596	20,988	680,576	21,269	680,576	21,269	17,774	555	17,774	555	17,774	555	0	0
SO2		18,054	282	18,054	282	36,107	564	722	11	722	11	0	0	0	0	0	0	0	0
SO3		414	5	414	5	827	10	579	7	579	7	0	0	0	0	0	0	0	0
Total Gas Flow, Wet		4,857,990	163,988	4,857,990	163,988	9,715,981	327,977	10,350,927	362,459	10,350,927	362,459	77,164	2,675	77,164	2,675	79,560	2,808	2,395	133
Total Gas Flow, Dry		4,666,564	153,363	4,666,564	153,363	9,333,128	306,725	9,389,255	309,078	9,389,255	309,078	76,642	2,646	76,642	2,646	76,642	2,646	0	0
Coal	654,924	0		0		0		0		0									
Ash	0	965		965		1,930		0		0									
Total Solids Flow	654,924	965		965		1,930		488		488									
Total Stream Mass Flow	654,924	4,858,956		4,858,956		9,717,911		10,351,414		10,351,414		77,164		77,164		79,560		2,395	
Gas Flow, ACFM		1,706,092		1,592,796		3,189,465		2,644,704		2,648,024		17,602		11,135		9,592		n/a	
Mol. Wt.			29.6240		29.6240		29.6240		28.5575		28.5575		28.8434		28.8434		28.3307		18.0153
Temp, deg F		321		349		349		128		128		70		251		121		70	
Pressure, psia		13.42		14.88		14.86		14.41		14.39		14.39		30.54		30.39		50	

Big Sandy Unit 2 - WFGD Primary Dewatering and Reagent Preparation Material Balance - 100% MCR Load Condition

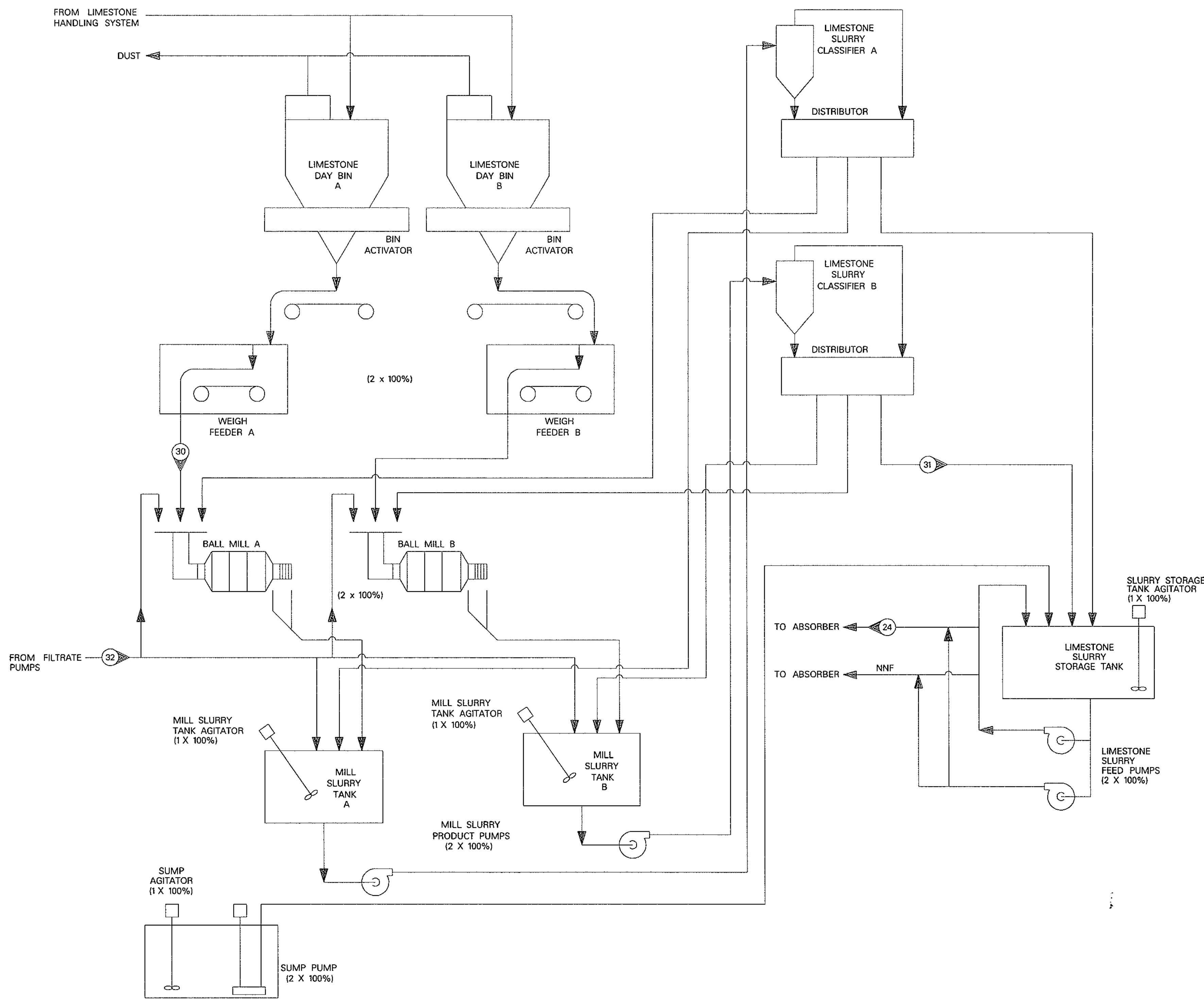
Stream	20	21	22	23	24	25	26	30	31	32
Component lb/hr	Hydrocyclone Feed	Hydrocyclone Overflow	Hydrocyclone Underflow	Blowdown	Limestone Slurry to Absorber	Filtrate to Absorber	Overheads to Reclaim Tank	Raw Limestone to Ball Mill	Classified Slurry to Storage Tank	Make-Up Water to Slurry Prep
	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
CaCO3	2,172	651	1,520	192	58,037	489	459	58,037	58,037	0
CaSO3:1/2H2O	554	277	277	82	0	201	195	0	0	0
CaSO4:2H2O	103,338	10,334	93,004	3,053	0	9,141	7,281	0	0	0
H2O	456,706	361,000	95,705	106,646	147,170	696,952	254,354	3,154	147,170	144,016
MgCO3	1,769	1,150	619	340	1,893	822	810	1,893	1,893	0
Alkali Inerts	5,946	3,865	2,081	1,142	3,154	2,765	2,723	3,154	3,154	0
Flyash	3,337	2,670	667	789	0	1,894	1,881	0	0	0
TDS	11,754	9,291	2,463	2,745	26	9,052	6,546	0	26	26
Total Flow	585,575	389,237	196,337	114,988	210,280	721,317	274,250	66,238	210,280	144,042
Flow, gpm	1031	751	280	222	347	1,429	529	n/a	347	291
Specific Gravity	1.13	1.03	1.40	1.03	1.21	1.01	1.03	n/a	1.21	0.99
Cl^-, ppmw	12,000	12,000	12,000	12,000	19	2638	12,000	n/a	19	19
TSS, %	20.00	4.87	50.00	4.87	30.00	0.44	4.87	95.24	30.00	0.00
TDS, %	2.51	2.51	2.51	2.51	0.02	0.56	2.51	n/a	0.02	0.02

PARSONS E&C	CLIENT NAME:	AEP	Revision:	A	0	1	2	3	JOB NUMBER:
	PROJECT NAME:	Big Sandy Unit 2	Originator:	Jay White	Jay White				53762301
CALCULATION SHEET	SUBJECT:	Boiler and FGD Material Balance Estimate	Reviewer:	B. Graeffe	B. Graeffe				CALCULATION NUMBER:
	WORKSHEET:	Material Balance Report Sheets	Date:	10/19/2004	12/6/2004				AEBS-2-DC-042-5-001

Big Sandy Unit 2 - WFGD Secondary Dewatering Material Balance - 100% MCR Load Condition

Stream	41	42	43	44	45	46	50	51
Component lb/hr	Vacuum Belt Filter Feed	Vacuum Belt Filter Cake Discharge	Cake to Stackout Conveyor	Vacuum Belt Filter Filtrate	Filter Cake Wash Water	Make-Up Water To Reclaim Tank	General Make-Up Water to Make-Up Tank	Water to Mist Eliminator
	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
CaCO3	1,520	1,490	1,490	30	0	0	0	0
CaSO3:1/2H2O	277	271	271	6	0	0	0	0
CaSO4:2H2O	93,004	91,144	91,144	1,860	0	0	0	0
H2O	95,705	10,667	10,667	107,162	22,123	335,436	711,853	207,883
MgCO3	619	607	607	12	0	0	0	0
Alkali Inerts	2,081	2,039	2,039	42	0	0	0	0
Flyash	667	654	654	13	0	0	0	0
TDS	2,463	22	22	2,445	4	61	130	38
Total Flow	196,337	106,895	106,895	111,570	22,127	335,497	711,983	207,921
Flow, gpm	280	n/a	n/a	899	45	670	1437	420
Specific Gravity	1.40	2.03	2.03	0.99	0.99	0.99	0.99	0.99
Cl^-, ppmw	12,000	1,000	1,000	2,638	19	19	19	19
TSS, %	50.00	90.00	90.00	0.44	0.00	0.00	0.00	0.00
TDS, %	2.51	0.21	0.21	0.56	0.02	0.02	0.02	0.02

DWG. NO. 2-5170000



REVISIONS

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
B	12/17/04	RAK				ELB		CWS
A	10/20/04	RAK				ELB		CWS

B: REVISED PUMP DISCHARGE FROM LIMESTONE SLURRY STORAGE TANK

A: ISSUED FOR INFORMATION

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LOE E.BLANKENBILLER10-11-04
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ORIGINATING PERSONNEL — PROFESSIONAL ENGINEER'S SEAL
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PROJECT ENGINEERING MANAGER
PROJECT MANAGER: C. W. SAMUELSON

KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY — KENTUCKY

PROCESS FLOW DIAGRAM
REAGENT PREPARATION SYSTEM
UNIT 2

DWG. NO. 2-5170000-B

SCALE: NONE — MECHANICAL ENGINEERING DIVISION

DOCUMENT PREPARED BY PARSONS E&C

AEP AMERICAN ELECTRIC POWER — AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

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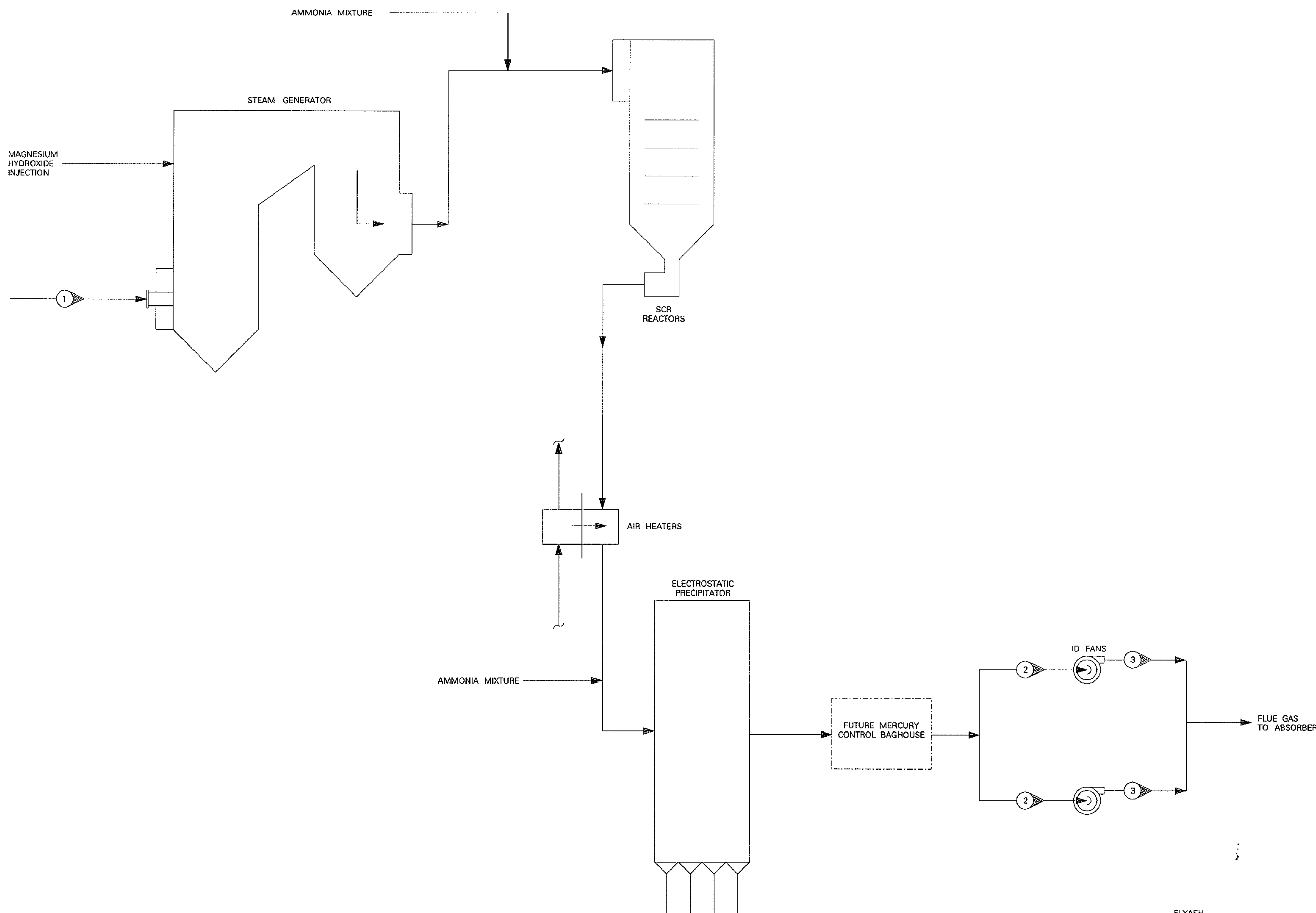

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REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	10/20/04	RAK				ELB		CWS

DATE	NO.	DESCRIPTION	APPD.

