APPENDIX F

Entergy Independence Four-Factor Documentation

Division of Environmental Quality

Office of Air Quality

Contents

APPENDIX F-1

Entergy Independence Information Collection Request

Division of Environmental Quality

Office of Air Quality

January 8, 2020

Stan Chivers
Environmental Analyst
Arkansas Environmental Support
Entergy Services, LLC

Sent via Electronic Mail

RE: Regional Haze Four-Factor Analysis; Information Collection Request; AFIN 32-00042

Dear Mr. Chivers:

The Arkansas Department of Energy and Environment, Division of Environmental Quality (DEQ) hereby requests that Entergy submit the information described in Section II no later than 90 days from the date of this letter.

I. BACKGROUND

DEQ must develop a Regional Haze Program state implementation plan (SIP) that demonstrates reasonable progress toward achieving natural visibility conditions in Arkansas Class I areas during the period between 2018 and 2028, which is referred to as Planning Period II. The SIP must also address emissions from within the state that may impair visibility in Class I areas in other states. The Regional Haze Program uses an iterative planning process led by the states with the ultimate goal of remedying existing and preventing future visibility impairment from anthropogenic sources of air pollution by 2064.

For the Planning Period II SIP, DEQ must develop a long-term strategy for reducing emissions of key pollutants and sources impacting visibility at Class I areas to make "reasonable" progress toward the goal of no anthropogenic visibility impairment by 2064. The Regional Haze Rule establishes four factors by which a state must consider potential control measures for the long-term strategy. The factors are the cost of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining useful life of existing sources that contribute to visibility impairment.

The key pollutants from anthropogenic sources impairing visibility at Arkansas Class I areas are ammonium sulfate and ammonium nitrate.[1] Ammonium sulfate is formed by chemical reactions between ammonia and sulfur dioxide (SO_2) in the atmosphere. Ammonium nitrate is formed by chemical reactions between ammonia and nitrogen oxides (NOx) in the atmosphere. EPA modeling projects that these two pollutants will continue to be the key pollutants contributing to visibility impairment at Arkansas Class I areas in 2028.[2]

The states in the Central States Air Resources Agencies (CENSARA) organization, which includes Arkansas, contracted with Ramboll US Corporation (Ramboll) to produce a study examining the impact of stationary sources of NOx and SO_2 on each Class I area in the central region of the United States. For each Class I area, the study took into account light extinction-weighted wind trajectory residence times, 2016 sulfur dioxide and nitrogen oxides facility emissions projections, and the distance from sources of nitrogen oxides and sulfur dioxide to Class I Areas. The study produced an area of influence (AOI) for each Class I area, which shows the geographic areas with a high probability of contributing to anthropogenic visibility impairment.

Based on the results of the AOI study, DEQ has identified both Entergy Independence and White Bluff as sources of Class I Area visibility impacting pollutant emissions that DEQ should evaluate for potential emission reduction measures during Planning Period II.

EPA guidance instructs states that "if a source is expected to close by December 31, 2028, under an enforceable requirement, a state may consider that to be sufficient reason not to select the source for a four-factor analysis. Therefore, DEQ is not requesting information on White Bluff. This information request focuses on potential emission reduction strategies for Independence.

II. <u>INFORMATION REQUESTED FOR POTENTIAL EMISSION REDUCTION STRATEGIES</u>

DEQ requests that Entergy provide information about potential emission reduction strategies for SO_2 and NOx emissions from Independence. Entergy should provide this information for each of the following units:

- Independence Unit 1 (AFIN 32-00042, SN-01)
- Independence Unit 2 (AFIN 32-00042, SN-02)

At a minimum, Entergy should include up-to-date information about the following potential strategies for each emission unit:

- SO_2 (ranked from highest control efficiency to lowest)[3]

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[1] http://vista.cira.colostate.edu/Improve/improve-data/
[2] https://www.epa.gov/visibility/visibility-guidance-documents
[3] From EPA Menu of Control Measures < https://www.epa.gov/sites/production/files/2016-02/menuofcontrolmeasures.xlsx>

- Fuel switching from subbituminous coal to natural gas (Typical SO_2 control efficiency for utility coal-fired boilers ≈ 99.9%)
  - Lime Spray Dryer System (Typical SO_2 control efficiency for utility coal-fired boilers ≈ 70 – 96%)
  - Limestone Forced Oxidation System (Typical SO_2 control efficiency for utility coal-fired boilers ≈ 52 – 98%)
  - In-Duct Dry Sorbent Injection (Typical SO_2 control efficiency for utility coal-fired boilers ≈ 90%)
- NOx (ranked from typical highest control efficiency to lowest) [4]
  - Selective Catalytic Reduction (Typical NOx control efficiency for utility coal-fired boilers ≈ 90%)
  - Selective Non-Catalytic Reduction (Typical NOx control efficiency for utility coal-fired boilers ≈ 35 – 50%)

The list above may not be comprehensive. Entergy may provide information about strategies in addition to those listed above. Entergy may include updates to information provided in previous assessments during Planning Period 1.

For each emission reduction strategy, Entergy should assess whether the strategy is technically feasible.[5] If a strategy is not technically feasible, Entergy should provide a robust explanation about why the strategy is not technically feasible.

For each technically feasible emission reduction strategy, Entergy should provide the following information for SO_2 and/or NOx:

- Control effectiveness (Percentage of NOx and/or SO_2 reduced) estimates specific to d Independence emission units in terms of actual emissions
- Emission reductions that would be achieved by implementation of the strategy:
  - Baseline actual emission rate in lb/hr or lb/MMBTU (maximum monthly value in the period between January 1, 2018 and December 31, 2019 for Unit 2 (SN-02) and between November 1, 2018 and December 31, 2019 for Unit 1 (SN-01).[6]

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[4] From EPA Menu of Control Measures < https://www.epa.gov/sites/production/files/2016-02/menuofcontrolmeasures.xlsx>

[5] From 40 CFR Appendix Y to Part 51 "Control technologies are technically feasible if either (1) they have been installed and operated successfully for the type of source under review under similar conditions, or (2) the technology could be applied to the source under review. Two key concepts are important in determining whether a technology could be applied: 'availability' and 'applicability.' As explained in more detail below, a technology is considered 'available' if the source owner may obtain it through commercial channels, or it is otherwise available within the common sense meaning of the term. An available technology is 'applicable' if it can reasonably be installed and operated on the source type under consideration. A technology that is available and applicable is technically feasible."

[6] A shorter baseline period is warranted for Independence because construction of low NOx burners with separated over fire air was completed on October 20, 2017 for Unit 1 (SN-01) and on December 22, 2017 for Unit 2 (SN-02) , which reduced NOx emissions.

  - Control rate in lb/hr or lb/MMBTU (units should match baseline actual emission rate)
  - Resulting annual emission reductions (tons/year)
- Time necessary to implement the strategy with an explanation justifying the time needed
  - A reasonable time period is one in which the source comes "into compliance in an efficient manner without unusual amounts of overtime, above-market wages and prices, or premium charges for expedited delivery of control equipment."[7]
  - The time during which the source begins taking steps to come into compliance is assumed to begin upon EPA approval of the SIP, which is projected to be no later than January 31, 2023 based on deadlines for the SIP submission and EPA action on the SIP.[8]
- Remaining useful life
  - Remaining useful life of an emission unit should be based on an enforceable shutdown date. Otherwise, the remaining useful life should be the full period of the useful life for the control technology evaluated
  - The EPA Pollution Control Cost Manual[9] provides guidance on typical values for the useful life of various emission control systems
- Energy and non-air quality environmental impacts
  - Specify any energy and non-air environmental impacts such as the generation of wastes for disposal, impacts on other environmental media, etc.
  - Factor any costs associated with energy and non-air environmental impacts into the cost of implementing the strategy, including without limitation:
    - Permitting costs if other regulatory requirements are triggered by the strategy
    - Costs associated with compliance with any other regulatory requirements triggered by the strategy
    - Cost of waste disposal for wastes generated by proposed control systems
- Cost of implementing the strategy
  - Use the EPA Pollution Control Cost Control Cost Manual[10] to quantify the following cost metrics:
    - Capital costs
    - Annual operating and maintenance costs
    - Annualized costs

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[7] https://www.epa.gov/visibility/guidance-regional-haze-state-implementation-plans-second-implementation-period

[8] The deadline for submission of this state implementation plan is July 31, 2021. EPA's deadlines for timely action on a SIP submittal are as follows: six months for determining whether a SIP is complete and one year from determining that a SIP is complete to take final action on the SIP.

[9] https://www.epa.gov/sites/production/files/2017-12/documents/epaccmcostestimationmethodchapter_7thedition_2017.pdf

[10] https://www.epa.gov/sites/production/files/2017-12/documents/epaccmcostestimationmethodchapter_7thedition_2017.pdf

- The amortization period should be based on the time between when the strategy could reasonably be in place and the remaining useful life of the emission unit or emission control system, whichever is less. [11]

III. CONCLUSION

Thank you for your timely response to this information request. This information is necessary for DEQ to prepare a technically and legally robust state implementation plan consistent with the Regional Haze Rule. Please respond with the requested information by April 7, 2020. If you have any questions, please contact Tricia Treece (treecep@adeq.state.ar.us) of my staff.

Sincerely,

William K. Montgomery
Interim Associate Director
Office of Air Quality
Division of Environmental Quality
Arkansas Department of Energy and Environment

[11] Amortization start date is equal to the time necessary for compliance for the strategy added to January 31, 2023 (Deadline for timely EPA action on a SIP submitted on July 31, 2021).

APPENDIX F-2

Entergy Independence ICR Response

Division of Environmental Quality

Office of Air Quality

Entergy Services LLC on behalf of Entergy Arkansas LLC

Response to January 8, 2020 Regional Haze Four-Factor Analysis Information Collection Request

Prepared By:

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April 7, 2020

Project 203702.0049

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Entergy's August 18, 2017 *Updated BART Five-Factor Analysis for SO_2 for Unit 1 and 2* ("Entergy's August 2017 White Bluff BART report")

Sargent & Lundy's (S&L's) August 3, 2017 *White Bluff Dry FGD Cost Estimate and Technical Basis*, SL-012831 ("S&L's August 2017 DFGD White Bluff Report")

S&L's January 31, 2018 *Independence Dry FGD Cost Estimate and Technical Basis*, SL-014308 ("S&L's January 2018 DFGD Independence Report")

S&L's August 3, 2017 *White Bluff DSI Cost Estimate Basis Document*, SL-014000, and *White Bluff Enhanced DSI Cost Estimate Basis Document*, SL-014001 (together: "S&L's August 2017 DSI White Bluff Reports")

Entergy's February 2, 2018 *Supplemental Information – Analysis of Reasonable Progress – Arkansas Regional Haze Program First Planning Period* report ("Entergy's February 2018 Independence report")

Entergy's September 27, 2017 *Analysis of Reasonable Progress Arkansas Regional Haze Program First Planning Period* ("Entergy's September 2017 RP Report")

S&L's May 16, 2013 *NO_X Control Technology Cost and Performance Study, Entergy Services, Inc. – White Bluff and Lake Catherine*, SL-011439 ("S&L's May 2013 NO_X Study")

Entergy's August 7, 2015 *Comments on the Proposed Regional Haze and Interstate Visibility Transport Federal Implementation Plan for Arkansas* ("Entergy's August 2015 FIP comments")

S&L's July 14, 2015 *Review of EPA's Cost Analysis for Arkansas Regional Haze Proposed Federal Implementation Plan*, SL-012913 ("S&L's July 2015 FIP comments")

1. Introduction

This report was prepared on behalf of Entergy Services LLC and Entergy Arkansas LLC (together: "Entergy") in response to the January 8, 2020 Regional Haze Four-Factor Analysis Information Collection Request ("the ICR") from the Arkansas Department of Energy and Environment, Division of Environmental Quality, Office of Air Quality ("the DEQ").

Per the ICR, this report provides information related to the following sulfur dioxide (SO_2) and nitrogen oxides (NO_X) emissions reduction options for Unit 1 and Unit 2 at Entergy's Independence Steam Electric Station (Independence):

SO_2 Emissions Reduction Options:

- Fuel switching from subbituminous coal to natural gas
- Lime Spray Dryer System
- Limestone Forced Oxidation System
- In-Duct Dry Sorbent Injection

NO_X Emissions Reduction Options:

- Selective Catalytic Reduction
- Selective Non-Catalytic Reduction

The following specific technical and economic information, where applicable, is provided in this report for each emissions reduction option considered, in accordance with instructions in the ICR:

- Technical feasibility
- Control effectiveness
- Emissions reductions
- Time necessary for implementation[1]
- Remaining useful life[1]
- Energy and non-air quality environmental impacts[1]
- Costs of implementation[1]

Most of the information requested by the ICR is available in the record prepared by the DEQ for the regional haze rule (RHR) first planning period (1PP) state implementation plan (SIP). The DEQ prepared the original 1PP SIP in 2008,[2] it was partially approved and partially disapproved in 2012,[3] and revisions were submitted in three phases in 2017 ("Phase I of the 1PP SIP revisions"), 2018 ("Phase II of the 1PP SIP revisions"), and 2019 ("Phase III of the 1PP SIP revisions").

[1] These are the four factors that must be included in evaluating emission reduction measures necessary to make reasonable progress determinations. *See* 40 CFR § 308(f)(2)(i).

[2] State of Arkansas Regional Haze Rule State Implementation Plan, available online as of February 11, 2020 at http://www.adeq.state.ar.us/air/planning/sip/pdfs/regional-haze/arkansas-regional-haze-sip.pdf, appendices available at http://www.adeq.state.ar.us/air/planning/sip/regional-haze.aspx.

[3] 77 Fed. Reg. 14604 (Mar. 12, 2012).

Phase I of the 1PP SIP revisions addressed NO_X emissions from several electric generating units (EGUs), including Independence.[4] It was submitted to the U.S. Environmental Protection Agency (EPA) on October 24, 2017 and approved by the EPA on February 12, 2018.[5] Concurrently, the EPA also withdrew its federal implementation plan (FIP) provisions for NO_X from EGUs in Arkansas.[6]

Phase II of the 1PP SIP revisions primarily addressed SO_2 emissions from several EGUs, including Independence.[7] It was submitted to the EPA on August 8, 2018 and approved by the EPA on September 27, 2019.[8] Concurrently, the EPA also withdrew its corresponding FIP provisions for EGUs in Arkansas.[9]

To the extent possible, information developed for the 1PP analyses – a "reasonable progress" analysis for Independence and a Best Available Retrofit Technology (BART) analysis for White Bluff Steam Electric Station (White Bluff)[10] – is presented in this report with updates regarding baseline emissions (per the ICR) and costs escalation. Section 2 of this report presents information for the SO_2 emissions reduction options, and Section 3 presents information for the NO_X emissions reduction options.

In addition to the information requested by the ICR, Section 4 of this report provides a summary of the most recent Interagency Monitoring of Protected Visual Environments (IMPROVE) network monitoring data for the two Class I areas in Arkansas: Caney Creek Wilderness Area (CACR) and Upper Buffalo Wilderness Area (UPBU). This information is an update to the report that Entergy originally submitted on August 7, 2015 and updated previously on November 15, 2016, September 27, 2017, and February 2, 2018. The previous reports should be reviewed for explanations of how the raw data were summarized, how the deciview metric is calculated, and other background information.

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[4] Revisions to the Arkansas State Implementation Plan – Regional Haze SIP Revision for 2008-2018 Planning Period. Available online as of April 6, 2020 at http://www.adeq.state.ar.us/air/planning/sip/pdfs/regional-haze/final-package.pdf.

[5] 83 Fed. Reg. 5927 (Feb. 12, 2018).

[6] 83 Fed. Reg. 5915 (Feb. 12, 2018).

[7] Phase II of the 1PP SIP revisions is available online at http://www.adeq.state.ar.us/air/planning/sip/regional-haze.aspx as of April 6, 2020 under the heading "2018 Arkansas Phase II Regional Haze SIP Revision."

[8] 84 Fed. Reg. 51033 (Sept. 27, 2019).

[9] 84 Fed. Reg. 51056 (Sept. 27, 2019).

[10] The units at White Bluff are similar in size, design, and operation to the units at Independence, and information related to controls for the White Bluff units is reasonably representative of the Independence units.

2. SO_2 Emissions Reductions Options

The ICR specifically listed the following four SO_2 emissions reduction options for consideration: (a) Fuel switching from subbituminous coal to natural gas, (b) Lime Spray Dryer System, (c) Limestone Forced Oxidation System, and (d) In-Duct Dry Sorbent Injection.

The fuel switch (a.k.a. "repowering") option must be considered independently of the other options, which involve installing post-combustion air pollution controls on the existing units. Switching the two (2) 880 megawatt (MW) (nominal) units from coal to natural gas would be a significant and fundamental change to the plant. Entergy is not aware of any previous coal-to-gas repowering projects for units of similar size to the Independence units. Switching the units to burn natural gas would involve significant modifications to the units, which were originally designed to only burn coal for electrical generation. Such a conversion would result in gas units which are less efficient than units that were originally designed to burn gas. Such a conversion would impact the heat rate of the units and could reduce their maximum generating capacity. Either of these changes would impact the manner and frequency with which the units are dispatched by the Midcontinent Independent System Operator (MISO). This recategorization would fundamentally change the Independence facility, and all co-owners would need to be involved in such a decision. Moreover, a switch to natural gas at Independence could not be achieved without building a new gas supply pipeline. A sufficiently sized natural gas pipeline currently does not serve the site. The nearest pipelines of sufficient capacity are more than five (5) miles away and are located on the other side of the White River. Constructing a new pipeline to bring adequate natural gas capacity to the Independence site could negatively impact streams and wetlands along the pipeline route, and would require significant environmental assessment to determine an appropriate route and mitigation measures. The change in source design, and the other considerations (e.g., the environmental impacts of building a pipeline) taken together render the fuel switch option profoundly infeasible. Accordingly, it is not considered further in this report. Should ADEQ believe that further evaluation of a fuel-switching option is appropriate, it would be necessary to conduct a detailed site-specific engineering study in order to determine the necessary modifications, costs, and the expected changes to unit operating characteristics following the switch.

Lime spray dryer systems (SDA) are generically referred to as dry flue gas desulfurization (DFGD) and limestone forced oxidation systems are generically referred to as wet flue gas desulfurization (WFGD). Both FGD options include in their design the installation of a fabric filter. An in-duct dry sorbent injection system (DSI) can be installed with or without a fabric filter; thus, the DSI option is split into two options: (1) DSI without a fabric filter (for this option, rebuilds of the existing electrostatic precipitators [ESPs] are considered), referred to as DSI, and (2) DSI with a fabric filter, referred to as Enhanced DSI.

2.1. Technical Feasibility

WFGD, DFGD, DSI, and Enhanced DSI are technically feasible for Unit 1 and Unit 2.

2.2. Control Effectiveness

Table 2-1 summarizes the control emission rates for the technically feasible SO_2 emissions reduction options for Unit 1 and Unit 2.

Table 2-1. Control Effectiveness of SO_2 Emissions Reduction Options

SO_2 Reduction Option	Controlled Emission Rate (lb/MMBtu)
WFGD	0.04
DFGD	0.06
Enhanced DSI	0.15
DSI	0.35

2.2.1. WFGD

The controlled emission rate of 0.04 pounds per million British thermal units (lb/MMBtu) for WFGD is based on information presented in Entergy's October 2013 *Revised BART Five Factor Analysis for White Bluff Steam Electric Station* ("Entergy's October 2013 White Bluff BART report"), at 5-3 – 5-4, included in Appendix D of Phase II of the 1PP SIP revisions. As discussed in Entergy's October 2013 White Bluff BART report, the 0.04-lb/MMBtu emission rate for WFGD does not represent a guarantee but is merely an estimate. If the DEQ anticipates requiring WFGD at Independence, Entergy would need an opportunity to conduct a site-specific study to determine the emission rate that could be achieved at Independence.

2.2.2. DFGD or SDA

The controlled emission rate for DFGD is based on information presented in the following 1PP documents:

- Entergy's August 18, 2017 *Updated BART Five-Factor Analysis for SO_2 for Unit 1 and 2* ("Entergy's August 2017 White Bluff BART report"), at 4-1 – 4-3, included in Appendix D of Phase II of the 1PP SIP revisions;
- Sargent & Lundy's (S&L's) August 3, 2017 *White Bluff Dry FGD Cost Estimate and Technical Basis*, SL-012831 ("S&L's August 2017 DFGD White Bluff Report"), which is included in Appendix A of this report;[11] and
- S&L's January 31, 2018 *Independence Dry FGD Cost Estimate and Technical Basis*, SL-014308 ("S&L's January 2018 DFGD Independence Report"), which is included in Appendix A of this report.[12]

2.2.3. DSI and Enhanced DSI

The controlled emission rates for DSI and Enhanced DSI are based on information presented in the following 1PP documents:

- Entergy's August 2017 White Bluff BART report, at 4-1 – 4-3;

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[11] S&L's August 2017 DFGD White Bluff Report was included in Appendix A in Entergy's August 2017 White Bluff BART report.

[12] S&L's January 2018 DFGD Independence Report was included as Appendix B of Entergy's February 2, 2018 *Supplemental Information – Analysis of Reasonable Progress – Arkansas Regional Haze Program First Planning Period* report ("Entergy's February 2018 Independence report"), and is included in Appendix F of Phase II of the 1PP SIP revisions.

- S&L's August 3, 2017 *White Bluff DSI Cost Estimate Basis Document*, SL-014000, and *White Bluff Enhanced DSI Cost Estimate Basis Document*, SL-014001 (together: "S&L's August 2017 DSI White Bluff Reports"), which are included in Appendix A of this report.[13]

As discussed in Entergy's August 2017 White Bluff BART report, DSI and Enhanced DSI have not been demonstrated on units the size of those at Independence. If the DEQ anticipates requiring DSI or Enhanced DSI at Independence, Entergy would need an opportunity to conduct a site-specific study to determine the emission rates that could be achieved at Independence with those technologies.

2.3. Emissions Reductions

Table 2-2 summarizes the baseline and controlled emission rates and emission reduction potentials, all in tons per year (tpy), for the technically feasible SO_2 reduction options for Unit 1 and Unit 2. Per the ICR, the baseline actual emission rate for each unit is taken as the maximum monthly value (annualized, i.e., multiplied by 12) from the EPA's Air Markets Program Data (AMPD)[14] from November 1, 2018 to December 31, 2019 for Unit 1 and from January 1, 2018 to December 31, 2019 for Unit 2 (i.e., the baseline periods). The controlled emission rate for each unit is based on the lb/MMBtu emission rates presented in Table 2-1 and each unit's baseline actual heat input in MMBtu/yr, which is determined in the same manner as the baseline emission rates. The emission reductions are the difference between the baseline and controlled emission rates.

Table 2-2. Baseline Emission Rates (Maximum Month Basis) and Controlled Emission Rates of SO_2 Emissions Reduction Options

Emissions Unit	SO_2 Reduction Option	Baseline Emission Rate (tpy)	Controlled Emission Rate (tpy)	Emissions Reduction (tpy)
Unit 1	WFGD	15,467	1,341	14,126
	DFGD		2,011	13,455
	Enhanced DSI		4,693	10,773
	DSI		11,398	4,069
Unit 2	WFGD	18,195	1,451	16,744
	DFGD		2,177	16,018
	Enhanced DSI		5,079	13,116
	DSI		12,334	5,861

Table 2-3 provides the same information but based on the average, rather than the maximum, monthly values (annualized, i.e., multiplied by 12) from the baseline periods. Average monthly values are more commonly used for control cost analyses because maximum monthly values result in much higher annual baseline emission rates than have actually occurred in the recent past (or than are expected to occur in the future). Control cost calculations presented later in this report are completed using both the maximum-monthly and average-monthly baseline emission rates.

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[13] S&L's August 2017 DSI White Bluff Reports were included in Appendix A in Entergy's August 2017 White Bluff BART report.

[14] https://ampd.epa.gov/ampd, queried on February 10, 2020.

Table 2-3. Baseline Emission Rates (Average Month Basis) and Controlled Emission Rates of SO_2 Emissions Reduction Options

Emissions Unit	SO_2 Reduction Option	Baseline Emission Rate (tpy)	Controlled Emission Rate (tpy)	Emissions Reduction (tpy)
Unit 1	WFGD	9,945	841	9,104
	DFGD		1,261	8,684
	Enhanced DSI		3,153	6,792
	DSI		7,358	2,587
Unit 2	WFGD	10,672	887	9,786
	DFGD		1,330	9,342
	Enhanced DSI		3,325	7,347
	DSI		7,759	2,914

2.4. Time Necessary for Implementation

A minimum of five (5) years, counting from the effective date of an approved determination, would be needed for implementing either the WFGD or DFGD options. This is consistent with the EPA's determination in the now-withdrawn FIP.[15] Three (3) years would be needed for implementing either DSI or Enhanced DSI.

2.5. Remaining Useful Life

Assuming an EPA review and approval period of one (1) year following the second planning period (2PP) SIP proposal deadline of July 31, 2021, the earliest effective date for any control requirements would be July 31, 2022. Thus, based on the times necessary for implementing the various controls, WFGD or DFGD could be implemented by July 31, 2027, and DSI or Enhanced DSI could be implemented by July 31, 2025.

Entergy plans to cease coal-fired operations of Unit 1 and Unit 2 at Independence by December 31, 2030, as the DEQ noted in Phase II of the 1PP SIP revisions. Entergy has entered into a proposed settlement agreement with Sierra Club and National Parks Conservation Association that is currently pending before the U.S. District Court for the Eastern District of Arkansas (*Sierra Club, et al. v. Entergy Arkansas, LLC, et al.*, No 4:18-cv-00854 -KGB (E.D. Ark.)). If the court approves the settlement, the cessation of coal-fired operation at the Independence units will become an enforceable commitment. Therefore, for costing purposes, the remaining useful life (RUL) of the Independence units is 3.42 years for WFGD and DFGD and 5.42 years for DSI and Enhanced DSI.

2.6. Energy and Non-air Quality Environmental Impacts

2.6.1. WFGD

As addressed in Entergy's October 2013 White Bluff BART report, at 5-7, WFGD has the following non-air quality environmental impacts:

[15] 81 Fed. Reg. 66336 (Sept. 27, 2016).

> …wet scrubbing is expected to achieve approximately the same level of visibility improvement as the proposed dry scrubbing technology. However, the negative non-air quality environmental impacts are greater with wet scrubbing systems. Such impacts include a potential increase in particulate and sulfuric acid (H_2SO_4) mist emissions. In addition, wet scrubbers require increased water use and generate large volumes of wastewater and solid waste/sludge that must be managed and/or treated. This places additional burdens on the wastewater treatment and solid waste management capabilities. Moreover, if wet scrubbing produces calcium sulfite sludge, the sludge will be water-laden, and it must be stabilized for landfilling. Wet scrubbing systems require increased power requirements and increased reagent usage over dry scrubbers. Thus, from an overall environmental perspective, dry scrubbing is superior to wet scrubbing.

2.6.2. DFGD

Per Phase II of the 1PP SIP revisions, DEQ recognized the following non-air quality environmental impacts for DFGD:

> DFGD utilizes lime slurry to remove SO_2 from flue gas. In the process, particulate matter is generated that must be controlled through use of a baghouse or electrostatic precipitator. Once collected, the waste material is disposed of through landfilling. Costs associated with control of particulate matter and additional power requirements were factored into the cost estimates calculated by Entergy and EPA. Entergy has not indicated unusual circumstances that would create greater problems than experienced elsewhere that Dry FGD was utilized as BART.[16]

Additionally, per Entergy's September 27, 2017 *Analysis of Reasonable Progress Arkansas Regional Haze Program First Planning Period* ("Entergy's September 2017 RP Report"), at 6-2, which is included in Appendix F of Phase II of the 1PP SIP revisions:

> Non-air quality environmental impacts of SDA primarily relate to available water resources and waste byproducts. SDA systems consume a significant quantity of water, and the required water must be relatively clean. In addition, SDA systems also generate a large waste byproduct stream, containing calcium salts, which must be landfilled. If not fixated during the disposal process, the calcium salts are soluble and may dissolve and appear in the landfill leachate.

2.6.3. DSI and Enhanced DSI

As addressed in Entergy's August 2017 White Bluff BART report, at 4-6, DSI and Enhanced DSI have the following energy and non-air quality environmental impacts:

> …(a) the need for substantial storage and transportation – both delivery via rail and conveyance on site – of Trona, (b) the forced abandonment of the beneficial re-use of fly ash, and (c) potential negative impacts on the PM control device.

Additionally, per S&L's August 2017 DSI White Bluff Reports:

> The DSI process produces a dry byproduct which can be landfilled. The waste products will contain sodium sulfate and sulfite ($NaSO_3$/$NaSO_4$) along with the unused sorbent and the

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[16] This discussion can be found in "rh-phase-ii-sip-narrative-final.pdf" at 52.

normal fly ash. These wastes will be collected in the ESP and can be transported with conventional pneumatic fly ash handling equipment. The waste from sodium-based sorbents will have relatively high concentrations of soluble salts, which may affect the byproduct handling. With the addition of dry sorbent byproducts fly ash cannot be sold for reuse.

…The sodium byproducts (salts) that are produced when Trona reacts with SO_2 and other acid gases, along with the unreacted sorbent are soluble in water. The resulting waste collected in the particulate collection device will need to be disposed of in a landfill that is lined and has a leachate collection system. With the addition of DSI, White Bluff will no longer be able to sell their fly ash for beneficial re-use due to the solubility of the sodium salts which would be present in the waste

2.7. Costs

Table 2-4 summarizes the estimated costs, including total and annualized capital costs,[17] annual operations and maintenance (O&M) costs, and cost effectiveness based on the emission reduction values from Table 2-2 (Maximum Month Basis) and Table 2-3 (Average Month Basis) for the technically feasible SO_2 reduction options.

Table 2-4. Estimated Costs ($2018) of SO_2 Emissions Reduction Options

Emissions Unit	SO_2 Reduction Option	Capital Costs ($MM)	Annualized Capital Costs ($MM/year)	Annual O&M Costs ($MM/year)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton) *Maximum Month Basis*	Cost Effectiveness ($/ton) *Average Month Basis*
Unit 1	WFGD	401.82	136.18	36.55	172.73	12,228	18,972
	DFGD	377.69	128.00	9.36	137.36	10,209	15,818
	Enhanced DSI	335.58	76.51	29.16	105.67	10,123	15,558
	DSI	175.00	39.90	16.60	56.50	15,135	21,837
Unit 2	WFGD	401.82	136.18	36.55	172.73	10,316	17,651
	DFGD	377.69	128.00	9.36	137.36	8,575	14,703
	Enhanced DSI	335.58	76.51	29.16	105.67	8,285	14,382
	DSI	175.00	39.90	16.60	56.50	10,277	19,392

[17] Capital cost values presented in this report omit the costs known as Allowance for Funds Used During Construction (AFUDC) and Owner's Costs as these costs, despite being significant for long-term projects such as considered in this report, are excluded by EPA's preferred "overnight" costing methodology. This issue is described in detail in multiple previous submittals:
(1) the Q&A document provided with Entergy's October 2013 White Bluff BART report in response to EPA's August 21, 2013 comments on the previously submitted BART report;
(2) Entergy's August 2017 White Bluff BART report, at 4-4;
(3) Entergy's August 7, 2015 *Comments on the Proposed Regional Haze and Interstate Visibility Transport Federal Implementation Plan for Arkansas*, at 10 – 11; and
(4) S&L's July 14, 2015 *Review of EPA's Cost Analysis for Arkansas Regional Haze Proposed Federal Implementation Plan*, SL-012913.

2.7.1. WFGD

Costs for WFGD are based on information presented in Entergy's October 2013 White Bluff BART report, at 5-6). The WFGD capital costs were based on a 2012 dollar value ($2012) and the O&M costs were based on $2011. These values are escalated to 2018 (the latest final information available as of February 2020) using the Chemical Engineering Plant Cost Index (CEPCI) values.[18]

2.7.2. DFGD

The capital and annual O&M costs for DFGD are based on information presented in Entergy's February 2018 Independence report, at 3-1, and S&L's January 2018 DFGD Independence report, which is included in Appendix A of this report. All costs for DFGD were based on $2017 and have been escalated to $2018.

2.7.3. DSI and Enhanced DSI

Costs for DSI and Enhanced DSI are based on information presented in Entergy's August 2017 White Bluff BART report, at 4-5, and S&L's August 2017 DSI White Bluff Reports, which are included in Appendix A of this report. The referenced costs for DSI and Enhanced DSI were based on $2016 and have been escalated to $2018.

[18] From https://www.chemengonline.com/pci-home, accessed on February 10, 2020:

Year:	2011	2012	2013	2014	2015	2016	2017	2018
CEPCI:	585.7	584.6	567.3	576.1	556.8	541.7	567.5	603.1

3. NO_X Emissions Reductions Options

The ICR specifically listed for consideration the following two NO_X emissions reduction options: Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR).

3.1. Technical Feasibility

Both SCR and SNCR are technically feasible NO_X emissions reduction options for Independence Unit 1 and Unit 2.

3.2. Control Effectiveness

Table 3-1 summarizes and ranks the control emission rates for the technically feasible NO_X emissions reduction options for Unit 1 and Unit 2. The controlled emission rates are based on information presented in Entergy's October 2013 White Bluff BART report, at 6-3 – 6-4, and S&L's May 16, 2013 *NO_X Control Technology Cost and Performance Study, Entergy Services, Inc. – White Bluff and Lake Catherine*, SL-011439 ("S&L's May 2013 NO_X Study"), which is included in Appendix B of this report.[19]

Table 3-1. Control Effectiveness of NO_X Emissions Reduction Options

NO_X Reduction Option	Controlled Emission Rate (lb/MMBtu)
SCR	0.055
SNCR	0.13

3.3. Emissions Reductions

Table 3-2 summarizes the baseline and controlled emission rates and emission reduction potentials, all in tpy, for the technically feasible NO_X reduction options for Unit 1 and Unit 2. Per the ICR, the baseline actual emission rate for each unit is taken as the maximum monthly value (annualized, i.e., multiplied by 12) from the EPA's AMPD[20] from November 1, 2018 to December 31, 2019 for Unit 1 and from January 1, 2018 to December 31, 2019 for Unit 2 (i.e., the baseline periods). The controlled emission rate for each unit is based on the lb/MMBtu emission rates presented in Table 3-1 and each unit's baseline actual heat input in MMBtu/yr, which is determined in the same manner as the baseline emission rates. The emission reductions are the difference between the baseline and controlled emission rates.

[19] S&L's May 2013 NOx Study had been included as Appendix E of Entergy's October 2013 White Bluff BART report.

[20] https://ampd.epa.gov/ampd, queried on February 10, 2020.

Table 3-2. Baseline Emission Rates (Maximum Month Basis) and Controlled Emission Rates of NO_X Emissions Reduction Options

Emissions Unit	NO_X Reduction Option	Baseline Emission Rate (tpy)	Controlled Emission Rate (tpy)	Emissions Reduction (tpy)
Unit 1	SCR	5,450	1,844	3,606
	SNCR		4,358	1,092
Unit 2	SCR	5,077	1,995	3,082
	SNCR		4,716	361

Table 3-3 provides the same information but based on the average, rather than the maximum, monthly values (annualized, i.e., multiplied by 12) from the baseline periods. Average monthly values are more commonly used for control cost analyses because maximum monthly values result in much higher annual baseline emission rates than have actually occurred in the recent past (and that are expected to occur in the future). Control cost calculations presented later in this report are completed using both the maximum-monthly and average-monthly baseline emission rates.

Table 3-3. Baseline Emission Rates (Average Month Basis) and Controlled Emission Rates of NO_X Emissions Reduction Options

Emissions Unit	NO_X Reduction Option	Baseline Emission Rate (tpy)	Controlled Emission Rate (tpy)	Emissions Reduction (tpy)
Unit 1	SCR	3,423	1,156	2,267
	SNCR		2,733	690
Unit 2	SCR	3,180	1,219	1,961
	SNCR		2,882	298

3.4. Time Necessary for Implementation

A minimum of five (5) years, counting from the effective date of an approved determination, would be needed to implement either SCR or SNCR. This is consistent with the EPA's determinations in the North Dakota FIP and Utah FIP.[21]

3.5. Remaining Useful Life

Assuming an EPA review and approval period of one (1) year following the 2PP SIP proposal deadline of July 31, 2021, the earliest effective date for any control requirements would be July 31, 2022. Thus, based on the time necessary for implementing the control options, SCR or SNCR could be implemented by July 31, 2027.

Entergy plans to cease coal-fired operations of Unit 1 and Unit 2 at Independence by December 31, 2030, as the DEQ noted in Phase II of the 1PP SIP revisions. Entergy has entered into a proposed settlement agreement with

[21] 77 Fed. Reg. 20944 (April 6, 2012) and 81 Fed. Reg. 43907 (July 5, 2016), respectively.

Sierra Club and National Parks Conservation Association that is currently pending before the U.S. District Court for the Eastern District of Arkansas (*Sierra Club, et al. v. Entergy Arkansas, LLC, et al.*, No 4:18-cv-00854 -KGB (E.D. Ark.)). If the court approves the settlement, the cessation of coal-fired operation at the Independence units will become an enforceable commitment. Therefore, for costing purposes, the remaining useful life (RUL) of the Independence units is 3.42 years for SCR and SNCR.

3.6. Energy and Non-air Quality Environmental Impacts

Per Entergy's October 2013 White Bluff BART report, at 6-9, SCR and SNCR have the following impacts:

> SCR and SNCR systems require electricity to operate the ancillary equipment. The need for electricity to help power some of the ancillary equipment creates a demand for energy that currently does not exist.
>
> SCR and SNCR can potentially cause significant environmental impacts. The primary avenue is related to the storage of ammonia. The storage of aqueous ammonia above 10,000 lbs is regulated by a risk management program (RMP), since the accidental release of ammonia has the potential to cause serious injury and death to persons in the vicinity of the release. Additionally, SCR and SNCR will likely also cause the release of unreacted ammonia to the atmosphere. This is referred to as ammonia slip. Ammonia slip from SCR and SNCR systems occurs either from ammonia injection at temperatures too low for effective reaction with NO_X, leading to an excess of unreacted ammonia, or from over injection of reagent leading to uneven distribution; which also leads to an excess of unreacted ammonia. Ammonia released from SCR and SNCR systems will react with sulfates and nitrates in the atmosphere to form ammonium sulfate and ammonium nitrate. Together, ammonium sulfate and ammonium nitrate are the predominant sources of regional haze.
>
> Another environmental impact associated with SCR is the disposal of catalyst waste. To maintain NO_X-removal effectiveness, the catalyst in an SCR system must periodically be cleaned, regenerated, or replaced. Cleaning and regeneration are preferred, but eventually the catalyst reaches the end of its useful life and must be replaced. Ideally the exhausted catalyst can be recycled for reuse, however, if the condition of the spent catalyst does not warrant recycling or a market is unavailable, the old catalyst must be disposed of. Current regulatory interpretations indicate spent SCR catalysts are exempted from hazardous waste regulation via 40 CFR § 261.4(b)(4) (Bevill Exemption) as flue gas emission control wastes. However, ongoing efforts by EPA to increase regulatory oversight of coal combustion residuals could alter that exemption, and create the potential that spent SCR catalysts would be characterized as hazardous wastes, hence increasing the cost of disposal. Regardless of the regulatory treatment of the waste, the disposal creates additional potential financial and environmental impacts associated with an SCR system.

3.7. Costs

Table 3-4 summarizes the estimated costs, including total and annualized capital costs, annual O&M costs, and cost effectiveness based on the emission reduction values from Table 3-2 (Maximum Month Basis) and Table 3-3 (Average Month Basis), for the technically feasible NO_X reduction options.

The cost values are based on information presented in S&L's May 2013 NO_X Study, which is included in Appendix E of Entergy's October 2013 White Bluff BART report, in Appendix D of Phase II of the 1PP SIP revisions, and in Appendix B of this report. The average of cost values for White Bluff's two units was taken to be representative of both Independence units. All costs were based on $2012 and have been escalated to $2018.

Table 3-4. Estimated Costs ($2018) of NO_X Emissions Reduction Options

Emissions Unit	NO_X Reduction Option	Capital Costs ($)	Annualized Capital Costs ($/year)	Annual O&M Costs ($/year)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton) *Maximum Month Basis*	Cost Effectiveness ($/ton) *Average Month Basis*
Unit 1	SCR	186.32	63.14	3.42	66.56	18,458	29,361
	SNCR	8.75	2.97	6.53	9.50	8,702	13,763
Unit 2	SCR	186.32	63.14	3.42	66.56	21,595	33,946
	SNCR	8.75	2.97	6.53	9.50	26,286	31,860

4. Updated IMPROVE Monitoring Data

As stated in Section 1, following is a summary of the most recent IMPROVE network monitoring data for the two Class I areas in Arkansas: Caney Creek Wilderness Area (CACR) and Upper Buffalo Wilderness Area (UPBU). This information is an update to that which was originally submitted on August 7, 2015 and updated previously on November 15, 2016, September 27, 2017, and February 2, 2018. The previous reports should be reviewed for explanations of how the raw data was summarized, how the deciview (dv) metric is calculated, and other background information. The only difference is that now, per EPA guidance,[22] all dv values have been re-calculated as the 20 percent most impaired and 20 percent least impaired values, based on anthropogenic (manmade) impairment only, rather than the 20 percent worst and 20 percent best values, which were based on both anthropogenic and biogenic (natural) impairment.

The most recent summary of annual IMPROVE monitoring data available for CACR and UPBU has been completed through the year 2018. As of February 14, 2020, no raw (non-summarized) data is available for 2019. Table 4-1 presents a summary of the annual-average haze index values for each year from 2002 to 2018.

Table 4-1. Summary of Annual-Average Haze Index Values from 2002 through 2018

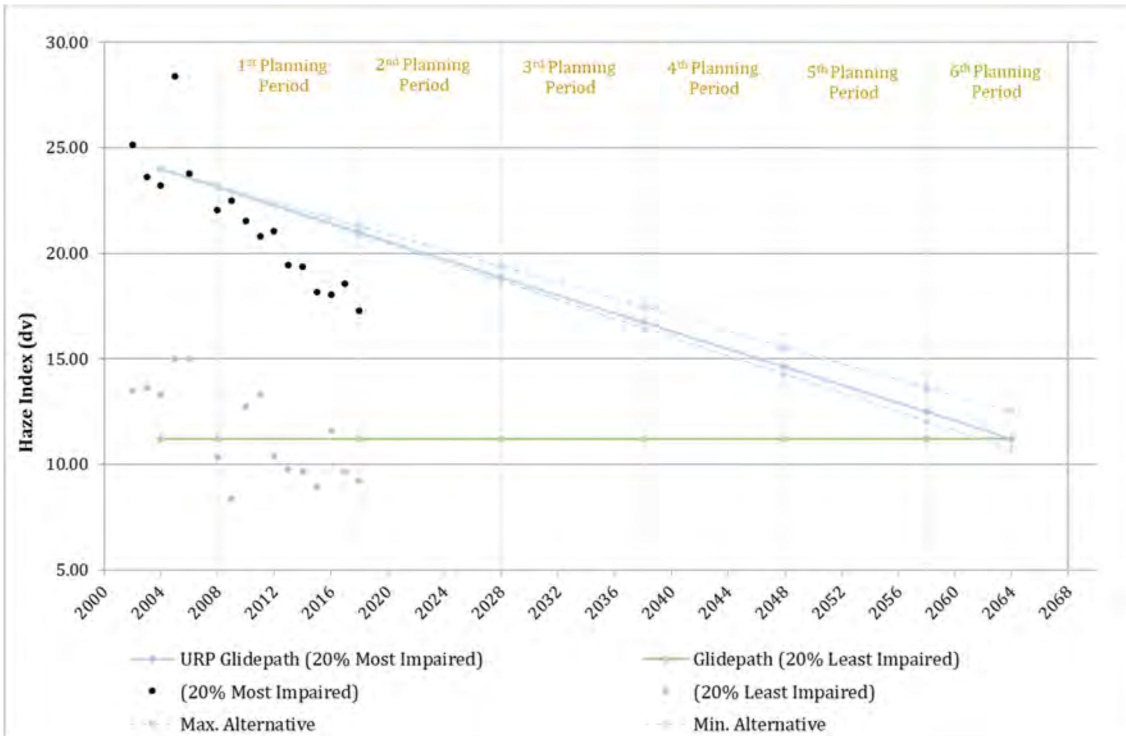
Year	Average of 20 Percent Most Impaired Days		Average of 20 Percent Least Impaired Days	
	CACR	**UPBU**	**CACR**	**UPBU**
2002	25.15	24.97	13.45	14.86
2003	23.61	24.66	13.64	14.22
2004	23.21	24.11	13.33	13.81
2005	28.37	29.29	14.99	14.62
2006	23.77	23.54	15.01	16.13
2007	--[A]	24.04	--[A]	15.77
2008	22.06	22.80	10.33	12.46
2009	22.48	21.29	8.39	11.35
2010	21.52	--[A]	12.69	--[A]
2011	20.83	21.19	13.30	13.73
2012	21.04	20.12	10.37	12.69
2013	19.46	19.29	9.76	9.58
2014	19.37	18.68	9.65	9.58
2015	18.17	17.84	8.94	8.65
2016	18.04	18.29	11.58	11.14
2017	18.57	17.92	9.67	9.84
2018	17.29	17.01	9.21	10.64

[A] Summarized data are not available for CACR for 2007 and UPBU for 2010.

[22] Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program, December 20, 2018. (https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf)

Figure 4-1 and Figure 4-2 present, for CACR and UPBU, respectively, comparisons of the annual-average haze index values from Table 4-1 to the Uniform Rate of Progress (URP) line (i.e., "glidepath") established for each area. The glidepaths presented are based on information published by EPA: 2000-2004 averages (starting points) and default, minimum alternative, and maximum alternative 2064 (end point) values.[23] As seen in the figures, the actual observed visibility impairment at these Class I areas has declined sharply overall, continues to trend downward, and has remained below the glidepaths since 2008.

Figure 4-1. CACR Monitored Observations Compared to Uniform Rate of Progress



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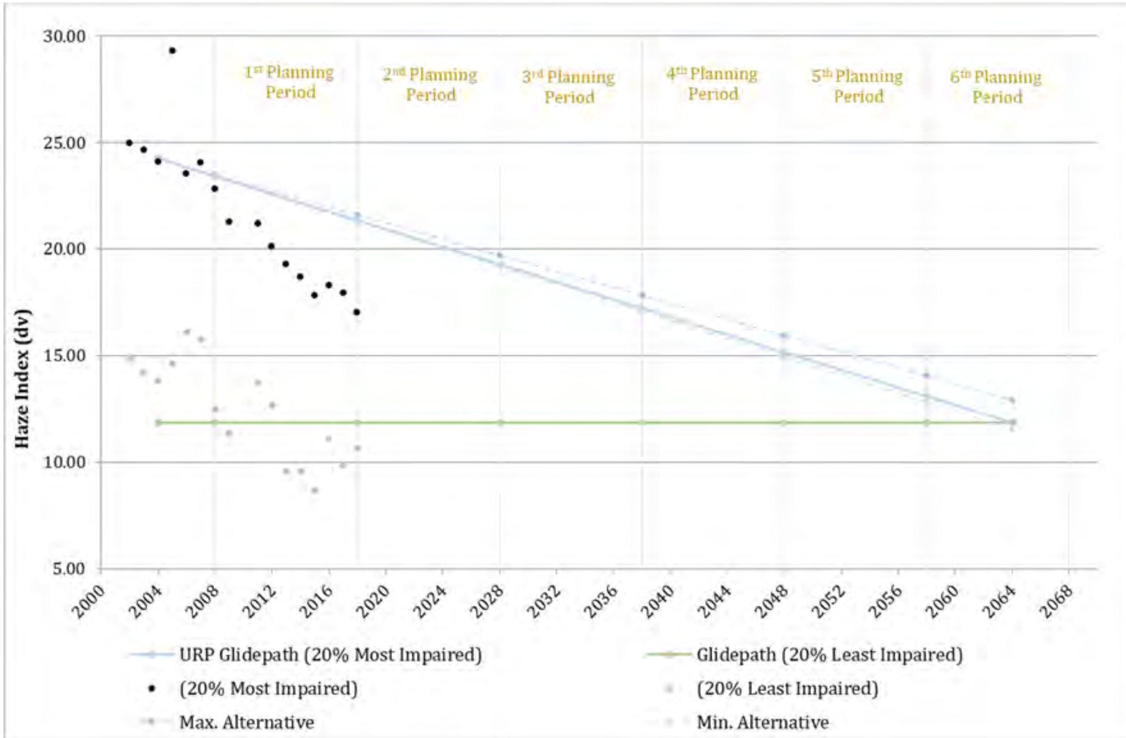
[23] Availability of Modeling Data and Associated Technical Support Document for the EPA's Updated 2028 Visibility Air Quality Modeling, September 19, 2019 (https://www.epa.gov/sites/production/files/2019-10/documents/updated_2028_regional_haze_modeling-tsd-2019_0.pdf)

Figure 4-2. UPBU Monitored Observations Compared to Uniform Rate of Progress



APPENDIX A: 1PP SO_2 CONTROLS STUDIES

- S&L's August 3, 2017 *White Bluff Dry FGD Cost Estimate and Technical Basis*, SL-012831
- S&L's January 31, 2018 *Independence Dry FGD Cost Estimate and Technical Basis*, SL-014308
- S&L's August 3, 2017 *White Bluff DSI Cost Estimate Basis Document*, SL-014000
- S&L's August 3, 2017 *White Bluff Enhanced DSI Cost Estimate Basis Document*, SL-014001

ENTERGY ARKANSAS, INC.

WHITE BLUFF DRY FGD

COST ESTIMATE AND TECHNICAL BASIS

SL-012831
Final, Rev. 1
August 3, 2017
Project 13027-002

Prepared by

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CONTENTS

EXECUTIVE SUMMARY

The purpose of this study is to estimate the total capital investment and operating and maintenance (O&M) costs associated with installing dry flue gas desulfurization (FGD) technology on White Bluff Units 1&2 using an Engineer, Procure, Construct (EPC) contracting strategy. A preliminary conceptual design was developed for implementation of dry FGD technology at the White Bluff station to serve as the technical basis of the capital and O&M estimates.

The capital cost estimate includes the following components which comprise the total cost the Owner will incur to install dry FGD technology at White Bluff:

- FGD Island Cost supplied by a Dry FGD System Supplier including the main process equipment
- Balance of Plant Cost including auxiliary equipment and systems, foundations and buildings, site work, demolition and relocation
- Other Direct and Construction Indirect Costs including labor premiums, freight, contractor's G&A and profit
- Indirect Costs including engineering, startup spare parts, technical field advisors, and the additional fee associated with an EPC contracting strategy
- Escalation and Interest During Construction associated with the project duration for implementation of a large air quality control technology
- Owner's Costs including internal labor, insurance, and initial lime reagent fill
- Third Party Services including construction management oversight, start-up and commissioning oversight, Owner's Engineer services, and performance testing
- Project Contingency to cover unknown and undefined scope associated with the project which would result in additional cost to the Owner

The total capital investment to install dry FGD on White Bluff Units 1 and 2 was estimated to be $991,489,000. The project definition and accuracy of the individual components included in this estimate result in an overall accuracy of ±20-25%. In addition, the O&M costs were estimated to be approximately $8,132,000 per year per unit and include the cost of lime (reagent), byproduct disposal, auxiliary power, water, replacement bags and cages, maintenance costs, and operating labor.

1. PURPOSE

The purpose of this study is to estimate the total capital investment and operating and maintenance costs associated with installing dry flue gas desulfurization (FGD) technology on White Bluff Units 1&2. This report documents the conceptual design and technical basis for the dry FGD cost estimate.

2. APPROACH

2.1 TECHNOLOGY SELECTION

Sargent & Lundy (S&L) previously performed an evaluation of wet and dry FGD technology for Entergy's White Bluff Station. The evaluation included development of a preliminary conceptual design for both wet and dry FGD systems at the White Bluff station. The preliminary designs were used as the basis of an evaluation which compared the overall economics of each system, including capital and operating costs. The study concluded that a dry FGD system had an economic advantage over wet FGD when the design coal sulfur is below 3 lb SO_2/MMBtu. Based on the current market and potential future regulations, dry FGD technology would have an economic advantage over wet FGD for SO_2 reduction at the White Bluff station.

2.2 CONTRACTING APPROACH

Many utilities elect to utilize a one contract engineer-procure-construct (EPC) approach for major retrofit projects, such as large FGD projects. The EPC approach allows the Owner to contract with one entity which then manages the overall project. The EPC Contractor procures the material, equipment and services needed to complete the project and the EPC Contractor takes full responsibility for the equipment and work supplied by each of its subcontractors.

With this approach the Owner takes on less risk in the overall management and coordination of the project. However, shifting this risk to the EPC Contractor increases the total price for the EPC contract; "Whilst there are… numerous advantages to using an EPC contract, there are some disadvantages. These include the fact that it can result in a higher contract price than alternative contractual structures. This higher price is a result of a number of factors not least of which is the allocation of almost all the construction risk to the contractor."[1] The additional cost due to an EPC contracting approach is represented in our cost estimate as an EPC Risk Fee.

The Owner's control over design details of the system is limited, using this contracting strategy, to the requirements specified in the contract. This results in an additional upfront effort for the Owner and the Owner's Engineer to thoroughly define the project in the specification. Whatever is not defined will be excluded from the EPC Contractor's scope resulting in potential change orders. The Owner and Owner's Engineer are also responsible for reviewing the EPC Contractor's submitted design drawings and schedules to ensure what has been agreed upon in the final contract is included.

2.3 CAPITAL COST DEVELOPMENT

The capital cost estimate is based on project-specific information, including:

- A preliminary conceptual design developed for implementation of dry FGD technology at the White Bluff station.
- An engineer-procure-construct (EPC) contracting strategy.
- A Dry FGD System Supplier, subcontracted by the EPC Contractor, providing the main process equipment as a complete FGD Island.
- The FGD Island equipment and installation cost is based on a budgetary proposal received from Alstom in September 2013. The budgetary proposal is based on installing SDA technology on both of the White Bluff units.

The capital cost estimate includes the following components which comprise the total price of the EPC Contract to complete the work:

- Equipment and material
- Installation labor
- Demolition and Relocation work
- Indirect field costs and BOP engineering
- Freight on Materials
- General and Administration
- Erection contractor profit

[1] "EPC Contracts in the Power Sector", prepared by DLA Piper, 2011, page 6. See: https://www.dlapiper.com/

- Engineering, Procurement and Project Services
- Spare parts
- EPC Fee
- Escalation

The equipment design basis is summarized in Section 3 of this report and the scope of the estimate is summarized in Section 4. The project definition and accuracy of the individual components included in this estimate result in an overall accuracy of ±20-25%. The costs provided in this report are in 2015 dollars.

In order to estimate the *total plant* capital cost for installation of FGD at White Bluff, the following costs which would be incurred outside of the scope of the EPC contract were included:

- Owner's Costs
- Third Party Services – Construction Management Oversight
- Third Party Services – Startup and Commissioning Oversight
- Third Party Services – Owner's Engineer
- Third Party Services – Performance Testing
- Project Contingency
- Interest During Construction or Allowance for Funds Used During Construction

The cash flow provided in Attachment 2 is based on a monthly progress payment schedule developed using the preliminary execution schedule included in Attachment 3. Specific details regarding the milestones making up the payment schedule are listed in Attachment 4. Below is a summary of those activities that represent major or large payment milestones based on a project start date of January 2015.

Month	Date	Milestone
1	February 2017	Award EPC Contract Execution
5	June 2017	EPC Contractor Procures Major Equipment
7	August 2017	EPC Contractor Procures Major Equipment
10	November 2017	Flue Gas Ductwork Procurement Initiated by EPC Contractor
13	February 2018	SDA and Fabric Filter Design Drawings
15	April 2018	Award Fabric Filter Bags and Cages Flue Gas Ductwork Start of Fabrication

Month	Date	Milestone
17	June 2018	Physical Flow Model Completed
19	August 2018	Mobilize On-Site
20-38	September 2018 to March 2020	Construction Activities
41	June 2020	Unit 1 Substantial Completion
45	October 2020	Unit 2 Substantial Completion
		Demobilization Complete
46	November 2020	Unit 1 Final Acceptance
47	December 2020	Unit 2 Final Acceptance

Each monthly cash outlay in the cash flow is broken down by category (labor, equipment and materials, and indirect costs).

3. DRY FGD CONCEPTUAL DESIGN AND SYSTEM COMPONENTS

A conceptual design for the implementation of Dry FGD at the White Bluff station was developed by Sargent & Lundy LLC (S&L) as a precursor to the development of the cost estimate. A general arrangement drawing showing the conceptual design is included in Attachment 7. The dry FGD conceptual design was developed for each of the following subsystems:

3.1 DRY FGD ISLAND

3.1.1 Reagent Preparation System

Lime will be supplied to the lime day bins from the long-term storage silo located in the Reagent Handling Area and supplied by the EPC Contractor. The lime day bins, located in the Reagent Preparation Area and provided by the Dry FGD System Supplier, will each have a storage capacity to supply the plant with lime reagent for 24 hours when firing 1.2 lb SO_2/mmBtu coal.

Lime from the day bin will be gravity-fed through feeders to a lime slaker, where the lime will be slaked (mixed with low pressure service water and converted from calcium oxide to calcium hydroxide slurry). The plant will have a total of two lime slaking trains (2 x 100%), each sized to process enough lime slurry to supply the entire plant. Each lime slaker will discharge to a lime slurry transfer tank, which is equipped with two lime slurry transfer pumps which will feed into the lime slurry storage tanks. The common lime slurry storage tanks will each be sized for 12 hours of storage for the entire plant when burning a 1.2 lb SO_2/mmBtu coal. The lime day bin, slaking trains, and lime slurry tanks are sized to provide the necessary reagent slurry to both units simultaneously. The lime slurry tanks are built with cross-ties such that either slurry tank can feed either the Unit 1 or Unit 2 FGD systems.

A total of four lime slurry feed pumps (two per unit), each sized for 100% flow to one unit, will pump the lime slurry from the storage tanks to the SDAs through one of 2 x 100% piping loops, and return unused slurry back to the lime slurry storage tank. The closed-loop reagent supply line requires a flow velocity between 4-10 fps to avoid any solids buildup in the piping. Because of this, the pumping requirement is higher than the actual SDA requirement and must be sufficiently greater than the slurry flow that is pumped into the absorbers to allow the returning flow to remain above 4 fps.

3.1.2 Absorbers

Three absorbers, each treating 33⅓% of the flue gas are provided for each unit. Depending on the supplier and the type of atomizer normally used, there may be one rotary atomizer per absorber with a shared spare (B&W), three rotary atomizers per absorber with one or more shared spares (Alstom, basis of the estimate), or multiple dual-fluid atomizers with 15% shared spares (Siemens). The cost estimate includes contingency to capture the possibility of any of these designs.

3.1.3 Baghouse

Each SDA will be paired with a pulse-jet baghouse with a gross air-to-cloth ratio of approximately 3.2-3.4 ft/min. The filter bags in each baghouse are cleaned by pulses of compressed air. The air compressors will be 4 x 33% for the station and are included in the scope of the baghouse supplier.

3.1.4 Byproduct Recycle System

The reaction byproducts from the absorbers will be collected in the baghouses and a portion of the collected material will be recycled. The baghouse hoppers will be emptied through air lock feeders and pneumatically conveyed to two recycle day bins located in the Byproduct Recycle Area and supplied by the Dry FGD System Supplier, which are common for both units. The air-lock feeders are installed without a spare. One recycle day bin is located in the recycle train for each unit. The common byproduct recycle day bins (one per unit) provide 8-hours of storage when burning 1.2 lb SO_2/mmBtu coal.

Each byproduct recycle day bin is equipped with two recycle slurry preparation systems. The byproduct in each recycle day bin is gravimetrically conveyed to one of two systems where the byproduct is slurried with water (cooling tower blowdown). The byproduct recycle slurry is stored in one of four plant wide recycle slurry tanks, two per unit (combined 4-hour storage capacity).

Two recycle water make-up tanks are located in the recycle area with a capacity of 250,000 gallons (to be supplied by the EPC Contractor). The recycled by-product slurry will be combined with fresh lime slurry for feed to the SDA atomizers. Recycle feed slurry pumps (4 x 100%, two installed per unit) will be used to transfer the recycle slurry from the recycle slurry tanks to the atomizers. In addition, all recycle feed lines are provided in a loop configuration as with the reagent system, with a complete redundant loop to allow unhindered operation due to any pluggage of pumps or feed piping.

3.2 REAGENT HANDLING SYSTEM

As part of the conceptual design, several lime delivery methods were evaluated and it was determined that rail delivery provided the best alternative for White Bluff based on ease of implementation, overall plant interface, and lowest evaluated cost (in terms of required capital investment and delivered cost of lime). Therefore, the basis of the estimate is delivery of lime via hopper-bottom railcars with truck unloading as a backup. In order to accommodate rail delivery to the site, a new rail spur will be constructed from the existing track bordering the west side of the plant. Lime trains will enter and exit the station from this spur. A trackmobile car positioner will position railcars, two at a time, in the enclosed delivery shed for unloading. The cost estimate includes the capital cost associated with railcar unloading, including the new rail spur and the renovation of the existing rail spur to handle lime delivery. A vacuum pneumatic system will unload the railcars into either of the two (2) lime storage silos. The lime storage silos will be sized for supply of reagent for 14 days of storage at full load when firing 1.2 lb SO2/mmBtu coal. Lime from the long-term storage silos will be pneumatically transferred to two lime day bins located in the Reagent Preparation Area and supplied by the Dry FGD System Supplier.

3.3 BYPRODUCT HANDLING SYSTEM

Excess FGD byproduct from the recycle system will be pneumatically conveyed to either of the two common long- term FGD byproduct storage silos. The two long-term FGD byproduct storage silos are each sized to handle the byproduct for a total of 7 days of storage when firing the 1.2 lb SO_2/mmBtu coal. The byproduct will be mixed with a small amount of fly ash and water to form a final product which contains approximately 65% FGD byproduct, 5% fly ash, and 30% water. In order to achieve this mixture, a common fly ash blending bin (7-day storage) will be located near the new byproduct silos. The feed rate of fly ash discharged from the blending bin is controlled to maintain the ratio of byproduct to fly ash. A pneumatic airslide conveyor will discharge fly ash directly into an unloading conditioner, simultaneously mixing fly ash with the proper ratios of water and FGD byproduct (discharged from the silo). The wetted byproduct/fly ash mixture is then loading into dump trucks, which will deposit the FGD byproduct in a final storage location in the landfill. A bulldozer will maintain the landfill pile. The capital cost for the silos, conveying system and byproduct/fly ash blending system is included in the cost estimate. As part of the conceptual design, the existing landfill was evaluated and was determined to have sufficient capacity to accommodate the addition of FGD byproduct. Therefore no costs were included in the capital estimate for the (existing) landfill. In addition, it was assumed that the existing haul trucks would be used to transport the FGD byproduct.

3.4 FLUE GAS HANDLING SYSTEM

The flue gas from the existing ID fans will be ducted to the absorbers. The gases from the absorbers will be ducted to the baghouses to collect the reaction by-products and residual fly ash. Two axial booster fans (2 x 50% for each unit) will be located downstream of the absorbers and baghouse; the booster ID fans can be provided by the Dry FGD System Supplier or the EPC Contractor. Due to the dry condition of the scrubbed flue gas, the existing stack and liners will be used for the retrofit case.

The existing chimney and carbon steel liners were evaluated as part of the conceptual design and were deemed to be suitable for a dry FGD application. In addition, the top 50 feet of the existing chimney liners are constructed of 316 stainless steel so an acid resistant coating on the liner is not required. However, downwash may result in acid attack and discoloration on the outer concrete shell of the chimney; it was determined that an acid resistant coating to the top 100 feet of the concrete shell is recommended; therefore, the cost estimate includes the coating of the top 100 feet of the chimney's outer concrete shell.

3.5 ELECTRICAL BOP SYSTEM

The existing auxiliary power system was evaluated as part of the conceptual design for the White Bluff dry FGD system. In order to feed the new dry FGD and other BOP equipment, significant modifications and additions to the existing power system are required. These include installation of new auxiliary transformers, medium- and low-voltage switchgear buses, motor control centers (MCCs) and upgrades to the isolated phase tap-off buses.

3.6 I&C BOP SYSTEM

As part of the conceptual design, the existing control system was evaluated to determine the required modifications necessary to implement dry FGD technology at the White Bluff station. The dry FGD system will be controlled using a new Foxboro I/A system which will integrate with the existing power block Foxboro I/A system. The control processors, I/O cabinets, and other system components will be located in the new electrical equipment building (EEB) for each unit. Two HMIs will be installed in the new EEB for each unit to provide any local controls for the lime preparation and byproduct recycle systems provided by the Dry FGD System Supplier. The baghouse will be controlled through the Allen-Bradley ControlLogix PLC and the ID booster fans will be controlled through the existing Foxboro I/A system controller(s), which are used to control boiler air and furnace pressure.

4. CAPITAL AND O&M COST ESTIMATE TECHNICAL BASIS

The following summarizes the design inputs used as the basis for the White Bluff dry FGD Systems:

- Design SO_2 inlet concentration of 1.2 lb SO_2/MMBtu for equipment design, based on the current coal contract sulfur limit.
- SO_2 inlet concentration of 0.57 lb SO_2/MMBtu for annual operating costs, based on the annual heat input weighted average emission from 2009 through 2013.
- Design SO_2 outlet concentration of 0.06 lb SO_2/MMBtu.
- Annual capacity factor of 72.1% (annual average capacity factor for White Bluff Units 1 and 2 based on historical heat input from 2009 through 2013).
- Compliance deadline of December 2020, based on a project start date of January 2015.

4.1 EPC CONTRACT PRICE

The Dry FGD System Supplier will provide all of the equipment within the FGD Island. The FGD Island will include the Reagent Preparation Equipment, Absorber Area Equipment, Baghouse Area Equipment and the Byproduct Recycle Equipment. The booster ID fans could be provided by either the Dry FGD System Supplier or the EPC Contractor; the basis of this estimate is supply of the booster fans by the Dry FGD System Supplier. The EPC Contractor will provide the remaining BOP scope in order to provide a complete and operable FGD system. In addition, the EPC Contractor will install/construct the entire system including the equipment provided by the DFGD supplier.

The scope of work for the cost estimate is broken out by area below:

1. <u>Dry FGD Island</u>
   a. Reagent Preparation System, common to both units:
      - Two lime day bins, 24-hours storage each
      - Two detention lime slakers at 100% capacity, each with a grit screen, gravimetric feeder
      - Two lime slurry transfer tanks
      - Four slurry transfer centrifugal pumps
      - Two lime slurry storage tanks
      - Four slurry feed centrifugal pumps

- Cost estimate based on budgetary proposal from Alstom; the budgetary proposal is based on a design sulfur of 2.0 lb/MMBtu, cost adjustments were included in the estimate for a lower design sulfur of 1.2 lb/MMBtu. These cost adjustments were developed by estimating the differential equipment cost for the reagent preparation and waste handling equipment. The impacted equipment is identified in Section 4.5 which discusses the sulfur design basis sensitivity.

b. Absorber Area, per unit
   - Three absorber vessels per unit, with access doors
   - Rotary atomizers, two spare atomizers included
   - Vessel material carbon steel, ¼ in. – ⅝ in. carbon steel
   - Heating and ventilation
   - Vacuum piping
   - SDA Superstructure
   - Cost estimate based on budgetary proposal from Alstom

c. Baghouse Area, per unit
   - New baghouse, including pulse jet cleaning system and all appurtenances
   - Cost estimate based on budgetary proposal from Alstom

d. Byproduct Recycle System, per unit (located remotely in common location for both units)
   - One recycle silo with bin vent filter per unit, 8-hour total capacity
   - Two recycle mix tanks per unit
   - Two recycle slurry tanks per unit, with two recycle slurry centrifugal pumps per unit
   - Agitators for each tank
   - Baghouse ash handling system common to both units
   - Rotary air-lock valves from baghouse hopper outlets to pressure pneumatic conveying system (60-degree typical)
   - Pneumatic pressure blowers (8 x 33⅓ %)
   - Cost estimate based on budgetary proposal from Alstom

e. ID Booster Fans, per unit
   - Two approximately 5,200 hp axial booster fans per unit sized to overcome pressure drop associated with FGD and baghouse
   - Includes motors - no spare motor included
   - Cost estimate based on budgetary proposal from Alstom
   - Dampers from ID fan to booster fans (cost estimated separately, not included in Alstom budgetary proposal)

f. Interconnecting Ductwork, per unit
   - ID fan outlet to absorber inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm
   - Absorber outlet to baghouse inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm
   - Baghouse outlet to new booster fans and fan outlet to the stack inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm

2. FGD Island Foundations and Enclosures

   a. Absorber tower foundations including caissons

   b. Baghouse area foundations including 18” auger cast piles 60’ long

   c. Booster fan area foundations

   d. 6” insulation with lagging for Absorbers and Baghouses (cost estimated separately, not included in Alstom budgetary proposal)

   e. Penthouse enclosure for Absorbers located in FGD Island (cost estimated separately, not included in Alstom budgetary proposal)

   f. Two elevators (one for each unit) to provide maintenance access to Absorber and Baghouse Areas

   g. Enclosure around hoppers for Baghouses located in FGD Island (cost estimated separately, not included in Alstom budgetary proposal)

   h. Lime preparation building for Reagent Preparation Area in FGD Island, 50’ x 50’ x 50’, including substructure and superstructure (cost estimated separately, not included in Alstom budgetary proposal)

   i. Byproduct recycle building for Byproduct Recycle Area in FGD Island, 60’ x 60’ x 60’, including substructure and superstructure (cost estimated separately, not included in Alstom budgetary proposal)

3. Reagent Storage and Handling, common to both units:

   a. Lime rail car unloader:
      - Lime delivery via 25-car unit train
      - System consists of mobile receiving pan and associated vacuum pneumatic equipment to unload railcar through railcar bottom hoppers
      - Enclosed railcar unloading building
      - One vacuum pneumatic system operating to unload a car
      - Pneumatic vacuum exhausters (2 x 100%)
      - Filter separator with vacuum-to-pressure transfer hopper and valves
      - One lot of pneumatic conveying piping located on an above-grade sleeper pipe rack

- Cost estimate based on vendor quote from United Conveyor Corporation (UCC) for a similar unit

b. Lime storage silos:
   - Two silos, 14-days storage and capable of storing a train load of lime, 2,400-tons storage total, including substructure and superstructure
   - 32’ diameter and 95’ height to top
   - 1,200-tons storage, each
   - Continuous level detection systems
   - Bin vent filters
   - Live bottom hopper outlets
   - Rotary airlock assemblies
   - Lime transfer systems:
     - Pressure pneumatic conveying system from lime storage silos to lime day bins
     - Pneumatic pressure blowers (3 x 100%)
     - One lot of pneumatic conveying piping located on an elevated pipe rack

c. Concrete foundations including caissons for all material silos

d. Concrete foundations for pneumatic conveying blowers and exhausters

4. Byproduct Handling System, common to both units

a. Two FGD by-product storage silos (7-day capacity each, common to both units) with bin vent filter, fluidizing system, and two unloading conditioners (one operating, one spare per silo)

b. One common fly ash blending, 7-day storage bin with bin vent filter, fluidizing system, and four pneumatic airslide conveyors

c. Water pumps and associated piping for unloading conditioners (pin mixers) at both silos

d. Compressed air system for air operated valves

e. Storage silo substructure and superstructure

f. Continuous level detection system

g. One lot pneumatic conveying piping located on an above grade pipe rack

h. Two truck scales and substructure

i. Existing road improvements for truck haulage to existing landfill

j. Cost estimate based on budgetary proposal from UCC for similar project

k. Concrete foundations including caissons for all material silos

l. Concrete foundations for pneumatic conveying blowers and exhausters

5. Flue Gas Handling BOP, per unit
   a. ID fan outlet to absorber inlet ductwork insulation; 6” with lagging6” insulation with lagging
   b. Absorber outlet to baghouse inlet ductwork insulation; 6” with lagging
   c. Baghouse outlet to new booster fans and fan outlet to the stack inlet ductwork insulation; 6” with lagging
   d. Concrete foundations for all flue gas ductwork
   e. Epoxy trowel coating on top 100 feet of outside of chimney shell

6. Civil BOP
   a. Roadwork
   b. Site grading
   c. Soil removal earthwork
   d. Excavation, backfill, and compaction for all foundations
   e. Storm sewer work
   f. Two-cell pond for wastewater storage of process water/slurry
   g. Laydown Area
      - Development of a new laydown area, approximately 10 acres, including site preparation, fencing, and temporary power. It was assumed that this area would be located on existing plant property, and does not required land to be purchased.
   h. Highway Intersection Upgrade to provide sufficient plant access for construction period
      - New Bypass Lane on Westside of Highway 365
      - New Southbound Left Turn Lane on Highway 365
      - New Northbound Merge Lane on Highway 365
      - New Northbound Right Turn Lane on Highway 365
      - Extension and upgrade of existing Contractor Haul Road (Highway 46 Spur) to Highway 365
      - Widening of the existing Main Plant Road from the Contractor Haul Road (Highway 46 Spur) to Main Guard House
      - Track crossing signal system at Haul Road (Highway 46 Spur) track crossing
   i. New warehouse building 200’ x 75’ x 15’, including substructure and superstructure.

7. Mechanical BOP System
   a. Interconnecting piping, above-ground and buried
   b. Valves for interconnecting piping, above-ground and buried
   c. Lime slaking water storage tank, 115,000-gallon capacity

d. Slaker water 3” in-line heaters, 475 kW each

e. Recycle make-up water tanks, 2 x 250,000-gallon capacity

f. Pipe Racks, common to both units
   - Between lime railcar unloading enclosure and lime silos
   - Between lime silos and lime day bins
   - From baghouse hoppers to recycle silos and FGD by-product silo
   - From lime slurry storage tanks to absorber
   - From recycle slurry storage tank to absorber
   - Concrete foundations including caissons for all pipe racks
   - Shallow concrete foundations for other miscellaneous structures

g. BOP Pumps
   - Three by-product recycle water forwarding pumps to recycle slurry, 1000 gpm @ 150’ TDH
   - Four reagent prep/recycle sump pumps, 120 gpm @ 150’ TDH
   - Two lime silo and unloading area sump pumps, 120 gpm @ 150’ TDH
   - Two by-product ash silo area sump pumps, 120 gpm @ 150’ TDH
   - Two by-product recycle make-up water tank supply pumps, 2600 gpm @ 200’ TDH
   - Two lime slaking water pumps, 750 gpm @ 100’ TDH
   - One new Low Pressure Service Water (LPSW) pump, 20,000 gpm @ 100’ TDH, including new intake structure, piping and valves
   - Two leachate pumps, 50 hp

h. Instrument Air System, common to both units
   - Air compressors; 2 x 100%, 250 scfm each @ 100 psig
   - IA dryers w/filters; 2 x 100%, 250 net scfm each
   - Air receivers; 2 x 100%
   - Instrument air piping to every silo or day bin, bin vent and reagent preparation/recycle area
   - Heat-traced piping

i. Service Air System, common to both units
   - Air compressors; 2 x 100%
   - Air receivers; 2 x 100%

j. Field painting
   - Multiple coat system used for exposed ductwork only
   - Inorganic zinc primer and polyurethane system used for steel

- Allowance for underground piping shop coatings built into piping cost

8. Demolition and Relocation
   a. Hazardous material accumulation building
   b. Ash handling maintenance building
   c. Drainage ditch
   d. Pipe trench
   e. Fabrication shop
   f. Existing contractor electrical hook up
   g. Existing drainage ditches, rerouted with new concrete trenches
   h. Relocation of ACI injection location from the air heater inlet to upstream of the DFGD
   i. Rail Yard Extension, common to both units
      - Extend rail spur to north to allow lime train to be unloaded and cars to be stored on site, designed for 136 lb rail to be consistent with existing coal spurs
   j. Fire Protection System Modifications
      - Deluge system has been included for the new transformers
      - Allowances have been included for fire protection in all of the new buildings; including piping and post indicator valves
      - The new fire protection systems will tie-in to the existing system on-site. It was assumed that the current capacity of the plant fire protections system is sufficient to accommodate the new systems; an evaluation of the current system capacity was not performed.