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PROJECT MANAGER C. W. SAMUELSON	ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: STATE: LIC. NO.: DATE:

KENTUCKY POWER COMPANY

BIG SANDY PLANT

BIG SANDY KENTUCKY

PROCESS FLOW DIAGRAM

COMBUSTION AIR AND FUEL GAS UNIT 2

DWG. NO. 2-5170001-A

SCALE: NONE — MECHANICAL ENGINEERING DIVISION

DR:
CH:
DES SUPV:
DATE:
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AMERICAN ELECTRIC POWER

AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

PE&C-FILE: 2-5170001.dgn
PE&C-DATE: 20-Oct-04 12:11

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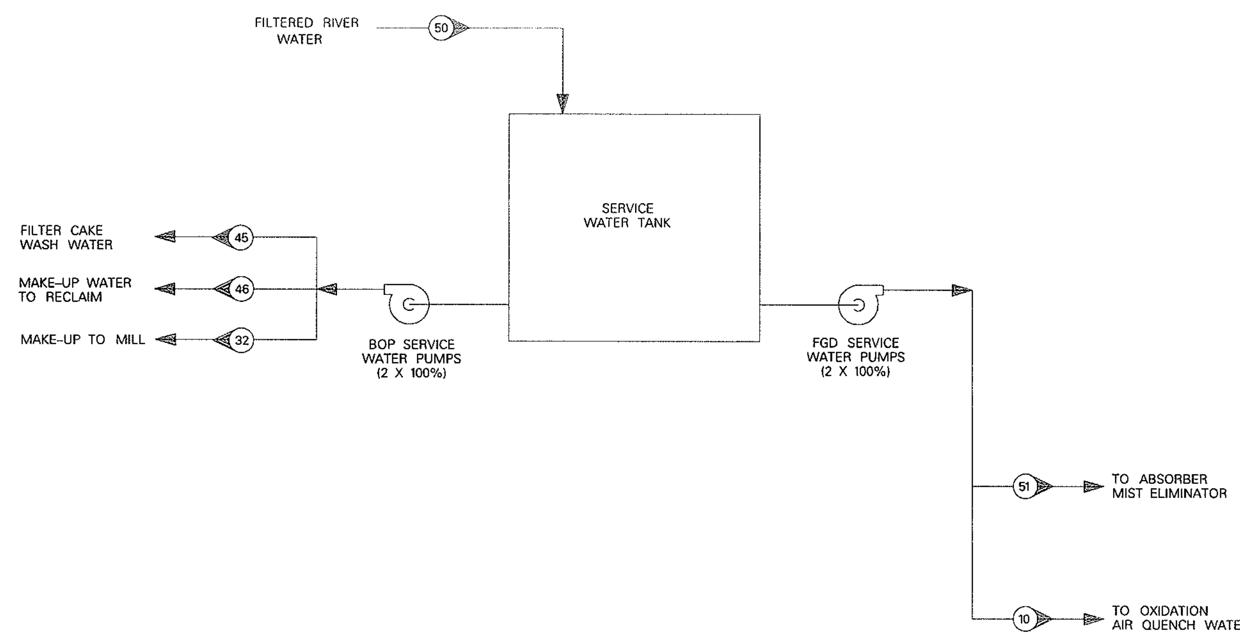

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REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	10/20/04	RAK				ELB		CWS

DATE	NO.	DESCRIPTION	APPD.

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LDE

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LEAD DESIGNER	
ENGINEER/TECH SPECIALIST	
PROJECT ENGINEERING MANAGER	
PROJECT MANAGER C. W. SAMUELSON	ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: ______ STATE: ______ LIC. NO.: ______ DATE: ______

KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY

PROCESS FLOW DIAGRAM
MAKE-UP WATER SYSTEM
UNIT 2

DWG. NO. 2-5170002-A

SCALE: NONE — MECHANICAL ENGINEERING DIVISION
DR:
CH:
DES SUPV:
DATE:
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AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

1050694

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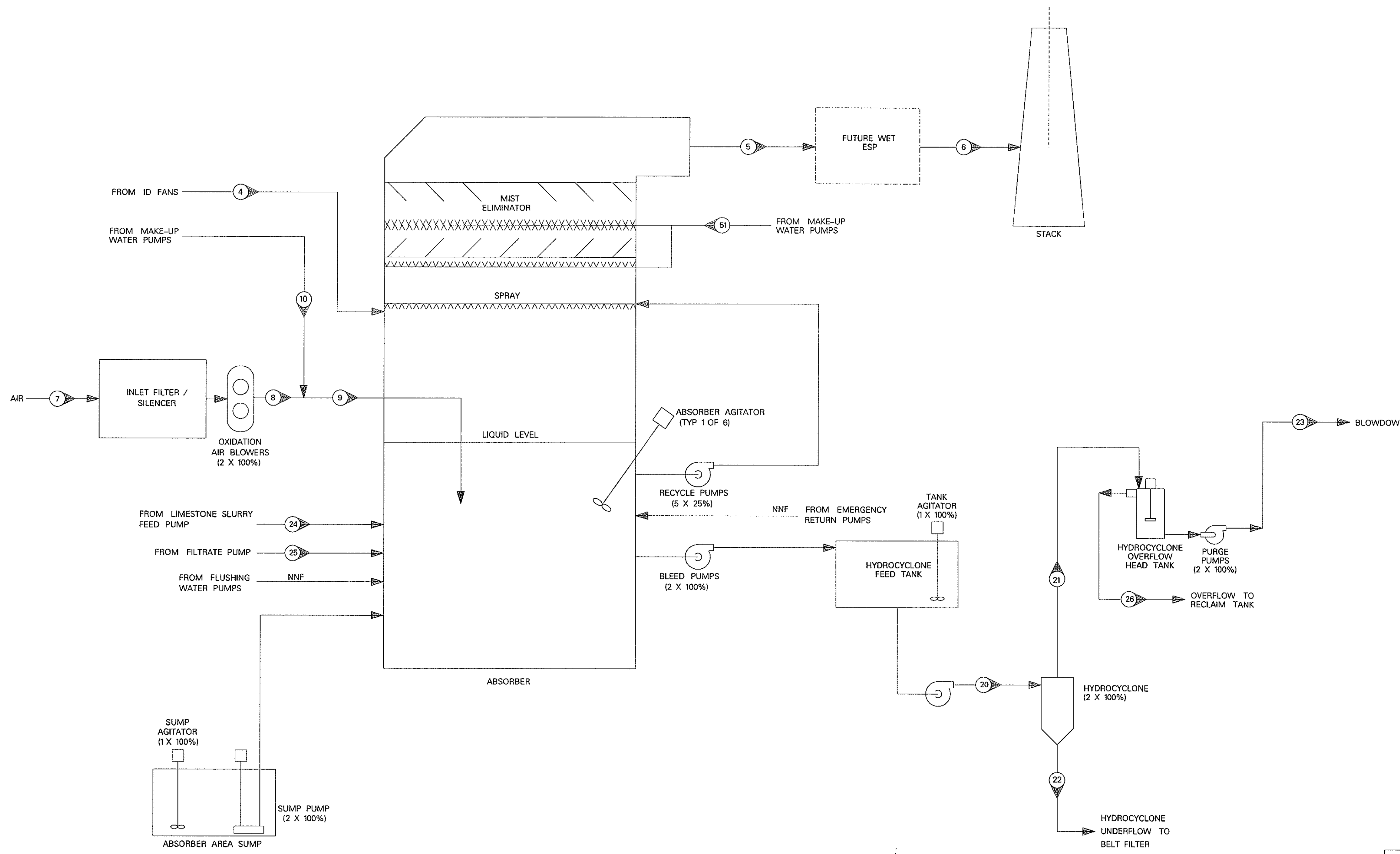

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	10/20/04	RAK				ELB		CWS

DATE | NO. | DESCRIPTION | APPD.

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LOC

ORIGINATING PERSONNEL | PROFESSIONAL ENGINEER'S SEAL

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PROJECT ENGINEERING MANAGER
PROJECT MANAGER: C. W. SAMUELSON

KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY — KENTUCKY
PROCESS FLOW DIAGRAM
ABSORBER ISLAND
UNIT 2

DWG. NO. 2-5170003-A

SCALE: NONE — MECHANICAL ENGINEERING DIVISION

DOCUMENT PREPARED BY PARSONS E&C

AEP AMERICAN ELECTRIC POWER — AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

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PE&C-DATE: 11-Oct-04 12:35
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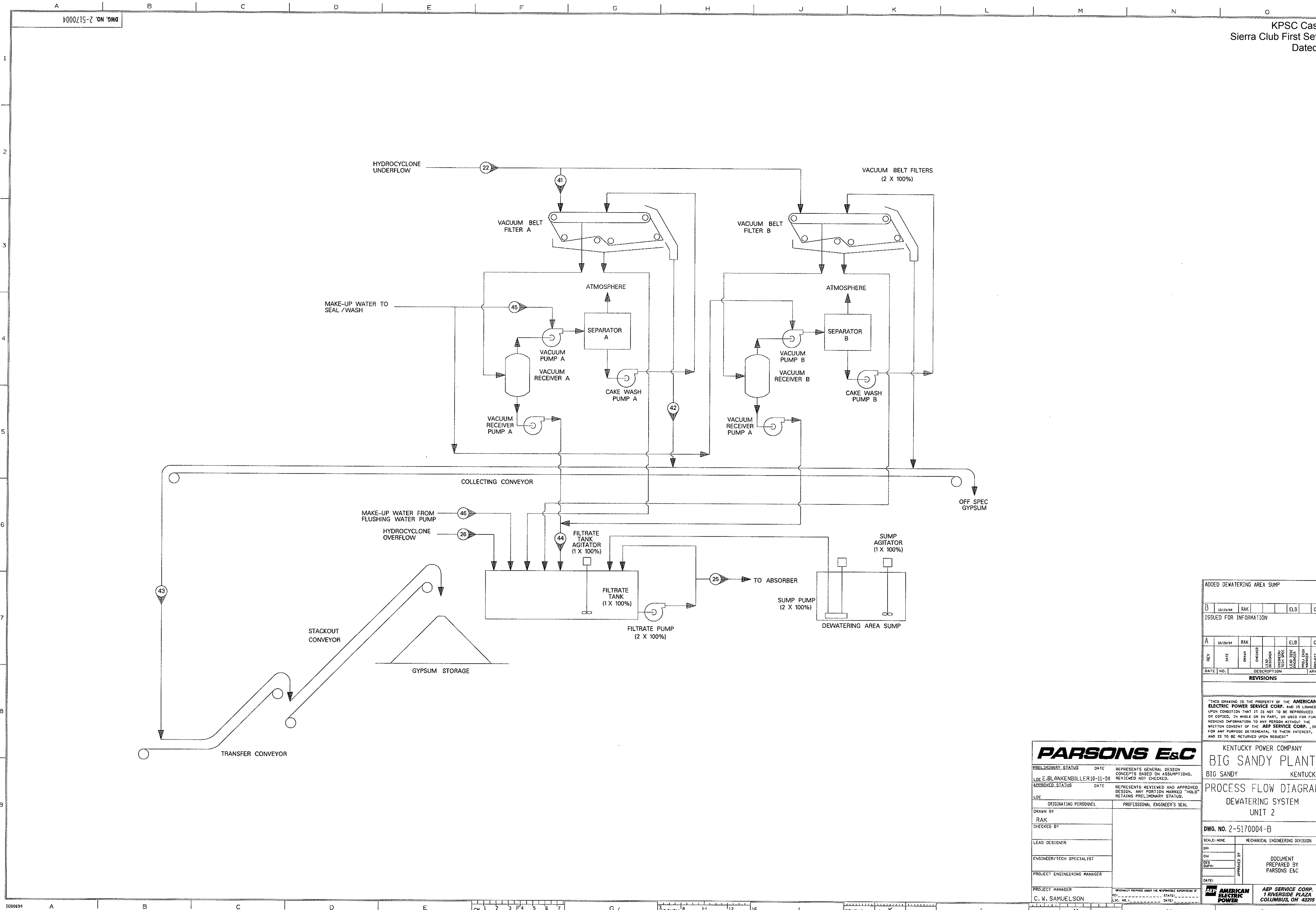
DWG. NO. 2-5170004
HYDROCYCLONE UNDERFLOW
22
41
VACUUM BELT FILTERS
(2 X 100%)
VACUUM BELT FILTER A
VACUUM BELT FILTER B
ATMOSPHERE
ATMOSPHERE
MAKE-UP WATER TO SEAL /WASH
45
SEPARATOR A
SEPARATOR B
VACUUM PUMP A
VACUUM PUMP B
VACUUM RECEIVER A
VACUUM RECEIVER B
CAKE WASH PUMP A
CAKE WASH PUMP B
42
VACUUM RECEIVER PUMP A
VACUUM RECEIVER PUMP A
COLLECTING CONVEYOR
OFF SPEC GYPSUM
MAKE-UP WATER FROM FLUSHING WATER PUMP
46
HYDROCYCLONE OVERFLOW
26
44
FILTRATE TANK AGITATOR
(1 X 100%)
SUMP AGITATOR
(1 X 100%)
FILTRATE TANK
(1 X 100%)
25
TO ABSORBER
SUMP PUMP
(2 X 100%)
DEWATERING AREA SUMP
FILTRATE PUMP
(2 X 100%)
43
STACKOUT CONVEYOR
GYPSUM STORAGE
TRANSFER CONVEYOR
ADDED DEWATERING AREA SUMP
B 12/23/04 RAK ELB CWS
ISSUED FOR INFORMATION
A 10/20/04 RAK ELB CWS
REV DATE DRAWN CHECKED LEAD DESIGNER ENGINEER/TECH SPEC LEAD DISC ENGINEER PROJ ENGR MANAGER PROJECT MANAGER
DATE NO. DESCRIPTION APPD.
REVISIONS
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PARSONS E&C
PRELIMINARY STATUS DATE
LDE E.BLANKENBILLER 10-11-04
REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE
LDE
REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
ORIGINATING PERSONNEL
PROFESSIONAL ENGINEER'S SEAL
DRAWN BY
RAK
CHECKED BY
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER
PROJECT MANAGER
C. W. SAMUELSON
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
PROCESS FLOW DIAGRAM
DEWATERING SYSTEM
UNIT 2
DWG. NO. 2-5170004-B
SCALE: NONE
MECHANICAL ENGINEERING DIVISION
DR:
CH:
DES SUPV:
DATE:
APPROVED BY
DOCUMENT PREPARED BY PARSONS E&C
AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215
PE&C-FILE: 2-5170004.dgn
PE&C-DATE: 30-Sep-04 07:21
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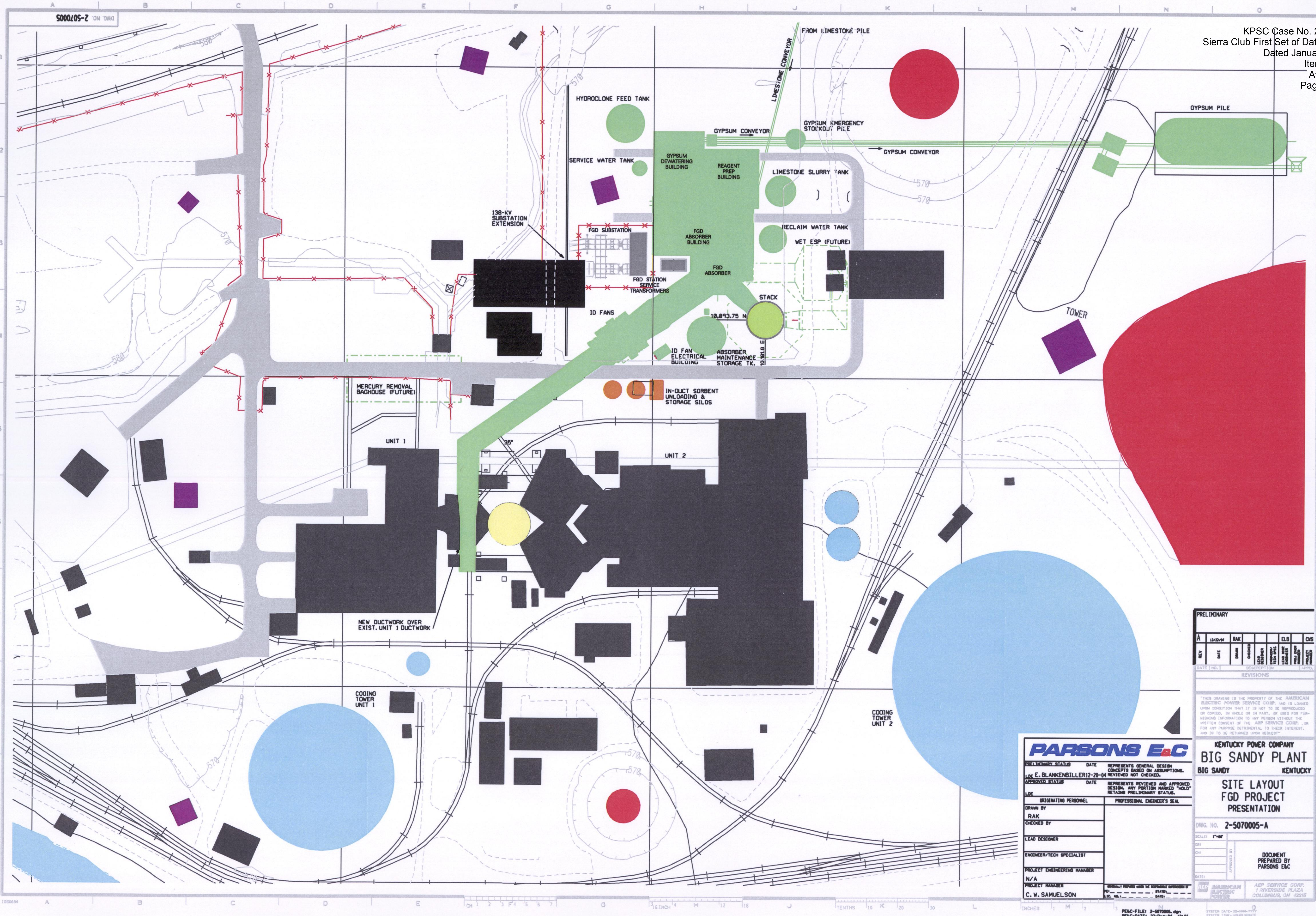
SYSTEM TIME-HOUR:MINUTE