9. Electrical BOP System
   a. One 115-kV, 1200A isolation disconnect switch
   b. One startup transformer
   c. Two unit auxiliary transformers (UAT)
   d. Three medium-voltage (6.9-kV) switchgear buses (outdoor walk-in type)
   e. Two medium-voltage (6.9-kV) double ended switchgear per unit (total of two)
   f. Two 480-V double ended switchgear buses per unit (total of four)
   g. Six 480-V motor control centers per unit (total of twelve)
   h. Four 6.9-kV/480-V step-down transformers per unit (total of eight)
   i. Two isolated phase UAT tap bus extensions

j. Non-segregated phase bus
k. Medium-voltage cable
l. Low voltage, control and instrumentation cable, as necessary
m. Two electrical equipment buildings

10. <u>Instrumentation and Controls BOP System</u>

a. Controls System based on an estimated number of I/O points:
   - Approximately 1,000 I/O points are required for each unit's DFGD system (including reagent preparation), for a total of 2,000 I/O points the cost of which is included in Alstom budgetary proposal pricing.
   - Approximately 2,000 I/O points for the common areas at the station, located outside of the DFGD Island.

b. CEMS, per unit
   - Existing CEMS analyzers for both units will be recalibrated and recertified; if the existing CEMS analyzers cannot be recalibrated for lower SO_2 emission, new CEMS analyzers will be installed.

11. <u>Labor Costs</u>

Installation/labor costs were included in the base estimate under the direct costs. Manhours are estimated for each item in the base estimate and are based on the type of work and typical estimates for similar work. The labor costs are based on the labor wage rates and labor crews developed by S&L.

a. Labor Wage Rates

Crew labor rates were developed using prevailing craft rates, fringe benefits and state specific worker's compensation rates as published in the 2015 edition of R.S. Means Labor Rates for Pine Bluff, Arkansas area. Costs were added to cover FICA, workers compensation, all applicable taxes, small tools, incidentals, construction equipment, and contractor's overhead. A 1.15 geographic labor productivity multiplier is included based on the Compass International Construction Yearbook for Arkansas. The crew rates do not include an allowance for weather related delays.

b. Labor crews

Construction/erection labor cost is based on the use of applicable construction crews typically required for projects of this type. The construction crew costs were specifically developed for utility industry and are proprietary to S&L. The prevailing craft rates are incorporated into work crews appropriate for the activities, and include costs for small tools, construction equipment, insurance, and site overheads.

12. Other Direct and Construction Indirect Costs

In addition to the base labor costs, other construction indirect costs for the project were broken out in the estimate as well as other contractor direct costs. The following items were included as other direct and construction indirect costs.

a. Scaffolding and Consumables
b. Premiums and per diems ($10 per hour)
c. Overtime is included based on five 10-hour shifts per week work schedule
d. Freight on construction materials
e. Contractor's General & Administration Fees (included at 10% of total direct and construction indirect costs)
f. Contractor's Profit (included at 5% of total direct and construction indirect costs)

13. EPC Indirect Costs

The final contribution to the overall EPC project price are the EPC Contractor's indirect costs; these include the EPC engineering services, startup spare parts and initial fills, technical field advisors, and the EPC risk fee.

a. EPC Engineering Services

The EPC engineering services was estimated based on recent projects with similar scopes and schedules. The total cost of the EPC engineering services was estimated to be $23,000,000 without escalation.

b. Startup Spare Parts and Initial Fills

An allowance has been included for initial fills for equipment, including first fills for lubrication of any motorized equipment. The initial fill of pebble lime was not included in the EPC Contractor's scope, as this is considered to be an operating cost rather than a capital expense. The initial fill of pebble lime is included in the Owner's costs.

c. Technical Field Advisors (Vendors)

Allowances were included for equipment supplier's technical field advisory services based on an estimated 300 man-days. The estimate includes technical field advisors for the FGD system supplier (including FGD system subcontractors) and the DCS supplier.

d. EPC Risk Fee

An EPC approach provides an alternative which is expected to reduce risk for Entergy by placing the responsibility for the project on a single entity, the EPC Contractor. The EPC Risk Fee is a premium included by the contractor which accounts for the additional coordination and management of the project as well as the additional risk assumed by the contractor (See Section 2.2 for a discussion on the contracting strategy and the EPC Risk Fee). Based on S&L's experience with recent EPC projects, an EPC Risk Fee was included at 10% of the total EPC project costs.

14. Escalation

Escalation was included in the estimate based on the preliminary execution schedule at an escalation rate of 2.15% on equipment and materials and 3.35% on labor and indirects. These escalation rates were developed by S&L based on recent pricing and in-house escalation projections.

For commodities and equipment related to power plant construction, S&L tracks over 200 U.S. indices from major industrial sources such as BLS, Chemical Engineering, Handy Whitman, and Engineering News Records. S&L reviews the various indices in order to develop an overall average and then evaluates the change in the indices over the last three years and the last five years. Based on this analysis, an annual rate of 2.15%/year escalation is projected for commodities and equipment for the time frame for the project.

S&L uses RS Means as the basis for estimating labor craft rates. In order to project the escalation rate for the estimate, S&L reviewed five major craft labor types typically used in the power plant industry over the last five years using the average cost of craft labor. Based on this information, S&L projected an annual rate of 3.35%/year escalation on labor and indirects.

15. Sales Tax

Sales Tax is included in the estimate, and was applied at a rate of 8.125% on all material costs.

4.2 OVERALL PROJECT COSTS FOR CAPITAL ESTIMATE

Outside of the EPC Contractor's total cost, Entergy will incur other costs associated with the project, such as Owner's costs, services procured from third parties (including Owner's engineer, construction management support, startup and commissioning support and performance testing), and other project related costs. The following summarizes the additional project costs to Entergy associated with installing dry FGD at the White Bluff Station:

1. Owner's Costs (by Entergy)

Owner's Costs are direct costs that the Owner incurs over the life of the project. Entergy estimated the cost for the following items which would be real costs Entergy would incur based on the scope and schedule of this project:

a. Internal Labor – For all major projects, Entergy assigns internal resources to manage the project from initiation through development, contracting, installation, and commissioning. Internal labor includes personnel from several departments including Capital Project Management & Technology, Engineering, Fossil Operations, Legal, Environmental Services, Supply Chain, Risk Management, Finance, Regulatory, and the Operating Company. The internal labor is estimated based on a proposed staffing plan, developed from the project scope and preliminary schedule using average wage rates. Costs are based on the following anticipated staffing levels:

- Project Development (through EPC Award) – 25 months, equivalent of 10 people

- Project Execution (beginning at EPC Award) – 53 months, equivalent of 22 people

b. Internal Indirects – Indirect costs incurred by Entergy include a payroll allocation, materials and supplies allocation, a depreciation allocation, and capital suspense allocation. The payroll allocation includes payroll overhead costs for items such as employee benefits. The materials and supplies allocation is used to distribute the overhead costs of managing storerooms that are used to procure, track, and issue material and supplies. The depreciation allocation distributes depreciation and amortization expenses for the new assets. Capital suspense is a distribution of overhead costs associated with administrators, engineers, and supervisors and includes function specific rates and A&G (Corporate Accounting) rates.

c. Travel Expenses –Travel expenses are included to support the oversight of the project, including travel for site-visits, monthly status meetings, critical design reviews, etc. Travel expenses are estimated based on projects with similar schedules and scope.

d. Legal Services – Legal services are contracted from external law firms. These services include contract and regulatory compliance support. Entergy estimated the cost of the legal services based on recent EPC projects.

e. Builders Risk Insurance - Builder's Risk Insurance is included in the estimate and covers the materials, equipment, and labor associated with a large scale construction project in case of physical loss or damage. The estimated is based on estimated project value and schedules.

f. Initial Fills - Entergy will procure a supply contract for pebble lime to the station. Under this contract, Entergy will arrange to provide the initial fill of pebble lime to the station for startup, commissioning, and performance testing. A 120 day supply of pebble lime for both units has been included in the estimate based on the reagent pricing identified in Section 4.3.

2. Third Party Services – Construction Management Oversight

The construction management support was estimated based on the proposed staffing plan shown below, developed from the overall project scope and the preliminary schedule. It was assumed that Entergy will not have the internal support personnel required to perform this task, and therefore it will be outsourced. The cost of labor is based on present day cost, without escalation. Travel and living expenses are based on the current per diem rate for the White Bluff area of $129/day. Costs are based on the following anticipated staffing levels:

a. Home Office Support – 15 months, 1 person

b. On-Site Construction Manager – 35 months, 1 person

c. On-Site Construction Admin/Project Controls Engineer – 35 months, 1 person

d. Construction Field Engineers – 31.5 months, 2 people

The total cost of the Construction Management Support was estimated to be $4,969,000 without escalation.

3. Third Party Services – Startup and Commissioning Oversight

The startup and commissioning support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform this task, and therefore it will be outsourced. Costs are based on the following anticipated staffing levels:

a. Commissioning Support Specialists – 8 months, 2 people

The total cost of the startup and commissioning support was estimated to be $550,000 without escalation.

4. Third Party Services – Owner's Engineer

The Owner's Engineer cost includes scope as summarized below and was estimated based on the preliminary project schedule, including assumptions on manpower requirements, as well as a comparison cost to other projects with similar scope.

The cost of labor is based on present day cost, without escalation. Costs are based on the following scope for the Owner's Engineer work:

a. Conceptual Study Support
b. EPC Specification Supporting Documents
c. Project Schedule Development
d. EPC Specification Development
e. EPC Bid Evaluation and Contract Conformance
f. General Project Support
    - Monthly Project Status Meetings
    - Weekly Teleconferences
    - Overall Coordination
    - Project Administration
    - Site Visits and Travel
g. Permitting (Construction Permits and Modification to Title V and Solid Waste Permits)
h. Design Review of Drawing Submittals
i. Technical support during design, fabrication, construction, commissioning, and testing
j. Equipment vendor QA/QC audits

The total cost of the Owner's Engineer was estimated to be $6,750,000 without escalation.

5. Third Party Services – Performance testing

The cost for performance testing was developed as a factored estimate using costs from projects of similar scope. This cost includes the testing, performed by a third-party contractor hired by the Owner, and also includes the cost for S&L's assistance in the following tasks:

a. Development of the test protocol

b. Procuring the services of the testing contractor

c. Overseeing the performance test campaign

d. Evaluating the results of the testing with respect to guarantee compliance

The estimate for the third party testing contractor is based on the assumption that the contractor would be onsite for up to 3 days for each unit.

The total cost of the Performance Testing was estimated to be $275,000 without escalation.

6. Project Contingency

Project contingency is included in the estimate to cover the uncertainty associated with the project costs, and was developed utilizing Entergy's procedure for developing a project's contingency. The process includes developing three components of contingency:

a. Risk Contingency: This category of contingency is developed with the use of a Risk Register that is used to identify risks that may impact the project. Each risk in the Risk Register is analyzed to determine the probability of the risk and the impacts of the risk to the project.

b. Estimate Uncertainty: This category of contingency uses the estimate accuracy classifications to develop an appropriate level of contingency. Entergy has adopted expected accuracy ranges for estimates with upper and lower boundaries for each class of costs estimate. These ranges recognize the uncertainty that exists in the technical engineering and project management deliverables that define scope.

c. Unknown/Emergent Risks: This category of contingency is used to account for any issues that arise during the project that are not contained within the risk register or to cover any costs associated with unanticipated changes in project scope.

A cost qualitative risk assessment (QRA) was performed using Palisade Corporation's @RISK software. QRAs are used to validate the reasonableness of cost estimates, provide confidence for cost projections, and help establish a reasonable level of contingency based on risk-weighted estimates and project risk profiles. The QRA identifies various confidence levels that the contingency amount is sufficient for the project. For this estimate's cost QRA, an 80% confidence level was selected which means the project is 80% likely to be completed at or below the calculated value. The 80% confidence level results in a contingency value of 15% of the total project cost before escalation and IDC. This level of contingency is within Entergy's guidelines for target contingency range for this class of estimate. The contingency estimate is included in Attachment 8.

7. Escalation on Owner's Costs

Escalation was included in the estimate at an escalation rate 3.35% on the Owner's costs. This escalation rate is based on the rate developed by S&L for labor and indirects above.

8. Interest During Construction

Interest during construction (IDC) accounts for the time value of money associated with the distribution of construction cash flows over the construction period. IDC was applied to the total EPC project costs including contingency. The IDC was calculated based on the milestone payment schedule included in Attachment 4 and a typical interest rate of 7.0% per year which was assumed based on a low interest market environment.

4.3 VARIABLE OPERATING AND MAINTENANCE COSTS

The following unit costs were used to develop the variable Operating and Maintenance (O&M) costs. All of these values, with the exception of the reagent costs, were provided by Entergy and are consistent with typical industry values. The reagent costs are based on recent supplier quotes received for White Bluff.

Table 4-1: Unit Pricing for Utilities (Provided by Entergy)

Unit Cost	Units	Value
Pebble Lime	$/ton	$130.0
High Quality Water	$/1000 gal	$2.00
Low Quality Water	$/1000 gal	$0.53
Byproduct Disposal	$/ton	$7.50
Aux Power Cost[1]	$/MWh	$43.35

Note 1: Entergy provided auxiliary power costs for the first year of operation.

Table 4-2 below summarizes the consumption rates estimated as well as the first year variable O&M costs for the Dry FGD system.

Table 4-2: Variable O&M Rates and First Year Costs, per Unit

	Units	Value
Dry FGD System Parameters		
Reagent Consumption	lb/hr	5,900
Byproduct Waste Production	lb/hr	13,000
Aux Power Consumption	kW	11,000
High Quality Water Consumption	gpm	65
Low Quality Water Consumption	gpm	775
First Year[1] Variable O&M Costs (@CF[2])		
Reagent Cost	$/year	$2,422,000
Byproduct Waste Disposal Cost	$/year	$308,000
Aux Power Cost	$/year	$3,012,000
Water Cost	$/year	$205,000
Bag and Cage Replacement Cost	$/year	$372,000
Total First Year Variable O&M Cost	**$/year**	**$6,319,000**

Note 1: First year costs are provided in $2015.

Note 2: The first year costs are calculated using an annual capacity factor of 72.1%.

4.4 FIXED OPERATING AND MAINTENANCE COSTS

The fixed O&M costs for the systems consist of operating personnel as well as maintenance costs (including material and labor). Based on the conceptual design for the dry FGD system, the estimated staffing additions are 28 personnel for two systems on adjacent units.

The annual maintenance costs are estimated as a percentage of the total capital equipment cost, based on the amount of operating equipment which will require routine maintenance. For this evaluation, the maintenance costs (maintenance and labor) were estimated to be approximately 1.3% of the project capital. This is a lower value than typical because items such as track work and civil work are high capital cost items with little to no maintenance.

Table 4-3 below summarizes the first year fixed O&M costs for the design and typical cases.

Table 4-3: First Year Fixed O&M Costs for Dry FGD, per Unit

First Year[1] Fixed O&M Costs	Units	Value
Operating Labor[2]	$/year	$1,660,000
Maintenance Material	$/year	$975,000
Maintenance Labor	$/year	$650,000
Total First Year Fixed O&M Cost	**$/year**	**$3,285,000**

Note 1: First year costs are provided in $2015.

Note 2: Operating labor costs are based on a labor rate of $56.95, which was provided by Entergy.

Note 3: Installation of systems on both units would require 28 operators total. For accounting purposes, this is considered 14 operators per unit.

4.5 SULFUR DESIGN BASIS SENSITIVITY

The average sulfur content of coal received at the White Bluff station is 0.57 lb SO_2/MMBtu; however, the White Bluff station has the ability to receive coal with sulfur content up to 1.2 lb SO_2/MMBtu. In order to provide a system which is capable of meeting the design SO_2 emission rate on a continuous basis through the range of coals delivered to site, the FGD equipment must be designed for the maximum coal sulfur which could be burned in the units.

S&L evaluated the incremental cost impact of designing the FGD system for an inlet sulfur of 1.2 lb SO_2/MMBtu versus a lower inlet sulfur of 0.57 lb SO_2/MMBtu. It is important to note that the majority of the components within the FGD Island are designed to accommodate the maximum volumetric flue gas flowrate from the unit. The size and cost of these components, primarily the absorber vessels, baghouses, and ID fans, remains the same regardless of the inlet design sulfur. In addition, the majority of the BOP scope items which have been included in the capital cost estimate would remain constant regardless of the inlet design sulfur.

The primary equipment which is impacted by the design inlet sulfur would be the reagent handling, reagent preparation, and the waste handling systems. The inlet sulfur has a direct impact on the quantity of SO_2 which is being removed in the FGD system, and therefore a direct impact on the required lime (reagent) consumption rate as well as the quantity of byproduct produced. The following areas and associated equipment are impacted by adjusting the design inlet sulfur:

a. Reagent Storage and Handling System:
   - Two long-term storage silos
b. Reagent Preparation System (FGD Island):
   - Two lime day bins
   - Two detention lime slakers
   - Two lime slurry storage tanks
c. By-product Handling System:
   - Two FGD by-product storage silos

The quantity of byproduct which is recycled through the system to achieve the required performance will remain relatively constant regardless of inlet design sulfur and is therefore not impacted. In addition, the lime slurry and byproduct recycle are continuously circulated in a loop to the units and back to the storage tanks; therefore, a variation in the design sulfur would not significantly impact the sizing of the recycle storage equipment, pumps or piping systems.

The cost differential was determined by vendor quotes who were requested to provide equipment costs for design capacities at each of the design sulfur levels; this is the same approach used to adjust the Alstom budgetary proposal from a design sulfur of 2.0 lb/MMBtu to 1.2 lb/MMBtu for the cost estimate. The following table summarizes the cost differential for the equipment identified above that is impacted by the sulfur design basis:

Equipment	Design Capacity @ 1.2 lb/MMBtu	Design Capacity @ 0.57 lb/MMBtu	Cost Reduction for 1.2 to 0.57 lb/MMBtu[1]
Two long-term storage silos	2,200 tons each	1,000 tons each	- $4,717,000
Two lime day bins	650 tons each	300 tons each	- $321,000
Two detention lime slakers	13 tons/hour each	6 tons/hour each	- $134,000
Two lime slurry storage tanks	2,000 tons each	1,000 tons each	- $472,000

Two FGD by-product storage silos	3,000 tons each	1,200 tons each	- $3,391,000
One lime slaking water storage tank	175,000 gallons	100,000 gallons	-$34,000
		TOTAL Differential	**- $9,069,000**

Note 1: Cost Reduction shows the reduction in direct installed capital cost including reductions associated with BOP, i.e. reduced foundation sizes.

The reduction in the total direct installed costs associated with reducing the design sulfur level from 1.2 lb SO_2/MMBtu to 0.57 lb SO_2/MMBtu is approximately $9M.

5. SUMMARY

The cost estimate for the White Bluff Units 1&2 Dry FGD systems is based on the addition of two SDA FGD systems for SO_2 removal. The attached capital estimate for the White Bluff Dry FGD system is based on this technical basis.

6. ATTACHMENTS

1. White Bluff DFGD Project Units 1 and 2 Conceptual Capital Cost Estimate, Sargent & Lundy Estimate No. 33387A

2. White Bluff DFGD Project Units 1 and 2 Conceptual Cost Estimate Cash Flow, Sargent & Lundy Estimate No. 33387A

3. White Bluff DFGD Project Units 1 and 2 Level 1 Preliminary Execution Schedule

4. Monthly Progress Payment Schedule for White Bluff DFGD Project

5. S&L Estimating Documentation: Indirects and Construction Equipment included in Crew Rates

6. S&L Estimating Documentation: Escalation Projections

7. White Bluff DFGD Project Units 1 and 2 Conceptual General Arrangement Drawing

8. Entergy Basis of Contingency

ATTACHMENT 1

Conceptual Capital Cost Estimate

ENTERGY ARKANSAS
WHITE BLUFF STATION SDA EPC
CONCEPTUAL COST ESTIMATE

Estimator	A. KOCI
Labor rate table	15ARPBL
Project No.	13027-002
Client	ENTERGY ARKANSAS
Station Name	WHITE BLUFF
Unit	1 & 2
Estimate Date	12/18/2015
Reviewed By	BA
Approved By	MNO
Estimate No.	33387B
Cost index	ARPBL

Estimate Totals

Description	Amount	Totals	Hours
Direct Costs:			
Labor	83,083,008		1,085,764
Material	50,642,339		
Subcontract	313,285,100		
Process Equipment	23,037,000		
	470,047,447	**470,047,447**	
Other Direct & Construction Indirect Costs:			
91-1 Scaffolding	5,816,000		
91-2 Cost Due To OT 5-10's	11,616,000		
91-4 Per Diem	10,858,000		
91-5 Consumables	831,553		
91-6 Freight on Material	2,532,000		
91-8 Sales Tax	7,821,000		
91-9 Contractors G&A	16,696,000		
91-10 Contractors Profit	8,348,000		
	64,518,553	**534,566,000**	
Indirect Costs:			
93-1 Engineering Services	23,000,000		
93-4 SU/S Parts/ Initial Fills	300,000		
93-5 Technical Field Advisors	600,000		
93-8 EPC Fee	55,847,000		
	79,747,000	**614,313,000**	
Escalation:			
96-1 Escalation on Material	6,012,000		
96-2 Escalation on Labor	18,769,000		
96-3 Escalation on Subcontract	37,429,000		
96-4 Escalation on Process Eq	2,115,000		
96-5 Escalation on Indirects	11,600,000		
	75,925,000	**690,238,000**	
Total EPC Cost		***690,238,000***	
Owner's Costs:			
99-1 Owner's Costs	58,546,000		
	58,546,000	**748,784,000**	
Third Party Services:			
100 CM Oversight	4,969,000		
102 Start-up Oversight	550,000		
103 Owner's Engineer	6,750,000		
104 Performance Testing	275,000		
	12,544,000	**761,328,000**	
Project Contingency :			
110 Project Contingency	102,810,000		
	102,810,000	**864,138,000**	
Escalation Addition:			
120 Escalation on Lines 99-110	2,273,000		
	2,273,000	**866,411,000**	
Interest During Construction:			
130 Interest During Constr.	125,078,000		
	125,078,000	**991,489,000**	
Total		***991,489,000***	

ENTERGY ARKANSAS
WHITE BLUFF STATION SDA EPC
CONCEPTUAL COST ESTIMATE

Area	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Total Cost
10	FGD ISLAND	297,904,000	(1,649,000)		-7,814	(680,533)	295,574,467
101	FGD ISLAND FOUNDATIONS AND ENCLOSURES			14,838,628	254,893	18,939,033	33,777,661
102	REAGENT HANDLING SYSTEM	6,000,000	2,046,000	3,162,954	59,192	4,646,650	15,855,604
105	BYPRODUCT HANDLING SYSTEM	7,713,100	6,872,000	1,089,675	107,800	7,935,771	23,610,546
111	FLUE GAS SYSTEM			3,267,828	113,961	7,898,036	11,165,864
121	CIVIL BOP	570,000		8,073,474	106,878	11,535,049	20,178,523
151	MECHANICAL BOP	998,000	1,969,000	6,882,913	115,659	9,189,021	19,038,934
190	DEMOLITION / RELOCATION	100,000		1,578,182	33,735	2,546,302	4,224,484
201	ELECTRICAL BOP SYSTEM		12,299,000	10,665,684	290,576	20,231,688	43,196,372
211	INSTRUMENTATION AND CONTROLS BOP SYSTEM		1,500,000	1,083,000	10,884	841,993	3,424,993
	TOTAL DIRECT	**313,285,100**	**23,037,000**	**50,642,339**	**1,085,764**	**83,083,008**	**470,047,447**

Note: Negative costs included in the cost estimate are due to adjustments to the FGD Budgetary Proposal which was based on a design sulfur of 2.0 lb/MMBTU. Cost adjustments are included to adjust the design sulfur basis to 1.2 lb/MMBTU.

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
10			**FGD ISLAND**									
	23.00.00		**STEEL**									
		23.13.75	**SILO**									
			SILO - LIME DAY BINS 650 TONS - EQUIPMENT ONLY	CREDIT FOR REDUCTION FROM 1200 TONS	-2.00 LS		(273,000)			73.12 /MH		(273,000)
			SILO - LIME DAY BINS 650 TONS - LABOR ONLY	CREDIT FOR REDUCTION FROM 1200 TONS	-2.00 LS				-690	73.12 /MH	(50,428)	(50,428)
			SILO				**(273,000)**		**-690**		**(50,428)**	**(323,428)**
			STEEL				**(273,000)**		**-690**		**(50,428)**	**(323,428)**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.45.00	**FGD EQUIPMENT**									
			DRY FGD -UNITS 1 & 2 FGD ISLAND - EQUIPMENT	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	152,030,000		-		97.28 /MH		152,030,000
			DRY FGD -UNITS 1 & 2 FGD ISLAND - INSTALLATION COST	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	145,874,000		-		97.28 /MH		145,874,000
			DRY FGD - INLUDES ABSORBERS	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES BAGHOUSES	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES REGEANT PREP EQUIPMENT FROM DAY SILOS	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES BYPRODUCT RECYCLE PREPARATION EQUIPMENT	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES ID BOOSTER FANS	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES PROCESS INSTRUMENTATION AND DCS	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES INTERCONNECTING WIRING, PIPING ETC... WITHIN FGD ISLAND	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES DUCTWORK FROM INLET FLANGE TO OUTLET BOOSTER FAN FLANGE	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			FLOW MODEL	INCLUDED WITH ALSTOM PROPOSAL	1.00 LT	-		-		/MH		
			REAGENT PREPARATION - LIME SLURRY FEED TANKS - EQUIPMENT ONLY	REDUCTION IN SIZE TO 2000 TON FROM 3900 TONS BASED ON ALSTOM SDA BUDGETARY PROPOSAL 8/2013	-2.00 LT	-	(1,300,000)	-		90.81 /MH		(1,300,000)
			REAGENT PREPARATION - LIME SLURRY FEED TANKS - LABOR	REDUCTION IN SIZE TO 2000 TON FROM 3900 TONS BASED ON ALSTOM SDA BUDGETARY PROPOSAL 8/2013	-2.00 LT	-		-	-6,370	90.81 /MH	(578,470)	(578,470)
			FGD EQUIPMENT			**297,904,000**	**(1,300,000)**		**-6,370**		**(578,470)**	**296,025,530**
			MECHANICAL EQUIPMENT			**297,904,000**	**(1,300,000)**		**-6,370**		**(578,470)**	**296,025,530**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.14.00	**MATERIAL HANDLING EQUIPMENT**									
			MATERIAL HANDLING SYSTEM - LIME SLAKING TRAIN - REDUCTION FROM 25 TPH TO 13 TPH - EQUIPMENT ONLY	CREDIT BASED ON ALSTOM SDA BUDGETARY PROPOSAL 8/2013	-2.00 EA	-	(76,000)	-		68.48 /MH		(76,000)
			MATERIAL HANDLING SYSTEM - LIME SLAKING TRAIN - REDUCTION FROM 25 TPH TO 13 TPH - LABOR ONLY	CREDIT BASED ON ALSTOM SDA BUDGETARY PROPOSAL 8/2013	-2.00 EA	-		-	-754	68.48 /MH	(51,635)	(51,635)
			MATERIAL HANDLING EQUIPMENT				**(76,000)**		**-754**		**(51,635)**	**(127,635)**
			MATERIAL HANDLING EQUIPMENT				**(76,000)**		**-754**		**(51,635)**	**(127,635)**
			10 FGD ISLAND			**297,904,000**	**(1,649,000)**		**-7,814**		**(680,533)**	**295,574,467**
101			**FGD ISLAND FOUNDATIONS AND ENCLOSURES**									
	21.00.00		**CIVIL WORK**									
		21.53.00	**PILING**									
			PILE - 18" AUGER CAST X 60' LONG	UNIT 1 BAGHOUSE FDN	252.00 EA	-	-	480,816	6,662	108.46 /MH	722,568	1,203,384
			PILE - 18" AUGER CAST X 60' LONG	UNIT 2 BAGHOUSE FDN	252.00 EA	-	-	480,816	6,662	108.46 /MH	722,568	1,203,384
			PILING					**961,632**	**13,324**		**1,445,136**	**2,406,768**
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	ABSORBER TOWERS FOUNDATIONS	180.00 EA	-	-	334,260	4,552	108.46 /MH	493,680	827,940
			2.5 FT DIA X 30 FT DEEP CAISSON	ABSORBER TOWERS FOUNDATIONS	180.00 EA	-	-	334,260	4,552	108.46 /MH	493,680	827,940
			2.5 FT DIA X 30 FT DEEP CAISSON	REAGENT PREP ENCLOSURE 50'X50' SUBSTRUCTURE	50.00 EA	-	-	92,850	1,264	108.46 /MH	137,133	229,983
			2.5 FT DIA X 30 FT DEEP CAISSON	BYPRODUCTS RECYCLE EQUIPMENT BLDG 60' X 60' SUBSTRUCTURE	72.00 EA	-	-	133,704	1,821	108.46 /MH	197,472	331,176
			2.5 FT DIA X 30 FT DEEP CAISSON	UNIT 1 BOOSTER FAN FOUNDATION	40.00 EA	-	-	74,280	1,011	108.46 /MH	109,707	183,987
			2.5 FT DIA X 30 FT DEEP CAISSON	UNIT 2 BOOSTER FAN FOUNDATION	40.00 EA	-	-	74,280	1,011	108.46 /MH	109,707	183,987
			CAISSON					**1,043,634**	**14,211**		**1,541,379**	**2,585,013**

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CIVIL WORK					**2,005,266**	**27,536**		**2,986,515**	**4,991,781**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	REAGENT PREP ENCLOSURE 50'X50' SUBSTRUCTURE	300.00 CY	-	-	69,000	2,414	59.71 /MH	144,128	213,128
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	BYPRODUCTS RECYCLE EQUIPMENT BLDG 60' X 60' SUBSTRUCTURE	432.00 CY	-	-	99,360	3,476	59.71 /MH	207,544	306,904
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	UNIT 1 BOOSTER FAN FOUNDATION	600.00 CY	-	-	138,000	4,828	59.71 /MH	288,255	426,255
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	UNIT 2 BOOSTER FAN FOUNDATION	600.00 CY	-	-	138,000	4,828	59.71 /MH	288,255	426,255
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ABSORBER TOWER FOUNDATION	1,300.00 CY	-	-	299,000	10,460	59.71 /MH	624,553	923,553
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ABSORBER TOWERS FOUNDATIONS	1,300.00 CY	-	-	299,000	10,460	59.71 /MH	624,553	923,553
			CONCRETE FOUNDATIONS - COMPOSITE RATE	LIME SLURRY FEED TANKS	400.00 CY	-	-	92,000	3,218	59.71 /MH	192,170	284,170
			CONCRETE FOUNDATIONS - COMPOSITE RATE	UNIT 1 BAGHOUSE FDN 3 FDNS 83'X63'X3'	1,743.00 CY	-	-	400,890	14,024	59.71 /MH	837,381	1,238,271
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' UNIT 1 BAGHOUSE AREA, COMPRESSOR BLDG	6.00 CY	-	-	1,380	48	59.71 /MH	2,883	4,263
			CONCRETE FOUNDATIONS - COMPOSITE RATE	UNIT 2 BAGHOUSE FDN 3 FDNS 83'X63'X3'	1,743.00 CY	-	-	400,890	14,024	59.71 /MH	837,381	1,238,271
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' UNIT 2 BAGHOUSE AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	59.71 /MH	2,883	4,263
			CONCRETE					**1,938,900**	**67,828**		**4,049,985**	**5,988,885**
			CONCRETE					**1,938,900**	**67,828**		**4,049,985**	**5,988,885**
	23.00.00		**STEEL**									
		23.17.00	**GALLERY**									
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	4,000.00 SF	-	-	60,000	460	66.07 /MH	30,377	90,377
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	BYPRODUCTS RECYCLE EQUIPMENT BLDG	5,760.00 SF	-	-	86,400	662	66.07 /MH	43,743	130,143
			3" HEAVY DUTY GRATING	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	200.00 SF	-	-	11,200	39	66.07 /MH	2,582	13,782
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	3,000.00 LF	-	-	159,000	621	66.07 /MH	41,009	200,009
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	4,320.00 LF	-	-	228,960	894	66.07 /MH	59,053	288,013
			SELF CLOSING SWING GATE - USER DEFINED	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	40.00 EA	-	-	11,200	184	66.07 /MH	12,151	23,351
			SELF CLOSING SWING GATE - USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	58.00 EA	-	-	16,240	267	66.07 /MH	17,619	33,859
			LADDER	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	800.00 LF	-	-	40,000	368	66.07 /MH	24,302	64,302
			LADDER	BYPRODUCTS RECYCLE EQUIPMENT BLDG	1,100.00 LF	-	-	55,000	506	66.07 /MH	33,415	88,415
			STAIR SYSTEM	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	2,400.00 SF	-	-	218,400	3,172	66.07 /MH	209,601	428,001
			STAIR SYSTEM	BYPRODUCTS RECYCLE EQUIPMENT BLDG	3,500.00 SF	-	-	318,500	4,626	66.07 /MH	305,669	624,169
			GALLERY					**1,204,900**	**11,798**		**779,520**	**1,984,420**
		23.25.00	**ROLLED SHAPE**									
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	REAGENT PREP ENCLOSURE 50'X50' GALLERY SUPPORT	200.00 TN	-	-	716,000	5,057	92.62 /MH	468,423	1,184,423
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	BYPRODUCTS RECYCLE EQUIPMENT BLDG	288.00 TN	-	-	1,031,040	7,283	92.62 /MH	674,529	1,705,569
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	U1 BAGHOUSE SKIRTS STEEL GIRTS	36.00 TN	-	-	138,240	910	92.62 /MH	84,316	222,556
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	U2 BAGHOUSE SKIRTS STEEL GIRTS	36.00 TN	-	-	138,240	910	92.62 /MH	84,316	222,556
			BUILDING MIX, TWO COAT PAINTED		50.00 TN	-	-	128,000	920	92.62 /MH	85,168	213,168
			BUILDING MIX, TWO COAT PAINTED		50.00 TN	-	-	128,000	920	92.62 /MH	85,168	213,168
			BUILDING MIX, TWO COAT PAINTED	REAGENT PREP ENCLOSURE SUPERSTRUCTURE	500.00 TN	-	-	1,280,000	9,195	92.62 /MH	851,678	2,131,678
			BUILDING MIX, TWO COAT PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	720.00 TN	-	-	1,843,200	13,241	92.62 /MH	1,226,417	3,069,617
			ROLLED SHAPE					**5,402,720**	**38,437**		**3,560,015**	**8,962,735**
			STEEL					**6,607,620**	**50,235**		**4,339,534**	**10,947,154**
	24.00.00		**ARCHITECTURAL**									
		24.17.00	**ELEVATOR**									
			PASSENGER, TRACTION, 4 STOPS, 3500LB, 350 FT/MIN	SCHINDLER ELEVATOR BUDGET	1.00 LS	-	-	159,350	943	106.04 /MH	99,946	259,296
			PASSENGER, TRACTION, 4 STOPS, 3500LB, 350 FT/MIN	SCHINDLER ELEVATOR BUDGET	1.00 LS	-	-	159,350	943	106.04 /MH	99,946	259,296

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			ELEVATOR					**318,700**	**1,885**		**199,892**	**518,592**
		24.35.00	**PRE-ENGINEERED BUILDING**									
			PRE-ENGINEERED BUILDING	8' X 10' UNIT 1 BAGHOUSE AREA, COMPRESSOR BLDG	1.00 LT	-	-	20,000	115	92.62 /MH	10,646	30,646
			PRE-ENGINEERED BUILDING	8' X 10' UNIT 2 BAGHOUSE AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	92.62 /MH	10,646	20,646
			PRE-ENGINEERED BUILDING					**30,000**	**230**		**21,292**	**51,292**
		24.37.00	**ROOFING**									
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	U1 SDA TOP ENCLOSURE ROOF	3,318.00 SF	-	-	54,946	339	35.02 /MH	11,887	66,833
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	U2 SDA TOP ENCLOSURE ROOF	3,318.00 SF	-	-	54,946	339	35.02 /MH	11,887	66,833
			METAL, INSULATED- USER DEFINED	REAGENT PREP ENCLOSURE SUPERSTRUCTURE	2,500.00 SF	-	-	19,425	862	35.02 /MH	30,190	49,615
			METAL, INSULATED- USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	3,600.00 SF	-	-	27,972	1,241	35.02 /MH	43,473	71,445
			ROOFING					**157,289**	**2,782**		**97,436**	**254,725**
		24.41.00	**SIDING**									
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	U1 SDA TOP ENCLOSURE SIDING	2,450.00 SF	-	-	40,572	251	79.59 /MH	19,948	60,520
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	U2 SDA TOP ENCLOSURE SIDING	2,450.00 SF	-	-	40,572	251	79.59 /MH	19,948	60,520
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	REAGENT PREP ENCLOSURE	10,000.00 SF	-	-	165,600	1,023	79.59 /MH	81,420	247,020
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	14,400.00 SF	-	-	238,464	1,473	79.59 /MH	117,244	355,708
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	U1 BAGHOUSE SKIRTS 6x(83'+63) x30' tall '	26,260.00 SF	-	-	85,345	1,238	79.59 /MH	98,496	183,841
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	U2 BAGHOUSE SKIRTS 6x(83'+63) x30' tall '	26,280.00 SF	-	-	85,410	1,238	79.59 /MH	98,571	183,981
			SIDING					**655,963**	**5,473**		**435,626**	**1,091,589**
		24.99.00	**ARCHITECTURAL, MISCELLANEOUS**									
			PENTHOUSE HEATING	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	64.10 /MH	4,715	68,715
			PENTHOUSE LIGHTING	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	82.05 /MH	6,036	70,036
			PENTHOUSE FIRE PROTECTION	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	32,000	37	82.05 /MH	3,018	35,018
			PENTHOUSE HEATING	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	64.10 /MH	4,715	68,715
			PENTHOUSE LIGHTING	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	82.05 /MH	6,036	70,036
			PENTHOUSE FIRE PROTECTION	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	32,000	37	82.05 /MH	3,018	35,018
			ARCHITECTURAL, MISCELLANEOUS - USER DEFINED	U1 BAGHOUSE SKIRTS MANDOORS	3.00 EA	-	-	1,500	28	51.10 /MH	1,410	2,910
			ARCHITECTURAL, MISCELLANEOUS - USER DEFINED	U2 BAGHOUSE SKIRTS MANDOORS	3.00 EA	-	-	1,500	28	51.10 /MH	1,410	2,910
			ARCHITECTURAL, MISCELLANEOUS					**323,000**	**423**		**30,358**	**353,358**
			ARCHITECTURAL					**1,484,952**	**10,794**		**784,604**	**2,269,556**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.41.00	**FIRE PROTECTION EQUIPMENT & SYSTEM**									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	REAGENT PREP ENCLOSURE 50'X50' FIRE PROTECTION ALLOWANCE	5,000.00 SF	-	-	27,500	385	68.48 /MH	26,369	53,869
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG' FIRE PROTECTION ALLOWANCE	10,800.00 SF	-	-	59,400	832	68.48 /MH	56,956	116,356
			FIRE PROTECTION EQUIPMENT & SYSTEM					**86,900**	**1,217**		**83,325**	**170,225**
		31.83.00	**TANK**									
			TANK - MOVE OIL TANK FROM USED OIL SHED AND REINSTALL AT WASTE MANAGEMENT FACILITY	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	1.00 EA	-	-	-	345	90.81 /MH	31,314	31,314
			TANK						**345**		**31,314**	**31,314**
			MECHANICAL EQUIPMENT					**86,900**	**1,562**		**114,639**	**201,539**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	REAGENT PREP ENCLOSURE 50'X50' LIGHTING ALLOWANCE	5,000.00 SF	-	-	55,000	57	64.10 /MH	3,684	58,684
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	BYPRODUCTS RECYCLE EQUIPMENT BLDG LIGHTING ALLOWANCE	10,800.00 SF	-	-	118,800	124	64.10 /MH	7,957	126,757
			HVAC, MISCELLANEOUS					**173,800**	**182**		**11,641**	**185,441**
			HVAC					**173,800**	**182**		**11,641**	**185,441**
	36.00.00		**INSULATION**									
		36.13.00	**DUCT**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		36.13.00	**DUCT**									
			MINERAL WOOL INSULATION, 4 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	U1 BAGHOUSE INSUILATION TOP, SIDES AND HOPPERS	141,831.00 SF	-	-	850,986	35,050	68.76 /MH	2,410,051	3,261,037
			MINERAL WOOL INSULATION, 4 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	U2 BAGHOUSE INSULATIOIN - TOPS, SIDES AND HOPPERS	141,831.00 SF	-	-	850,986	35,050	68.76 /MH	2,410,051	3,261,037
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA SHELL INSULATION	40,167.00 SF	-	-	261,086	10,388	68.76 /MH	714,280	975,366
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA ROOF INSULATION	11,019.00 SF	-	-	71,624	2,850	68.76 /MH	195,948	267,572
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA SHELL INSULATION	40,167.00 SF	-	-	261,086	10,388	68.76 /MH	714,280	975,366
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA ROOF INSULATION	11,019.00 SF	-	-	71,624	2,850	68.76 /MH	195,948	267,572
			DUCT					**2,367,390**	**96,576**		**6,640,559**	**9,007,949**
			INSULATION					**2,367,390**	**96,576**		**6,640,559**	**9,007,949**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.37.00	**LIGHTING ACCESSORY (FIXTURE)**									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	REAGENT PREP ENCLOSURE 50'X50' LIGHTING ALLOWANCE	5,000.00 SF	-	-	55,000	57	63.63 /MH	3,657	58,657
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	BYPRODUCTS RECYCLE EQUIPMENT BLDG LIGHTING ALLOWANCE	10,800.00 SF	-	-	118,800	124	63.63 /MH	7,899	126,699
			LIGHTING ACCESSORY (FIXTURE)					**173,800**	**182**		**11,556**	**185,356**
			ELECTRICAL EQUIPMENT					**173,800**	**182**		**11,556**	**185,356**
			101 FGD ISLAND FOUNDATIONS AND ENCLOSURES					**14,838,628**	**254,893**		**18,939,033**	**33,777,661**
102			**REAGENT HANDLING SYSTEM**									
	21.00.00		**CIVIL WORK**									
		21.53.00	**PILING**									
			PILE - 18" AUGER CAST X 60' LONG	UNLOADING SHED 200' X 75 WIDE	63.00 EA	-	-	120,204	1,666	108.46 /MH	180,642	300,846
			PILING					**120,204**	**1,666**		**180,642**	**300,846**
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	SUBSTRUCTURE 2200 TON LIME STORAGE SILOS	100.00 EA	-	-	185,700	2,529	108.46 /MH	274,267	459,967
			CAISSON					**185,700**	**2,529**		**274,267**	**459,967**
		21.71.00	**TRACKWORK**									
			RAIL, TIE & BALLAST - 136 LB/YD	REAGENT HANDLING SYSTEM UPGRADE AND EXTEND LIME RAIL TRACK TO AVOID BLOCKING ACCESS BY 150 CAR COAL TRAINS	9,060.00 TF	-	-	1,540,200	15,621	81.27 /MH	1,269,493	2,809,693
			TRACKWORK - EXTEND LIME RAIL SPUR AND RELOCATE SWITCH 2060 FT	RELOCATE COAL TRACK SWITCH TO WEST TO AVOID INTERFERENCE WITH 150 CAR COAL TRAINS	1.00 LS	-	-	374,000	7,989	81.27 /MH	649,226	1,023,226
			TRACKWORK					**1,914,200**	**23,609**		**1,918,719**	**3,832,919**
			CIVIL WORK					**2,220,104**	**27,803**		**2,373,628**	**4,593,732**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	SUBSTRUCTURE 2-2200 TON LIME STORAGE SILOS	600.00 CY	-	-	138,000	4,828	59.71 /MH	288,255	426,255
			FOUNDATION, 4500 PSI - COMPOSITE RATE	UNLOADING SHED 200' X 75 WIDE	925.00 CY	-	-	212,750	7,443	59.71 /MH	444,393	657,143
			CONCRETE					**350,750**	**12,270**		**732,649**	**1,083,399**
			CONCRETE					**350,750**	**12,270**		**732,649**	**1,083,399**
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	UNLOADING SHED 200' X 75 WIDE x15' TALL	15,000.00 SF	-	-	525,000	4,828	92.62 /MH	447,131	972,131
			PRE-ENGINEERED BUILDING					**525,000**	**4,828**		**447,131**	**972,131**
			ARCHITECTURAL					**525,000**	**4,828**		**447,131**	**972,131**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - 2200 TON LIME STORAGE SILO	ERECTED - 46' DIA X 154' TALL EA - OPTION 2	2.00 LS	6,000,000				59.71 /MH		6,000,000

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO			**6,000,000**			**0**			**6,000,000**
			MISCELLANEOUS STRUCTURAL ITEM			**6,000,000**			**0**			**6,000,000**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.25.00	**CRANES & HOISTS**									
			CRANES & HOISTS - & TROLLEYS ALLOWANCE	REAGENT HANDLING SYSTEM	1.00 LT	-	275,000	-		68.48 /MH		275,000
			CRANES & HOISTS				**275,000**					**275,000**
			MECHANICAL EQUIPMENT				**275,000**					**275,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.14.00	**MATERIAL HANDLING EQUIPMENT**									
			LIME HANDLING SYSTEM - 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM		1.00 LS	-	500,000	-	3,306	68.48 /MH	226,378	726,378
			LIME HANDLING SYSTEM - VACUUM EXHAUSTER WITH SOUND ENCLOSURES	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	2.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - RECEIVING PANS UNDER RAIL CARS	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - FILTER SEPARATORS ON TOP OF SILO	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - 25 TPH PNEUMATIC TRANSPORT SYSTEM		1.00 LS	-	500,000	-	3,306	68.48 /MH	226,378	726,378
			LIME HANDLING SYSTEM - PRESSURE BLOWERS WITH SOUND ENCLOSURES	INCLUDED WITH 25 TPH PNEUMATIC TRANSPORT SYSTEM	3.00 LS	-		-		/MH		
			LIME HANDLING SYSTEM - PRESSURE FEEDERS	INCLUDED WITH 25 TPH PNEUMATIC TRANSPORT SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - SPARE PARTS FOR STARTUP AND SPECIAL TOOLS		1.00 LS	-	8,000	-		68.48 /MH		8,000
			LIME HANDLING SYSTEM - FREIGHT		1.00 LS	-	50,000	-		68.48 /MH		50,000
			MATERIAL HANDLING EQUIPMENT				**1,058,000**		**6,611**		**452,755**	**1,510,755**
		33.41.00	**MOBILE YARD EQUIPMENT**									
			MOBILE YARD EQUIPMENT - TRACKMOBILE	REAGENT HANDLING SYSTEM	1.00 EA	-	225,000	-		68.48 /MH		225,000
			MOBILE YARD EQUIPMENT				**225,000**					**225,000**
		33.51.00	**RAIL CAR UNLOADER**									
			RAIL CAR UNLOADER -	IN UNLOADING SHED 200'X75' WIDE	1.00 LT	-	225,000	-	3,103	92.62 /MH	287,441	512,441
			RAIL CAR UNLOADER				**225,000**		**3,103**		**287,441**	**512,441**
			MATERIAL HANDLING EQUIPMENT				**1,508,000**		**9,715**		**740,197**	**2,248,197**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	2-2200 TON LIME STORAGE SILOS	3,600.00 SF	-	-	39,600	41	64.10 /MH	2,652	42,252
			HVAC, MISCELLANEOUS					**39,600**	**41**		**2,652**	**42,252**
			HVAC					**39,600**	**41**		**2,652**	**42,252**
	35.00.00		**PIPING**									
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			8 IN DIA, SCH 40, 8" VACUUM CONVEY PIPING WITH 4 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	500.00 LF	-	38,000		540	77.36 /MH	41,792	79,792
			12 IN DIA, 3/8 IN STD- 2500 LF OF 10"/12" TRANSPORT PRESSURE PIPING W 8 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRANSPORT SYSTEM	2,500.00 LF	-	225,000		3,966	77.36 /MH	306,772	531,772
			CARBON STEEL, STRAIGHT RUN				**263,000**		**4,506**		**348,565**	**611,565**
			PIPING				**263,000**		**4,506**		**348,565**	**611,565**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.37.00	**LIGHTING ACCESSORY (FIXTURE)**									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	4200 TON LIME STORAGE SILO	2,500.00 SF	-	-	27,500	29	63.63 /MH	1,828	29,328
			LIGHTING ACCESSORY (FIXTURE)					**27,500**	**29**		**1,828**	**29,328**
			ELECTRICAL EQUIPMENT					**27,500**	**29**		**1,828**	**29,328**
			102 REAGENT HANDLING SYSTEM			**6,000,000**	**2,046,000**	**3,162,954**	**59,192**		**4,646,650**	**15,855,604**
105			**BYPRODUCT HANDLING SYSTEM**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
	21.00.00		**CIVIL WORK**									
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	ASH SILO AND FGD BYPRODUCT SILOS	125.00 EA	-	-	232,125	3,161	108.46 /MH	342,833	574,958
			CAISSON					**232,125**	**3,161**		**342,833**	**574,958**
			CIVIL WORK					**232,125**	**3,161**		**342,833**	**574,958**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FGD BYPRODUCT SILOS	614.00 CY	-	-	141,220	4,940	59.71 /MH	294,981	436,201
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FLY ASH BLENDING SILO	67.00 CY	-	-	15,410	539	59.71 /MH	32,188	47,598
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	FOR TRUCK SCALES	144.00 CY	-	-	33,120	1,159	59.71 /MH	69,181	102,301
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	MISC	100.00 CY	-	-	23,000	805	59.71 /MH	48,043	71,043
			CONCRETE					**212,750**	**7,443**		**444,393**	**657,143**
			CONCRETE					**212,750**	**7,443**		**444,393**	**657,143**
	23.00.00		**STEEL**									
		23.13.75	**SILO**									
			NEW 250 TON FLYASH BLENDING BIN SILO - 24FT DIA X 72 FT HIGH - ERECTION AND FREIGHT INCLUDED	SILO	1.00 EA		275,000		2,839	73.12 /MH	207,594	482,594
			SILO				**275,000**		**2,839**		**207,594**	**482,594**
			STEEL				**275,000**		**2,839**		**207,594**	**482,594**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - 3000 TON FGD BYPRODUCT SILO	ERECTED - 52' DIA X 162' TALL EA	2.00 LS	7,600,000				59.71 /MH		7,600,000
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - SPARE PARTS FOR STARTUP AND SPECIAL TOOLS		1.00 LS	-	10,000			73.12 /MH		10,000
			CONCRETE SILO - FREIGHT		1.00 LS	-	70,000			73.12 /MH		70,000
			CONCRETE SILO			**7,600,000**	**80,000**		**0**			**7,680,000**
			MISCELLANEOUS STRUCTURAL ITEM			**7,600,000**	**80,000**		**0**			**7,680,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.13.00	**BYPRODUCT HANDLING EQUIPMENT**									
			PNEUMATIC ASH CONVEYORS	EQUIPMENT INCLUDES FREIGHT	1.00 LS	-	5,655,000	-		73.12 /MH		5,655,000
			PNEUMATIC ASH CONVEYORS	INSTALLATION COST	1.00 LT	-		-	79,293	73.12 /MH	5,797,912	5,797,912
			BLOWERS, PRESSURE FEEDERS, TRANSPORT PIPING AND VACUUM / PRESSURE RELIEF VALVES	INCLUDED ABOVE	1.00 LT	-		-		73.12 /MH		
			-FOUR PIN MIXERS BELOW CONCRETE SILOS INCL ALL VALVES AND ACCESSORIES		1.00 LT	-	540,000	-	3,347	73.12 /MH	244,742	784,742
			-DRY UNLOADING SPOUT BELOW THE PRODUCT SILO		2.00 EA	-	60,000	-	258	73.12 /MH	18,877	78,877
			AIRSLIDE CONVEYORS FROM BLENDING BIN MIXER/PIPE CONVEYOR, INCL ALL VALVES AND ACCESSORIES		4.00 EA	-	80,000	-	688	73.12 /MH	50,327	130,327
			BYPRODUCT HANDLING EQUIPMENT				**6,335,000**		**83,587**		**6,111,857**	**12,446,857**
		33.57.00	**SCALE**									
			SCALE - NEW TRUCK SCALES	BYPRODUCT HANDLING SYSTEM	2.00 EA	-	182,000	-	460	68.48 /MH	31,485	213,485
			SCALE				**182,000**		**460**		**31,485**	**213,485**
			MATERIAL HANDLING EQUIPMENT				**6,517,000**		**84,046**		**6,143,342**	**12,660,342**
	34.00.00		**HVAC**									
		34.37.00	**DUST COLLECTOR**									
			DUST COLLECTOR - INSTALLED COST		1.00 LS	113,100	-			64.10 /MH		113,100
			DUST COLLECTOR			**113,100**						**113,100**
			HVAC			**113,100**						**113,100**
	35.00.00		**PIPING**									
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			12 IN DIA, 3/8 IN STD	CONVEYOR PIPING	5,000.00 LF	-	-	496,000	7,931	77.36 /MH	613,545	1,109,545
			12 IN DIA, 3/8 IN STD	12" TIE IN PIPING TO BYPRODUCT SILO	1,500.00 LF	-	-	148,800	2,379	77.36 /MH	184,063	332,863

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		35.14.10	CARBON STEEL, STRAIGHT RUN									
			12 IN DIA, 3/8 IN STD	FROM THE EXISTING 50 TPH FLY ASH PRESSURE SYSTEM	1,500.00 LF	-	-	148,800	2,379	77.36 /MH	184,063	332,863
			CARBON STEEL, STRAIGHT RUN					644,800	10,310		797,608	1,442,408
			PIPING					644,800	10,310		797,608	1,442,408
			105 BYPRODUCT HANDLING SYSTEM			**7,713,100**	**6,872,000**	**1,089,675**	**107,800**		**7,935,771**	**23,610,546**
111			**FLUE GAS SYSTEM**									
	21.00.00		CIVIL WORK									
		21.53.00	PILING									
			PILE - 18" AUGER CAST X 60' LONG	UNIT 1 FLUE GAS SYSTEM	138.00 EA	-	-	263,304	3,648	108.46 /MH	395,692	658,996
			PILE - 18" AUGER CAST X 60' LONG	UNIT 2 FLUE GAS SYSTEM	138.00 EA	-	-	263,304	3,648	108.46 /MH	395,692	658,996
			PILING					526,608	7,297		791,384	1,317,992
			CIVIL WORK					526,608	7,297		791,384	1,317,992
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	UNIT 1 FLUE GAS SYSTEM	966.00 CY	-	-	222,180	7,772	59.71 /MH	464,091	686,271
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	UNIT 2 FLUE GAS SYSTEM	966.00 CY	-	-	222,180	7,772	59.71 /MH	464,091	686,271
			CONCRETE					444,360	15,545		928,182	1,372,542
			CONCRETE					444,360	15,545		928,182	1,372,542
	23.00.00		STEEL									
		23.15.00	DUCTWORK									
			PANEL CONSTRUCTION, DUCT PLATE WITH STIFFENERS, INTERNAL TRUSSES, AND TURNING VANES	UNIT 1 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	TN	-	-			97.25 /MH		
			PANEL CONSTRUCTION, DUCT PLATE WITH STIFFENERS, INTERNAL TRUSSES, AND TURNING VANES	UNIT 2 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	TN	-	-			97.25 /MH		
		23.21.00	GIRDER									
			ROLLED SHAPE GIRDER - USER DEFINED	UNIT 1 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	TN	-	-			92.62 /MH		
			ROLLED SHAPE GIRDER - USER DEFINED	UNIT 2 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	TN	-	-			92.62 /MH		
	27.00.00		PAINTING & COATING									
		27.17.00	PAINTING									
			PAINTING - CHIMNEY	UNIT 1 FLUE GAS SYSTEM	1.00 LT	-	-	110,000	4,109	47.61 /MH	195,639	305,639
			PAINTING					110,000	4,109		195,639	305,639
			PAINTING & COATING					110,000	4,109		195,639	305,639
	31.00.00		MECHANICAL EQUIPMENT									
		31.27.00	DAMPERS & ACCESSORIES									
			DAMPERS & ACCESSORIES	UNIT 1 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	SF	-				97.25 /MH		
			DAMPERS & ACCESSORIES	UNIT 2 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	SF	-				97.25 /MH		
		31.33.00	EXPANSION JOINT									
			EXPANSION JOINT	UNIT 1 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	LF	-				97.25 /MH		
			EXPANSION JOINT	UNIT 2 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	LF	-				97.25 /MH		
	36.00.00		INSULATION									
		36.13.00	DUCT									
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	UNIT 1 FLUE GAS SYSTEM	168,220.00 SF	-	-	1,093,430	43,505	68.76 /MH	2,991,416	4,084,846
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	UNIT 2 FLUE GAS SYSTEM	168,220.00 SF	-	-	1,093,430	43,505	68.76 /MH	2,991,416	4,084,846
			DUCT					2,186,860	87,010		5,982,831	8,169,691
			INSULATION					2,186,860	87,010		5,982,831	8,169,691
			111 FLUE GAS SYSTEM					**3,267,828**	**113,961**		**7,898,036**	**11,165,864**
121			**CIVIL BOP**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
	21.00.00		CIVIL WORK									
		21.14.00	STRIP & STOCKPILE TOPSOIL									
			STRIP & STOCKPILE TOPSOIL - 12"		300,000.00 SF	-	-		690	182.33 /MH	125,745	125,745
			STRIP & STOCKPILE TOPSOIL - ONSITE		40,000.00 CY	-	-		5,287	182.33 /MH	964,044	964,044
			STRIP & STOCKPILE TOPSOIL - 12"	SITE GRADING	600,000.00 SF	-	-		1,379	182.33 /MH	251,490	251,490
			STRIP & STOCKPILE TOPSOIL - ONSITE	SITE GRADING	160,000.00 CY	-	-		21,149	182.33 /MH	3,856,175	3,856,175
			STRIP & STOCKPILE TOPSOIL						28,506		5,197,453	5,197,453
		21.17.00	EXCAVATION									
			MASS EXCAVATION, COMMON EARTH USING 1.5 CY BACKHOE AND (6) 12 CY DUMP TRUCKS, 4 MI ROUNDTRIP	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	7,000.00 CY	-	-		523	182.33 /MH	95,356	95,356
			EXCAVATION - EXCAVATION , BACKFILL & COMPACT ALL FOUNDATIONS		12,600.00 CY	-	-		4,345	79.31 /MH	344,588	344,588
			EXCAVATION						4,868		439,945	439,945
		21.19.00	DISPOSAL									
			DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	7,000.00 CY	-	-		483	79.31 /MH	38,288	38,288
			DISPOSAL						483		38,288	38,288
		21.20.00	BACKFILL									
			FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	1,000.00 CY	-	-		172	79.31 /MH	13,674	13,674
			BACKFILL						172		13,674	13,674
		21.39.00	STORM DRAINAGE UTILITIES									
			STORM SEWER WORK	SITE GRADING	1.00 LT	-	-	110,000	2,299	72.14 /MH	165,839	275,839
			STORM DRAINAGE UTILITIES					110,000	2,299		165,839	275,839
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK		33,334.00 SY	-	-	355,007	1,149	97.31 /MH	111,853	466,860
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	SITE GRADING	66,667.00 SY	-	-	710,004	2,299	97.31 /MH	223,702	933,706
			EROSION AND SEDIMENTATION CONTROL					1,065,011	3,448		335,555	1,400,566
		21.57.00	ROAD, PARKING AREA, & SURFACED AREA									
			BITUMINOUS ROAD - ROAD UPGRADE	BYPRODUCT HAUL ROAD - EAST OF COAL PILE	10,000.00 LF	-	-	500,000	8,046	78.37 /MH	630,563	1,130,563
			BITUMINOUS ROAD - ELIMINATE CHICANE CURVES AT LOW PRESSURE SERVICE WATER PUMPS		1.00 LT	-	-	500,000		78.37 /MH		500,000
			BITUMINOUS ASPHALT (10,000 - 49,999 SF) ROADWORK 24' WIDE 4" ASPHALT	SITE GRADING	1,668.00 LF	-	-	201,828	2,013	78.37 /MH	157,767	359,595
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	HWY 365, NEW BYPASS LANE (ON WEST SIDE)	9,000.00 LF	-	-	603,000	1,655	78.37 /MH	129,716	732,716
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	HWY 365, NEW LEFT TURN LANE (SOUTH BOUND)	3,000.00 LF	-	-	201,000	552	78.37 /MH	43,239	244,239
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	HWY 365, NEW MERGE LANE (NORTH BOUND)	4,175.00 LF	-	-	279,725	768	78.37 /MH	60,174	339,899
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	HWY 365, NEW RIGHT TURN LANE (NORTH BOUND)	4,000.00 LF	-	-	268,000	736	78.37 /MH	57,651	325,651
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	CONTRACTOR HAUL ROAD (HWY 46 SPUR), UPGRADE, REMOVE EXISTING ASPHALT, SUBGRADE PREP NEW BASE AND NEW ASPHALT	4,250.00 LF	-	-	514,250	3,126	78.37 /MH	245,019	759,269
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	CONTRACTOR HAUL ROAD (HWY 46 SPUR), EXTENSION, 24' WIDE	580.00 LF	-	-	84,100	907	78.37 /MH	71,055	155,155
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	WIDENING OF EXISTING MAIN PLANT ROAD FROM CONTRACTOR HAUL ROAD (HWY 46 SPUR) TO MAIN GUARD HOUSE	2,900.00 LF	-	-	194,300	1,767	78.37 /MH	138,454	332,754
			ROAD, PARKING AREA, & SURFACED AREA					3,346,203	19,569		1,533,638	4,879,841
		21.71.00	TRACKWORK									
			SIGNAL SYSTEM - RR CROSSING SIGNALS AND GATES	CONTRACTOR HAUL ROAD (HWY 46 SPUR) CROSSING	1.00 LS	220,000	-			/MH		220,000
			TRACKWORK			220,000						220,000
		21.99.00	CIVIL WORK, MISCELLANEOUS									
			CIVIL WORK - CONSTRUCTION LAYDOWN AREAS	FENCING, POWER ETC...	10.00 AC	-	-	780,000	9,195	79.31 /MH	729,287	1,509,287

ENTERGY ARKANSAS
WHITE BLUFF STATION SDA EPC
CONCEPTUAL COST ESTIMATE

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CIVIL WORK, MISCELLANEOUS					**780,000**	**9,195**		**729,287**	**1,509,287**
			CIVIL WORK			**220,000**		**5,301,214**	**68,540**		**8,453,679**	**13,974,892**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	75.00 CY	-	-	17,250	603	59.71 /MH	36,032	53,282
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	555.00 CY	-	-	127,650	4,466	59.71 /MH	266,636	394,286
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	59.71 /MH	2,883	4,263
			CONCRETE FOUNDATIONS	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	1,800.00 CY	-	-	216,000	2,586	59.71 /MH	154,422	370,422
			CONCRETE					**362,280**	**7,703**		**459,973**	**822,253**
		22.15.00	**EMBEDMENT**									
			EMBEDMENTS, CARBON STEEL	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	10,000.00 LB	-	-	30,000	575	51.10 /MH	29,368	59,368
			EMBEDMENT					**30,000**	**575**		**29,368**	**59,368**
		22.17.00	**FORMWORK**									
			BUILT UP INSTALL & STRIP	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	11,000.00 SF	-	-	27,500	2,529	81.61 /MH	206,370	233,870
			FORMWORK					**27,500**	**2,529**		**206,370**	**233,870**
		22.25.00	**REINFORCING**									
			UNCOATED A615 GR60	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	135.00 TN	-	-	138,375	2,793	56.35 /MH	157,391	295,766
			REINFORCING					**138,375**	**2,793**		**157,391**	**295,766**
			CONCRETE					**558,155**	**13,600**		**853,102**	**1,411,257**
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL ONLY, STEEL UNINSULATED 22 GA, 45 FT X 45 FT	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	56,700	791	92.62 /MH	73,298	129,998
			SHELL ONLY, STEEL UNINSULATED 22 GA, 200 FT X 75 FT x 15' TALL	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	420,000	5,862	92.62 /MH	542,945	962,945
			PRE-ENGINEERED BUILDING	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	92.62 /MH	10,646	20,646
			PRE-ENGINEERED BUILDING					**486,700**	**6,768**		**626,888**	**1,113,588**
		24.41.00	**SIDING**									
			INSULATION, 2 IN THICK FIBERGLASS,	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	3,240.00 SF	-	-	3,888	37	79.59 /MH	2,964	6,852
			INSULATION, 2 IN THICK FIBERGLASS,	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	8,250.00 SF	-	-	9,900	95	79.59 /MH	7,547	17,447
			SIDING					**13,788**	**132**		**10,511**	**24,299**
			ARCHITECTURAL					**500,488**	**6,900**		**637,400**	**1,137,888**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.99.00	**MISCELLANEOUS STRUCTURAL ITEM, MISCELLANEOUS**									
			MISCELLANEOUS STRUCTURAL ITEM - WATER INTAKE PUMP STRUCTURE - ONE BAY		1.00 LS	-	-	1,110,000	15,537	92.62 /MH	1,439,017	2,549,017
			MISCELLANEOUS STRUCTURAL ITEM, MISCELLANEOUS					**1,110,000**	**15,537**		**1,439,017**	**2,549,017**
			MISCELLANEOUS STRUCTURAL ITEM					**1,110,000**	**15,537**		**1,439,017**	**2,549,017**
	27.00.00		**PAINTING & COATING**									
		27.17.00	**PAINTING**									
			PAINTING - ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	15,000	172	47.61 /MH	8,209	23,209
			PAINTING					**15,000**	**172**		**8,209**	**23,209**
			PAINTING & COATING					**15,000**	**172**		**8,209**	**23,209**
	31.00.00		**MECHANICAL EQUIPMENT**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.41.00	FIRE PROTECTION EQUIPMENT & SYSTEM									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	11,138	156	68.48 /MH	10,679	21,817
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	NEW WAREHOUSE BUILDING 200'X75'X15' TALL, FIRE PROTECTION ALLOWANCE	15,000.00 SF	-	-	82,500	1,155	68.48 /MH	79,106	161,606
			FIRE PROTECTION EQUIPMENT & SYSTEM					93,638	1,311		89,786	183,423
			MECHANICAL EQUIPMENT					93,638	1,311		89,786	183,423
	34.00.00		HVAC									
		34.99.00	HVAC, MISCELLANEOUS									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	22,275	23	64.10 /MH	1,492	23,767
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	165,000	172	64.10 /MH	11,052	176,052
			HVAC, MISCELLANEOUS					187,275	196		12,544	199,819
			HVAC					187,275	196		12,544	199,819
	36.00.00		INSULATION									
		36.99.00	INSULATION, MISCELLANEOUS									
			INSULATION - ROOF INSULATION	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	2,430	23	51.10 /MH	1,189	3,619
			INSULATION - ROOF INSULATION	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	18,000	172	51.10 /MH	8,810	26,810
			INSULATION, MISCELLANEOUS					20,430	196		10,000	30,430
			INSULATION					20,430	196		10,000	30,430
	41.00.00		ELECTRICAL EQUIPMENT									
		41.37.00	LIGHTING ACCESSORY (FIXTURE)									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	22,275	23	63.63 /MH	1,481	23,756
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL, LIGHTING ALLOWANCE	15,000.00 SF	-	-	165,000	172	63.63 /MH	10,971	175,971
			LIGHTING ACCESSORY (FIXTURE)					187,275	196		12,452	199,727
		41.99.00	ELECTRICAL EQUIPMENT, MISCELLANEOUS									
			ELECTRICAL EQUIPMENT, MISCELLANEOUS -	ADD BAY TO EXISTING INTAKE STRUCTURE FOR 3RD PUMP	1.00 LT	-	-	100,000	230	82.05 /MH	18,862	118,862
			ELECTRICAL EQUIPMENT, MISCELLANEOUS					100,000	230		18,862	118,862
			ELECTRICAL EQUIPMENT					287,275	426		31,314	318,589
	71.00.00		PROJECT INDIRECT									
		71.25.00	CONSULTANT, THIRD PARTY									
			CONSULTANT - SUBSURFACE INVESTIGATION		1.00 LS	200,000	-			/MH		200,000
			CONSULTANT - GEOTECHNICAL		1.00 LS	150,000	-			/MH		150,000
			CONSULTANT, THIRD PARTY			350,000						350,000
			PROJECT INDIRECT			350,000						350,000
			121 CIVIL BOP			**570,000**		**8,073,474**	**106,878**		**11,535,049**	**20,178,523**
151			**MECHANICAL BOP**									
	11.00.00		DEMOLITION									
		11.21.00	CIVIL WORK									
			CIVIL WORK - DIG AND REFILL PIPE TRENCH	BYPRODUCT PIPE FROM RACK	100.00 LF	-	-		172	79.31 /MH	13,674	13,674
			CIVIL WORK - DIG AND REFILL PIPE TRENCH	REAGENT UNLOADING PIPE FROM RACK	200.00 LF	-	-		345	79.31 /MH	27,348	27,348
			CIVIL WORK						517		41,022	41,022
			DEMOLITION						517		41,022	41,022
	21.00.00		CIVIL WORK									
		21.17.00	EXCAVATION									
			EXCAVATION - 6" PIPE 4' DEEP PIPE TRENCH & BEDDING		1,430.00 LF	-	-	8,680	526	79.31 /MH	41,715	50,395
			EXCAVATION - 6" PIPE 4' DEEP PIPE TRENCH & BEDDING		750.00 LF	-	-	4,553	276	79.31 /MH	21,879	26,431
			EXCAVATION - 3" PIPE 4' DEEP PIPE TRENCH & BEDDING		3,000.00 LF	-	-	12,750	966	79.31 /MH	76,575	89,325
			EXCAVATION - 3" PIPE 4' DEEP PIPE TRENCH & BEDDING		1,000.00 LF	-	-	4,250	322	79.31 /MH	25,525	29,775
			EXCAVATION - 3" PIPE 4' DEEP PIPE TRENCH & BEDDING		5,260.00 LF	-	-	22,355	1,693	79.31 /MH	134,262	156,617
			EXCAVATION - 8" PIPE 4' DEEP PIPE TRENCH & BEDDING		1,340.00 LF	-	-	9,929	539	79.31 /MH	42,754	52,684
			EXCAVATION - 36" PIPE 4' DEEP PIPE TRENCH & BEDDING	RIVER WATER PIPE TIE IN	20.00 LF	-	-	733	21	79.31 /MH	1,677	2,411
			EXCAVATION - 32" PIPE 4' DEEP PIPE TRENCH & BEDDING	LPSW PIPE	2,100.00 LS	-	-	60,375	1,859	79.31 /MH	147,407	207,782

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		21.17.00	EXCAVATION									
			EXCAVATION - 10" PIPE 4' DEEP PIPE TRENCH & BEDDING	RECYCLE ASH WATER PIPE DISCHARGE BURIED	1,800.00 LF	-	-	15,930	786	79.31 /MH	62,354	78,284
			EXCAVATION - 4" PIPE 4' DEEP PIPE TRENCH & BEDDING	LEACHATE PIPING	3,500.00 LF	-	-	16,905	1,167	79.31 /MH	92,528	109,433
			EXCAVATION					156,460	8,154		646,677	803,138
		21.54.00	CAISSON									
			2.5 FT DIA X 30 FT DEEP CAISSON	TANK FOUNDATIONS	76.00 EA	-	-	141,132	1,922	108.46 /MH	208,443	349,575
			2.5 FT DIA X 30 FT DEEP CAISSON	COMMON PIPE RACK FOUNDATIONS	186.00 EA	-	-	345,402	4,703	108.46 /MH	510,136	855,538
			2.5 FT DIA X 30 FT DEEP CAISSON	BYPRODUCT PIPE RACK FOUNDATIONS	94.00 EA	-	-	174,558	2,377	108.46 /MH	257,811	432,369
			2.5 FT DIA X 30 FT DEEP CAISSON	REAGENT UNLOADING PIPE RACK FOUNDATIONS	16.00 EA	-	-	29,712	405	108.46 /MH	43,883	73,595
			CAISSON					690,804	9,407		1,020,272	1,711,076
			CIVIL WORK					847,264	17,561		1,666,949	2,514,214
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			SPREAD FOOTING FOUNDATION, 4500 PSI - COMPOSITE RATE	3X 35' DIA TANK FDN	81.00 CY	-	-	18,630	652	59.71 /MH	38,914	57,544
			CONCRETE FOUNDATIONS - COMPOSITE RATE	COMMON PIPE RACK FOUNDATIONS	207.00 CY	-	-	47,610	1,666	59.71 /MH	99,448	147,058
			CONCRETE FOUNDATIONS - COMPOSITE RATE	BYPRODUCT PIPE RACK FOUNDATIONS	105.00 CY	-	-	24,150	845	59.71 /MH	50,445	74,595
			CONCRETE FOUNDATIONS - COMPOSITE RATE	REAGENT UNLOADING PIPE RACK FOUNDATIONS	18.00 CY	-	-	4,140	145	59.71 /MH	8,648	12,788
			CONCRETE					94,530	3,307		197,455	291,985
			CONCRETE					94,530	3,307		197,455	291,985
	23.00.00		STEEL									
		23.21.00	GIRDER									
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	COMMON 500'LX20'W, 400'Lx15'W,400'Lx9'W, ALL 20' HIGH	196.00 TN	-	-	531,160	3,830	92.62 /MH	354,724	885,884
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	BYPRODUCT PIPE RACK, 650LF X6 WIDE X 20' HIGH	39.00 TN	-	-	105,690	762	92.62 /MH	70,583	176,273
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	REAGENT UNLOADING PIPE RACK, 100LF X 6' WIDE X 20' HIGH	6.00 TN	-	-	16,260	117	92.62 /MH	10,859	27,119
			GIRDER					653,110	4,709		436,166	1,089,276
			STEEL					653,110	4,709		436,166	1,089,276
	27.00.00		PAINTING & COATING									
		27.13.00	COATING									
			COATING - CHIMNEY - ACID RESISTANT COATING TOP 100 FT OUTSIDE SHELL		1.00 LS	270,000	-			47.61 /MH		270,000
			COATING			270,000						270,000
			PAINTING & COATING			270,000						270,000
	31.00.00		MECHANICAL EQUIPMENT									
		31.17.00	COMPRESSOR & ACCESSORIES									
			AIR COMPRESSOR, CENTRIFUGAL - 250 SCFM EA @ 200 PSIG	SERVICE AIR	2.00 EA	-	310,000	-	92	68.48 /MH	6,297	316,297
			AIR COMPRESSOR, CENTRIFUGAL - 250 SCFM EA @ 200 PSIG	INSTRUMENT AIR	2.00 EA	-	310,000	-	92	68.48 /MH	6,297	316,297
			AIR DRYER - W/FILTERS, 250 NET SCFM EA	SERVICE AIR	2.00 EA	-	33,400	-	74	68.48 /MH	5,038	38,438
			AIR DRYER - W/FILTERS, 250 NET SCFM EA	INSTRUMENT AIR	2.00 EA	-	33,400	-	74	68.48 /MH	5,038	38,438
			AIR RECEIVER - 1,000 GALLON EA	SERVICE AIR	2.00 EA	-	11,200	-	37	68.48 /MH	2,519	13,719
			AIR RECEIVER - 1,000 GALLON EA	INSTRUMENT AIR	2.00 EA	-	11,200	-	37	68.48 /MH	2,519	13,719
			COMPRESSOR & ACCESSORIES				709,200		405		27,707	736,907
		31.41.00	FIRE PROTECTION EQUIPMENT & SYSTEM									
			DELUGE - POWER TRANSFORMERS		3.00 EA	-	-	127,500	1,959	77.36 /MH	151,519	279,019
			FIRE PROTECTION EQUIPMENT & SYSTEM					127,500	1,959		151,519	279,019
		31.65.00	HEAT EXCHANGER									
			HEAT EXCHANGER - SLAKER WATER HEATER 3" IN-LINE, 475 KW		4.00 EA	-	220,000	-	368	63.63 /MH	23,404	243,404
			HEAT EXCHANGER				220,000		368		23,404	243,404
		31.75.00	PUMP									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.75.00	**PUMP**									
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - MAKEUP WATER PUMPS, 2600 GPM, 200 TDH		2.00 EA	-	96,000	-	577	68.48 /MH	39,514	135,514
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - RECYCLE ASH WATER PUMP, 50 HP		3.00 EA	-	72,000	-	221	68.48 /MH	15,113	87,113
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - LIME SLAKING WATER PIUMPS, 50 HP		2.00 EA	-	48,000	-	147	68.48 /MH	10,075	58,075
			CENTRIFUGAL, VERTICAL, CANNED - LEACHATE PUMPS, 50 HP		2.00 EA	-	134,000	-	828	68.48 /MH	56,673	190,673
			CENTRIFUGAL, VERTICAL, WET PIT - LPSW PUMP, 650 HP		1.00 EA	-	188,000	-	690	68.48 /MH	47,228	235,228
			SUMP, CENTRIFUGAL, WET BEARING - REGENT PREP/RECYCLE SUMP, 120GPM, 150 TDH		4.00 EA	-	220,000	-	276	68.48 /MH	18,891	238,891
			SUMP, CENTRIFUGAL, WET BEARING - LIME SILO & UNLOADING AREA SUMP 120 GPM @ 150 TDH		2.00 EA	-	88,000	-	138	68.48 /MH	9,446	97,446
			SUMP, CENTRIFUGAL, WET BEARING - WASTE ASH SILO AREA SUMP 120GPM @150 TDH		2.00 EA	-	88,000	-	138	68.48 /MH	9,446	97,446
			SUMP, CENTRIFUGAL, WET BEARING - WASTEWATER FORWARDING PUMP TO RECYCLED SLURRY, 100 GPM@150 TDH		4.00 EA	-	28,800	-	294	68.48 /MH	20,150	48,950
			SUMP, SUBMERSIBLE - RECYCLE ASH WATER TANK SUPPLY PUMP, 100 HP		2.00 EA	-	77,000	-	690	68.48 /MH	47,228	124,228
			PUMP				**1,039,800**		**3,998**		**273,763**	**1,313,563**
		31.83.00	**TANK**									
			ATMOSPHERIC, FIELD FABRICATED - LIME SLAKING WATER TANK, 175,000 GALLON	35' DIA X 24' HIGH	1.00 EA	220,000		-		90.81 /MH		220,000
			ATMOSPHERIC, FIELD FABRICATED - RECYCLE ASH WATER TANK, 250,000 GALLON	35' DIA X 36' HIGH	2.00 EA	508,000		-		90.81 /MH		508,000
			TANK			**728,000**						**728,000**
			MECHANICAL EQUIPMENT			**728,000**	**1,969,000**	**127,500**	**6,729**		**476,392**	**3,300,892**
	35.00.00		**PIPING**									
		35.13.01	**SS 304, ABOVE GROUND, PROCESS AREA**									
			1 IN DIA, SCH 40S		1,520.00 LF	-	-	32,832	1,974	77.36 /MH	152,728	185,560
			1.5 IN DIA, SCH 40S		1,380.00 LF	-	-	52,302	2,094	77.36 /MH	161,976	214,278
			2 IN DIA, SCH 40S		2,070.00 LF	-	-	113,022	3,426	77.36 /MH	265,051	378,073
			SS 304, ABOVE GROUND, PROCESS AREA					**198,156**	**7,494**		**579,755**	**777,911**
		35.13.10	**CARBON STEEL, ABOVE GROUND, PROCESS AREA**									
			1 IN DIA, SCH 80		260.00 LF	-	-	2,314	305	77.36 /MH	23,581	25,895
			2 IN DIA, SCH 80		2,260.00 LF	-	-	48,138	3,273	77.36 /MH	253,207	301,345
			2.5 IN DIA, SCH 40		1,000.00 LF	-	-	15,400	1,437	77.36 /MH	111,149	126,549
			3 IN DIA, SCH 40		7,160.00 LF	-	-	125,300	11,028	77.36 /MH	853,130	978,430
			3 IN DIA, SCH 80		1,760.00 LF	-	-	38,720	3,055	77.36 /MH	236,313	275,033
			4 IN DIA, SCH 40		1,000.00 LF	-	-	22,600	1,701	77.36 /MH	131,601	154,201
			6 IN DIA, SCH 40		880.00 LF	-	-	28,248	1,629	77.36 /MH	125,981	154,229
			6 IN DIA, SCH 40 VACUUM PIPE		2,260.00 LF	-	-	72,546	4,182	77.36 /MH	323,543	396,089
			8 IN DIA, SCH 80		3,520.00 LF	-	-	256,608	9,832	77.36 /MH	760,582	1,017,190
			CARBON STEEL, ABOVE GROUND, PROCESS AREA					**609,874**	**36,441**		**2,819,087**	**3,428,961**
		35.13.36	**DUCTILE IRON, ABOVE GROUND, PROCESS AREA**									
			12 IN DIA, - ASHCOLITE PIPE		1,620.00 LF	-	-	162,000	3,594	72.14 /MH	259,256	421,256
			DUCTILE IRON, ABOVE GROUND, PROCESS AREA					**162,000**	**3,594**		**259,256**	**421,256**
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			6 IN DIA, SCH 40, LIME SLAKING TANK MAKEUP	LIME SLAKING TANK MAKEUP	1,200.00 LF	-	-	27,480	1,214	77.36 /MH	93,899	121,379
			8 IN DIA, SCH 40, LIME SLAKING TANK MAKEUP	LIME SLAKING TANK MAKEUP	450.00 LF	-	-	13,905	486	77.36 /MH	37,613	51,518
			8 IN DIA, SCH 40, RECYCLE ASH WATER PIPING	RECYCLE ASH WATER PIPING	2,000.00 LF	-	-	61,800	2,161	77.36 /MH	167,169	228,969
			10 IN DIA, SCH 40, RECYCLE ASH TANK MAKEUP	RECYCLE ASH TANK MAKEUP	450.00 LF	-	-	24,660	610	77.36 /MH	47,216	71,876
			CARBON STEEL, STRAIGHT RUN					**127,845**	**4,471**		**345,897**	**473,742**
		35.15.10	**CARBON STEEL, BURIED**									
			3 IN DIA, SCH 40, WRAPPED		3,000.00 LF	-	-	51,000	2,241	77.36 /MH	173,393	224,393
			4 IN DIA, SCH 40, WRAPPED, LEACHATE PIPING	LEACHATE PIPING	3,500.00 LF	-	-	72,800	2,856	77.36 /MH	220,965	293,765
			6 IN DIA, SCH 40, WRAPPED		750.00 LF	-	-	23,925	776	77.36 /MH	60,021	83,946
			10 IN DIA, SCH 40, WRAPPED, RECYCLE ASH WATER PIPE DISCHARGE BURIED	RECYCLE ASH WATER PIPE DISCHARGE BURIED	1,800.00 LF	-	-	119,700	2,441	77.36 /MH	188,865	308,565
			32 IN DIA, 3/8 IN STD, WRAPPED - LPSW PIPE	LPSW PIPE	2,100.00 LF	-	-	638,610	11,079	77.36 /MH	857,095	1,495,705

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		35.15.10	**CARBON STEEL, BURIED**									
			36 IN DIA, 3/8 IN STD, WRAPPED - RIVER WATER PIPE	RIVER WATER PIPE - TIE IN	20.00 LF	-	-	6,772	138	77.36 /MH	10,706	17,478
			CARBON STEEL, BURIED					**912,807**	**19,533**		**1,511,045**	**2,423,852**
		35.15.25	**FRP, BURIED**									
			3 IN DIA, TAPER		1,000.00 LF	-	-	14,800	460	77.36 /MH	35,568	50,368
			3 IN DIA, TAPER FRP/HDPE PIPE		2,380.00 LF	-	-	35,224	1,094	77.36 /MH	84,651	119,875
			FRP, BURIED					**50,024**	**1,554**		**120,219**	**170,243**
		35.15.30	**HDPE, BURIED**									
			6 IN DIA, DR 9		1,430.00 LF	-	-	12,870	1,134	77.36 /MH	87,737	100,607
			8 IN DIA, DR 9		1,340.00 LF	-	-	20,770	1,278	77.36 /MH	98,896	119,666
			HDPE, BURIED					**33,640**	**2,413**		**186,633**	**220,273**
		35.36.00	**PIPE SUPPORTS, RACK**									
			SUPPORT SLEEPERS	BYPRODUCT PIPE, 1750LF	125.00 EA	-	-	43,750	575	77.36 /MH	44,460	88,210
			SUPPORT SLEEPERS	REAGENT UNLOADING PIPE, 1500LF	108.00 EA	-	-	37,800	497	77.36 /MH	38,413	76,213
			PIPE SUPPORTS, RACK					**81,550**	**1,071**		**82,873**	**164,423**
		35.45.00	**VALVES**									
			VALVE - 36" 150 LB CS BUTTERFLY, FLANGED		2.00 EA	-	-	79,920	96	77.36 /MH	7,398	87,318
			VALVE - 12" 150 LB CS KNIFE GATE, FLANGED		6.00 EA	-	-	20,160	195	77.36 /MH	15,099	35,259
			VALVE - 12" 150 LB CS GATE VALVE, FLANGED		2.00 EA	-	-	8,920	65	77.36 /MH	5,033	13,953
			VALVE - 10" 150 LB CS SWING CHECK, FLANGED		2.00 EA	-	-	9,200	55	77.36 /MH	4,268	13,468
			VALVE - 10" 150 LB CS BUTTERFLY, FLANGED		5.00 EA	-	-	22,200	138	77.36 /MH	10,670	32,870
			VALVE - 8" 150 LB CS GATE, FLANGED		20.00 EA	-	-	100,000	425	77.36 /MH	32,900	132,900
			VALVE - 6" 150 LB CS GATE, FLANGED		6.00 EA	-	-	19,800	110	77.36 /MH	8,536	28,336
			VALVE - 6" 150 LB CS AIR OPERATED GATE, FLANGED		4.00 EA	-	-	20,400	74	77.36 /MH	5,691	26,091
			VALVE - 6" 150 LB CS AIR OPERATED GLOBE, FLANGED		4.00 EA	-	-	20,400	74	77.36 /MH	5,691	26,091
			VALVE - 6" 150 LB CS SWING CHECK, FLANGED		2.00 EA	-	-	3,400	37	77.36 /MH	2,845	6,245
			VALVE - 4" 150 LB CS GATE, FLANGED		3.00 EA	-	-	3,825	25	77.36 /MH	1,921	5,746
			VALVE - 3" AND BELOW CS FOR SERVICE WATER ISOLATION		120.00 EA	-	-	1,224,000	1,076	77.36 /MH	83,229	1,307,229
			VALVE - 3" AND BELOW CS FOR SERVICE AIR ISOLATION		120.00 EA	-	-	1,224,000	1,076	77.36 /MH	83,229	1,307,229
			VALVE - 3" 150 LB CS GATE, FLANGED		20.00 EA	-	-	15,000	179	77.36 /MH	13,871	28,871
			VALVE - 3" CS PST IND FOR FP 250 LB		6.00 EA	-	-	6,600	54	77.36 /MH	4,161	10,761
			VALVE - 2" AND ABOVE BRONZE VALVES FOR INSTRUMENT AIR ISOLATION		600.00 EA	-	-	78,000	501	77.36 /MH	38,787	116,787
			VALVE - 1" CS FLANGED		4.00 EA	-	-	880	21	77.36 /MH	1,636	2,516
			VALVE - 6" CI POST INDICATOR 250 LB., MECHANICAL JOINT WITH BOXES BURIED VALVE		6.00 EA	-	-	4,080	28	77.36 /MH	2,134	6,214
			VALVES					**2,860,785**	**4,228**		**327,099**	**3,187,884**
			PIPING					**5,036,681**	**80,799**		**6,231,866**	**11,268,547**
	36.00.00		**INSULATION**									
		36.17.01	**PIPE, CALCIUM SILICATE W/ALUMINUM JACKETING**									
			CALCIUM SILICATE W/ALUMINUM JACKETING - 8" PIPE 1.5" THICK		2,520.00 LF	-	-	16,380	487	68.76 /MH	33,460	49,840
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 3" PIPE		1,260.00 LF	-	-	3,591	155	68.76 /MH	10,655	14,246
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 3" PIPE		5,660.00 LF	-	-	16,131	696	68.76 /MH	47,865	63,996
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 2.5" PIPE		380.00 LS	-	-	1,083	47	68.76 /MH	3,214	4,297
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 2.0" PIPE		4,140.00 LS	-	-	10,309	476	68.76 /MH	32,720	43,029
			PIPE, CALCIUM SILICATE W/ALUMINUM JACKETING					**47,494**	**1,860**		**127,914**	**175,408**
			INSULATION					**47,494**	**1,860**		**127,914**	**175,408**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.33.00	**HEAT TRACING**									
			HEAT TRACING - 8" PIPE		2,520.00 LS	-	-	18,749	43	63.63 /MH	2,765	21,513
			HEAT TRACING - 3" PIPE		1,260.00 LF	-	-	9,374	22	63.63 /MH	1,382	10,757
			HEAT TRACING - 3" PIPE		5,660.00 LF	-	-	42,110	98	63.63 /MH	6,209	48,320
			HEAT TRACING - 2.5" PIPE		380.00 LS	-	-	2,827	7	63.63 /MH	417	3,244
			HEAT TRACING - 2.0" PIPE		440.00 LS	-	-	3,274	8	63.63 /MH	483	3,756
			HEAT TRACING					**76,334**	**177**		**11,256**	**87,590**
			ELECTRICAL EQUIPMENT					**76,334**	**177**		**11,256**	**87,590**
			151 MECHANICAL BOP			**998,000**	**1,969,000**	**6,882,913**	**115,659**		**9,189,021**	**19,038,934**

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
190			DEMOLITION / RELOCATION									
	11.00.00		DEMOLITION									
		11.21.00	CIVIL WORK									
			CIVIL WORK - REMOVE FENCING & GATES	HAZARDOUS MATERIAL ACCUMULATION BLDG	1,133.00 LF	-	-		91	107.10 /MH	9,763	9,763
			CIVIL WORK - DIG AND REFILL PIPE TRENCH	TRENCH N.1784.33 FROM E905' TO 1180'	550.00 LF	-	-		948	79.31 /MH	75,208	75,208
			CIVIL WORK - REMOVE DRAINAGE DITCH	DRAINAGE DITCH E970 FROM N2055 'TO N1350'	705.00 LF	-	-		1,216	79.31 /MH	96,403	96,403
			CIVIL WORK - REMOVE DRAINAGE DITCH	DRAINAGE DITCH e1350 from n970' to n1180'	210.00 LF	-	-		362	79.31 /MH	28,716	28,716
			CIVIL WORK - DEMO AREA PAVEMENT	ASH HANDLING / ELECT BLDG	1.00 LS	-	-		115	107.10 /MH	12,310	12,310
			CIVIL WORK						2,732		222,400	222,400
		11.22.00	CONCRETE									
			CONCRETE FOUNDATION - HAZARDOUS MATERIAL ACCUMULATION BLDG	HAZARDOUS MATERIAL ACCUMULATION BLDG, 50'X50'X20'	80.00 CY	-	-		230	107.10 /MH	24,621	24,621
			CONCRETE FOUNDATION - HAZARDOUS MATERIAL ACCUMULATION BLDG	HAZARDOUS MATERIAL ACCUMULATION BLDG, HAZMAT PAVEMENT DEMO	12.00 CY	-	-		61	107.10 /MH	6,574	6,574
			CONCRETE FOUNDATION - ASH HANDLING MAINT BLDG	ASH HANDLING / ELECT BLDG FDN	225.00 CY	-	-		647	107.10 /MH	69,246	69,246
			CONCRETE FOUNDATION - PAVING & FOUNDATION DEMO	FLOURESCENT LIGHT TUBE DISPOSAL SHED FDN	2.00 CY	-	-		10	107.10 /MH	1,096	1,096
			CONCRETE FOUNDATION - PAVING & FOUNDATION DEMO	USED OIL SHED DEMO	35.00 CY	-	-		101	107.10 /MH	10,772	10,772
			CONCRETE						1,049		112,307	112,307
		11.23.00	STEEL									
			STRUCTURAL STEEL DISASSEMBLE BLDG STEEL & TOOL CRIB FOR RELOCATION	ASH HANDLING / ELECT BLDG	52.00 TN	-	-		359	107.10 /MH	38,408	38,408
			STEEL						359		38,408	38,408
		11.24.00	ARCHITECTURAL									
			ARCHITECTURAL - HAZARDOUS MATERIAL ACCUMULATION BLDG 50'X50'X20'	HAZARDOUS MATERIAL ACCUMULATION BLDG, 50'X50'X20'	50,000.00 CF	-	-		632	107.10 /MH	67,707	67,707
			ARCHITECTURAL - HAZARDOUS MATERIAL ACCUMULATION BLDG 50'X50'X20'	HAZARDOUS MATERIAL ACCUMULATION BLDG, CONTAINER DISPOSAL AREA	1.00 LT	-	-		287	107.10 /MH	30,776	30,776
			ARCHITECTURAL - DEMO EXISTING INSULATED SIDING & ROOFING , DEMO INTERIOR OFFICES	ASH HANDLING / ELECT BLDG	15,000.00 CF	-	-		862	107.10 /MH	92,328	92,328
			ARCHITECTURAL - BLDG DEMO	COAL DUMPER AIR COMPRESSOR DEMOLITION	100.00 SF	-	-		11	107.10 /MH	1,231	1,231
			ARCHITECTURAL - BLDG DEMO	USED OIL SHED DEMO	600.00 SF	-	-		8	107.10 /MH	812	812
			ARCHITECTURAL						1,801		192,854	192,854
		11.31.00	MECHANICAL EQUIPMENT									
			MECHANICAL EQUIPMENT - DEMOLISH SEPTIC TANKS	ASH HANDLING / ELECT BLDG	2.00 EA	-	-		0	107.10 /MH	25	25
			MECHANICAL EQUIPMENT - REMOVE 15 TN BRIDGE CRANE (50 FT SPAN) , CRANE SUPPORT STEEL AND 3 JIB CRANES FGOR RELOCATION	ASH HANDLING / ELECT BLDG	21.00 TN	-	-		290	92.62 /MH	26,828	26,828
			MECHANICAL EQUIPMENT						290		26,852	26,852
		11.35.00	PIPING									
			PIPING - REMOVE 12" BA PIPE IN PIPE TRENCH	TRENCH N.1784.33 FROM E905' TO 1180'	550.00 LF	-	-		87	107.10 /MH	9,276	9,276
			PIPING - REMOVE 10" FA PIPE	TRENCH N.1784.33 FROM E905' TO 1180'	550.00 LF	-	-		76	107.10 /MH	8,125	8,125
			PIPING						162		17,401	17,401
		11.99.00	DEMOLITION, MISCELLANEOUS									
			DEMOLITION - MISC	ALLOWANCE	1.00 LT	-	-		2,299	92.62 /MH	212,920	212,920
			DEMOLITION, MISCELLANEOUS						2,299		212,920	212,920
			DEMOLITION						8,691		823,142	823,142
	21.00.00		CIVIL WORK									
		21.16.00	GENERAL EARTHWORK									
			EARTHWORK - COVER AREA WITH BACKFILL AND GRADE	HAZARDOUS MATERIAL ACCUMULATION BLDG	300.00 CY	-	-	4,800	138	182.33 /MH	25,149	29,949
			EARTHWORK - COVER AREA WITH BACKFILL AND GRADE	ASH HANDLING / ELECT BLDG	1,000.00 CY	-	-	16,000	460	182.33 /MH	83,830	99,830
			EARTHWORK - COVER AREA WITH BACKFILL AND GRADE 250'X250'X2'	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG) AREA FILL	5,000.00 CY	-	-	80,000	259	182.33 /MH	47,154	127,154
			GENERAL EARTHWORK				100,800	856		156,133	256,933
		21.17.00	EXCAVATION									
			EXCAVATION - ALLOWANCE FOR NEW DITCHES	WASTE MANAGEMENT FACILITY (	1,200.00 CY	-	-		276	79.31 /MH	21,879	21,879

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		21.17.00	EXCAVATION									
			EXCAVATION - ALLOWANCE FOR NEW DITCHES	REPLACES HAZMAT BLDG) AREA FILL	1,200.00 CY	-	-		276	79.31 /MH	21,879	21,879
			EXCAVATION						276		21,879	21,879
		21.20.00	BACKFILL									
			FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL, ALLOWANCE FOR OLD DITCHES	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG) AREA FILL	100.00 CY	-	-		17	79.31 /MH	1,367	1,367
			BACKFILL						17		1,367	1,367
		21.21.00	MASS FILL									
			MASS FILL, COMMON EARTH USING DUMP TRUCK, 2 MI ROUND TRIP, ALLWANCE FOR MISC ADDITIONAL FILL	RELOCATED BLDGS	1.00 LT	-	-	30,000	345	79.31 /MH	27,348	57,348
			MASS FILL					30,000	345		27,348	57,348
		21.39.00	STORM DRAINAGE UTILITIES									
			EXTEND CULVERTS UNDER ROAD	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG) AREA FILL	48.00 LF	-	-	4,800	166	79.31 /MH	13,127	17,927
			STORM DRAINAGE UTILITIES					4,800	166		13,127	17,927
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			EROSION AND SEDIMENTATION CONTROL - ALLOWANCE	RELOCATED BLDGS	1.00 LS	-	-	20,000	345	36.12 /MH	12,455	32,455
			EROSION AND SEDIMENTATION CONTROL					20,000	345		12,455	32,455
		21.43.00	FENCEWORK									
			FABRIC, WIRE & POSTS, CHAIN LINK FENCE, GALVANIZED, 6 FT TALL, 6 GAGE 3 STRANDS OF BARB WIRE, 2 IN POST AT 10 FT O.C.	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	800.00 FT	-	-	18,880	92	36.12 /MH	3,321	22,201
			VEHICLE GATE, 14 FT WIDE BY 7 FT TALL	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	4.00 EA	-	-	4,000	110	36.12 /MH	3,986	7,986
			FENCEWORK					22,880	202		7,307	30,187
		21.47.00	LANDSCAPING									
			LANDSCAPING - ALLOWANCE FOR PAVING GRADING & SEEDING	RELOCATED BLDGS	1.00 LS	-	-	40,000	460	36.12 /MH	16,607	56,607
			LANDSCAPING					40,000	460		16,607	56,607
		21.57.00	ROAD, PARKING AREA, & SURFACED AREA									
			BITUMINOUS ASPHALT (10,000 - 49,999 SF) ASHPALT PAVING FOR TRUCK TURNAROUND , DRIVEWAY AND AROUND BLDG	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	43,000.00 SF	-	-	216,720	1,236	78.37 /MH	96,836	313,556
			ROAD, PARKING AREA, & SURFACED AREA					216,720	1,236		96,836	313,556
			CIVIL WORK					435,200	3,902		353,060	788,260
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	320.00 CY	-	-	73,600	2,575	59.71 /MH	153,736	227,336
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)- CONTAINER DISPOSAL SLAB & APRON	550.00 CY	-	-	126,500	4,425	59.71 /MH	264,234	390,734
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ACI PORT STAIRTOWER FDNS	60.00 CY	-	-	13,800	483	59.71 /MH	28,826	42,626
			CONCRETE					213,900	7,483		446,796	660,696
			CONCRETE					213,900	7,483		446,796	660,696
	23.00.00		STEEL									
		23.17.00	GALLERY									
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	ACI PORT STAIR TOWERS AND PLATFORMS	728.00 SF	-	-	10,920	84	66.07 /MH	5,529	16,449
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	ACI PORT STAIR TOWERS AND PLATFORMS	436.00 LF	-	-	23,108	90	66.07 /MH	5,960	29,068
			STAIR SYSTEM	ACI PORT STAIR TOWERS AND PLATFORMS	896.00 SF	-	-	81,536	1,184	66.07 /MH	78,251	159,787
			GALLERY					115,564	1,358		89,740	205,304
		23.21.00	GIRDER									
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	UNIT 2 ACI PIPE RACK OVER ROADWAY, 35LF X 23 WIDE X 20' HIGH	1.26 TN	-	-	3,415	25	92.62 /MH	2,280	5,695

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			GIRDER					3,415	25		2,280	5,695
		23.25.00	**ROLLED SHAPE**									
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	ACI PORT STAIRTOWER FRAMING - 2 TOWERS	4.40 TN	-	-	15,752	111	92.62 /MH	10,305	26,057
			REASSEMBLE ASH HANDLING/ELEC BLDG METAL FRAME, PURLINS & GIRTS AS NEW LABOR SHOP	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	50.00 TN	-	-		1,379	92.62 /MH	127,752	127,752
			ROLLED SHAPE					15,752	1,491		138,057	153,809
			STEEL					134,731	2,873		230,077	364,808
	24.00.00		**ARCHITECTURAL**									
		24.15.00	**DOOR (INCL. FRAME & HARDWARE)**									
			DOOR (INCL. FRAME & HARDWARE) - ROLL UP DOOR MAN DOOR ETC...	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	1.00 LS	-	-	5,000	92	51.10 /MH	4,699	9,699
			DOOR (INCL. FRAME & HARDWARE)					5,000	92		4,699	9,699
		24.27.00	**MASONRY**									
			BLOCK, CONCRETE, 8 IN, HOLLOW REINFORCED, ALTERNATE COURSES	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	850.00 SF	-	-	4,242	106	53.08 /MH	5,601	9,842
			MASONRY					4,242	106		5,601	9,842
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	5,000.00 SF	-	-	140,000	1,954	92.62 /MH	180,982	320,982
			PRE-ENGINEERED BUILDING					140,000	1,954		180,982	320,982
		24.37.00	**ROOFING**									
			METAL, INSULATED- NEW INSULATED SIDING & ROOFING	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	6,500.00 SF	-	-	50,505	2,241	35.02 /MH	78,493	128,998
			ROOFING					50,505	2,241		78,493	128,998
		24.41.00	**SIDING**									
			METAL, INSULATED, NEW INSULATED SIDING & ROOFING	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	8,500.00 SF	-	-	140,760	870	79.59 /MH	69,207	209,967
			SIDING					140,760	870		69,207	209,967
		24.99.00	**ARCHITECTURAL, MISCELLANEOUS**									
			ARCHITECTURAL, MISCELLANEOUS - OFFICE ALLOWANCE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	1.00 LS	-	-	100,000	2,299	51.10 /MH	117,471	217,471
			ARCHITECTURAL, MISCELLANEOUS - TOOL CRIB	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	1.00 LS	-	-	5,000	92	51.10 /MH	4,699	9,699
			ARCHITECTURAL, MISCELLANEOUS					105,000	2,391		122,170	227,170
			ARCHITECTURAL					445,507	7,653		461,151	906,658
	27.00.00		**PAINTING & COATING**									
		27.17.00	**PAINTING**									
			PAINTING - ALLOWANCE	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	2,025	23	47.61 /MH	1,108	3,133
			PAINTING					2,025	23		1,108	3,133
			PAINTING & COATING					2,025	23		1,108	3,133
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.25.00	**CRANES & HOISTS**									
			BRIDGE CRANE - INSTALL SALVAGED 15 TN BRIDGE CRANE AND 2 JIB CRANES WITH EXISTING SUPPORT STEEL	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	21.00 TN	-	-	-	290	92.62 /MH	26,828	26,828
			BRIDGE CRANE - LOAD TEST & CERTIFY BRIDGE CRANE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	1.00 EA	-	-	-	230	92.62 /MH	21,292	21,292
			MOTORIZED HOIST - 1 TON	RELOCATED FROM PRESENT PORT LOCATIOIN	2.00 EA	-	-	-	138	68.48 /MH	9,446	9,446
			CRANES & HOISTS						657		57,565	57,565
		31.41.00	**FIRE PROTECTION EQUIPMENT & SYSTEM**									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	1.00 LT	-	-	10,000	138	68.48 /MH	9,446	19,446
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	WASTE MANAGEMENT FACILITY (	5,000.00 SF	-	-	27,500	385	68.48 /MH	26,369	53,869

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.41.00	**FIRE PROTECTION EQUIPMENT & SYSTEM**									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	REPLACES HAZMAT BLDG)	5,000.00 SF	-	-	27,500	385	68.48 /MH	26,369	53,869
			FIRE PROTECTION EQUIPMENT & SYSTEM					**37,500**	**523**		**35,814**	**73,314**
		31.51.00	**MERCURY REMOVAL EQUIPMENT**									
			ACTIVATED CARBON INJECTION (ACI) - LANCE RELOCATIONS	RELOCATED FROM PRESENT PORT LOCATIOIN (16 PER UNIT)	32.00 EA	-	-	-	368	68.48 /MH	25,188	25,188
			ACTIVATED CARBON INJECTION (ACI) - 40 HP BLOWERS	NEW BLOWERS (2 PER UNIT)	4.00 EA	-	-	80,000	184	68.48 /MH	12,594	92,594
			ACTIVATED CARBON INJECTION (ACI) - REMOVE EXISTING 20 HP BLOWERS	REMOVE EXISTING	2.00 EA	-	-	-	23	68.48 /MH	1,574	1,574
			MERCURY REMOVAL EQUIPMENT					**80,000**	**575**		**39,356**	**119,356**
			MECHANICAL EQUIPMENT					**117,500**	**1,755**		**132,736**	**250,236**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	2,100.00 SF	-	-	23,100	24	64.10 /MH	1,547	24,647
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	2,100.00 SF	-	-	23,100	24	64.10 /MH	1,547	24,647
			HVAC, MISCELLANEOUS					**46,200**	**48**		**3,094**	**49,294**
			HVAC					**46,200**	**48**		**3,094**	**49,294**
	35.00.00		**PIPING**									
		35.13.25	**FRP, ABOVE GROUND, PROCESS AREA**									
			1.5 IN DIA, TAPER	INJECTION PORTS	12.00 LF	-	-	353	6	77.36 /MH	437	790
			2 IN DIA, TAPER	INJECTION PORTS	16.00 LF	-	-	421	9	77.36 /MH	697	1,118
			3 IN DIA, TAPER	INJECTION PORTS	40.00 LF	-	-	1,032	31	77.36 /MH	2,383	3,415
			FRP, ABOVE GROUND, PROCESS AREA					**1,806**	**45**		**3,518**	**5,323**
		35.14.25	**FRP, STRAIGHT RUN**									
			4 IN DIA, TAPER	NEW ACI PIPING	600.00 LF	-	-	12,660	400	77.36 /MH	30,944	43,604
			FRP, STRAIGHT RUN					**12,660**	**400**		**30,944**	**43,604**
		35.36.00	**PIPE SUPPORTS, RACK**									
			U-BOLT FOR 4 IN PIPE	ACI PIPE	27.00 EA	-	-	81	62	77.36 /MH	4,802	4,883
			SUPPORT SLEEPERS	ACI PIPE 330 LF	17.00 EA	-	-	5,950	78	77.36 /MH	6,047	11,997
			SUPPORT FOR 4 IN DIA PIPE - USER DEFINED		2.00 EA	-	-	306	18	77.36 /MH	1,423	1,729
			SUPPORT FOR 3 IN DIA PIPE - USER DEFINED		4.00 EA	-	-	576	32	77.36 /MH	2,490	3,066
			PIPE SUPPORTS, RACK					**6,913**	**191**		**14,761**	**21,674**
		35.45.00	**VALVES**									
			VALVE - 4" 150 LB CS GATE, FLANGED	ACI AUTO MATIC ISOLATION VALVES (RELOCATE 4 PER UNIT)	8.00 EA	-	-	160	66	77.36 /MH	5,122	5,282
			VALVES					**160**	**66**		**5,122**	**5,282**
			PIPING					**21,539**	**702**		**54,344**	**75,883**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.37.00	**LIGHTING ACCESSORY (FIXTURE)**									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	6,500.00 SF	-	-	71,500	75	63.63 /MH	4,754	76,254
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	5,000.00 SF	-	-	55,000	57	63.63 /MH	3,657	58,657
			LIGHTING ACCESSORY (FIXTURE)					**126,500**	**132**		**8,411**	**134,911**
		41.46.00	**MOTOR CONTROL CENTER (MCC), COMPONENT**									
			FVN STARTER - #4,	NEW BLOWERS	3.00 EA	-	-	14,700	55	63.63 /MH	3,511	18,211
			MOTOR CONTROL CENTER (MCC), COMPONENT					**14,700**	**55**		**3,511**	**18,211**
			ELECTRICAL EQUIPMENT					**141,200**	**187**		**11,921**	**153,121**
	42.00.00		**RACEWAY, CABLE TRAY & CONDUIT**									
		42.15.23	**CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY**									
			1-1/2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS	NEW BLOWERS	3.00 EA	-	-	258	4	61.79 /MH	266	524
			CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**258**	**4**		**266**	**524**
		42.15.37	**CONDUIT, RGS**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		42.15.37	CONDUIT, RGS									
			3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	HOIST	450.00 LF	-	-	1,319	100	61.79 /MH	6,200	7,519
			1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	NEW BLOWERS	400.00 LF	-	-	2,688	131	61.79 /MH	8,068	10,756
			CONDUIT, RGS					4,007	231		14,269	18,275
			RACEWAY, CABLE TRAY & CONDUIT					4,264	235		14,535	18,799
	43.00.00		CABLE									
		43.10.00	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
			CONTROL/INSTRUMENTATION/COMMUNICATION TERMINATION - MISC	ACI RELOCATION	600.00 LF	-	-	1,920	55	82.05 /MH	4,527	6,447
			CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					1,920	55		4,527	6,447
		43.20.00	600V CABLE & TERMINATION									
			600V #8 3/C CU EPR TS-CPE	HOIST	500.00 LF	-	-	3,280	14	82.05 /MH	1,179	4,459
			600V #4/0 3/C W/G CU EPR TS-CPE	NEW BLOWERS	450.00 LF	-	-	10,728	72	82.05 /MH	5,942	16,670
			TERMINATION - COMPRESSION LUG, #8, 2 HOLE, COPPER	HOIST	12.00 EA	-	-	78	4	82.05 /MH	340	418
			TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER	NEW BLOWERS	12.00 EA	-	-	111	7	82.05 /MH	566	677
			600V CABLE & TERMINATION					14,197	98		8,026	22,223
			CABLE					16,117	153		12,553	28,670
	44.00.00		CONTROL & INSTRUMENTATION									
		44.21.00	INSTRUMENT									
			ACCOUSTIC MONITOR	RELOCATE TO NEW INJECTION LANCES	6.00 EA	-	-		28	64.68 /MH	1,784	1,784
			INSTRUMENT						28		1,784	1,784
			CONTROL & INSTRUMENTATION						28		1,784	1,784
	71.00.00		PROJECT INDIRECT									
		71.25.00	CONSULTANT, THIRD PARTY									
			COMPUTATIONAL FLUID DYNAMIC ANALYSIS (CFD)	ACI SYSTEM	1.00 LS	100,000	-			/MH		100,000
			CONSULTANT, THIRD PARTY			100,000						100,000
			PROJECT INDIRECT			100,000						100,000
			190 DEMOLITION / RELOCATION			**100,000**		**1,578,182**	**33,735**		**2,546,302**	**4,224,484**
201			**ELECTRICAL BOP SYSTEM**									
	21.00.00		CIVIL WORK									
		21.54.00	CAISSON									
			2.5 FT DIA X 30 FT DEEP CAISSON	U1 MAIN ELECT BLDG 40'X100'	23.00 EA	-	-	42,711	582	108.46 /MH	63,081	105,792
			2.5 FT DIA X 30 FT DEEP CAISSON	2 UAT AND 1 SST TRANSFORMER SUBSTRUCTURE	36.00 EA	-	-	66,852	910	108.46 /MH	98,736	165,588
			2.5 FT DIA X 30 FT DEEP CAISSON	BUS DUCT SUPPORTS	167.00 EA	-	-	310,119	4,223	108.46 /MH	458,025	768,144
			2.5 FT DIA X 30 FT DEEP CAISSON	OVERHEAD TRANSMISSION LINE STRUCTURAL - INCLUDES 115 KV DISCONNECT SWITCH FOUNDATION	10.00 EA	-	-	18,570	253	108.46 /MH	27,427	45,997
			2.5 FT DIA X 30 FT DEEP CAISSON	U2 MAIN ELECT BLDG 40'X100'	23.00 EA	-	-	42,711	582	108.46 /MH	63,081	105,792
			CAISSON					480,963	6,549		710,351	1,191,314
			CIVIL WORK					480,963	6,549		710,351	1,191,314
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			CONCRETE FOUNDATIONS - COMPOSITE RATE	U1 MAIN ELECT BLDG 40'X100'	300.00 CY	-	-	69,000	2,414	59.71 /MH	144,128	213,128
			CONCRETE FOUNDATIONS - COMPOSITE RATE	2 UAT AND 1 SST TRANSFORMER SUBSTRUCTURE	600.00 CY	-	-	138,000	4,828	59.71 /MH	288,255	426,255
			CONCRETE FOUNDATIONS - COMPOSITE RATE	BUS DUCT SUPPORTS	333.00 CY	-	-	76,590	2,679	59.71 /MH	159,982	236,572
			CONCRETE FOUNDATIONS - COMPOSITE RATE	OVERHEAD TRANSMISSION LINE STRUCTURAL	50.00 CY	-	-	11,500	402	59.71 /MH	24,021	35,521
			CONCRETE FOUNDATIONS - COMPOSITE RATE	U2 MAIN ELECT BLDG 40'X100'	300.00 CY	-	-	69,000	2,414	59.71 /MH	144,128	213,128
			CONCRETE					364,090	12,737		760,513	1,124,603
			CONCRETE					364,090	12,737		760,513	1,124,603
	23.00.00		STEEL									
		23.99.00	STEEL, MISCELLANEOUS									
			STEEL, MISCELLANEOUS - AUX SUPPORT STEEL	AUX SUPPORT STEEL	100.00 TN	-	-	271,000	1,954	92.62 /MH	180,982	451,982

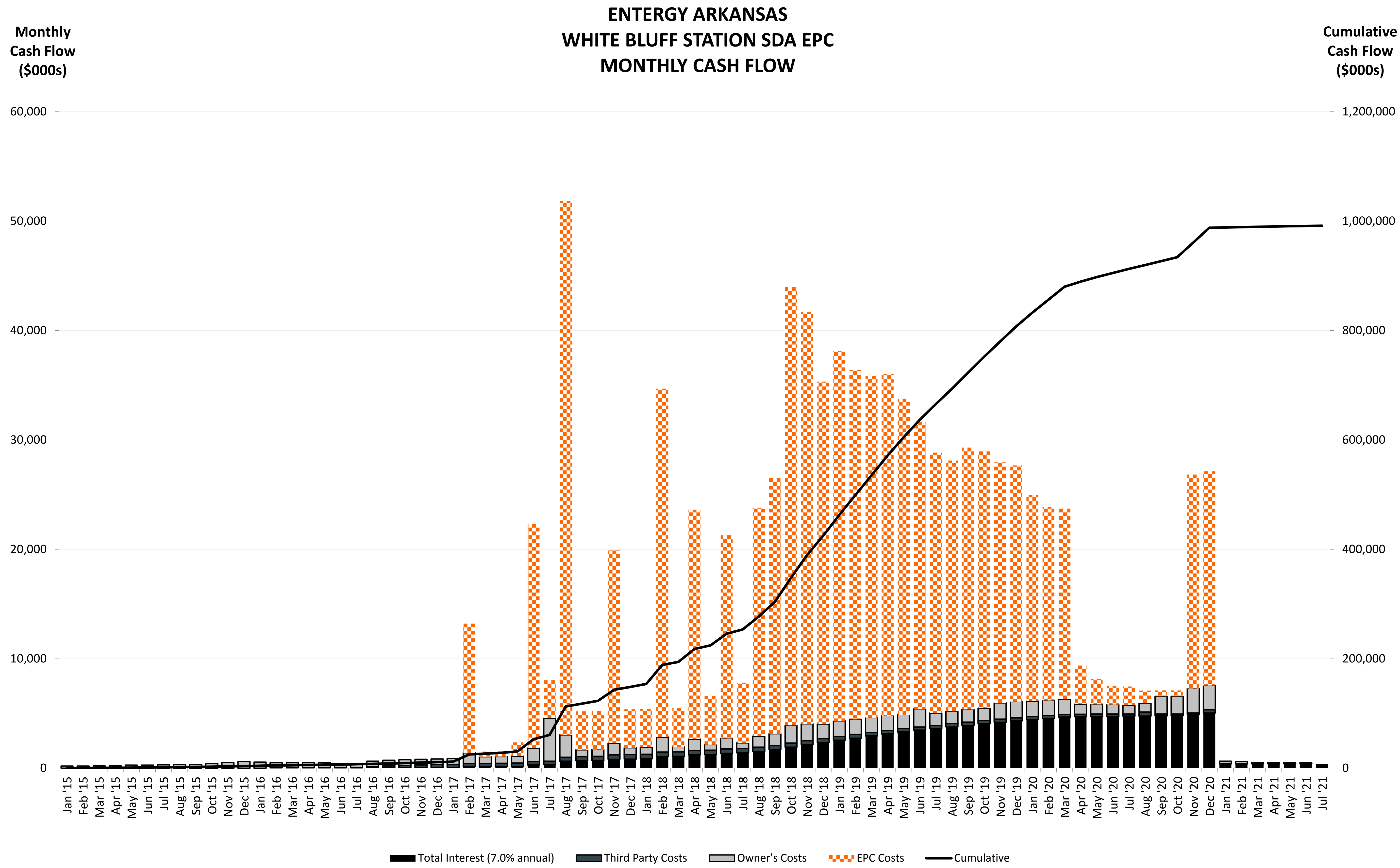
Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		23.99.00	**STEEL, MISCELLANEOUS**									
			STEEL, MISCELLANEOUS -	BUS DUCT SUPPORTS	167.00 TN	-	-	452,570	3,263	92.62 /MH	302,239	754,809
			STEEL, MISCELLANEOUS -	OVERHEAD TRANSMISSION LINE STRUCTURAL	15.00 TN	-	-	40,650	293	92.62 /MH	27,147	67,797
			STEEL, MISCELLANEOUS					**764,220**	**5,510**		**510,368**	**1,274,588**
			STEEL					**764,220**	**5,510**		**510,368**	**1,274,588**
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			PRE-ENGINEERED BUILDING - MAIN ELECT BLDG 40'X100'	U1 MAIN ELECT BLDG 40'X100' FURNISH ONLY	1.00 EA	-	504,000		4,598	51.10 /MH	234,943	738,943
			PRE-ENGINEERED BUILDING - MAIN ELECT BLDG 40'X100'	U1 MAIN ELECT BLDG 40'X100' INSTALLATION	1.00 EA	-			414	92.62 /MH	38,326	38,326
			PRE-ENGINEERED BUILDING - MAIN ELECT BLDG 40'X100'	U2 MAIN ELECT BLDG 40'X100' FURNISH ONLY	1.00 EA	-	504,000		4,598	51.10 /MH	234,943	738,943
			PRE-ENGINEERED BUILDING - MAIN ELECT BLDG 40'X100'	U2 MAIN ELECT BLDG 40'X100' INSTALLATION	1.00 EA	-			414	92.62 /MH	38,326	38,326
			PRE-ENGINEERED BUILDING				**1,008,000**		**10,023**		**546,536**	**1,554,536**
			ARCHITECTURAL				**1,008,000**		**10,023**		**546,536**	**1,554,536**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.13.00	**BUS DUCT**									
			ISO PHASE, SELF COOLED	TAP BUS EXTENSIONS	200.00 LF	-	315,000		4,828	63.63 /MH	307,179	622,179
			NON SEGREGATED - (600V) (2000A) FGD ONLY		800.00 LF	-	588,000		5,517	63.63 /MH	351,062	939,062
			BUS DUCT				**903,000**		**10,345**		**658,241**	**1,561,241**
		41.45.00	**MOTOR CONTROL CENTER (MCC), COMPLETE**									
			MOTOR CONTROL CENTER (MCC), COMPLETE - 480V FGD		12.00 EA	-	636,000		5,931	63.63 /MH	377,392	1,013,392
			MOTOR CONTROL CENTER (MCC), COMPLETE				**636,000**		**5,931**		**377,392**	**1,013,392**
		41.51.00	**POWER TRANSFORMER**									
			STARTUP, RESERVE AUXILIARY (RAT) - 36/48 MVA 115/6.9/6.9 KV	LABOR INCLUDES DRESS OUT AND FILL	1.00 EA	-	875,000		1,379	63.63 /MH	87,766	962,766
			STARTUP, RESERVE AUXILIARY (RAT) - 36/48 MVA 115/6.9/6.9 KV	HEAVY HAUL FROM RAIL TO PAD	1.00 EA	-	95,000			/MH		95,000
			UNIT AUXILIARY - 36/48 MVA 25/6.9/6.9 KV	LABOR INCLUDES DRESS OUT AND FILL	2.00 EA	-	1,700,000		2,759	63.63 /MH	175,531	1,875,531
			UNIT AUXILIARY - 36/48 MVA 25/6.9/6.9 KV	HEAVY HAUL FROM RAIL TO PAD	2.00 EA	-	190,000			/MH		190,000
			POWER TRANSFORMER - 6.9-.48 kV UNIT SUBSTATION X FMRS - 2000 KVA		4.00 EA	-	360,000		667	63.63 /MH	42,420	402,420
			POWER TRANSFORMER - 6.9-.48 kV UNIT SUBSTATION X FMRS - 1500 KVA		4.00 EA	-	300,000		598	63.63 /MH	38,032	338,032
			POWER TRANSFORMER				**3,520,000**		**5,402**		**343,748**	**3,863,748**
		41.55.00	**SWITCHGEAR, COMPLETE**									
			480 V - REAGENT SWITCHGEAR		4.00 EA	-	212,000		1,977	63.63 /MH	125,797	337,797
			480 V - 480V FGD SWITCHGEAR		4.00 EA	-	840,000		4,138	63.63 /MH	263,297	1,103,297
			6.9 KV - SWITCHGEAR FGD		4.00 EA	-	1,680,000		14,713	63.63 /MH	936,166	2,616,166
			6.9 KV - SWITCHGEAR WALK IN TYPE		3.00 EA	-	660,000		5,810	63.63 /MH	369,712	1,029,712
			SWITCHGEAR, COMPLETE				**3,392,000**		**26,638**		**1,694,972**	**5,086,972**
		41.99.00	**ELECTRICAL EQUIPMENT, MISCELLANEOUS**									
			ELECTRICAL EQUIPMENT, MISCELLANEOUS AUX POWER EQUIPMENT		1.00 LT	-	2,840,000		11,494	63.63 /MH	731,379	3,571,379
			ELECTRICAL EQUIPMENT, MISCELLANEOUS				**2,840,000**		**11,494**		**731,379**	**3,571,379**
			ELECTRICAL EQUIPMENT				**11,291,000**		**59,810**		**3,805,732**	**15,096,732**
	42.00.00		**RACEWAY, CABLE TRAY & CONDUIT**									
		42.13.00	**CABLE TRAY**									
			CABLE TRAY - ALLOTMENT		1.00 LT	-	-	505,000	33,333	61.79 /MH	2,059,667	2,564,667
			CABLE TRAY					**505,000**	**33,333**		**2,059,667**	**2,564,667**
		42.15.37	**CONDUIT, RGS**									
			XX IN DIA - CONDUIT ALLOTMENT		1.00 LT	-	-	90,000	74,138	61.79 /MH	4,580,983	4,670,983
			CONDUIT, RGS					**90,000**	**74,138**		**4,580,983**	**4,670,983**
		42.18.00	**DUCT BANK**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		42.18.00	**DUCT BANK**									
			DUCT BANK - UNDERGROUND DUCT BANKS NOT APPLICABLE		LT	-	-			61.79 /MH		
			RACEWAY, CABLE TRAY & CONDUIT					**595,000**	**107,471**		**6,640,649**	**7,235,649**
	43.00.00		**CABLE**									
		43.10.00	**CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION**									
			CONTROL/INSTRUMENTATION/COMMUNICATION TERMINATION - MISC		201,600.00 LF	-	-	645,120	18,538	82.05 /MH	1,521,037	2,166,157
			CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**645,120**	**18,538**		**1,521,037**	**2,166,157**
		43.20.00	**600V CABLE & TERMINATION**									
			600V CABLE - MISC		218,000.00 LF	-	-	1,881,340	30,069	82.05 /MH	2,467,159	4,348,499
			600V CABLE & TERMINATION					**1,881,340**	**30,069**		**2,467,159**	**4,348,499**
		43.40.00	**5/8KV CABLE & TERMINATION**									
			5/8KV #750 KCMIL 1/C CU EPR TS-CPE , FEEDS TO 8KV SWGR BLDG		225,000.00 LF	-	-	5,415,750	23,276	82.05 /MH	1,909,784	7,325,534
			5/8KV MISC		40,200.00 LF	-	-	297,480	10,628	82.05 /MH	871,993	1,169,473
			5/8KV CABLE & TERMINATION					**5,713,230**	**33,903**		**2,781,778**	**8,495,008**
		43.50.00	**15KV CABLE & TERMINATION**									
			15KV CABLE - MISC		22,300.00 LF	-	-	206,721	5,895	82.05 /MH	483,718	690,439
			15KV CABLE & TERMINATION					**206,721**	**5,895**		**483,718**	**690,439**
			CABLE					**8,446,411**	**88,406**		**7,253,692**	**15,700,103**
	51.00.00		**SUBSTATION, SWITCHYARD & TRANSMISSION LINE**									
		51.15.27	**CIRCUIT BREAKER**									
			CIRCUIT BREAKER - SWITCHYARD BAY AND 3 BREAKERS	ADDITION OF A SWITCHYARD BAY IS AVOIDED BY PLACING THE NEW SST NEXT TO THE EXISTING SST AND USING THE SAME OVERHEAD LINE.	0.00 LT	-				55.78 /MH		
		51.15.53	**DISCONNECT SWITCH**									
			115KV, 1200A, VERTICAL BREAK SWITCH WITH INSULATORS,INCLUDING GROUND SWITCH AND WITHOUT MOTORIZED OPERATOR	FOR ISOLATION OF RAT	1.00 EA	-	-	15,000	69	55.78 /MH	3,847	18,847
			DISCONNECT SWITCH					**15,000**	**69**		**3,847**	**18,847**
			SUBSTATION, SWITCHYARD & TRANSMISSION LINE					**15,000**	**69**		**3,847**	**18,847**
			201 ELECTRICAL BOP SYSTEM				**12,299,000**	**10,665,684**	**290,576**		**20,231,688**	**43,196,372**
211			**INSTRUMENTATION AND CONTROLS BOP SYSTEM**									
	44.00.00		**CONTROL & INSTRUMENTATION**									
		44.13.00	**CONTROL SYSTEM**									
			DISTRIBUTED CONTROL SYSTEM (DCS) - I/O POINTS	ESTIMATED BOP 2000 I/O POINTS, (ANOTHER 1000 POINTS PER UNIT ARE INCLUDED IN THE DFGD PROPOSAL PRICES AND ARE NOT INCLUDED HERE)	1.00 LT	-	1,500,000		2,299	64.68 /MH	148,690	1,648,690
			CONTROL SYSTEM				**1,500,000**		**2,299**		**148,690**	**1,648,690**
		44.21.00	**INSTRUMENT**									
			INSTRUMENT - BOP INSTRUMENTS		1.00 LT	-	-	478,000	7,946	82.05 /MH	651,967	1,129,967
			INSTRUMENT - THERMOCOUPLES IN STACK ENTRANCE W ALARM		1.00 LT	-	-	100,000		82.05 /MH		100,000
			INSTRUMENT					**578,000**	**7,946**		**651,967**	**1,229,967**
		44.25.00	**MONITORING EQUIPMENT**									
			CONTINUOUS EMISSION MONITORING SYSTEM (CEMS) - REFURBISHING		2.00 EA	-	-	460,000	625	64.68 /MH	40,444	500,444
			MONITORING EQUIPMENT - LOCAL HMI		3.00 EA	-	-	45,000	14	64.68 /MH	892	45,892

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			MONITORING EQUIPMENT					505,000	639		41,336	546,336
			CONTROL & INSTRUMENTATION				1,500,000	1,083,000	10,884		841,993	3,424,993
			211 INSTRUMENTATION AND CONTROLS				**1,500,000**	**1,083,000**	**10,884**		**841,993**	**3,424,993**
			BOP SYSTEM									

ATTACHMENT 2

Conceptual Capital Cost Estimate Cash Flow

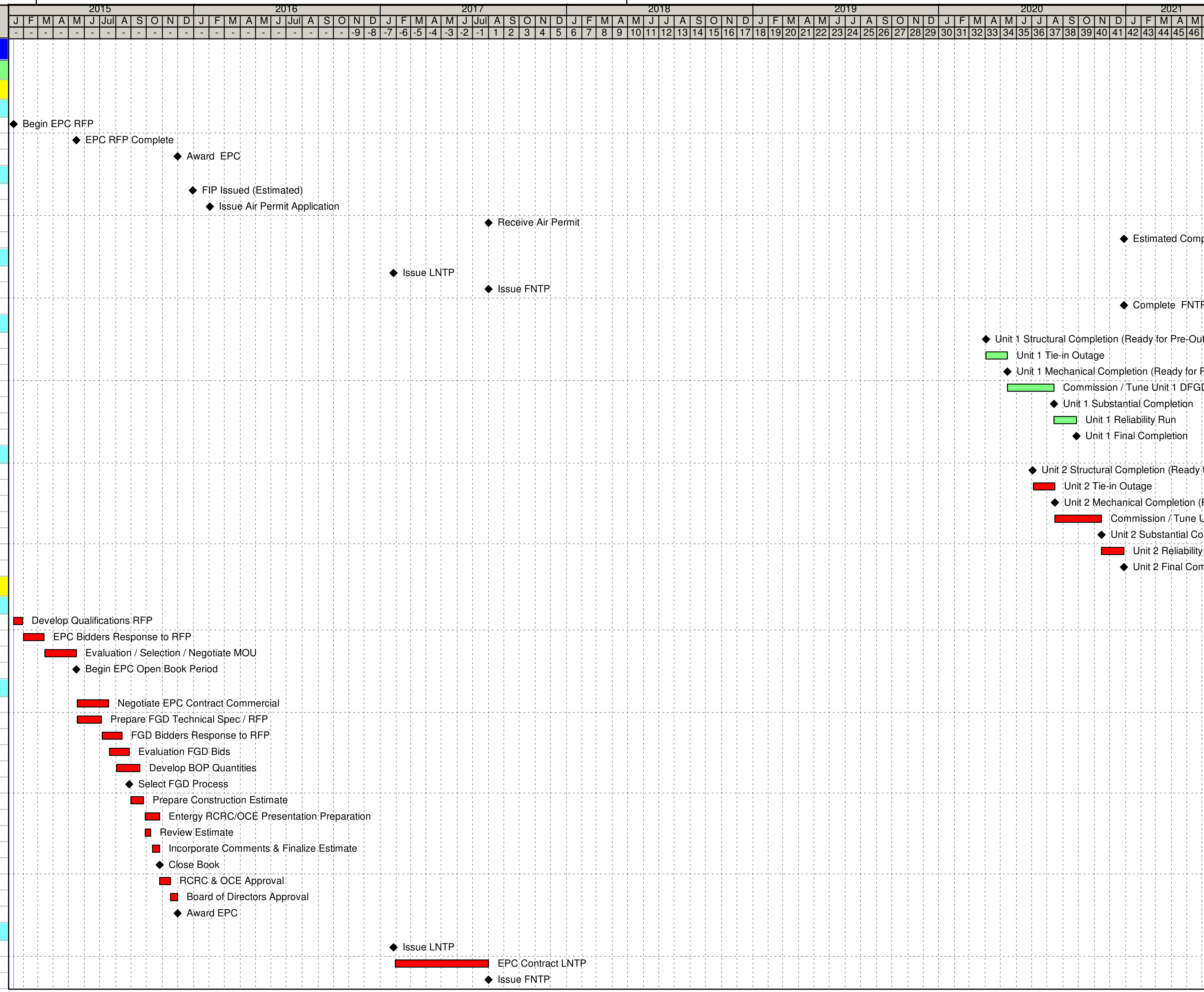


ENTERGY ARKANSAS
WHITE BLUFF STATION SDA EPC
MONTHLY CASH FLOW
Monthly Cash Flow ($000s)
Cumulative Cash Flow ($000s)
60,000
50,000
40,000
30,000
20,000
10,000
0
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Jan '15
Jul '21
Total Interest (7.0% annual)
Third Party Costs
Owner's Costs
EPC Costs
Cumulative

ATTACHMENT 3

Level 1 Preliminary Execution Schedule

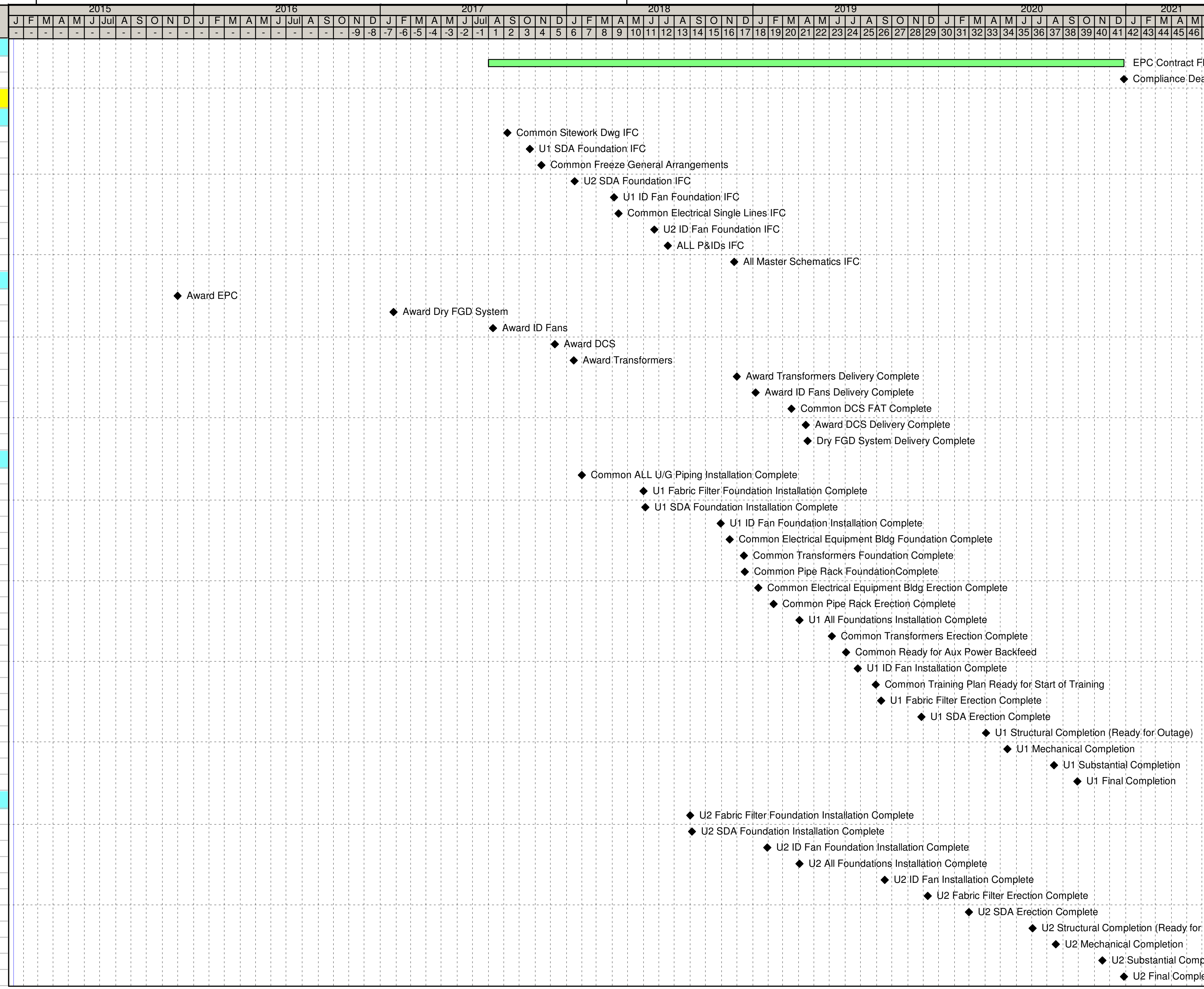
Activity ID	Activity Name	Orig Dur	Start	Finish
WHITE BLUFF FGD SCHEDULE (December 2020)		1556	13-Jan-15	29-Dec-20
Milestones		1556	13-Jan-15	29-Dec-20
Project Milestones		1556	13-Jan-15	29-Dec-20
EPC RFP		225	13-Jan-15	30-Nov-15
MS010	Begin EPC RFP	0	13-Jan-15	
MS100	EPC RFP Complete	0		15-May-15
MS225	Award EPC	0		30-Nov-15
Permitting		1272	30-Dec-15	29-Dec-20
MS275	FIP Issued (Estimated)	0		30-Dec-15
MS015	Issue Air Permit Application	0		02-Feb-16
MS020	Receive Air Permit	0		31-Jul-17
MS285	Estimated Compliance Date	0		29-Dec-20
LNTP/FNTP		998	27-Jan-17	28-Dec-20
MS260	Issue LNTP	0		27-Jan-17
MS030	Issue FNTP	0		31-Jul-17
MS265	Complete FNTP Period	0		28-Dec-20
Unit 1 & Common Outage, Start-Up & Commissioning		178	02-Apr-20	27-Sep-20
MS0100	Unit 1 Structural Completion (Ready for Pre-Outage)	0		02-Apr-20
MS0110	Unit 1 Tie-in Outage	42	03-Apr-20	14-May-20
MS0120	Unit 1 Mechanical Completion (Ready for Flue Gas)	0		14-May-20
MS0130	Commission / Tune Unit 1 DFGD System	91	15-May-20	13-Aug-20
MS0140	Unit 1 Substantial Completion	0		13-Aug-20
MS0150	Unit 1 Reliability Run	45	14-Aug-20	27-Sep-20
MS0160	Unit 1 Final Completion	0		27-Sep-20*
Unit 2 Outage, Start-Up & Commissioning		179	03-Jul-20	29-Dec-20
MS0200	Unit 2 Structural Completion (Ready for Pre-Outage)	0		03-Jul-20
MS0210	Unit 2 Tie-in Outage	43	04-Jul-20	15-Aug-20
MS0220	Unit 2 Mechanical Completion (Ready for Flue Gas)	0		15-Aug-20
MS0230	Commission / Tune Unit 2 DFGD System	91	16-Aug-20	14-Nov-20
MS0240	Unit 2 Substantial Completion	0		14-Nov-20
MS0250	Unit 2 Reliability Run	45	15-Nov-20	29-Dec-20
MS0260	Unit 2 Final Completion	0		29-Dec-20
Project Overview		1556	13-Jan-15	29-Dec-20
EPC RFP		89	13-Jan-15	15-May-15
OV1000	Develop Qualifications RFP	14	13-Jan-15	30-Jan-15
OV1010	EPC Bidders Response to RFP	30	02-Feb-15	13-Mar-15
OV1020	Evaluation / Selection / Negotiate MOU	45	16-Mar-15	15-May-15
OV1040	Begin EPC Open Book Period	0		15-May-15
EPC Development Phase		141	18-May-15	30-Nov-15
OV1030	Negotiate EPC Contract Commercial	45	18-May-15	17-Jul-15
OV1050	Prepare FGD Technical Spec / RFP	35	18-May-15	03-Jul-15
OV1060	FGD Bidders Response to RFP	30	06-Jul-15	14-Aug-15
OV1070	Evaluation FGD Bids	30	20-Jul-15	28-Aug-15
OV1090	Develop BOP Quantities	35	03-Aug-15	18-Sep-15
OV1080	Select FGD Process	0		28-Aug-15
OV1100	Prepare Construction Estimate	20	31-Aug-15	25-Sep-15
OV1110	Entergy RCRC/OCE Presentation Preparation	21	28-Sep-15	26-Oct-15
OV1103	Review Estimate	10	28-Sep-15	09-Oct-15
OV1105	Incorporate Comments & Finalize Estimate	11	12-Oct-15	26-Oct-15
OV1120	Close Book	0		26-Oct-15
OV1130	RCRC & OCE Approval	15	27-Oct-15	16-Nov-15
OV1140	Board of Directors Approval	10	17-Nov-15	30-Nov-15
OV1145	Award EPC	0		30-Nov-15
LNTP		132	27-Jan-17	01-Aug-17
OV1150	Issue LNTP	0		27-Jan-17
OV1160	EPC Contract LNTP	132	30-Jan-17	01-Aug-17
OV1170	Issue FNTP	0		01-Aug-17



Remaining Work
Actual Work
WBS Summary
Critical Remaining Work
Milestone

TASK filter: Exclude WBS Activities_1.

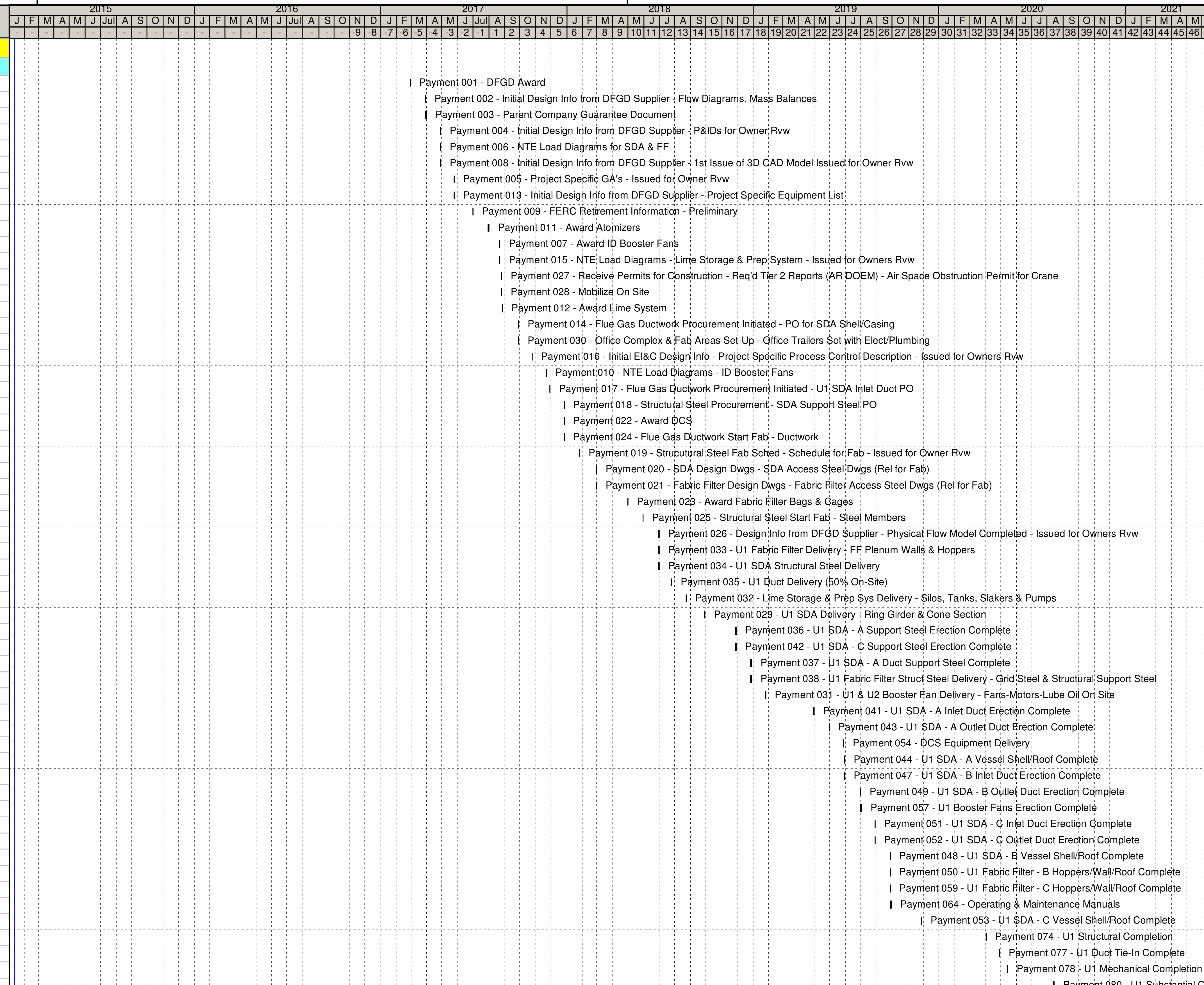
Activity ID	Activity Name	Orig Dur	Start	Finish
FNTP		890	02-Aug-17	29-Dec-20
OV1180	EPC Contract FNTP Period	889	02-Aug-17	28-Dec-20
OV1230	Compliance Deadline	0		29-Dec-20*
EPC Milestones		1292	30-Nov-15	29-Dec-20
Engineering		308	07-Sep-17	26-Nov-18
EPC325	Common Sitework Dwg IFC	0		07-Sep-17
EPC345	U1 SDA Foundation IFC	0		20-Oct-17
EPC340	Common Freeze General Arrangements	0		13-Nov-17
EPC510	U2 SDA Foundation IFC	0		16-Jan-18
EPC350	U1 ID Fan Foundation IFC	0		03-Apr-18
EPC320	Common Electrical Single Lines IFC	0		13-Apr-18
EPC485	U2 ID Fan Foundation IFC	0		22-Jun-18
EPC355	ALL P&IDs IFC	0		18-Jul-18
EPC240	All Master Schematics IFC	0		26-Nov-18
Procurement		858	30-Nov-15	19-Apr-19
EPC010	Award EPC	0		30-Nov-15
EPC100	Award Dry FGD System	0		27-Jan-17
EPC110	Award ID Fans	0		09-Aug-17
EPC335	Award DCS	0		08-Dec-17
EPC315	Award Transformers	0		15-Jan-18
EPC545	Award Transformers Delivery Complete	0		30-Nov-18
EPC535	Award ID Fans Delivery Complete	0		07-Jan-19
EPC415	Common DCS FAT Complete	0		18-Mar-19
EPC540	Award DCS Delivery Complete	0		15-Apr-19
EPC530	Dry FGD System Delivery Complete	0		19-Apr-19
Unit 1 & Common Construction & Commissioning		677	30-Jan-18	28-Sep-20
EPC425	Common ALL U/G Piping Installation Complete	0		30-Jan-18
EPC370	U1 Fabric Filter Foundation Installation Complete	0		01-Jun-18
EPC360	U1 SDA Foundation Installation Complete	0		05-Jun-18
EPC365	U1 ID Fan Foundation Installation Complete	0		30-Oct-18
EPC395	Common Electrical Equipment Bldg Foundation Complete	0		16-Nov-18
EPC405	Common Transformers Foundation Complete	0		14-Dec-18
EPC460	Common Pipe Rack FoundationComplete	0		17-Dec-18
EPC400	Common Electrical Equipment Bldg Erection Complete	0		11-Jan-19
EPC390	Common Pipe Rack Erection Complete	0		11-Feb-19
EPC310	U1 All Foundations Installation Complete	0		02-Apr-19
EPC410	Common Transformers Erection Complete	0		05-Jun-19
EPC435	Common Ready for Aux Power Backfeed	0		02-Jul-19
EPC380	U1 ID Fan Installation Complete	0		25-Jul-19
EPC420	Common Training Plan Ready for Start of Training	0		29-Aug-19
EPC385	U1 Fabric Filter Erection Complete	0		09-Sep-19
EPC375	U1 SDA Erection Complete	0		28-Nov-19
EPC440	U1 Structural Completion (Ready for Outage)	0		02-Apr-20
EPC445	U1 Mechanical Completion	0		14-May-20
EPC450	U1 Substantial Completion	0		13-Aug-20
EPC455	U1 Final Completion	0		28-Sep-20
Unit 2 Construction & Commissioning		593	31-Aug-18	29-Dec-20
EPC475	U2 Fabric Filter Foundation Installation Complete	0		31-Aug-18
EPC515	U2 SDA Foundation Installation Complete	0		04-Sep-18
EPC490	U2 ID Fan Foundation Installation Complete	0		29-Jan-19
EPC465	U2 All Foundations Installation Complete	0		02-Apr-19
EPC495	U2 ID Fan Installation Complete	0		16-Sep-19
EPC470	U2 Fabric Filter Erection Complete	0		09-Dec-19
EPC505	U2 SDA Erection Complete	0		28-Feb-20
EPC520	U2 Structural Completion (Ready for Outage)	0		03-Jul-20
EPC500	U2 Mechanical Completion	0		17-Aug-20
EPC525	U2 Substantial Completion	0		16-Nov-20
EPC480	U2 Final Completion	0		29-Dec-20



Remaining Work — Actual Work — WBS Summary
Critical Remaining Work — Milestone

TASK filter: Exclude WBS Activities_1.

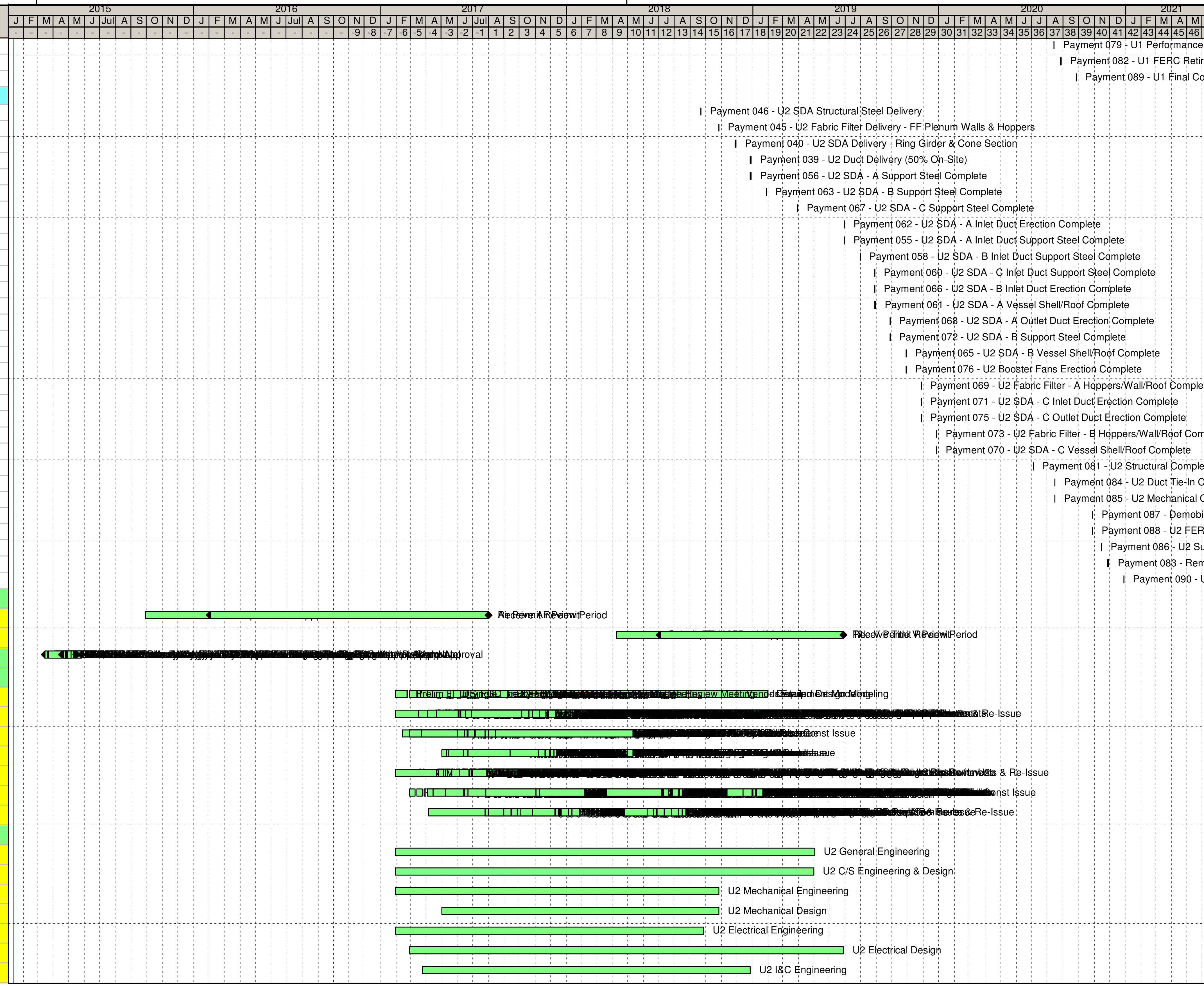
Activity ID	Activity Name	Ori Dur	Start	Finish
Payment Milestones		1401	28-Feb-17	29-Dec-20
Unit 1 & Common		1308	28-Feb-17	27-Sep-20
PAY001	Payment 001 - DFGD Award	1	28-Feb-17	28-Feb-17
PAY002	Payment 002 - Initial Design Info from DFGD Supplier - Flow ...	1	29-Mar-17	29-Mar-17
PAY003	Payment 003 - Parent Company Guarantee Document	1	30-Mar-17	30-Mar-17
PAY004	Payment 004 - Initial Design Info from DFGD Supplier - P&IDs...	1	28-Apr-17	28-Apr-17
PAY006	Payment 006 - NTE Load Diagrams for SDA & FF	1	28-Apr-17	28-Apr-17
PAY008	Payment 008 - Initial Design Info from DFGD Supplier - 1st Iss...	1	28-Apr-17	28-Apr-17
PAY005	Payment 005 - Project Specific GA's - Issued for Owner Rvw	1	25-May-17	25-May-17
PAY013	Payment 013 - Initial Design Info from DFGD Supplier - Projec...	1	25-May-17	25-May-17
PAY009	Payment 009 - FERC Retirement Information - Preliminary	1	30-Jun-17	30-Jun-17
PAY011	Payment 011 - Award Atomizers	1	31-Jul-17	31-Jul-17
PAY007	Payment 007 - Award ID Booster Fans	1	22-Aug-17	22-Aug-17
PAY015	Payment 015 - NTE Load Diagrams - Lime Storage & Prep Sy...	1	22-Aug-17	22-Aug-17
PAY027	Payment 027 - Receive Permits for Construction - Req'd Tier ...	1	25-Aug-17	25-Aug-17
PAY028	Payment 028 - Mobilize On Site	1	26-Aug-17	26-Aug-17
PAY012	Payment 012 - Award Lime System	1	28-Aug-17	28-Aug-17
PAY014	Payment 014 - Flue Gas Ductwork Procurement Initiated - PO...	1	28-Sep-17	28-Sep-17
PAY030	Payment 030 - Office Complex & Fab Areas Set-Up - Office Tr...	1	28-Sep-17	28-Sep-17
PAY016	Payment 016 - Initial EI&C Design Info - Project Specific Proc...	1	24-Oct-17	24-Oct-17
PAY010	Payment 010 - NTE Load Diagrams - ID Booster Fans	1	22-Nov-17	22-Nov-17
PAY017	Payment 017 - Flue Gas Ductwork Procurement Initiated - U1 ...	1	28-Nov-17	28-Nov-17
PAY018	Payment 018 - Structural Steel Procurement - SDA Support St...	1	26-Dec-17	27-Dec-17
PAY022	Payment 022 - Award DCS	1	26-Dec-17	27-Dec-17
PAY024	Payment 024 - Flue Gas Ductwork Start Fab - Ductwork	1	26-Dec-17	27-Dec-17
PAY019	Payment 019 - Strucutural Steel Fab Sched - Schedule for Fa...	1	26-Jan-18	26-Jan-18
PAY020	Payment 020 - SDA Design Dwgs - SDA Access Steel Dwgs (...	1	28-Feb-18	28-Feb-18
PAY021	Payment 021 - Fabric Filter Design Dwgs - Fabric Filter Acces...	1	28-Feb-18	28-Feb-18
PAY023	Payment 023 - Award Fabric Filter Bags & Cages	1	30-Apr-18	30-Apr-18
PAY025	Payment 025 - Structural Steel Start Fab - Steel Members	1	30-May-18	30-May-18
PAY026	Payment 026 - Design Info from DFGD Supplier - Physical Flo...	1	30-Jun-18	30-Jun-18
PAY033	Payment 033 - U1 Fabric Filter Delivery - FF Plenum Walls & ...	1	30-Jun-18	30-Jun-18
PAY034	Payment 034 - U1 SDA Structural Steel Delivery	1	30-Jun-18	30-Jun-18
PAY035	Payment 035 - U1 Duct Delivery (50% On-Site)	1	25-Jul-18	25-Jul-18
PAY032	Payment 032 - Lime Storage & Prep Sys Delivery - Silos, Tan...	1	23-Aug-18	23-Aug-18
PAY029	Payment 029 - U1 SDA Delivery - Ring Girder & Cone Section	1	28-Sep-18	28-Sep-18
PAY036	Payment 036 - U1 SDA - A Support Steel Erection Complete	1	28-Nov-18	28-Nov-18
PAY042	Payment 042 - U1 SDA - C Support Steel Erection Complete	1	28-Nov-18	28-Nov-18
PAY037	Payment 037 - U1 SDA - A Duct Support Steel Complete	1	28-Dec-18	28-Dec-18
PAY038	Payment 038 - U1 Fabric Filter Struct Steel Delivery - Grid Ste...	1	28-Dec-18	28-Dec-18
PAY031	Payment 031 - U1 & U2 Booster Fan Delivery - Fans-Motors-L...	1	26-Jan-19	26-Jan-19
PAY041	Payment 041 - U1 SDA - A Inlet Duct Erection Complete	1	30-Apr-19	30-Apr-19
PAY043	Payment 043 - U1 SDA - A Outlet Duct Erection Complete	1	30-May-19	30-May-19
PAY054	Payment 054 - DCS Equipment Delivery	1	28-Jun-19	28-Jun-19
PAY044	Payment 044 - U1 SDA - A Vessel Shell/Roof Complete	1	29-Jun-19	29-Jun-19
PAY047	Payment 047 - U1 SDA - B Inlet Duct Erection Complete	1	29-Jun-19	29-Jun-19
PAY049	Payment 049 - U1 SDA - B Outlet Duct Erection Complete	1	31-Jul-19	31-Jul-19
PAY057	Payment 057 - U1 Booster Fans Erection Complete	1	01-Aug-19	01-Aug-19
PAY051	Payment 051 - U1 SDA - C Inlet Duct Erection Complete	1	28-Aug-19	28-Aug-19
PAY052	Payment 052 - U1 SDA - C Outlet Duct Erection Complete	1	28-Aug-19	28-Aug-19
PAY048	Payment 048 - U1 SDA - B Vessel Shell/Roof Complete	1	27-Sep-19	27-Sep-19
PAY050	Payment 050 - U1 Fabric Filter - B Hoppers/Wall/Roof Complete	1	27-Sep-19	27-Sep-19
PAY059	Payment 059 - U1 Fabric Filter - C Hoppers/Wall/Roof Complete	1	27-Sep-19	27-Sep-19
PAY064	Payment 064 - Operating & Maintenance Manuals	1	28-Sep-19	28-Sep-19
PAY053	Payment 053 - U1 SDA - C Vessel Shell/Roof Complete	1	28-Nov-19	28-Nov-19
PAY074	Payment 074 - U1 Structural Completion	1	02-Apr-20	02-Apr-20
PAY077	Payment 077 - U1 Duct Tie-In Complete	1	29-Apr-20	29-Apr-20
PAY078	Payment 078 - U1 Mechanical Completion	1	15-May-20	15-May-20
PAY080	Payment 080 - U1 Substantial Completion	1	13-Aug-20	13-Aug-20



Remaining Work | Actual Work | WBS Summary
Critical Remaining Work | Milestone

TASK filter: Exclude WBS Activities_1.