Appendix B

Plot Plans and General Arrangement Drawings

Big Sandy Unit 2


DWG. NO. 2-5070005
FROM LIMESTONE PILE
LIMESTONE CONVEYOR
HYDROCLONE FEED TANK
GYPSUM CONVEYOR
GYPSUM EMERGENCY STOCKOUT PILE
GYPSUM CONVEYOR
GYPSUM PILE
SERVICE WATER TANK
GYPSUM DEWATERING BUILDING
REAGENT PREP BUILDING
LIMESTONE SLURRY TANK
138-KV SUBSTATION EXTENSION
FGD SUBSTATION
FGD ABSORBER BUILDING
RECLAIM WATER TANK
WET ESP (FUTURE)
FGD ABSORBER
FGD STATION SERVICE TRANSFORMERS
STACK
ID FANS
10,093.75 N
TOWER
ID FAN ELECTRICAL BUILDING
ABSORBER MAINTENANCE STORAGE TK.
MERCURY REMOVAL BAGHOUSE (FUTURE)
IN-DUCT SORBENT UNLOADING & STORAGE SILOS
UNIT 1
UNIT 2
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
COOLING TOWER UNIT 1
COOLING TOWER UNIT 2
PARSONS E&C
PRELIMINARY STATUS
DATE
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LDE E. BLANKENBILLER 12-20-04
APPROVED STATUS
DATE
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LDE
ORIGINATING PERSONNEL
PROFESSIONAL ENGINEER'S SEAL
DRAWN BY
RAK
CHECKED BY
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER
N/A
PROJECT MANAGER
C. W. SAMUELSON
PRELIMINARY
A 12/22/04 RAK ELB CWS
REV DATE DRAWN CHECKED LEAD DESIGNER ENGINEER/TECH SPEC LEAD DISC ENGINEER PROJ ENGR MANAGER PROJECT MANAGER
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KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY
KENTUCKY
SITE LAYOUT
FGD PROJECT
PRESENTATION
DWG. NO. 2-5070005-A
DOCUMENT PREPARED BY PARSONS E&C
AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215
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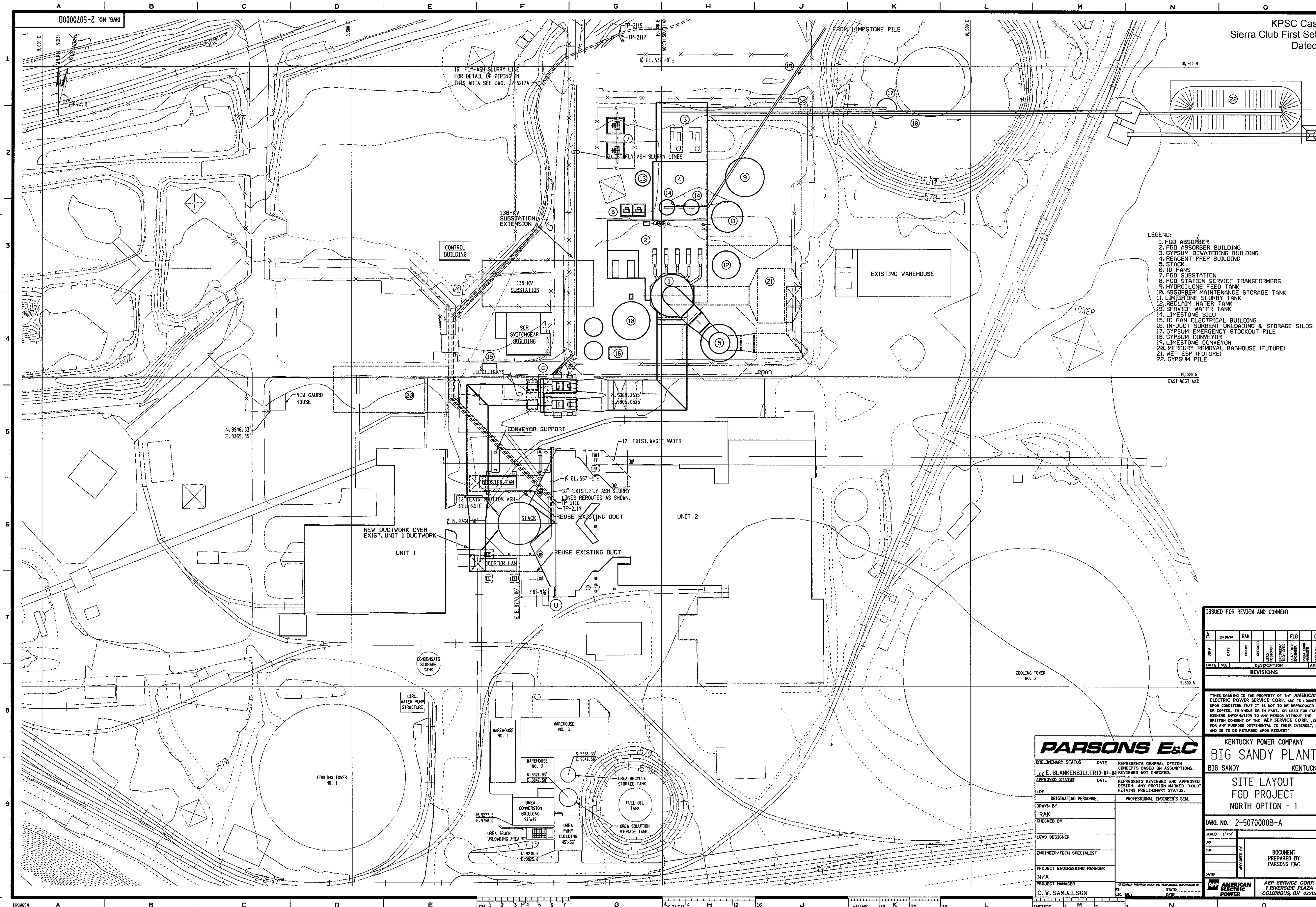
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FROM LIMESTONE PILE
16" FLY-ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
(2) FLY ASH SLURRY LINES
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
EXISTING WAREHOUSE
ELECT. TRAYS
ROAD
NEW GAURD HOUSE
CONVEYOR SUPPORT
12" EXIST. WASTE WATER
BOOSTER FAN
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
STACK
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
UNIT 1
UNIT 2
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA CONVERSION BUILDING 67'x45'
UREA PUMP BUILDING 45'x56'
UREA TRUCK UNLOADING AREA
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
EAST-WEST AXIS
LEGEND:
1. FGD ABSORBER
2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
15. ID FAN ELECTRICAL BUILDING
16. IN-DUCT SORBENT UNLOADING & STORAGE SILOS
17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
ISSUED FOR REVIEW AND COMMENT
A 10/20/04 RAK ELB CWS
REV DATE DRAWN CHECKED LEAD DESIGNER ENGINEER/TECH SPEC LEAD DISC ENGINEER PROJ ENGR MANAGER PROJECT MANAGER
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LDE E. BLANKENBILLER 10-04-04
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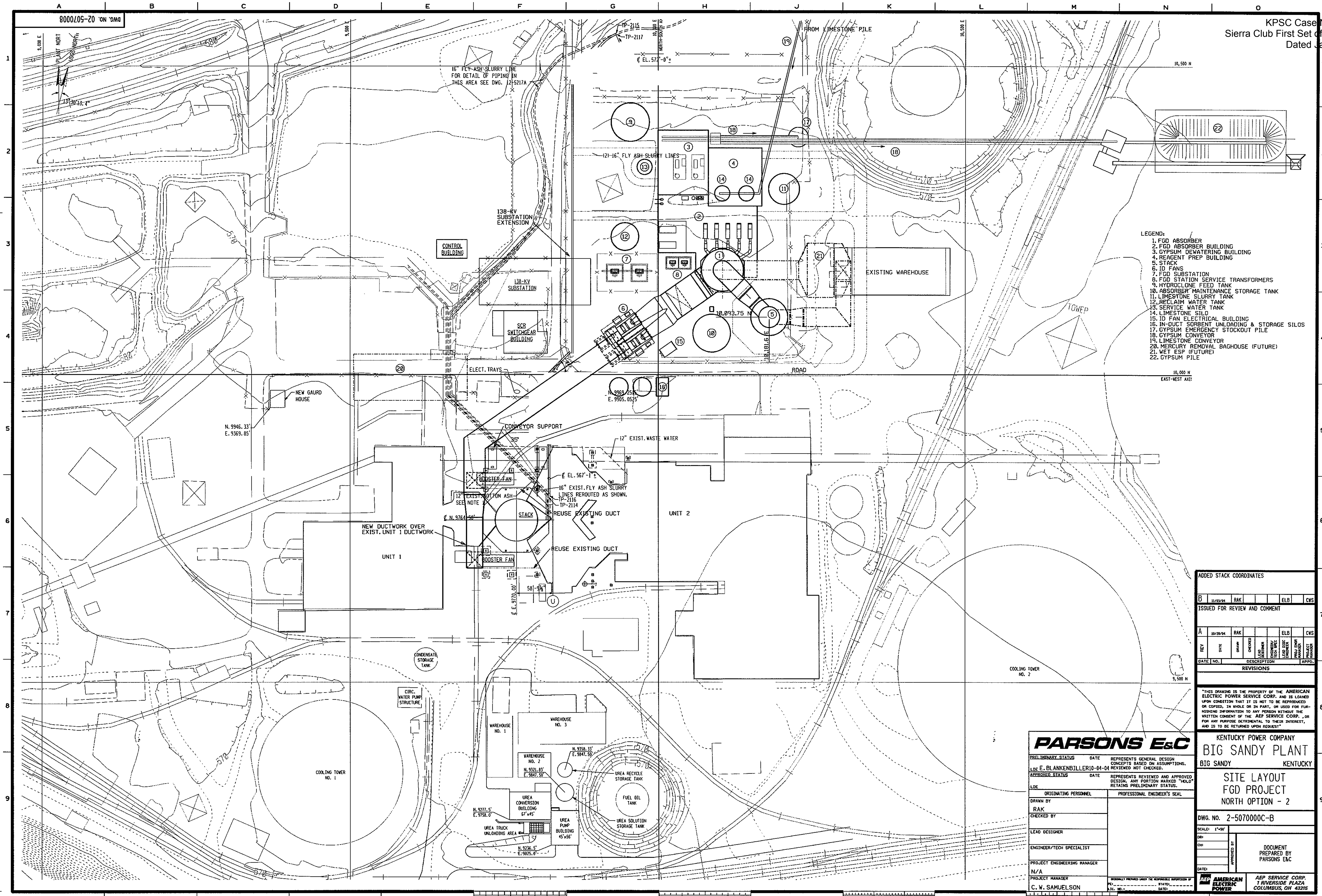
LDE
ORIGINATING PERSONNEL
PROFESSIONAL ENGINEER'S SEAL
DRAWN BY RAK
CHECKED BY
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER N/A
PROJECT MANAGER C. W. SAMUELSON
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
NORTH OPTION - 1
DWG. NO. 2-5070000B-A
SCALE: 1"=50'
DOCUMENT PREPARED BY PARSONS E&C
AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215
PE&C-FILE: 2-5070000b.dgn
PE&C-DATE: 20-Oct-04 07:47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LEGEND:
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2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
15. ID FAN ELECTRICAL BUILDING
16. IN-DUCT SORBENT UNLOADING & STORAGE SILOS
17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
FROM LIMESTONE PILE
16" FLY ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
(2)-16" FLY ASH SLURRY LINES
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
EXISTING WAREHOUSE
ELECT. TRAYS
ROAD
NEW GAURD HOUSE
CONVEYOR SUPPORT