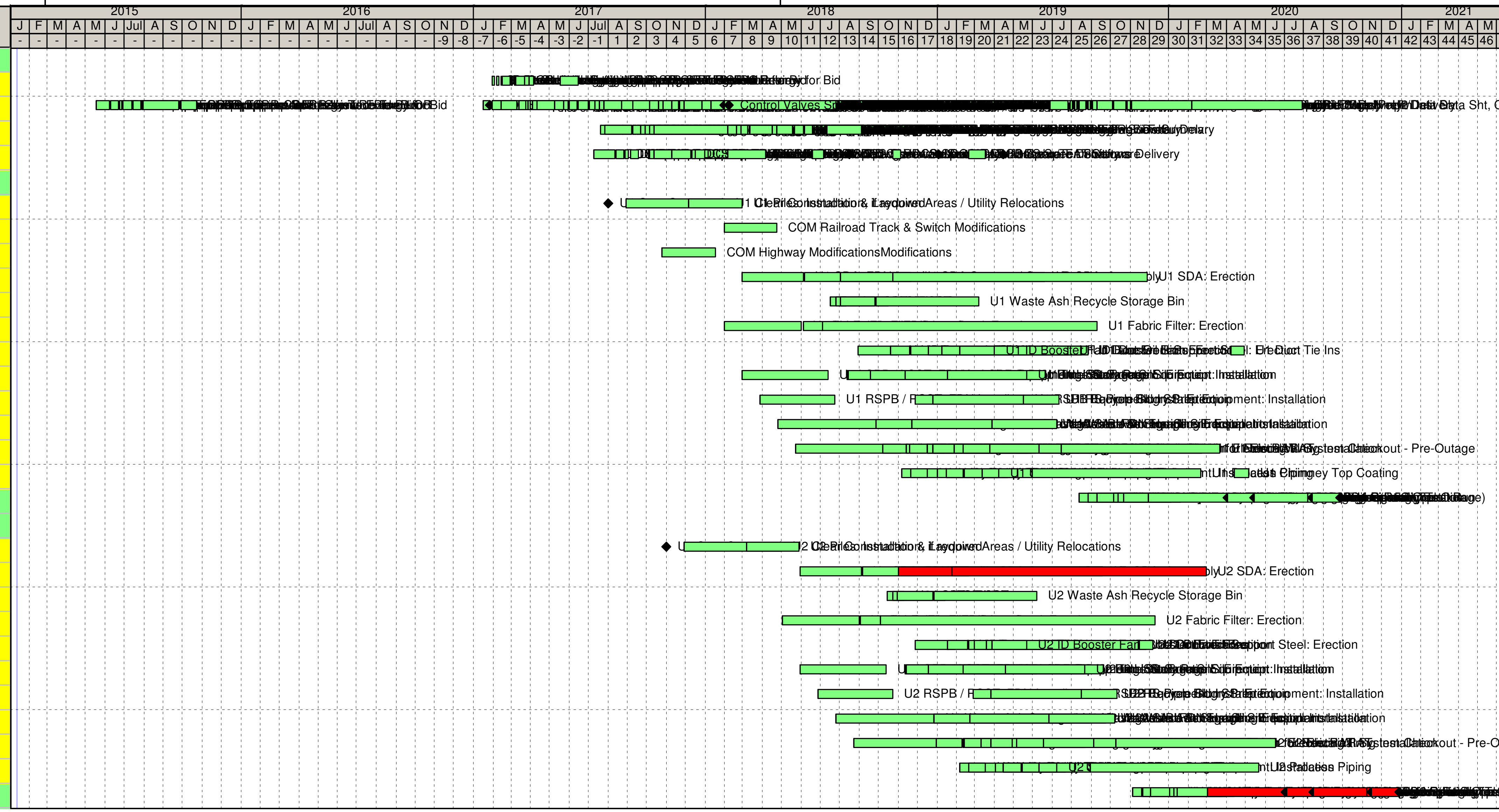
Activity ID	Activity Name	Orig Dur	Start	Finish
PAY079	Payment 079 - U1 Performance Test Report	1	14-Aug-20	14-Aug-20
PAY082	Payment 082 - U1 FERC Retirement Information	1	27-Aug-20	27-Aug-20
PAY089	Payment 089 - U1 Final Completion	1	27-Sep-20	27-Sep-20
Unit 2		830	22-Sep-18	29-Dec-20
PAY046	Payment 046 - U2 SDA Structural Steel Delivery	1	22-Sep-18	22-Sep-18
PAY045	Payment 045 - U2 Fabric Filter Delivery - FF Plenum Walls & ...	1	27-Oct-18	27-Oct-18
PAY040	Payment 040 - U2 SDA Delivery - Ring Girder & Cone Section	1	28-Nov-18	28-Nov-18
PAY039	Payment 039 - U2 Duct Delivery (50% On-Site)	1	28-Dec-18	28-Dec-18
PAY056	Payment 056 - U2 SDA - A Support Steel Complete	1	28-Dec-18	28-Dec-18
PAY063	Payment 063 - U2 SDA - B Support Steel Complete	1	28-Jan-19	28-Jan-19
PAY067	Payment 067 - U2 SDA - C Support Steel Complete	1	30-Mar-19	30-Mar-19
PAY062	Payment 062 - U2 SDA - A Inlet Duct Erection Complete	1	29-Jun-19	29-Jun-19
PAY055	Payment 055 - U2 SDA - A Inlet Duct Support Steel Complete	1	30-Jun-19	30-Jun-19
PAY058	Payment 058 - U2 SDA - B Inlet Duct Support Steel Complete	1	31-Jul-19	31-Jul-19
PAY060	Payment 060 - U2 SDA - C Inlet Duct Support Steel Complete	1	28-Aug-19	28-Aug-19
PAY066	Payment 066 - U2 SDA - B Inlet Duct Erection Complete	1	28-Aug-19	28-Aug-19
PAY061	Payment 061 - U2 SDA - A Vessel Shell/Roof Complete	1	29-Aug-19	29-Aug-19
PAY068	Payment 068 - U2 SDA - A Outlet Duct Erection Complete	1	27-Sep-19	27-Sep-19
PAY072	Payment 072 - U2 SDA - B Support Steel Complete	1	27-Sep-19	27-Sep-19
PAY065	Payment 065 - U2 SDA - B Vessel Shell/Roof Complete	1	29-Oct-19	29-Oct-19
PAY076	Payment 076 - U2 Booster Fans Erection Complete	1	29-Oct-19	29-Oct-19
PAY069	Payment 069 - U2 Fabric Filter - A Hoppers/Wall/Roof Complete	1	28-Nov-19	28-Nov-19
PAY071	Payment 071 - U2 SDA - C Inlet Duct Erection Complete	1	28-Nov-19	28-Nov-19
PAY075	Payment 075 - U2 SDA - C Outlet Duct Erection Complete	1	28-Nov-19	28-Nov-19
PAY073	Payment 073 - U2 Fabric Filter - B Hoppers/Wall/Roof Complete	1	27-Dec-19	27-Dec-19
PAY070	Payment 070 - U2 SDA - C Vessel Shell/Roof Complete	1	28-Dec-19	28-Dec-19
PAY081	Payment 081 - U2 Structural Completion	1	04-Jul-20	04-Jul-20
PAY084	Payment 084 - U2 Duct Tie-In Complete	1	16-Aug-20	16-Aug-20
PAY085	Payment 085 - U2 Mechanical Completion	1	16-Aug-20	16-Aug-20
PAY087	Payment 087 - Demobilization Complete	1	28-Oct-20	28-Oct-20
PAY088	Payment 088 - U2 FERC Retirement Information	1	28-Oct-20	28-Oct-20
PAY086	Payment 086 - U2 Substantial Completion	1	15-Nov-20	15-Nov-20
PAY083	Payment 083 - Removal of Fabrication Tables Complete	1	28-Nov-20	28-Nov-20
PAY090	Payment 090 - U2 Final Completion	1	29-Dec-20	29-Dec-20
Permitting		949	29-Sep-15	27-Jun-19
Air Permit		465	29-Sep-15	31-Jul-17
Title V Operating Permit		310	09-Apr-18	27-Jun-19
TRAX Boiler Pressure Analysis		81	16-Mar-15	08-Jul-15
U1 Engineering		540	30-Jan-17	15-Mar-19
U1 General Engineering & Design		507	30-Jan-17	29-Jan-19
U1 C/S/A Engineering and Design		500	30-Jan-17	18-Jan-19
U1 Mechanical Engineering		364	13-Feb-17	18-Jul-18
U1 Mechanical Design		309	01-May-17	18-Jul-18
U1 Electrical Engineering		344	30-Jan-17	05-Jun-18
U1 Electrical Design		520	27-Feb-17	15-Mar-19
U1 I&C Engineering		368	06-Apr-17	17-Sep-18
U2 Engineering		630	30-Jan-17	28-Jun-19
U2 General Engineering & Design		590	30-Jan-17	03-May-19
U2 C/S/A Engineering and Design		587	30-Jan-17	30-Apr-19
U2 Mechanical Engineering		455	30-Jan-17	26-Oct-18
U2 Mechanical Design		389	02-May-17	26-Oct-18
U2 Electrical Engineering		434	30-Jan-17	27-Sep-18
U2 Electrical Design		610	27-Feb-17	28-Jun-19
U2 I&C Engineering		460	24-Mar-17	27-Dec-18



Remaining Work
Actual Work
WBS Summary
Critical Remaining Work
Milestone

TASK filter: Exclude WBS Activities_1.

Activity ID	Activity Name	Ori Dur	Start	Finish
	Procurement	1357	18-May-15	28-Jul-20
	C/S/A Procurement	98	30-Jan-17	15-Jun-17
	Mechanical Procurement	1357	18-May-15	28-Jul-20
	Electrical Procurement	347	20-Jul-17	30-Nov-18
	I&C Procurement	448	10-Jul-17	15-Apr-19
	U1 Construction	720	02-Aug-17	05-May-20
	U1 Sitework	150	02-Aug-17	27-Feb-18
	U1 Railroad Track & Switch Mods	60	31-Jan-18	24-Apr-18
	U1 Highway Mods	60	25-Oct-17	16-Jan-18
	U1 SDA	457	28-Feb-18	28-Nov-19
	U1 Field Fabricated Tanks	170	16-Jul-18	08-Mar-19
	U1 Fabric Filter	419	31-Jan-18	09-Sep-19
	U1 ID Booster Fans / Ductwork	436	29-Aug-18	29-Apr-20
	U1 Lime Slurry	343	28-Feb-18	21-Jun-19
	U1 Recycle Slurry	337	29-Mar-18	12-Jul-19
	U1 Byproduct Handling	314	25-Apr-18	08-Jul-19
	U1 Auxiliary Power	478	23-May-18	20-Mar-20
	U1 Balance of Plant	390	07-Nov-18	05-May-20
	U1 System Testing and Commissioning	294	13-Aug-19	27-Sep-20
	U2 Construction	686	01-Nov-17	17-Jun-20
	U2 Sitework	150	01-Nov-17	29-May-18
	U2 SDA	458	30-May-18	28-Feb-20
	U2 Field Fabricated Tanks	170	15-Oct-18	07-Jun-19
	U2 Fabric Filter	419	02-May-18	09-Dec-19
	U2 ID Booster Fans / Ductwork	268	28-Nov-18	07-Dec-19
	U2 Lime Slurry	343	30-May-18	20-Sep-19
	U2 Recycle Slurry	337	28-Jun-18	11-Oct-19
	U2 Byproduct Handling	314	25-Jul-18	07-Oct-19
	U2 Auxiliary Power	476	22-Aug-18	17-Jun-20
	U2 Balance of Plant	337	06-Feb-19	21-May-20
	U2 System Testing and Commissioning	301	05-Nov-19	29-Dec-20



Remaining Work
Actual Work
WBS Summary
Critical Remaining Work
Milestone

TASK filter: Exclude WBS Activities_1.

ATTACHMENT 4

Milestone Progress Payment Schedule

Attachment 4

MONTHLY PROGRESS PAYMENT SCHEDULE

Month	Date	Milestone	Individual Payment (%)	Cumulative Payment (%)
1	Feb-17	Award Dry FGD Contract Execution	1.51	1.51
2	Mar-17	DFGD Supplier - Process Flow Diagrams and Mass Balances	0.06	1.57
3	Apr-17	DFGD Supplier - P&ID Drawings	0.06	1.63
4	May-17	DFGD Supplier - General Arrangement Drawings NTE Load Diagrams	0.16	1.79
5	Jun-17	DFGD Supplier - Preliminary 3D CAD Model Award Booster Fans	2.62	4.41
6	Jul-17	NTE Load Diagrams Award Atomizers	0.45	4.86
7	Aug-17	DFGD Supplier - Equipment Lists Award Lime System	6.24	11.10
8	Sep-17	Flue Gas Ductwork Procurement Initiated	0.45	11.55
9	Oct-17	Initial EI&C Design Information NTE Load Diagrams	0.45	12.00
10	Nov-17	Flue Gas Ductwork Procurement Initiated	2.26	14.26
11	Dec-17	Structural Steel Procurement Initiated	0.45	14.71
12	Jan-18	Structural Steel Fabrication Schedule Complete	0.45	15.16
13	Feb-18	SDA and Fabric Filter Design Drawings	4.07	19.23
14	Mar-18	Award DCS	0.45	19.68
15	Apr-18	Award Fabric Filter Bags and Cages Flue Gas Ductwork Start of Fabrication	2.68	22.36
16	May-18	Structural Steel Start of Fabrication	0.57	22.93
17	Jun-18	Physical Flow Model Completed	2.38	25.31
18	Jul-18	Receive Permits for Construction	0.70	26.01
19	Aug-18	Mobilize On-Site	2.67	28.68
20	Sep-18	Unit 1 SDA Delivery Office Complex and Fabrication Areas Set-Up	2.99	31.67
21	Oct-18	Unit 1 and Unit 2 Booster Fan Delivery Lime Storage and Preparation System Delivery Unit 1 Fabric Filter Delivery	5.12	36.79
22	Nov-18	Unit 1 SDA Structural Steel Delivery Unit 1 Duct Delivery Unit 1 SDA-A Support Steel Erection Complete	4.81	41.60
23	Dec-18	Unit 1 SDA-A Inlet Duct Support Steel Complete Unit 1 Fabric Filter Structural Steel Delivery Unit 2 Duct Delivery	4.00	45.60
24	Jan-19	Unit 2 SDA Delivery Unit 1 SDA-A Inlet Duct Erection Complete Unit 1 SDA-C Support Steel Erection Complete	4.32	49.92
25	Feb-19	Unit 1 SDA-A Outlet Duct Erection Complete Unit 1 SDA-A Vessel Shell/Roof Complete Unit 2 Fabric Filter Delivery	4.08	54.00
26	Mar-19	Unit 2 Structural Steel Delivery Unit 1 SDA-B Inlet Duct Erection Complete Unit 1 Fabric Filter-B Hoppers/Wall/Roof Complete	3.99	57.99

Attachment 4

MONTHLY PROGRESS PAYMENT SCHEDULE

Month	Date	Milestone	Individual Payment (%)	Cumulative Payment (%)
27	Apr-19	Unit 1 SDA-B Vessel Shell/Roof Complete	3.99	61.98
		Unit 1 SDA-B Outlet Duct Erection Complete		
		Unit 1 Fabric Filter-B Hoppers/Wall/Roof Complete		
28	May-19	Unit 1 SDA-C Inlet Duct Erection Complete	3.69	65.67
		Unit 1 SDA-C Outlet Duct Erection Complete		
29	Jun-19	Unit 1 SDA-C Vessel Shell/Roof Complete	3.35	69.02
		DCS Equipment Delivery		
		Unit 2 SDA-A Inlet Duct Support Steel Complete		
		Unit 2 SDA-A Support Steel Complete		
30	Jul-19	Unit 1 Booster Fans Erection Complete	3.04	72.06
		Unit 2 SDA-B Inlet Duct Support Steel Complete		
		Unit 1 Fabric Filter-C Hoppers/Wall/Roof Complete		
31	Aug-19	Unit 2 SDA-C Inlet Duct Support Steel Complete	2.93	74.99
		Unit 2 SDA-A Vessel Shell/Roof Complete		
		Unit 2 SDA-A Inlet Duct Erection Complete		
32	Sep-19	Unit 2 SDA-B Support Steel Complete	3.06	78.05
		Operating and Maintenance Manuals		
33	Oct-19	Unit 2 SDA-B Vessel Shell/Roof Complete	3.00	81.05
		Unit 2 SDA-B Inlet Duct Erection Complete		
		Unit 2 SDA-C Support Steel Complete		
34	Nov-19	Unit 2 SDA-A Outlet Duct Erection Complete	2.81	83.86
		Unit 2 Fabric Filter-A Hoppers/Wall/Roof Complete		
35	Dec-19	Unit 2 SDA-C Vessel Shell/Roof Complete	2.76	86.62
		Unit 2 SDA-C Inlet Duct Erection Complete		
36	Jan-20	Unit 2 SDA-B Outlet Duct Erection Complete	2.41	89.03
		Unit 2 Fabric Filter-B Hoppers/Wall/Roof Complete		
		Unit 1 Structural Completion		
37	Feb-20	Unit 2 SDA-C Outlet Duct Erection Complete	2.26	91.29
		Unit 2 Booster Fans Erection Complete		
38	Mar-20	Unit 1 Duct Tie-In Complete	2.23	93.52
39	Apr-20	Unit 1 Mechanical Completion	0.45	93.97
40	May-20	Unit 1 Performance Test Report	0.30	94.27
41	Jun-20	Unit 1 Substantial Completion	0.22	94.49
		Unit 2 Structural Completion		
42	Jul-20	Removal of Fabrication Tables Complete	0.22	94.71
43	Aug-20	Unit 2 Duct Tie-In Complete	0.15	94.86
44	Sep-20	Unit 2 Mechanical Completion	0.07	94.93
45	Oct-20	Unit 2 Substantial Completion	0.07	95.00
		Demobilization Complete		
46	Nov-20	Unit 1 Final Acceptance	2.50	97.50
47	Dec-20	Unit 2 Final Acceptance	2.50	100.00

ATTACHMENT 5

S&L Estimating Documentation:

Indirects and Construction Equipment included in Crew Rates

Indirects and Construction Equipment included in Crew Rates

Typical Construction Equipment included in our Crew Rates

- Air compressor
- Air tugger
- Crane, 5 ton
- Crane, 15 ton mobile
- Crane, 35 ton
- Crane, 50 ton
- Crane, 60 ton
- Dozer
- Finishing machine
- Flat bed trailer
- Fork lift
- Front end loader
- Generator
- Grader
- Pickup truck
- Powdered riding buggy
- Roller, sheepsfoot
- Roller, vibratory
- Radial saw
- Scraper
- Stress relieving machine
- Tremie
- Truck mounted concrete pump
- Vibrator
- Water wagon
- Welding machine
- Wire puller

Site Indirects included in Crew Rates

- Job Supervision-Field Staff
- Administration-Field Staff
- Personnel Hiring
- Craft Superintendents
- Safety / Purchasing/Expediting-Field Staff
- Material Control-Field Staff
- Engineering Liaison-Field Staff
- Project Controls-Field Staff
- Cost/Schedule Controls-Field Staff
- Quality Control Inspection-Field Staff
- Project Office Supplies-Field Staff
- Computer Expenses
- Service Trucks/Supplies
- Field and Shop Mechanics and Supplies
- Subcontract Administration
- Warehousing-Field Staff
- Field Surveying
- Water & Ice
- Sanitation and Cleanup
- Move In/Move Out
- Detours/Barricades/Flags
- Security
- Temp. Utilities/Distr/Hookup
- Temporary Site Improvement
- Temporary Facilities/Buildings
- Utilities Consumption
- Employee Expenses
- Legal Expenses/Claims
- Permits and Fees
- Timekeeping

ATTACHMENT 6

S&L Estimating Documentation:

Escalation Projections

Entergy
White Bluff DGFD Project
Escalation Projections

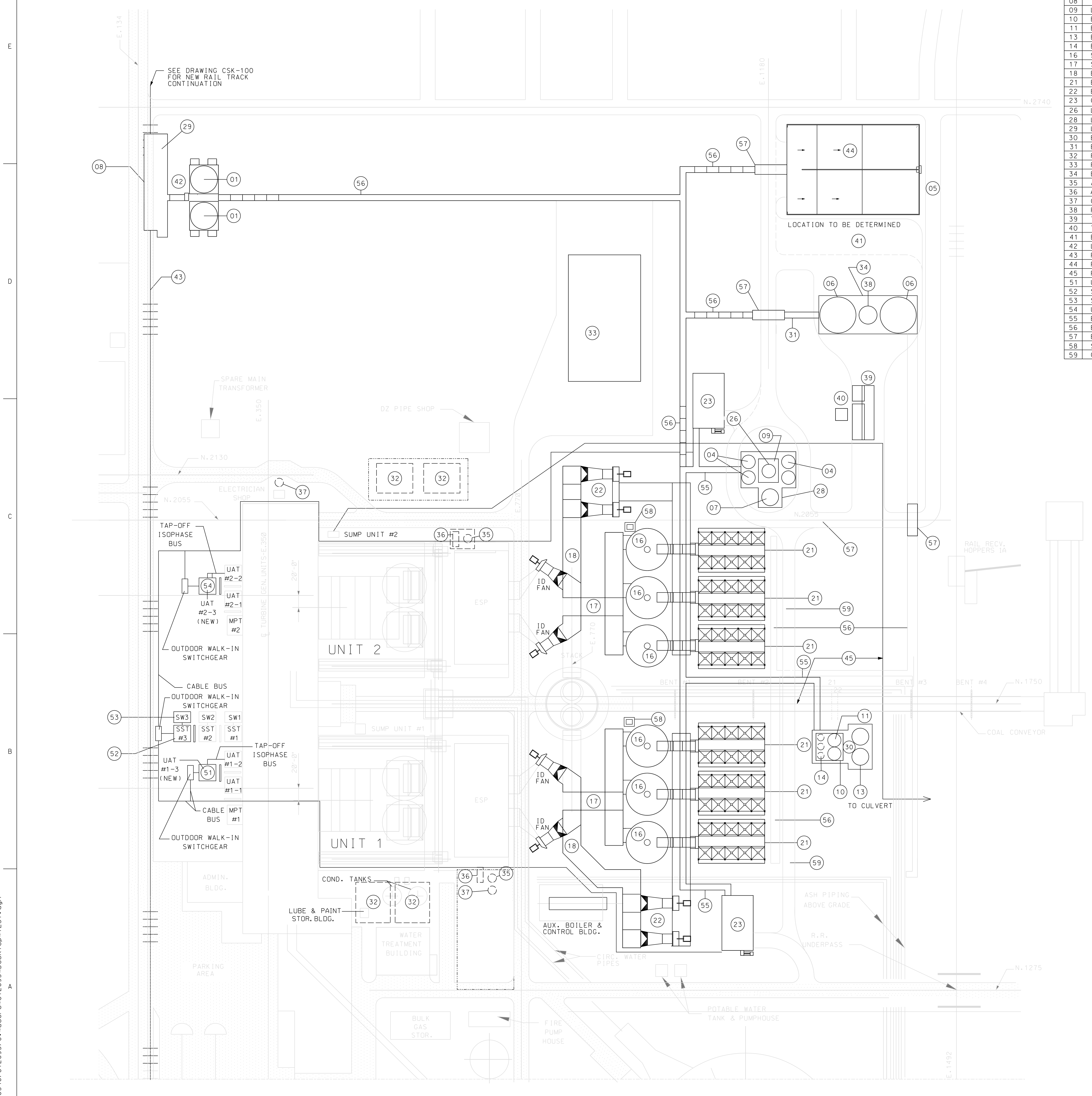
Basis: Pine Bluff Arkansas Labor rates as published in RS Means	Yearly Base Rates + Fringes										
Craft Description	2009	2010	2011	2012	2013	2014	% increase in past 1 year	% increase in past 2 years	% increase in past 3 years	% increase in past 5 years	Projected Potential overall % labor increase next 5 years.
Boilermaker	$38.59	$41.59	$41.59	$41.59	$43.10	$44.39	2.99%	6.73%	6.73%	15.03%	
Iron worker	$28.06	$30.44	$30.44	$30.44	$32.05	$34.00	6.08%	11.70%	11.70%	21.17%	
Pipe Fitter	$25.28	$31.65	$31.65	$31.65	$35.56	$35.56	0.00%	12.35%	12.35%	40.66%	
Electrician	$35.74	$35.74	$35.74	$35.74	$36.95	$36.95	0.00%	3.39%	3.39%	3.39%	
Common Laborer	$16.83	$17.47	$17.47	$17.47	$17.47	$17.47	0.00%	0.00%	0.00%	3.80%	
Average increase in five major crafts							1.82%	6.83%	6.83%	16.81%	**18%**

Misc Material and Equipment (Please see Note 1)									% increase in past 3 years	% increase in past 5 years	Projected Potential overall % increase next 5 years.
Construction & Building Index									8%	15%	17.00%
Material Price, Construction Mat.									8%	7%	10.00%
Plant Cost Index									no increase	slightly negative	5.00%
Civil Work									8%	14%	15.00%
Steel - ductwork									no increase	slightly negative	8.00%
Steel - rolled shape									8%	no increase	10.00%
Architectural									5%	4%	8.00%
Overall mechanical equipment									4%	1%	7.00%
Overall piping									6%	11%	12.00%
Overall electrical equipment									9%	17%	18.00%
Raceway, Cable Tray, & Conduit									8%	slightly negative	10.00%
Electrical cable									14%	7%	15.00%
Controls & Instrumentation									1%	1%	5.00%
Average overall increase for Power back-fit projects									**7%**	**9%**	**11%**

Note 1: From major industrial sources such as BLS, Chemical Engineering, Handy Whitman, ENR Commodity pricing (20 city average),

ATTACHMENT 7

Conceptual General Arrangement Drawing



LEGEND	
01	LIME STORAGE SILOS
03	NOT USED
04	LIME SLURRY FEED TANKS
05	BYPRODUCT HAUL ROAD
06	BYPRODUCT STORAGE SILOS
07	SLAKING WATER STORAGE TANK
08	TRAIN UNLOADING SHED
09	LIME PREPARATION BUILDING
10	BYPRODUCT RECYCLE EQUIPMENT BUILDING
11	BYPRODUCT RECYCLE DAY BINS
13	BYPRODUCT RECYCLE MAKE-UP WATER TANKS
14	BYPRODUCT RECYCLE SLURRY TANKS
16	SPRAY DRYER ABSORBERS
17	SDA FLUE GAS INLET DUCTS
18	BOOSTER FAN DISCHARGE
21	BAG HOUSES
22	BOOSTER FANS
23	COMPRESSOR / ELECTRICAL BUILDINGS
26	LIME DAY BIN
28	LIME PREPARATION AREA
29	LIME UNLOADING EQUIPMENT ROOM
30	BYPRODUCT RECYCLE AREA
31	ELEVATED BOP CONTRACTOR UTILITY RACK
32	FUTURE PROVISION SPACE FOR SCRS
33	FGD SPARE PARTS WAREHOUSE
34	BYPRODUCT HANDLING AREA
35	ACI SILOS
36	ACI ELECTRICAL BUILDINGS
37	CHI TANK
38	FLY ASH SILO
39	TRUCK SCALES
40	TRUCK SCALE HOUSE
41	BYPRODUCT TRUCK PARKING
42	LIME UNLOADING AND STORAGE AREA
43	RAIL SPUR
44	PROCESS WATER RETENTION PONDS
45	PROPOSED GRATED CONCRETE TRENCH
51	UNIT AUX. TRANSFORMER UNIT 1
52	STARTUP / STANDBY TRANSFORMER COMMON (UNITS 1&2)
53	SWITCH
54	UNIT AUX. TRANSFORMER UNIT 2
55	ELEVATED FGD CONTRACTOR UTILITY RACK
56	BOP SLEEPER RACK
57	BOP TRENCH
58	SDA PENTHOUSE ELEVATOR
59	CRANE MAINTENANCE AISLE

HOLD INFORMATION

NO.	DATE	DESCRIPTION
△		

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION

REV.	DATE	DESCRIPTION

ISSUE PURPOSE: ISSUED FOR STUDY

SPECIFICATION: -

PROJECT NO.: 13138-001

I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF ARKANSAS.

ENTER NAME
ENTER DATE

MY LICENSE RENEWAL DATE IS: ENTER DATE
PAGES OR SHEETS COVERED BY THIS SEAL:
THIS DOCUMENT ONLY.

CAD FILE NAME: M-GA-001.DGN

PREPARED BY: D.J.MERRICK

REVIEWED BY: G.A.RIVERA

APPROVED BY: S.C.MCHONE

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.

SARGENT & LUNDY LLC
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603-5780
WWW.SARGENTLUNDY.COM
CERTIFICATE OF AUTHORIZATION NO. 6938

PROJECT

WHITE BLUFF STATION
UNITS 1 & 2
ENTERGY

DRAWING TITLE

GENERAL ARRANGEMENT
SDA SITE DEVELOPMENT

PRELIMINARY
NOT FOR
CONSTRUCTION

DRAWING NUMBER	REVISION
M-GA-001	N/A

SHEET 1 OF 1

ATTACHMENT 8

Entergy Basis of Contingency

WB FGD Project
Risk Register

Contingency Estimate					
Estimate Total w/o Contingency, IDC, Escalation	$ 740,968,200				
	P90	P80	P70	P60	P50
Risk Contingency	$ 35,870,000	$ 27,220,000	$ 20,550,000	$ 16,210,000	$ 13,090,000
Estimate Uncertainty Contingency	$ 95,350,000	$ 66,600,000	$ 41,540,000	$ 21,330,000	$ (290,000)
Unknown Risk Contingency	$ 18,560,000	$ 17,380,000	$ 16,450,000	$ 15,610,000	$ 14,810,000
Total Contingency	$ 149,780,000	$ 111,200,000	$ 78,540,000	$ 53,150,000	$ 27,610,000
Percentage of Total	20%	15%	11%	7%	4%
Total Estimate w/ Contingency	$ 890,748,200	$ 852,168,200	$ 819,508,200	$ 794,118,200	$ 768,578,200

Project Delivery Standard

	Estimate Characteristic			Resulting Range	
Estimate class	Maturity level of project definition expressed as % of complete engineering	End usage typical purpose of estimate	Methodology typical estimating method	Estimate accuracy range typical variation in low & high ranges	Target contingency range
Class 5	0 to 2%	Rough Order of Magnitude (ROM)	Capacity factored, parametric models, judgment, or analogy	-50 to +100%	30 to 50%
Class 4	1 to 15%	Feasibility	Equipment factored or parametric models	-30 to +50%	25 to 40%
Class 3	10 to 50%	Funding Authorization	Semi-detailed unit costs with assembly level line items	-20 to +30%	15 to 30%
Class 2	30 to 90%	Control	Detailed unit costs with forced detailed take-off	-15 to +20%	5 to 20%
Class 1	50 to 100%	Check Estimate	Detailed unit cost with detailed take-off	-10 to +15%	2 to 7%

ESTIMATE UNCERTAINTY

Risk Category	Description of Risk	Quantitative Risk Analysis					Status / Comments
		Estimate Total w/out Contingency	Min ($)	Expected	Max ($)	QRA Comments	
Estimate Uncertainty	**EPC Contract**	$ 752,912,300	($188,228,075)	$0	$188,228,075	From S&L estimate report, the project definition and accuracy of the individual components in this estimate result in an overall accuracy of +/- 25%.	
Estimate Uncertainty	**Owner's Costs**	$ 58,546,000	($11,709,200)	$0	$17,563,800	Estimate from Entergy, estimate is considered a Class 3 (+30% to -20%).	Entergy Indirects were calculated utilizing the Entergy FVET tool. The risk associated with the individual rates will be included in the estimate uncertainty of the internal loaders estimate.
Estimate Uncertainty	**Third Party Services**	$ 12,544,000	($3,136,000)	$0	$3,136,000	From S&L estimate report, estimate is considered a Class 3 (+25% to -25%)	

UNKNOWN RISK

Risk Category	Description of Risk	Quantitative Risk Analysis: Estimate Total w/out Contingency	Min ($)	Expected	Max ($)	QRA Comments	Status / Comments
Unknown Risks	**UNKNOWN RISKS:** This is part of the calculation for the overall contingency to include in the project budget.	$ 740,968,200	$ 7,409,682	$ 14,819,364	$ 22,229,046	Estimating standard guidance. Min = 1%, Exp = 2%, Max = 3%	Due to lack of historical data and current project development, there are a range of potential impacts from unknown risks not yet captured in the estimate uncertainty and identified risks, Entergy contingency guidance is to use 1% - 3% of the total estimate without contingency. This item can be captured in the risk register and modeled with the identified risks when estimating contingency.

WB FGD Project
Risk Register

IDENTIFIED RISKS																		
				SCORING							Quantitative Risk Analysis							
Risk ID	Risk Category	Description of Risk	Unit	Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-007	Budget	**PROJECT BUDGET - CRAFT LABOR - PER DIEM RATE RISK:** This risk is related to the required craft labor per diem increasing due to the high demand of craft labor, at a percentage greater than the estimated rate.	ALL	3	2	0	0	**6**	Low	An increase to per diem to attract labor will increase the project total estimate.	45%	$0	$0	$4,290,000	Yes	The estimated Per Diem is $13M. Assume a 33% increase as a max.	
2014-002	Budget	**PROJECT BUDGET - CRAFT LABOR - WAGE RATE ESCALATION:** This risk is related to wage rates rising, at a rate greater than the rate used in the estimate, due to the high demand for craft labor.	ALL	3	3	0	0	**9**	Low	Received rates over 10-year period from S&L. Range has fluctuated from 0% to 21.23% during that period. Current economic conditions indicate a high probability of craft labor rates increasing beyond the current projection of 3.35% provided by S&L.	45%	($19,700,000)	$0	$42,300,000	Yes	Received rates over 10-year period from S&L. Looked at range and average high and low rates. Expected escalation rate is 3.35%. Assumed Min rate of 1.675% and Max rate of 6.7%. Results in potential increase of $42.3M over current escalation estimate and potential decrease of $19.7M.	
2014-001	Budget	**PROJECT BUDGET - IDC:** This risk is related to the cost of capital increasing over the life of the project, at a rate different than the current estimated escalation rate.	ALL	1	5	0	2	**7**	Low	The EPA Cost Control Manual uses a rate of 7% which was used for the estimate. Historical EAI AFUDC rates have been under 7%.	5%	$0	$0	$25,000,000	Yes	Assumes an index rate of 7.5%; this results in an increase of ~$25M over current IDC estimate.	
2014-006	Budget	**PROJECT BUDGET - CAPITAL SUSPENSE ADJUSTMENTS:** The risk is related to Capital Suspense increasing over the life of the project from the current Entergy forecasted rate.	ALL	2	3	1	1	**10**	Low	Adjustment of rates impact the project total estimate.	25%	$0	$0	$0	No	Entergy Indirects will be calculated utilizing the Entergy FVET tool. The risk associated with the individual rates will be included in the estimate uncertainty of the internal loaders estimate.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING: Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Quantitative Risk Analysis: Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-005	Budget	**PROJECT BUDGET - EPC MATERIAL ESCALATION:** Project material cost may be subject to escalation	ALL	1	3	0	1	**4**	Low	Material escalation is included in the project estimate.	5%	$0	$0	$0	No	Material escalation is included in the project estimate. The estimate uncertainty addresses the risk of the amount of material and the material escalation rate being different than the current forecasted rates.	
2014-003	Budget	**PROJECT BUDGET - LIME ESCALATION:** Project lime cost may be subject to escalation different than the estimated rate.	ALL	3	1	0	0	**3**	Low	Assume that lime escalation rate will increase during project.	45%	$0	$0	$0	No	Budgeted Lime escalation rate is 2.15%. The estimate uncertainty addresses the risk of the amount of material and the escalation rate being different than the current forecasted escalation rate.	
2014-005	Budget	**PROJECT BUDGET - MATERIAL LOADER ADJUSTMENTS:** The risk is related to the material loaders increasing over the life of the project from the current Entergy forecasted loaders.	ALL	4	1	0	0	**4**	Low	Probability that Material Loaders will change over life of the project.	20%	$0	$0	$0	No	Entergy Indirects will be calculated utilizing the Entergy FVET tool. The risk associated with the individual rates will be included in the estimate uncertainty of the internal loaders estimate.	
2014-004	Budget	**PROJECT BUDGET - PAYROLL LOADER ADJUSTMENTS:** The risk is related to the payroll loaders increasing over the life of the project from the current Entergy forecasted loaders.	ALL	4	2	0	0	**8**	Low	Probability that Payroll Loaders will change over the life of the project.	70%	$0	$0	$0	No	Entergy Indirects will be calculated utilizing the Entergy FVET tool. The risk associated with the individual rates will be included in the estimate uncertainty of the Entergy Payroll estimate.	
2014-006	Budget	**SALES TAX:** Risk that the sales tax rate will change and add additional costs to the project.	ALL	2	1	0	0	**2**	Low	Probability that the Sales Tax will change order the life of the project.	20%	$0	$0	$0	No	The risk associated with a Sales Tax change will be included in the estimate uncertainty, which also includes the risk of the quantity of materials subject to sales tax.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-010	Eng	**DESIGN CRITERIA:** Design criteria is missing information, or information is incorrect resulting in changes to the technical specifications and requirements during the project. The risk would result in re-engineering / re-work.	ALL	2	3	3	1	**14**	Medium Low	The Owner's Engineer (S&L) has performed Engineering Studies in 2009 and 2013. The revised Design Criteria document reflects the current project requirements.	20%	$0	$5,000,000	$25,000,000	Yes	Assumption that the design criteria accurately reflects the requirements of the project, any corrections will have minimal impact to detailed design. Min is 0%, Expected is 1%, Max is 5% of EPC Direct Costs $500M.	
2014-011	Eng	**ENGINEERING SUPPORT:** Inadequate support to review EPC contractor's design to ensure it meets Entergy requirements. The risk would result in re-engineering / re-work.	ALL	1	3	3	2	**8**	Low	The Project will use an Owner's Engineer to augment staff requirements to mitigate this risk. This risk is the potential for redesign based on inadequate reviews.	5%	$0	$5,000,000	$25,000,000	Yes	Assumption that there will be minimal rework based on inadequate Entergy review of EPC contractor design. Min is 0%, Expected is 1%, Max is 5% of EPC Direct Costs $500M.	
2014-012	Eng	**SCOPE GAP OR CHANGES:** Work scope not defined in EPC contract, and not identified/unforeseen conditions in project budget. Risk would result in additional scope to EPC contract.	ALL	2	4	3	2	**18**	Medium Low	Low probability due to 2009 and 2013 studies. BOP scope not as defined as FGD island. There is only minimal engineering complete at this stage. Also, risk covers the potential for additional design requirements over base FGD design to meet Entergy standard designs.	20%	$5,000,000	$15,000,000	$45,000,000	Yes	Assumption that any missed scope will not be significant, there is an Open Book period for development. Assume minimum of 1% of the $500M FGD direct costs, 3% expected, 9% max.	
2014-013	Eng	**TECHNOLOGY - BAGHOUSE**: The baghouse on each of the units fails to meet the PM emissions limits.	ALL	1	3	5	5	**13**	Medium Low	Low probability due to proven technologies will be specified, and EPC contract will have vendor guarantees.	5%	$0	$0	$0	No	Not included in QRA. Final payment of EPC contract will be based on successful demonstration of performance.	
2014-014	Eng	**TECHNOLOGY - Dry FGD**: The selection of the technology to meet the emission limits with margin is insufficient to meet the required limits.	ALL	1	3	5	5	**13**	Medium Low	Low probability due to proven technologies will be specified, and EPC contract will have vendor guarantees.	5%	$0	$0	$0	No	Not included in QRA. Final payment of EPC contract will be based on successful demonstration of performance.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING: Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Quantitative Risk Analysis: Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-015	Env	**AIR PERMIT (AR) - DELAY**: Delay in receiving the permit, for an additional 6 months (24 total).	ALL	1	2	3	3	**8**	Low	Cost impact to expedite project to stay on schedule as a result in the delay. The current timeline of 18 months accounts for some expected delay.	5%	$0	$0	$3,000,000	Yes	Assume $500k/month for up to 6 mo of delay. This would be prior to FNTP.	In the current timeline, there is some schedule float that could be used. Entergy could release FNTP prior to receipt of the air permit.
2014-016	Env	**ASH DISPOSAL:** EPA determines that combustion byproducts are a hazardous waste resulting in need to utilize other material to stabilize scrubber byproduct.	ALL	1	1	0	3	**4**	Low	Cost impact: possible HAZMAT training and treatment of ash. Still would landfill on site. Loss of ash sales.	5%	$0	$0	$150,000	Yes	Assume some additional training, and minimal equipment modifications.	Most ash will be collected in the ESP. This risk would be addressed by a separate project.
2014-018	Env	**COMPLIANCE RULE - Vacated or Delayed:** If the rule is vacated or delayed, what is the impact?	ALL	1	2	0	0	**2**	Low	Assume delay prior to project approval but same compliance period to comply. Cost impact: engineering, payroll, AFUDC during delay period.	5%	$0	$0	$3,000,000	Yes	Project delayed prior to LNTP. Assume $500k/month for 6 months.	
2014-017	Env	**ASH DISPOSAL:** The ADEQ might impose the same permit restriction as it did at the Flint Creek Plant and not allow WB to route landfill leachate directly to the surge pond.	ALL	3	0	0	1	**3**	Low	Project will not increase probablility to occurrence; plant O&M risk. Cost impact: treatment of leachate prior to sending to surge pond.	45%	$0	$0	$0	No	Plant O&M risk.	
2014-019	EPC	**CONSTRUCTION DELAYS:** Construction delays could negatively affect the project and ability to meet a compliance date target. It includes the following contractor identified risks: 1) Damage or late delivery of equipment and materials 2) Weather impact to craft productivity and full or partial site shutdown 3) Craft productivity 4) Labor availability of pipefitters, welders, and electricians	WB1	2	2	3	2	**14**	Medium Low	The contracting strategy will use schedule incentives to maintain the schedule. The labor availability risk will be shared with the contractor, craft labor escalation is a separate risk item.	20%	$0	$4,000,000	$16,000,000	Yes	These delay estimates represent Owner's costs due to the delay (AFUDC, labor) 0-8 mo delay at $2M/month. Current schedule reflects adequate available time for the EPC contractor to account for these delays. Escalation is a separate risk.	Identified risks will be assigned to the EPC contractor.

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-021	EPC	**Delay in FNTP:** Delay in Entergy issuing FNTP	ALL	2	2	2	3	**14**	Medium Low	Delay in issuing FNTP. Delays for receipt of the air permit or regulatory approval are separately identified risks.	20%	$0	$3,000,000	$6,000,000	Yes	Assume EPC contractor request compensation for the FNTP delay (equipment contracts, etc). ($1M/month delay)	
2014-022	EPC	**Delay in LNTP:** Delay in Entergy issuing LNTP	ALL	2	2	2	3	**14**	Medium Low	Delay in receiving internal approvals.	20%	$0	$1,500,000	$3,000,000	Yes	Assume EPC contractor request compensation for the LNTP delay (equipment contracts, etc). ($0.5M/month delay)	
2014-023	EPC	**EPC CONTRACT EQUIPMENT VALUE:** Equipment estimate uncertainty during the period from when the contract price is developed to the LNTP.	ALL	2	4	0	1	**10**	Low	The time between the Open Book Period and LNTP is approximately 14 months.	20%	$0	$8,000,000	$20,000,000	Yes	Risk of price changes for $400M of the EPC contract, subject to 14 months between negotiation and award. Min = 0%, Exp = 2%, Max = 5%	
2014-024	EPC	**EPC CONTRACT:** Negotiated EPC fee	ALL	2	4	0	2	**12**	Medium Low	EPC Fee assumed to be in the 8%-15% range.	20%	($12,000,000)	$0	$12,000,000	Yes	Estimate includes a 10% fee or ~$60M. Min = 8% fee, Max = 12% fee.	
2014-069	EPC	**EPC CREDIT RISK:** EPC contractor default on contractor (EPC procurement costs)	ALL	1	1	1	3	**5**	Low	Entergy will work with qualified vendors that have had a credit risk review.	5%	$0	$0	$7,500,000	Yes	Estimate of EPC procurement costs, negotiating, and potential incrase on contract value. To account for procurement activities, Max 1% of EPC value	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-070	EPC	**EPC CREDIT RISK:** EPC contractor default on contractor (schedule delay)	ALL	1	5	5	5	**15**	Low	Entergy will work with qualified vendors that have had a credit risk review.	5%	$0	$0	$36,000,000	Yes	Default of the EPC contractor would result in delay of project to procure and onboard a new contractor. For this calculation, the EPC contractor is assumed to default during construction. Apply amount of IDC ($4M/mo) plus carrying costs of Entergy costs ($500k/mo) at this date through end of project to the expected delays (max: 8 mo).	
2014-032	EPC	**SCHEDULE - Delayed:** Change in project schedule due to longer compliance timeline.	ALL	1	1	1	1	**3**	Low	Assume that, if compliance date is delayed, then all costs will shift accordingly. Incremental costs would be maintaining internal staff in the interim, IDC.	5%	$0	$0	$12,000,000	Yes	Assume delay would be known before contract award, when the FIP or SIP is issued. Delay of min = 0 mo, exp = 0 mo, max = 24 mo @ $500k/mo	
2014-033	EPC	**SCHEDULE - Shorter Compliance Timeline:** Change in project schedule that shortens compliance timeline.	ALL	1	4	0	3	**7**	Low	Assume that labor costs and costs to expidite equipment would increase to comply with earlier timeline.	5%	$0	$0	$30,000,000	Yes	Assumption that current schedule has some float, add $ for premium time, less IDC costs. Assume 15% increase of estimated craft labor of ~$200M.	
2014-035	EPC	**UN-IDENTIFIED UNDERGROUND OBSTRUCTION:** Claims for extra work for un-identified underground pipe, etc.	ALL	2	3	2	2	**14**	Medium Low	Project plans to perform exploration work to identify unknown underground obstructions during the Open Book period. This risk if realized will increase the EPC contract price.	20%	$0	$500,000	$3,000,000	Yes	Assumption that any missed scope will not be significant. Schedule delays of $500k/month.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING: Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Quantitative Risk Analysis: Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-036	EPC	**WEATHER-RELATED DELAYS:** Extreme weather can greatly affect craft productivity and result in partial or complete site shutdown. Such weather conditions can increase the risk and provide the basis for a contractor claim for a change order.	ALL	1	1	3	2	**6**	Low	The project is subject to extreme weather events. This risk will be further developed during the Open Book period.	5%	$0	$4,000,000	$12,000,000	Yes	These delay estimates represent Owner's costs due to the delay (AFUDC, labor) 0-6 mo delay at $2M/month. Assumption that the current schedule has sufficient float to mitigate this risk. The Open Book period will be used to develop a more detailed schedule.	The project execution plan is to perform a majority of the construction prior to any outage. Weather risks will be assigned to the EPC contractor.
2014-020	EPC	**CONSTRUCTION DELAYS:** Construction delays could negatively affect the project and ability to meet a compliance date target. It includes the following contractor identified risks: 1) Damage or late delivery of equipment and materials 2) Weather impact to craft productivity and full or partial site shutdown 3) Craft productivity 4) Labor availability of pipefitters, welders, and electricians	WB2	2	2	3	2	**14**	Medium Low	The contracting strategy will use schedule incentives to maintain the schedule. The labor availability risk will be shared with the contractor, craft labor escalation is a separate risk item.	20%	$0	$0	$0	No	Risk QRA combined with EPC Construction Delays for WB1. Current schedule reflects adequate available time for the EPC contractor to account for these delays. Escalation is a separate risk.	Identified risks will be assigned to the EPC contractor.
2014-008	EPC	**LABOR:** Schedule delays due to union labor disputes.	ALL	1	2	2	2	**6**	Low	Using non-union labor.	5%	$0	$0	$0	No	Using non-union labor.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING: Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Quantitative Risk Analysis: Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-027	EPC	**OPEN BOOK PERIOD**: Change in contract terms (Limitiation of Liability) during EPC contract negotiations.	ALL	1	3	0	1	**4**	Low	The RFP process to select the EPC contractor will require the contractor to state required terms for an EPC contractor prior to their selection. The Open Book period should not increase their project risk profile, which would be a driver for a change in their terms.	5%	$0	$0	$0	No	Not included in QRA. Project estimate includes estimate uncertainty for this risk.	
2014-028	EPC	**OPEN BOOK PERIOD**: Change in rates from EPC contractor during open book period.	ALL	1	1	0	1	**2**	Low	The EPC contractor's labor and equipment rates will be negotiated during the Open Book period to develop the contract price.	5%	$0	$0	$0	No	Not included in QRA. Project estimate includes estimate uncertainty for this risk.	
2014-029	EPC	**OPEN BOOK PERIOD**: Unable to negotiate a fixed price contract.	ALL	1	0	0	0	**0**	Low	The scope and schedule of this project are sufficient to meet the project goals. There is no indication that this risk is probable.	5%	$0	$0	$0	No	Not included in QRA.	
2014-030	EPC	**POOR PERFORMANCE BY CONTRACTOR ON PROJECT:** Risk of claims and change orders increases if contractor expects and/or experiences loss on the project.	ALL	1	1	2	1	**4**	Low	Risk exists for contractor claims, project controls will be in-place to support Entergy. Risk is for total claims greater than the amount of contingency.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	
2014-031	EPC	**POOR QUALITY OF CONTRACTOR WORK**: Schedule impact due to rework and adverse affect on long-term plant operation.	ALL	1	1	2	1	**4**	Low	EPC bidders will be selected based on Entergy experience and previous work experience.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
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2014-034	EPC	**SCOPE OR DESIGN PROBLEMS:** Poor scope, technical design, or unclear technical requirements could result in change orders with added cost and/or schedule delay or an end product that does meet customer needs	ALL	3	3	3	2	**24**	Medium Low	Complicated project with many interfaces to exisitng facility. Assume multiple small change orders.	45%	$0	$0	$0	No	Not included in QRA. This risk is similar to Engineering risks. Project estimate includes estimate uncertainty for this risk.	
2014-037	EPC	**POOR PERFORMANCE:** Contractor does not meet schedule or performance requirements.	ALL	2	1	2	1	**8**	Low	Risk exists for contractor claims, project controls will be in-place to support Entergy.	20%	$0	$0	$12,000,000	Yes	These delay estimates represent Owner's costs due to the delay (AFUDC, labor) 0-6 mo delay at $2M/month.	
2014-038	Goal	**COMPLIANCE - NON-COMPLIANCE**: The new emission standards cannot be met by the units.	ALL	1	5	5	5	**15**	Medium Low	Industry information shows that the emission compliance levels can be met with the available tecnologies.	5%	$0	$0	$0	No	Cost estimate is beyond project value.	
2014-053	Ops	**LONG TERM OPERATION - CAPACITY:** Unit derate or capacity restriction resulting from control technologies.	ALL	1	1	1	1	**3**	Low	Unit capacity will be affected by this project. It will be defined and a guarantee will be negotiated with the EPC contractor.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	Review this risk after Open Book Period to determine capacity impact of project.
2014-054	Ops	**LONG TERM OPERATION - INCREASED O&M:** Increases to the unit's O&M due to control technology.	ALL	1	1	1	1	**3**	Low	Additional O&M will be required by this project. It will be defined when the technology is selected during the Open Book period.	5%	$0	$0	$0	No	Not a project risk.	Review this risk after Open Book Period to determine O&M impact of project.
2014-055	Ops	**LONG TERM OPERATION - OPERATOR INTERFACE:** An increase in training requirements due to control technology.	ALL	1	1	1	1	**3**	Low	Additional Operator interface will be required by this project.	5%	$0	$0	$0	No	Not a project risk.	Additional Operations staff is included in the project estimate. Review this risk after Open Book Period to determine impact of project.

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
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2014-056	Ops	**LONG TERM OPERATION - RELIABILITY:** Impacts to the unit's reliability.	ALL	1	1	1	1	**3**	Low	The EPC contract will require equipment guarantees and system redundancy to provide reliability.	5%	$0	$0	$0	No	Not a project risk.	Review this risk after Open Book Period to determine O&M impact of project.
2014-057	Permiting	**Department of Transportation:** Impact of schedule delay due to permitting the road modification.	ALL	1	1	1	0	**2**	Low	Unable to determine risk until Open Book Period to understand permit time required and date when road modification must be in place.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	Review this risk after Open Book Period to determine O&M impact of project.
2014-058	Permitting	**REGULATION CHANGE:** Change in future regulation to lower emission limits or 30-day rolling average.	ALL	1	1	0	0	**1**	Low	Need additional information, this would be a future project. Technology for FGD has not been determined	5%	$0	$0	$0	No	Risk will be mitigated during technology selection.	
2014-040	PM	**INTERNAL APPROVALS:** Possible delays due to delay of internal approval of contracts	ALL	2	1	1	2	**8**	Low	Risk exists with the challenges of obtaining internal approvals.	20%	$0	$0	$1,500,000	Yes	Assume internal project team continues to support Board approval during the regulatory and permitting periods. (Assume $500k/mo).	
2014-041	PM	**ISSUE RESOLUTION:** Possible schedule delays due to non-resolution of issues as they arise.	ALL	2	2	3	2	**14**	Medium Low	Risk exists for undefined issues.	20%	$4,500,000	$9,000,000	$13,500,000	Yes	Undefined issues may impact schedule & project scope. (Assume AFUDC ($4M) + Owner's costs ($500k) per month) Min = 1 mo, expected = 2 mo, max = 3 mo)	
2014-039	PM	**COMMUNICATIONS:** Possible schedule delays and costs increases due to poor communication between all parties	ALL	1	1	2	2	**5**	Low	Risk exists for contractor claims. The contracting strategy using only one EPC contractor should minimize this risk.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $. Adequate staffing of project is a separate risk.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-042	PM	**MANAGEMENT - INSUFFICIENT INTERNAL PROJECT STAFF:** Insufficient Internal project resources - unable to meet schedule. Project costs increase.	ALL	2	2	0	2	**8**	Low	Internal labor costs would be higher than budgeted.	20%	$0	$0	$0	No	Project will plan to use outside contractors to staff project.	
2014-043	PM	**MANAGEMENT - PRUDENCY DETERMINATION:** The project team is unable to justify and document project decisions and the related costs to defend decisions as prudent in future rate cases. Mitigation includes processes for contemporaneous documentation.	ALL	1	1	1	3	**5**	Low	The project will follow project delivery standards, risk should be minimal.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	
2014-044	PM	**PROJECT CONTROLS:** Project has insufficient project controls / oversight / documentation to manage and control cost.	ALL	1	3	0	4	**7**	Low	Stage Gate process requires project controls. Generic project costs would be higher than budgeted.	5%	$0	$0	$0	No	Additional staff included in the project estimate to cover PEI oversight of project.	
2014-045	PM	**RECORDS MANAGEMENT:** Document control is insufficient leading to inability to support Regulatory Recovery	ALL	1	1	1	3	**5**	Low	The project will follow project delivery standards, risk should be minimal.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	
2014-048	PM	**SCOPE CHANGES:** Possible delays or increased cost due to improperly managed project scope changes.	ALL	1	2	2	2	**6**	Low	Potential delays due to internal decisions in a timely manner.	5%	$0	$0	$0	No	Not included in QRA. Missed scope part of the Engineering risks.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-059	Reg	**REGULATORY - DELAY:** Regulatory delays could negatively affect the project schedule. The expected duration is estimated to be 18 months.	ALL	2	2	5	4	**22**	Medium Low	Project schedule assumes 18 mo to receive approval. If additional time is required, Entergy may choose to issue FNTP prior to receipt to avoid potential costs.	20%	$0	$0	$3,000,000	Yes	Assumption that current schedule has some float, add $ for premium time, less AFUDC costs. ($0.5M/month delay)	
2014-068	Schedule	**SCHEDULE - FORCE MAJEURE** - Increase in cost of project due to force majeure	ALL	1	1	1	1	**3**	Low	BAR insurance will be in place.	5%	$0	$0	$10,000,000	Yes	Insurance deductible is expected to be structured similar to other projects. $500,000 deductible for flood, 5% of insured value for Named Windstorm with min of $1,000,000 and max of $10,000,000.	
2014-062	Schedule	**COMPLIANCE - DEADLINE**: Risk that the project will not meet the deadline?	ALL	1	3	4	3	**10**	Low	Current timeline has sufficient time to develop project.	5%	$0	$0	$0	No	Current schedule reflects adequate available time to complete the project. EPC contract will include schedule requirements.	
2014-063	Schedule	**OUTAGE SCHEDULE:** Outage schedule moves from current schedule dates.	WB1	2	1	1	1	**6**	Low	Project expects the current scheduled outages to move to meet project requirements.	20%	$0	$0	$0	No	Schedule flexibility is expected.	
2014-064	Schedule	**OUTAGE SCHEDULE:** Outage schedule moves from current schedule dates.	WB2	2	1	1	1	**6**	Low	Project expects the current scheduled outages to move to meet project requirements.	20%	$0	$0	$0	No	Schedule flexibility is expected.	
2014-066	Schedule	**SCHEDULE INSUFFICIENT:** EPC Contractor does not provide schedule with sufficient level of detail to coordinate activities	ALL	1	1	1	1	**3**	Low	EPC contract will require detailed project schedule. Entergy project controls will be in-place to support schedule development and maintenance.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	
2014-067	Supply Chain	**LIME AVAILABILITY:** Will the required lime for the long term operation be available?	ALL	1	1	1	1	**3**	Low	S&L study did not identify lime availability concerns.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	

Probability and Impact Definition

Probability Rating	Probability Definition (Likelihood of Occurrence)	Discreet Value for QRA
1	Less than or equal to 10 % Probability of Occurrence	5%
2	Greater than 10% but less that 30 % Probability of Occurrence	20%
3	Greater than 30% but less that 60 % Probability of Occurrence	45%
4	Greater than 60% but less that 80 % Probability of Occurrence	70%
5	Greater than 80% Probability of Occurrence	90%

Cost Impact Rating	Cost Impact Value (Impact to Entergy Cost only) (Project Cost = $500M)	Min Cost Impact (QRA)	Most Likely Cost Impact (QRA)	Max Cost Impact (QRA)
1	(<0.5% of project cost)	$ 100,000	$ 1,000,000	$ 2,500,000
2	(0.5% - 1.4% of project cost)	$ 2,500,000	$ 4,750,000	$ 7,000,000
3	(1.5% - 2.9% of project cost)	$ 7,000,000	$ 11,000,000	$ 15,000,000
4	(3% - 4.9% of project cost)	$ 15,000,000	$ 20,000,000	$ 25,000,000
5	(>5% of project cost)	$ 25,000,000	$ 37,500,000	$ 50,000,000

Schedule Impact Rating	Schedule Impact Value (Impact to Affected Summary Activity)	Min Schedule Impact (QRA)	Most Likely Schedule Impact (QRA)	Max Schedule Impact (QRA)
1	Less than 30 days	0	15	30
2	Between 30 and 60 Calendar days	30	45	60
3	Between 60 and 90 Calendar days	60	75	90
4	Between 90 and 150 calendar days	90	120	150
5	Between 150 and 210 calendar days	150	180	210

Other Impact Rating	Other Effect on Project (Regulatory/Legal, Safety, Company Reputation and Quality) - more details below
1	No impact
2	Minimal Impact
3	Moderate Impact
4	Significant Impact
5	Severe Impact

Other Impact Value	IMPACT (Effect on Project)
1	Has no impact on (**Company Reputation**)
	Has no impact on quality (**Quality**)
	Not likely to result in injury or illness (**Safety**)
	No impact on timely CPCN or full cost recovery (**Regulatory/Legal**)
2	Has limited impact on (**Company Reputation**)
	Quality issue has minimal impact on project (**Quality**)
	Has a direct, minor impact on a near miss driver, an OSHA RA driver, or human error mechanism. Is an emerging
	CPCN delayed by less than 1 month and/or cost disallowance up to $7,500,000 (**Regulatory/Legal**)
3	Has moderate impact on (**Company Reputation**)
	Quality issue affects work activities and requires application of the corrective action program (**Quality**)
	Will create a near miss driver, an OSHA RA driver, or human error mechanism. An emerging safety issue where a
	CPCN delayed between 1-3 months and/or cost disallowance between $7,500,000 and $12,500,000
4	Has significant impact on (**Company Reputation**)
	Quality issue requires immediate management attention (**Quality**)
	Will create a near miss driver, an OSHA RA driver, or human error mechanism. No workaround is present.
	CPCN delayed between 3-5 months and/or cost disallowance between $12,500,000 and $20,000,000
5	Has severe impact on (**Company Reputation**)
	Quality issue requires work stoppage (**Quality**)
	Likely to cause one or more deaths (**Safety**)
	CPCN delayed more than 5 months and/or cost disallowance greater than $20,000,000 (**Regulatory/Legal**)

* The Project manager should establish clear thresholds for financial impact at the outset of the project. These should be articulated in the Project Execution Plan and be approved in accordance with the provisions of the Project Management Manual.

ENTERGY ARKANSAS, INC.

INDEPENDENCE DRY FGD

COST ESTIMATE AND TECHNICAL BASIS

SL-014308
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Project 13027-004

Prepared by

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1. PURPOSE

The purpose of this study is to estimate the total capital investment and operating and maintenance costs associated with installing dry flue gas desulfurization (FGD) technology on Independence Units 1&2. This report documents the conceptual design and technical basis for the dry FGD cost estimate.

2. TECHNOLOGY DESCRIPTION

2.1.1. Reagent Preparation System

Lime will be supplied to the lime day bins from the long-term storage silo located in the Reagent Handling Area and supplied by the EPC Contractor. The lime day bins, located in the Reagent Preparation Area and provided by the Dry FGD System Supplier, will each have a storage capacity to supply the plant with lime reagent for 24 hours when firing 1.2 lb SO_2/mmBtu coal.

Lime from the day bin will be gravity-fed through feeders to a lime slaker, where the lime will be slaked (mixed with low pressure service water and converted from calcium oxide to calcium hydroxide slurry). The plant will have a total of two lime slaking trains (2 x 100%), each sized to process enough lime slurry to supply the entire plant. Each lime slaker will discharge to a lime slurry transfer tank, which is equipped with two lime slurry transfer pumps which will feed into the lime slurry storage tanks. The common lime slurry storage tanks will each be sized for 12 hours of storage for the entire plant when burning a 1.2 lb SO_2/mmBtu coal. The lime day bin, slaking trains, and lime slurry tanks are sized to provide the necessary reagent slurry to both units simultaneously. The lime slurry tanks are built with cross-ties such that either slurry tank can feed either the Unit 1 or Unit 2 FGD systems.

A total of four lime slurry feed pumps (two per unit), each sized for 100% flow to one unit, will pump the lime slurry from the storage tanks to the SDAs through one of 2 x 100% piping loops, and return unused slurry back to the lime slurry storage tank. The closed-loop reagent supply line requires a flow velocity between 4-10 fps to avoid any solids buildup in the piping. Because of this, the pumping requirement is higher than the actual SDA requirement and must be sufficiently greater than the slurry flow that is pumped into the absorbers to allow the returning flow to remain above 4 fps.

2.1.2. Absorbers

Three absorbers, each treating 33⅓% of the flue gas are provided for each unit. Depending on the supplier and the type of atomizer normally used, there may be one rotary atomizer per absorber with a shared spare (B&W), three rotary atomizers per absorber with one or more shared spares (Alstom, basis of the estimate), or multiple dual-fluid atomizers with 15% shared spares (Siemens). The cost estimate includes contingency to capture the possibility of any of these designs.

2.1.3. Baghouse

Each SDA will be paired with a pulse-jet baghouse with a gross air-to-cloth ratio of approximately 3.2-3.4 ft/min. The filter bags in each baghouse are cleaned by pulses of compressed air. The air compressors will be 4 x 33% for the station and are included in the scope of the baghouse supplier.

2.1.4. Byproduct Recycle System

The reaction byproducts from the absorbers will be collected in the baghouses and a portion of the collected material will be recycled. The baghouse hoppers will be emptied through air lock feeders and pneumatically conveyed to two recycle day bins located in the Byproduct Recycle Area and supplied by the Dry FGD System Supplier, which are common for both units. The air-lock feeders are installed without a spare. One recycle day bin is located in the recycle train for each unit. The common byproduct recycle day bins (one per unit) provide 8-hours of storage when burning 1.2 lb SO_2/mmBtu coal.

Each byproduct recycle day bin is equipped with two recycle slurry preparation systems. The byproduct in each recycle day bin is gravimetrically conveyed to one of two systems where the byproduct is slurried with water (cooling tower blowdown). The byproduct recycle slurry is stored in one of four plant wide recycle slurry tanks, two per unit (combined 4-hour storage capacity).

Two recycle water make-up tanks are located in the recycle area. The recycled by-product slurry will be combined with fresh lime slurry for feed to the SDA atomizers. Recycle feed slurry pumps (4 x 100%, two installed per unit) will be used to transfer the recycle slurry from the recycle slurry tanks to the atomizers. In addition, all recycle feed lines are provided in a loop configuration as with the reagent system, with a complete redundant loop to allow unhindered operation due to any pluggage of pumps or feed piping.

2.1.5. Reagent Handling System

The basis of the estimate is delivery of lime via hopper-bottom railcars with truck unloading as a backup. In order to accommodate rail delivery to the site, a new rail spur will be constructed from the existing track on the plant site for unloading. A trackmobile car positioner will position railcars, two at a time, in the enclosed delivery shed for unloading. A vacuum pneumatic system will unload the railcars into either of the two (2) lime storage silos. The lime storage silos will be sized for supply of reagent for 14 days of storage at full load when firing 1.2 lb SO2/mmBtu coal. Lime from the long-term storage silos will be pneumatically transferred to two lime day bins located in the Reagent Preparation Area and supplied by the Dry FGD System Supplier.

2.1.6. Byproduct Handling System

Excess FGD byproduct from the recycle system will be pneumatically conveyed to either of the two common long- term FGD byproduct storage silos. The two long-term FGD byproduct storage silos are each sized to handle the byproduct for a total of 7 days of storage when firing the 1.2 lb SO_2/mmBtu coal. The byproduct will be mixed with a small amount of fly ash and water to form a final product which contains approximately 65% FGD byproduct, 5% fly ash, and 30% water. In order to achieve this mixture, a common fly ash blending bin (7-day storage) will be located near the new byproduct silos. The wetted byproduct/fly ash mixture is then loading into dump trucks, which will deposit the FGD byproduct in a final storage location in the landfill. It is assumed that the existing landfill will have sufficient capacity to accommodate the addition of FGD byproduct. Therefore no costs were included in the capital estimate for the (existing) landfill.

2.1.7. Flue Gas Handling System

The flue gas from the existing ID fans will be ducted to the absorbers. The gases from the absorbers will be ducted to the baghouses to collect the reaction by-products and residual fly ash. Two axial booster fans (2 x 50% for each unit) will be located downstream of the absorbers and baghouse; the booster ID fans can be provided by the Dry FGD System Supplier or the EPC Contractor. Due to the dry condition of the scrubbed flue gas, the existing stack and liners will be used for the retrofit case.

2.1.8. Electrical BOP System

In order to feed the new dry FGD and other BOP equipment, significant modifications and additions to the existing power system would be required. These include, at a minimum, installation of new auxiliary transformers, medium- and low-voltage switchgear buses, motor control centers (MCCs) and upgrades to the isolated phase tap-off buses. As a detailed conceptual design was not developed an allowance was included for the Electrical BOP Scope.

2.1.9. I&C BOP System

The dry FGD system will be integrated into the existing DCS system. The baghouse will be controlled through a PLC and the ID booster fans will be integrated into the existing DCS system. As a detailed conceptual design was not developed an allowance was included for the I&C BOP Scope.

3. APPROACH

The project capital and O&M cost estimates are based on project-specific information, including:

- An engineer-procure-construct (EPC) contracting strategy with the Dry FGD technology supplier providing the main process equipment as a complete FGD Island.
- On-site disposal of Dry FGD byproduct using new ash handling equipment. The byproduct will be collected in the new fabric filter and blended with fly ash prior to disposal.
- Reagent injection rates based on achieving an outlet SO_2 emission rate of 0.06 lb SO_2/MMBtu from a design inlet concentration of 1.20 lb SO_2/MMBtu, based on the sulfur limit in the fuel supply contracts.
    - Annual operating costs will be based on an uncontrolled SO_2 rate of 0.49 lb SO_2/MMBtu, based on the annual heat input weighted average emission from 2009 through 2013.
    - The system will be designed to control emissions to meet a permit limit of 0.06 SO_2/MMBtu, based on the required permit limits in the EPA Arkansas FIP.

- A high level conceptual system design was used as input to the Dry FGD cost estimate. The following were estimated based on previous projects and scaled for the predicted dry sorbent injection rate for Independence:
    - Auxiliary power consumption
    - Annual reagent consumption
    - Equipment Sparing and Quantities
    - BOP Allowances (Mechanical, Electrical and I&C)

The total plant capital cost estimate includes the following:

- Equipment and material
- Installation labor
- Demolition and Relocation work
- Indirect field costs and BOP engineering
- Freight on Materials
- General and Administration
- Erection contractor profit
- Engineering, Procurement and Project Services
- Spare parts/initial fills (other than reagent)
- EPC Fee

As part of this project, S&L estimated the costs for Owner's services and costs outside of the EPC contract including the following:

- Owner's Costs
- Owner's Engineer
- Construction Management Support
- Startup and Commissioning Support
- Performance Testing
- Contingency
- Escalation
- Interest During Construction

Cost Estimate 34261 provided in Attachment 1 represents the total cost to Entergy to install Dry FGD technology on both units at Independence (Unit 1 and 2) including the EPC Contract price and all additional Owner's costs and third party services.

The total unit O&M cost estimate includes the following:

- Waste disposal (Dry FGD waste)
- Reagent consumption
- Auxiliary power consumption
- Water consumption for reagent and byproduct handling
- Operating labor
- Maintenance material
- Maintenance labor

The O&M Cost Estimate and Capital Cost Estimate were developed using the assumptions and scope provided in this document. The project definition and accuracy corresponds to a study level estimate as defined in U.S.EPA's Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual. The costs provided in this report are in 2017 dollars.

4. CAPITAL AND O&M COST ESTIMATE TECHNICAL BASIS

4.1. DESIGN INPUTS AND ASSUMPTIONS

The following summarizes the design inputs used as the basis for the Independence dry FGD Systems:

- Design SO_2 inlet concentration of 1.2 lb SO_2/MMBtu for equipment design, based on the current coal contract sulfur limit.
- SO_2 inlet concentration of 0.49 lb SO_2/MMBtu for annual operating costs, based on the annual heat input weighted average emission from 2009 through 2013.
- Design SO_2 outlet concentration of 0.06 lb SO_2/MMBtu.
- Annual capacity factor of 75.0% (annual average capacity factor for Independence Units 1 and 2 based on historical heat input from 2009 through 2013).
- Project duration of five years.

4.2. TOTAL INSTALLED CAPITAL INVESTMENT

The Dry FGD System Supplier will provide all of the equipment within the FGD Island. The FGD Island will include the Reagent Preparation Equipment, Absorber Area Equipment, Baghouse Area Equipment and the Byproduct Recycle Equipment. The booster ID fans could be provided by either the Dry FGD System Supplier or the EPC Contractor; the basis of this estimate is supply of the booster fans by the Dry FGD System Supplier. The EPC Contractor will provide the remaining BOP scope in order to provide a complete and operable FGD system. In addition, the EPC Contractor will install/construct the entire system including the equipment provided by the DFGD supplier. The scope of work for the cost estimate is broken out by the following areas:

4.2.1. Dry FGD Island

a. Reagent Preparation System, common to both units:
- Two lime day bins, 24-hours storage each
- Two detention lime slakers at 100% capacity, each with a grit screen, gravimetric feeder
- Two lime slurry transfer tanks
- Four slurry transfer centrifugal pumps
- Two lime slurry storage tanks
- Four slurry feed centrifugal pumps
- Cost estimate based on budgetary proposal from Alstom; the budgetary proposal is based on a design sulfur of 2.0 lb/MMBtu, cost adjustments were included in the estimate for a lower design sulfur of 1.2 lb/MMBtu. These cost adjustments were developed by estimating the differential equipment cost for the reagent preparation and waste handling equipment. The impacted equipment is identified in Section 4.5 which discusses the sulfur design basis sensitivity.

b. Absorber Area, per unit
- Three absorber vessels per unit, with access doors
- Rotary atomizers, two spare atomizers included
- Vessel material carbon steel, ¼ in. – ⅝ in. carbon steel
- Heating and ventilation
- Vacuum piping
- SDA Superstructure
- Cost estimate based on budgetary proposal from Alstom

c. Baghouse Area, per unit
   - New baghouse, including pulse jet cleaning system and all appurtenances
   - Cost estimate based on budgetary proposal from Alstom

d. Byproduct Recycle System, per unit (located remotely in common location for both units)
   - One recycle silo with bin vent filter per unit, 8-hour total capacity
   - Two recycle mix tanks per unit
   - Two recycle slurry tanks per unit, with two recycle slurry centrifugal pumps per unit
   - Agitators for each tank
   - Baghouse ash handling system common to both units
   - Rotary air-lock valves from baghouse hopper outlets to pressure pneumatic conveying system (60-degree typical)
   - Pneumatic pressure blowers (8 x 33⅓ %)
   - Cost estimate based on budgetary proposal from Alstom

e. ID Booster Fans, per unit
   - Two approximately 5,200 hp axial booster fans per unit sized to overcome pressure drop associated with FGD and baghouse
   - Includes motors - no spare motor included
   - Cost estimate based on budgetary proposal from Alstom
   - Dampers from ID fan to booster fans (cost estimated separately, not included in Alstom budgetary proposal)

f. Interconnecting Ductwork, per unit
   - ID fan outlet to absorber inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm
   - Absorber outlet to baghouse inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm
   - Baghouse outlet to new booster fans and fan outlet to the stack inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm

4.2.2. <u>FGD Island BOP</u>

a. Absorber tower foundations including caissons

b. Baghouse area foundations including 18” auger cast piles 60’ long

c. Booster fan area foundations

d. Concrete foundations for all flue gas ductwork

e. 6” insulation with lagging for Absorbers, Baghouses and Ductwork

f. Penthouse enclosure for Absorbers located in FGD Island

g. Two elevators (one for each unit) to provide maintenance access to Absorber and Baghouse Areas

h. Enclosure around hoppers for Baghouses located in FGD Island

i. Lime preparation building for Reagent Preparation Area in FGD Island, including substructure and superstructure

j. Byproduct recycle building for Byproduct Recycle Area in FGD Island, including substructure and superstructure

4.2.3. Reagent Storage and Handling, common to both units:

a. Lime rail car unloader:
   - Lime delivery via 25-car unit train
   - System consists of mobile receiving pan and associated vacuum pneumatic equipment to unload railcar through railcar bottom hoppers
   - Enclosed railcar unloading building
   - One vacuum pneumatic system operating to unload a car
   - Pneumatic vacuum exhausters (2 x 100%)
   - Filter separator with vacuum-to-pressure transfer hopper and valves
   - Cost estimate based on vendor quote for a similar unit

b. Lime storage silos:
   - Two lime storage silos, (14-day capacity each, common to both units) with bin vent filter, including substructure and superstructure
   - 1,000-tons storage, each
   - Continuous level detection systems
   - Live bottom hopper outlets
   - Rotary airlock assemblies
   - Lime transfer systems:
     - Pressure pneumatic conveying system from lime storage silos to lime day bins
     - Pneumatic pressure blowers
     - One lot of pneumatic conveying piping located on an elevated pipe rack

c. Concrete foundations including caissons for all material silos

d. Concrete foundations for pneumatic conveying blowers and exhausters

4.2.4. Byproduct Handling System, common to both units

a. Two FGD by-product storage silos (7-day capacity each, common to both units) with bin vent filter, fluidizing system, and two unloading conditioners (one operating, one spare per silo), including substructure and superstructure

b. One common fly ash blending, 7-day storage bin with bin vent filter, fluidizing system, and four pneumatic airslide conveyors

c. Water pumps and associated piping for unloading conditioners (pin mixers) at both silos

d. Continuous level detection system

e. Two truck scales and substructure

f. Concrete foundations including caissons for all material silos

g. Concrete foundations for pneumatic conveying blowers and exhausters

h. Allowance for existing road improvements for truck haulage to existing landfill

4.2.5. Civil BOP

a. Site grading

b. Soil removal earthwork

c. Excavation, backfill, and compaction for all foundations

d. Development of a new laydown area, approximately 10 acres, including site preparation, fencing, and temporary power. It was assumed that this area would be located on existing plant property, and does not require land to be purchased.

4.2.6. Mechanical BOP System

a. Interconnecting piping, above-ground and buried

b. Valves for interconnecting piping, above-ground and buried

c. Lime slaking water storage tank, 175,000-gallon capacity

d. Recycle make-up water tanks, 2 x 200,000-gallon capacity

e. Pipe Racks, common to both units
   - Between lime railcar unloading enclosure and lime silos
   - Between lime silos and lime day bins
   - From baghouse hoppers to recycle silos and FGD by-product silo
   - From lime slurry storage tanks to absorber
   - From recycle slurry storage tank to absorber
   - Concrete foundations including caissons for all pipe racks
   - Shallow concrete foundations for other miscellaneous structures

f. BOP Pumps
   - Three by-product recycle water forwarding pumps to recycle slurry
   - Four reagent prep/recycle sump pumps
   - Two lime silo and unloading area sump pumps
   - Two by-product ash silo area sump pumps
   - Two by-product recycle make-up water tank supply pumps
   - Two lime slaking water pumps

g. Instrument Air System, common to both units
   - Air compressors; 2 x 100%,
   - IA dryers w/filters; 2 x 100%,
   - Air receivers; 2 x 100%
   - Instrument air piping to every silo or day bin, bin vent and reagent preparation/recycle area
   - Heat-traced piping

h. Service Air System, common to both units
   - Air compressors; 2 x 100%
   - Air receivers; 2 x 100%

i. Field painting
   - Multiple coat system used for exposed ductwork only
   - Inorganic zinc primer and polyurethane system used for steel
   - Allowance for underground piping shop coatings built into piping cost

4.2.7. Demolition and Relocation

a. Allowance of $1,800,000, plus labor costs, is included for demolition and relocation of existing equipment and infrastructure which may interfere with the new Dry FGD system. This allowance is based on recent in-house cost estimates for similar projects.

4.2.8. Electrical BOP System

a. Allowances of $13,900,000, $8,500,000 and $1,400,000, plus labor costs, are included for electrical equipment upgrades and modifications, cables and conduits/raceway, respectively. These allowances are based on recent in-house cost estimates for similar projects.

4.2.9. Instrumentation and Controls BOP System

a. Allowance of $1,585,000, plus labor costs, is include for DCS upgrades and added instrumentation. This allowance is based on recent in-house cost estimates for similar projects.

4.2.10. Labor Costs

Installation/labor costs were included in the base estimate under the direct costs. Manhours are estimated for each item in the base estimate and are based on the type of work and typical estimates for similar work. The labor costs are based on the labor wage rates and labor crews developed by S&L.

a. Labor Wage Rates

   Crew labor rates were developed using prevailing craft rates, fringe benefits and state specific worker's compensation rates as published in the 2017 edition of R.S. Means Labor Rates for Pine Bluff, Arkansas area. Costs were added to cover FICA, workers compensation, all applicable taxes, small tools, incidentals, construction equipment, and contractor's overhead. A 1.15 geographic labor productivity multiplier is included based on the Compass International Construction Yearbook for Arkansas. The crew rates do not include an allowance for weather related delays.

b. Labor crews

   Construction/erection labor cost is based on the use of applicable construction crews typically required for projects of this type. The construction crew costs were specifically developed for utility industry and are proprietary to S&L. The prevailing craft rates are incorporated into work crews appropriate for the activities, and include costs for small tools, construction equipment, insurance, and site overheads.

4.2.11. Other Direct and Construction Indirect Costs

In addition to the base labor costs, other construction indirect costs for the project were broken out in the estimate as well as other contractor direct costs. The following items were included as other direct and construction indirect costs.

a. Scaffolding and Consumables
b. Premiums and per diems ($10 per hour)
c. Overtime is included based on five 10-hour shifts per week work schedule
d. Freight on construction materials
e. Contractor's General & Administration Fees (included at 10% of total direct and construction indirect costs)
f. Contractor's Profit (included at 5% of total direct and construction indirect costs)

4.2.12. EPC Indirect Costs

The final contribution to the overall EPC project price are the EPC Contractor's indirect costs; these include the EPC engineering services, startup spare parts and initial fills, technical field advisors, and the EPC risk fee.

a. EPC Engineering Services

The EPC engineering services was estimated based on recent projects with similar scopes and schedules. The total cost of the EPC engineering services was estimated to be $23,000,000.

b. Startup Spare Parts and Initial Fills

An allowance has been included for initial fills for equipment, including first fills for lubrication of any motorized equipment. The initial fill of pebble lime was not included in the EPC Contractor's scope, as this is considered to be an operating cost rather than a capital expense. The initial fill of pebble lime is included in the Owner's costs. The total cost of the initial fills was estimated to be $300,000.

c. Technical Field Advisors (Vendors)

Allowances were included for equipment supplier's technical field advisory services based on an estimated 600 man-days. The estimate includes technical field advisors for the FGD system supplier (including FGD system subcontractors) and the DCS supplier. The total cost of the technical field advisors was estimated to be $600,000.

d. EPC Risk Fee

An EPC approach provides an alternative which is expected to reduce risk for Entergy by placing the responsibility for the project on a single entity, the EPC Contractor. The EPC risk fee is a premium charged by the contractor which accounts for the additional coordination and management of the project as well as the additional risk assumed by the contractor. Based on S&L's experience with recent EPC projects, an EPC risk fee was included at 10% of the total EPC project costs.

4.2.13. Owner's Costs and Services

Outside of the EPC Contractor's total cost, Entergy will incur other costs associated with the project, such as services procured from third parties (including Owner's engineer, construction management support, startup and commissioning support and performance testing), and other project related costs.

a. Owner's Costs

Owner's Costs are direct costs that the Owner incurs over the life of the project. The following items are real costs Entergy will incur to install DSI at Independence based on the scope and schedule of this project:

- Internal Labor
- Internal Indirects

- Travel Expenses
- Legal Services
- Builders Risk Insurance
- Initial Fills (Reagent)

Owner's costs were included in the estimate at 8% of the total project cost.

b. Construction Management Support

The construction management support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The cost of labor is based on present day cost. The total cost of the construction management support was estimated to be $4,969,000.

c. Startup and Commissioning Support

The startup and commissioning support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The total cost of the startup and commissioning support was estimated to be $550,000.

d. Owner's Engineer

The Owner's Engineer cost was developed as a high level estimate based on a typical scope for Owner's Engineer work for this type of project; including the following tasks:

- Conceptual Study Support
- EPC Specification Supporting Documents
- Project Schedule Development
- EPC Specification Development
- EPC Bid Evaluation and Contract Conformance
- General Project Support
    - Monthly Project Status Meetings
    - Weekly Teleconferences
    - Overall Coordination
    - Project Administration
    - Site Visits and Travel
- Permitting Support
- Design Review of Drawing Submittals
- Technical support during design, fabrication, construction, commissioning, and testing

- Equipment vendor QA/QC audits

The total cost of the Owner's Engineer was estimated to be $6,500,000.

e. Performance testing

The cost for performance testing was developed as a factored estimate using costs from projects of similar scope. This cost includes the testing, performed by a third-party contractor hired by the Owner, and also includes the cost for S&L's assistance in the following tasks:

- Development of the test protocol
- Procuring the services of the testing contractor
- Overseeing the performance test campaign
- Evaluating the results of the testing with respect to guarantee compliance

The estimate for the third party testing contractor is based on the assumption that the contractor would be onsite for up to 5 days. The total cost of the Performance Testing was estimated to be $275,000.

f. Contingency

Contingency is included in the estimate to cover the uncertainty associated with the project costs. The cost estimate includes a recommended contingency of 15% (due to a greater extent of project definition), which is consistent with cost estimating guidelines for a conceptual design and the current level of project definition. Contingency was applied to the total project costs before escalation.

g. Escalation

Escalation was included in the estimate based on a typical schedule for implementation of a Dry FGD system at an escalation rate of 2.15% on equipment and materials and 3.35% on labor and indirects. These escalation rates were developed by S&L based on recent pricing and in-house escalation projections.

h. Interest During Construction

Interest during construction (IDC) accounts for the time value of money associated with the distribution of construction cash flows over the construction period. IDC was applied to the total EPC project costs including contingency. The IDC was calculated based on a typical schedule for implementation of a DSI system and a typical interest rate of 7.8% per year which was assumed based on a low interest market environment.

4.3. VARIABLE OPERATING AND MAINTENANCE COSTS

The following unit costs were used to develop the variable Operating and Maintenance (O&M) costs. All of these values, with the exception of the reagent costs, were provided by Entergy or are typical industry values confirmed by Entergy. The reagent costs are based on recent supplier quotes for the area.

Table 4-1: Unit Pricing for Utilities (Provided by Entergy)

Unit Cost	Units	Value
Pebble Lime	$/ton	$130.0
High Quality Water	$/1000 gal	$2.00
Low Quality Water	$/1000 gal	$0.50
Byproduct Disposal	$/ton	$7.50
Aux Power Cost[1]	$/MWh	$43.35

Note 1: Entergy provided auxiliary power costs for the first year of operation.

Table 4-2 below summarizes the consumption rates estimated as well as the first year variable O&M costs for the Dry FGD system.

Table 4-2: Variable O&M Rates and First Year Costs, per Unit

	Units	Value
Dry FGD System Parameters		
Reagent Consumption	lb/hr	4,800
Byproduct Waste Production	lb/hr	10,600
Aux Power Consumption	kW	10,000
High Quality Water Consumption	gpm	50
Low Quality Water Consumption	gpm	880
First Year[1] Variable O&M Costs (@CF[2])		
Reagent Cost	$/year	$2,050,000
Byproduct Waste Disposal Cost	$/year	$261,000
Aux Power Cost	$/year	$2,628,000
Water Cost	$/year	$213,000
Bag and Cage Replacement Cost	$/year	$372,000
Total First Year Variable O&M Cost	**$/year**	**$5,524,000**

Note 1: First year costs are provided in $2017.

Note 2: The first year costs are calculated using an annual capacity factor of 75.0%.

4.4. FIXED OPERATING AND MAINTENANCE COSTS

The fixed O&M costs for the systems consist of operating personnel as well as maintenance costs (including material and labor). Based on the conceptual design for the dry FGD system, the estimated staffing additions are 28 personnel for two systems on adjacent units.

The annual maintenance costs are estimated as a percentage of the total capital equipment cost, based on the amount of operating equipment which will require routine maintenance. For this evaluation, the maintenance costs (maintenance and labor) were estimated to be approximately 1.3% of the project capital. This is a lower value than typical because items such as track work and civil work are high capital cost items with little to no maintenance.

Table 4-3 below summarizes the first year fixed O&M costs for the design and typical cases.

Table 4-1: First Year Fixed O&M Costs for Dry FGD, per Unit

First Year[1] Fixed O&M Costs	Units	Value
Operating Labor[2]	$/year	$1,660,000
Maintenance Material	$/year	$975,000
Maintenance Labor	$/year	$650,000
Total First Year Fixed O&M Cost	**$/year**	**$3,285,000**

Note 1: First year costs are provided in $2017.

Note 2: Operating labor costs are based on a labor rate of $56.95, which was provided by Entergy.

Note 3: Installation of systems on both units would require 28 operators total. For accounting purposes, this is considered 14 operators per unit.

5. SUMMARY

The cost estimate for the Independence Units 1&2 Dry FGD systems is based on the addition of two SDA FGD systems for SO_2 removal. The attached capital estimate for the Independence Dry FGD system is based on this technical basis and is presented in 2017 dollars.

6. ATTACHMENTS

1. Independence DFGD Project Units 1 and 2 Conceptual Capital Cost Estimate, Sargent & Lundy Estimate No. 34261

ENTERGY ARKANSAS
INDEPENDENCE STATION DRY (SDA) FGD
CONCEPTUAL COST ESTIMATE

Estimator	A. KOCI
Labor rate table	17ARPBL
Project No.	13027-004
Estimate Date	10/04/2017
Reviewed By	GA
Approved By	BA
Estimate No.	34261A
Cost index	ARPBL

ENTERGY ARKANSAS
INDEPENDENCE STATION DRY (SDA) FGD
CONCEPTUAL COST ESTIMATE

Area	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Total Cost
101	FGD ISLAND	147,908,000	150,000,000	16,508,216	343,779	26,553,044	340,969,260
102	REAGENT HANDLING SYSTEM	5,830,400	2,591,000	1,325,175	39,706	3,315,997	13,062,572
105	BYPRODUCT HANDLING SYSTEM	6,120,000	6,810,000	792,075	103,041	8,417,500	22,139,575
121	CIVIL BOP	350,000		3,731,841	63,706	8,336,292	12,418,133
151	MECHANICAL BOP	720,000	1,647,000	5,962,113	88,963	8,343,711	16,672,824
190	DEMOLITION / RELOCATION			1,800,000	33,333	3,276,667	5,076,667
201	ELECTRICAL BOP SYSTEM		12,300,000	11,500,000	284,184	22,691,518	46,491,518
211	INSTRUMENTATION AND CONTROLS BOP SYSTEM		1,500,000	1,085,000	10,920	789,374	3,374,374
	TOTAL DIRECT	160,928,400	174,848,000	42,704,420	967,632	81,724,103	460,204,922

Estimate Totals

Description	Amount	Totals	Hours
Direct Costs:			
Labor	81,724,103		967,632
Material	42,704,420		
Subcontract	160,928,400		
Process Equipment	174,848,000		
	460,204,923	**460,204,923**	
Other Direct & Construction Indirect Costs:			
91-1 Scaffolding	5,721,000		
91-2 Cost Due To OT 5-10's	11,337,000		
91-4 Per Diem	9,676,000		
91-5 Consumables	817,077		
91-6 Freight on Material	2,135,000		
91-8 Sales Tax	7,566,000		
91-9 Contractors G&A	15,776,000		
91-10 Contractors Profit	7,888,000		
	60,916,077	**521,121,000**	
Indirect Costs:			
93-1 Engineering Services	23,000,000		
93-4 SU/S Parts/ Initial Fills	300,000		
93-5 Technical Field Advisors	600,000		
93-8 EPC Fee	54,502,000		
	78,402,000	**599,523,000**	
Escalation:			
96-1 Escalation on Material	5,731,000		
96-2 Escalation on Labor	20,520,000		
96-3 Escalation on Subcontract	26,919,000		
96-4 Escalation on Process Eq	17,974,000		
96-5 Escalation on Indirects	12,802,000		
	83,946,000	**683,469,000**	
Total EPC Cost		***683,469,000***	
Owner's Costs:			
99-1 Owner's Costs	47,962,000		
	47,962,000	**731,431,000**	
Third Party Services:			
100 CM Oversight	4,969,000		
102 Start-up Oversight	550,000		
103 Owner's Engineer	6,500,000		
104 Performance Testing	275,000		
	12,294,000	**743,725,000**	
Project Contingency :			
110 Project Contingency	98,966,000		
	98,966,000	**842,691,000**	
Escalation Addition:			
120 Escalation on Lines 99-110	8,897,000		
	8,897,000	**851,588,000**	
Interest During Construction:			
130 Interest During Constr.	132,199,000		
	132,199,000	**983,787,000**	
Total		***983,787,000***	

ENTERGY ARKANSAS
INDEPENDENCE STATION DRY (SDA) FGD
CONCEPTUAL COST ESTIMATE

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
101			**FGD ISLAND**									
	21.00.00		**CIVIL WORK**									
		21.53.00	**PILING**									
			PILE - MOB/DEMOB		1.00 LS	100,000	-			115.48 /MH		100,000
			PILE - 18" AUGER CAST X 60' LONG	UNIT 1 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	138.00 EA	496,800	-			115.48 /MH		496,800
			PILE - 18" AUGER CAST X 60' LONG	UNIT 2 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	138.00 EA	496,800	-			115.48 /MH		496,800
			PILE - 18" AUGER CAST X 60' LONG	UNIT 1 BAGHOUSE FDN	252.00 EA	907,200	-			115.48 /MH		907,200
			PILE - 18" AUGER CAST X 60' LONG	UNIT 2 BAGHOUSE FDN	252.00 EA	907,200	-			115.48 /MH		907,200
			PILING			**2,908,000**						**2,908,000**
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	ABSORBER TOWERS FOUNDATIONS	180.00 EA	-	-	334,260	4,552	115.48 /MH	525,633	859,893
			2.5 FT DIA X 30 FT DEEP CAISSON	ABSORBER TOWERS FOUNDATIONS	180.00 EA	-	-	334,260	4,552	115.48 /MH	525,633	859,893
			2.5 FT DIA X 30 FT DEEP CAISSON	REAGENT PREP ENCLOSURE 50'X50' SUBSTRUCTURE	50.00 EA	-	-	92,850	1,264	115.48 /MH	146,009	238,859
			2.5 FT DIA X 30 FT DEEP CAISSON	BYPRODUCTS RECYCLE EQUIPMENT BLDG 60' X 60' SUBSTRUCTURE	72.00 EA	-	-	133,704	1,821	115.48 /MH	210,253	343,957
			2.5 FT DIA X 30 FT DEEP CAISSON	UNIT 1 BOOSTER FAN FOUNDATION	40.00 EA	-	-	74,280	1,011	115.48 /MH	116,807	191,087
			2.5 FT DIA X 30 FT DEEP CAISSON	UNIT 2 BOOSTER FAN FOUNDATION	40.00 EA	-	-	74,280	1,011	115.48 /MH	116,807	191,087
			CAISSON					**1,043,634**	**14,211**		**1,641,143**	**2,684,777**
			CIVIL WORK			**2,908,000**		**1,043,634**	**14,211**		**1,641,143**	**5,592,777**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	REAGENT PREP ENCLOSURE 50'X50' SUBSTRUCTURE	300.00 CY	-	-	69,000	2,414	68.52 /MH	165,393	234,393
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	BYPRODUCTS RECYCLE EQUIPMENT BLDG 60' X 60' SUBSTRUCTURE	432.00 CY	-	-	99,360	3,476	68.52 /MH	238,166	337,526
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	UNIT 1 BOOSTER FAN FOUNDATION	600.00 CY	-	-	138,000	4,828	68.52 /MH	330,786	468,786
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	UNIT 2 BOOSTER FAN FOUNDATION	600.00 CY	-	-	138,000	4,828	68.52 /MH	330,786	468,786
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	UNIT 1 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	966.00 CY	-	-	222,180	7,772	68.52 /MH	532,566	754,746
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	UNIT 2 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	966.00 CY	-	-	222,180	7,772	68.52 /MH	532,566	754,746
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ABSORBER TOWER FOUNDATION	1,300.00 CY	-	-	299,000	10,460	68.52 /MH	716,703	1,015,703
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ABSORBER TOWERS FOUNDATIONS	1,300.00 CY	-	-	299,000	10,460	68.52 /MH	716,703	1,015,703
			CONCRETE FOUNDATIONS - COMPOSITE RATE	LIME SLURRY FEED TANKS	400.00 CY	-	-	92,000	3,218	68.52 /MH	220,524	312,524
			CONCRETE FOUNDATIONS - COMPOSITE RATE	UNIT 1 BAGHOUSE FDN 3 FDNS 83'X63'X3'	1,743.00 CY	-	-	400,890	14,024	68.52 /MH	960,934	1,361,824
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' UNIT 1 BAGHOUSE AREA, COMPRESSOR BLDG	6.00 CY	-	-	1,380	48	68.52 /MH	3,308	4,688
			CONCRETE FOUNDATIONS - COMPOSITE RATE	UNIT 2 BAGHOUSE FDN 3 FDNS 83'X63'X3'	1,743.00 CY	-	-	400,890	14,024	68.52 /MH	960,934	1,361,824
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' UNIT 2 BAGHOUSE AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	68.52 /MH	3,308	4,688
			CONCRETE					**2,383,260**	**83,372**		**5,712,678**	**8,095,938**
			CONCRETE					**2,383,260**	**83,372**		**5,712,678**	**8,095,938**
	23.00.00		**STEEL**									
		23.17.00	**GALLERY**									
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	4,000.00 SF	-	-	60,000	460	72.48 /MH	33,324	93,324
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	BYPRODUCTS RECYCLE EQUIPMENT BLDG	5,760.00 SF	-	-	86,400	662	72.48 /MH	47,987	134,387
			3" HEAVY DUTY GRATING	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	200.00 SF	-	-	11,200	39	72.48 /MH	2,833	14,033
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	3,000.00 LF	-	-	159,000	621	72.48 /MH	44,988	203,988
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	4,320.00 LF	-	-	228,960	894	72.48 /MH	64,782	293,742
			SELF CLOSING SWING GATE - USER DEFINED	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	40.00 EA	-	-	11,200	184	72.48 /MH	13,330	24,530
			SELF CLOSING SWING GATE - USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	58.00 EA	-	-	16,240	267	72.48 /MH	19,328	35,568
			LADDER	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	800.00 LF	-	-	40,000	368	72.48 /MH	26,659	66,659
			LADDER	BYPRODUCTS RECYCLE EQUIPMENT BLDG	1,100.00 LF	-	-	55,000	506	72.48 /MH	36,657	91,657
			STAIR SYSTEM	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	2,400.00 SF	-	-	218,400	3,172	72.48 /MH	229,937	448,337

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		23.17.00	GALLERY									
			STAIR SYSTEM	BYPRODUCTS RECYCLE EQUIPMENT BLDG	3,500.00 SF	-	-	318,500	4,626	72.48 /MH	335,324	653,824
			GALLERY					1,204,900	11,798		855,147	2,060,047
		23.25.00	ROLLED SHAPE									
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	REAGENT PREP ENCLOSURE 50'X50' GALLERY SUPPORT	200.00 TN	-	-	716,000	5,057	98.30 /MH	497,149	1,213,149
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	BYPRODUCTS RECYCLE EQUIPMENT BLDG	288.00 TN	-	-	1,031,040	7,283	98.30 /MH	715,895	1,746,935
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	U1 BAGHOUSE SKIRTS STEEL GIRTS	36.00 TN	-	-	138,240	910	98.30 /MH	89,487	227,727
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	U2 BAGHOUSE SKIRTS STEEL GIRTS	36.00 TN	-	-	138,240	910	98.30 /MH	89,487	227,727
			BUILDING MIX, TWO COAT PAINTED		50.00 TN	-	-	128,000	920	98.30 /MH	90,391	218,391
			BUILDING MIX, TWO COAT PAINTED		50.00 TN	-	-	128,000	920	98.30 /MH	90,391	218,391
			BUILDING MIX, TWO COAT PAINTED	REAGENT PREP ENCLOSURE SUPERSTRUCTURE	500.00 TN	-	-	1,280,000	9,195	98.30 /MH	903,908	2,183,908
			BUILDING MIX, TWO COAT PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	720.00 TN	-	-	1,843,200	13,241	98.30 /MH	1,301,628	3,144,828
			ROLLED SHAPE					5,402,720	38,437		3,778,336	9,181,056
			STEEL					6,607,620	50,235		4,633,483	11,241,103
	24.00.00		ARCHITECTURAL									
		24.17.00	ELEVATOR									
			PASSENGER, TRACTION, 4 STOPS, 3500LB, 350 FT/MIN	SCHINDLER ELEVATOR BUDGET	2.00 LS	-	-	318,700	1,885	114.46 /MH	215,764	534,464
			ELEVATOR					318,700	1,885		215,764	534,464
		24.35.00	PRE-ENGINEERED BUILDING									
			PRE-ENGINEERED BUILDING	8' X 10' UNIT 1 BAGHOUSE AREA, COMPRESSOR BLDG	1.00 LT	-	-	20,000	115	98.30 /MH	11,299	31,299
			PRE-ENGINEERED BUILDING	8' X 10' UNIT 2 BAGHOUSE AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	98.30 /MH	11,299	21,299
			PRE-ENGINEERED BUILDING					30,000	230		22,598	52,598
		24.37.00	ROOFING									
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	U1 SDA TOP ENCLOSURE ROOF	3,318.00 SF	-	-	54,946	339	60.10 /MH	20,400	75,346
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	U2 SDA TOP ENCLOSURE ROOF	3,318.00 SF	-	-	54,946	339	60.10 /MH	20,400	75,346
			METAL, INSULATED- USER DEFINED	REAGENT PREP ENCLOSURE SUPERSTRUCTURE	2,500.00 SF	-	-	19,425	862	60.10 /MH	51,810	71,235
			METAL, INSULATED- USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	3,600.00 SF	-	-	27,972	1,241	60.10 /MH	74,607	102,579
			ROOFING					157,289	2,782		167,216	324,506
		24.41.00	SIDING									
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	U1 SDA TOP ENCLOSURE SIDING	2,450.00 SF	-	-	40,572	251	87.92 /MH	22,036	62,608
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	U2 SDA TOP ENCLOSURE SIDING	2,450.00 SF	-	-	40,572	251	87.92 /MH	22,036	62,608
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	REAGENT PREP ENCLOSURE	10,000.00 SF	-	-	165,600	1,023	87.92 /MH	89,941	255,541
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	14,400.00 SF	-	-	238,464	1,473	87.92 /MH	129,515	367,979
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	U1 BAGHOUSE SKIRTS 6x(83'+63) x30' tall '	26,260.00 SF	-	-	85,345	1,238	87.92 /MH	108,805	194,150
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	U2 BAGHOUSE SKIRTS 6x(83'+63) x30' tall '	26,280.00 SF	-	-	85,410	1,238	87.92 /MH	108,887	194,297
			SIDING					655,963	5,473		481,220	1,137,183
		24.99.00	ARCHITECTURAL, MISCELLANEOUS									
			PENTHOUSE HEATING	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	73.32 /MH	5,394	69,394
			PENTHOUSE LIGHTING	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	84.60 /MH	6,223	70,223
			PENTHOUSE FIRE PROTECTION	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	32,000	37	84.60 /MH	3,112	35,112
			PENTHOUSE HEATING	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	73.32 /MH	5,394	69,394
			PENTHOUSE LIGHTING	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	84.60 /MH	6,223	70,223
			PENTHOUSE FIRE PROTECTION	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	32,000	37	84.60 /MH	3,112	35,112
			ARCHITECTURAL, MISCELLANEOUS - USER DEFINED	U1 BAGHOUSE SKIRTS MANDOORS	3.00 EA	-	-	1,500	28	58.15 /MH	1,604	3,104
			ARCHITECTURAL, MISCELLANEOUS - USER DEFINED	U2 BAGHOUSE SKIRTS MANDOORS	3.00 EA	-	-	1,500	28	58.15 /MH	1,604	3,104
			ARCHITECTURAL, MISCELLANEOUS					323,000	423		32,666	355,666
			ARCHITECTURAL					1,484,952	10,794		919,463	2,404,415
	31.00.00		MECHANICAL EQUIPMENT									
		31.41.00	FIRE PROTECTION EQUIPMENT & SYSTEM									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.41.00	**FIRE PROTECTION EQUIPMENT & SYSTEM**									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	REAGENT PREP ENCLOSURE 50'X50' FIRE PROTECTION ALLOWANCE	5,000.00 SF	-	-	27,500	385	75.53 /MH	29,083	56,583
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG' FIRE PROTECTION ALLOWANCE	10,800.00 SF	-	-	59,400	832	75.53 /MH	62,820	122,220
			FIRE PROTECTION EQUIPMENT & SYSTEM					**86,900**	**1,217**		**91,904**	**178,804**
		31.45.00	**FGD EQUIPMENT**									
			DRY FGD ISLAND -UNITS 1 & 2 FGD SYSTEMS	INCLUDES ABSORBERS, BAGHOUSES, REAGENT PREP, BYPRODUCT RECYCLE, ID BOOSTER FANS, CONTROLS, PIPING, DUCTWORK, AND WIRING WITHIN FGD ISLAND (BASED ON RECENT BUDGETARY QUOTE FROM SIMILARLY SIZED PROJECT)	1.00 LS		150,000,000	-		100.38 /MH		150,000,000
			DRY FGD ISLAND -UNITS 1 & 2 FGD SYSTEMS	INSTALLATION COST FOR DRY FGD ISLAND INCLUDING ITEMS LISTED ABOVE	1.00 LS	145,000,000		-		100.38 /MH		145,000,000
			FGD EQUIPMENT			**145,000,000**	**150,000,000**					**295,000,000**
			MECHANICAL EQUIPMENT			**145,000,000**	**150,000,000**	**86,900**	**1,217**		**91,904**	**295,178,804**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	REAGENT PREP ENCLOSURE 50'X50' LIGHTING ALLOWANCE	5,000.00 SF	-	-	55,000	57	73.32 /MH	4,214	59,214
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	BYPRODUCTS RECYCLE EQUIPMENT BLDG LIGHTING ALLOWANCE	10,800.00 SF	-	-	118,800	124	73.32 /MH	9,102	127,902
			HVAC, MISCELLANEOUS					**173,800**	**182**		**13,316**	**187,116**
			HVAC					**173,800**	**182**		**13,316**	**187,116**
	36.00.00		**INSULATION**									
		36.13.00	**DUCT**									
			MINERAL WOOL INSULATION, 4 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	U1 BAGHOUSE INSUILATION TOP, SIDES AND HOPPERS	141,831.00 SF	-	-	850,986	35,050	73.69 /MH	2,582,848	3,433,834
			MINERAL WOOL INSULATION, 4 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	U2 BAGHOUSE INSULATIOIN - TOPS, SIDES AND HOPPERS	141,831.00 SF	-	-	850,986	35,050	73.69 /MH	2,582,848	3,433,834
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA SHELL INSULATION	40,167.00 SF	-	-	261,086	10,388	73.69 /MH	765,493	1,026,578
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA ROOF INSULATION	11,019.00 SF	-	-	71,624	2,850	73.69 /MH	209,997	281,621
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA SHELL INSULATION	40,167.00 SF	-	-	261,086	10,388	73.69 /MH	765,493	1,026,578
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA ROOF INSULATION	11,019.00 SF	-	-	71,624	2,850	73.69 /MH	209,997	281,621
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	UNIT 1 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	168,220.00 SF	-	-	1,093,430	43,505	73.69 /MH	3,205,896	4,299,326
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	UNIT 2 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	168,220.00 SF	-	-	1,093,430	43,505	73.69 /MH	3,205,896	4,299,326
			DUCT					**4,554,250**	**183,586**		**13,528,470**	**18,082,720**
			INSULATION					**4,554,250**	**183,586**		**13,528,470**	**18,082,720**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.37.00	**LIGHTING ACCESSORY (FIXTURE)**									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	REAGENT PREP ENCLOSURE 50'X50' LIGHTING ALLOWANCE	5,000.00 SF	-	-	55,000	57	69.31 /MH	3,983	58,983
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	BYPRODUCTS RECYCLE EQUIPMENT BLDG LIGHTING ALLOWANCE	10,800.00 SF	-	-	118,800	124	69.31 /MH	8,604	127,404
			LIGHTING ACCESSORY (FIXTURE)					**173,800**	**182**		**12,587**	**186,387**
			ELECTRICAL EQUIPMENT					**173,800**	**182**		**12,587**	**186,387**
			101 FGD ISLAND			**147,908,000**	**150,000,000**	**16,508,216**	**343,779**		**26,553,044**	**340,969,260**
102			**REAGENT HANDLING SYSTEM**									
	21.00.00		**CIVIL WORK**									
		21.14.00	**STRIP & STOCKPILE TOPSOIL**									
			STRIP & STOCKPILE TOPSOIL - 12"	EXTEND REAGENT RAIL TRACK	22,500.00 SF	-	-		52	185.95 /MH	9,618	9,618
			STRIP & STOCKPILE TOPSOIL						**52**		**9,618**	**9,618**
		21.41.00	**EROSION AND SEDIMENTATION CONTROL**									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	EXTEND REAGENT RAIL TRACK	2,500.00 SY	-	-	26,625	86	103.37 /MH	8,911	35,536

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			EROSION AND SEDIMENTATION CONTROL					**26,625**	**86**		**8,911**	**35,536**
		21.53.00	**PILING**									
			PILE - 18" AUGER CAST X 60' LONG	UNLOADING SHED 200' X 75 WIDE	64.00 EA	230,400	-			115.48 /MH		230,400
			PILING			**230,400**						**230,400**
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	SUBSTRUCTURE 2200 TON LIME STORAGE SILOS	100.00 EA	-	-	185,700	2,529	115.48 /MH	292,018	477,718
			CAISSON					**185,700**	**2,529**		**292,018**	**477,718**
		21.71.00	**TRACKWORK**									
			LIME RAILCAR UNLOADING SPUR	ALLOWANCE	1,000.00 LF	-	-	170,000	1,724	87.32 /MH	150,552	320,552
			TRACKWORK					**170,000**	**1,724**		**150,552**	**320,552**
			CIVIL WORK			**230,400**		**382,325**	**4,391**		**461,099**	**1,073,824**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	SUBSTRUCTURE 2-2,000 TON LIME STORAGE SILOS	600.00 CY	-	-	138,000	4,828	68.52 /MH	330,786	468,786
			FOUNDATION, 4500 PSI - COMPOSITE RATE	UNLOADING SHED 200' X 75 WIDE	925.00 CY	-	-	212,750	7,443	68.52 /MH	509,962	722,712
			CONCRETE					**350,750**	**12,270**		**840,748**	**1,191,498**
			CONCRETE					**350,750**	**12,270**		**840,748**	**1,191,498**
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	UNLOADING SHED 200' X 75 WIDE x15' TALL	15,000.00 SF	-	-	525,000	4,828	98.30 /MH	474,552	999,552
			PRE-ENGINEERED BUILDING					**525,000**	**4,828**		**474,552**	**999,552**
			ARCHITECTURAL					**525,000**	**4,828**		**474,552**	**999,552**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - 2,000 TON LIME STORAGE SILO	SUBCONTRACT - ERECTED	2.00 LS	5,600,000				68.52 /MH		5,600,000
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO			**5,600,000**			**0**			**5,600,000**
			MISCELLANEOUS STRUCTURAL ITEM			**5,600,000**			**0**			**5,600,000**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.25.00	**CRANES & HOISTS**									
			CRANES & HOISTS & TROLLEYS	REAGENT HANDLING SYSTEM ALLOWANCE	1.00 LT	-	275,000	-		75.53 /MH		275,000
			CRANES & HOISTS				**275,000**					**275,000**
			MECHANICAL EQUIPMENT				**275,000**					**275,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.14.00	**MATERIAL HANDLING EQUIPMENT**									
			LIME HANDLING SYSTEM - 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM		1.00 LS	-	500,000	-	3,306	75.53 /MH	249,683	749,683
			LIME HANDLING SYSTEM - VACUUM EXHAUSTER WITH SOUND ENCLOSURES	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	2.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - RECEIVING PANS UNDER RAIL CARS	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - FILTER SEPARATORS ON TOP OF SILO	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - 25 TPH PNEUMATIC TRANSPORT SYSTEM		2.00 LS	-	1,000,000	-	6,611	75.53 /MH	499,366	1,499,366
			LIME HANDLING SYSTEM - PRESSURE BLOWERS WITH SOUND ENCLOSURES	INCLUDED WITH 25 TPH PNEUMATIC TRANSPORT SYSTEM	3.00 LS	-		-		/MH		
			LIME HANDLING SYSTEM - PRESSURE FEEDERS	INCLUDED WITH 25 TPH PNEUMATIC TRANSPORT SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - SPARE PARTS FOR STARTUP AND SPECIAL TOOLS		1.00 LS	-	8,000	-		75.53 /MH		8,000
			LIME HANDLING SYSTEM - FREIGHT		1.00 LS	-	50,000	-		75.53 /MH		50,000
			MATERIAL HANDLING EQUIPMENT				**1,558,000**		**9,917**		**749,049**	**2,307,049**
		33.41.00	**MOBILE YARD EQUIPMENT**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		33.41.00	**MOBILE YARD EQUIPMENT**									
			MOBILE YARD EQUIPMENT - TRACKMOBILE	REAGENT HANDLING SYSTEM	1.00 EA	-	225,000	-		75.53 /MH		225,000
			MOBILE YARD EQUIPMENT				**225,000**					**225,000**
		33.51.00	**RAIL CAR UNLOADER**									
			RAIL CAR UNLOADER -	IN UNLOADING SHED 200'X75' WIDE	2.00 LT	-	270,000	-	3,724	98.30 /MH	366,083	636,083
			RAIL CAR UNLOADER				**270,000**		**3,724**		**366,083**	**636,083**
			MATERIAL HANDLING EQUIPMENT				**2,053,000**		**13,641**		**1,115,132**	**3,168,132**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	2-2000 TON LIME STORAGE SILOS	3,600.00 SF	-	-	39,600	41	73.32 /MH	3,034	42,634
			HVAC, MISCELLANEOUS					**39,600**	**41**		**3,034**	**42,634**
			HVAC					**39,600**	**41**		**3,034**	**42,634**
	35.00.00		**PIPING**									
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			8 IN DIA, SCH 40, 8" VACUUM CONVEY PIPING WITH 4 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	500.00 LF	-	38,000		540	93.09 /MH	50,290	88,290
			12 IN DIA, 3/8 IN STD- 2500 LF OF 10"/12" TRANSPORT PRESSURE PIPING W 8 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRANSPORT SYSTEM	2,500.00 LF	-	225,000		3,966	93.09 /MH	369,150	594,150
			CARBON STEEL, STRAIGHT RUN				**263,000**		**4,506**		**419,440**	**682,440**
			PIPING				**263,000**		**4,506**		**419,440**	**682,440**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.37.00	**LIGHTING ACCESSORY (FIXTURE)**									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	2-2000 TON LIME STORAGE SILO	2,500.00 SF	-	-	27,500	29	69.31 /MH	1,992	29,492
			LIGHTING ACCESSORY (FIXTURE)					**27,500**	**29**		**1,992**	**29,492**
			ELECTRICAL EQUIPMENT					**27,500**	**29**		**1,992**	**29,492**
			102 REAGENT HANDLING SYSTEM			**5,830,400**	**2,591,000**	**1,325,175**	**39,706**		**3,315,997**	**13,062,572**
105			**BYPRODUCT HANDLING SYSTEM**									
	21.00.00		**CIVIL WORK**									
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	ASH SILO AND FGD BYPRODUCT SILOS	125.00 EA	-	-	232,125	3,161	115.48 /MH	365,023	597,148
			CAISSON					**232,125**	**3,161**		**365,023**	**597,148**
			CIVIL WORK					**232,125**	**3,161**		**365,023**	**597,148**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FGD BYPRODUCT SILOS	614.00 CY	-	-	141,220	4,940	68.52 /MH	338,505	479,725
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FLY ASH BLENDING SILO	67.00 CY	-	-	15,410	539	68.52 /MH	36,938	52,348
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	FOR TRUCK SCALES	144.00 CY	-	-	33,120	1,159	68.52 /MH	79,389	112,509
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	MISC	100.00 CY	-	-	23,000	805	68.52 /MH	55,131	78,131
			CONCRETE					**212,750**	**7,443**		**509,962**	**722,712**
			CONCRETE					**212,750**	**7,443**		**509,962**	**722,712**
	23.00.00		**STEEL**									
		23.13.75	**SILO**									
			NEW 250 TON FLYASH BLENDING BIN SILO - 24FT DIA X 72 FT HIGH - ERECTION AND FREIGHT INCLUDED	SILO	1.00 EA		275,000		2,839	80.89 /MH	229,653	504,653
			SILO				**275,000**		**2,839**		**229,653**	**504,653**
			STEEL				**275,000**		**2,839**		**229,653**	**504,653**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - 2-2,200 TON FGD BYPRODUCT SILO	SUBCONTRACTED - ERECTED	2.00 LS	6,000,000				68.52 /MH		6,000,000
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CONCRETE SILO			**6,000,000**			**0**			**6,000,000**
			MISCELLANEOUS STRUCTURAL ITEM			**6,000,000**			**0**			**6,000,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.13.00	**BYPRODUCT HANDLING EQUIPMENT**									
			PNEUMATIC ASH CONVEYORS	EQUIPMENT INCLUDES FREIGHT	1.00 LS	-	5,655,000	-		80.89 /MH		5,655,000
			PNEUMATIC ASH CONVEYORS	INSTALLATION COST	1.00 LT	-		-	79,293	80.89 /MH	6,414,019	6,414,019
			BLOWERS, PRESSURE FEEDERS, TRANSPORT PIPING AND VACUUM / PRESSURE RELIEF VALVES	INCLUDED ABOVE	1.00 LT	-		-		80.89 /MH		
			-FOUR PIN MIXERS BELOW CONCRETE SILOS INCL ALL VALVES AND ACCESSORIES		1.00 LT	-	540,000	-	3,347	80.89 /MH	270,749	810,749
			-DRY UNLOADING SPOUT BELOW THE PRODUCT SILO		2.00 EA	-	60,000	-	258	80.89 /MH	20,883	80,883
			AIRSLIDE CONVEYORS FROM BLENDING BIN MIXER/PIPE CONVEYOR, INCL ALL VALVES AND ACCESSORIES		4.00 EA	-	80,000	-	688	80.89 /MH	55,675	135,675
			BYPRODUCT HANDLING EQUIPMENT				**6,335,000**		**83,587**		**6,761,325**	**13,096,325**
		33.57.00	**SCALE**									
			SCALE - NEW TRUCK SCALES	BYPRODUCT HANDLING SYSTEM	2.00 EA	-	200,000	-	460	75.53 /MH	34,726	234,726
			SCALE				**200,000**		**460**		**34,726**	**234,726**
			MATERIAL HANDLING EQUIPMENT				**6,535,000**		**84,046**		**6,796,052**	**13,331,052**
	34.00.00		**HVAC**									
		34.37.00	**DUST COLLECTOR**									
			DUST COLLECTOR - INSTALLED COST		1.00 LS	120,000	-			73.32 /MH		120,000
			DUST COLLECTOR			**120,000**						**120,000**
			HVAC			**120,000**						**120,000**
	35.00.00		**PIPING**									
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			12 IN DIA, 3/8 IN STD	CONVEYOR PIPING	2,000.00 LF	-	-	198,400	3,172	93.09 /MH	295,320	493,720
			12 IN DIA, 3/8 IN STD	12" TIE IN PIPING TO BYPRODUCT SILO FROM THE EXISTING 50 TPH FLY ASH PRESSURE SYSTEM	1,500.00 LF	-	-	148,800	2,379	93.09 /MH	221,490	370,290
			CARBON STEEL, STRAIGHT RUN					**347,200**	**5,552**		**516,810**	**864,010**
			PIPING					**347,200**	**5,552**		**516,810**	**864,010**
			105 BYPRODUCT HANDLING SYSTEM			**6,120,000**	**6,810,000**	**792,075**	**103,041**		**8,417,500**	**22,139,575**
121			**CIVIL BOP**									
	21.00.00		**CIVIL WORK**									
		21.14.00	**STRIP & STOCKPILE TOPSOIL**									
			STRIP & STOCKPILE TOPSOIL - 12"		300,000.00 SF	-	-		690	185.95 /MH	128,241	128,241
			STRIP & STOCKPILE TOPSOIL - ONSITE		40,000.00 CY	-	-		5,287	185.95 /MH	983,184	983,184
			STRIP & STOCKPILE TOPSOIL - 12"	SITE GRADING	600,000.00 SF	-	-		1,379	185.95 /MH	256,483	256,483
			STRIP & STOCKPILE TOPSOIL - ONSITE	SITE GRADING	160,000.00 CY	-	-		21,149	185.95 /MH	3,932,736	3,932,736
			STRIP & STOCKPILE TOPSOIL						**28,506**		**5,300,644**	**5,300,644**
		21.17.00	**EXCAVATION**									
			EXCAVATION - EXCAVATION , BACKFILL & COMPACT	ALL FOUNDATIONS	12,600.00 CY	-	-		4,345	84.40 /MH	366,703	366,703
			EXCAVATION						**4,345**		**366,703**	**366,703**
		21.39.00	**STORM DRAINAGE UTILITIES**									
			STORM SEWER WORK	SITE GRADING	1.00 LT	-	-	110,000	2,299	86.33 /MH	198,460	308,460
			STORM DRAINAGE UTILITIES					**110,000**	**2,299**		**198,460**	**308,460**
		21.41.00	**EROSION AND SEDIMENTATION CONTROL**									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK		33,334.00 SY	-	-	355,007	1,149	103.37 /MH	118,818	473,826
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	SITE GRADING	66,667.00 SY	-	-	710,004	2,299	103.37 /MH	237,633	947,637
			EROSION AND SEDIMENTATION CONTROL					**1,065,011**	**3,448**		**356,452**	**1,421,462**
		21.57.00	**ROAD, PARKING AREA, & SURFACED AREA**									
			ONSITE ROAD UPGRADES	ALLOWANCE	1.00 LS	-	-	700,000	3,483	86.08 /MH	299,796	999,796
			ROAD, PARKING AREA, & SURFACED AREA					**700,000**	**3,483**		**299,796**	**999,796**
		21.99.00	**CIVIL WORK, MISCELLANEOUS**									
			CIVIL WORK - CONSTRUCTION LAYDOWN AREAS	FENCING, POWER ETC...	10.00 AC	-	-	842,400	9,195	84.40 /MH	776,092	1,618,492

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CIVIL WORK, MISCELLANEOUS					**842,400**	**9,195**		**776,092**	**1,618,492**
			CIVIL WORK					**2,717,411**	**51,276**		**7,298,147**	**10,015,557**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	555.00 CY	-	-	127,650	4,466	68.52 /MH	305,977	433,627
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	68.52 /MH	3,308	4,688
			CONCRETE					**129,030**	**4,514**		**309,285**	**438,315**
			CONCRETE					**129,030**	**4,514**		**309,285**	**438,315**
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL ONLY, STEEL UNINSULATED 22 GA, 200 FT X 75 FT x 15' TALL	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	420,000	5,862	98.30 /MH	576,241	996,241
			PRE-ENGINEERED BUILDING	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	98.30 /MH	11,299	21,299
			PRE-ENGINEERED BUILDING					**430,000**	**5,977**		**587,540**	**1,017,540**
		24.41.00	**SIDING**									
			INSULATION, 2 IN THICK FIBERGLASS,	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	8,250.00 SF	-	-	9,900	95	87.92 /MH	8,337	18,237
			SIDING					**9,900**	**95**		**8,337**	**18,237**
			ARCHITECTURAL					**439,900**	**6,072**		**595,877**	**1,035,777**
	27.00.00		**PAINTING & COATING**									
		27.17.00	**PAINTING**									
			PAINTING - ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	15,000	172	64.47 /MH	11,116	26,116
			PAINTING					**15,000**	**172**		**11,116**	**26,116**
			PAINTING & COATING					**15,000**	**172**		**11,116**	**26,116**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.41.00	**FIRE PROTECTION EQUIPMENT & SYSTEM**									
			FIRE PROTECTION EQUIPMENT & SYSTEM	NEW WAREHOUSE BUILDING 200'X75'X15' TALL, FIRE PROTECTION ALLOWANCE	15,000.00 SF	-	-	82,500	1,155	75.53 /MH	87,250	169,750
			FIRE PROTECTION EQUIPMENT & SYSTEM					**82,500**	**1,155**		**87,250**	**169,750**
			MECHANICAL EQUIPMENT					**82,500**	**1,155**		**87,250**	**169,750**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	165,000	172	73.32 /MH	12,641	177,641
			HVAC, MISCELLANEOUS					**165,000**	**172**		**12,641**	**177,641**
			HVAC					**165,000**	**172**		**12,641**	**177,641**
	36.00.00		**INSULATION**									
		36.99.00	**INSULATION, MISCELLANEOUS**									
			INSULATION - ROOF INSULATION	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	18,000	172	58.15 /MH	10,026	28,026
			INSULATION, MISCELLANEOUS					**18,000**	**172**		**10,026**	**28,026**
			INSULATION					**18,000**	**172**		**10,026**	**28,026**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.37.00	**LIGHTING ACCESSORY (FIXTURE)**									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL, LIGHTING ALLOWANCE	15,000.00 SF	-	-	165,000	172	69.31 /MH	11,950	176,950
			LIGHTING ACCESSORY (FIXTURE)					**165,000**	**172**		**11,950**	**176,950**
			ELECTRICAL EQUIPMENT					**165,000**	**172**		**11,950**	**176,950**
	71.00.00		**PROJECT INDIRECT**									
		71.25.00	**CONSULTANT, THIRD PARTY**									
			CONSULTANT - SUBSURFACE INVESTIGATION		1.00 LS	200,000	-			/MH		200,000
			CONSULTANT - GEOTECHNICAL		1.00 LS	150,000	-			/MH		150,000

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CONSULTANT, THIRD PARTY			350,000						350,000
			PROJECT INDIRECT			350,000						350,000
			121 CIVIL BOP			350,000		3,731,841	63,706		8,336,292	12,418,133
151			MECHANICAL BOP									
	21.00.00		CIVIL WORK									
		21.54.00	CAISSON									
			2.5 FT DIA X 30 FT DEEP CAISSON	TANK FOUNDATIONS	76.00 EA	-	-	141,132	1,922	115.48 /MH	221,934	363,066
			2.5 FT DIA X 30 FT DEEP CAISSON	COMMON PIPE RACK FOUNDATIONS	223.00 EA	-	-	414,111	5,639	115.48 /MH	651,201	1,065,312
			2.5 FT DIA X 30 FT DEEP CAISSON	BYPRODUCT PIPE RACK FOUNDATIONS	57.00 EA	-	-	105,849	1,441	115.48 /MH	166,450	272,299
			2.5 FT DIA X 30 FT DEEP CAISSON	REAGENT UNLOADING PIPE RACK FOUNDATIONS	32.00 EA	-	-	59,424	809	115.48 /MH	93,446	152,870
			CAISSON					720,516	9,811		1,133,031	1,853,547
			CIVIL WORK					720,516	9,811		1,133,031	1,853,547
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			SPREAD FOOTING FOUNDATION, 4500 PSI - COMPOSITE RATE	3X 35' DIA TANK FDN	81.00 CY	-	-	18,630	652	68.52 /MH	44,656	63,286
			CONCRETE FOUNDATIONS - COMPOSITE RATE	COMMON PIPE RACK FOUNDATIONS	250.00 CY	-	-	57,500	2,011	68.52 /MH	137,828	195,328
			CONCRETE FOUNDATIONS - COMPOSITE RATE	BYPRODUCT PIPE RACK FOUNDATIONS	65.00 CY	-	-	14,950	523	68.52 /MH	35,835	50,785
			CONCRETE FOUNDATIONS - COMPOSITE RATE	REAGENT UNLOADING PIPE RACK FOUNDATIONS	36.00 CY	-	-	8,280	290	68.52 /MH	19,847	28,127
			CONCRETE					99,360	3,476		238,166	337,526
			CONCRETE					99,360	3,476		238,166	337,526
	23.00.00		STEEL									
		23.21.00	GIRDER									
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	COMMON 750'LX20'W, 550'Lx15'W, ALL 20' HIGH	235.00 TN	-	-	636,850	4,592	98.30 /MH	451,389	1,088,239
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	BYPRODUCT PIPE RACK, 200'LX12'W X 20' HIGH	24.00 TN	-	-	65,040	469	98.30 /MH	46,099	111,139
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	REAGENT UNLOADING PIPE RACK, 200'LX6' WIDE X 20' HIGH	12.00 TN	-	-	32,520	234	98.30 /MH	23,050	55,570
			GIRDER					734,410	5,295		520,538	1,254,948
			STEEL					734,410	5,295		520,538	1,254,948
	31.00.00		MECHANICAL EQUIPMENT									
		31.17.00	COMPRESSOR & ACCESSORIES									
			AIR COMPRESSOR, CENTRIFUGAL - 250 SCFM EA @ 200 PSIG	SERVICE AIR	2.00 EA	-	310,000	-	92	75.53 /MH	6,945	316,945
			AIR COMPRESSOR, CENTRIFUGAL - 250 SCFM EA @ 200 PSIG	INSTRUMENT AIR	2.00 EA	-	310,000	-	92	75.53 /MH	6,945	316,945
			AIR DRYER - W/FILTERS, 250 NET SCFM EA	SERVICE AIR	2.00 EA	-	33,400	-	74	75.53 /MH	5,556	38,956
			AIR DRYER - W/FILTERS, 250 NET SCFM EA	INSTRUMENT AIR	2.00 EA	-	33,400	-	74	75.53 /MH	5,556	38,956
			AIR RECEIVER - 1,000 GALLON EA	SERVICE AIR	2.00 EA	-	11,200	-	37	75.53 /MH	2,778	13,978
			AIR RECEIVER - 1,000 GALLON EA	INSTRUMENT AIR	2.00 EA	-	11,200	-	37	75.53 /MH	2,778	13,978
			COMPRESSOR & ACCESSORIES				709,200		405		30,559	739,759
		31.41.00	FIRE PROTECTION EQUIPMENT & SYSTEM									
			DELUGE - POWER TRANSFORMERS		3.00 EA	-	-	127,500	1,959	93.09 /MH	182,328	309,828
			FIRE PROTECTION EQUIPMENT & SYSTEM					127,500	1,959		182,328	309,828
		31.65.00	HEAT EXCHANGER									
			HEAT EXCHANGER - SLAKER WATER HEATER 3" IN-LINE, 475 KW		4.00 EA	-	220,000	-	368	69.31 /MH	25,493	245,493
			HEAT EXCHANGER				220,000		368		25,493	245,493
		31.75.00	PUMP									
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - MAKEUP WATER PUMPS, 2600 GPM, 200 TDH		2.00 EA	-	96,000	-	577	75.53 /MH	43,582	139,582
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - RECYCLE ASH WATER PUMP, 50 HP		3.00 EA	-	72,000	-	221	75.53 /MH	16,669	88,669
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - LIME SLAKING WATER PIUMPS, 50 HP		2.00 EA	-	48,000	-	147	75.53 /MH	11,112	59,112
			SUMP, CENTRIFUGAL, WET BEARING - REGENT PREP/RECYCLE SUMP, 120GPM, 150 TDH		4.00 EA	-	220,000	-	276	75.53 /MH	20,836	240,836
			SUMP, CENTRIFUGAL, WET BEARING - LIME SILO & UNLOADING AREA SUMP 120 GPM @ 150 TDH		2.00 EA	-	88,000	-	138	75.53 /MH	10,418	98,418

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.75.00	**PUMP**									
			SUMP, CENTRIFUGAL, WET BEARING - WASTE ASH SILO AREA SUMP 120GPM @150 TDH		2.00 EA	-	88,000	-	138	75.53 /MH	10,418	98,418
			SUMP, CENTRIFUGAL, WET BEARING - WASTEWATER FORWARDING PUMP TO RECYCLED SLURRY, 100 GPM@150 TDH		4.00 EA	-	28,800	-	294	75.53 /MH	22,225	51,025
			SUMP, SUBMERSIBLE - RECYCLE ASH WATER TANK SUPPLY PUMP, 100 HP		2.00 EA	-	77,000	-	690	75.53 /MH	52,090	129,090
			PUMP				**717,800**		**2,480**		**187,349**	**905,149**
		31.83.00	**TANK**									
			ATMOSPHERIC, FIELD FABRICATED - LIME SLAKING WATER TANK, 175,000 GALLON	35' DIA X 24' HIGH	1.00 EA	220,000		-		94.32 /MH		220,000
			ATMOSPHERIC, FIELD FABRICATED - RECYCLE ASH WATER TANK, 200,000 GALLON	35' DIA X 30' HIGH	2.00 EA	500,000		-		94.32 /MH		500,000
			TANK			**720,000**						**720,000**
			MECHANICAL EQUIPMENT			**720,000**	**1,647,000**	**127,500**	**5,211**		**425,730**	**2,920,230**
	35.00.00		**PIPING**									
		35.13.01	**SS 304, ABOVE GROUND, PROCESS AREA**									
			1 IN DIA, SCH 40S		1,520.00 LF	-	-	32,832	1,974	93.09 /MH	183,783	216,615
			1.5 IN DIA, SCH 40S		1,380.00 LF	-	-	52,302	2,094	93.09 /MH	194,911	247,213
			2 IN DIA, SCH 40S		2,070.00 LF	-	-	113,022	3,426	93.09 /MH	318,946	431,968
			SS 304, ABOVE GROUND, PROCESS AREA					**198,156**	**7,494**		**697,640**	**895,796**
		35.13.10	**CARBON STEEL, ABOVE GROUND, PROCESS AREA**									
			1 IN DIA, SCH 80		260.00 LF	-	-	2,314	305	93.09 /MH	28,376	30,690
			2 IN DIA, SCH 80		2,260.00 LF	-	-	48,138	3,273	93.09 /MH	304,693	352,831
			2.5 IN DIA, SCH 40		1,000.00 LF	-	-	15,400	1,437	93.09 /MH	133,750	149,150
			3 IN DIA, SCH 40		7,160.00 LF	-	-	125,300	11,028	93.09 /MH	1,026,601	1,151,901
			3 IN DIA, SCH 80		1,760.00 LF	-	-	38,720	3,055	93.09 /MH	284,363	323,083
			4 IN DIA, SCH 40		1,000.00 LF	-	-	22,600	1,701	93.09 /MH	158,360	180,960
			6 IN DIA, SCH 40		880.00 LF	-	-	28,248	1,629	93.09 /MH	151,598	179,846
			6 IN DIA, SCH 40 VACUUM PIPE		2,260.00 LF	-	-	72,546	4,182	93.09 /MH	389,330	461,876
			8 IN DIA, SCH 80		3,520.00 LF	-	-	256,608	9,832	93.09 /MH	915,235	1,171,843
			CARBON STEEL, ABOVE GROUND, PROCESS AREA					**609,874**	**36,441**		**3,392,307**	**4,002,181**
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			6 IN DIA, SCH 40, LIME SLAKING TANK MAKEUP	LIME SLAKING TANK MAKEUP	1,200.00 LF	-	-	27,480	1,214	93.09 /MH	112,992	140,472
			8 IN DIA, SCH 40, LIME SLAKING TANK MAKEUP	LIME SLAKING TANK MAKEUP	450.00 LF	-	-	13,905	486	93.09 /MH	45,261	59,166
			8 IN DIA, SCH 40, RECYCLE ASH WATER PIPING	RECYCLE ASH WATER PIPING	2,000.00 LF	-	-	61,800	2,161	93.09 /MH	201,160	262,960
			10 IN DIA, SCH 40, RECYCLE ASH TANK MAKEUP	RECYCLE ASH TANK MAKEUP	450.00 LF	-	-	24,660	610	93.09 /MH	56,817	81,477
			CARBON STEEL, STRAIGHT RUN					**127,845**	**4,471**		**416,230**	**544,075**
		35.15.10	**CARBON STEEL, BURIED**									
			3 IN DIA, SCH 40, WRAPPED		3,000.00 LF	-	-	51,000	2,241	93.09 /MH	208,650	259,650
			6 IN DIA, SCH 40, WRAPPED		750.00 LF	-	-	23,925	776	93.09 /MH	72,225	96,150
			10 IN DIA, SCH 40, WRAPPED, RECYCLE ASH WATER PIPE DISCHARGE BURIED	RECYCLE ASH WATER PIPE DISCHARGE BURIED	1,800.00 LF	-	-	119,700	2,441	93.09 /MH	227,268	346,968
			CARBON STEEL, BURIED					**194,625**	**5,459**		**508,143**	**702,768**
		35.15.25	**FRP, BURIED**									
			3 IN DIA, TAPER		1,000.00 LF	-	-	14,800	460	93.09 /MH	42,800	57,600
			3 IN DIA, TAPER FRP/HDPE PIPE		2,380.00 LF	-	-	35,224	1,094	93.09 /MH	101,864	137,088
			FRP, BURIED					**50,024**	**1,554**		**144,664**	**194,688**
		35.15.30	**HDPE, BURIED**									
			6 IN DIA, DR 9		1,430.00 LF	-	-	12,870	1,134	93.09 /MH	105,577	118,447
			8 IN DIA, DR 9		1,340.00 LF	-	-	20,770	1,278	93.09 /MH	119,005	139,775
			HDPE, BURIED					**33,640**	**2,413**		**224,582**	**258,222**
		35.36.00	**PIPE SUPPORTS, RACK**									
			SUPPORT SLEEPERS	BYPRODUCT PIPE, 1750LF	125.00 EA	-	-	43,750	575	93.09 /MH	53,500	97,250
			SUPPORT SLEEPERS	REAGENT UNLOADING PIPE, 1500LF	108.00 EA	-	-	37,800	497	93.09 /MH	46,224	84,024
			PIPE SUPPORTS, RACK					**81,550**	**1,071**		**99,724**	**181,274**
		35.45.00	**VALVES**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		35.45.00	**VALVES**									
			VALVE - 36" 150 LB CS BUTTERFLY, FLANGED		2.00 EA	-	-	79,920	96	93.09 /MH	8,902	88,822
			VALVE - 12" 150 LB CS KNIFE GATE, FLANGED		6.00 EA	-	-	20,160	195	93.09 /MH	18,169	38,329
			VALVE - 12" 150 LB CS GATE VALVE, FLANGED		2.00 EA	-	-	8,920	65	93.09 /MH	6,056	14,976
			VALVE - 10" 150 LB CS SWING CHECK, FLANGED		2.00 EA	-	-	9,200	55	93.09 /MH	5,136	14,336
			VALVE - 10" 150 LB CS BUTTERFLY, FLANGED		5.00 EA	-	-	22,200	138	93.09 /MH	12,840	35,040
			VALVE - 8" 150 LB CS GATE, FLANGED		20.00 EA	-	-	100,000	425	93.09 /MH	39,590	139,590
			VALVE - 6" 150 LB CS GATE, FLANGED		6.00 EA	-	-	19,800	110	93.09 /MH	10,272	30,072
			VALVE - 6" 150 LB CS AIR OPERATED GATE, FLANGED		4.00 EA	-	-	20,400	74	93.09 /MH	6,848	27,248
			VALVE - 6" 150 LB CS AIR OPERATED GLOBE, FLANGED		4.00 EA	-	-	20,400	74	93.09 /MH	6,848	27,248
			VALVE - 6" 150 LB CS SWING CHECK, FLANGED		2.00 EA	-	-	3,400	37	93.09 /MH	3,424	6,824
			VALVE - 4" 150 LB CS GATE, FLANGED		3.00 EA	-	-	3,825	25	93.09 /MH	2,311	6,136
			VALVE - 3" AND BELOW CS FOR SERVICE WATER ISOLATION		120.00 EA	-	-	1,224,000	1,076	93.09 /MH	100,152	1,324,152
			VALVE - 3" AND BELOW CS FOR SERVICE AIR ISOLATION		120.00 EA	-	-	1,224,000	1,076	93.09 /MH	100,152	1,324,152
			VALVE - 3" 150 LB CS GATE, FLANGED		20.00 EA	-	-	15,000	179	93.09 /MH	16,692	31,692
			VALVE - 3" CS PST IND FOR FP 250 LB		6.00 EA	-	-	6,600	54	93.09 /MH	5,008	11,608
			VALVE - 2" AND ABOVE BRONZE VALVES FOR INSTRUMENT AIR ISOLATION		600.00 EA	-	-	78,000	501	93.09 /MH	46,673	124,673
			VALVE - 1" CS FLANGED		4.00 EA	-	-	880	21	93.09 /MH	1,969	2,849
			VALVE - 6" CI POST INDICATOR 250 LB., MECHANICAL JOINT WITH BOXES BURIED VALVE		6.00 EA	-	-	4,080	28	93.09 /MH	2,568	6,648
			VALVES					**2,860,785**	**4,228**		**393,610**	**3,254,395**
			PIPING					**4,156,499**	**63,131**		**5,876,900**	**10,033,399**
	36.00.00		**INSULATION**									
		36.17.01	**PIPE, CALCIUM SILICATE W/ALUMINUM JACKETING**									
			CALCIUM SILICATE W/ALUMINUM JACKETING - 8" PIPE 1.5" THICK		2,520.00 LF	-	-	16,380	487	73.69 /MH	35,859	52,239
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 3" PIPE		1,260.00 LF	-	-	3,591	155	73.69 /MH	11,419	15,010
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 3" PIPE		5,660.00 LF	-	-	16,131	696	73.69 /MH	51,297	67,428
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 2.5" PIPE		380.00 LS	-	-	1,083	47	73.69 /MH	3,444	4,527
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 2.0" PIPE		4,140.00 LS	-	-	10,309	476	73.69 /MH	35,066	45,375
			PIPE, CALCIUM SILICATE W/ALUMINUM JACKETING					**47,494**	**1,860**		**137,085**	**184,579**
			INSULATION					**47,494**	**1,860**		**137,085**	**184,579**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.33.00	**HEAT TRACING**									
			HEAT TRACING - 8" PIPE		2,520.00 LS	-	-	18,749	43	69.31 /MH	3,011	21,760
			HEAT TRACING - 3" PIPE		1,260.00 LF	-	-	9,374	22	69.31 /MH	1,506	10,880
			HEAT TRACING - 3" PIPE		5,660.00 LF	-	-	42,110	98	69.31 /MH	6,764	48,874
			HEAT TRACING - 2.5" PIPE		380.00 LS	-	-	2,827	7	69.31 /MH	454	3,281
			HEAT TRACING - 2.0" PIPE		440.00 LS	-	-	3,274	8	69.31 /MH	526	3,799
			HEAT TRACING					**76,334**	**177**		**12,261**	**88,595**
			ELECTRICAL EQUIPMENT					**76,334**	**177**		**12,261**	**88,595**
			151 MECHANICAL BOP			**720,000**	**1,647,000**	**5,962,113**	**88,963**		**8,343,711**	**16,672,824**
190			**DEMOLITION / RELOCATION**									
	11.00.00		**DEMOLITION**									
		11.99.00	**DEMOLITION, MISCELLANEOUS**									
			DEMOLITION - MISC	ALLOWANCE	1.00 LT	-	-	1,800,000	33,333	98.30 /MH	3,276,667	5,076,667
			DEMOLITION, MISCELLANEOUS					**1,800,000**	**33,333**		**3,276,667**	**5,076,667**
			DEMOLITION					**1,800,000**	**33,333**		**3,276,667**	**5,076,667**
			190 DEMOLITION / RELOCATION					**1,800,000**	**33,333**		**3,276,667**	**5,076,667**
201			**ELECTRICAL BOP SYSTEM**									
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.99.00	**ELECTRICAL EQUIPMENT, MISCELLANEOUS**									
			ELECTRICAL EQUIPMENT AND MISCELLANEOUS COMPONENTS	ALLOWANCE	1.00 LT	-	12,300,000	1,600,000	88,322	69.31 /MH	6,121,587	20,021,587
			ELECTRICAL COMMODITIES - CABLE	ALLOWANCE	1.00 LT	-		8,500,000	88,391	84.60 /MH	7,477,862	15,977,862
			ELECTRICAL COMMODITIES - CONDUITS, RACEWAY, ETC.	ALLOWANCE	1.00 LT	-		1,400,000	107,471	84.60 /MH	9,092,069	10,492,069
			ELECTRICAL EQUIPMENT, MISCELLANEOUS				**12,300,000**	**11,500,000**	**284,184**		**22,691,518**	**46,491,518**
			ELECTRICAL EQUIPMENT				**12,300,000**	**11,500,000**	**284,184**		**22,691,518**	**46,491,518**

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			201 ELECTRICAL BOP SYSTEM				**12,300,000**	**11,500,000**	**284,184**		**22,691,518**	**46,491,518**
211			**INSTRUMENTATION AND CONTROLS BOP SYSTEM**									
	44.00.00		**CONTROL & INSTRUMENTATION**									
		44.99.00	**CONTROL & INSTRUMENTATION, MISCELLANEOUS**									
			CONTROL & INSTRUMENTATION - MISC	ALLOWANCE	1.00 LT	-	1,500,000	1,085,000	10,920	72.29 /MH	789,374	3,374,374
			CONTROL & INSTRUMENTATION, MISCELLANEOUS				**1,500,000**	**1,085,000**	**10,920**		**789,374**	**3,374,374**
			CONTROL & INSTRUMENTATION				**1,500,000**	**1,085,000**	**10,920**		**789,374**	**3,374,374**
			211 INSTRUMENTATION AND CONTROLS BOP SYSTEM				**1,500,000**	**1,085,000**	**10,920**		**789,374**	**3,374,374**

ENTERGY ARKANSAS, INC.

WHITE BLUFF

DSI COST ESTIMATE BASIS DOCUMENT

SL-014000
Final, Rev. 0
August 3, 2017
Project 13027-002

Prepared by

Sargent & Lundy LLC

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CONTENTS

1. PURPOSE

Entergy has requested that Sargent & Lundy (S&L) evaluate installation of a new dry sorbent injection (DSI) system on the units at White Bluff to control sulfur dioxide (SO_2) emissions. The purpose of this document is to define the project scope and identify the assumptions that were used as the basis for the operating and maintenance (O&M) and the capital cost estimates.

2. TECHNOLOGY DESCRIPTION

DSI is a proven technology, which has only recently been implemented, for moderate removal of SO_2 and other acid gases from coal-fired power plants. It involves injection of sodium-based sorbents into the ductwork after the boiler and prior to the particulate collection device. DSI is a relatively low capital cost, moderate SO_2 removal alternative to wet or dry FGD systems. No slurry equipment or separate reactor vessel is required with a DSI system. With the proper temperature profile and stoichiometry, the sorbent can effectively react with $SO_2$and other acid gases in the flue gas. The resulting particulate matter is removed from the flue gas by a particulate collection device, typically an existing electrostatic precipitator (ESP).

The typical DSI sorbents include sodium bicarbonate ($NaHCO_3$) and Trona ($Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$). Sorbent injection into the ductwork (downstream of the boiler and upstream of the ESP) has been tested in the industry using sodium-based sorbents. The process works through neutralization of SO_2 and other acid gases with the caustic sorbent; the neutralization occurs as long as the sorbent remains in contact with the gas. Sorbent injection has been proven effective on a variety of pulverized coal-fired boilers using a range of low to high sulfur coals. It is considered a commercial technology although with a limited supplier base due to the historically limited interest.

The DSI process produces a dry byproduct which can be landfilled. The waste products will contain sodium sulfate and sulfite ($NaSO_3$/$NaSO_4$) along with the unused sorbent and the normal fly ash. These wastes will be collected in the ESP and can be transported with conventional pneumatic fly ash handling equipment. The waste from sodium-based sorbents will have relatively high concentrations of soluble salts, which may affect the byproduct handling. With the addition of dry sorbent byproducts fly ash cannot be sold for reuse.

3. APPROACH

The project capital and O&M cost estimates are based on project-specific information, including:

- An engineer-procure-construct (EPC) contracting strategy with the DSI technology supplier providing the main process equipment, including reagent storage, milling, conveyance, and injection lances.
- Reagent injection at the air preheater (APH) outlet, upstream of the existing ESP. The cost to rebuild/upgrade the ESP was included to ensure there is no increase in PM emissions as a significant quantity of reagent will be added upstream of the existing ESP.
- On-site disposal of DSI byproduct using upgraded ESP ash handling equipment. The byproduct will be collected in the existing ESP in conjunction with the fly ash from the units; no additional blending equipment is required.
- Reagent injection rates based on 50% SO_2 removal from a design inlet concentration of 0.76 lb SO_2/MMBtu, based on the highest 5% of SO_2 emissions from 2009 through 2013.
    - Annual operating costs will be based on 50% SO_2 removal from an uncontrolled SO_2 rate of 0.57 lb SO_2/MMBtu, based on the annual heat input weighted average emission from 2009 through 2013.
    - The system will be designed to control emissions to meet a permit limit of 0.35 lb/MMBtu on a 30-boiler day rolling average, based on a maximum 30-day average SO_2 emission rate of 0.66 lb/MMBtu from 2014 through 2016.
- Trona was used as the DSI reagent for the purposes of this estimate.
- Increase in carbon consumption by 1 lb/mmacf to mitigate any impacts on mercury performance associated with ACI/DSI interference and mitigate potential for a brown plume.
- A high level conceptual system design, based on the estimated injection rate, was used as input to the DSI cost estimate. The following were estimated based on previous projects and scaled for the predicted dry sorbent injection rate for White Bluff:
    - Auxiliary power consumption
    - Annual reagent consumption
    - Additional carbon consumption
    - Additional water consumption
    - Additional waste production
    - Reagent storage silos
    - Quantity of mills
    - Quantity of blower trains

The total plant capital cost estimate includes the following:

- Equipment and material
- Installation labor
- Indirect field costs
- Freight
- General and Administration
- Erection contractor profit
- Engineering, Procurement and Project Services
- Spare parts/initial fills (other than reagent)
- EPC Fee

As part of this project, S&L estimated the costs for Owner's services and costs outside of the EPC contract including the following:

- Owner's Costs
- Owner's Engineer
- Construction Management Support
- Startup and Commissioning Support
- Performance Testing
- Contingency
- Escalation
- Interest During Construction

Cost Estimate 34018A provided in Attachment 1 represents the total cost to Entergy to install DSI technology on a single unit at White Bluff (Unit 1 or 2) including the EPC Contract price and all additional Owner's costs and third party services.