12" EXIST. WASTE WATER
BOOSTER FAN
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
12" EXIST. BOTTOM ASH SEE NOTE
STACK
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
UNIT 1
UNIT 2
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA CONVERSION BUILDING
UREA TRUCK UNLOADING AREA
UREA PUMP BUILDING
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
ADDED STACK COORDINATES
ISSUED FOR REVIEW AND COMMENT
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PARSONS E&C
PRELIMINARY STATUS
E. BLANKENBILLER 10-04-04
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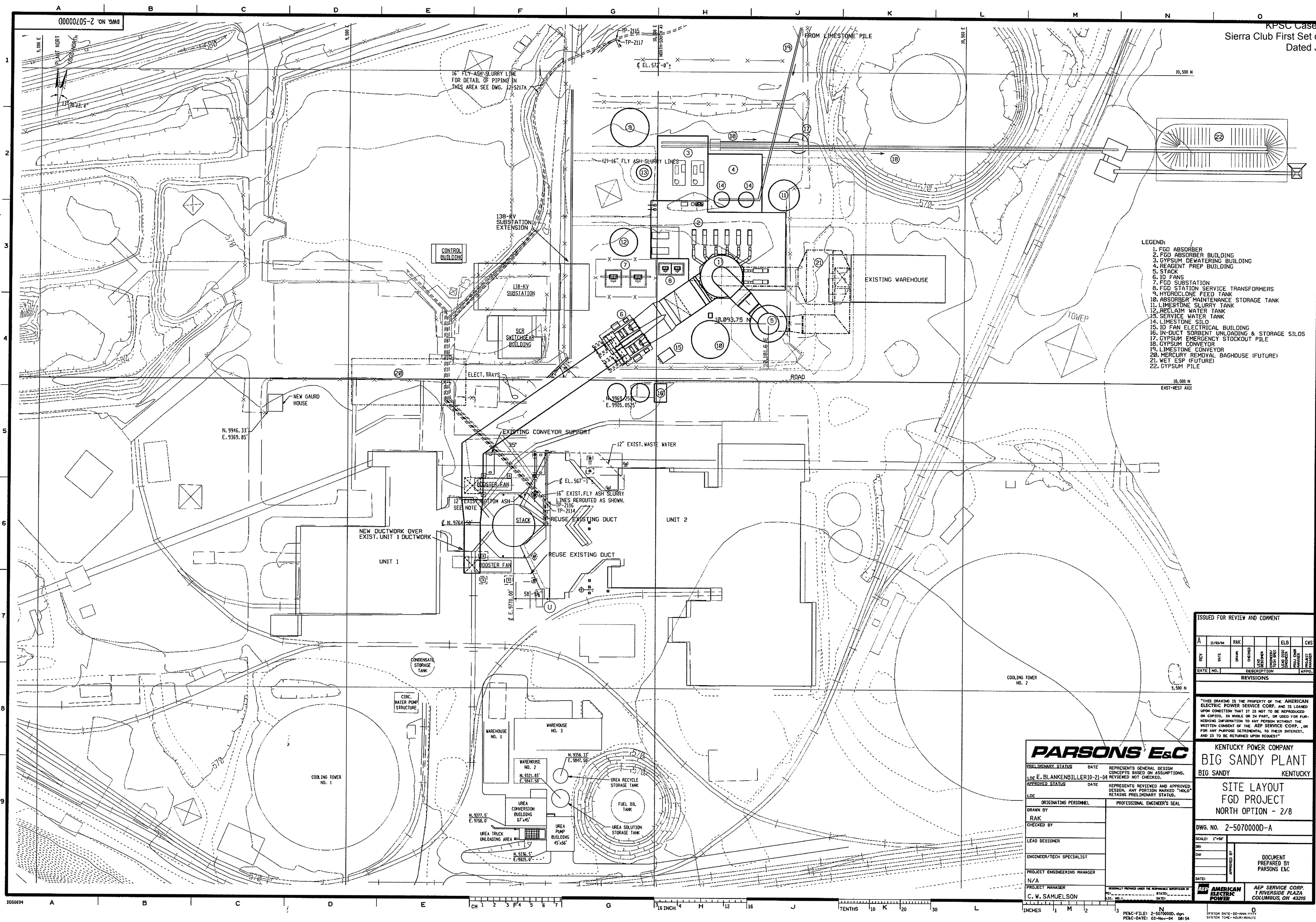
DRAWN BY RAK
PROJECT MANAGER C. W. SAMUELSON
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
NORTH OPTION - 2
DWG. NO. 2-5070000C-B
DOCUMENT PREPARED BY PARSONS E&C
AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215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2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
15. ID FAN ELECTRICAL BUILDING
16. IN-DUCT SORBENT UNLOADING & STORAGE SILOS
17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
FROM LIMESTONE PILE
16" FLY ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
(2)-16" FLY ASH SLURRY LINES
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
EXISTING WAREHOUSE
TOWER
ELECT. TRAYS
ROAD
NEW GAURD HOUSE
EXISTING CONVEYOR SUPPORT
12" EXIST. WASTE WATER
BOOSTER FAN
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
STACK
REUSE EXISTING DUCT
UNIT 2
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
UNIT 1
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
UREA CONVERSION BUILDING 67'x45'
UREA PUMP BUILDING 45'x56'
UREA TRUCK UNLOADING AREA
ISSUED FOR REVIEW AND COMMENT
A 11/03/04 RAK ELB CWS
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PARSONS E&C
PRELIMINARY STATUS
LDE E. BLANKENBILLER 10-21-04
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APPROVED STATUS
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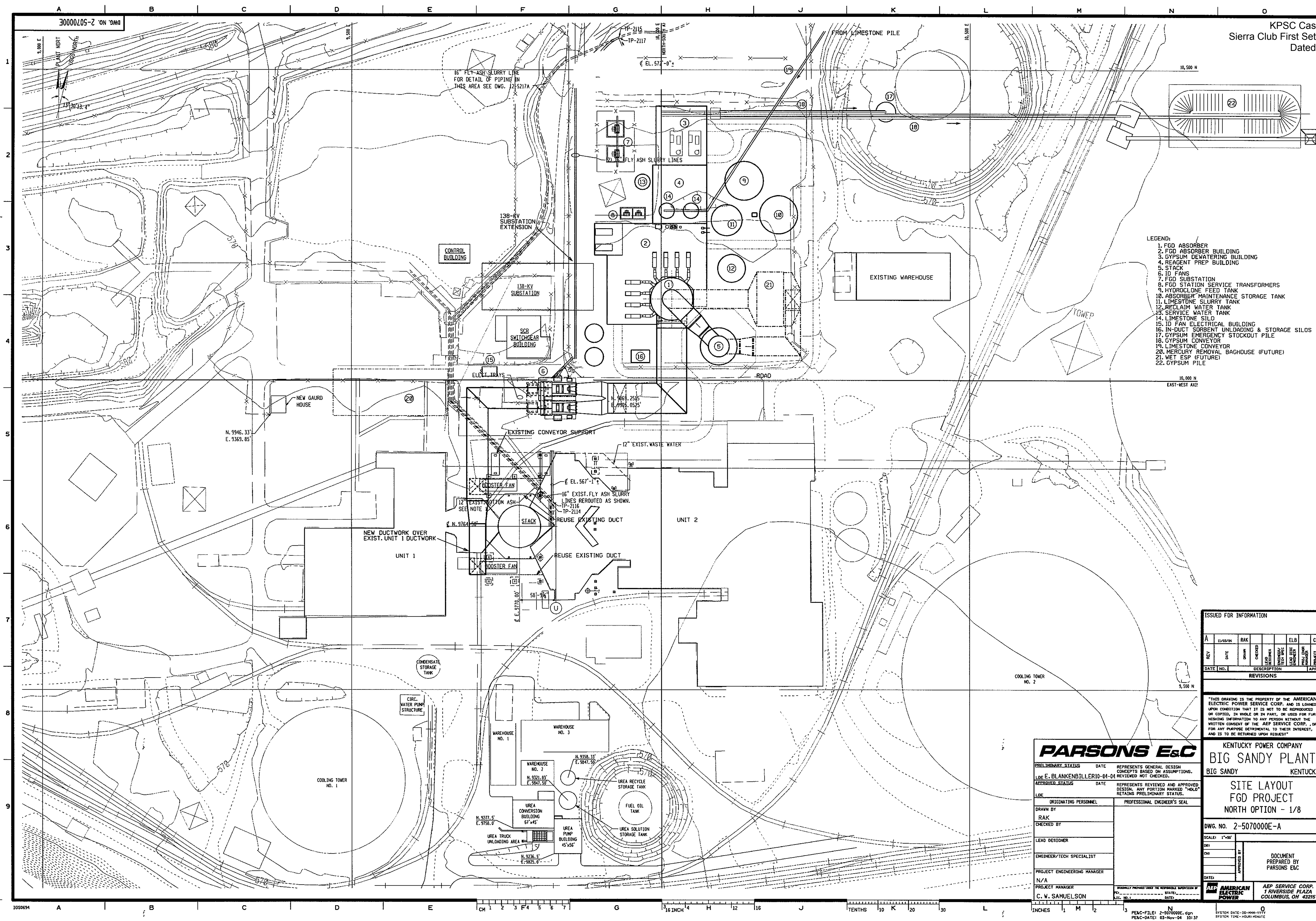
ORIGINATING PERSONNEL
PROFESSIONAL ENGINEER'S SEAL
DRAWN BY RAK
CHECKED BY
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER N/A
PROJECT MANAGER C. W. SAMUELSON
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
NORTH OPTION - 2/8
DWG. NO. 2-5070000D-A
DOCUMENT PREPARED BY PARSONS E&C
AMERICAN ELECTRIC POWER
AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215


DWG. NO. 2-5070000E
FROM LIMESTONE PILE
16" FLY-ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
(2) 16" FLY ASH SLURRY LINES
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
EXISTING WAREHOUSE
ELECT TRAYS
ROAD
NEW GAURD HOUSE
EXISTING CONVEYOR SUPPORT
12" EXIST. WASTE WATER
BOOSTER FAN
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
12" EXIST. BOTTOM ASH SEE NOTE 1
STACK
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
UNIT 1
UNIT 2
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA CONVERSION BUILDING 67'x45'
UREA TRUCK UNLOADING AREA
UREA PUMP BUILDING 45'x56'
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
LEGEND:
1. FGD ABSORBER
2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
15. ID FAN ELECTRICAL BUILDING
16. IN-DUCT SORBENT UNLOADING & STORAGE SILOS
17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
ISSUED FOR INFORMATION
A 11/03/04 RAK ELB CWS
REV DATE DRAWN CHECKED LEAD DESIGNER ENGINEER/TECH SPEC LEAD DISC ENGINEER PROJ ENGR MANAGER PROJECT MANAGER
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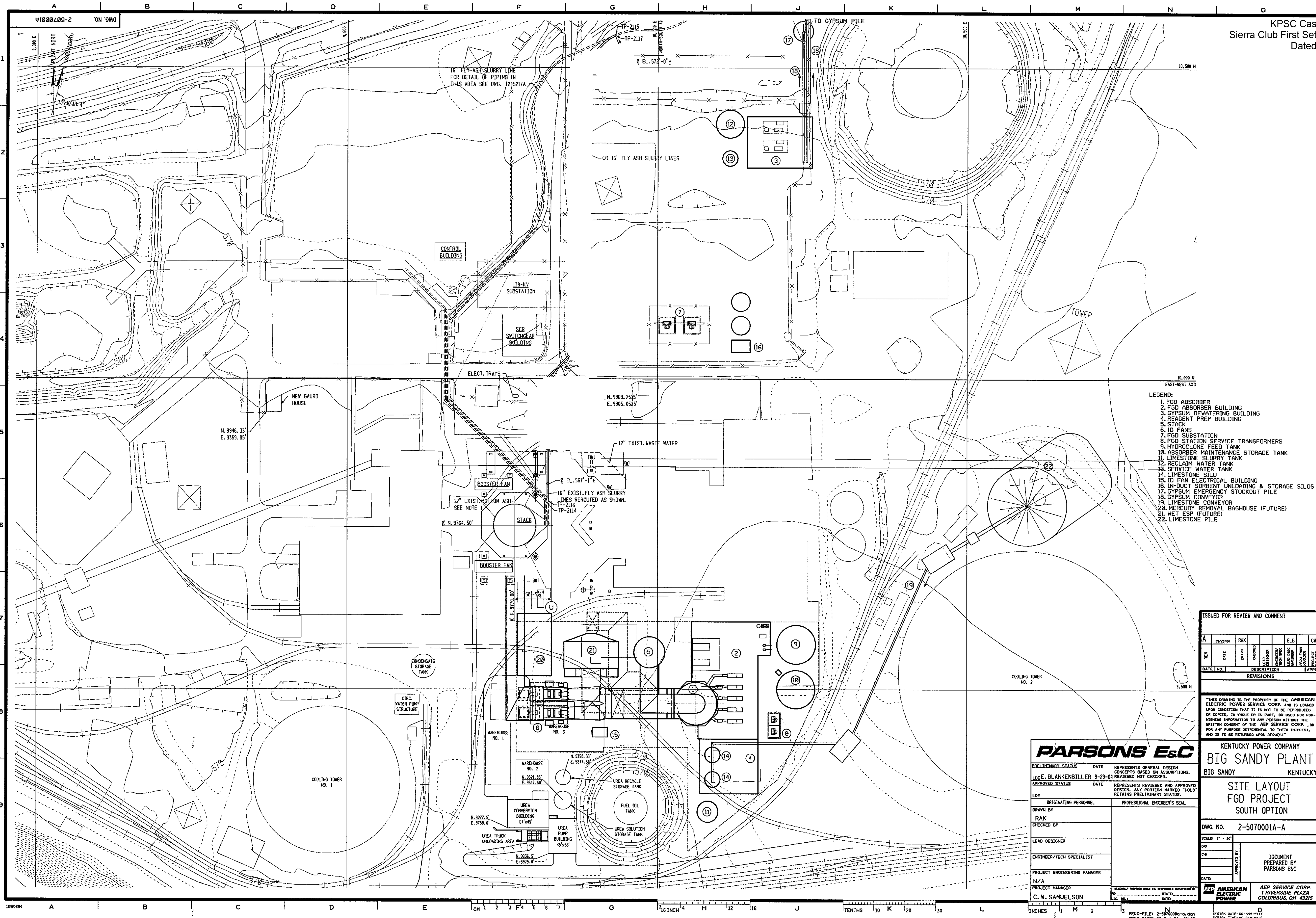
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER N/A
PROJECT MANAGER C. W. SAMUELSON
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
NORTH OPTION - 1/8
DWG. NO. 2-5070000E-A
SCALE: 1"=50'
DOCUMENT PREPARED BY PARSONS E&C
AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215