The total unit O&M cost estimate includes the following:

- Waste disposal (DSI waste + increased carbon + unsold fly ash)
- Loss of revenue from fly ash sales
- Reagent consumption (including increased carbon consumption)
- Auxiliary power consumption
- Low quality water consumption for mill cleaning
- Operating labor
- Maintenance material
- Maintenance labor

The O&M Cost Estimate and Capital Cost Estimate 34018A were developed using the assumptions and scope provided in this document. The project definition and accuracy corresponds to a study level estimate as defined in U.S.EPA's Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual. The costs provided in this report are in 2016 dollars.

4. CAPITAL AND O&M COST ESTIMATE TECHNICAL BASIS

4.1 DESIGN INPUTS AND ASSUMPTIONS

The following assumptions were made for the design basis for the White Bluff DSI Systems:

- Design SO_2 inlet concentration of 0.76 lb SO_2/MMBtu.
- SO_2 inlet concentration of 0.57 lb SO_2/MMBtu for annual operating costs.
- Design SO_2 removal efficiency of 50% (defined by injection rate, described in Section 4.1.1)
- Annual capacity factor of 71.2% (annual average capacity factor for White Bluff Units 1 and 2 based on historical heat input from 2009 through 2013).
- Reagent injection at the APH outlet, upstream of the existing ESP.
- Reagent delivery by rail.
- Existing activated carbon silo storage time will be reduced, rather than adding additional or larger storage silos to the system.
- Compliance deadline of three years from the effective date of the rule.

Before proceeding with a DSI project, a demonstration test should be completed at White Bluff to confirm the feasibility of DSI technology at White Bluff and quantify the potential BOP impacts associated with the project, such as impacts to the ESP performance, interference with mercury control technologies, and leachability of the byproduct.

4.1.1 ESP/Ash Handling Modifications

The DSI system, as defined in this report would require an estimated Trona injection rate of approximately 22,000 lb/hour to achieve 50% reduction at the design SO_2 inlet concentration. This injection rate would result in an increase in the particulate loading to the ESP of almost 40% from the current ash loading, due to the DSI byproducts and unreacted DSI reagent.

The addition of sodium compounds to the fly ash lowers the overall resistivity of the particulate being captured as well as shifting the particle size distribution. These changes have been shown to improve the removal efficiency of an ESP; in some cases this increase has been shown to offset the increased particulate loading to the ESP.

ESP performance can also be negatively impacted by a significant increase in particulate loading associated with the high reagent injection rates required for SO_2 control. It is uncertain whether modifications to the ESPs and ash handling systems would be required to accommodate the addition of DSI at White Bluff. However, at the very high injection rates expected for this project, an ESP rebuild will likely be required to ensure the PM emissions stay below the PSD threshold. Therefore, the capital cost estimate includes the costs to completely rebuild the existing ESPs and ash handling systems at White Bluff.

The size and condition of the existing ESP can play a critical role in the overall performance of DSI. In order to evaluate the existing White Bluff ESP with respect to future operation with DSI, S&L used the EPA program ESPVI 4.0W Performance Prediction Model (ESPVI 4.0W) to simulate the baseline and future operating scenarios, as described below. In addition, S&L contacted an ESP vendor to provide input relating to installation of DSI upstream of the existing ESPs at White Bluff.

The baseline operation was established using various design inputs for the units (as needed by the ESPVI 4.0W model), recent operating data and stack emissions to estimate the efficiency at which the ESP is currently operating. ESPVI 4.0W showed that at the baseline operating conditions the White Bluff ESP operates at approximately 99.7% removal of the total inlet loading, corresponding to a filterable PM emission limit of 0.0155 lb/MMBtu.

ESPs operate at a constant efficiency assuming the operating conditions (such as temperature, ash resistivity, or flue gas velocity) stay the same. DSI can impact some of the operating conditions, specifically ash resistivity and particle size distribution. The addition of DSI thus could result in a higher efficiency than the same ESP, without DSI, could achieve.

The ESPVI 4.0W model was developed prior to the introduction of DSI technology and has not been updated to account for the impacts of adding sorbents upstream of the ESP. However, the model was used to predict the high level impact and/or limitations of installing DSI technology by modifying some of the inputs to simulate the characteristics of a fly ash/sodium sorbent mixture.

Based on the modified ash resistivity and adjusted particle sizes associated with the addition of DSI, the baseline ESPVI 4.0W model was used to estimate the predicted removal efficiency for the White Bluff ESP with DSI, as defined in this report, and assuming all other operating conditions remained the same. ESPVI 4.0W showed an overall removal efficiency which was very similar to the current ESP removal efficiency and resulted in an increase in particulate emissions with the additional loading from the DSI system.

Based on the results from ESPVI 4.0W, the White Bluff ESP may be operating at a marginally higher reduction efficiency with the installation of DSI; however, the loading to the ESP is also increasing significantly. Therefore, the modeling showed that even though the ESP efficiency may increase, the overall PM emissions will still be higher than the current level. This evaluation supports the conclusion that improvement of the existing ESP in conjunction with the DSI project is necessary to avoid increasing PM emissions.

In addition to the modeling that was performed using ESPVI 4.0W, S&L also engaged a vendor experienced with ESP retrofits to provide costs and expertise associated with injection of DSI on an existing ESP. As part of their budgetary quote, the supplier indicated that "while the ESPs are large they are still an efficiency machine and overcoming the new total inlet loading of over 73,000 lb/hr[1] will be extremely difficult to achieve the requested 0.015 lbs/MMBtu outlet PM emissions, without retrofitting the entire ESPs to BART technology. Essentially, the ESPs will need to be rebuilt to 'as-new' condition with the most state-of-the-art technology options" (see Attachment 2).

Finally, in addition to the performance of the ESP, the increased loading will also have an impact on the ash handling system. Therefore, for the purposes of this cost estimate, based on the significant increase in loading, modifications to the ash handling equipment were included in the cost estimate.

4.1.2 Landfill Modifications

The sodium byproducts (salts) that are produced when Trona reacts with SO_2 and other acid gases, along with the unreacted sorbent are soluble in water. The resulting waste collected in the particulate collection device will need to be disposed of in a landfill that is lined and has a leachate collection system. With the addition of DSI, White Bluff will no longer be able to sell their fly ash for beneficial re-use due to the solubility of the sodium salts which would be

[1] The 73,000 lb/hr loading reflects the design fly ash loading plus the additional loading from the DSI injection (byproduct/unreacted sorbent).

present in the waste. The cost to maintain a landfill and open new cells is included in the typical maintenance budget of a plant. It was assumed, that any future landfill cells would include lining and leachate collection; therefore, no landfill modifications will be required to accommodate the addition of DSI and no costs were included in this estimate.

4.2 TOTAL INSTALLED CAPITAL INVESTMENT

The DSI system supplier will provide all of the equipment related to storing, milling, conveying and injecting the reagent; in this case, the system is designed for Trona. The remaining BOP scope will be provided by the EPC Contractor. In addition, the EPC Contractor will install/construct the entire system including the equipment provided by the DSI system supplier.

Quantities were developed based on limited project design effort, project experience of a plant of comparable size and then adjusted based on actual size and capacity differences and also taking into consideration the specific site layout based on the general arrangement. In most cases, the costs for bulk materials and equipment were derived from S&L database and recent vendor or manufacturer's quote for similar items on other projects. The scope of work for the capital cost estimate is broken out by the following areas:

4.2.1 DSI Area (Single Unit)

a. Reagent Storage Silos:
- Twelve silos capable of storing approximately 14 days of sorbent per unit, 4,200-tons storage total, including substructure
- 14' diameter and 125' high, each
- 350-tons working storage, each
- Continuous level detection systems
- One bin vent filter per silo
- Live bottom hopper outlets
- Rotary airlock assemblies

b. Reagent conveying systems:
- 4 trains (4 x 50%)
- Pneumatic pressure blowers (1 x100% per train)
- One dehumidifier and chiller per train

c. Reagent Milling
- One 7-tph mill per train
- One set of bypass piping per mill

d. Reagent Injection
- Splitters with piping to two APH outlets
- Six injection lances per injection location

e. Concrete foundations including piles for all reagent silo, blower, and mill areas; the approximate footprint for DSI Area is 165' x 125'

f. Buildings, enclosures, and roofs, including:
- Blower Building, approximately 25' x 100'
- Electrical Building; approximately 15' x 20'
- Mill Building; approximately 40 x 80'
- Dehumidifier Roof; approximately 30' x 125'
- Heat Exchanger Roof; approximately 10' x 80'

g. Geotechnical and subsurface investigation contractor work, including hydro excavation

h. Equipment pricing based on recent vendor pricing for a similar project.

4.2.2 Reagent Handling System

The conceptual design basis for the reagent handling system is to unload two cars at a time. Based on the estimated injection rate and typical railcar capacities, it is anticipated that approximately 20 railcars will be required each week per unit assuming a 100% capacity factor. The reagent handling system includes modification to the existing rail spur on-site to accommodate storage and handling of the reagent railcars. It was assumed that the reagent will be delivered via a 25-car unit train as a maximum. The following equipment and components are included in the cost estimate as part of the reagent handling system:

a. Reagent rail car unloader:
- System consists of mobile receiving pad and associated vacuum pneumatic connection equipment to unload railcar
- Enclosed railcar unloading building; approximately 200' x 75'
- Trackmobile used to haul and queue the rail cars before and after unloading; capable of moving approximately 25 cars at once.

b. Reagent unloading systems:
- Two trains (2 x 100%)
- Pneumatic pressure blowers (1 x 100%) per train
- One conveying air dehumidifier and chiller per train
- Pneumatic conveying piping located on an above-grade sleeper pipe rack
- The equipment pricing included in this estimate is based on recent firm pricing for similar projects. The basis of the conceptual design is a typical UCC arrangement and equipment.

c. Rail track spur extension to north to allow reagent train to be unloaded and cars to be stored on site, designed for 136 lb rail to be consistent with existing coal spurs

4.2.3 ESP/Ash Handling Modifications

a. ESP Rebuild – Based on the budgetary quote provided in Attachment 2.

b. Ash Handling Modifications – Equipment pricing based on recent vendor pricing for a similar project.

4.2.4 Civil Work

a. Site grading

b. Soil removal earthwork

c. Excavation, backfill, and compaction for all foundations

d. Development of a new laydown area, approximately 2 acres, including site preparation, fencing, and temporary power. It was assumed that this area would be located on existing plant property, and does not require land to be purchased.

4.2.5 Mechanical Work

a. Allowance of $975,000 provided for mechanical system including transport piping, pipe rack, instrument/service air and other miscellaneous items based on recent in-house cost estimates for similar projects.

4.2.6 Demolition/Relocation

a. Allowance of $650,000 is provided for demolition and relocation of existing equipment and infrastructure which may interfere with the new DSI system based on recent in-house cost estimates for similar projects.

4.2.7 Electrical

a. Allowance of $3,575,000 is provided for electrical equipment upgrades and modifications based on recent in-house cost estimates for similar projects.

4.2.8 Instrumentation

a. Allowance of $520,000 provided for DCS upgrades and added instrumentation based on recent in-house cost estimates for similar projects.

4.2.9 Labor Costs

Installation/labor costs were included in the base estimate under the direct costs. Manhours are estimated for each item in the base estimate and are based on the type of work and typical estimates for similar work. The labor costs are based on the labor wage rates and labor crews developed by S&L.

a. Labor Wage Rates

Crew labor rates were developed using prevailing craft rates and fringe benefits and state specific worker's compensation rates as published in the 2016 edition of R.S. Means Labor Rates for Pine Bluff, Arkansas area. Costs were added to cover FICA, workers compensation, all applicable taxes, small tools, incidentals, construction equipment, and contractor's overhead. State specific workman's compensation rates are from R.S. Means. A 1.15 geographic labor productivity multiplier is included based on the Compass International Construction Yearbook for Arkansas. The crew rates do not include an allowance for weather related delays.

b. Labor crews

Construction/erection labor cost is based on the use of applicable construction crews typically required for projects of this type. The construction crew costs were specifically developed for utility industry and are proprietary to S&L. The prevailing craft rates are incorporated into work crews appropriate for the activities; and include costs for small tools, construction equipment, insurance, and site overheads.

4.2.10 Other Direct and Construction Indirect Costs

In addition to the base labor costs, other construction indirect costs for the project were broken out in the estimate as well as other contractor direct costs. The following items were included as other direct and construction indirect costs.

a. Scaffolding and Consumables

b. Premiums and per diems ($10 per hour)

c. Overtime at five 10-hour shifts per week

d. Freight on construction materials

e. Contractor's General & Administration Fees (included at 10% of total direct costs)

f. Contractor's Profit (included at 5% of total direct costs)

g. Sales tax was included in the cost estimate at 8.125%.

Freight on the DSI System equipment was not included in the cost estimate.

4.2.11 EPC Indirect Costs

The final contribution to the overall EPC project price are the EPC Contractor's indirect costs; these include the EPC engineering services, startup spare parts and initial fills, technical field advisors, and the EPC risk fee.

a. EPC Engineering Services

The EPC engineering services was estimated based on recent projects with similar scopes and schedules. The total cost of the EPC engineering services was estimated to be $4,000,000.

b. Startup Spare Parts and Initial Fills

An allowance has been included for initial fills for equipment, including first fills for lubrication of any motorized equipment. The initial fill of Trona was not included in the EPC Contractor's scope, as this will be supplied by the Owner and is covered as part of the Owner's Costs. The total cost of the initial fills was estimated to be $75,000.

c. Technical Field Advisors (Vendors)

Allowances were included for equipment supplier's technical field advisory services based on an estimated 150 man-days. The estimate includes technical field advisors for the DSI system supplier (including DSI system subcontractors) and the DCS supplier. The total cost of the technical field advisors was estimated to be $300,000.

d. EPC Risk Fee

An EPC approach provides an alternative which is expected to reduce risk for Entergy by placing the responsibility for the project on a single entity, the EPC Contractor. The EPC risk fee is a premium charged by the contractor which accounts for the additional coordination and management of the project as well as the additional risk assumed by the contractor. Based on S&L's experience with recent EPC projects, an EPC risk fee was included at 10% of the total EPC project costs.

4.2.12 Owner's Costs and Services

Outside of the EPC Contractor's total cost, Entergy will incur other costs associated with the project, such as services procured from third parties (including Owner's engineer, construction management support, startup and commissioning support and performance testing), and other project related costs.

a. Owner's Costs

Owner's Costs are direct costs that the Owner incurs over the life of the project. The following items are real costs Entergy will incur to install DSI at White Bluff based on the scope and schedule of this project:

- Internal Labor
- Internal Indirects
- Travel Expenses
- Legal Services
- Builders Risk Insurance
- Initial Fills (Reagent)

Owner's costs were included in the estimate at 8% of the total project cost.

b. Construction Management Support

The construction management support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The cost of labor is based on present day cost. The total cost of the construction management support was estimated to be $1,500,000.

c. Startup and Commissioning Support

The startup and commissioning support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The total cost of the startup and commissioning support was estimated to be $300,000.

d. Owner's Engineer

The Owner's Engineer cost was developed as a high level estimate based on a typical scope for Owner's Engineer work for this type of project; including the following tasks:

- Conceptual Study Support
- EPC Specification Supporting Documents
- Project Schedule Development
- EPC Specification Development
- EPC Bid Evaluation and Contract Conformance
- General Project Support
  - Monthly Project Status Meetings
  - Weekly Teleconferences
  - Overall Coordination
  - Project Administration
  - Site Visits and Travel
- Permitting Support
- Design Review of Drawing Submittals
- Technical support during design, fabrication, construction, commissioning, and testing
- Equipment vendor QA/QC audits

The total cost of the Owner's Engineer was estimated to be $1,750,000.

e. Performance testing

The cost for performance testing was developed as a factored estimate using costs from projects of similar scope. This cost includes the testing, performed by a third-party contractor hired by the Owner, and also includes the cost for S&L's assistance in the following tasks:

- Development of the test protocol
- Procuring the services of the testing contractor
- Overseeing the performance test campaign
- Evaluating the results of the testing with respect to guarantee compliance

The estimate for the third party testing contractor is based on the assumption that the contractor would be onsite for up to 3 days. The total cost of the Performance Testing was estimated to be $175,000.

f. Contingency

Contingency is included in the estimate to cover the uncertainty associated with the project costs. The cost estimate includes a recommended contingency of 25%, which is consistent with cost estimating guidelines for a conceptual design and the current level of project definition. Contingency was applied to the total project costs before escalation.

g. Escalation

Escalation was included in the estimate based on a typical schedule for implementation of a DSI system at an escalation rate of 2.15% on equipment and materials and 3.35% on labor and indirects. These escalation rates were developed by S&L based on recent pricing and in-house escalation projections.

h. Interest During Construction

Interest during construction (IDC) accounts for the time value of money associated with the distribution of construction cash flows over the construction period. IDC was applied to the total EPC project costs including contingency. The IDC was calculated based on a typical schedule for implementation of a DSI system and a typical interest rate of 7.8% per year which was assumed based on a low interest market environment.

4.3 VARIABLE OPERATING AND MAINTENANCE COSTS

The following unit costs were used to develop the variable O&M costs for each reagent specific system. All of these values, with the exception of the reagent costs, were provided by Entergy. The reagent costs are based on recent pricing received by S&L for another project.

Table 4-1: Unit Pricing for Utilities (Provided by Entergy)

Unit Cost	Units	Value
Trona	$/ton	$205
Activated Carbon	$/ton	$1,700
Low Quality Water	$/1000 gal	$0.53
Byproduct Disposal	$/ton	$7.50
Fly Ash Revenue	$/ton	$5.85
Aux Power Cost [1]	$/MWh	$41.02

Note 1: Entergy provided auxiliary power costs for the first year of operation.

Table 4-2 below summarizes the consumption rates estimated as well as the first year variable O&M costs for each case. The reagent consumption rate was developed using a normalized stoichiometric ratio (NSR) of 1.3 which is consistent with test data for similar projects.

Table 4-2: Variable O&M Rates and First Year Costs

	Units	Value
DSI System Parameters		
Reagent Consumption	lb/hr	16,500
Increased Carbon Consumption	lb/hr	210
DSI Waste Production + Increased Carbon + Unsold Fly Ash[3]	lb/hr	40,700
Aux Power Consumption	kW	1,700
Low Quality Water Consumption	gpm	4

	Units	Value
First Year[1] Variable O&M Costs (@CF[2])		
Reagent Cost	$/year	$10,548,500
Waste Disposal Cost (DSI Waste + Increased Carbon + Unsold Fly Ash)	$/year	$951,900
Increased Carbon Consumption Cost	$/year	$1,113,000
Aux Power Cost	$/year	$434,900
Low Quality Water Cost	$/year	$800
Loss of Fly Ash Sales[3]	$/year	$496,000
Total First Year Variable O&M Cost	**$/year**	**$13,545,100**

Note 1: First year costs are provided in $2016.

Note 2: The first year costs are calculated using an annual capacity factor of 71.2%.

Note 3: Assumes 57% of the station's fly ash was being sold on an annual basis for an average of approximately $5.85 per ton (based on historical data from Entergy).

4.4 FIXED O&M COSTS

The fixed O&M costs for the systems consist of operating personnel as well as maintenance costs (including material and labor). The recommended staffing additions for the DSI system are 9 personnel for one system.

The annual maintenance costs are estimated as a percentage of the total capital equipment cost, based on the amount of operating equipment which will require routine maintenance. For this evaluation, the maintenance costs (maintenance and labor) were estimated to be approximately 0.3% of the project capital. Items such as track work and civil work would be considered high capital cost items with little to no maintenance. Table 4-3 below summarizes the first year fixed O&M costs for the design and typical cases.

Table 4-3: First Year Fixed O&M Costs

First Year[1] Fixed O&M Costs	Units	Value
Operating Labor[2]	$/year	$1,066,000
Maintenance Material	$/year	$180,000
Maintenance Labor	$/year	$120,000
Total First Year Fixed O&M Cost	**$/year**	**$1,366,000**

Note 1: First year costs are provided in $2016.

Note 2: Operating labor costs are based on a labor rate of $56.95, which was provided by Entergy.

Note 3: Installation of systems on a single unit would require 9 operators total.

5. ATTACHMENTS

1. White Bluff Station DSI System EPC Conceptual Cost Estimate, Sargent & Lundy Estimate No. 34018A
2. ESP Rebuild Budgetary Quote

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
DSI SYSTEM EPC

Estimator	A. KOCI
Labor rate table	16ARPBL
Project No.	13027-004
Estimate Date	10/20/2016
Reviewed By	MNO
Approved By	MNO
Estimate No.	34018A
Cost index	ARPBL

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
DSI SYSTEM EPC

Area	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Total Cost
101	UNIT 1 OR 2 (SINGLE UNIT) DSI AREA	3,359,550	15,000,000	527,160	18,441	11,107,036	29,993,746
102	REAGENT HANDLING SYSTEM	1,505,400	1,360,000	1,218,523	26,487	1,956,963	6,040,885
103	ESP/ASH HANDLING MODIFICATIONS	50,000,000	1,050,000		9,885	680,982	51,730,982
104	EARTHWORK			79,496	2,169	183,755	263,251
105	UPGRADE PLANT ENTRANCE						
106	LAYDOWN AREAS			156,000	1,839	146,722	302,722
107	MECHANICAL MISCELLANEOUS	975,000					975,000
108	DEMOLITION / RELOCATION COSTS	650,000					650,000
109	ELECTRICAL	3,575,000					3,575,000
110	INSTRUMENTATION	520,000					520,000
	TOTAL DIRECT	60,584,950	17,410,000	1,981,179	58,822	14,075,457	94,051,586

Estimate Totals

Description	Amount	Totals	Hours
Direct Costs:			
Labor	14,075,457		58,822
Material	1,981,179		
Subcontract	60,584,950		
Process Equipment	17,410,000		
	94,051,586	**94,051,586**	
Other Direct & Construction Indirect Costs:			
91-1 Scaffolding	985,000		
91-2 Cost Due To OT 5-10's	1,859,000		
91-4 Per Diem	588,000		
91-5 Consumables	141,414		
91-6 Freight on Material	99,000		
91-8 Sales Tax	2,384,000		
91-9 Contractors G&A	1,990,000		
91-10 Contractors Profit	994,000		
	9,040,414	**103,092,000**	
Indirect Costs:			
93-1 Engineering Services	4,000,000		
93-4 SU/S Parts/ Initial Fills	75,000		
93-5 Technical Field Advisors	300,000		
93-8 EPC Fee	10,747,000		
	15,122,000	**118,214,000**	
Escalation:			
96-1 Escalation on Material	137,000		
96-2 Escalation on Labor	1,693,000		
96-3 Escalation on Subcontract	5,238,000		
96-4 Escalation on Process Eq	926,000		
96-5 Escalation on Indirects	1,261,000		
	9,255,000	**127,469,000**	
Total EPC Cost		***127,469,000***	
Owner's Costs:			
99-1 Owner's Costs	9,457,000		
	9,457,000	**136,926,000**	
Third Party Services:			
100 CM Oversight	1,500,000		
101 Start-Up Oversight	300,000		
102 Owner's Engineer	1,750,000		
103 Performance Testing	175,000		
	3,725,000	**140,651,000**	
Project Contingency :			
110 Project Contingency	32,851,000		
	32,851,000	**173,502,000**	
Escalation Addition:			
120 Escalation on Lines 99-110	960,000		
	960,000	**174,462,000**	
Interest During Construction:			
130 Interest During Constr.	15,649,000		
	15,649,000	**190,111,000**	
Total		***190,111,000***	

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
101			**UNIT 1 OR 2 (SINGLE UNIT) DSI AREA**									
	21.00.00		**CIVIL WORK**									
		21.53.00	**PILING**									
			AUGER CAST GROUT PILE, 18 IN DIA BY 80 FT LONG	DSI AREA FOUNDATIONS INCLUDING REAGENT SILOS	323.00 EA	1,162,800	-	-		108.88 /MH		1,162,800
			PILE - MOB/DEMOB		1.00 LS	100,000	-			108.88 /MH		100,000
			PILING			**1,262,800**						**1,262,800**
		21.98.00	**CIVIL WORK,TESTING**									
			AUGER CAST GROUT PILE - TESTING		1.00 LS	65,000	-	-		-	-	65,000
			CIVIL WORK,TESTING			**65,000**						**65,000**
			CIVIL WORK			**1,327,800**						**1,327,800**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			CONCRETE FOUNDATIONS - COMPOSITE RATE	DSI AREA FOUNDATIONS INCLUDING REAGENT SILOS	2,292.00 CY	-	-	527,160	18,441	60.03 /MH	1,107,036	1,634,196
			CONCRETE					**527,160**	**18,441**		**1,107,036**	**1,634,196**
			CONCRETE					**527,160**	**18,441**		**1,107,036**	**1,634,196**
	23.00.00		**STEEL**									
		23.25.00	**ROLLED SHAPE**									
			BUILDING MIX, TWO COAT PAINTED		TN	-	-			93.00 /MH		
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	BLOWER BUILDING 25 FT X 100 FT	2,500.00 SF	500,000	-			93.00 /MH		500,000
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	ELECTRICAL BUILDING 15 FT X 20 FT	300.00 SF	105,000	-			93.00 /MH		105,000
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	MILL BUILDING 40 FT X 80 FT	3,200.00 SF	640,000	-			93.00 /MH		640,000
			SHELL - ROOF ONLY AREA	DEHUMIDIFIER - 30 FT X 125 FT	3,750.00 SF	318,750	-			93.00 /MH		318,750
			SHELL - ROOF ONLY AREA	HEAT EXCHANGER - 10 FT X 80 FT	800.00 SF	68,000	-			93.00 /MH		68,000
			PRE-ENGINEERED BUILDING			**1,631,750**						**1,631,750**
		24.37.00	**ROOFING**									
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	DSI AREA ENCLOSURE ROOF	SF	-	-			35.25 /MH		
		24.41.00	**SIDING**									
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	DSI AREA ENCLOSURE SIDING	SF	-	-			79.98 /MH		
		24.99.00	**ARCHITECTURAL, MISCELLANEOUS**									
			HEATING	DSI AREA	SF	-	-			64.51 /MH		
			LIGHTING	DSI AREA	SF	-	-			82.56 /MH		
			FIRE PROTECTION	DSI AREA	SF	-	-			82.56 /MH		
			ARCHITECTURAL			**1,631,750**						**1,631,750**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.99.00	**MECHANICAL EQUIPMENT, MISCELLANEOUS**									
			DSI SYSTEM EQUIPMENT	EQUIPMENT COST FOR UNIT 1 OR 2 (SINGLE UNIT)	1.00 LS		15,000,000	-		/MH	10,000,000	25,000,000
			STORAGE SILOS WITH BIN VENT FILTERS (~14 DAYS STORAGE)	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			BLOWERS, HEAT EXCHANGERS, DEHUMIDIFIERS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			MILLING EQUIPMENT	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			PIPING SYSTEMS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			COMPRESSORS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			FLOW MODELING	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			MECHANICAL EQUIPMENT, MISCELLANEOUS				**15,000,000**				**10,000,000**	**25,000,000**
			MECHANICAL EQUIPMENT				**15,000,000**				**10,000,000**	**25,000,000**
	71.00.00		**PROJECT INDIRECT**									
		71.25.00	**CONSULTANT, THIRD PARTY**									
			CONSULTANT - SUBSURFACE INVESTIGATION		1.00 LS	250,000	-			/MH		250,000
			CONSULTANT - GEOTECHNICAL		1.00 LS	150,000	-			/MH		150,000

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CONSULTANT, THIRD PARTY			400,000						400,000
			PROJECT INDIRECT			400,000						400,000
			101 UNIT 1 OR 2 (SINGLE UNIT) DSI AREA			**3,359,550**	**15,000,000**	**527,160**	**18,441**		**11,107,036**	**29,993,746**
102			**REAGENT HANDLING SYSTEM**									
	21.00.00		CIVIL WORK									
		21.14.00	STRIP & STOCKPILE TOPSOIL									
			STRIP & STOCKPILE TOPSOIL - 12"	EXTEND REAGENT RAIL TRACK	90,000.00 SF	-	-		207	182.87 /MH	37,835	37,835
			STRIP & STOCKPILE TOPSOIL						207		37,835	37,835
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	EXTEND REAGENT RAIL TRACK	10,000.00 SY	-	-	106,500	345	97.70 /MH	33,690	140,190
			EROSION AND SEDIMENTATION CONTROL					106,500	345		33,690	140,190
		21.53.00	PILING									
			AUGER CAST GROUT PILE, 18 IN DIA BY 80 FT LONG	UNLOADING SHED 200' X 75' WIDE	64.00 EA	230,400	-	-	0	108.88 /MH	1	230,401
			PILING			230,400			0		1	230,401
		21.71.00	TRACKWORK									
			RAIL, TIE & BALLAST - 136 LB/YD	EXTEND REAGENT RAIL TRACK	4,500.00 TF	-	-	765,000	7,759	81.75 /MH	634,267	1,399,267
			TRACKWORK					765,000	7,759		634,267	1,399,267
			CIVIL WORK			230,400		871,500	8,310		705,793	1,807,693
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			FOUNDATION, 4500 PSI - COMPOSITE RATE	UNLOADING SHED 200' X 75' WIDE	926.00 CY	-	-	212,980	7,451	60.03 /MH	447,258	660,238
			CONCRETE					212,980	7,451		447,258	660,238
			CONCRETE					212,980	7,451		447,258	660,238
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	UNLOADING SHED 200' X 75' WIDE x 20' TALL	15,000.00 SF	1,275,000	-			93.00 /MH		1,275,000
			PRE-ENGINEERED BUILDING			1,275,000						1,275,000
			ARCHITECTURAL			1,275,000						1,275,000
	33.00.00		MATERIAL HANDLING EQUIPMENT									
		33.14.00	MATERIAL HANDLING EQUIPMENT									
			REAGENT PNEUMATIC TRAIN UNLOADING EQUIPMENT		2.00 LS	-	1,000,000	-	6,611	68.89 /MH	455,466	1,455,466
			MATERIAL HANDLING EQUIPMENT				1,000,000		6,611		455,466	1,455,466
		33.41.00	MOBILE YARD EQUIPMENT									
			MOBILE YARD EQUIPMENT - TRACKMOBILE	REAGENT HANDLING SYSTEM	1.00 EA	-	225,000	-		68.89 /MH		225,000
			MOBILE YARD EQUIPMENT				225,000					225,000
		33.51.00	RAIL CAR UNLOADER									
			RAIL CAR UNLOADER	IN UNLOADING SHED 200' X 75' WIDE	1.00 LT	-	135,000	-	1,862	93.00 /MH	173,172	308,172
			RAIL CAR UNLOADER				135,000		1,862		173,172	308,172
			MATERIAL HANDLING EQUIPMENT				1,360,000		8,474		628,638	1,988,638
	35.00.00		PIPING									
		35.14.10	CARBON STEEL, STRAIGHT RUN									
			8 IN DIA, SCH 40, 8" VACUUM CONVEY PIPING WITH 4 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	250.00 LF	-	-	10,043	270	77.80 /MH	21,015	31,057
			12 IN DIA, 3/8 IN STD- 2500 LF OF 10"/12" TRANSPORT PRESSURE PIPING W 8 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRANSPORT SYSTEM	1,250.00 LF	-	-	124,000	1,983	77.80 /MH	154,259	278,259
			CARBON STEEL, STRAIGHT RUN					134,043	2,253		175,274	309,316
			PIPING					134,043	2,253		175,274	309,316
			102 REAGENT HANDLING SYSTEM			**1,505,400**	**1,360,000**	**1,218,523**	**26,487**		**1,956,963**	**6,040,885**
103			**ESP/ASH HANDLING MODIFICATIONS**									
	33.00.00		MATERIAL HANDLING EQUIPMENT									
		33.99.00	MATERIAL HANDLING EQUIPMENT, MISCELLANEOUS									
			ESP EQUIPMENT MODIFICATION	FULL REBUILD OF ESP, INCLUDING INSTALLATION COST	1.00 LS	50,000,000	-	-		68.89 /MH		50,000,000

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		33.99.00	MATERIAL HANDLING EQUIPMENT, MISCELLANEOUS									
			ASH HANDLING COMPONENT MODIFICATION	ALLOWANCE	1.00 LS		1,050,000	-	9,885	68.89 /MH	680,982	1,730,982
			MATERIAL HANDLING EQUIPMENT, MISCELLANEOUS			50,000,000	1,050,000		9,885		680,982	51,730,982
			MATERIAL HANDLING EQUIPMENT			50,000,000	1,050,000		9,885		680,982	51,730,982
			103 ESP/ASH HANDLING MODIFICATIONS			**50,000,000**	**1,050,000**		**9,885**		**680,982**	**51,730,982**
104			**EARTHWORK**									
	21.00.00		CIVIL WORK									
		21.14.00	STRIP & STOCKPILE TOPSOIL									
			STRIP & STOCKPILE TOPSOIL - 12"	SITE GRADING ALLOWANCE	30,000.00 SF	-	-		69	182.87 /MH	12,612	12,612
			STRIP & STOCKPILE TOPSOIL - ONSITE	BUILDINGS	600.00 CY	-	-		79	182.87 /MH	14,503	14,503
			STRIP & STOCKPILE TOPSOIL						148		27,115	27,115
		21.17.00	EXCAVATION									
			EXCAVATION - EXCAVATION , BACKFILL & COMPACT ALL FOUNDATIONS	BUILDINGS	2,860.00 CY	-	-		986	79.78 /MH	78,680	78,680
			EXCAVATION						986		78,680	78,680
		21.39.00	STORM DRAINAGE UTILITIES									
			STORM SEWER WORK	SITE GRADING ALLOWANCE	1.00 LT	-	-	44,000	920	72.57 /MH	66,731	110,731
			STORM DRAINAGE UTILITIES					44,000	920		66,731	110,731
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	SITE GRADING ALLOWANCE	3,333.00 SY	-	-	35,496	115	97.70 /MH	11,229	46,725
			EROSION AND SEDIMENTATION CONTROL					35,496	115		11,229	46,725
			CIVIL WORK					79,496	2,169		183,755	263,251
			104 EARTHWORK					**79,496**	**2,169**		**183,755**	**263,251**
105			**UPGRADE PLANT ENTRANCE**									
	21.00.00		CIVIL WORK									
		21.57.00	ROAD, PARKING AREA, & SURFACED AREA									
			UPGRADE PLANT ENTRANCE	WORK NOT REQUIRED	0.00 LF	-	-			78.79 /MH		
106			**LAYDOWN AREAS**									
	21.00.00		CIVIL WORK									
		21.99.00	CIVIL WORK, MISCELLANEOUS									
			CIVIL WORK - CONSTRUCTION LAYDOWN AREAS	FENCING, POWER ETC...	2.00 AC	-	-	156,000	1,839	79.78 /MH	146,722	302,722
			CIVIL WORK, MISCELLANEOUS					156,000	1,839		146,722	302,722
			CIVIL WORK					156,000	1,839		146,722	302,722
			106 LAYDOWN AREAS					**156,000**	**1,839**		**146,722**	**302,722**
107			**MECHANICAL MISCELLANEOUS**									
	31.00.00		MECHANICAL EQUIPMENT									
		31.99.00	MECHANICAL EQUIPMENT, MISCELLANEOUS									
			MECHANICAL EQUIPMENT	INCLUDES PIPE RACK - ALLOWANCE SUBCONTRACT COST	1.00 LS	975,000	-	-		68.89 /MH		975,000
			MECHANICAL EQUIPMENT, MISCELLANEOUS			975,000						975,000
			MECHANICAL EQUIPMENT			975,000						975,000
			107 MECHANICAL MISCELLANEOUS			**975,000**						**975,000**
108			**DEMOLITION / RELOCATION COSTS**									
	11.00.00		DEMOLITION									
		11.99.00	DEMOLITION, MISCELLANEOUS									
			DEMOLITION AND RELOCATION	ALLOWANCE - SUBCONTRACT COST	1.00 LS	650,000	-			107.47 /MH		650,000
			DEMOLITION, MISCELLANEOUS			650,000						650,000
			DEMOLITION			650,000						650,000
			108 DEMOLITION / RELOCATION COSTS			**650,000**						**650,000**
109			**ELECTRICAL**									
	41.00.00		ELECTRICAL EQUIPMENT									
		41.99.00	ELECTRICAL EQUIPMENT, MISCELLANEOUS									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		41.99.00	ELECTRICAL EQUIPMENT, MISCELLANEOUS									
			ELECTRICAL EQUIPMENT, MISCELLANEOUS	ALLOWANCE - SUBCONTRACT COST	1.00 LS	3,575,000	-			64.04 /MH		3,575,000
			ELECTRICAL EQUIPMENT, MISCELLANEOUS			3,575,000						3,575,000
			ELECTRICAL EQUIPMENT			3,575,000						3,575,000
			109 ELECTRICAL			3,575,000						3,575,000
110			INSTRUMENTATION									
	44.00.00		CONTROL & INSTRUMENTATION									
		44.99.00	CONTROL & INSTRUMENTATION, ALLOWANCE									
			CONTROL & INSTRUMENTATION	ALLOWANCE - SUBCONTRACT COST	1.00 LS	520,000	-			65.15 /MH		520,000
			CONTROL & INSTRUMENTATION, ALLOWANCE			520,000						520,000
			CONTROL & INSTRUMENTATION			520,000						520,000
			110 INSTRUMENTATION			520,000						520,000

FUEL TECH
Technologies to enable clean efficient energy

27881 Clemens Road
Westlake, OH 44145
Phone: 440.899.3888
Fax: 440.899.3890

October 17, 2016

Sargent & Lundy
Attention: Danielle Flagg
55 East Monroe Street
Chicago, IL 60603

Subject: Fuel Tech, Inc. (FTI) Estimate #16-B-111 Rev1
Confidential Client ESP Retrofit
High Level Estimate

Dear Ms. Flagg,

In response to Sargent & Lundy's (S&L)'s recent request, Fuel Tech, Inc. (FTI), has assembled a high level estimate for the materials and installation necessary to retrofit Sargent & Lundy's "Confidential Client" Electrostatic Precipitators. Please consider the pricing as +/- 30% for high level budgetary estimation purposes.

The ESPs have been evaluated by our engineering staff and the estimate includes the most comprehensive improvements possible. Improvements that we have included in the estimate to increase performance and reliability include all new internals; collecting plates at 16" wide plate spacing, rigid discharge electrodes, top-rapped MIGI rapper conversion with increased rapping sectionalization, increased high voltage frame electrical sectionalization, and the addition of high frequency power supplies.

The estimates and information provided above are based upon FTI's historical information and experience, and should be used for accounting purposes ONLY. Should S&L want to move forward with a more in-depth budgetary proposal, FTI can provide such a document with additional lead-time. Thank you for your interest in our products and services, and we will continue to support Sargent & Lundy's efforts in any way practical for this and other opportunities. Should you require any additional information regarding this submittal, please contact me directly.

Respectfully,

Dustin Ekey
Regional Sales Manager

FTI Budgetary Proposal #16-B-111
Rev 1

Sargent & Lundy
Confidential Client ESP Retrofit

Sargent & Lundy LLC

Submitted by:

FUEL TECH
Technologies to enable clean efficient energy

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FUEL TECH
Technologies to enable clean efficient energy
27881 Clemens Road
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CONFIDENTIAL

EXECUTIVE SUMMARY

<u>Sargent & Lundy – Confidential Client ESP Rebuild Budgetary Request:</u>

In accordance with Sargent & Lundy's RFQ dated September 30, 2016, Fuel Tech, Inc. (FTI) has provided a high level estimate based on historical data to engineer, design, supply, and deliver an ESP Retrofit based on the provided information as follows;

A confidential client is currently evaluating the costs associated with rebuilding an existing ESP. As part of this project, the client will potentially be installing dry sorbent injection (DSI) upstream of the upgraded ESP.

The following summarizes the ESP design of the unit being evaluated:

- PC Walther original OEM installed in the early 1980s.
- Consists of four (4) identical ESP casings, with two (2) casings on top of the other two (2) casings; AKA "Piggybacked".
- Each ESP casing has eight (8) mechanical fields, two (2) mechanical fields wide by four (4) mechanical fields deep.
- Each field is 14' in length and contains forty-four (44) collecting electrodes with forty-three (43) gas passages.
- The collecting electrodes are 48' in height with 12" plate spacing.
- The total collecting surface area is 1,900,000 ft^2.
- Design flue gas flowrate is approximately 3,500,000 acfm, and a design velocity of 5 feet per second.
- The SCA of the existing ESP is approximately 540 ft^2/MMacfm.
- The overall dimension for each ESP is approximately 85'L x 90'W x 50'H.
- Each gas passage has discharge frame electrodes.
- The system is equipped with a Walther tumbling hammer rapper system.
- There are eight (8) T/R sets on each ESP, with a total of thirty-two (32).

ESP rebuild design and performance considerations:

- Achieve an outlet PM emissions rate of 0.015 lb/MMBtu or lower.
- Design inlet ash loading of 55,000 lb/hr.
- Non-halogenated PAC is injected at 150 lb/hr.
- Trona will be injected at 22,500 lb/hr, resulting in an increased particulate loading of 18,200 lb/hr to the ESP.
- Inlet flue gas temperature up to 315 deg F.

Fuel Tech, Inc. – Retrofitted ESP Arrangement and Summary:

While the existing ESPs are considered to be relatively large by industry standards, the design information provided shows that 22,500 lb/hr of Trona will be injected in addition to the existing inlet ash loading is 55,000 lb/hr. With this being said, while the ESPs are large they are still an efficiency machine and overcoming the new total inlet loading of over 73,000 lb/hr will be extremely difficult to achieve the requested 0.015 lbs/MMbtu outlet PM emissions, without retrofitting the entire ESPs to BART technology. Essentially, the ESPs will need to be rebuilt to "as-new" condition with the most state-of-the-art technology options. At the very least, new internals and electrical control systems would require new:

- Assembled Panel Collecting Electrodes
- Rigid Discharge Electrodes
- Top-Rapped MIGI Style Rapper Conversion
- All new Hot Roof, Cold Roof, and Penthouse
- Heated Purge Air Systems
- High Frequency Switch-Mode Power Supplies (SMPS)
- New Access Doors
- All new 3-Phase Electrical Supply Wiring
- New Controllers
- New Hopper Arrangement

Retrofit ESP Arrangement; Quantities are for one (1) ESP, there are four (4) ESPs total:

Number of ESP's / Unit:	4
Mechanical Fields & Size / ESP:	6 @ 9'
Electrical Fields & Size / ESP:	12 @ 4.5'
Chambers / ESP:	2
Gas Passages / Chamber:	33
Collecting Plates / Chamber:	32
Collecting Plate Height:	44'
Plate Spacing:	16"
RDE's / ESP:	1,536
Rapping Arrangment:	Top Rapped – MIGI
Collecting System Rappers / ESP:	176
Discharge System Rappers / ESP:	48
High Frequency Power Supplies / ESP:	16

The amount of planning, engineering, material supply, installation, and installation oversight necessary for a project listed above will be very significant. Pricing estimation can be found below.

High-Level Pricing Estimation for one (1) Confidential Unit including all four (4) ESPs:

Pricing estimate is based upon +/- 30%

The total budgetary estimate to provide ESP materials and engineering: **$ 20,000,000.00**

The total budgetary estimate to provide non-union installation: **$ 30,000,000.00**

*Note: The estimates and information provided above are based upon FTI's historical information and experience, and should be used for accounting purposes ONLY. Should S&L want to move forward with a more in-depth budgetary proposal, FTI can provide such a document with additional lead-time.

ENTERGY ARKANSAS, INC.

WHITE BLUFF

ENHANCED DSI COST ESTIMATE BASIS DOCUMENT

SL-014001
Final, Rev. 0
August 3, 2017
Project 13027-002

Prepared by

Sargent & Lundy LLC

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CONTENTS

1. PURPOSE

Entergy has requested that Sargent & Lundy (S&L) evaluate installation of an enhanced dry sorbent injection (DSI) system utilizing a baghouse in conjunction with the DSI system at White Bluff to control sulfur dioxide (SO_2) emissions. The purpose of this document is to define the project scope and identify the assumptions that were used as the basis for the operating and maintenance (O&M) and the capital cost estimates.

2. TECHNOLOGY DESCRIPTION

DSI is a proven technology, which has only recently been implemented, for moderate removal of $SO_2$and other acid gases from coal-fired power plants. It involves injection of sodium-based sorbents into the ductwork after the boiler and prior to the particulate collection device. DSI is considered a relatively low capital cost, moderate SO_2 removal alternative to wet or dry FGD systems. No slurry equipment or separate reactor vessel is required with a DSI system. With the proper temperature profile and stoichiometry, the sorbent can effectively react with $SO_2$and other acid gases in the flue gas. The resulting particulate matter is removed from the flue gas by a particulate collection device, typically an existing electrostatic precipitator (ESP). The performance of DSI technology has been shown to be enhanced by implementation with a downstream fabric filter or baghouse. A baghouse increases the overall residence time due to longer ductwork and additional contact through the filter cake which builds up on the bags. The additional residence time improves performance and in some applications has resulted in much higher achievable removal efficiencies than traditional DSI technology upstream of an existing ESP.

The typical DSI sorbents include sodium bicarbonate ($NaHCO_3$) and Trona ($Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$). Sorbent injection into the ductwork (downstream of the boiler and upstream of the ESP or baghouse) has been tested in the industry using sodium-based sorbents. The process works through neutralization of SO_2 and other acid gases with the caustic sorbent; the neutralization occurs as long as the sorbent remains in contact with the gas. Sorbent injection has been proven effective on a variety of pulverized coal-fired boilers using a range of low to high sulfur coals. It is considered a commercial technology although with a limited supplier base due to the historically limited interest.

The DSI process produces a dry byproduct which can be landfilled. The waste products will contain sodium sulfate and sulfite ($NaSO_3$/$NaSO_4$) along with the unused sorbent and the normal fly ash. These wastes will be collected in a baghouse and can be transported with conventional pneumatic fly ash handling equipment. The waste from sodium-based sorbents will have relatively high concentrations of soluble salts, which may affect the byproduct handling. With the addition of dry sorbent byproducts fly ash cannot be sold for reuse.

3. APPROACH

The project capital and O&M cost estimates are based on project-specific information, including:

- An engineer-procure-construct (EPC) contracting strategy with the DSI technology supplier providing the main process equipment, including reagent storage, milling, conveyance, injection lances, baghouse, and booster fans.
- Installation of a pulse jet fabric filter (PJFF) downstream of the existing ESPs to assist in SO_2 removal efficiency and capture of the DSI byproduct.
- Installation of new booster fans to account for increased draft pressure loss mainly due to the baghouse.
- Reagent injection at the ESP outlet, upstream of a new baghouse to collect flyash separately and preserve flyash sales
- On-site disposal of DSI byproduct, including flyash blending equipment for stabilization.
- Reagent injection rates based on 80% SO_2 removal from a design inlet concentration of 0.76 lb SO_2/MMBtu, based on the highest 5% of SO_2 emissions from 2009 through 2013.
  - Annual operating costs will be based on 80% SO_2 removal from an uncontrolled SO_2 rate of 0.57 lb SO_2/MMBtu, based on the annual heat input weighted average emission from 2009 through 2013.
  - The system will be designed to control emissions to meet a permit limit of 0.15 lb/MMBtu on a 30-boiler day rolling average, based on a maximum 30-day average SO_2 emission rate of 0.66 lb/MMBtu from 2009 through 2013.
- Trona was used as the DSI reagent for the purposes of this estimate.

- A high level conceptual system design, based on the estimated injection rate, was used as input to the Enhanced DSI cost estimate. The following were estimated based on previous projects and scaled for the predicted dry sorbent injection rate for White Bluff:
  - Auxiliary power consumption
  - Annual reagent consumption
  - Additional carbon consumption
  - Additional water consumption
  - Additional waste production
  - Reagent storage silos
  - Quantity of mills
  - Quantity of blower trains

The fabric filter and ID fan equipment costs are scaled based on flue gas volume in comparison to industry data and recent budgetary cost estimates.

The total plant capital cost estimate includes the following:

- Equipment and material
- Installation labor
- Indirect field costs
- Freight
- General and Administration
- Erection contractor profit
- Engineering, Procurement and Project Services
- Spare parts/initial fills (other than reagent)
- EPC Fee

As part of this project, S&L estimated the costs for Owner's services and costs outside of the EPC contract including the following:

- Owner's Costs
- Owner's Engineer
- Construction Management Support
- Startup and Commissioning Support
- Performance Testing
- Contingency
- Escalation
- Interest During Construction

Cost Estimate 34019A provided in Attachment 1 represents the total cost to Entergy to install Enhanced DSI technology on a single unit at White Bluff (Unit 1 or 2) including the EPC Contract price and all additional Owner's costs and third party services.

The total unit O&M cost estimate includes the following:

- Waste disposal (DSI waste)
- Reagent consumption
- Auxiliary power consumption
- Low quality water consumption for mill cleaning
- PJFF bag and cage replacement
- Operating labor
- Maintenance material
- Maintenance labor

The O&M Cost Estimate and Capital Cost Estimate 34019A were developed using the assumptions and scope provided in this document. The project definition and accuracy corresponds to a study level estimate as defined in U.S.EPA's Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual. The costs provided in this report are in 2016 dollars.

4. CAPITAL AND O&M COST ESTIMATE TECHNICAL BASIS

4.1 DESIGN INPUTS AND ASSUMPTIONS

The following assumptions were made for the design basis for the White Bluff DSI Systems:

- Design SO_2 inlet concentration of 0.76 lb SO_2/MMBtu.
- SO_2 inlet concentration of 0.57 lb SO_2/MMBtu for annual operating costs.
- Design SO_2 removal efficiency of 80%
- Annual capacity factor of 72.1% (annual average capacity factor for White Bluff Units 1 and 2 based on historical heat input from 2009 through 2013).
- Reagent injection at the ESP outlet, upstream of the new baghouse.
- Reagent delivery by rail.
- Compliance deadline of three years from the effective date of the rule.

Before proceeding with a DSI project, a demonstration test should be completed at White Bluff to confirm the feasibility of DSI technology at White Bluff and quantify the potential BOP impacts associated with the project, such as leachability of the byproduct.

4.1.1 Landfill Modifications

The sodium byproducts (salts) that are produced when Trona reacts with SO_2 and other acid gases, along with the unreacted sorbent are soluble in water. The resulting waste collected in the particulate collection device will need to be disposed of in a landfill that is lined and has a leachate collection system. With the addition of DSI, White Bluff will no longer be able to sell their fly ash for beneficial re-use due to the solubility of the sodium salts which would be present in the waste. The cost to maintain a landfill and open new cells is included in the typical maintenance budget of a plant. It was assumed, that any future landfill cells would include lining and leachate collection; therefore, no landfill modifications will be required to accommodate the addition of DSI and no costs were included in this estimate.

4.2 TOTAL INSTALLED CAPITAL INVESTMENT

The DSI system supplier will provide all of the equipment related to storing, milling, conveying and injecting the reagent; in this case, the system is designed for Trona. The baghouse area equipment, ID fan equipment, and the remaining BOP scope will be provided by the EPC Contractor. In addition, the EPC Contractor will install/construct the entire system including the equipment provided by the DSI system supplier.

Quantities were developed based on limited project design effort, project experience of a plant of comparable size and then adjusted based on actual size and capacity differences and also taking into consideration the specific site layout based on the general arrangement. In most cases, the costs for bulk materials and equipment were derived from S&L database and recent vendor or manufacturer's quote for similar items on other projects. The scope of work for the capital cost estimate is broken out by the following areas:

4.2.1 DSI Area (Single Unit)

a. Reagent Storage Silos:
- Twenty silos capable of storing approximately 14 days of sorbent per unit, 7,000-tons storage total, including substructure
- 14' diameter and 125' high, each
- 350-tons working storage, each
- Continuous level detection systems
- One bin vent filter per silo
- Live bottom hopper outlets
- Rotary airlock assemblies

b. Reagent conveying systems:
- 5 trains (5 x 33%)
- Pneumatic pressure blowers (1 x100% per train)
- One dehumidifier and chiller per train

c. Reagent Milling
- One 7-tph mill per train
- One set of bypass piping per mill

d. Reagent Injection
- Splitters with piping to two ESP outlets
- Six injection lances per injection location

e. Concrete foundations including piles for all reagent silo, blower, and mill areas; the approximate footprint for DSI Area is 160' x 200'

f. Buildings, enclosures, and roofs, including:
- Blower Building, approximately 25' x 125'
- Electrical Building; approximately 30' x 20'
- Mill Building; approximately 50' x 100'
- Dehumidifier Roof; approximately 30' x 160'
- Heat Exchanger Roof; approximately 10' x 100'

g. Geotechnical and subsurface investigation contractor work, including hydro excavation

h. Equipment pricing based on recent vendor pricing for a similar project.

4.2.2 Reagent Handling System

The conceptual design basis for the reagent handling system is to unload three cars at a time. Based on the estimated injection rate and typical railcar capacities, it is anticipated that approximately 35 railcars will be required each week per unit assuming a 100% capacity factor. The reagent handling system includes modification to the existing rail spur on-site to accommodate storage and handling of the reagent railcars. It was assumed that the reagent will be delivered via a 25-car unit train as a maximum. The following equipment and components are included in the cost estimate as part of the reagent handling system:

a. Reagent rail car unloader:
- System consists of mobile receiving pad and associated vacuum pneumatic connection equipment to unload railcar
- Enclosed railcar unloading building; approximately 300' x 75'
- Trackmobile used to haul and queue the rail cars before and after unloading; capable of moving approximately 25 cars at once.

b. Reagent unloading systems:
- Three trains (3 x 100%)
- Pneumatic pressure blowers (1 x 100%) per train
- One conveying air dehumidifier and chiller per train

- Pneumatic conveying piping located on an above-grade sleeper pipe rack
- The equipment pricing included in this estimate is based on recent firm pricing for similar projects. The basis of the conceptual design is a typical UCC arrangement and equipment.

c. Rail track spur extension to north to allow reagent train to be unloaded and cars to be stored on site, designed for 136 lb rail to be consistent with existing coal spurs

4.2.3 Byproduct Handling

a. Two DSI by-product storage silos (approximately 7-day capacity) with bin vent filter, fluidizing system, and four unloading conditioners (pin mixers)
b. One common fly ash blending bin with bin vent filter, fluidizing system, and four pneumatic airslide conveyors
c. Water pumps and associated piping for unloading conditioners at both silos
d. Compressed air system for air operated valves
e. Storage silo substructure and superstructure
f. Concrete foundations including piles for silos
g. Continuous level detection system
h. One lot pneumatic conveying piping located on an above grade pipe rack
i. Two truck scales and substructure
j. Cost estimate based on a recent budgetary proposal for similar project

4.2.4 Baghouse Area

a. New baghouse, including pulse jet cleaning system and all appurtenances
b. Two casings with 8 compartments
c. 10 meter bags and cages
d. 6” insulation with lagging
e. Enclosure around hopper area
f. Baghouse area foundations including 18” auger cast piles 60’ long
g. Equipment pricing based on recent pricing for similar projects

4.2.5 Ductwork and Supports

a. ID fan outlet to Baghouse inlet:
   - Two ID fan outlet ducts, combine to a single duct to carry flue gas to the new baghouse
   - Carbon steel, ¼ in.
   - Velocity, 3,600 fpm

b. Baghouse outlet to Booster fans
- A single baghouse outlet duct which splits into two booster fan inlets.
- Carbon steel, ¼ in.
- Velocity, 3,600 fpm

c. Booster fan outlet to the stack inlet ductwork and supports:
- Two booster fan inlets, combine to a single duct which connects to the existing chimney breeching duct.
- Carbon steel, ¼ in.
- Velocity, 3,600 fpm

d. Dampers and expansion joints

e. 6” insulation and lagging

f. Steel support structure and concrete mat foundations for all new flue gas ductwork

4.2.6 ID Booster Fans

a. Two, approximately 4,000 hp, axial booster fans sized to overcome pressure drop associated with baghouse

b. Includes motors - no spare motor included

c. Booster fan area foundations

4.2.7 Civil Work

a. Site grading

b. Soil removal earthwork

c. Excavation, backfill, and compaction for all foundations

d. Development of a new laydown area, approximately 4 acres, including site preparation, fencing, and temporary power. It was assumed that this area would be located on existing plant property, and does not require land to be purchased.

4.2.8 Mechanical Work

a. Allowance of $2,600,000 provided for mechanical system including transport piping, pipe rack, instrument/service air and other miscellaneous items based on recent in-house cost estimates for similar projects.

4.2.9 Demolition/Relocation

a. Allowance of $975,000 is provided for demolition and relocation of existing equipment and infrastructure which may interfere with the new DSI system based on recent in-house cost estimates for similar projects.

4.2.10 Electrical

a. Allowance of $16,250,000 is provided for electrical equipment upgrades and modifications based on recent in-house cost estimates for similar projects.

4.2.11 Instrumentation

a. Allowance of $2,210,000 provided for DCS upgrades and added instrumentation based on recent in-house cost estimates for similar projects.

4.2.12 Labor Costs

Installation/labor costs were included in the base estimate under the direct costs. Manhours are estimated for each item in the base estimate and are based on the type of work and typical estimates for similar work. The labor costs are based on the labor wage rates and labor crews developed by S&L.

a. Labor Wage Rates

Crew labor rates were developed using prevailing craft rates and fringe benefits and state specific worker's compensation rates as published in the 2016 edition of R.S. Means Labor Rates for Pine Bluff, Arkansas area. Costs were added to cover FICA, workers compensation, all applicable taxes, small tools, incidentals, construction equipment, and contractor's overhead. State specific workman's compensation rates are from R.S. Means. A 1.15 geographic labor productivity multiplier is included based on the Compass International Construction Yearbook for Arkansas. The crew rates do not include an allowance for weather related delays.

b. Labor crews

Construction/erection labor cost is based on the use of applicable construction crews typically required for projects of this type. The construction crew costs were specifically developed for utility industry and are proprietary to S&L. The prevailing craft rates are incorporated into work crews appropriate for the activities; and include costs for small tools, construction equipment, insurance, and site overheads.

4.2.13 Other Direct and Construction Indirect Costs

In addition to the base labor costs, other construction indirect costs for the project were broken out in the estimate as well as other contractor direct costs. The following items were included as other direct and construction indirect costs.

a. Scaffolding and Consumables

b. Premiums and per diems ($10 per hour)

c. Overtime at five 10-hour shifts per week

d. Freight on construction materials

e. Contractor's General & Administration Fees (included at 10% of total direct costs)

f. Contractor's Profit (included at 5% of total direct costs)

g. Sales tax was included at 8.125%.

Freight on the DSI System equipment was not included in the cost estimate.

4.2.14 EPC Indirect Costs

The final contribution to the overall EPC project price are the EPC Contractor's indirect costs; these include the EPC engineering services, startup spare parts and initial fills, technical field advisors, and the EPC risk fee.

a. EPC Engineering Services

The EPC engineering services was estimated based on recent projects with similar scopes and schedules. The total cost of the EPC engineering services was estimated to be $10,000,000.

b. Startup Spare Parts and Initial Fills

An allowance has been included for initial fills for equipment, including first fills for lubrication of any motorized equipment. The initial fill of Trona was not included in the EPC Contractor's scope, as this will be supplied by the Owner and is covered as part of the Owner's Costs. The total cost of the initial fills was estimated to be $150,000.

c. Technical Field Advisors (Vendors)

Allowances were included for equipment supplier's technical field advisory services based on an estimated 200 man-days. The estimate includes technical field advisors for the DSI system supplier (including DSI system subcontractors) and the DCS supplier. The total cost of the technical field advisors was estimated to be $400,000.

d. EPC Risk Fee

An EPC approach provides an alternative which is expected to reduce risk for Entergy by placing the responsibility for the project on a single entity, the EPC Contractor. The EPC risk fee is a premium charged by the contractor which accounts for the additional coordination and management of the project as well as the additional risk assumed by the contractor. Based on S&L's experience with recent EPC projects, an EPC risk fee was included at 10% of the total EPC project costs.

4.2.15 Owner's Costs and Services

Outside of the EPC Contractor's total cost, Entergy will incur other costs associated with the project, such as services procured from third parties (including Owner's engineer, construction management support, startup and commissioning support and performance testing), and other project related costs.

a. Owner's Costs

Owner's Costs are direct costs that the Owner incurs over the life of the project. The following items are real costs Entergy will incur to install DSI at White Bluff based on the scope and schedule of this project:

- Internal Labor
- Internal Indirects
- Travel Expenses
- Legal Services
- Builders Risk Insurance
- Initial Fills (Reagent)

Owner's costs were included in the estimate at 8% of the total project cost.

b. Construction Management Support

The construction management support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The cost of labor is based on present day cost. The total cost of the construction management support was estimated to be $2,500,000.

c. Startup and Commissioning Support

The startup and commissioning support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The total cost of the startup and commissioning support was estimated to be $350,000.

d. Owner's Engineer

The Owner's Engineer cost was developed as a high level estimate based on a typical scope for Owner's Engineer work for this type of project; including the following tasks:

- Conceptual Study Support
- EPC Specification Supporting Documents
- Project Schedule Development
- EPC Specification Development
- EPC Bid Evaluation and Contract Conformance
- General Project Support
  - Monthly Project Status Meetings
  - Weekly Teleconferences
  - Overall Coordination
  - Project Administration
  - Site Visits and Travel

- Permitting Support
- Design Review of Drawing Submittals
- Technical support during design, fabrication, construction, commissioning, and testing
- Equipment vendor QA/QC audits

The total cost of the Owner's Engineer was estimated to be $2,750,000.

e. Performance testing

The cost for performance testing was developed as a factored estimate using costs from projects of similar scope. This cost includes the testing, performed by a third-party contractor hired by the Owner, and also includes the cost for S&L's assistance in the following tasks:

- Development of the test protocol
- Procuring the services of the testing contractor
- Overseeing the performance test campaign
- Evaluating the results of the testing with respect to guarantee compliance

The estimate for the third party testing contractor is based on the assumption that the contractor would be onsite for up to 3 days. The total cost of the Performance Testing was estimated to be $175,000.

f. Contingency

Contingency is included in the estimate to cover the uncertainty associated with the project costs. The cost estimate includes a recommended contingency of 25%, which is consistent with cost estimating guidelines for a conceptual design and the current level of project definition. Contingency was applied to the total project costs before escalation.

g. Escalation

Escalation was included in the estimate based on a typical schedule for implementation of a DSI system at an escalation rate of 2.15% on equipment and materials and 3.35% on labor and indirects. These escalation rates were developed by S&L based on recent pricing and in-house escalation projections.

h. Interest During Construction

Interest during construction (IDC) accounts for the time value of money associated with the distribution of construction cash flows over the construction period. IDC was applied to the total EPC project costs including contingency. The IDC was calculated based on a typical schedule for implementation of a DSI system and a typical interest rate of 7.8% per year which was assumed based on a low interest market environment.

4.3 VARIABLE OPERATING AND MAINTENANCE COSTS

The following unit costs were used to develop the variable O&M costs for each reagent specific system. All of these values, with the exception of the reagent costs, were provided by Entergy. The reagent costs are based on recent pricing received by S&L for another project.

Table 4-1: Unit Pricing for Utilities (Provided by Entergy)

Unit Cost	Units	Value
Trona	$/ton	$205
Low Quality Water	$/1000 gal	$0.53
Bag Cost [1]	$/bag	100.00
Cage Cost [1]	$/cage	30.00
Waste Disposal	$/ton	$7.50
Aux Power Cost [2]	$/MWh	$41.02

Note 1: Bags will be replaced every 3 years and cages will be replaced every 9 years.

Note 2: Entergy provided auxiliary power costs for the first year of operation.

Table 4-2 below summarizes the consumption rates estimated as well as the first year variable O&M costs for each case. The reagent consumption rate was developed using a normalized stoichiometric ratio (NSR) of 2.4 which is consistent with test data for similar projects.

Table 4-2: Variable O&M Rates and First Year Costs

	Units	Value
DSI System Parameters		
Reagent Consumption	lb/hr	30,400
DSI Waste Production	lb/hr	24,100
Aux Power Consumption	kW	8,800
Low Quality Water Consumption	gpm	6
First Year[1] Variable O&M Costs (@CF[2])		
Reagent Cost	$/year	$19,434,900
Waste Disposal Cost	$/year	$563,700
Aux Power Cost	$/year	$2,251,500
Low Quality Water Cost	$/year	$1,200
Bag and Cage Replacement Cost	$/year	$1,796,000
Total First Year Variable O&M Cost	**$/year**	**$24,047,300**

Note 1: First year costs are provided in $2016.

Note 2: The first year costs are calculated using an annual capacity factor of 72.1%.

4.4 FIXED O&M COSTS

The fixed O&M costs for the systems consist of operating personnel as well as maintenance costs (including material and labor). The recommended staffing additions for the DSI system are 9 personnel for one system.

The annual maintenance costs are estimated as a percentage of the total capital equipment cost, based on the amount of operating equipment which will require routine maintenance. For this evaluation, the maintenance costs (maintenance and labor) were estimated to be approximately 0.5% of the project capital. Items such as track work and civil work would be considered high capital cost items with little to no maintenance.

Table 4-3 below summarizes the first year fixed O&M costs for the design and typical cases.

Table 4-3: First Year Fixed O&M Costs

First Year[1] Fixed O&M Costs	Units	Value
Operating Labor[2]	$/year	$1,066,000
Maintenance Material	$/year	$645,000
Maintenance Labor	$/year	$430,000
Total First Year Fixed O&M Cost	**$/year**	**$2,141,000**

Note 1: First year costs are provided in $2016.

Note 2: Operating labor costs are based on a labor rate of $56.95, which was provided by Entergy.

Note 3: Installation of systems on a single unit would require 9 operators total.