DWG. NO. 2-5070001A
TO GYPSUM PILE
TP-2115
TP-2117
℄ EL. 572'-0"
16" FLY ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
(2) 16" FLY ASH SLURRY LINES
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
ELECT. TRAYS
NEW GAURD HOUSE
N. 9946.33'
E. 9369.85'
N. 9969.2515
E. 9905.0525
12" EXIST. WASTE WATER
BOOSTER FAN
℄ EL. 567'-1"
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
12" EXIST. BOTTOM ASH SEE NOTE 1
TP-2116
TP-2114
STACK
℄ N. 9764.50'
BOOSTER FAN
TOWER
10,500 N
10,000 N
EAST-WEST AXIS
9,500 N
LEGEND:
1. FGD ABSORBER
2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
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19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. LIMESTONE PILE
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
WAREHOUSE NO. 1
WAREHOUSE NO. 3
WAREHOUSE NO. 2
COOLING TOWER NO. 1
COOLING TOWER NO. 2
N. 9358.33'
E. 9849.56'
N. 9321.83'
E. 9847.50'
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
UREA CONVERSION BUILDING 63'x45'
N. 9272.5'
E. 9758.0'
UREA TRUCK UNLOADING AREA
UREA PUMP BUILDING 45'x56'
N. 9236.6'
E. 9825.0'
ISSUED FOR REVIEW AND COMMENT
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PROFESSIONAL ENGINEER'S SEAL
DRAWN BY RAK
CHECKED BY
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER N/A
PROJECT MANAGER C. W. SAMUELSON
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
SOUTH OPTION
DWG. NO. 2-5070001A-A
SCALE: 1" = 50'
DOCUMENT PREPARED BY PARSONS E&C
APPROVED BY
AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215
PE&C-FILE: 2-5070000a-a.dgn
PE&C-DATE: 13-Oct-04 15:45
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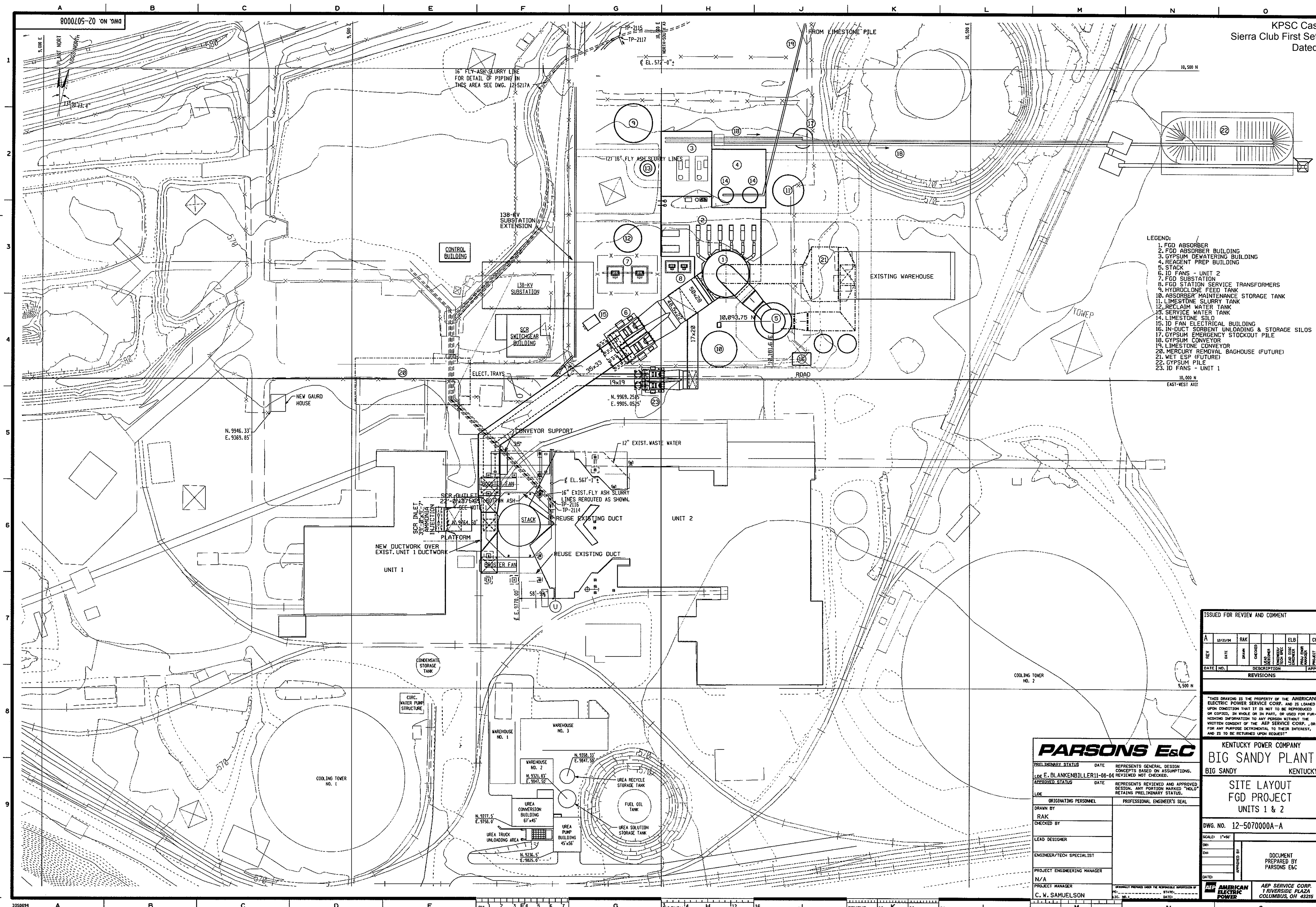
SYSTEM TIME-HOUR:MINUTE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LEGEND:
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2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS - UNIT 2
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
15. ID FAN ELECTRICAL BUILDING
16. IN-DUCT SORBENT UNLOADING & STORAGE SILOS
17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
23. ID FANS - UNIT 1
16" FLY ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
FROM LIMESTONE PILE
(2) 16" FLY ASH SLURRY LINES
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
EXISTING WAREHOUSE
ELECT. TRAYS
ROAD
NEW GAURD HOUSE
CONVEYOR SUPPORT
12" EXIST. WASTE WATER
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
REUSE EXISTING DUCT
STACK
BOOSTER FAN
PLATFORM
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
UNIT 1
UNIT 2
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
UREA CONVERSION BUILDING 61'x45'
UREA PUMP BUILDING 45'x56'
UREA TRUCK UNLOADING AREA
ISSUED FOR REVIEW AND COMMENT
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KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
UNITS 1 & 2
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ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER N/A
PROJECT MANAGER C. W. SAMUELSON
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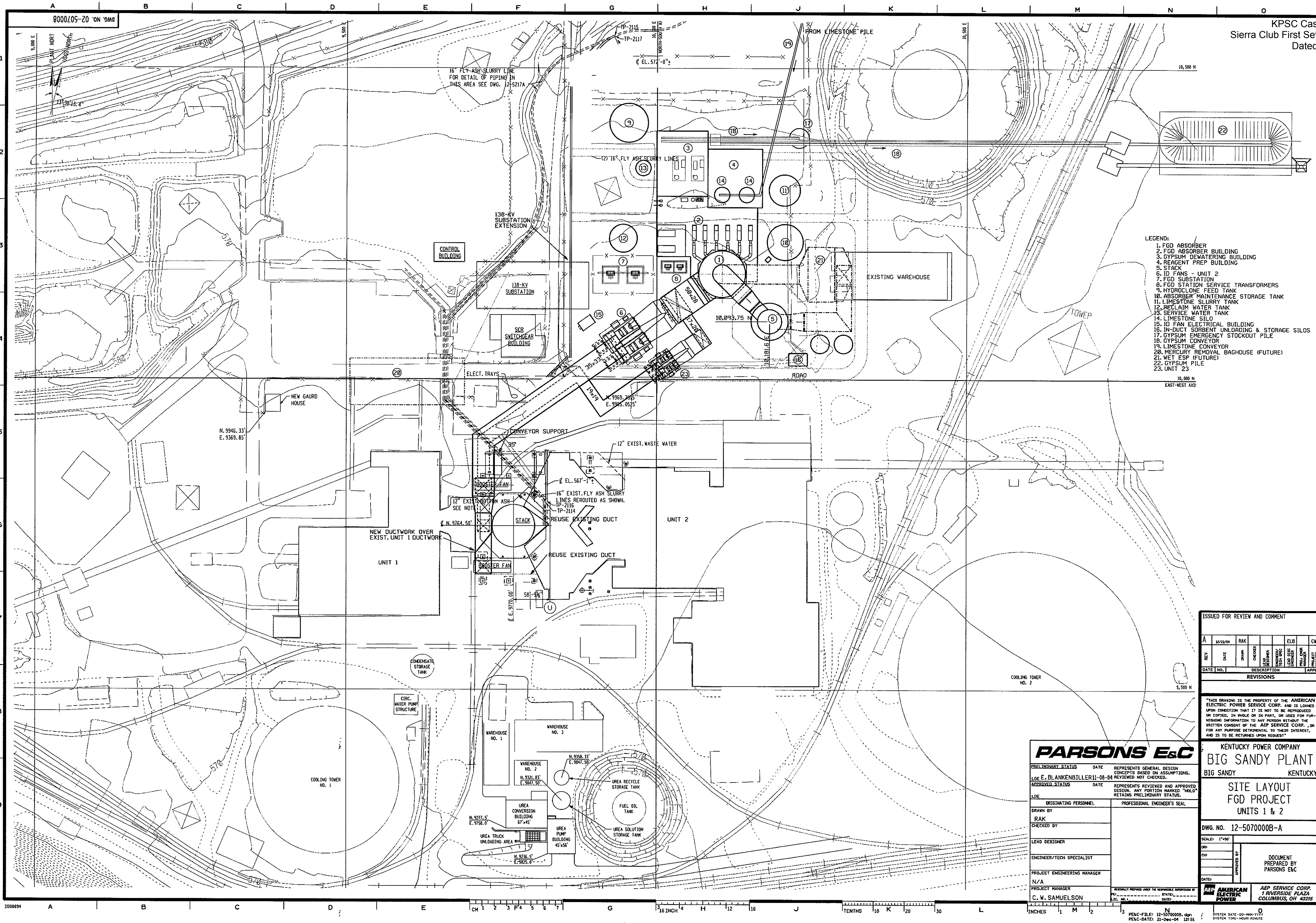
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2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS - UNIT 2
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
14. LIMESTONE SILO
15. ID FAN ELECTRICAL BUILDING
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17. GYPSUM EMERGENCY STOCKOUT PILE
18. GYPSUM CONVEYOR
19. LIMESTONE CONVEYOR
20. MERCURY REMOVAL BAGHOUSE (FUTURE)
21. WET ESP (FUTURE)
22. GYPSUM PILE
23. UNIT 23
DWG. NO. 02-5070008
FROM LIMESTONE PILE
16" FLY ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
(2) 16" FLY ASH SLURRY LINES
138-KV SUBSTATION EXTENSION
CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
EXISTING WAREHOUSE
ELECT. TRAYS
ROAD
NEW GAURD HOUSE
CONVEYOR SUPPORT
12" EXIST. WASTE WATER
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
BOOSTER FAN
STACK
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
UNIT 1
UNIT 2
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
UREA CONVERSION BUILDING 67'x45'
UREA PUMP BUILDING 45'x56'
UREA TRUCK UNLOADING AREA
UREA RECYCLE STORAGE TANK
UREA SOLUTION STORAGE TANK
FUEL OIL TANK
TOWER
ISSUED FOR REVIEW AND COMMENT
A 12/21/04 RAK ELB CWS
REV DATE DRAWN CHECKED LEAD DESIGNER ENGINEER/TECH SPEC LEAD DISC ENGINEER PROJ ENGR MANAGER PROJECT MANAGER
DATE NO. DESCRIPTION APPD.
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PROJECT MANAGER C. W. SAMUELSON
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
UNITS 1 & 2
DWG. NO. 12-5070000B-A
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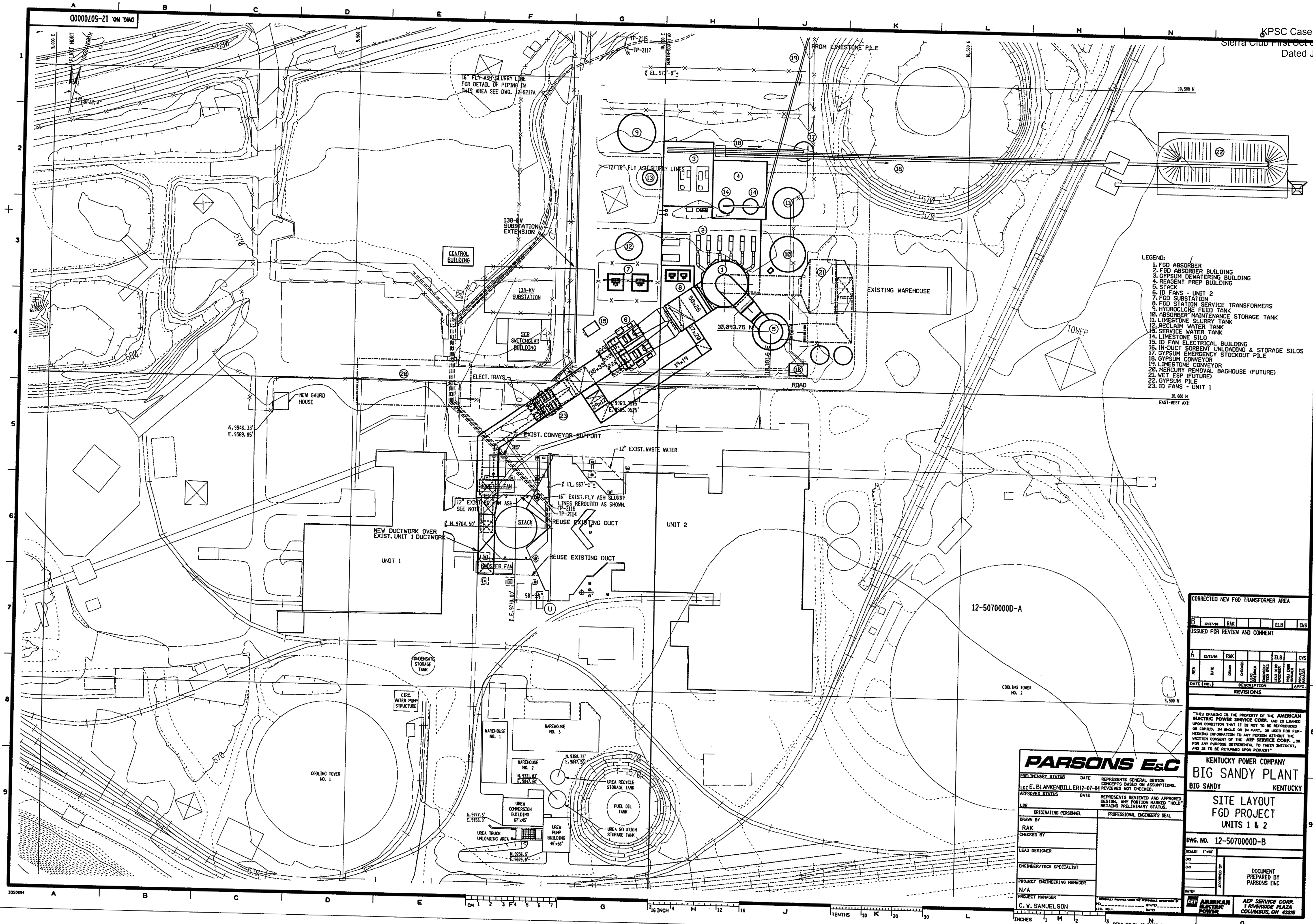
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LEGEND:
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2. FGD ABSORBER BUILDING
3. GYPSUM DEWATERING BUILDING
4. REAGENT PREP BUILDING
5. STACK
6. ID FANS - UNIT 2
7. FGD SUBSTATION
8. FGD STATION SERVICE TRANSFORMERS
9. HYDROCLONE FEED TANK
10. ABSORBER MAINTENANCE STORAGE TANK
11. LIMESTONE SLURRY TANK
12. RECLAIM WATER TANK
13. SERVICE WATER TANK
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21. WET ESP (FUTURE)
22. GYPSUM PILE
23. ID FANS - UNIT 1
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16" FLY ASH SLURRY LINE FOR DETAIL OF PIPING IN THIS AREA SEE DWG. 12-5217A
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CONTROL BUILDING
138-KV SUBSTATION
SCR SWITCHGEAR BUILDING
EXISTING WAREHOUSE
TOWER
ROAD
ELECT. TRAYS
NEW GAURD HOUSE
EXIST. CONVEYOR SUPPORT
12" EXIST. WASTE WATER
16" EXIST. FLY ASH SLURRY LINES REROUTED AS SHOWN.
STACK
REUSE EXISTING DUCT
NEW DUCTWORK OVER EXIST. UNIT 1 DUCTWORK
BOOSTER FAN
UNIT 1
UNIT 2
12-5070000D-A
CONDENSATE STORAGE TANK
CIRC. WATER PUMP STRUCTURE
COOLING TOWER NO. 1
COOLING TOWER NO. 2
WAREHOUSE NO. 1
WAREHOUSE NO. 2
WAREHOUSE NO. 3
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UREA PUMP BUILDING 45'x56'
UREA TRUCK UNLOADING AREA
UREA RECYCLE STORAGE TANK
FUEL OIL TANK
UREA SOLUTION STORAGE TANK
CORRECTED NEW FGD TRANSFORMER AREA
B 12/27/04 RAK ELB CVS
ISSUED FOR REVIEW AND COMMENT
A 12/21/04 RAK ELB CVS
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PROJECT MANAGER C.W. SAMUELSON
KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY
SITE LAYOUT
FGD PROJECT
UNITS 1 & 2
DWG. NO. 12-5070000D-B
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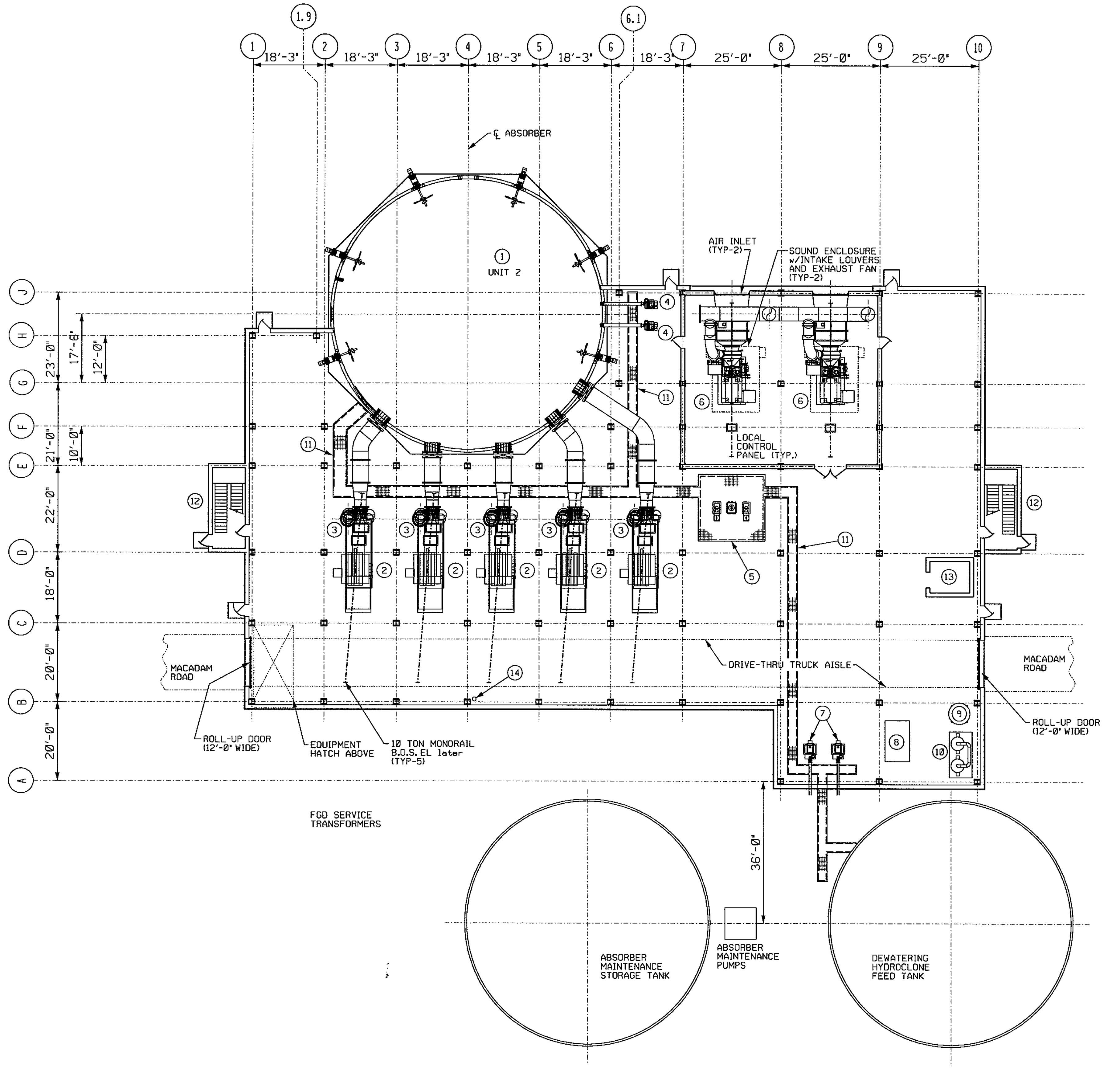
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

DWG. NO. 2-5070002A

LEGEND:

1 ABSORBER
2 ABSORBER RECYCLE PUMP
3 ABSORBER RECYCLE PUMP DISCHARGE RISER
4 ABSORBER BLEED PUMP
5 ABSORBER AREA SUMP
6 OXIDATION AIR COMPRESSOR
7 HYDROCLONE FEED PUMP
8 AIR COMPRESSOR
9 AIR RECEIVER
10 INSTRUMENT AIR DRYER
11 FLOOR TRENCH
12 STAIRTOWER
13 ELEVATOR
14 EMERGENCY EYE & FACE WASH



PLAN - GROUND FLOOR

10 0 10 30
SCALE IN FEET

ISSUED FOR REVIEW AND COMMENT

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	5/28/04	RAK				ELB		CWS

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ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY RAK	
CHECKED BY	
LEAD DESIGNER	
ENGINEER/TECH SPECIALIST	
PROJECT ENGINEERING MANAGER N/A	
PROJECT MANAGER C. W. SAMUELSON	ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: STATE: LIC. NO.: DATE:

KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY

GENERAL ARRANGEMENT FGD BUILDING GROUND FLOOR

DWG. NO. 2-5070002A-A

SCALE: 3/32"=1'-0"
DR:
CH:
DATE:
APPROVED BY

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AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

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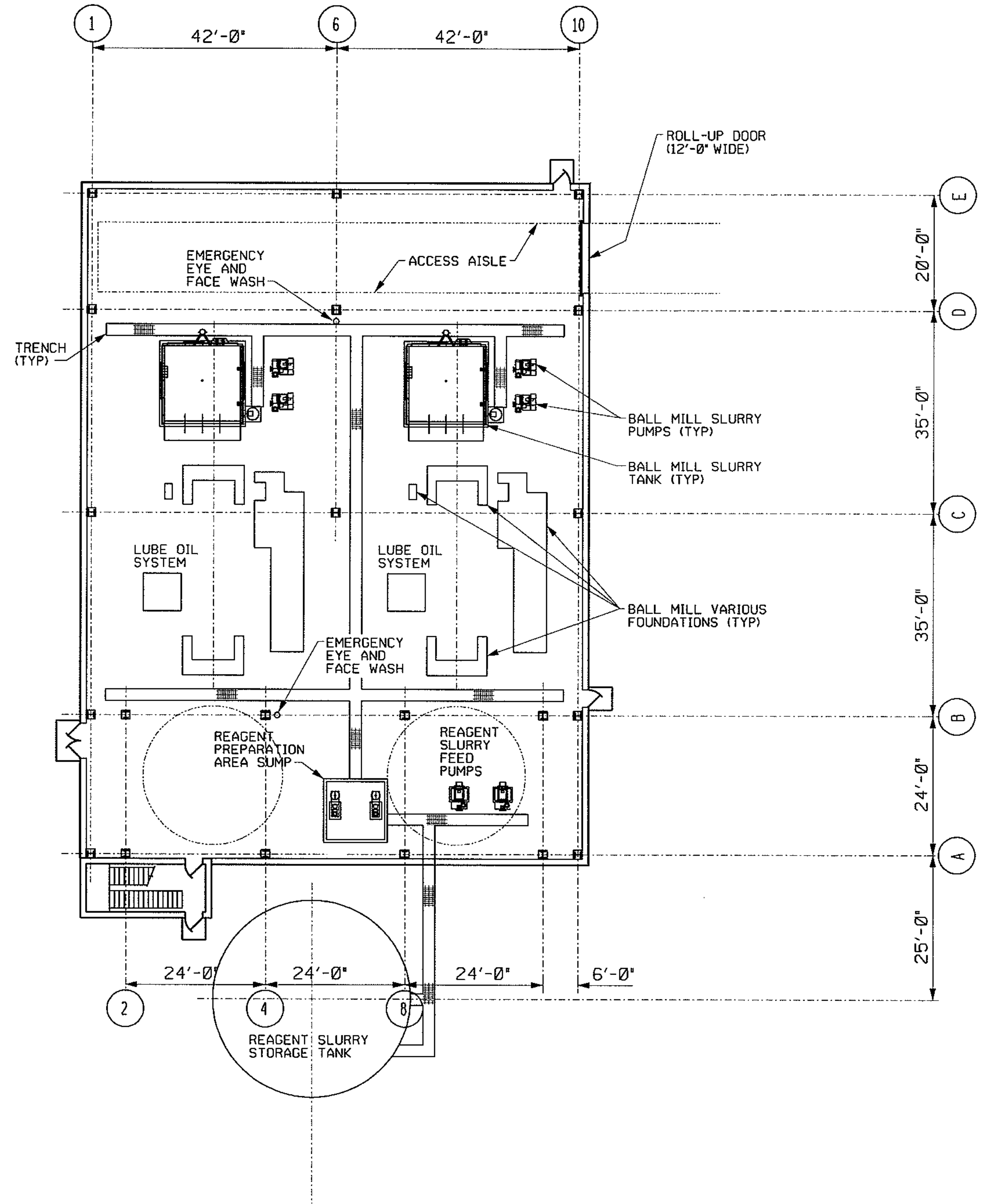
SYSTEM DATE-DD-MMM-YYYY
SYSTEM TIME-HOUR:MINUTE