5. ATTACHMENTS

1. White Bluff Station Enhanced DSI System EPC Conceptual Cost Estimate, Sargent & Lundy Estimate No. 34019A

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
ENHANCED DSI SYSTEM W/BAGHOUSE EPC

Estimator	A. KOCI
Labor rate table	16ARPBL
Project No.	13027-004
Estimate Date	10/20/2016
Reviewed By	MNO
Approved By	MNO
Estimate No.	34019A
Cost index	ARPBL

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
ENHANCED DSI SYSTEM W/BAGHOUSE EPC

Area	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Total Cost
101	UNIT 1 OR 2 (SINGLE UNIT) DSI AREA	4,693,000	20,500,000	817,880	28,611	15,417,548	41,428,428
102	REAGENT HANDLING SYSTEM	2,258,100	2,445,000	1,325,013	35,380	2,581,496	8,609,609
103	BYPRODUCT HANDLING SYSTEM	7,713,100	6,872,000	853,055	76,615	5,670,075	21,108,230
104	UNIT 1 OR 2 FLUE GAS SYSTEM	496,800	240,000	8,136,840	162,932	14,173,748	23,047,388
105	UNIT 1 OR 2 BOOSTER FANS		5,400,000	212,595	27,391	1,888,104	7,500,699
106	UNIT 1 OR 2 BAGHOUSE	1,173,600	20,000,000	3,638,113	85,175	19,008,734	43,820,447
107	EARTHWORK			2,021,832	44,398	5,879,245	7,901,077
108	LAYDOWN AREAS			312,000	3,678	293,444	605,444
109	MECHANICAL MISCELLANEOUS	2,600,000					2,600,000
110	DEMOLITION/RELOCATION	975,000					975,000
111	ACI RELOCATION	100,000		146,775	1,954	135,859	382,635
112	ELECTRICAL	16,250,000					16,250,000
113	INSTRUMENTATION	2,210,000					2,210,000
	TOTAL DIRECT	38,469,600	55,457,000	17,464,103	466,134	65,048,253	176,438,956

Estimate Totals

Description	Amount	Totals	Hours
Direct Costs:			
Labor	65,048,253		466,134
Material	17,464,103		
Subcontract	38,469,600		
Process Equipment	55,457,000		
	176,438,956	**176,438,956**	
Other Direct & Construction Indirect Costs:			
91-1 Scaffolding	4,553,000		
91-2 Cost Due To OT 5-10's	8,760,000		
91-4 Per Diem	4,661,000		
91-5 Consumables	650,044		
91-6 Freight on Material	873,000		
91-8 Sales Tax	2,897,000		
91-9 Contractors G&A	10,350,000		
91-10 Contractors Profit	5,175,000		
	37,919,044	**214,358,000**	
Indirect Costs:			
93-1 Engineering Services	10,000,000		
93-4 SU/S Parts/ Initial Fills	150,000		
93-5 Technical Field Advisors	400,000		
93-8 EPC Fee	22,491,000		
	33,041,000	**247,399,000**	
Escalation:			
96-1 Escalation on Material	1,212,000		
96-2 Escalation on Labor	8,026,000		
96-3 Escalation on Subcontract	3,326,000		
96-4 Escalation on Process Eq	2,948,000		
96-5 Escalation on Indirects	2,756,000		
	18,268,000	**265,667,000**	
Total EPC Cost		***265,667,000***	
Owner's Costs:			
99-1 Owner's Costs	19,792,000		
	19,792,000	**285,459,000**	
Third Party Services:			
100 CM Oversight	2,500,000		
101 Start-Up Oversight	350,000		
102 Owner's Engineer	2,750,000		
103 Performance Testing	175,000		
	5,775,000	**291,234,000**	
Project Contingency :			
110 Project Contingency	68,242,000		
	68,242,000	**359,476,000**	
Escalation Addition:			
120 Escalation on Lines 99-110	1,893,000		
	1,893,000	**361,369,000**	
Interest During Construction:			
130 Interest During Constr.	32,375,000		
	32,375,000	**393,744,000**	
Total		***393,744,000***	

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
ENHANCED DSI SYSTEM W/BAGHOUSE EPC

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
101			**UNIT 1 OR 2 (SINGLE UNIT) DSI AREA**									
	21.00.00		**CIVIL WORK**									
		21.53.00	**PILING**									
			AUGER CAST GROUT PILE, 18 IN DIA BY 60 FT LONG	DSI AREA FOUNDATIONS INCLUDING REAGENT SILOS	500.00 EA	1,800,000	-	-		108.88 /MH		1,800,000
			PILE - MOB/DEMOB		1.00 LS	100,000	-			108.88 /MH		100,000
			PILING			**1,900,000**						**1,900,000**
		21.98.00	**CIVIL WORK,TESTING**									
			AUGER CAST GROUT PILE - TESTING		1.00 LS	65,000	-	-		-	-	65,000
			CIVIL WORK,TESTING			**65,000**						**65,000**
			CIVIL WORK			**1,965,000**						**1,965,000**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			CONCRETE FOUNDATIONS - COMPOSITE RATE	DSI AREA FOUNDATIONS INCLUDING REAGENT SILOS	3,556.00 CY	-	-	817,880	28,611	60.03 /MH	1,717,548	2,535,428
			CONCRETE					**817,880**	**28,611**		**1,717,548**	**2,535,428**
			CONCRETE					**817,880**	**28,611**		**1,717,548**	**2,535,428**
	23.00.00		**STEEL**									
		23.25.00	**ROLLED SHAPE**									
			BUILDING MIX, TWO COAT PAINTED		TN	-	-			93.00 /MH		
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	BLOWER BUILDING 25 FT X 125 FT	3,125.00 SF	625,000	-			93.00 /MH		625,000
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	ELECTRICAL BUILDING 30 FT X 20 FT	600.00 SF	210,000	-			93.00 /MH		210,000
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	MILL BUILDING 50 FT X 100 FT	5,000.00 SF	1,000,000	-			93.00 /MH		1,000,000
			SHELL - ROOF ONLY AREA	DEHUMIDIFIER - 30 FT X 160 FT	4,800.00 SF	408,000	-			93.00 /MH		408,000
			SHELL - ROOF ONLY AREA	HEAT EXCHANGER - 10 FT X 100 FT	1,000.00 SF	85,000	-			93.00 /MH		85,000
			PRE-ENGINEERED BUILDING			**2,328,000**						**2,328,000**
		24.37.00	**ROOFING**									
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	DSI AREA ENCLOSURE ROOF	SF	-	-			35.25 /MH		
		24.41.00	**SIDING**									
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	DSI AREA ENCLOSURE SIDING	SF	-	-			79.98 /MH		
		24.99.00	**ARCHITECTURAL, MISCELLANEOUS**									
			HEATING	DSI AREA	SF	-	-			64.51 /MH		
			LIGHTING	DSI AREA	SF	-	-			82.56 /MH		
			FIRE PROTECTION	DSI AREA	SF	-	-			82.56 /MH		
			ARCHITECTURAL			**2,328,000**						**2,328,000**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.99.00	**MECHANICAL EQUIPMENT, MISCELLANEOUS**									
			DSI SYSTEM EQUIPMENT	EQUIPMENT COST FOR UNIT 1 OR 2 (SINGLE UNIT)	1.00 LS		20,500,000	-		/MH	13,700,000	34,200,000
			STORAGE SILOS WITH BIN VENT FILTERS (~14 DAYS STORAGE)	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			BLOWERS, HEAT EXCHANGERS, DEHUMIDIFIERS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			MILLING EQUIPMENT	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			PIPING SYSTEMS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			COMPRESSORS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			FLOW MODELING	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			MECHANICAL EQUIPMENT, MISCELLANEOUS				**20,500,000**				**13,700,000**	**34,200,000**
			MECHANICAL EQUIPMENT				**20,500,000**				**13,700,000**	**34,200,000**
	71.00.00		**PROJECT INDIRECT**									
		71.25.00	**CONSULTANT, THIRD PARTY**									
			CONSULTANT - SUBSURFACE INVESTIGATION		1.00 LS	250,000	-			/MH		250,000
			CONSULTANT - GEOTECHNICAL		1.00 LS	150,000	-			/MH		150,000

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CONSULTANT, THIRD PARTY			400,000						400,000
			PROJECT INDIRECT			400,000						400,000
			101 UNIT 1 OR 2 (SINGLE UNIT) DSI AREA			**4,693,000**	**20,500,000**	**817,880**	**28,611**		**15,417,548**	**41,428,428**
102			**REAGENT HANDLING SYSTEM**									
	21.00.00		CIVIL WORK									
		21.14.00	STRIP & STOCKPILE TOPSOIL									
			STRIP & STOCKPILE TOPSOIL - 12"	EXTEND REAGENT RAIL TRACK	90,000.00 SF	-	-		207	182.87 /MH	37,835	37,835
			STRIP & STOCKPILE TOPSOIL						207		37,835	37,835
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	EXTEND REAGENT RAIL TRACK	10,000.00 SY	-	-	106,500	345	97.70 /MH	33,690	140,190
			EROSION AND SEDIMENTATION CONTROL					106,500	345		33,690	140,190
		21.53.00	PILING									
			AUGER CAST GROUT PILE, 18 IN DIA BY 60 FT LONG	UNLOADING SHED 300' X 75' WIDE	96.00 EA	345,600	-	-		108.88 /MH		345,600
			PILING			345,600						345,600
		21.71.00	TRACKWORK									
			RAIL, TIE & BALLAST - 136 LB/YD	EXTEND REAGENT RAIL TRACK	4,500.00 TF	-	-	765,000	7,759	81.75 /MH	634,267	1,399,267
			TRACKWORK					765,000	7,759		634,267	1,399,267
			CIVIL WORK			345,600		871,500	8,310		705,792	1,922,892
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			FOUNDATION, 4500 PSI - COMPOSITE RATE	UNLOADING SHED 300' X 75' WIDE	1,389.00 CY	-	-	319,470	11,176	60.03 /MH	670,887	990,357
			CONCRETE					319,470	11,176		670,887	990,357
			CONCRETE					319,470	11,176		670,887	990,357
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	UNLOADING SHED 300' X 75' WIDE x 20' TALL	22,500.00 SF	1,912,500	-			93.00 /MH		1,912,500
			PRE-ENGINEERED BUILDING			1,912,500						1,912,500
			ARCHITECTURAL			1,912,500						1,912,500
	33.00.00		MATERIAL HANDLING EQUIPMENT									
		33.14.00	MATERIAL HANDLING EQUIPMENT									
			REAGENT PNEUMATIC TRAIN UNLOADING EQUIPMENT		3.00 LS	-	1,500,000	-	9,917	68.89 /MH	683,199	2,183,199
			MATERIAL HANDLING EQUIPMENT				1,500,000		9,917		683,199	2,183,199
		33.41.00	MOBILE YARD EQUIPMENT									
			MOBILE YARD EQUIPMENT - TRACKMOBILE	REAGENT HANDLING SYSTEM	3.00 EA	-	675,000	-		68.89 /MH		675,000
			MOBILE YARD EQUIPMENT				675,000					675,000
		33.51.00	RAIL CAR UNLOADER									
			RAIL CAR UNLOADER	IN UNLOADING SHED 300' X 75' WIDE	2.00 LT	-	270,000	-	3,724	93.00 /MH	346,345	616,345
			RAIL CAR UNLOADER				270,000		3,724		346,345	616,345
			MATERIAL HANDLING EQUIPMENT				2,445,000		13,641		1,029,544	3,474,544
	35.00.00		PIPING									
		35.14.10	CARBON STEEL, STRAIGHT RUN									
			8 IN DIA, SCH 40, 8" VACUUM CONVEY PIPING WITH 4 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	250.00 LF	-	-	10,043	270	77.80 /MH	21,015	31,057
			12 IN DIA, 3/8 IN STD- 2500 LF OF 10"/12" TRANSPORT PRESSURE PIPING W 8 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRANSPORT SYSTEM	1,250.00 LF	-	-	124,000	1,983	77.80 /MH	154,259	278,259
			CARBON STEEL, STRAIGHT RUN					134,043	2,253		175,274	309,316
			PIPING					134,043	2,253		175,274	309,316
			102 REAGENT HANDLING SYSTEM			**2,258,100**	**2,445,000**	**1,325,013**	**35,380**		**2,581,496**	**8,609,609**
103			**BYPRODUCT HANDLING SYSTEM**									
	21.00.00		CIVIL WORK									
		21.54.00	CAISSON									
			2.5 FT DIA X 30 FT DEEP CAISSON	ASH SILO AND DSI BYPRODUCT SILOS	125.00 EA	-	-	232,125	3,161	108.88 /MH	344,161	576,286
			CAISSON					232,125	3,161		344,161	576,286

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CIVIL WORK					**232,125**	**3,161**		**344,161**	**576,286**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	DSI BYPRODUCT SILOS	614.00 CY	-	-	141,220	4,940	60.03 /MH	296,562	437,782
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FLY ASH BLENDING SILO	67.00 CY	-	-	15,410	539	60.03 /MH	32,361	47,771
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	FOR TRUCK SCALES	144.00 CY	-	-	33,120	1,159	60.03 /MH	69,552	102,672
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	MISC	100.00 CY	-	-	23,000	805	60.03 /MH	48,300	71,300
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	60.03 /MH	2,898	4,278
			CONCRETE					**214,130**	**7,491**		**449,673**	**663,803**
			CONCRETE					**214,130**	**7,491**		**449,673**	**663,803**
	23.00.00		**STEEL**									
		23.13.75	**SILO**									
			NEW 250 TON FLYASH BLENDING BIN SILO - 24FT DIA X 72 FT HIGH - ERECTION AND FREIGHT INCLUDED	SILO	1.00 EA		275,000		2,839	73.51 /MH	208,701	483,701
			SILO				**275,000**		**2,839**		**208,701**	**483,701**
			STEEL				**275,000**		**2,839**		**208,701**	**483,701**
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			PRE-ENGINEERED BUILDING	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	93.00 /MH	10,690	20,690
			PRE-ENGINEERED BUILDING					**10,000**	**115**		**10,690**	**20,690**
			ARCHITECTURAL					**10,000**	**115**		**10,690**	**20,690**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - DSI BYPRODUCT SILO	ERECTED - 52' DIA	2.00 LS	7,600,000				60.03 /MH		7,600,000
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - SPARE PARTS FOR STARTUP AND SPECIAL TOOLS		1.00 LS	-	10,000			73.51 /MH		10,000
			CONCRETE SILO - FREIGHT		1.00 LS	-	70,000			73.51 /MH		70,000
			CONCRETE SILO			**7,600,000**	**80,000**		**0**			**7,680,000**
			MISCELLANEOUS STRUCTURAL ITEM			**7,600,000**	**80,000**		**0**			**7,680,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.13.00	**BYPRODUCT HANDLING EQUIPMENT**									
			PNEUMATIC ASH CONVEYORS	EQUIPMENT INCLUDES FREIGHT	1.00 LS	-	5,655,000	-		73.51 /MH		5,655,000
			PNEUMATIC ASH CONVEYORS	INSTALLATION COST	1.00 LT	-		-	51,910	73.51 /MH	3,815,929	3,815,929
			BLOWERS, PRESSURE FEEDERS, TRANSPORT PIPING AND VACUUM / PRESSURE RELIEF VALVES	INCLUDED ABOVE	1.00 LT	-		-		73.51 /MH		
			-DRY UNLOADING SPOUT BELOW THE PRODUCT SILO		2.00 EA	-	60,000	-	258	73.51 /MH	18,977	78,977
			AIRSLIDE CONVEYORS FROM BLENDING BIN MIXER/PIPE CONVEYOR, INCL ALL VALVES AND ACCESSORIES		4.00 EA	-	80,000	-	688	73.51 /MH	50,595	130,595
			-FOUR PIN MIXERS BELOW CONCRETE SILOS INCL ALL VALVES AND ACCESSORIES		1.00 LT	-	540,000	-	3,347	73.51 /MH	246,047	786,047
			BYPRODUCT HANDLING EQUIPMENT				**6,335,000**		**56,204**		**4,131,549**	**10,466,549**
		33.57.00	**SCALE**									
			SCALE - NEW TRUCK SCALES	BYPRODUCT HANDLING SYSTEM	2.00 EA	-	182,000	-	460	68.89 /MH	31,674	213,674
			SCALE				**182,000**		**460**		**31,674**	**213,674**
			MATERIAL HANDLING EQUIPMENT				**6,517,000**		**56,664**		**4,163,223**	**10,680,223**
	34.00.00		**HVAC**									
		34.37.00	**DUST COLLECTOR**									
			DUST COLLECTOR - INSTALLED COST		1.00 LS	113,100	-			64.51 /MH		113,100
			DUST COLLECTOR			**113,100**						**113,100**

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			HVAC			113,100						113,100
	35.00.00		PIPING									
		35.14.10	CARBON STEEL, STRAIGHT RUN									
			12 IN DIA, 3/8 IN STD	CONVEYOR PIPING	2,500.00 LF	-	-	248,000	3,966	77.80 /MH	308,517	556,517
			12 IN DIA, 3/8 IN STD	12" TIE IN PIPING TO BYPRODUCT SILO FROM THE EXISTING 50 TPH FLY ASH PRESSURE SYSTEM	1,500.00 LF	-	-	148,800	2,379	77.80 /MH	185,110	333,910
			CARBON STEEL, STRAIGHT RUN					396,800	6,345		493,628	890,428
			PIPING					396,800	6,345		493,628	890,428
			103 BYPRODUCT HANDLING SYSTEM			7,713,100	6,872,000	853,055	76,615		5,670,075	21,108,230
104			UNIT 1 OR 2 FLUE GAS SYSTEM									
	21.00.00		CIVIL WORK									
		21.53.00	PILING									
			AUGER CAST GROUT PILE, 18 IN DIA BY 60 FT LONG		138.00 EA	496,800	-	-		108.88 /MH		496,800
			PILING			496,800						496,800
			CIVIL WORK			496,800						496,800
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE		966.00 CY	-	-	222,180	7,772	60.03 /MH	466,578	688,758
			CONCRETE					222,180	7,772		466,578	688,758
			CONCRETE					222,180	7,772		466,578	688,758
	23.00.00		STEEL									
		23.15.00	DUCTWORK									
			PANEL CONSTRUCTION, DUCT PLATE WITH STIFFENERS, INTERNAL TRUSSES, AND TURNING VANES		867.40 TN	-	-	2,819,050	59,821	97.70 /MH	5,844,481	8,663,531
			DUCTWORK					2,819,050	59,821		5,844,481	8,663,531
		23.21.00	GIRDER									
			ROLLED SHAPE STEEL		1,308.00 TN	-	-	3,544,680	45,103	93.00 /MH	4,194,621	7,739,301
			GIRDER					3,544,680	45,103		4,194,621	7,739,301
			STEEL					6,363,730	104,924		10,039,102	16,402,832
	31.00.00		MECHANICAL EQUIPMENT									
		31.27.00	DAMPERS & ACCESSORIES									
			DAMPERS & ACCESSORIES		800.00 SF	-	240,000		1,471	97.70 /MH	143,743	383,743
			DAMPERS & ACCESSORIES				240,000		1,471		143,743	383,743
		31.33.00	EXPANSION JOINT									
			EXPANSION JOINTS		1,830.00 LF	-		457,500	5,259	97.70 /MH	513,767	971,267
			EXPANSION JOINT					457,500	5,259		513,767	971,267
			MECHANICAL EQUIPMENT				240,000	457,500	6,730		657,510	1,355,010
	36.00.00		INSULATION									
		36.13.00	DUCT									
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE		168,220.00 SF	-	-	1,093,430	43,505	69.20 /MH	3,010,558	4,103,988
			DUCT					1,093,430	43,505		3,010,558	4,103,988
			INSULATION					1,093,430	43,505		3,010,558	4,103,988
			104 UNIT 1 OR 2 FLUE GAS SYSTEM			496,800	240,000	8,136,840	162,932		14,173,748	23,047,388
105			UNIT 1 OR 2 BOOSTER FANS									
	21.00.00		CIVIL WORK									
		21.54.00	CAISSON									
			2.5 FT DIA X 30 FT DEEP CAISSON		40.00 EA	-	-	74,280	1,011	108.88 /MH	110,131	184,411
			CAISSON					74,280	1,011		110,131	184,411
			CIVIL WORK					74,280	1,011		110,131	184,411
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		22.13.00	CONCRETE									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE		600.00 CY	-	-	138,000	4,828	60.03 /MH	289,800	427,800
			CONCRETE					138,000	4,828		289,800	427,800
			CONCRETE					138,000	4,828		289,800	427,800
	31.00.00		MECHANICAL EQUIPMENT									
		31.35.00	FANS & ACCESSORIES (EXCL HVAC)									
			BOOSTER FAN 1.8 MACFM, 4000 HP MOTOR		2.00 EA	-	5,400,000	-	10,345	68.89 /MH	712,655	6,112,655
			FANS & ACCESSORIES (EXCL HVAC)				5,400,000		10,345		712,655	6,112,655
			MECHANICAL EQUIPMENT				5,400,000		10,345		712,655	6,112,655
	36.00.00		INSULATION									
		36.15.00	EQUIPMENT									
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED ON GROUND		1,500.00 SF	-	-	315	11,207	69.20 /MH	775,517	775,832
			EQUIPMENT					315	11,207		775,517	775,832
			INSULATION					315	11,207		775,517	775,832
			105 UNIT 1 OR 2 BOOSTER FANS				**5,400,000**	**212,595**	**27,391**		**1,888,104**	**7,500,699**
106			**UNIT 1 OR 2 BAGHOUSE**									
	21.00.00		CIVIL WORK									
		21.53.00	PILING									
			AUGER CAST GROUT PILE, 18 IN DIA BY 60 FT LONG		326.00 EA	1,173,600	-	-		108.88 /MH		1,173,600
			PILING			1,173,600						1,173,600
			CIVIL WORK			1,173,600						1,173,600
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			CONCRETE FOUNDATIONS - COMPOSITE RATE		2,260.00 CY	-	-	519,800	18,184	60.03 /MH	1,091,580	1,611,380
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' COMPRESSOR BLDG	6.00 CY	-	-	1,380	48	60.03 /MH	2,898	4,278
			CONCRETE					521,180	18,232		1,094,478	1,615,658
			CONCRETE					521,180	18,232		1,094,478	1,615,658
	23.00.00		STEEL									
		23.25.00	ROLLED SHAPE									
			BUILDING MIX, GALVANIZED	UNIT 1 BAGHOUSE	560.00 TN	-	-	1,534,400	10,299	93.00 /MH	957,793	2,492,193
			ROLLED SHAPE					1,534,400	10,299		957,793	2,492,193
			STEEL					1,534,400	10,299		957,793	2,492,193
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			PRE-ENGINEERED BUILDING	8' X 10' COMPRESSOR BLDG	1.00 LT	-	-	20,000	115	93.00 /MH	10,690	30,690
			PRE-ENGINEERED BUILDING					20,000	115		10,690	30,690
		24.41.00	SIDING									
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	BAGHOUSE SKIRTS	68,112.00 SF	-	-	221,364	3,210	79.98 /MH	256,726	478,090
			SIDING					221,364	3,210		256,726	478,090
		24.99.00	ARCHITECTURAL, MISCELLANEOUS									
			MISCELLANEOUS	BAGHOUSE SKIRTS MANDOORS	4.00 EA	-	-	2,000	37	51.46 /MH	1,893	3,893
			ARCHITECTURAL, MISCELLANEOUS					2,000	37		1,893	3,893
			ARCHITECTURAL					243,364	3,362		269,308	512,672
	31.00.00		MECHANICAL EQUIPMENT									
		31.57.00	PARTICULATE REMOVAL									
			BAGHOUSE SYSTEM - INCLUDES PENTHOUSE, BYPASS, DAMPERS, EXP. JOINTS, TUBESHEETS, BAGS, CAGES, CLEANING PIPING, VALVES, BLOWERS, ETC.		1.00 LS	-	20,000,000	-		/MH	13,000,000	33,000,000
			PARTICULATE REMOVAL				20,000,000				13,000,000	33,000,000
			MECHANICAL EQUIPMENT				20,000,000				13,000,000	33,000,000
	36.00.00		INSULATION									
		36.13.00	DUCT									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		36.13.00	**DUCT**									
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	BAGHOUSE INSUILATION TOP, SIDES AND HOPPERS	206,026.00 SF	-	-	1,339,169	53,283	69.20 /MH	3,687,155	5,026,324
			DUCT					**1,339,169**	**53,283**		**3,687,155**	**5,026,324**
			INSULATION					**1,339,169**	**53,283**		**3,687,155**	**5,026,324**
			106 UNIT 1 OR 2 BAGHOUSE			**1,173,600**	**20,000,000**	**3,638,113**	**85,175**		**19,008,734**	**43,820,447**
107			**EARTHWORK**									
	21.00.00		**CIVIL WORK**									
		21.14.00	**STRIP & STOCKPILE TOPSOIL**									
			STRIP & STOCKPILE TOPSOIL - 12"	SITE GRADING	600,000.00 SF	-	-		1,379	182.87 /MH	252,234	252,234
			STRIP & STOCKPILE TOPSOIL - ONSITE	SITE GRADING	160,000.00 CY	-	-		21,149	182.87 /MH	3,867,595	3,867,595
			STRIP & STOCKPILE TOPSOIL						**22,529**		**4,119,830**	**4,119,830**
		21.17.00	**EXCAVATION**									
			EXCAVATION - EXCAVATION , BACKFILL & COMPACT ALL FOUNDATIONS		20,917.00 CY	-	-		7,213	79.78 /MH	575,434	575,434
			EXCAVATION						**7,213**		**575,434**	**575,434**
		21.39.00	**STORM DRAINAGE UTILITIES**									
			STORM SEWER WORK	SITE GRADING	1.00 LT	-	-	110,000	2,299	72.57 /MH	166,828	276,828
			STORM DRAINAGE UTILITIES					**110,000**	**2,299**		**166,828**	**276,828**
		21.41.00	**EROSION AND SEDIMENTATION CONTROL**									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	SITE GRADING	66,667.00 SY	-	-	710,004	2,299	97.70 /MH	224,599	934,602
			EROSION AND SEDIMENTATION CONTROL					**710,004**	**2,299**		**224,599**	**934,602**
		21.57.00	**ROAD, PARKING AREA, & SURFACED AREA**									
			BITUMINOUS ROAD - ROAD UPGRADE	BYPRODUCT HAUL ROAD - EAST OF COAL PILE	10,000.00 LF	-	-	500,000	8,046	78.79 /MH	633,943	1,133,943
			BITUMINOUS ROAD - ELIMINATE CHICANE CURVES AT LOW PRESSURE SERVICE WATER PUMPS		1.00 LT	-	-	500,000		78.79 /MH		500,000
			BITUMINOUS ASPHALT (10,000 - 49,999 SF) ROADWORK 24' WIDE 4" ASPHALT	SITE GRADING	1,668.00 LF	-	-	201,828	2,013	78.79 /MH	158,612	360,440
			ROAD, PARKING AREA, & SURFACED AREA					**1,201,828**	**10,059**		**792,555**	**1,994,383**
			CIVIL WORK					**2,021,832**	**44,398**		**5,879,245**	**7,901,077**
			107 EARTHWORK					**2,021,832**	**44,398**		**5,879,245**	**7,901,077**
108			**LAYDOWN AREAS**									
	21.00.00		**CIVIL WORK**									
		21.99.00	**CIVIL WORK, MISCELLANEOUS**									
			CIVIL WORK - CONSTRUCTION LAYDOWN AREAS	FENCING, POWER ETC...	4.00 AC	-	-	312,000	3,678	79.78 /MH	293,444	605,444
			CIVIL WORK, MISCELLANEOUS					**312,000**	**3,678**		**293,444**	**605,444**
			CIVIL WORK					**312,000**	**3,678**		**293,444**	**605,444**
			108 LAYDOWN AREAS					**312,000**	**3,678**		**293,444**	**605,444**
109			**MECHANICAL MISCELLANEOUS**									
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.99.00	**MECHANICAL EQUIPMENT, MISCELLANEOUS**									
			MECHANICAL EQUIPMENT	INCLUDES PIPE RACK - ALLOWANCE	1.00 LS	2,600,000	-	-		68.89 /MH		2,600,000
			MECHANICAL EQUIPMENT, MISCELLANEOUS			**2,600,000**						**2,600,000**
			MECHANICAL EQUIPMENT			**2,600,000**						**2,600,000**
			109 MECHANICAL MISCELLANEOUS			**2,600,000**						**2,600,000**
110			**DEMOLITION/RELOCATION**									
	11.00.00		**DEMOLITION**									
		11.99.00	**DEMOLITION, MISCELLANEOUS**									
			DEMOLITION AND RELOCATION	ALLOWANCE	1.00 LS	975,000	-			107.47 /MH		975,000
			DEMOLITION, MISCELLANEOUS			**975,000**						**975,000**
			DEMOLITION			**975,000**						**975,000**
			110 DEMOLITION/RELOCATION			**975,000**						**975,000**
111			**ACI RELOCATION**									
	22.00.00		**CONCRETE**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		22.13.00	CONCRETE									
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ACI PORT STAIRTOWER FDNS	30.00 CY	-	-	6,900	241	60.03 /MH	14,490	21,390
			CONCRETE					6,900	241		14,490	21,390
			CONCRETE					6,900	241		14,490	21,390
	23.00.00		STEEL									
		23.17.00	GALLERY									
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	ACI PORT STAIR TOWERS AND PLATFORMS	364.00 SF	-	-	5,460	42	66.40 /MH	2,778	8,238
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	ACI PORT STAIR TOWERS AND PLATFORMS	218.00 LF	-	-	11,554	45	66.40 /MH	2,995	14,549
			STAIR SYSTEM -	ACI PORT STAIR TOWERS AND PLATFORMS	448.00 SF	-	-	40,768	592	66.40 /MH	39,321	80,089
			GALLERY					57,782	679		45,094	102,876
		23.21.00	GIRDER									
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	ACI PIPE RACK OVER ROADWAY, 35LF X 23 WIDE X 20' HIGH	1.26 TN	-	-	3,415	25	93.00 /MH	2,290	5,704
			GIRDER					3,415	25		2,290	5,704
		23.25.00	ROLLED SHAPE									
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	ACI PORT STAIRTOWER FRAMING - 1 TOWER	2.20 TN	-	-	7,876	56	93.00 /MH	5,174	13,050
			ROLLED SHAPE					7,876	56		5,174	13,050
			STEEL					69,073	759		52,558	121,630
	31.00.00		MECHANICAL EQUIPMENT									
		31.25.00	CRANES & HOISTS									
			MOTORIZED HOIST - 1 TON	RELOCATED FROM PRESENT PORT LOCATIOIN	1.00 EA	-	-	-	69	68.89 /MH	4,751	4,751
			CRANES & HOISTS						69		4,751	4,751
		31.51.00	MERCURY REMOVAL EQUIPMENT									
			ACTIVATED CARBON INJECTION (ACI) - LANCE RELOCATIONS	RELOCATED FROM PRESENT PORT LOCATIOIN (16 PER UNIT)	16.00 EA	-	-	-	184	68.89 /MH	12,669	12,669
			ACTIVATED CARBON INJECTION (ACI) - 40 HP BLOWERS	NEW BLOWERS (2 PER UNIT)	2.00 EA	-	-	40,000	92	68.89 /MH	6,335	46,335
			ACTIVATED CARBON INJECTION (ACI) - REMOVE EXISTING 20 HP BLOWERS	REMOVE EXISTING	1.00 EA	-	-	-	11	68.89 /MH	792	792
			MERCURY REMOVAL EQUIPMENT					40,000	287		19,796	59,796
			MECHANICAL EQUIPMENT					40,000	356		24,547	64,547
	35.00.00		PIPING									
		35.13.25	FRP, ABOVE GROUND, PROCESS AREA									
			1.5 IN DIA, TAPER	INJECTION PORTS	6.00 LF	-	-	176	3	77.80 /MH	220	396
			2 IN DIA, TAPER	INJECTION PORTS	8.00 LF	-	-	210	5	77.80 /MH	351	561
			3 IN DIA, TAPER	INJECTION PORTS	20.00 LF	-	-	516	15	77.80 /MH	1,198	1,714
			FRP, ABOVE GROUND, PROCESS AREA					903	23		1,769	2,672
		35.14.25	FRP, STRAIGHT RUN									
			4 IN DIA, TAPER	NEW ACI PIPING	300.00 LF	-	-	6,330	200	77.80 /MH	15,560	21,890
			FRP, STRAIGHT RUN					6,330	200		15,560	21,890
		35.36.00	PIPE SUPPORTS, RACK									
			U-BOLT FOR 4 IN PIPE	ACI PIPE	13.50 EA	-	-	41	31	77.80 /MH	2,414	2,455
			SUPPORT SLEEPERS	ACI PIPE	8.50 EA	-	-	2,975	39	77.80 /MH	3,040	6,015
			SUPPORT FOR 4 IN DIA PIPE - USER DEFINED		1.00 EA	-	-	153	9	77.80 /MH	715	868
			SUPPORT FOR 3 IN DIA PIPE - USER DEFINED		2.00 EA	-	-	288	16	77.80 /MH	1,252	1,540
			PIPE SUPPORTS, RACK					3,457	95		7,422	10,879
		35.45.00	VALVES									
			VALVE - 4" 150 LB CS GATE, FLANGED	ACI AUTO MATIC ISOLATION VALVES (RELOCATE 4 PER UNIT)	4.00 EA	-	-	80	33	77.80 /MH	2,575	2,655
			VALVES					80	33		2,575	2,655
			PIPING					10,769	351		27,327	38,096
	41.00.00		ELECTRICAL EQUIPMENT									
		41.46.00	MOTOR CONTROL CENTER (MCC), COMPONENT									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		41.46.00	**MOTOR CONTROL CENTER (MCC), COMPONENT**									
			FVN STARTER - #4,	NEW BLOWERS	2.00 EA	-	-	9,800	37	64.04 /MH	2,355	12,155
			MOTOR CONTROL CENTER (MCC), COMPONENT					**9,800**	**37**		**2,355**	**12,155**
			ELECTRICAL EQUIPMENT					**9,800**	**37**		**2,355**	**12,155**
	42.00.00		**RACEWAY, CABLE TRAY & CONDUIT**									
		42.15.23	**CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY**									
			1-1/2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS	NEW BLOWERS	2.00 EA	-	-	172	3	62.27 /MH	179	351
			CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					**172**	**3**		**179**	**351**
		42.15.37	**CONDUIT, RGS**									
			3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	HOIST	225.00 LF	-	-	659	50	62.27 /MH	3,124	3,783
			1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	NEW BLOWERS	200.00 LF	-	-	1,344	65	62.27 /MH	4,065	5,409
			CONDUIT, RGS					**2,003**	**115**		**7,190**	**9,193**
			RACEWAY, CABLE TRAY & CONDUIT					**2,175**	**118**		**7,369**	**9,544**
	43.00.00		**CABLE**									
		43.10.00	**CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION**									
			CONTROL/INSTRUMENTATION/COMMUNICATION TERMINATION - MISC	ACI RELOCATION	300.00 LF	-	-	960	28	82.56 /MH	2,278	3,238
			CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**960**	**28**		**2,278**	**3,238**
		43.20.00	**600V CABLE & TERMINATION**									
			600V #8 3/C CU EPR TS-CPE	HOIST	250.00 LF	-	-	1,640	7	82.56 /MH	593	2,233
			600V #4/0 3/C W/G CU EPR TS-CPE	NEW BLOWERS	225.00 LF	-	-	5,364	36	82.56 /MH	2,989	8,353
			TERMINATION - COMPRESSION LUG, #8, 2 HOLE, COPPER	HOIST	6.00 EA	-	-	39	2	82.56 /MH	171	210
			TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER	NEW BLOWERS	6.00 EA	-	-	56	3	82.56 /MH	285	340
			600V CABLE & TERMINATION					**7,099**	**49**		**4,038**	**11,136**
			CABLE					**8,059**	**76**		**6,315**	**14,374**
	44.00.00		**CONTROL & INSTRUMENTATION**									
		44.21.00	**INSTRUMENT**									
			ACCOUSTIC MONITOR	RELOCATE TO NEW INJECTION LANCES	3.00 EA	-	-		14	65.15 /MH	899	899
			INSTRUMENT						**14**		**899**	**899**
			CONTROL & INSTRUMENTATION						**14**		**899**	**899**
	71.00.00		**PROJECT INDIRECT**									
		71.25.00	**CONSULTANT, THIRD PARTY**									
			COMPUTATIONAL FLUID DYNAMIC ANALYSIS (CFD)	ACI SYSTEM	1.00 LS	100,000	-			/MH		100,000
			CONSULTANT, THIRD PARTY			**100,000**						**100,000**
			PROJECT INDIRECT			**100,000**						**100,000**
			111 ACI RELOCATION			**100,000**		**146,775**	**1,954**		**135,859**	**382,635**
112			**ELECTRICAL**									
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.99.00	**ELECTRICAL EQUIPMENT, MISCELLANEOUS**									
			ELECTRICAL EQUIPMENT, MISCELLANEOUS	ALLOWANCE	1.00 LS	16,250,000	-			64.04 /MH		16,250,000
			ELECTRICAL EQUIPMENT, MISCELLANEOUS			**16,250,000**						**16,250,000**
			ELECTRICAL EQUIPMENT			**16,250,000**						**16,250,000**
			112 ELECTRICAL			**16,250,000**						**16,250,000**
113			**INSTRUMENTATION**									
	44.00.00		**CONTROL & INSTRUMENTATION**									
		44.99.00	**CONTROL & INSTRUMENTATION, ALLOWANCE**									
			CONTROL & INSTRUMENTATION	ALLOWANCE	1.00 LS	2,210,000	-			65.15 /MH		2,210,000
			CONTROL & INSTRUMENTATION, ALLOWANCE			**2,210,000**						**2,210,000**
			CONTROL & INSTRUMENTATION			**2,210,000**						**2,210,000**
			113 INSTRUMENTATION			**2,210,000**						**2,210,000**

APPENDIX B: 1PP NO_X CONTROLS STUDIES

- S&L's May 16, 2013 *NO_X Control Technology Cost and Performance Study, Entergy Services, Inc. – White Bluff and Lake Catherine*, SL-011439

Prepared for
Gill Elrod Ragon Owen & Sherman, P.A.

NOx Control Technology Cost and Performance Study

Entergy Services, Inc.
White Bluff & Lake Catherine

SL-011439
Final Report
Rev. 4

May 16, 2013
Project No.: 13027-001

Prepared by

Sargent & Lundy LLC

55 East Monroe Street
Chicago, IL 60603-5780 USA

LEGAL NOTICE

White Bluff & Lake Catherine
NOx Control Technology Cost and Performance Study

ISSUE SUMMARY AND APPROVAL PAGE

This is to certify that this report has been prepared, reviewed and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0405, which is based on ANSI/ISO/ASSQC Q9001 Quality Management Systems.

CONTRIBUTORS

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ENTERGY SERVICES, INC.

WHITE BLUFF AND LAKE CATHERINE

NO_X CONTROL TECHNOLOGY COST AND PERFORMANCE STUDY

CERTIFICATION PAGE

Sargent & Lundy, L.L.C. is registered in the State of Arkansas to practice engineering.
The registration number is 620.

I certify that this study was prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Arkansas.

Certified By: Sean C. McHone Date: 5/16/2013

Seal:

Sean C. McHone
5/16/2013

Issue:	Date:	Certified By:	Pages Certified:

1. INTRODUCTION

1.1. OBJECTIVE

The intent of this study is to provide Gill Elrod Ragon Owen & Sherman, P.A. with a technology evaluation and cost estimates for available methods of NOx control at two Entergy stations including: White Bluff – Units 1 & 2, the White Bluff Auxiliary Boiler, and Lake Catherine – Unit 4. The information developed in this study will be used to create a BART analysis, for compliance with Arkansas DEQ regulations.

1.2. UNIT DESCRIPTIONS

1.2.1. White Bluff - Units 1 & 2

White Bluff - Units 1 & 2 are Alstom-designed, tangentially-fired, pulverized-coal fueled units, rated at 815 MWnet and 844 MWnet respectively. Powder River Basin coal is the primary fuel source for Units 1 & 2. Currently, the units have no NOx controls installed.

1.2.2. White Bluff Auxiliary Boiler

The White Bluff Auxiliary boiler is a small industrial boiler capable of producing 140,000 lb/hr of steam, used for startup of the White Bluff coal units. The auxiliary boiler combusts No. 2 Diesel Oil, and does not have any existing NOx controls.

1.2.3. Lake Catherine - Unit 4

Lake Catherine - Unit 4 is an Alstom-designed, tangentially-fired, natural gas fueled unit, capable of generating 558 MWnet. The unit was originally designed as a dual-fuel unit, able to use natural gas or No. 2 Fuel Oil as fuel. This evaluation will be for natural gas firing only. If No. 2 Fuel Oil is to be combusted in the future, a separate BART analysis will be submitted. The unit currently has no NOx controls.

1.3. ESTIMATE METHODOLOGY

1.3.1. Capital Cost Estimates

S&L's capital cost estimates for retrofit NOx control technologies for White Bluff Units 1&2, White Bluff Auxiliary Boiler and Lake Catherine – Unit 4 encompass the equipment, material, labor, and all other required direct costs. The underlying assumption is that the project will be implemented on a multiple-contracting basis. The capital cost estimates provided herein are "total plant cost," and include the following:

- Equipment and material
- Installation labor
- Indirect field costs and BOP engineering
- Contingency (percentage varies with project size)
- Erection contractor profit (at 10% of material and labor)
- General and administration (at 5% of material and labor)
- Freight on material (at 5% of material)
- Freight on equipment (included with equipment costs)
- Sales/use tax (not included)
- Startup and commissioning (at 1% of construction cost)
- Spare parts (included with equipment costs)
- Consumables (0.5% of material and labor)

Owner's engineering and other Owner's costs were not included. Engineering, Procurement & Project Services and Contingency varied depending on the size of the project. License fees and royalties are not expected for the proposed control strategies. The Basis of Estimate and capital costs are summarized in Appendix A.

Capital cost estimates were calculated in one of three ways. In some cases, vendors were contacted to provide budgetary estimates for equipment and labor. These vendor's costs were used to create Total Installed Cost Estimates. In situations where Sargent & Lundy had performed cost estimates for these units previously, the existing cost estimates were updated to reflect current equipment, labor, and currency values. Remaining cost estimates were developed from similar projects that Sargent & Lundy has completed and adjusted for unit size.

1.3.2. Operating and Maintenance Cost Estimates

Operating and Maintenance Costs for White Bluff - Units 1 & 2 and Lake Catherine – Unit 4 were developed from similar projects Sargent & Lundy has completed. Costs were applied to the units on a $/kW basis, and assuming a 10% capacity factor for Lake Catherine – Unit 4, and 76% for White Bluff—Units 1 & 2. Operating and Maintenance Costs include the following costs:

- Fixed Operating and Maintenance
- Variable Operating and Maintenance
- Fuel Impact Costs

For the White Bluff Auxiliary boiler, costs were developed using Office of Air Quality Planning and Standards (OAQPS) calculations, assuming a 10% capacity factor.

1.4. DESIGN TARGET vs. COMPLIANCE NO_X EMISSION RATES

NOx control systems retrofit onto existing coal or gas-fired boilers are typically designed to achieve varying levels of NOx removal efficiencies from 10%-94%, depending on the control technologies selected. Controlled NOx emissions fluctuate during normal boiler operation in response to a number of design/operating parameters including, but not necessarily limited to: inlet NOx concentrations, boiler load, load changes, particulate matter loading, flue gas temperatures, flue gas velocities and mixing, catalyst volume and surface area, NH_3:NOx stoichiometric ratio, catalyst age and activity, and the quantity of ammonia slip deemed to be acceptable.

The "design target" NOx emission rate is the rate that a NOx control technology vendor would be willing to guarantee. Based on engineering judgment, and taking into consideration emissions data from existing coal- and gas-fired sources, a compliance margin above the design target is recommended for high removal efficiency/low emission rate technologies (such as SCR) to establish an enforceable permit limit based on long-term (e.g., annual average) emissions. Additional compliance margin would be required to establish enforceable permit limits based on shorter-term averaging times. For example, S&L recommends a compliance margin of 0.02 to 0.03 lb/MMBtu for coal units and 0.01 to 0.02 lb/MMBtu for gas units above the design target emission rate for permit limits based on a 30-day rolling average for control strategies including SCR. The NOx control technology emission rates for strategies including SCR in this report have been adjusted to include margin for compliance. The permit level NOx emission rates for SCR are higher by 0.02 to 0.03 lb/MMBtu for coal units and 0.01 to 0.02 lb/MMBtu for gas units.

2. WHITE BLUFF - UNITS 1 & 2

2.1. FUEL SWITCHING OPTIONS

2.1.1. Natural Gas

For White Bluff Units 1 & 2, fuel switching is not a feasible option. Typically, units could be switched from coal to natural gas or propane for NOx reductions. The nearest natural gas pipeline to the White Bluff facility is approximately 20 miles away. Construction of a pipeline is currently estimated at $2M per mile resulting in a cost of $40M to bring natural gas to the site, not including the additional upgrades the boiler would require to burn natural gas instead of coal.

2.1.2. Propane

White Bluff – Units 1 & 2 are each over 800 MWnet. Units of this size require more heat input than can practically be achieved with a propane delivery and storage system. Since a propane pipeline is not available, fuel switching to propane is not a feasible option.

2.2. COMBUSTION CONTROLS

2.2.1. Low NOx Burners and Over-Fire Air

Low NOx burners (LNB) limit NOx formation by controlling both the stoichiometric and temperature profiles of the combustion flame in each burner flame envelope. Control is achieved with design features that regulate the aerodynamic distribution and mixing of the fuel and air, yielding reduced oxygen (O_2) in the primary combustion zone, reduced flame temperature, and reduced residence time at peak combustion temperatures. The combination of these techniques produces lower NOx emissions during the combustion process.

OFA involves injecting combustion air downstream of the fuel-rich primary combustion zone by using over-fire air or side-fired air ports. The fuel-rich mixture that is fed to the burners reduces the flame temperature and oxygen concentration thus reducing the formation of thermal NOx. Generally, OFA is more effective when used with low nitrogen content fuels such as natural gas and propane, since OFA is more effective in controlling thermal NOx rather than fuel NOx.

LNB + OFA is a technically feasible retrofit solution for White Bluff - Units 1 & 2. The combination of LNB + OFA is capable of achieving a NOx emission rate of 0.15 lb/MMBtu. From Unit 1's baseline emissions of 0.33 lb/MMBtu, this is approximately 54.5% NOx removal efficiency. A removal efficiency of 61.5% can be expected for Unit 2, with a baseline NOx of 0.39 lb/MMBtu.

2.2.2. Flue Gas Recirculation (FGR)

NOx reduction efficiency data for coal-fired units with FGR are limited. The amount of NOx reduction achievable with FGR depends primarily on the fuel nitrogen content and amount of FGR used. Generally, FGR is more effective when used with low nitrogen content fuels such as natural gas and propane, since FGR is more effective in controlling thermal NOx rather than fuel NOx. Industry experience with FGR on coal-fired units for steam temperature control has shown very high maintenance on the gas recirculation fans due to erosion and corrosion. Many of the units with FGR for steam temperature control have removed the recirculation fans from service. The NOx control achievable on tangentially fired units like White Bluff – Units 1&2 with LNB+OFA has been comparable to that of FGR at lower capital and O&M cost. Currently, FGR technology is not offered by OEMs for coal-fired units. For these reasons, FGR is not a feasible technology for the White Bluff coal-fired units.

2.2.3. Neural Network

Neural Network (NN) systems are on-line enhancements to digital control systems (DCS) and plant information systems that improve boiler performance parameters such as heat rate, NOx emissions, and CO levels. The Neural Network model is based on historical data and parametric test data. The software applies an optimizing procedure to identify the best set points for the boiler, which are implemented without operator intervention (closed loop), or, at the plant's discretion, conveyed to the plant operators for implementation (open loop).

A Neural Network system is a technically feasible retrofit option for the White Bluff units. A NN is already installed for monitoring and controlling heat rate at White Bluff – Units 1&2. The reprogrammed

NN would be optimized first for minimizing NOx emissions and second for heat rate. It is possible that heat rate may increase as a result. Based on information available from vendors, it is expected that Neural Network technology on a coal-fired boiler can maintain the guaranteed performance of low NOx burners and potentially can achieve approximately 10% NOx reduction over a period of years, resulting in NOx emission rates of 0.30 lb/MMBtu, at max load for Unit 1, and of 0.35 lb/MMBtu for Unit 2. The cost for modifying the existing NNs at White Bluff is estimated to be approximately $250,000 per unit.

2.3. POST COMBUSTION CONTROLS

2.3.1. Selective Non-Catalytic Reduction

Selective non-catalytic reduction (SNCR) involves the direct injection of ammonia (NH_3) or urea ($(CO(NH_2)_2)$) into the furnace at high flue gas temperatures (approximately 1600 ºF – 2000 ºF). The ammonia or urea reacts with NOx in the flue gas to produce N_2 and water as shown in the following equations:

$$(CO(NH_2)_2) + 2NO + \frac{1}{2}O_2 \rightarrow 2H_2O + CO_2 + 2N_2$$

$$2NH_3 + 2NO + \frac{1}{2}O_2 \rightarrow 2N_2 + 3H_2O$$

Flue gas temperature at the point of reactant injection can greatly affect NOx removal efficiencies and the quantity of NH_3 or urea that will pass through the furnace unreacted (referred to as NH_3 slip). In general, SNCR reactions are effective at a temperature range of 1600 ºF – 2000 ºF. At temperatures below the desired operating range, the NOx reduction reactions diminish and unreacted NH_3 emissions increase. Above the desired temperature range, NH_3 is oxidized to NOx resulting in low NOx reduction efficiencies.

Mixing of the reactant and flue gas within the reaction zone is also an important factor to SNCR performance. In large boilers, the physical distance over which reagent must be dispersed increases, and the surface area/volume ratio of the convective pass decreases. Both of these factors make it difficult to achieve good mixing of reagent and flue gas, delivery of reagent in the proper temperature window, and sufficient residence time of the reactant and flue gas in that temperature window.

The temperatures and residence times required for an SNCR system make it a feasible option for NOx reduction for White Bluff - Units 1 & 2. Based on vendor input, a unit with no additional controls and a baseline NOx of 0.33 lb/MMBtu could see a 26.5% NOx reduction, for an outlet rate of 0.24 lb/MMBtu on Unit 1. For Unit 2, with a baseline NOx of 0.39 lb/MMBtu could see a 26.5% reduction to an outlet rate of 0.29 lb/MMBtu.

SNCR systems can also be installed in conjunction with LNB + OFA controls. On these coupled systems, the starting NOx of approximately 0.15 lb/MMBtu can be reduced to 0.13 lb/MMBtu, for a total reduction (LNB + OFA + SNCR) of around 61% for Unit 1 and 67% for Unit 2. In addition to the SNCR equipment, the process requires additional demineralized water at a rate of 170 gpm. An additional water treatment system capable of providing the required flows is included in the capital cost. The cost of the SNCR equipment for the combination technology would be approximately 10% lower based on the lower starting NOx rate with LNB/OFA.

2.3.2. Selective Catalytic Reduction

Selective Catalytic Reduction (SCR) involves injecting ammonia into boiler flue gas in the presence of a catalyst to reduce NOx to N_2 and water. The overall SCR reactions are:

$$4NH_3 + 4NO + O_2 \rightarrow 4N_2 + 6H_2O$$
$$8NH_3 + 4NO_2 + 2O_2 \rightarrow 6N_2 + 12H_2O$$

The optimal temperature range depends on the type of catalyst used, but is typically between 560 °F and 800 °F to maximize NOx reduction efficiency and minimize ammonium sulfate formation. Below this range, ammonium sulfate is formed resulting in catalyst deactivation. Above the optimum temperature, the catalyst will sinter and thus deactivate rapidly. Another factor affecting SCR performance is the condition of the catalyst material. As the catalyst degrades over time or is damaged, NOx removal decreases which is typically compensated by increased ammonia slip.

SCR has been installed on many large coal-fired and some gas-fired boilers and is considered a feasible technology. Because of the expense of the reagent, SCR systems are usually installed on units with existing LNB + OFA systems, or the upgrades are done simultaneously. At White Bluff, an SCR+LNB/OFA system is capable of removing approximately 90% of NOx emissions on a continuous long-term basis. With a starting NOx of 0.33 lb/MMBtu (Unit 1) to 0.39 lb/MMBtu (Unit 2), an SCR can be expected to achieve permitted emissions compliance at 0.055 lb/MMBtu.

2.4. CAPITAL COSTS

Capital costs for the technically feasible control options for the White Bluff coal units are listed in Table 2.1. The cost of SCR on White Bluff – Unit 1 is higher than for White Bluff – Unit 2 because the ductwork arrangement is different and there is more total ductwork, support steel, and foundations for Unit 1.

Table 2.1: Expected NOx Emissions and Capital Costs, White Bluff Units 1 & 2

Technology	**Controlled NOx (lb/MMBTU)**		**Unit 1 Total Installed Capital Cost (2012$)**	**Unit 2 Total Installed Capital Cost (2012$)**
	Unit 1	Unit 2		
Baseline	0.33	0.39	NA	NA
LNB + OFA	0.15	0.15	7,804,000[1]	11,831,000
Neural Network	0.30	0.35	250,000[2]	250,000[2]
SNCR	0.24	0.29	9,372,000	9,372,000
SNCR (+ LNB/OFA)	0.13	0.13	16,290,000[1]	20,317,000
SCR (+ LNB/OFA)	0.055	0.055	202,601,000	178,240,000

1. LNB/OFA material already purchased for Unit 1. The total cost to Entergy would be the same for Unit 1 as shown for Unit 2.
2. The cost for modifying the existing neural networks on Units 1 & 2.

2.5. OPERATING AND MAINTENANCE COSTS

Annual Operating and Maintenance costs for each of the feasible technologies for White Bluff Units 1 & 2 are shown in Table 2.2. Costs were calculated assuming full load operation, and a capacity factor (C.F.) of 76%.

Table 2.2: Operating and Maintenance Costs, White Bluff – Units 1 & 2 (Based on a C.F. of 76%)

	Unit 1			**Unit 2**		
Technology	**Variable O&M[1] Costs (2012$)**	**Fixed O&M Costs (2012$)**	**Total O&M Costs (2012$)**	**Variable O&M[1] Costs (2012$)**	**Fixed O&M Costs (2012$)**	**Total O&M Costs (2012$)**
LNB + OFA	--	142,000	142,000	--	142,000	142,000
Neural Network	--	50,000	50,000	--	50,000	50,000
SNCR	5,658,000	169,000	5,827,000	6,671,000	169,000	6,840,000
SNCR (+ LNB/OFA)	4,538,000	311,000	4,849,000	4,542,000	311,000	4,853,000
SCR (+ LNB/OFA)	2,836,000	608,000	3,444,000	2,858,000	608,000	3,466,000

Note 1: Variable O&M includes fuel cost impacts.

Note 2: The current costs of ammonia and urea are highly volatile and may exceed the values used in this report.

3. WHITE BLUFF AUXILIARY BOILER

3.1. FUEL SWITCHING

The White Bluff auxiliary boiler is a B&W, single burner boiler, firing No. 2 diesel oil, rated at 140,000 lb/hr of steam. Fuel switching to natural gas or propane is not practical because the nearest natural gas pipeline is 20 miles from the site. The costs to convert the White Bluff aux boiler to either natural gas or propane would not be justified based on the low capacity factor.

3.2. COMBUSTION CONTROLS

3.2.1. Low NOx Burners + Over-Fire Air

For an auxiliary boiler such as the one at White Bluff, NOx reduction can be achieved with a combination of technologies. LNB + OFA for aux boilers achieve NOx reduction under the same principles as a coal boiler. By modifying temperatures and fuel-rich areas, less NOx is generated. LNB + OFA are feasible technologies for auxiliary boilers, and vendor data indicates that the White Bluff Aux Boiler could achieve 35% reduction with LNB + OFA, for a final emission of 0.11 lb/MMBtu. The baseline NOx emissions from the White Bluff aux boiler are calculated using US EPA's AP-42 emissions factors.

3.2.2. Flue Gas Recirculation

NOx reduction efficiency data for oil-fired units with FGR are limited. The amount of NOx reduction achievable with FGR depends primarily on the fuel nitrogen content and amount of FGR used. Generally, FGR is more effective when used with low nitrogen content fuels such as natural gas and propane, since FGR is more effective in controlling thermal NOx rather than fuel NOx. FGR is a feasible technology for the White Bluff auxiliary boiler. With a recirculation of 15% of the flue gas, the unit could expect to see 13% NOx removal, for an outlet of 0.149 lb/MMBtu.

3.2.3. Low NOx Burners + Over-fire Air + Flue Gas Recirculation

These three technologies are often installed simultaneously for greater NOx reduction. A vendor has proposed that for the White Bluff aux boiler, a combination of LNB + OFA + FGR will reduce the NOx from 0.171 lb/MMBtu to 0.100 lb/MMBtu when burning No. 2 Fuel Oil. This reduction of 42% will come from a new LNB and OFA system and the recirculation of 15% of the flue gas flow.

3.2.4. Neural Network

The White Bluff Auxiliary Boiler is not a candidate for a neural network (NN) because there are few controllable variables to be optimized. The aux boiler also uses a relatively new PLC control system.

3.3. POST COMBUSTION CONTROLS

3.3.1. Selective Non-Catalytic Reduction

SNCR control has proven to be difficult to apply to industrial boilers because of the temperature and mixing requirements, especially industrial boilers that modulate or cycle frequently. In order to effectively reduce NOx emissions, the reactant (ammonia or urea) must be injected into the flue gas within a specific flue gas temperature window, and must remain within that temperature window for a sufficient residence time. In industrial boilers that cycle frequently, the location of the specific exhaust gas temperature window is constantly changing. Thus, SNCR has not been effective on industrial boilers that have high turndown capabilities and modulate or cycle frequently. Based on the temperature and residence time requirements associated with effective NOx reduction, the planned use of the auxiliary boiler, and the limited availability of SNCR control systems for industrial boilers, it has been determined that SNCR is not technically feasible for the White Bluff auxiliary boiler.

3.3.2. Selective Catalytic Reduction

SCR for NOx control on auxiliary boilers is not common, because of their cycling operation, and the use of fuel oil. SCRs have critical operating temperature ranges, which are difficult to achieve and maintain in short periods of time. Because of the sulfur content of diesel oil, the SCR catalyst can become poisoned, resulting in a lower NOx removal efficiency. With this lower efficiency and high cost, an SCR is not considered a feasible technology.

3.4. CAPITAL COST ESTIMATES

Capital costs for the technically feasible control options for the White Bluff Auxiliary Boiler are listed in Table 3.1.

Table 3.1: Expected NOx Emissions and Capital Costs, White Bluff Units 1 & 2

Technology	Controlled NOx	Total Installed Capital Cost (2012$)
Baseline	0.171	--
LNB	0.111	255,000
OFA	0.137	231,000
FGR	0.149	366,000
LNB + OFA + FGR	0.100	852,000

3.5. OPERATING AND MAINTENANCE COST ESTIMATES

Annual Operating and Maintenance costs for each of the feasible technologies for White Bluff Units 1 & 2 are shown in Table 3.2. Costs were calculated assuming full load operation and a capacity factor (C.F.) of 10%.

Table 3.2: White Bluff Auxiliary Boiler Operating and Maintenance Costs (Based on a C.F. of 10%)

Technology	**Variable O&M Costs (2012$)**	**Fixed O&M Costs (2012$)**	**Total O&M Costs (2012$)**
LNB	4,000	4,000	8,000
OFA	5,000	4,000	9,000
FGR	0	7,000	7,000
LNB + OFA + FGR	9,000	15,000	24,000

4. LAKE CATHERINE - UNIT 4

4.1. FUEL SWITCHING

Lake Catherine - Unit 4 already combusts natural gas, which has the lowest NOx formation of potential fuels. Because fuel switching would not result in a lower NOx emission rate, it is not a feasible option for NOx control.

4.2. COMBUSTION CONTROLS

4.2.1. Burners-Out-Of-Service

Burners-Out-Of-Service (BOOS) allows operators to stop fuel flow to certain burners in the boiler (typically the top level of burners), while air flow is maintained. By removing fuel from the top row of burners, the combustion air becomes over-fire air and the production of thermal NOx is reduced. While the reduction of NOx can be significant, the tradeoff is a reduced generating capacity, if no further modifications to the firing system are made. BOOS is a feasible technology for Lake Catherine - Unit 4. Testing of BOOS at Lake Catherine by Entropy Technology & Environmental Consultants, Inc. (ETEC) with the top levels of burners out resulted in a maximum load of 405 MW, a 28% reduction in capacity, and NOx levels of 0.12 lb/MMBtu, a reduction of 55% from the baseline while using the existing burners.

Recovery of the lost unit capacity is possible by increasing the fuel fired in the three levels of burners that remain in service. The burners remaining in service would have to increase fuel throughput by 25%. The natural gas piping to each burner may also have to be increased in size for the higher fuel flow rates. ETEC, Inc. has experience with several units similar in design to Lake Catherine – Unit 4 that have been able to achieve full capacity by increasing the original “high” burner header pressure (BHP) to increase fuel flow to the burners (See Appendix D). The increase in BHP from 42 to 50 psig at Lake Catherine – Unit 4 would increase fuel flow by 25% and the burners would be operated “fuel rich”, lowering NOx formation. Using this approach would reduce NOx emissions at a small capital cost. The costs for BOOS with recovery of full unit capacity were based on vendor cost information for a previous project adjusted on a $/kW basis to Lake Catherine – Unit 4 and escalated to 2012. The cost provided does not include any modifications to the boiler. A boiler OEM or consultant would need to evaluate the existing fuel piping, superheat and reheat attemperation sprays, tube metal temperatures and burner tilt positions for the new operating conditions. The expected NOx reduction would range from 40% at low load to 50% at full load and NOx levels of 0.24 lb/MMBtu.

4.2.2. Low NOx Burners + Over-Fire Air

Low NOx Burners and Over-Fire Air for a gas-fired unit function similarly to coal-fired boilers, as discussed for White Bluff - Units 1 & 2. By controlling the temperature and stoichiometric profiles, the NOx produced as a result of thermal processes is reduced.

LNB + OFA are commonly installed on gas-fired units of this size, and are a feasible retrofit technology for Lake Catherine - Unit 4. With the installation of LNB + OFA, Lake Catherine could expect a 60% reduction in NOx, from 0.4825 lb/MMBtu to 0.19 lb/MMBtu.

4.2.3. Flue Gas Recirculation

Flue Gas Recirculation (FGR) reduces NOx by recirculating flue gas to the furnace. This recirculated gas has lower oxygen content than ambient air usually used for combustion. Lower oxygen and lower flame temperatures reduces thermal NOx formation. FGR can be installed on a unit in two ways. Traditional FGR installations require a new recirculation fan. Induced FGR, or IFGR, installs ductwork from the air preheater outlet to the suction of the existing forced draft fan. IFGR does not require a separate fan, but due to FD fan capacity restrictions, IFGR is not available at higher loads, because the forced draft fans were not designed for the higher air and gas flow rate.

FGR is technically feasible on Lake Catherine - Unit 4 and can result in reductions of 60%. For Unit 4, this would be equivalent to NOx emissions of 0.19 lb/MMBtu.

4.2.4. Water Injection

Water injection operates on similar principles to LNB + OFA and FGR. By injecting water into the furnace, the temperature of the flue gas is reduced, thereby reducing the amount of thermal NOx formed.

Water injection is a feasible technology for Lake Catherine - Unit 4, and can reduce NOx emissions by 9% at full load. Water injection is typically used as a trimming technology at high load. On Unit 4, the emissions would be lowered from the baseline of 0.4825 lb/MMBtu to 0.44 lb/MMBtu.

4.2.5. Neural Network

Lake Catherine – Unit 4 could also install a neural network (NN) but for the low capacity factor and current lack of NOx CEMS, a NN would not be practical. Several of the other technologies would provide greater NOx reductions.

4.3. POST COMBUSTION CONTROLS

4.3.1. Selective Non-Catalytic Reduction

Selective Non-Catalytic Reduction for gas-fired units operates under the same principles as SNCR for coal-fired units, with a few design changes. One of the keys of SNCR design is adequate chemical distribution at the right temperature for the reaction. Lake Catherine - Unit 4 has horizontal superheat platens, which requires multiple-nozzle lances to distribute the urea; the gas pattern does not provide adequate distribution. The reaction and temperature requirements are the same for gas-fired boilers as they are for coal-fired units.

SNCR has been installed on boilers such as Lake Catherine 4 and is considered a feasible technology, although the residence time in the desired temperature zone is lower for a gas-fired unit and the temperature window moves as unit load changes. The unit could expect to see reductions in NOx from the baseline of 0.4825 lb/MMBtu to 0.29 lb/MMBtu, or approximately 40% reduction at full load. In addition to the SNCR equipment, the process requires additional demineralized water at a rate of 85 gpm. An additional water treatment system capable of providing the required flows is included in the capital cost.

SNCR can be combined with LNB/OFA to achieve a combined NOx removal efficiency of 70% for an outlet emission of approximately 0.14 lb/MMBtu,

4.3.2. Selective Catalytic Reduction

Selective Catalytic Reduction units are similar for gas and coal-fired units. Ammonia or urea reagent reacts with NOx to form nitrogen and water, in the presence of a catalyst. Because gas boilers do not have particulate control or sulfur dioxide control, they typically have a shorter distance from the economizer outlet to the stack, which may result in long ductwork runs to and from the SCR.

SCR is a feasible technology for Lake Catherine - Unit 4. Combined with a LNB + OFA installation, which is typical of SCR installations, the unit could achieve a combined NOx removal efficiency of 94%, for a permitted outlet NOx of 0.03 lb/MMBtu at full load. This includes a margin for compliance as discussed in Section 1.4. Without the LNB + OFA installed, the SCR can also be designed to achieve 90% removal efficiency for an outlet emission of approximately 0.05 lb/MMBtu.

4.4. CAPITAL COST ESTIMATES

Capital costs for the technically feasible control options for Lake Catherine - Unit 4 are listed in Table 4.1.

Table 4.1: Expected NOx Emissions and Capital Costs, Lake Catherine Unit 4

Technology	Controlled NOx (lb/MMBtu)	Total Installed Capital Cost (2012$)
Baseline	0.4825[1]	--
BOOS (at full capacity)	0.24	893,000
LNB / OFA	0.19	8,762,000
IFGR (below 500 MW)	0.39	2,166,000
FGR	0.19	11,489,000
Water Injection	0.44	2,177,000
SNCR	0.29	15,507,000
SNCR (+ LNB/OFA)	0.14	24,269,000
SCR	0.05	59,587,000
SCR (+ LNB/OFA)	0.03	68,349,000

Note 1: The baseline NOx rate is the maximum daily emission rate from the 2001-2003 baseline period.

4.5. OPERATING AND MAINTENANCE COST ESTIMATES

Annual Operating and Maintenance costs for each of the feasible technologies for Lake Catherine - Unit 4 are shown in Table 4.2. Costs were calculated assuming full load operation, and a capacity factor (C.F. of 10%).

Table 4.2: Annual Operating and Maintenance Costs, Lake Catherine Unit 4 (Based on C.F. of 10%)

Technology	**Variable O&M[1,2] Costs (2012$)**	**Fixed O&M Costs (2012$)**	**Total O&M Costs (2012$)**
BOOS	--	21,000	21,000
LNB + OFA	--	210,000	210,000
IFGR	--	52,000	52,000
FGR	142,000	207,000	349,000
Water Injection	486,000	52,000	538,000
SNCR	1,640,000	279,000	1,919,000
SNCR (+ LNB/OFA)	462,000	489,000	951,000
SCR	254,000	358,000	612,000
SCR (+ LNB/OFA)	268,000	568,000	836,000

Note 1: Variable O&M includes fuel cost impacts.

Note 2: The current costs of ammonia and urea are highly volatile and may exceed the values used in this report.

APPENDIX A: CAPITAL COST ESTIMATE

1. BASIS OF ESTIMATES

2. CONCEPTUAL COST ESTIMATE SUMMARY SHEETS

Basis of Estimate

Estimates:
31813A – Lake Catherine, Unit 4 - Low NOx Burners and Over Fired Air
31814A – Lake Catherine, Unit 4 - SCR
31815A – Lake Catherine, Unit 4 - SNCR
31816A – White Bluff, Unit 1 - Low NOx Burners and Over Fired Air
31817A – White Bluff, Unit 1 – SCR
31818A – White Bluff, Unit 2 – SCR
31819A – White Bluff, Units 1 and 2 – SNCR
31820A – White Bluff, Auxiliary Boiler – Low NOx Burners, Over Fired Air, and Flue Gas Recirculation
31832A – White Bluff, Unit 2 - Low NOx Burners and Over Fired Air

General Information

Project Type – Compliance study for Lake Catherine Unit 4 and White Bluff Station Units 1&2.
Type of estimates – Conceptual Cost Estimate for the SCR Case and Order of Magnitude Cost Estimates for all other cases.
Project location – White Bluff: Close to Pine Bluff, Arkansas; Lake Catherine: Close to Mahern, AR
MW rating: White Bluff Unit 1: 815 MW, Unit 2: 844 MW; Lake Catherine Unit 4: 558 MW
Unique site issues – Existing Site.
Contracting strategy – Multiple Lump Sum.

The major components of the capital cost consist of equipment, field materials and supplies, direct labor, indirect field labor, and indirect construction costs. The capital cost was determined through the process of estimating the cost of equipment, components and bulk quantity.

The cost estimates are based largely on Sargent & Lundy LLC experience on similar projects. Detailed engineering has not been performed to firm up the project details, and specific site characteristics have not been fully analyzed. We have attempted to assign allowances where necessary to cover issues that are likely to arise but are not clearly quantified at this time.

Estimate Development

The cost estimates for the Low NOx Burners/Over Fired Air cases were based on a previous estimate prepared in 2011. Equipment costs were escalated to current pricing level. Also, material and labor have been updated to 2012 pricing.
Cost estimates for the SNCR technology (two cases) were based on budgetary quotes received from engineering and on previous estimates.
The cost estimates for the White Bluff SCR was mainly based on similar size and scope cost estimates from other projects and structural takeoffs from engineering. All equipment common to both Units was divided evenly between the two estimates.
The cost estimate for Lake Catherine SCR was adjusted from another cost estimate for a gas fired power station. White Bluff's auxiliary boiler cost estimate for Low NOx Burners/Over Fired Air/Flue Gas Recirculation was also adjusted from a similar project.

Pricing and Quantities

The data used to develop these estimates is based on using material and equipment types and sizes typically used in a power plant.
Equipment and material costs were estimated on the basis of S&L in house data, vendor catalogs, industry publications and other related projects. In most cases, the costs for bulk materials and equipment were derived from recent vendor or manufacturer's quote for similar items on other projects. Where actual or specific information regarding equipment specifications was available, that information was used to size and quantify material and equipment requirements. Where information was not furnished or was not adequate, requirements were assumed and estimated based on information available from project estimates of similar type and size.

Quantities contained herein are intended to be reasonable and representative of projects of this type. All quantity data was developed internally by S&L. Quantities were developed based on project experience of a plant of comparable size and then adjusted based on actual size and capacity differences and also taking into consideration the specific site layout based on the general arrangement drawing. While project specifics will certainly have an impact on these quantities, we feel they are appropriate for a study at this level.

Labor Wage Rates

Labor Profile – Union

Labor wage rate selected for the estimate - 2012 Union rates for Pine Bluff, Arkansas. Base craft rates are as published in RS Means Labor Rates for the Construction Industry, 2012 Edition. The craft rates are then incorporated into work crews appropriate for the activities by adding allowances for small tools, construction equipment, insurance, and site overheads to arrive at crew rates detailed in the cost estimate. A 1.15 regional labor productivity multiplier is included based on the Compass International Global Construction Yearbook.

Labor Work Schedule and Incentives - Assumed 5x10 work week for regular work and 7x10 work week for outage work. 10% of the work is assumed to be outage related.

Project Direct & Construction Indirect Costs

The estimate is constructed in such a manner where most of the direct construction costs are determined directly and several direct construction cost accounts are determined indirectly by taking a percentage of the directly determined costs and are identified as “Variable Accounts”. These percentages are based on our experience with similar type and size projects. Sales tax is specific to location. Listed below are the variable accounts.

- Cost of overtime – 5-10’s Hour Days and Outage Work at a 7-10 Schedule
- Subsistence (per diem) – not included
- Consumables – 0.5% of material and labor
- Freight on Equipment - included with equipment cost
- Freight on Material @ 5% of material
- Spare Parts – included with equipment costs
- Contractors G&A Expense @ 10%
- Contractors Profit @ 5%

Project Indirect Costs

Included are the following:

- Engineering, Procurement & Project Services varied depending on the size of the project estimated.
  - 31813A @ 19% of construction cost
  - 31814A @ 8% of construction cost
  - 31815A @ 8% of construction cost
  - 31816A @ 16% of construction cost
  - 31817A @ 6% of construction cost
  - 31818A @ 6% of construction cost
  - 31819A @ 8% of construction cost
  - 31820A @ 12% of construction cost
  - 31832A @ 16% of construction cost
- Construction Management varied depending on the size of the project estimated.
  - 31813A @ 6% of construction cost
  - 31814A @ 3% of construction cost
  - 31815A @ 2% of construction cost
  - 31816A @ 6% of construction cost
  - 31817A @ 2% of construction cost

- 31818A @ 2% of construction cost
- 31819A @ 2% of construction cost
- 31820A @ 0% of construction cost
- 31832A @ 6% of construction cost

- Craft start-up and commission support @ 1% of construction cost
- General Owner's Costs, including Owners Engineering & Bond Fees – not included
- EPC Fee – not included

These percentages are based on our experience with similar type and size projects.

Escalation

Not included.

Contingency

The contingency rates vary for each project based on the project's size. The rates are based on past history of similar projects. This rate relates to pricing and quantity variation in the specific scope estimated. The contingency does not cover new scope outside of what has been estimated, only the variation in the defined scope. This is a composite rate and already takes into account the plus and minuses of expected actual costs. The rate does not represent the high range of all costs, nor is it expected that the project will experience all actual costs be realized at the maximum value of their range of variation.

Exclusions

There are items that have been specifically excluded from the estimate. In order to establish the overall project costs, the following items must also be accounted for. This list is for information only and is not intended to be all inclusive.

- Permitting costs
- Rock excavation
- Remediation of soil for hazardous materials
- Power outage cost during construction

Assumptions

- No rock excavation, no dewatering
- Assumed that asbestos removal or lead paint abatement will not be required.
- No obstruction for the ammonia pipe routing. 6" clearing & grubbing of existing terrain is included, no tree removal.
- Directional boring underneath the existing railroad tracks is included, but with no major interferences or obstructions.
- Electrical equipment and wiring installation is based on non-hazardous location.
- Adjustments for plant unit size were made based on good engineering practice. Actual design and quantities may be significantly different than the quantities shown in the estimates.

Estimate Totals

Description	Amount	Totals	
Labor	331,677		
Material	125,263		
Subcontract	2,850,000		
Equipment			
Other	2,000,000		
	5,306,940	5,306,940	USD
91-1 Scaffolding	46,000		
91-2 OT Working 5-10 Hour Days	41,000		
91-3 OT Working 7-10 Hr Days			
91-4 Per Diem			
91-5 Consumables	2,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	6,000		
91-9 Freight on Process Equip.	100,000		
91-10 Sales Tax			
91-11 Contractor's G&A Expense	65,000		
91-12 Contractor's Profit	32,000		
	292,000	5,598,940	USD
93-1 EP&P Services	1,064,000		
93-2 CM Support	168,000		
93-3 Start-Up/Commissioning	56,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	1,288,000	6,886,940	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	50,000		
94-4 Contingency on Labor	145,000		
94-5 Contingency on Sub.	713,000		
94-6 Contingency on Equipment	525,000		
94-7 Contingency on Indirect	386,000		
	1,819,000	8,705,940	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		8,705,940	USD
98 - Interest During Constr			
		8,705,940	USD
Total		8,705,940	USD

Estimate Totals

Description	Amount	Totals	
Labor	19,780,000		
Material	15,815,652		
Subcontract	2,590,000		
Equipment			
Other	8,290,000		
	46,475,652	46,475,652	USD
91-1 Scaffolding			
91-2 OT Working 5-10 Hour Days			
91-3 OT Working 7-10 Hr Days			
91-4 Per Diem			
91-5 Consumables			
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material			
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense			
91-12 Contractor's Profit			
		46,475,652	USD
93-1 EP&P Services	3,718,100		
93-2 CM Support	1,394,300		
93-3 Start-Up/Commissioning	464,800		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	5,577,200	52,052,852	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	2,372,400		
94-4 Contingency on Labor	2,967,000		
94-5 Contingency on Sub.	388,500		
94-6 Contingency on Equipment	1,243,500		
94-7 Contingency on Indirect	836,600		
	7,808,000	59,860,852	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		59,860,852	USD
98 - Interest During Constr			
		59,860,852	USD
Total		59,860,852	USD

Estimate Totals

Description	Amount	Totals	
Labor	2,629,958		
Material	1,083,165		
Subcontract	80,600		
Equipment			
Other	6,193,056		
	9,986,779	9,986,779	USD
91-1 Scaffolding	445,600		
91-2 OT Working 5-10 Hour Days	311,700		
91-3 OT Working 7-10 Hr Days	99,200		
91-4 Per Diem			
91-5 Consumables	18,600		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	54,200		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	458,800		
91-12 Contractor's Profit	229,500		
	1,617,600	11,604,379	USD
93-1 EP&P Services	928,400		
93-2 CM Support	232,100		
93-3 Start-Up/Commissioning	116,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	1,276,500	12,880,879	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	390,000		
94-4 Contingency on Labor	1,209,300		
94-5 Contingency on Sub.	24,200		
94-6 Contingency on Equipment	619,300		
94-7 Contingency on Indirect	383,000		
	2,625,800	15,506,679	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		15,506,679	USD
98 - Interest During Constr			
		15,506,679	USD
Total		15,506,679	USD

Estimate Totals

Description	Amount	Totals	
Labor	653,648		
Material	306,347		
Subcontract	3,700,000		
Equipment			
Other			
	4,659,995	4,659,995	USD
91-1 Scaffolding	48,000		
91-2 OT Working 5-10 Hour Days	77,000		
91-3 OT Working 7-10 Hr Days	24,000		
91-4 Per Diem			
91-5 Consumables	5,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	15,000		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	112,000		
91-12 Contractor's Profit	55,000		
	336,000	4,995,995	USD
93-1 EP&P Services	799,000		
93-2 CM Support	300,000		
93-3 Start-Up/Commissioning	50,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	1,149,000	6,144,995	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	110,000		
94-4 Contingency on Labor	279,000		
94-5 Contingency on Sub.	925,000		
94-6 Contingency on Equipment			
94-7 Contingency on Indirect	345,000		
	1,659,000	7,803,995	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		7,803,995	USD
98 - Interest During Constr			
		7,803,995	USD
Total		7,803,995	USD

Estimate Totals

Description	Amount	Totals	
Labor	2,255,791		
Material	1,089,242		
Subcontract	68,100		
Equipment			
Other	1,948,100		
	5,361,233	5,361,233	USD
91-1 Scaffolding	368,000		
91-2 OT Working 5-10 Hour Days	267,300		
91-3 OT Working 7-10 Hr Days	85,100		
91-4 Per Diem			
91-5 Consumables	16,700		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	54,500		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	408,200		
91-12 Contractor's Profit	204,100		
	1,403,900	6,765,133	USD
93-1 EP&P Services	541,200		
93-2 CM Support	135,300		
93-3 Start-Up/Commissioning	67,700		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	744,200	7,509,333	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	392,100		
94-4 Contingency on Labor	1,032,500		
94-5 Contingency on Sub.	20,400		
94-6 Contingency on Equipment	194,800		
94-7 Contingency on Indirect	223,300		
	1,863,100	9,372,433	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		9,372,433	USD
98 - Interest During Constr			
		9,372,433	USD
Total		9,372,433	USD

Estimate Totals

Description	Amount	Totals	
Labor	56,778,212		
Material	34,013,262		
Subcontract	8,156,000		
Equipment			
Other	21,324,260		
	120,271,734	120,271,734	USD
91-1 Scaffolding	2,270,000		
91-2 OT Working 5-10 Hour Days	6,730,000		
91-3 OT Working 7-10 Hr Days	2,142,000		
91-4 Per Diem			
91-5 Consumables	454,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	1,701,000		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	10,238,000		
91-12 Contractor's Profit	5,120,000		
	28,655,000	148,926,734	USD
93-1 EP&P Services	8,936,000		
93-2 CM Support	2,979,000		
93-3 Start-Up/Commissioning	1,489,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	13,404,000	162,330,734	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	8,163,000		
94-4 Contingency on Labor	15,726,000		
94-5 Contingency on Sub.	1,631,000		
94-6 Contingency on Equipment	4,265,000		
94-7 Contingency on Indirect	2,681,000		
	32,466,000	194,796,734	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		194,796,734	USD
98 - Interest During Constr			
		194,796,734	USD
Total		194,796,734	USD

Estimate Totals

Description	Amount	Totals	
Labor	653,648		
Material	306,347		
Subcontract	3,700,000		
Equipment			
Other	2,600,000		
	7,259,995	7,259,995	USD
91-1 Scaffolding	48,000		
91-2 OT Working 5-10 Hour Days	77,000		
91-3 OT Working 7-10 Hr Days	24,000		
91-4 Per Diem			
91-5 Consumables	5,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	15,000		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	112,000		
91-12 Contractor's Profit	55,000		
	336,000	7,595,995	USD
93-1 EP&P Services	1,215,000		
93-2 CM Support	456,000		
93-3 Start-Up/Commissioning	76,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	1,747,000	9,342,995	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	110,000		
94-4 Contingency on Labor	279,000		
94-5 Contingency on Sub.	925,000		
94-6 Contingency on Equipment	650,000		
94-7 Contingency on Indirect	524,000		
	2,488,000	11,830,995	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		11,830,995	USD
98 - Interest During Constr			
		11,830,995	USD
Total		11,830,995	USD

Estimate Totals

Description	Amount	Totals	
Labor	2,255,791		
Material	1,089,242		
Subcontract	68,100		
Equipment			
Other	1,948,100		
	5,361,233	5,361,233	USD
91-1 Scaffolding	368,000		
91-2 OT Working 5-10 Hour Days	267,300		
91-3 OT Working 7-10 Hr Days	85,100		
91-4 Per Diem			
91-5 Consumables	16,700		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	54,500		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	408,200		
91-12 Contractor's Profit	204,100		
	1,403,900	6,765,133	USD
93-1 EP&P Services	541,200		
93-2 CM Support	135,300		
93-3 Start-Up/Commissioning	67,700		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	744,200	7,509,333	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	392,100		
94-4 Contingency on Labor	1,032,500		
94-5 Contingency on Sub.	20,400		
94-6 Contingency on Equipment	194,800		
94-7 Contingency on Indirect	223,300		
	1,863,100	9,372,433	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		9,372,433	USD
98 - Interest During Constr			
		9,372,433	USD
Total		9,372,433	USD

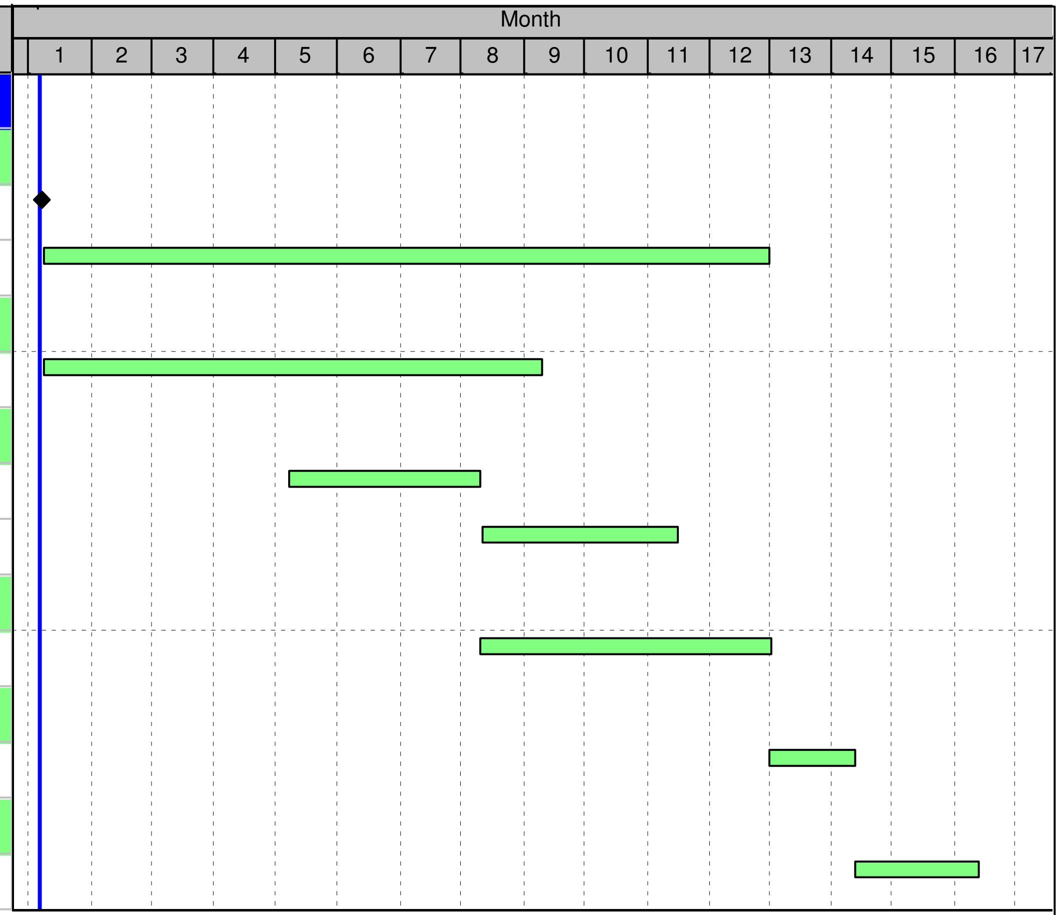
Estimate Totals

Description	Amount	Totals	
Labor	48,597,255		
Material	26,751,692		
Subcontract	6,577,640		
Equipment			
Other	21,324,260		
	103,250,847	103,250,847	USD
91-1 Scaffolding	1,884,000		
91-2 OT Working 5-10 Hour Days	5,759,000		
91-3 OT Working 7-10 Hr Days	1,834,000		
91-4 Per Diem			
91-5 Consumables	377,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	1,338,000		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	8,520,000		
91-12 Contractor's Profit	4,261,000		
	23,973,000	127,223,847	USD
93-1 EP&P Services	7,633,000		
93-2 CM Support	2,544,000		
93-3 Start-Up/Commissioning	1,272,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	11,449,000	138,672,847	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	6,421,000		
94-4 Contingency on Labor	13,444,000		
94-5 Contingency on Sub.	1,316,000		
94-6 Contingency on Equipment	4,265,000		
94-7 Contingency on Indirect	2,290,000		
	27,736,000	166,408,847	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		166,408,847	USD
98 - Interest During Constr			
		166,408,847	USD
Total		166,408,847	USD