PLAN - GROUND FLOOR
REAGENT PREPARATION AREA

10 0 10 30
SCALE IN FEET

ISSUED FOR REVIEW AND COMMENT

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	09/28/04	RAK				ELB		CWS

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CHECKED BY
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER: N/A
PROJECT MANAGER: C. W. SAMUELSON

KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY — KENTUCKY

GENERAL ARRANGEMENT
REAGENT PREP AREA
GROUND FLOOR

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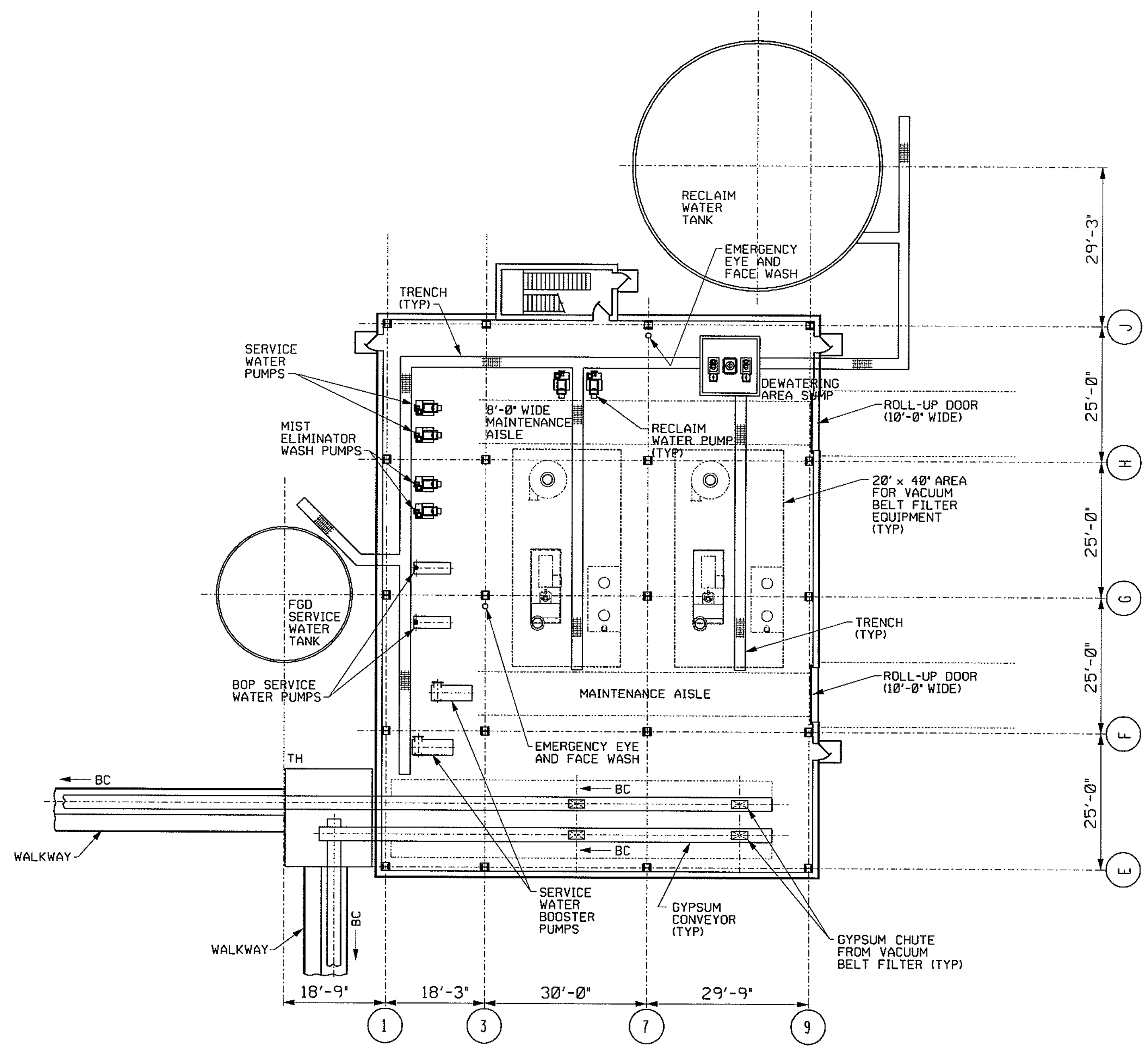

PLAN - GROUND FLOOR
DEWATERING AREA

10 0 10 30
SCALE IN FEET

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REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	09/28/04	RAK				ELB		CWS

DATE | NO. | DESCRIPTION | APPD.

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ORIGINATING PERSONNEL | PROFESSIONAL ENGINEER'S SEAL

DRAWN BY: RAK
CHECKED BY
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER: N/A
PROJECT MANAGER: C. W. SAMUELSON

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: ____ STATE: ____ LIC. NO.: ____ DATE: ____

KENTUCKY POWER COMPANY
BIG SANDY PLANT
BIG SANDY KENTUCKY

GENERAL ARRANGEMENT
DEWATERING AREA
GROUND FLOOR

DWG. NO. 2-5070004A-A

SCALE: 3/32"=1'-0"
DR:
CH:
APPROVED BY
DATE:

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AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

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SYSTEM TIME-HOUR:MINUTE

Appendix C

Process Equipment List

Big Sandy Unit 2

Big Sandy Unit 2 Process Equipment List

Description		
Unit Rating	MW	800
Annual Capacity Factor		90
Chimneys		
No of Shells		1
Type		Reinforced Concrete
No of Flues per Unit		1
Design Velocity	ft/sec	49
Flue Diameter	ft	34
Height	ft	750 - 1,000
Shell Base Diameter	ft	~ 90
ID Fans		
Type		Axial
No Per Unit		2
Capacity per fan (TB)	acfm	1,879,000
Fan Static (TB)	In WG	43.6
Fan Motor Size	HP	20,000
Motor Type		
FGD Absorber		
Type		TBD
Quantity		1
Design SO2 Removal	%	98
L:G ratio	gal/1,000 ft^3	115
Diameter - Spray	Ft	65
Diameter - Rxn Tank	Ft	65
Height – Rxn Tank	Ft	50
Height – Overall	Ft	155
FGD Recycle Pumps		
Quantity		6 (5 op, 1 sp)
Capacity per Pump	gpm	65,000
Active Spray Levels		5
Pumps Per Level		1
Pump motor size	hp	2,100/2,350/2,510/2,660/2,820/3,100

FGD Bleed Pumps		
Quantity		2 (1 op, 1sp)
Capacity per Pump	gpm	2,130
Pump motor size	hp	60
Absorber Agitators		
Quantity		8
Size	hp	75
Oxidation Air Blowers		
Quantity		2 (1 op, 1 sp)
Capacity per Blower	Acfm	19,600
Blower motor size	hp	2,100
Absorber Maintenance Tank		
Quantity		1
Capacity	gal	1,400,000
Diameter x height	ft	56 x 73
Tank Mixer	hp	40
Absorber Maintenance Tank Return Pumps		
Quantity		2 (1 op, 1 sp)
Capacity per Pump	gpm	3,000
Pump motor size	hp	110
Sump Pit		
Quantity		1
Capacity	ft x ft x ft	10 x 10 x 10
Sump Pump		
Quantity		2 (1 op, 1 sp)
Capacity	gpm	500
Pump motor size	hp	75
Sump Agitator		
Quantity		1
Motor size	hp	20
Service Air Compressors		
Quantity		2 (1 op, 1 sp)
Capacity	scfm	300
Motor size	hp	100
Instrument Air Dryer		
Quantity		2 (1 op, 1 sp)
Capacity	scfm	300
Service Air Receiver		1
Instrument Air Receiver		1

Limestone Handling		
Stacking Conveyor		
Quantity		1
Capacity	Ton/hr	300
Motor size	hp	100
Reclaim Hopper / Hopper Activator		
Quantity		1
Capacity	Ton/hr	300
Motor size	hp	20
Reclaim Belt Feeder		
Quantity		1
Capacity	Ton/hr	300
Motor size	hp	20
Reclaim Belt Conveyor		
Quantity		1
Capacity	Ton/hr	300
Motor size	hp	120
Conveyor to Day Bin		
Quantity		1
Capacity	Ton/hr	300
Motor size	hp	20

Limestone Preparation		
Limestone Ball Mills		
Quantity		2 (1 op, 1 sp)
Capacity per Mill	Tons/hr	40
Mill motor size	hp	2,000
Limestone Day Silos		
Quantity		2
Capacity per silo	hours	8
Height Top Cone	ft	6
Height Bottom Cone	ft	11
Total Height	ft	42
Diameter	ft	14
Day Silo Bin Vent Filter		
Quantity		2 (1 op, 1sp)
Filter Fan Size	hp	5
Day Silo Bin Activator		
Quantity		2 (1 op, 1sp)
Diameter	ft	12
Motor size	hp	6
LS Weigh Belt Feeder		
Quantity		2 (1 op, 1sp)
Capacity per mill	Tons/hr	40
Motor size	hp	10
Mill Slurry Tanks		
Quantity		2 (1 op, 1sp)
Capacity / Tank	minutes	5
Diameter x height	ft	9 x 12
Tank Mixer	hp	8
Mill Slurry Pumps		
Quantity		2 (1 op, 1sp)
Capacity per Pump	gpm	900
Pump motor size	hp	100
Limestone Slurry Classifier		
Quantity		2 (1 op, 1sp)
Capacity	gpm	900
LS Slurry Storage Tanks		
Quantity		1
Capacity / Tank	hours	4
Diameter x height	ft	25 x 32
Tank Mixer	hp	40

Limestone Preparation (continued)		
LS Slurry Feed Pumps		
Quantity		2 (1 op, 1sp)
Capacity per Pump	gpm	790
Pump motor size	hp	50
Sump Pit		
Quantity		1
Capacity	ft x ft x ft	10 x 10 x 10
Sump Pump		
Quantity		2 (1 op, 1 sp)
Capacity	gpm	150
Pump motor size	Hp	50
Sump Agitator		
Quantity		1
Motor size	Hp	20

Gypsum Dewatering		
Hydrocyclone Feed Pumps		
Quantity		2 (1 op, 1 sp)
Capacity per Pump		1,200
Pump motor size		120
Hydrocyclones		
Quantity		2 (1 op, 1 sp)
Capacity per HC	gpm	1,200
Hydrocyclone Overflow Head Tank		
Quantity		1
Diameter x height	ft	9 x 10
Tank Mixer Size	hp	5
Purge Pumps		
Quantity		2 (1 op, 1 sp)
Capacity per Pump	gpm	250
Pump motor size	hp	30
Filtrate Tanks		
Quantity		1
Capacity per Tank	hours	8
Diameter x height	ft	43 x 56
Tank Mixer Size	hp	30
Filtrate Return Pumps		
Quantity		2 (1 op, 1sp)
Capacity per Pump	gpm	2,000
Pump motor size	hp	150
Gypsum Belt Filters		
Quantity		2 (1 op, 1sp)
Capacity per Filter	Tons/hr	55
Belt Drive motor size	hp	10
Vacuum Pumps		
Quantity		2 (1 op, 1sp)
Pump Motor size	hp	600

Gypsum Handling		
Gypsum Collecting Conveyor		
Quantity		1
Capacity	Ton/hr	55
Motor size	hp	30
Gypsum Conveyor		
Quantity		1
Capacity	Ton/hr	150
Motor size	hp	60
Gypsum Transfer Conveyor		
Quantity		1
Capacity	Ton/hr	150
Motor size	hp	35
Sump Pit		
Quantity		1
Capacity	ft x ft x ft	10 x 10 x 10
Sump Pump		
Quantity		2 (1 op, 1 sp)
Capacity	gpm	150
Pump motor size	hp	50
Sump Agitator		
Quantity		1
Motor size	hp	20

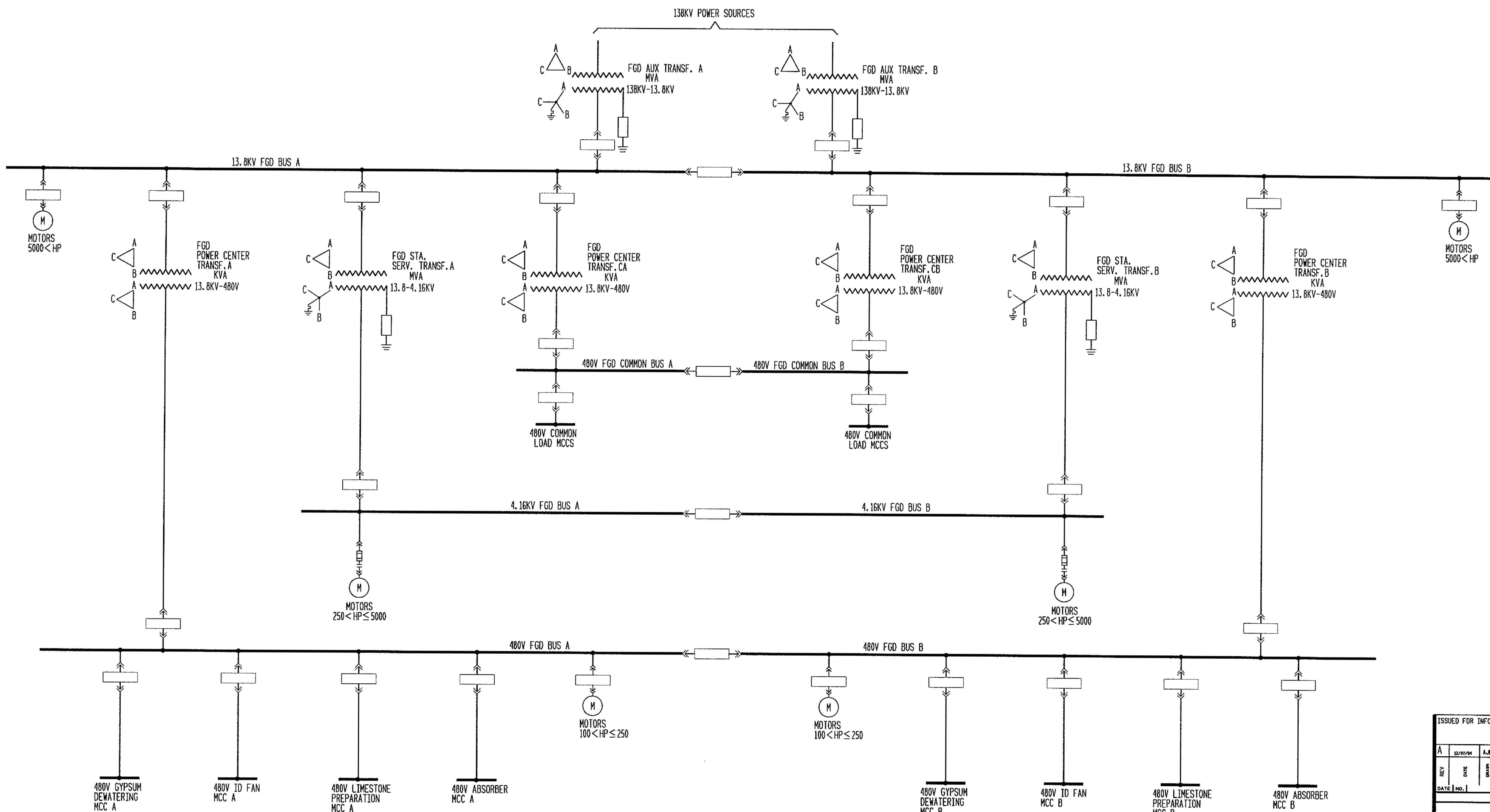
Makeup Water		
Makeup Water Tank		
Quantity		1
Capacity per Tank	hours	1
Diameter x height	ft	25 x 32
FGD Service Water Pumps		
Quantity		2 (1 op, 1 sp)
Capacity per Pump	gpm	500
Pump motor size	hp	70
BOP Service Water Pumps		
Quantity		2 (1 op, 1 sp)
Capacity per Pump	gpm	1,500
Pump motor size	hp	150

Appendix D

Conceptual Electrical One Line Diagram and Conceptual Electrical Load List

Big Sandy Unit 2

NOTES:



ISSUED FOR INFORMATION

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	12/07/04	AJM				MAG		CWS

DATE | NO. | DESCRIPTION | APPD.

REVISIONS

PARSONS E&C

PRELIMINARY STATUS — DATE — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE MA GERHARD 12/07/04

APPROVED STATUS — DATE — REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE

ORIGINATING PERSONNEL | PROFESSIONAL ENGINEER'S SEAL

DRAWN BY AJM
CHECKED BY
LEAD DESIGNER
ENGINEER/TECH SPECIALIST
PROJECT ENGINEERING MANAGER
PROJECT MANAGER CW SAMUELSON

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: STATE: LIC. NO.: DATE:

KENTUCKY POWER COMPANY

BIG SANDY PLANT

BIG SANDY KENTUCKY

ELECTRICAL

UNIT 2 FGD

CONCEPTUAL ONE LINE DIAGRAM

DWG. NO. AEBS-2-SK-EZ-206-001-A

SCALE: | ELECTRICAL & CONTROLS ENGINEERING DIV.
DR:
CH:
SUPV:
ENGR:
DATE:
APPROVED BY

DOCUMENT PREPARED BY PARSONS E&C

AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PE&C-FILE: aebs-2-sk-ez-206-001.dgn SYSTEM DATE-DD-MMM-YYYY
PE&C-DATE: 07-Dec-04 10:58 SYSTEM TIME-HOUR:MINUTE

BIG SANDY UNIT 2 FGD
CONCEPTUAL ELECTRICAL LOAD LIST
CONNECTED LOADS

BUS	LOAD	HP	KVA	KW	AMPS	COMMENTS
13.8KV FGD BUS A	ID FAN A	20,000				
4.16KV FGD BUS A	RECYCLE PP A	2,600				
	RECYCLE PP B	2,600				
	RECYCLE PP C	2,600				
	OXIDATION AIR BLOWER A	2,100				
	BALL MILL A	2,000				
	DEWATERING VACUUM PP A	600				
480V FGD BUS A	ABSORBER MAINT TANK RETURN PP A	110				
	GYP DEWATERING FILTRATE RETURN PP A	150				
	RAW WATER PP A	150				Assumed possible load
	BOP SERVICE WATER PP A	150				
	HYDROCYCLONE FEED PP A	120				
480V FGD COMMON BUS A						No directly connected end loads
480V COMMON LOAD MCC 1	FGD BLDG EXHAUST FANS					Mitchell = 10@10HP (14FLA ea); demand factor: 0.5. 70A total
					47	Big Sandy - use 2/3 of Mitchell value due to smaller FGD Building size. 47A total
	FGD BLDG ELEVATOR RM EXHAUST FAN	0.5				Value based on Mitchell
	DCS/BATT ROOM A/C UNIT FEED #1			75		Based on Mitchell. Assume this unit running; Common Load MCC 2 unit idle.
	FGD BLDG UNIT HEATERS					Mitchell PP1/PP2 = 14@10kW plus 26@15kW; demand factor: 0.5. 265kW total
				177		Big Sandy - use 2/3 of Mitchell value due to smaller FGD Building size. 177kW total
	SUBSTA XFMR PP FEED #1		125			Alternate to Common Load MCC 2 Feed #2
	SUBSTA UTILITIES FEED		150			Value based on Mitchell assumption
	CHIMNEY AOL		8			Value based on Mitchell
	CEMS FEED #1				100	Alternate to Common Load MCC 2 Feed #2
	CHIMNEY ELEVATOR		50			Value based on Mitchell
	FGD POTABLE WATER BOOSTER PP 1	5				Assumed load and value; based on Mitchell
	FGD BLDG INSTANT HOT WATER HTR			130		Assumed Battery Room eyewash/shower; based on Mitchell
	120/208V DISTRIBUTION PANEL XFMR		45			
480V COMMON LOAD MCC 3	LIMESTONE PREP BLDG UNIT HEATERS			140		Mitchell = 5@40kW; demand factor: 0.7. 140kW total. Big Sandy - use same as Mitchell
	LIMESTONE PREP BLDG ROOF EXH FANS				42	Mitchell = 6@10HP(14FLA ea); demand factor: 0.5. 42A total. Big Sandy - use same as Mitchell
	120/208V DISTRIBUTION PANEL XFMR		45			
480V ABSORBER MCC A	FGD BLEED PP A	60				
	ABSORBER REACTION TK AGITATOR A	75				
	ABSORBER REACTION TK AGITATOR B	75				
	ABSORBER REACTION TK AGITATOR C	75				
	ABSORBER REACTION TK AGITATOR D	75				
	ABSORBER AREA SUMP PP A	75				
	ABSORBER AREA SUMP AGITATOR	20				

BIG SANDY UNIT 2 FGD
CONCEPTUAL ELECTRICAL LOAD LIST
CONNECTED LOADS

	SERVICE AIR COMPRESSOR A	100				
	FGD SERVICE WATER PP A	70				
	INSTRUMENT AIR DRYER SKID (HEATER)			50		
	BATTERY CHARGER 1		40			
	UPS MAIN FEED		30			
	120/208V DISTRIBUTION PANEL XFMR		45			
480V LIMESTONE PREP MCC A	DAY BIN A VENT FILTER	5				
	DAY BIN A ACTIVATOR	6				
	ACTIVATOR A OUTPUT BELT FEEDER	10				Assumed name and HP rating
	LIMESTONE WEIGH BELT FEEDER A	10				
	MILL SLURRY TANK A MIXER	8				
	MILL SLURRY PUMP A	100				
	LIMESTONE SLURRY STORAGE TANK MIXER	40				
	LIMESTONE SLURRY FEED PP A	50				
	LIMESTONE PREP SUMP PUMP A	50				
	LIMESTONE PREP SUMP AGITATOR	20				
	120/208V DISTRIBUTION PANEL XFMR		45			
480V GYPSUM DEWATER MCC A	HYDROCYCLONE FEED TANK AGITATOR	10				
	HYDROCYC OVERFLOW HEAD TANK MIXER	5				
	HEAD TANK PURGE PP A	30				
	VACUUM BELT FILTER A	10				
	GYPSUM DEWATERING SUMP PP A	50				
	CAKE WASH PP A	3				
	VACUUM RECEIVER PP A	?				
	120/208V DISTRIBUTION PANEL XFMR		45			
480V ID FAN MCC A	ID FAN A AUXILIARIES				200	Assumption, based on Mitchell assumption
	ID FAN A INLET ISOL DAMPER	75				
	ID FAN A OUTLET ISOL DAMPER	60				
	ID FAN A INLT ISO DMPR SEAL AIR FAN	100				
	120/208V DISTRIBUTION PANEL XFMR		45			
13.8KV FGD BUS B	ID FAN B	20,000				
4.16KV FGD BUS B	RECYCLE PP D	2,600				
	RECYCLE PP E	2,600				
	RECYCLE PP F	2,600				
	OXIDATION AIR BLOWER B	2,100				
	BALL MILL B	2,000				
	DEWATERING VACUUM PP B	600				

BIG SANDY UNIT 2 FGD
CONCEPTUAL ELECTRICAL LOAD LIST
CONNECTED LOADS

480V FGD BUS B	ABSORBER MAINT TANK RETURN PP B	110				
	GYP DEWATERING FILTRATE RETURN PP B	150				
	RAW WATER PP B	150				
	BOP SERVICE WATER PP B	150				
	HYDROCYCLONE FEED PP B	120				
480V FGD COMMON BUS B						No directly connected end loads
480V COMMON LOAD MCC 2	OX AIR COMP & ELEC EQ RM FANS					Mitchell = 7@15HP (21FLA ea); demand factor: 0.5. 74A total
					49	Big Sandy - use 2/3 of Mitchell value due to smaller FGD Building size. 49A total
	DCS/BATT ROOM A/C UNIT FEED #2			75		Based on Mitchell. Assume this unit idle; Common Load MCC 1 unit running.
	FGD BLDG UNIT HTRS					Mitchell PP3/PP4 = 21@10kW plus 1@5kW; demand factor: 0.5. 108kW total
				72		Big Sandy - use 2/3 of Mitchell value due to smaller FGD Building size. 72kW total
	FGD BLDG LOUVERS					Mitchell = 39@50W = 1.95kW intermittent; demand factor: 0.2 <1kW; ignore
	FGD BLDG ELEVATOR	20				Assumed load and value; based on Mitchell
	SUBSTA XFMR PP FEED #2		125			Alternate to Common Load MCC 1 Feed #1
	CHIMNEY GENERAL SERVICE PWR FEED		237			Value based on Mitchell
	CEMS FEED #2				100	Alternate to Common Load MCC 1 Feed #1
	FGD POTABLE WATER BOOSTER PP 2	5				
	120/208V DISTRIBUTION PANEL XFMR		45			
480V COMMON LOAD MCC 4	GYPSUM DEWATER BLDG UNIT HEATERS					Mitchell = 7@40kW; demand factor: 0.7. 196kW total.
				147		Big Sandy - use 3/4 of Mitchell value due to smaller GD Building size. 147kW total
	GYPSUM DEWATER BLDG ROOF EXH FANS					Mitchell = 4@10HP(14FLA ea); demand factor: 0.5. 28A total.
					21	Big Sandy - use 3/4 of Mitchell value due to smaller GD Building size. 21A total
	120/208V DISTRIBUTION PANEL XFMR		45			
480V ABSORBER MCC B	FGD BLEED PP B	60				
	ABSORBER REACTION TK AGITATOR E	75				
	ABSORBER REACTION TK AGITATOR F	75				
	ABSORBER REACTION TK AGITATOR G	75				
	ABSORBER REACTION TK AGITATOR H	75				
	ABSORBER MAINT TANK MIXER	40				
	ABSORBER AREA SUMP PP B	75				
	SERVICE AIR COMPRESSOR B	100				
	FGD SERVICE WATER PP B	70				
	INSTRUMENT AIR DRYER SKID (HEATER)			50		
	BATTERY CHARGER 2		40			
	UPS ALTERNATE FEED		30			
	120/208V DISTRIBUTION PANEL XFMR		45			
480V LIMESTONE PREP MCC B	DAY BIN B VENT FILTER	5				
	DAY BIN B ACTIVATOR	6				
	ACTIVATOR B OUTPUT BELT FEEDER	10				Assumed name and HP rating

BIG SANDY UNIT 2 FGD
CONCEPTUAL ELECTRICAL LOAD LIST
CONNECTED LOADS

	LIMESTONE WEIGH BELT FEEDER B	10				
	MILL SLURRY TANK B MIXER	8				
	MILL SLURRY PUMP B	100				
	LIMESTONE SLURRY FEED PP B	50				
	LIMESTONE PREP SUMP PUMP B	50				
	120/208V DISTRIBUTION PANEL XFMR		45			
480V GYPSUM DEWATER MCC B	HEAD TANK PURGE PP B	30				
	FILTRATE TANK MIXER	30				
	VACUUM BELT FILTER B	10				
	GYPSUM DEWATERING SUMP PP B	50				
	GYPSUM DEWATERING SUMP AGITATOR	20				
	CAKE WASH PP B	3				
	VACUUM RECEIVER PP B	?				
	120/208V DISTRIBUTION PANEL XFMR		45			
480V ID FAN MCC B	ID FAN B AUXILIARIES				200	Assumption, based on Mitchell assumption
	ID FAN B INLET ISOL DAMPER	75				
	ID FAN B OUTLET ISOL DAMPER	60				
	ID FAN B INLT ISOL DMPR SEAL AIR FAN	100				
	120/208V DISTRIBUTION PANEL XFMR		45			
LIMESTONE HANDLING (480V)	STACKING CONVEYOR	100				
	STACKER TELESCOPIC SPOUT	10				Possible load, HP based on Mitchell
	RECLAIM HOPPER/HOPPER ACTIVATOR	20				
	RECLAIM BELT FEEDER	20				
	RECLAIM BELT CONVEYOR	120				
	MAGNETIC SEPARATOR RECTIFIER			5		Possible load, KW based on Mitchell
	MAGNETIC SEPARATOR BELT DRIVE	3				Possible load, HP based on Mitchell
	DIVERTER GATE	2				Possible load, HP based on Mitchell
	CONVEYOR TO DAY BINS	20				
	CONVEYOR TO SILO	40				Possible load, HP based on Mitchell
	120/208V DISTRIBUTION PANEL XFMR		45			
GYPSUM HANDLING (480V)	GYPSUM COLLECTING CONVEYOR	30				
	GYPSUM CONVEYOR	60				
	GYPSUM TRANSFER CONVEYOR	35				
	120/208V DISTRIBUTION PANEL XFMR		45			