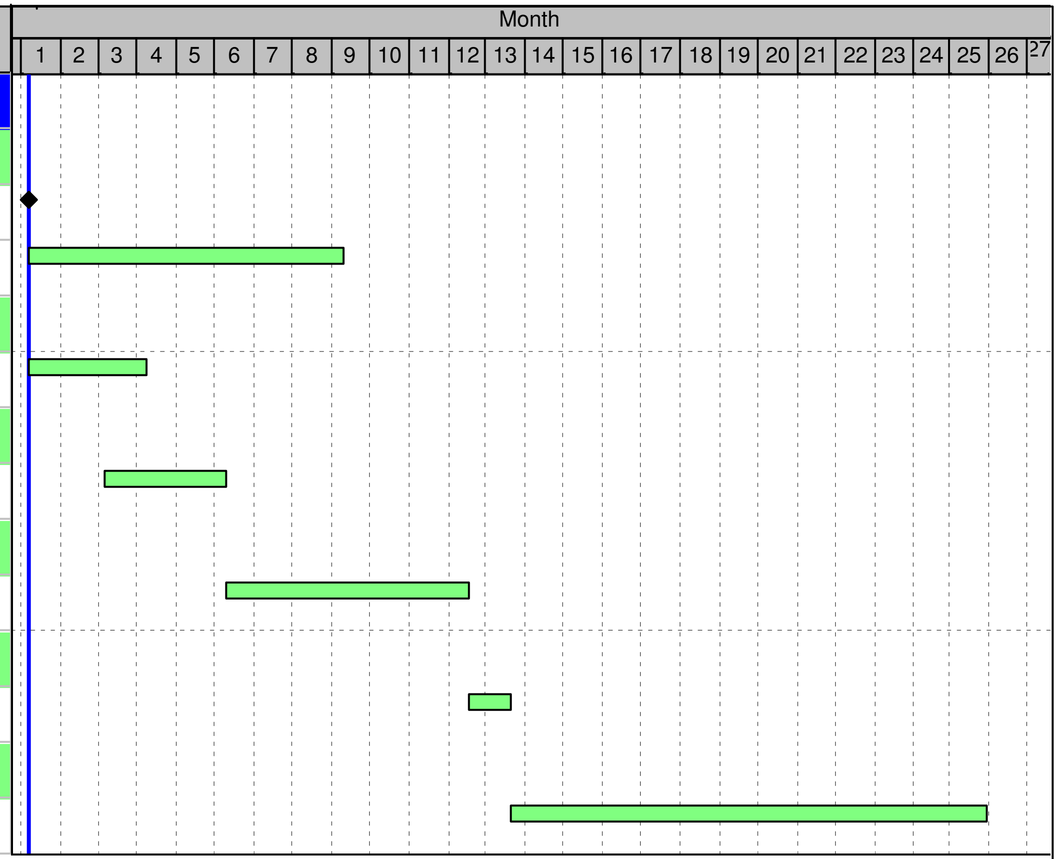
APPENDIX B

1. ESTIMATED PROJECT SCHEDULES

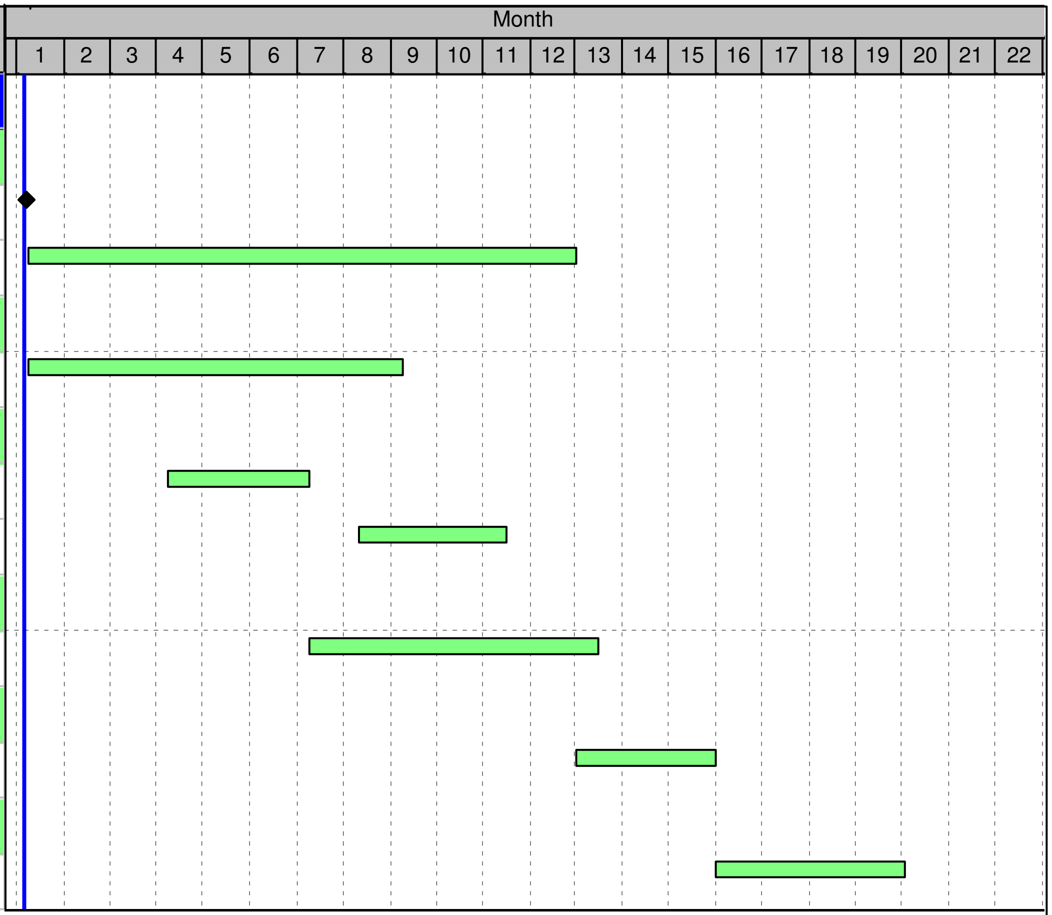
Activity ID	Activity Name	Org Dur (months)
	Entergy - NOx Strategy Study - Aux Boiler (LNB/OFA/F...	15m
	Permitting	12m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	12m
	Engineering	8m
A1020	Engineering	8m
	Procurement of Major Equipment	6m
A1030	LNB/OFA Spec - Prep/Bid/Eval/Award	3m
A1070	GWC Spec - Prep/Bid/Eval/Award	3m
	Vendor Engineering/Fab/Delivery	5m
A1040	LNB/OFA Vendor Engineering/Fabrication/Delivery	5m
	Installation	1m
A1050	Installation	1m
	Commissioning & Start-Up	2m
A1060	Commissioning & Start-Up	2m



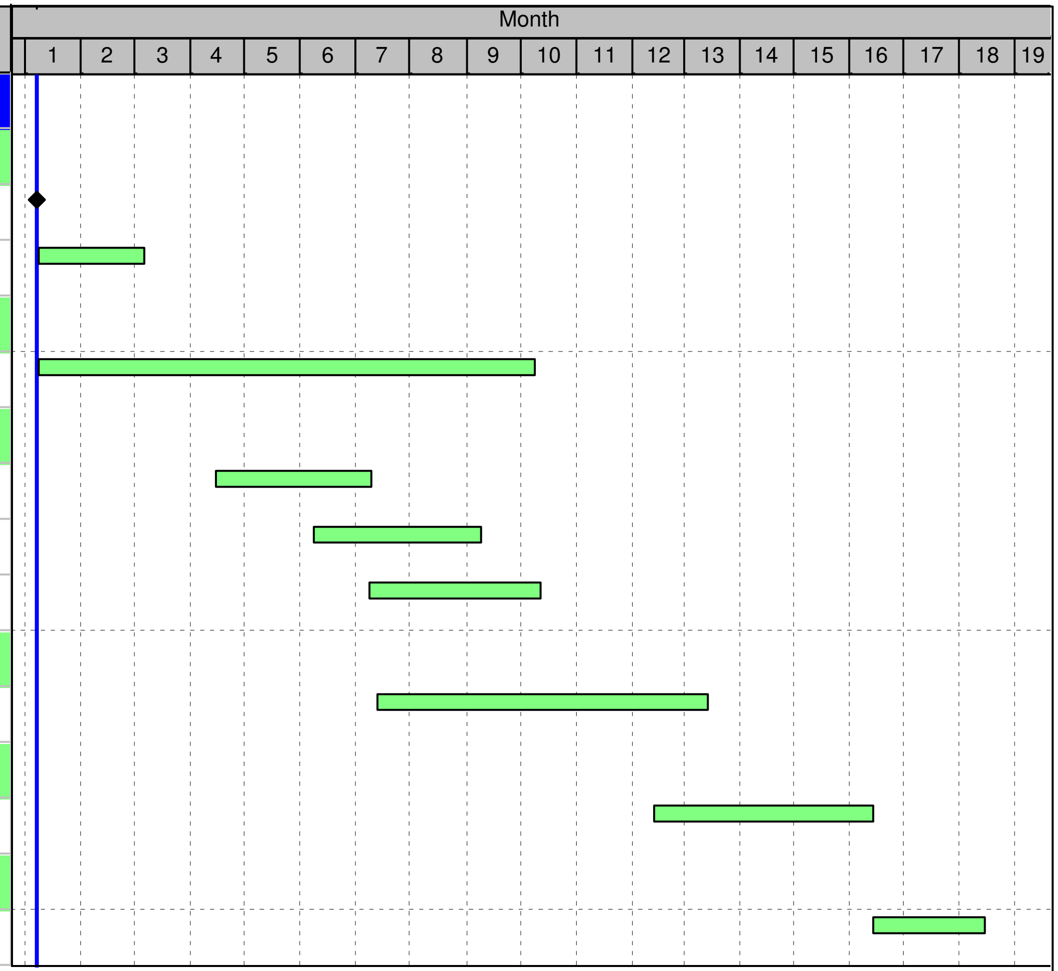
Activity ID	Activity Name	Org Dur (months)
Entergy - NOx Strategy Study - Neural Network		24m
Permitting		8m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	8m
Engineering		3m
A1020	Engineering	3m
Procurement of Major Equipment		3m
A1030	Neural Network Spec - Prep/Bid/Eval/Award	3m
Vendor Engineering/Fab/Delivery		6m
A1040	NN Vendor Engineering/Fabrication/Delivery	6m
Installation		1m
A1050	Installation	1m
Commissioning & Start-Up		12m
A1060	Commissioning & Start-Up	12m



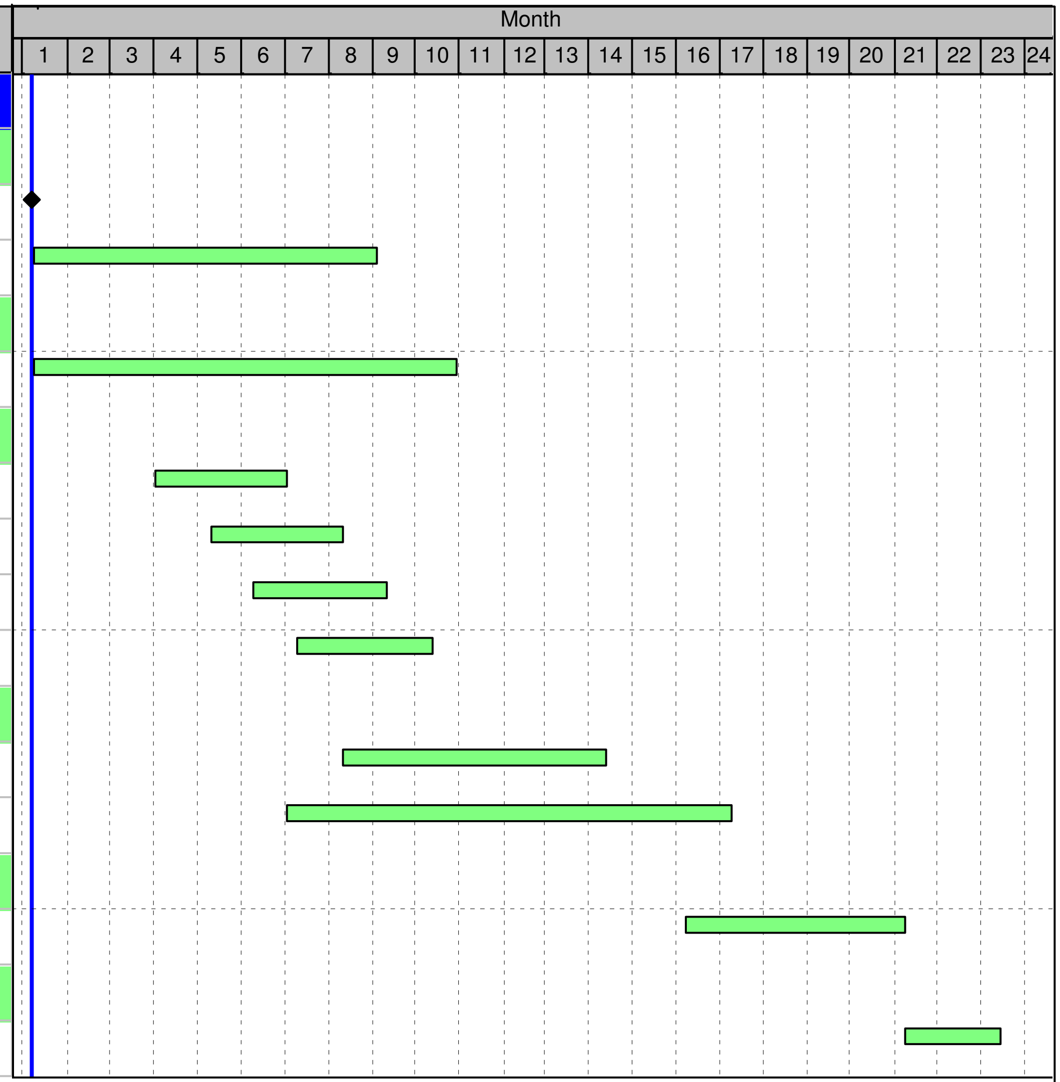
Activity ID	Activity Name	Org Dur (months)
	Entergy - NOx Strategy Study - Low NOx Burners/Over ...	19m
	Permitting	12m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	12m
	Engineering	8m
A1020	Engineering	8m
	Procurement of Major Equipment	7m
A1030	LNB/OFA Spec - Prep/Bid/Eval/Award	3m
A1070	GWC Spec - Prep/Bid/Eval/Award	3m
	Vendor Engineering/Fab/Delivery	6m
A1040	LNB/OFA Vendor Engineering/Fabrication/Delivery	6m
	Installation	3m
A1050	Installation	3m
	Commissioning & Start-Up	4m
A1060	Commissioning & Start-Up	4m



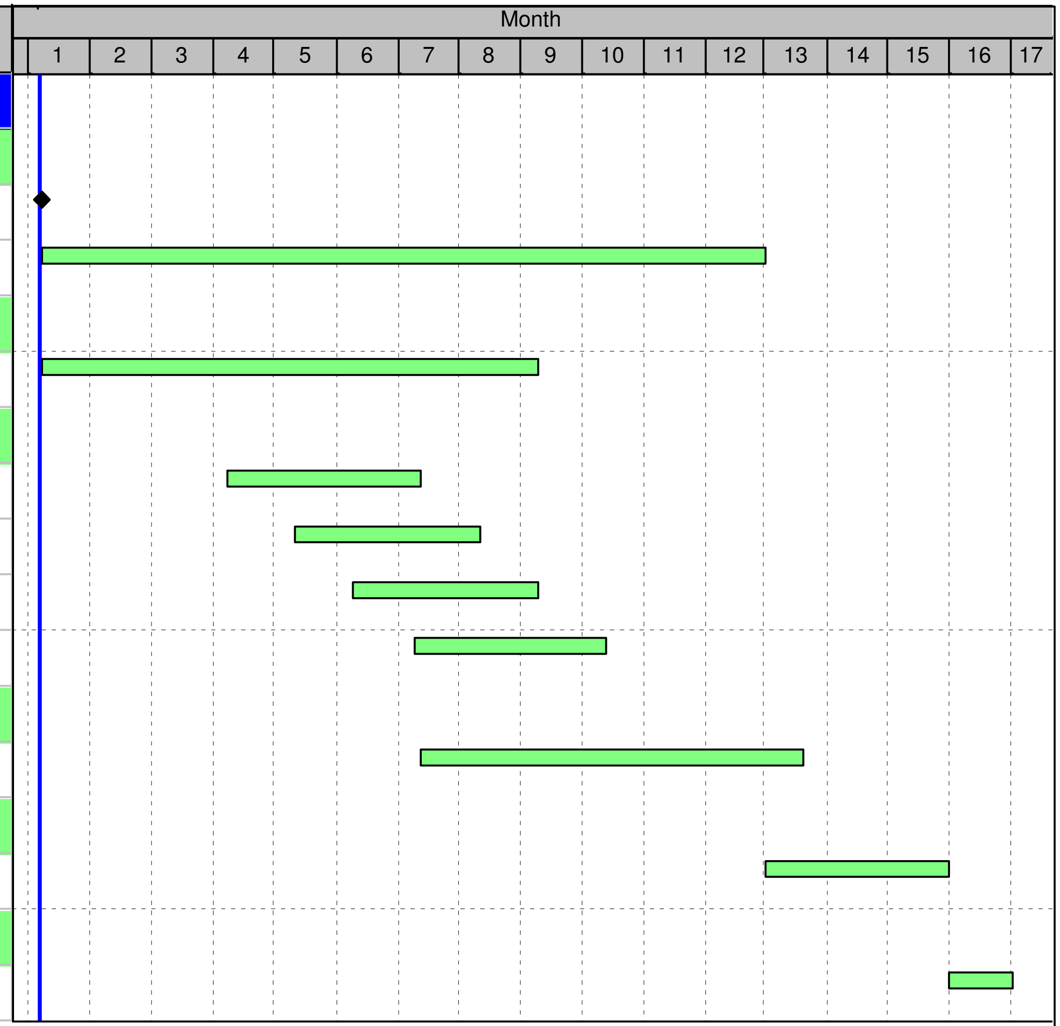
Activity ID	Activity Name	Org Dur (months)
Entergy - NOx Strategy Study - Induced Flue Gas Recir...		17m
Permitting		2m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	2m
Engineering		9m
A1020	BOP Engineering	9m
Procurement of Major Equipment		6m
A1140	FGR Duct Procurement Spec - Prep/Bid/Eval/Award	3m
A1030	Mech Install Spec - Prep/Bid/Eval/Award	3m
A1120	Elec Install Spec - Prep/Bid/Eval/Award	3m
Vendor Engineering/Fab/Delivery		6m
A1040	FGR Duct Vendor Engineering/Fabrication/Delivery	6m
Installation		4m
A1050	Installation	4m
Commissioning & Start-Up		2m
A1060	Commissioning & Start-Up	2m



Activity ID	Activity Name	Org Dur (months)
	Entergy - NOx Strategy Study - Flue Gas Recirculation ...	22m
	Permitting	8m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	8m
	Engineering	10m
A1020	BOP Engineering	10m
	Procurement of Major Equipment	6m
A1150	FGR Fan Procurement Spec - Prep/Bid/Eval/Award	3m
A1140	FGR Duct Procurement Spec - Prep/Bid/Eval/Award	3m
A1030	Mech Install Spec - Prep/Bid/Eval/Award	3m
A1120	Elec Install Spec - Prep/Bid/Eval/Award	3m
	Vendor Engineering/Fab/Delivery	10m
A1040	FGR Duct Vendor Engineering/Fabrication/Delivery	6m
A1160	FGR Fan Vendor Engineering/Fabrication/Delivery	10m
	Installation	5m
A1050	Installation	5m
	Commissioning & Start-Up	2m
A1060	Commissioning & Start-Up	2m



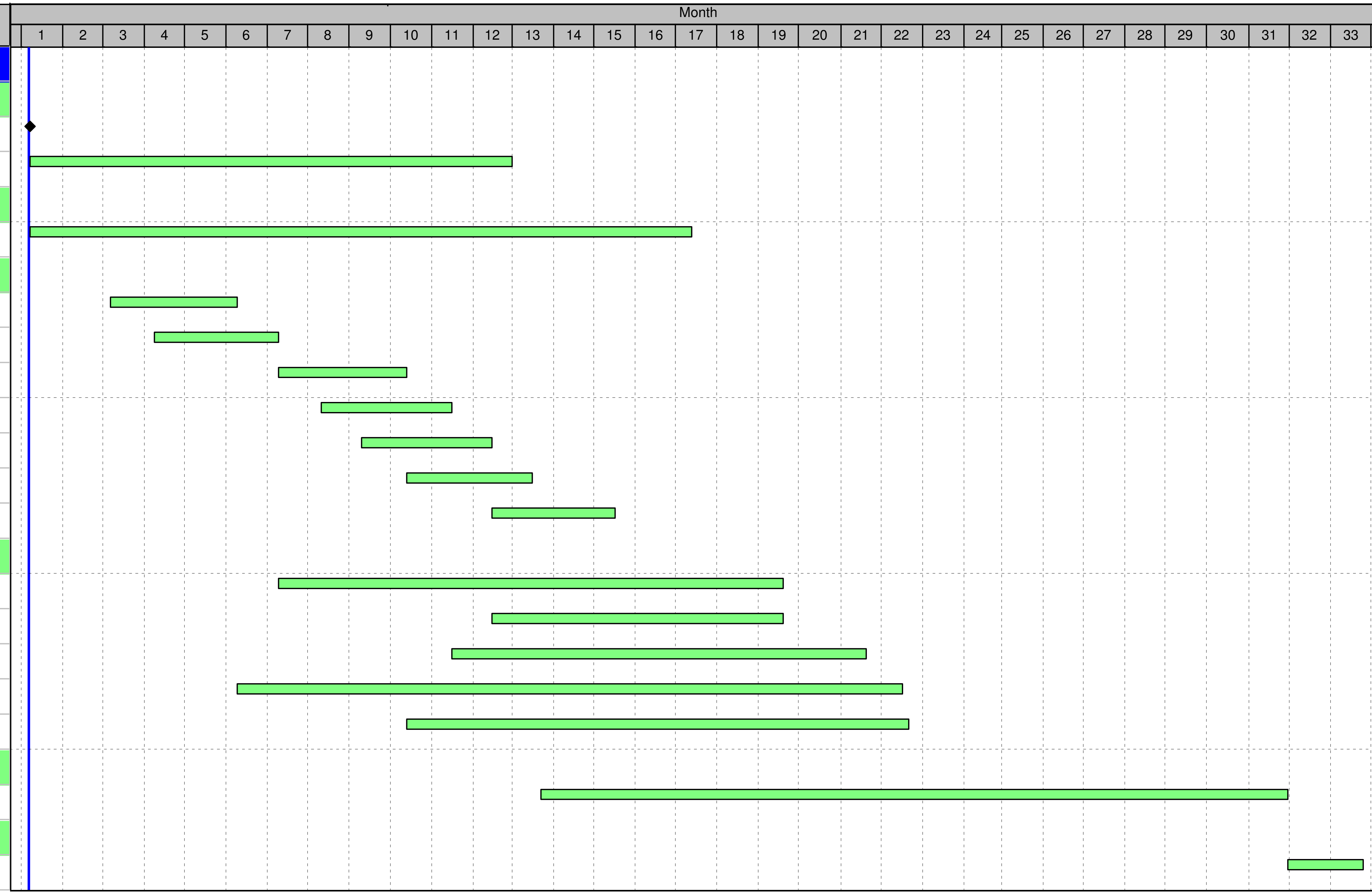
Activity ID	Activity Name	Org Dur (months)
	Entergy - NOx Strategy Study - Selective Non-Catalytic ...	16m
	Permitting	12m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	12m
	Engineering	8m
A1020	BOP Engineering	8m
	Procurement of Major Equipment	6m
A1030	SNCR Spec - Prep/Bid/Eval/Award	3m
A1070	Civil/Structural Installation Spec - Prep/Bid/Eval/Award	3m
A1080	Mech Installation Spec - Prep/Bid/Eval/Award	3m
A1090	Elec/I&C Installation Spec - Prep/Bid/Eval/Award	3m
	Vendor Engineering/Fab/Delivery	6m
A1040	SNCR Vendor Engineering/Fabrication/Delivery	6m
	Installation	3m
A1050	Installation	3m
	Commissioning & Start-Up	1m
A1060	Commissioning & Start-Up	1m



Run Date: 09-14-12

NOx Control Technology Cost and Performance Study for Entergy Services, Inc. White Bluff and Lake Catherine Selective Non-Catalytic Reduction (SNCR)

Activity ID	Activity Name	Org Dur (months)
Entergy - NOx Strategy Study - Selective Catalytic Red...		32m
Permitting		12m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	12m
Engineering		16m
A1020	BOP Engineering	16m
Procurement of Major Equipment		12m
A1140	Ammonia Injection System Procurement Spec - Prep/Bid/Eval/Award	3m
A1150	Catalyst Procurement Spec - Prep/Bid/Eval/Award	3m
A1170	Fan Spec - Prep/Bid/Eval/Award	3m
A1190	Ductwork Spec - Prep/Bid/Eval/Award	3m
A1130	Structural Steel Spec - Prep/Bid/Eval/Award	3m
A1030	Mech Install Spec - Prep/Bid/Eval/Award	3m
A1120	Elec Install Spec - Prep/Bid/Eval/Award	3m
Vendor Engineering/Fab/Delivery		16m
A1160	Catalyst Vendor Engineering/Fabrication/Delivery	12m
A1210	Structural Steel Vendor Engineering/Fabrication/Delivery	7m
A1200	Ductwork Vendor Engineering/Fabrication/Delivery	10m
A1040	Ammonia Injection System Vendor Engineering/Fabrication/Delivery	16m
A1180	Fan Vendor Engineering/Fabrication/Delivery	12m
Installation		18m
A1050	Installation	18m
Commissioning & Start-Up		2m
A1060	Commissioning & Start-Up	2m



APPENDIX C

1. OPERATING AND MAINTENANCE COST ESTIMATES

Unit Name White Bluff 1

Unit Data		Reagent Costs	
Size (Gross kW)	815,000	Aq.Ammonia $/t	$700
Average NOx Emission Rate (lb/MMBtu at full load)	**0.33**	An.Ammonia $/t	$400
Nominal Max. Boiler Heat Input (mmBtu/hr)	8,950.0	Urea $/t	$350
Avg. Heat Rate (Btu/kwh)	10,981.6	N/F-T Urea $/t	$618
Aux. Power (kw)	-	Coal Cost, $/Mbtu	2.650
Est. Capacity Factor (%)	76.00		
Boiler Type	T/F	Water Cost, $/1000 gal (3)	2
Boiler Eff. (%)	84	Electricity, $/MWh	41.50
Estimated NOx, tons/day Max	**26.936**		
Emission Limit, tons	-		
NOx Sales/Buy rate, $/ton	-		
Fuel -	PRB		
Seasonal Days	153		
Basis	0		
Analysis - Enter "0" for Annual and 1 for Seasonal			
CF For Variable O&M	76.00		

Technology	Estimated Reduction from Baseline	Emission Rate After Control	Tons of NOx Emission, Seasonal/Annual	Tons of NOx Removed, season/annual	Estimated Capital Cost		Operating & Maintenance Cost: Fixed O&M	Variable O&M, season or yr	Fuel Impact, season or yr
	%	(lb/mmBtu)	tons	tons	$/kW	$/unit	$/yr	$/@CF	$/@CF
LNB + OFA (Note 5)	54.5	0.15	4,469	5,363	9.6	$7,804,000	$142,000	$0	$0
Neural Net	10.0	0.30	8,848	983	0.3	$250,000	$50,000	$0	$0
Full SNCR	26.5	0.24	7,229	2,602	11.5	$9,372,000	$169,000	$5,377,000	$281,000
LNB+OFA+Full SNCR	61.4	0.13	3,799	6,033	20.0	$16,290,000	$311,000	$4,154,000	$384,000
LNB+OFA+Full SCR	83.3	0.055	1,639	8,193	248.6	$202,601,000	$608,000	$2,836,000	$0

(1) Aux. Power cost is calculated based on variation in capacity factor
(2) Assumed water cost of $2/1000 gallons.
(3) Assumed that 15% urea will be used for SNCR technology.
(4) Assumed that initial catalyst life is 12,000 hours
(5) LNB/OFA material already purchased for Unit 1. The total cost to Entergy would be the same for Unit 1 as shown for Unit 2.
(6) For SCR technology, the variable O&M costs are based on operating at NOx outlet emissions marginally below the compliance emission rate.

NO_X Compliance Costs

Unit Name White Bluff 2

Unit Data		Reagent Costs	
Size (Gross kW)	844,000	Aq.Ammonia $/t	$700
Average NOx Emission Rate (lb/MMBtu at full load)	**0.39**	An.Ammonia $/t	$400
Nominal Max. Boiler Heat Input (mmBtu/hr)	8,950.0	Urea $/t	$350
Avg. Heat Rate (Btu/kwh)	10,604.3	N/F-T Urea $/t	$618
Aux. Power (kw)	-	Coal Cost, $/Mbtu	2.650
Est. Capacity Factor (%)	76.00		
Boiler Type	T/F	Water Cost, $/1000 gal (3)	2
Boiler Eff. (%)	84	Electricity, $/MWh	41.50
Estimated NOx, tons/day Max	**31.833**		
Emission Limit, tons	-		
NOx Sales/Buy rate, $/ton	-		
Fuel -	PRB		
Seasonal Days	153		
Basis	0		
Analysis - Enter "0" for Annual and 1 for Seasonal			
CF For Variable O&M	76.00		

Technology	Estimated Reduction from Baseline	Emission Rate After Control	Tons of NOx Emission, Seasonal/Annual	Tons of NOx Removed, season/annual	Estimated Capital Cost		Operating & Maintenance Cost: Fixed O&M	Variable O&M, season or yr	Fuel Impact, season or yr
	%	(lb/mmBtu)	tons	tons	$/kW	$/unit	$/yr	$/@CF	$/@CF
LNB + OFA	61.5	0.15	4,469	7,150	14.0	$11,831,000	$142,000	$0	$0
Neural Net	10.0	0.35	10,457	1,162	0.3	$250,000	$50,000	$0	$0
Full SNCR	26.5	0.29	8,544	3,076	11.1	$9,372,000	$169,000	$6,338,000	$333,000
LNB+OFA+Full SNCR	67.3	0.13	3,799	7,821	24.1	$20,317,000	$311,000	$4,158,000	$384,000
LNB+OFA+Full SCR	85.9	0.055	1,639	9,981	211.2	$178,240,000	$608,000	$2,858,000	$0

(1) Aux. Power cost is calculated based on variation in capacity factor
(2) Assumed water cost of $2/1000 gallons.
(3) Assumed that 15% urea will be used for SNCR technology.
(4) Assumed that initial catalyst life is 12,000 hours
(5) For SCR technology, the variable O&M costs are based on operating at NOx outlet emissions marginally below the compliance emission rate.

NO_X Compliance Costs

Unit name Lake Catherine Unit 4

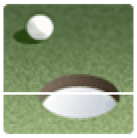
Unit Data		Reagent Costs	
Size (Gross kW)	558,000	Aq.Ammonia $/t	$700
Average NOx Emission Rate (lb/MMBtu)	0.4825	An.Ammonia $/t	$400
Nominal Max. Boiler Heat Input (mmBtu/hr)	5,850.0	Urea $/t	$350
Avg. Heat Rate (Btu/kwh)	10,483.9	N/F-T Urea $/t	$618
Aux. Power (kw)	-	Gas Cost, $/MBtu	4.900
Est. Capacity Factor (%)	10.00	Water Cost, $/1000 gal (3)	2
Boiler Type	T/F	Electricity, $/MWh	41.50
Boiler Eff. (%)	82		
Estimated NOx, tons/day Max	3.387		
Emission Limit, tons	-		
NOx Sales/Buy rate, $/ton	2500.0		
Fuel	Gas		
Seasonal Days	153		
Basis	0		
Analysis - Enter "0" for Annual and 1 for Seasonal			
CF For Variable O&M	10.00		

Technology	Estimated Reduction from Baseline	Emission Rate After Control	Tons of NOx Emission, Seasonal/Annual	Tons of NOx Removed, season/annual	Estimated Capital Cost		Operating & Maintenance Cost: Fixed O&M	Variable O&M, season or yr	Fuel Impact, season or yr
	%	(lb/mmBtu)	tons	tons	$/kW	$/unit	$/yr	$/@CF	$/@CF
Baseline	0	0.4825							
BOOS (at 558 MW)	50.0	0.24	618	618	1.6	$893,000	$21,000	$0	$0
LNB + OFA	60.0	0.19	495	742	15.7	$8,762,000	$210,000	$0	$0
SCR	90.0	0.05	124	1,113	106.8	$59,587,000	$358,000	$254,000	$0
SNCR	40.0	0.29	742	495	27.8	$15,507,000	$279,000	$1,542,000	$98,000
Water Injection	9.1	0.44	1,124	113	3.9	$2,177,000	$52,000	$18,000	$468,000
IFGR (below 500 MW)	19.0	0.39	1,001	235	3.9	$2,166,000	$52,000	$0	$0
FGR	60.0	0.19	495	742	20.6	$11,489,000	$207,000	$142,000	$0
LNB/OFA + SNCR	70.0	0.14	371	865	43.5	$24,269,000	$489,000	$393,000	$69,000
LNB/OFA + SCR	94.0	0.03	74	1,162	122.5	$68,349,000	$568,000	$268,000	$0

(1) Aux. Power cost is calculated based on variation in capacity factor
(2) Assumed water cost of $2/1000 gallons.
(3) Assumed that 15% urea will be used for SNCR technology.
(4) Assumed that initial catalyst life is 40,000 hours.
(5) Water Injection is used only for trimming at high load. Approximately 66% of Hours are affected.
(6) For SCR technology, the variable O&M costs are based on operating at NOx outlet emissions marginally below the compliance emission rate.

APPENDIX D

1. BOOS AT FULL UNIT LOAD



To: DAVID H PARK/Sargentlundy@Sargentlundy,
Cc:
Bcc:
Subject: Fw: BOOS for NOx Control
From: STEVE M KATZBERGER/Sargentlundy - Thursday 03/28/2013 03:32 PM

From: Stephen Wood [mailto:swood@etecinc.net]
Sent: Monday, March 25, 2013 2:20 PM
To: HANTZ, JOSEPH
Subject: BOOS for NOx Control

Joe,

The attached PDF file contains background information on utilizing burners out of service for NOx control, as well as, predicted Lake Catherine Unit 4 burner header pressures and NOx emissions, utilizing the top burner elevation out of service (4BOOS). If you have any questions, please let me know.

Regards,

Steve Wood
Principal Officer
Entropy Technology & Environmental Consultants, Inc. (ETEC Inc.)
12337 Jones Rd. Suite 414
Houston, TX 77070
Ph: 281-807-7007
Cell: 713-253-8230
Fax: 281-807-1414
Website: www.etecinc.net

 BOOS for NOx Control.pdf

Combustion Modification (BOOS) for NOx Control

Implementation of Burner Out Of Service (BOOS) operation is a practical and cost-effective means for achieving staged combustion (i.e., modifying burner stoichoimetry to reduce NOx emissions formation) on an existing gas/oil fired electric utility boiler. Utilizing BOOS operation for NOx control is well documented in the literature, e.g., EPA 456/F-99-006R "Nitrogen Oxides (NOx), Why And How They Are Controlled", November 1999, and EPRI TR-108181 "Retrofit NOx Control Guidelines for Gas- and Oil-Fired Boilers, Version 2.0", June 1997, among numerous others.

The technique of BOOS operation involves terminating the fuel flow to selected burners on the top elevation while leaving the air registers open. The remaining burners operate fuel-rich, thereby limiting oxygen availability, lowering peak flame temperatures, and reducing NOx formation. The un-reacted products combine with the air from the above terminated-fuel burners to complete burnout before exiting the furnace. I have personally been involved with implementing BOOS operation on virtually every gas fired electric utility boiler design across the country since the mid 1970's. In almost every case, the original "high" burner header pressure (BHP) set point had to be increased to accommodate BOOS operation. No adverse operational or maintenance problems corresponding to BOOS implementation have been reported.

BOOS operation can be a very effective NOx reduction technology, depending on the degree of staging, as shown for Ninemile Unit 4 (750 mw CE Tangential Fired) in Figure 1. The corresponding BOOS pattern is shown in Figure 2. The BHP corresponding to 4BOOS operation on Lake Catherine Unit 4 is shown in Figure 3. The "High" BHP set point would need to be increased from 42 to 50 psig. The predicted NOx emissions corresponding to 4BOOS operation are presented in Figure 4.

Figure 1- Stoichiometry Modification (BOOS) NOx Reduction

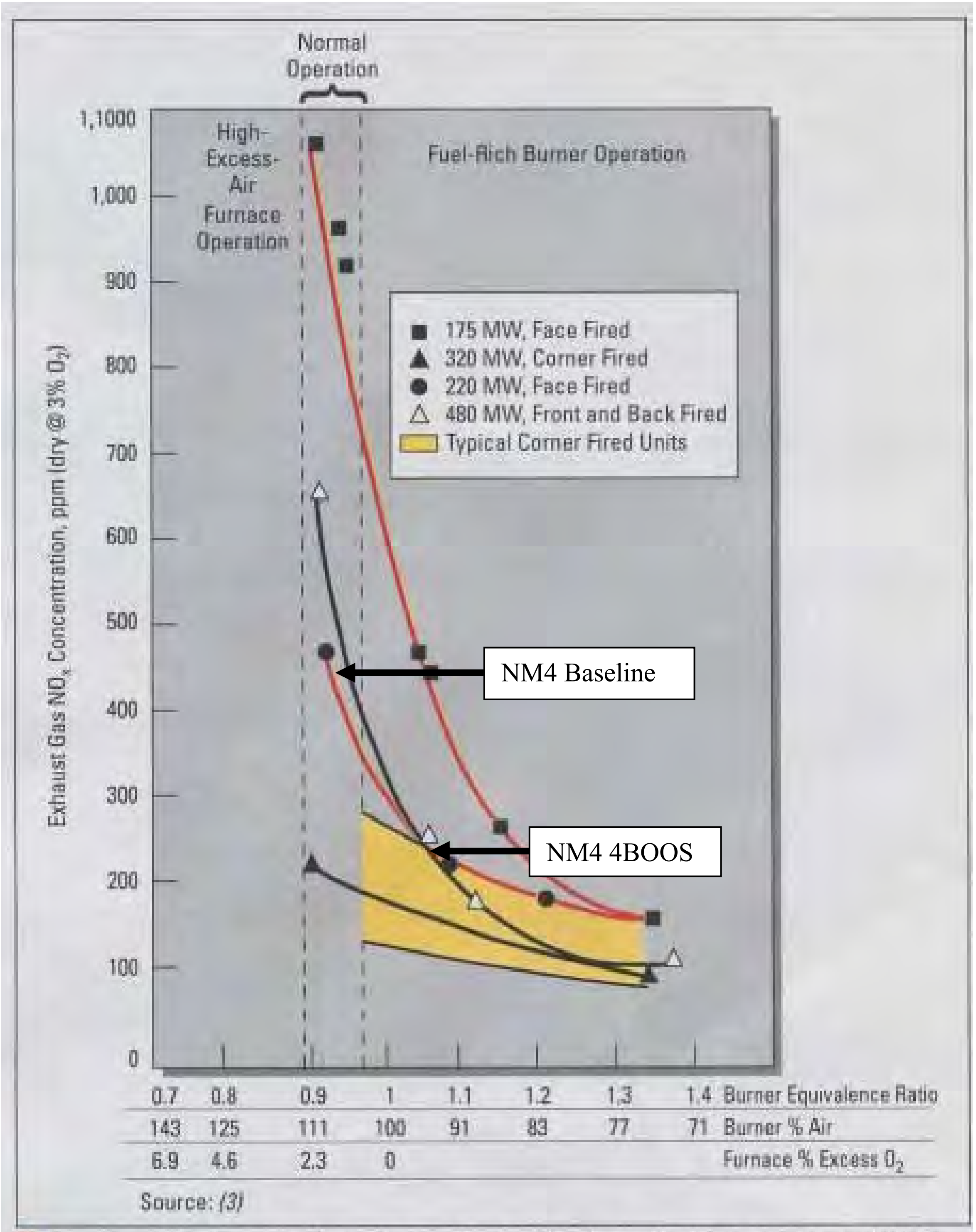


Figure 2. Burners-out-of-service can be an effective combustion staging technique.

Figure 2- Ninemile Units 4 and 5 BOOS Pattern
(Top Elevation Out of Service & Air Registers Open)

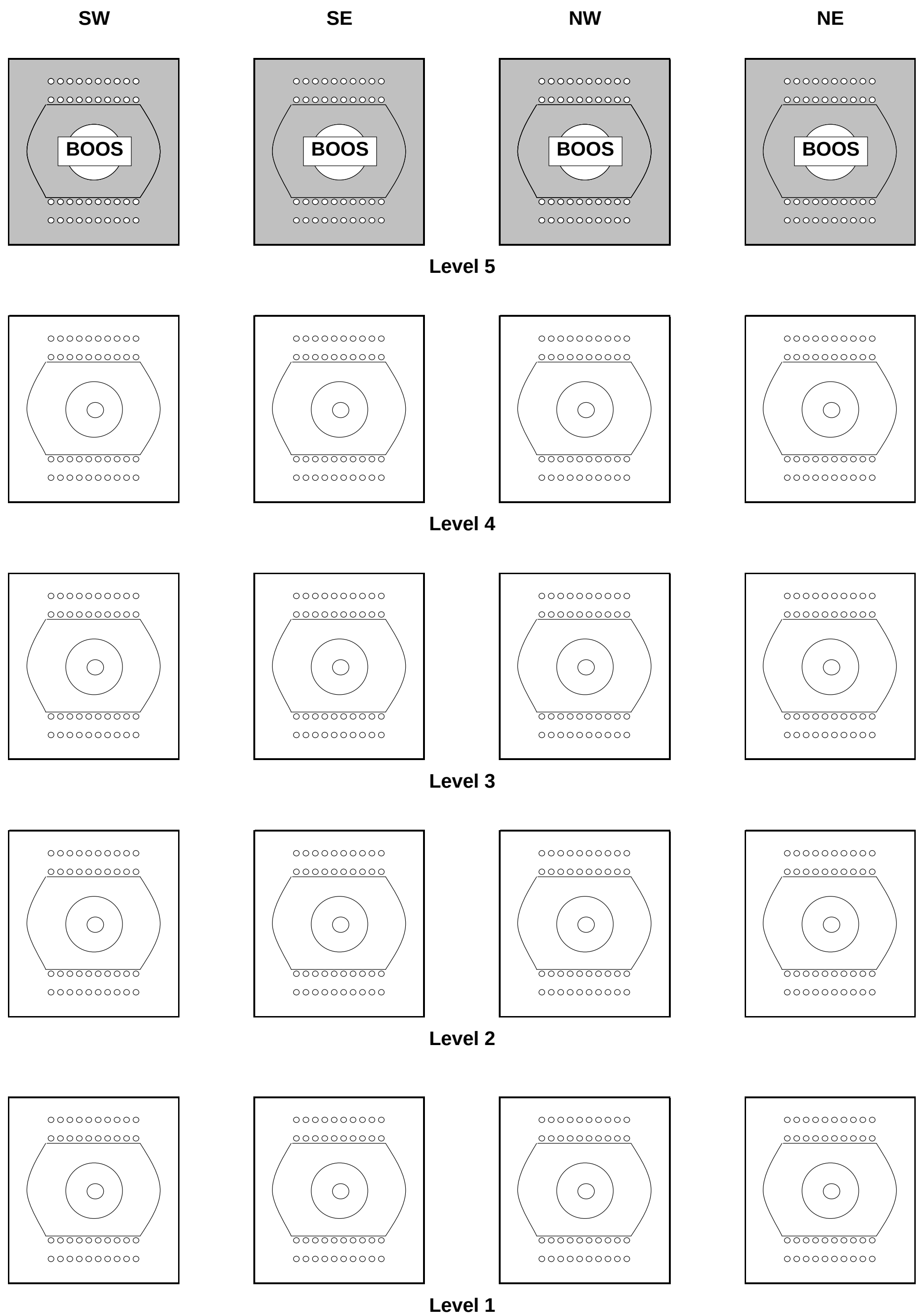


Figure 3- Lake Catherine Unit 4 Burner Header Pressure

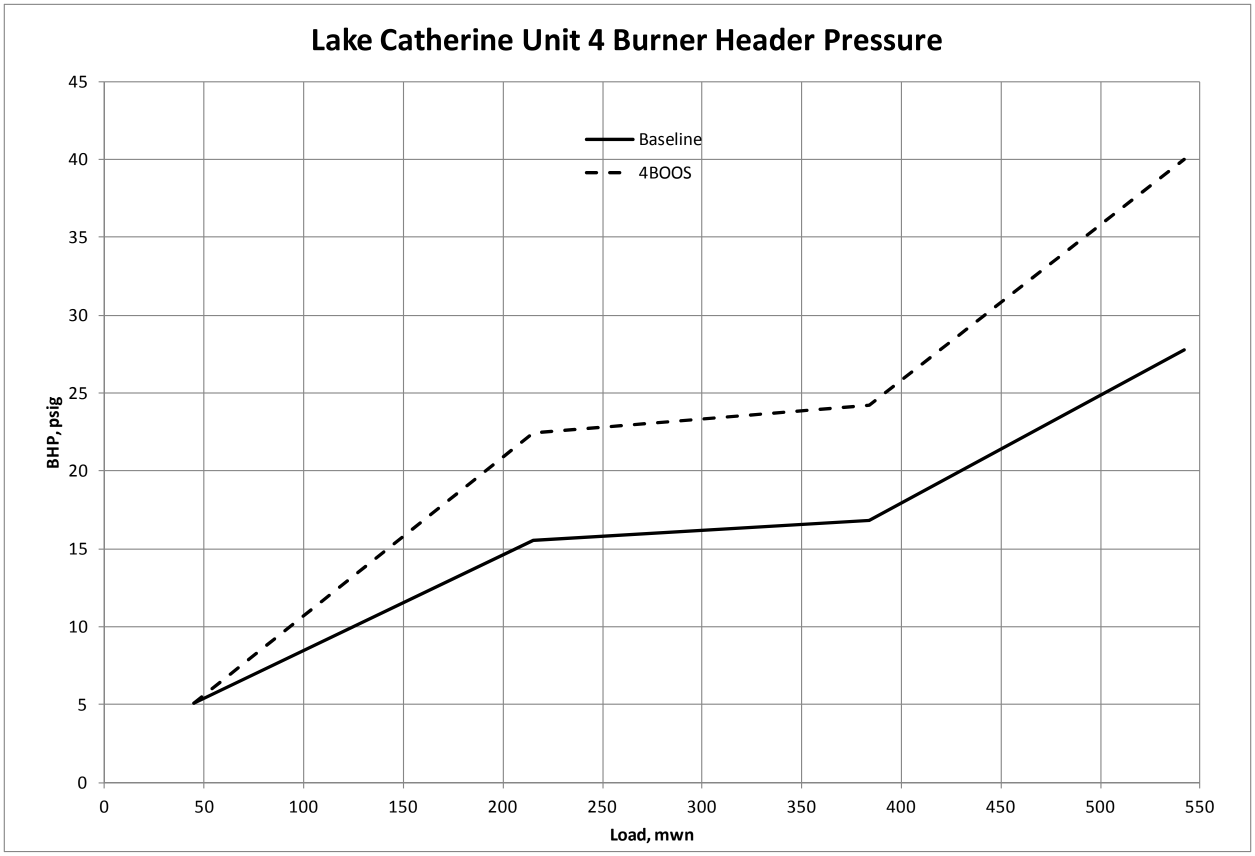
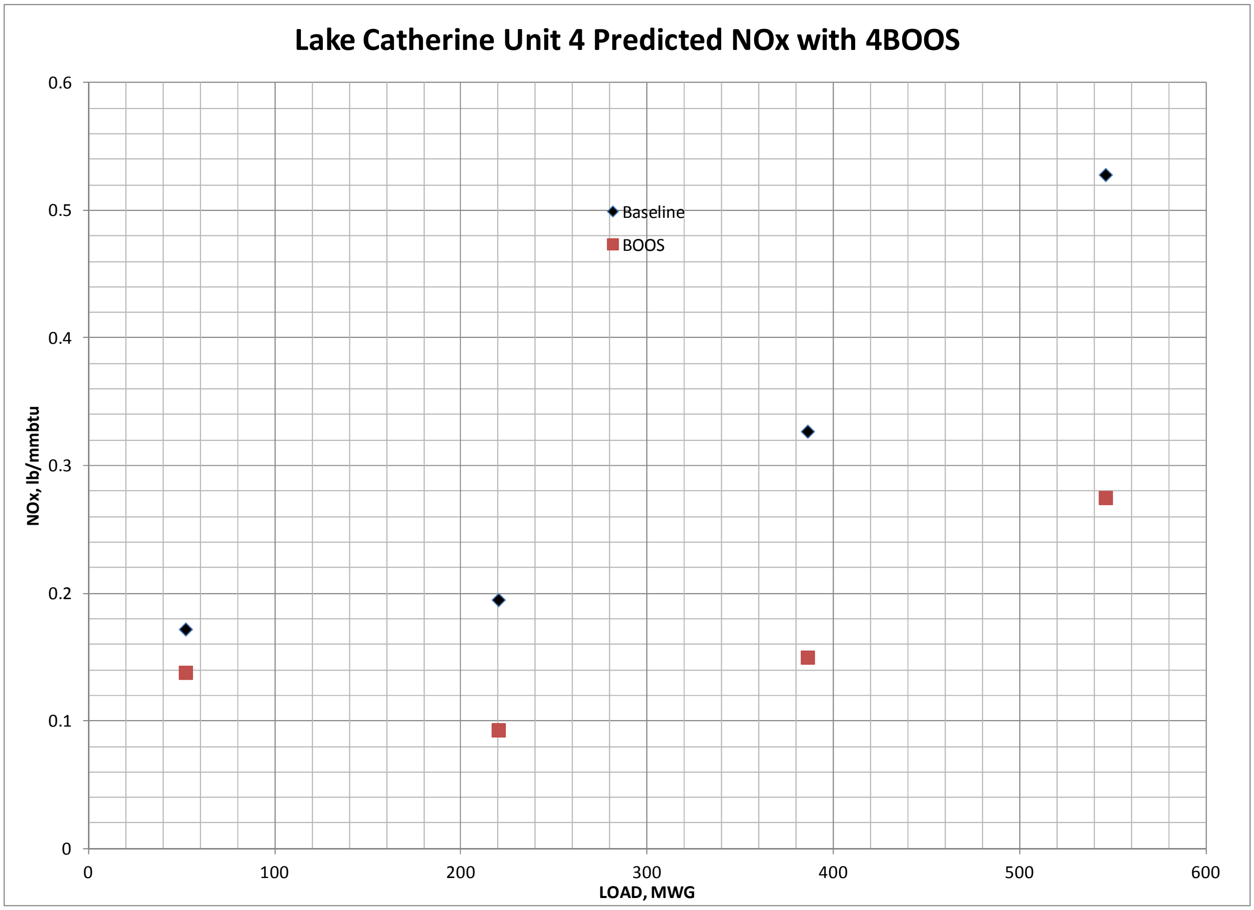


Figure 4- Lake Catherine Unit 4 NOx Emissions Prediction



APPENDIX F-3

Follow-up Consultation: Entergy Independence Revised Cost and Cost-Effectiveness

Division of Environmental Quality

Office of Air Quality

Treece, Tricia

From: Chivers, Stanley A <schiver@entergy.com>
Sent: Friday, July 24, 2020 10:20 AM
To: Treece, Tricia
Cc: Montgomery, William; Clark, David; McLaren, Russell; Triplett, David; JJewell@trinityconsultants.com
Subject: RE: Entergy Independence Regional Haze Evaluation Follow-Up
Attachments: ICR Response Report_Revised 07-23-2020.pdf

Tricia,

Thank you for the opportunity to review your control cost calculations. We offer the following five comments for your consideration. Additionally, for convenience we have attached an updated version of our ICR response report (originally submitted on 4/9/2020) that incorporates items 1, 2, and 5.

1. All costs should be escalated to $2019 now that the 2019 CEPCI has been finalized at 607.5 (approximately 0.73 % higher than the 2018 value of 603.1).

2. We believe it is inappropriate to use the bank prime rate for our capital recovery calculations. The cost analyses in our ICR response report follow Office of Management and Budget (OMB) guidance by using an interest rate of 7 % for evaluating the cost of capital recovery, as discussed below.

   The EPA Control Cost Manual (CCM or Manual) states that "when performing cost analysis, it is important to ensure that the correct interest rate is being used. Because this Manual is concerned with estimating private costs, the correct interest rate to use is the nominal interest rate, which is the rate firms actually face."[1] For our analyses, which evaluate equipment costs that may take place several years into the future, it is important to ensure that the selected interest rate represents a longer-term view of corporate borrowing rates. The CCM cites the bank prime rate as one indicator of the cost of borrowing as an option for use when the specific nominal interest rate is not available. Over the past 20 years, the annual average prime rate has varied from 3.25 % to 9.23 %, with an overall average of 4.86 % over the 20-year period.[2] But the CCM also adds the caution that the "base rates used by banks do not reflect entity and project specific characteristics and risks including the length of the project, and credit risks of the borrowers."[3] For this reason, the prime rate should be considered the low end of the range for estimating capital cost recovery.

   Actual borrowing costs are typically much higher than prime rates. For economic evaluations of the impact of federal regulations, the OMB uses an interest rate of 7 %. "As a default position, OMB Circular A-94 states that a real discount rate of 7 percent should be used as a base-case for regulatory analysis. The 7 percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. It is a broad measure that reflects the returns to real estate and small business capital as well as corporate capital. It approximates the opportunity cost of capital, and it is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector."[4]

[1] Sorrels, J. and Walton, T. "Cost Estimation: Concepts and Methodology," *EPA Air Pollution Control Cost Manual*, Section 1, Chapter 2, p. 15. U.S. EPA Air Economics Group, November 2017. https://www.epa.gov/sites/production/files/2017-12/documents/epaccmcostestimationmethodchapter_7thedition_2017.pdf
[2] Board of Governors of the Federal Reserve System Data Download Program, "H.15 Selected Interest Rates," accessed April 16, 2020. https://www.federalreserve.gov/datadownload/Download.aspx?rel=H15&series=8193c94824192497563a23e3787878ec&filetype=spreadsheetml&label=include&layout=seriescolumn&from=01/01/2000&to=12/31/2020

[3] Sorrels, J. and Walton, T. "Cost Estimation: Concepts and Methodology," *EPA Air Pollution Control Cost Manual*, Section 1, Chapter 2, p. 16. U.S. EPA Air Economics Group, November 2017. https://www.epa.gov/sites/production/files/2017-12/documents/epaccmcostestimationmethodchapter_7thedition_2017.pdf
[4] OMB Circular A-4, https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf - "

3. Entergy disagrees with ADEQ's analysis in the "EAI Equipment Life Assumptions" tab in the ADEQ's spreadsheet because it incorrectly assumes that Independence Units 1 and 2 will continue to combust coal after 12/31/2030, which is contrary to the information Entergy provided on the units' remaining useful life in the ICR response report.

4. The Annual O&M Costs values for NOX controls in the ADEQ's spreadsheet have been incorrectly transcribed from our ICR response report. The correct values are highlighted below in a table extracted from the "EAI RUL Assumptions" tab in the ADEQ's spreadsheet.

Emission Unit	NOx Reduction Options	Capital Cost ($MM)	Annualized Capital Costs	Annual O&M Costs ($MM/yr)	Total Annual Costs ($MM/yr)	Emission Reductions (Avg Month Basis)	Cost-effectiveness ($2018/ton)
Unit 1	SCR	186.32	63.14	3.42	66.56	2267	29,359
	SNCR	8.75	2.97	6.53	9.50	690	13,761
Unit 2	SCR	186.32	63.14	3.42	66.56	1961	33,940
	SNCR	8.75	2.97	6.53	9.50	298	31,863

5. We agree with the ADEQ's decision to use only the average month-based annual emission rates to establish baseline emissions from which the control costs are estimated. The maximum month-based cost effectiveness values have been removed from the tables in the attached report.

Stan Chivers
Environmental Analyst
Air Lead, Arkansas Environmental Support
Entergy Services, LLC
8-750-4033 (internal) | (501) 377-4033 (office) | (501) 215-0024 (cell)

Entergy WE POWER LIFE℠

From: Treece, Tricia <treecep@adeq.state.ar.us>
Sent: Tuesday, July 21, 2020 8:29 AM
To: Chivers, Stanley A <schiver@entergy.com>; McLaren, Russell <rmclare@entergy.com>; Triplett, David <dtripl1@entergy.com>; JJewell@trinityconsultants.com
Cc: Montgomery, William <Montgomery@adeq.state.ar.us>; Clark, David <CLARKD@adeq.state.ar.us>
Subject: Entergy Independence Regional Haze Evaluation Follow-Up

We have now completed a thorough review of the cost information provided in the "Response to January 8, 2020 Regional Haze Four-Factor Analysis Information Collection Request." Based on our review, each of the cost analyses require revision to ensure consistency with EPA guidance. DEQ has calculated, based on the information provided and EPA guidance, revised cost and cost-effectiveness values. See attached spreadsheet for an explanation of changes and DEQ's calculations. We are providing you the opportunity to review these calculation revisions and provide us additional information if site-specific considerations warrant changes to the control-cost methodology assumptions.

Please provide any feedback you may have on the revised control strategy cost calculations by COB 7/24/20.

Tricia Treece | SIP/Planning Supervisor
Division of Environmental Quality | **Office of Air Quality**
Policy and Planning Branch
5301 Northshore Drive | North Little Rock, AR 72118
t: 501.682.0055 | e: treecep@adeq.state.ar.us

ARKANSAS
ENERGY & ENVIRONMENT

APPENDIX F-4

Entergy Independence ICR Response, Revised

Division of Environmental Quality

Office of Air Quality

Entergy Services LLC on behalf of Entergy Arkansas LLC

Response to January 8, 2020 Regional Haze Four-Factor Analysis Information Collection Request

Prepared By:

Jeremy Jewell – Principal Consultant

TRINITY CONSULTANTS
5801 E. 41st St.
Suite 450
Tulsa, OK 74135
(918) 622-7111

April 7, 2020
Revised July 23, 2020

Project 203702.0049

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List of Previous Reports

In order of reference in this report:

Entergy's October 2013 *Revised BART Five Factor Analysis for White Bluff Steam Electric Station* ("Entergy's October 2013 White Bluff BART report")

Entergy's August 18, 2017 *Updated BART Five-Factor Analysis for SO_2 for Unit 1 and 2* ("Entergy's August 2017 White Bluff BART report")

Sargent & Lundy's (S&L's) August 3, 2017 *White Bluff Dry FGD Cost Estimate and Technical Basis*, SL-012831 ("S&L's August 2017 DFGD White Bluff Report")

S&L's January 31, 2018 *Independence Dry FGD Cost Estimate and Technical Basis*, SL-014308 ("S&L's January 2018 DFGD Independence Report")

S&L's August 3, 2017 *White Bluff DSI Cost Estimate Basis Document*, SL-014000, and *White Bluff Enhanced DSI Cost Estimate Basis Document*, SL-014001 (together: "S&L's August 2017 DSI White Bluff Reports")

Entergy's February 2, 2018 *Supplemental Information – Analysis of Reasonable Progress – Arkansas Regional Haze Program First Planning Period* report ("Entergy's February 2018 Independence report")

Entergy's September 27, 2017 *Analysis of Reasonable Progress Arkansas Regional Haze Program First Planning Period* ("Entergy's September 2017 RP Report")

S&L's May 16, 2013 *NO_X Control Technology Cost and Performance Study, Entergy Services, Inc. – White Bluff and Lake Catherine*, SL-011439 ("S&L's May 2013 NO_X Study")

Entergy's August 7, 2015 *Comments on the Proposed Regional Haze and Interstate Visibility Transport Federal Implementation Plan for Arkansas* ("Entergy's August 2015 FIP comments")

S&L's July 14, 2015 *Review of EPA's Cost Analysis for Arkansas Regional Haze Proposed Federal Implementation Plan*, SL-012913 ("S&L's July 2015 FIP comments")

1. Introduction

This report was prepared on behalf of Entergy Services LLC and Entergy Arkansas LLC (together: "Entergy") in response to the January 8, 2020 Regional Haze Four-Factor Analysis Information Collection Request ("the ICR") from the Arkansas Department of Energy and Environment, Division of Environmental Quality, Office of Air Quality ("the DEQ").

Per the ICR, this report provides information related to the following sulfur dioxide (SO_2) and nitrogen oxides (NO_X) emissions reduction options for Unit 1 and Unit 2 at Entergy's Independence Steam Electric Station (Independence):

SO_2 Emissions Reduction Options:
- Fuel switching from subbituminous coal to natural gas
- Lime Spray Dryer System
- Limestone Forced Oxidation System
- In-Duct Dry Sorbent Injection

NO_X Emissions Reduction Options:
- Selective Catalytic Reduction
- Selective Non-Catalytic Reduction

The following specific technical and economic information, where applicable, is provided in this report for each emissions reduction option considered, in accordance with instructions in the ICR:

- Technical feasibility
- Control effectiveness
- Emissions reductions
- Time necessary for implementation[1]
- Remaining useful life[1]
- Energy and non-air quality environmental impacts[1]
- Costs of implementation[1]

Most of the information requested by the ICR is available in the record prepared by the DEQ for the regional haze rule (RHR) first planning period (1PP) state implementation plan (SIP). The DEQ prepared the original 1PP SIP in 2008,[2] it was partially approved and partially disapproved in 2012,[3] and revisions were submitted in three phases in 2017 ("Phase I of the 1PP SIP revisions"), 2018 ("Phase II of the 1PP SIP revisions"), and 2019 ("Phase III of the 1PP SIP revisions").

---

[1] These are the four factors that must be included in evaluating emission reduction measures necessary to make reasonable progress determinations. *See* 40 CFR § 308(f)(2)(i).

[2] State of Arkansas Regional Haze Rule State Implementation Plan, available online as of February 11, 2020 at http://www.adeq.state.ar.us/air/planning/sip/pdfs/regional-haze/arkansas-regional-haze-sip.pdf, appendices available at http://www.adeq.state.ar.us/air/planning/sip/regional-haze.aspx.

[3] 77 Fed. Reg. 14604 (Mar. 12, 2012).

Phase I of the 1PP SIP revisions addressed NO_X emissions from several electric generating units (EGUs), including Independence.[4] It was submitted to the U.S. Environmental Protection Agency (EPA) on October 24, 2017 and approved by the EPA on February 12, 2018.[5] Concurrently, the EPA also withdrew its federal implementation plan (FIP) provisions for NO_X from EGUs in Arkansas.[6]

Phase II of the 1PP SIP revisions primarily addressed SO_2 emissions from several EGUs, including Independence.[7] It was submitted to the EPA on August 8, 2018 and approved by the EPA on September 27, 2019.[8] Concurrently, the EPA also withdrew its corresponding FIP provisions for EGUs in Arkansas.[9]

To the extent possible, information developed for the 1PP analyses – a "reasonable progress" analysis for Independence and a Best Available Retrofit Technology (BART) analysis for White Bluff Steam Electric Station (White Bluff)[10] – is presented in this report with updates regarding baseline emissions (per the ICR) and costs escalation. Section 2 of this report presents information for the SO_2 emissions reduction options, and Section 3 presents information for the NO_X emissions reduction options.

In addition to the information requested by the ICR, Section 4 of this report provides a summary of the most recent Interagency Monitoring of Protected Visual Environments (IMPROVE) network monitoring data for the two Class I areas in Arkansas: Caney Creek Wilderness Area (CACR) and Upper Buffalo Wilderness Area (UPBU). This information is an update to the report that Entergy originally submitted on August 7, 2015 and updated previously on November 15, 2016, September 27, 2017, and February 2, 2018. The previous reports should be reviewed for explanations of how the raw data were summarized, how the deciview metric is calculated, and other background information.

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[4] Revisions to the Arkansas State Implementation Plan – Regional Haze SIP Revision for 2008-2018 Planning Period. Available online as of April 6, 2020 at http://www.adeq.state.ar.us/air/planning/sip/pdfs/regional-haze/final-package.pdf.

[5] 83 Fed. Reg. 5927 (Feb. 12, 2018).

[6] 83 Fed. Reg. 5915 (Feb. 12, 2018).

[7] Phase II of the 1PP SIP revisions is available online at http://www.adeq.state.ar.us/air/planning/sip/regional-haze.aspx as of April 6, 2020 under the heading "2018 Arkansas Phase II Regional Haze SIP Revision."

[8] 84 Fed. Reg. 51033 (Sept. 27, 2019).

[9] 84 Fed. Reg. 51056 (Sept. 27, 2019).

[10] The units at White Bluff are similar in size, design, and operation to the units at Independence, and information related to controls for the White Bluff units is reasonably representative of the Independence units.

2. SO_2 Emissions Reductions Options

The ICR specifically listed the following four SO_2 emissions reduction options for consideration: (a) Fuel switching from subbituminous coal to natural gas, (b) Lime Spray Dryer System, (c) Limestone Forced Oxidation System, and (d) In-Duct Dry Sorbent Injection.

The fuel switch (a.k.a. "repowering") option must be considered independently of the other options, which involve installing post-combustion air pollution controls on the existing units. Switching the two (2) 880 megawatt (MW) (nominal) units from coal to natural gas would be a significant and fundamental change to the plant. Entergy is not aware of any previous coal-to-gas repowering projects for units of similar size to the Independence units. Switching the units to burn natural gas would involve significant modifications to the units, which were originally designed to only burn coal for electrical generation. Such a conversion would result in gas units which are less efficient than units that were originally designed to burn gas. Such a conversion would impact the heat rate of the units and could reduce their maximum generating capacity. Either of these changes would impact the manner and frequency with which the units are dispatched by the Midcontinent Independent System Operator (MISO). This recategorization would fundamentally change the Independence facility, and all co-owners would need to be involved in such a decision. Moreover, a switch to natural gas at Independence could not be achieved without building a new gas supply pipeline. A sufficiently sized natural gas pipeline currently does not serve the site. The nearest pipelines of sufficient capacity are more than five (5) miles away and are located on the other side of the White River. Constructing a new pipeline to bring adequate natural gas capacity to the Independence site could negatively impact streams and wetlands along the pipeline route, and would require significant environmental assessment to determine an appropriate route and mitigation measures. The change in source design, and the other considerations (e.g., the environmental impacts of building a pipeline) taken together render the fuel switch option profoundly infeasible. Accordingly, it is not considered further in this report. Should ADEQ believe that further evaluation of a fuel-switching option is appropriate, it would be necessary to conduct a detailed site-specific engineering study in order to determine the necessary modifications, costs, and the expected changes to unit operating characteristics following the switch.

Lime spray dryer systems (SDA) are generically referred to as dry flue gas desulfurization (DFGD) and limestone forced oxidation systems are generically referred to as wet flue gas desulfurization (WFGD). Both FGD options include in their design the installation of a fabric filter. An in-duct dry sorbent injection system (DSI) can be installed with or without a fabric filter; thus, the DSI option is split into two options: (1) DSI without a fabric filter (for this option, rebuilds of the existing electrostatic precipitators [ESPs] are considered), referred to as DSI, and (2) DSI with a fabric filter, referred to as Enhanced DSI.

2.1. Technical Feasibility

WFGD, DFGD, DSI, and Enhanced DSI are technically feasible for Unit 1 and Unit 2.

2.2. Control Effectiveness

Table 2-1 summarizes the control emission rates for the technically feasible SO_2 emissions reduction options for Unit 1 and Unit 2.

Table 2-1. Control Effectiveness of SO_2 Emissions Reduction Options

SO_2 Reduction Option	Controlled Emission Rate (lb/MMBtu)
WFGD	0.04
DFGD	0.06
Enhanced DSI	0.15
DSI	0.35

2.2.1. WFGD

The controlled emission rate of 0.04 pounds per million British thermal units (lb/MMBtu) for WFGD is based on information presented in Entergy's October 2013 *Revised BART Five Factor Analysis for White Bluff Steam Electric Station* ("Entergy's October 2013 White Bluff BART report"), at 5-3 – 5-4, included in Appendix D of Phase II of the 1PP SIP revisions. As discussed in Entergy's October 2013 White Bluff BART report, the 0.04-lb/MMBtu emission rate for WFGD does not represent a guarantee but is merely an estimate. If the DEQ anticipates requiring WFGD at Independence, Entergy would need an opportunity to conduct a site-specific study to determine the emission rate that could be achieved at Independence.

2.2.2. DFGD or SDA

The controlled emission rate for DFGD is based on information presented in the following 1PP documents:

- Entergy's August 18, 2017 *Updated BART Five-Factor Analysis for SO_2 for Unit 1 and 2* ("Entergy's August 2017 White Bluff BART report"), at 4-1 – 4-3, included in Appendix D of Phase II of the 1PP SIP revisions;
- Sargent & Lundy's (S&L's) August 3, 2017 *White Bluff Dry FGD Cost Estimate and Technical Basis*, SL-012831 ("S&L's August 2017 DFGD White Bluff Report"), which is included in Appendix A of this report;[11] and
- S&L's January 31, 2018 *Independence Dry FGD Cost Estimate and Technical Basis*, SL-014308 ("S&L's January 2018 DFGD Independence Report"), which is included in Appendix A of this report.[12]

2.2.3. DSI and Enhanced DSI

The controlled emission rates for DSI and Enhanced DSI are based on information presented in the following 1PP documents:

- Entergy's August 2017 White Bluff BART report, at 4-1 – 4-3;

[11] S&L's August 2017 DFGD White Bluff Report was included in Appendix A in Entergy's August 2017 White Bluff BART report.

[12] S&L's January 2018 DFGD Independence Report was included as Appendix B of Entergy's February 2, 2018 *Supplemental Information – Analysis of Reasonable Progress – Arkansas Regional Haze Program First Planning Period* report ("Entergy's February 2018 Independence report"), and is included in Appendix F of Phase II of the 1PP SIP revisions.

- S&L's August 3, 2017 *White Bluff DSI Cost Estimate Basis Document*, SL-014000, and *White Bluff Enhanced DSI Cost Estimate Basis Document*, SL-014001 (together: "S&L's August 2017 DSI White Bluff Reports"), which are included in Appendix A of this report.[13]

As discussed in Entergy's August 2017 White Bluff BART report, DSI and Enhanced DSI have not been demonstrated on units the size of those at Independence. If the DEQ anticipates requiring DSI or Enhanced DSI at Independence, Entergy would need an opportunity to conduct a site-specific study to determine the emission rates that could be achieved at Independence with those technologies.

2.3. Emissions Reductions

Table 2-2 summarizes the baseline and controlled emission rates and emission reduction potentials, all in tons per year (tpy), for the technically feasible SO_2 reduction options for Unit 1 and Unit 2. Per the ICR, the baseline actual emission rate for each unit is taken as the maximum monthly value (annualized, i.e., multiplied by 12) from the EPA's Air Markets Program Data (AMPD)[14] from November 1, 2018 to December 31, 2019 for Unit 1 and from January 1, 2018 to December 31, 2019 for Unit 2 (i.e., the baseline periods). The controlled emission rate for each unit is based on the lb/MMBtu emission rates presented in Table 2-1 and each unit's baseline actual heat input in MMBtu/yr, which is determined in the same manner as the baseline emission rates. The emission reductions are the difference between the baseline and controlled emission rates.

Table 2-2. Baseline Emission Rates (Maximum Month Basis) and Controlled Emission Rates of SO_2 Emissions Reduction Options

Emissions Unit	SO_2 Reduction Option	Baseline Emission Rate (tpy)	Controlled Emission Rate (tpy)	Emissions Reduction (tpy)
Unit 1	WFGD	15,467	1,341	14,126
	DFGD		2,011	13,455
	Enhanced DSI		4,693	10,773
	DSI		11,398	4,069
Unit 2	WFGD	18,195	1,451	16,744
	DFGD		2,177	16,018
	Enhanced DSI		5,079	13,116
	DSI		12,334	5,861

Table 2-3 provides the same information but based on the average, rather than the maximum, monthly values (annualized, i.e., multiplied by 12) from the baseline periods. Average monthly values are more commonly used for control cost analyses because maximum monthly values result in much higher annual baseline emission rates than have actually occurred in the recent past (or than are expected to occur in the future). Control cost calculations presented later in this report are completed using the average-monthly baseline emission rates.

[13] S&L's August 2017 DSI White Bluff Reports were included in Appendix A in Entergy's August 2017 White Bluff BART report.

[14] https://ampd.epa.gov/ampd, queried on February 10, 2020.

Table 2-3. Baseline Emission Rates (Average Month Basis) and Controlled Emission Rates of SO_2 Emissions Reduction Options

Emissions Unit	SO_2 Reduction Option	Baseline Emission Rate (tpy)	Controlled Emission Rate (tpy)	Emissions Reduction (tpy)
Unit 1	WFGD	9,945	841	9,104
	DFGD		1,261	8,684
	Enhanced DSI		3,153	6,792
	DSI		7,358	2,587
Unit 2	WFGD	10,672	887	9,786
	DFGD		1,330	9,342
	Enhanced DSI		3,325	7,347
	DSI		7,759	2,914

2.4. Time Necessary for Implementation

A minimum of five (5) years, counting from the effective date of an approved determination, would be needed for implementing either the WFGD or DFGD options. This is consistent with the EPA's determination in the now-withdrawn FIP.[15] Three (3) years would be needed for implementing either DSI or Enhanced DSI.

2.5. Remaining Useful Life

Assuming an EPA review and approval period of one (1) year following the second planning period (2PP) SIP proposal deadline of July 31, 2021, the earliest effective date for any control requirements would be July 31, 2022. Thus, based on the times necessary for implementing the various controls, WFGD or DFGD could be implemented by July 31, 2027, and DSI or Enhanced DSI could be implemented by July 31, 2025.

Entergy plans to cease coal-fired operations of Unit 1 and Unit 2 at Independence by December 31, 2030, as the DEQ noted in Phase II of the 1PP SIP revisions. Entergy has entered into a proposed settlement agreement with Sierra Club and National Parks Conservation Association that is currently pending before the U.S. District Court for the Eastern District of Arkansas (*Sierra Club, et al. v. Entergy Arkansas, LLC, et al.*, No 4:18-cv-00854 -KGB (E.D. Ark.)). If the court approves the settlement, the cessation of coal-fired operation at the Independence units will become an enforceable commitment. Therefore, for costing purposes, the remaining useful life (RUL) of the Independence units is 3.42 years for WFGD and DFGD and 5.42 years for DSI and Enhanced DSI.

2.6. Energy and Non-air Quality Environmental Impacts

2.6.1. WFGD

As addressed in Entergy's October 2013 White Bluff BART report, at 5-7, WFGD has the following non-air quality environmental impacts:

[15] 81 Fed. Reg. 66336 (Sept. 27, 2016).

> …wet scrubbing is expected to achieve approximately the same level of visibility improvement as the proposed dry scrubbing technology. However, the negative non-air quality environmental impacts are greater with wet scrubbing systems. Such impacts include a potential increase in particulate and sulfuric acid (H_2SO_4) mist emissions. In addition, wet scrubbers require increased water use and generate large volumes of wastewater and solid waste/sludge that must be managed and/or treated. This places additional burdens on the wastewater treatment and solid waste management capabilities. Moreover, if wet scrubbing produces calcium sulfite sludge, the sludge will be water-laden, and it must be stabilized for landfilling. Wet scrubbing systems require increased power requirements and increased reagent usage over dry scrubbers. Thus, from an overall environmental perspective, dry scrubbing is superior to wet scrubbing.

2.6.2. DFGD

Per Phase II of the 1PP SIP revisions, DEQ recognized the following non-air quality environmental impacts for DFGD:

> DFGD utilizes lime slurry to remove SO_2 from flue gas. In the process, particulate matter is generated that must be controlled through use of a baghouse or electrostatic precipitator. Once collected, the waste material is disposed of through landfilling. Costs associated with control of particulate matter and additional power requirements were factored into the cost estimates calculated by Entergy and EPA. Entergy has not indicated unusual circumstances that would create greater problems than experienced elsewhere that Dry FGD was utilized as BART.[16]

Additionally, per Entergy's September 27, 2017 *Analysis of Reasonable Progress Arkansas Regional Haze Program First Planning Period* ("Entergy's September 2017 RP Report"), at 6-2, which is included in Appendix F of Phase II of the 1PP SIP revisions:

> Non-air quality environmental impacts of SDA primarily relate to available water resources and waste byproducts. SDA systems consume a significant quantity of water, and the required water must be relatively clean. In addition, SDA systems also generate a large waste byproduct stream, containing calcium salts, which must be landfilled. If not fixated during the disposal process, the calcium salts are soluble and may dissolve and appear in the landfill leachate.

2.6.3. DSI and Enhanced DSI

As addressed in Entergy's August 2017 White Bluff BART report, at 4-6, DSI and Enhanced DSI have the following energy and non-air quality environmental impacts:

> …(a) the need for substantial storage and transportation – both delivery via rail and conveyance on site – of Trona, (b) the forced abandonment of the beneficial re-use of fly ash, and (c) potential negative impacts on the PM control device.

Additionally, per S&L's August 2017 DSI White Bluff Reports:

> The DSI process produces a dry byproduct which can be landfilled. The waste products will contain sodium sulfate and sulfite ($NaSO_3$/$NaSO_4$) along with the unused sorbent and the

[16] This discussion can be found in "rh-phase-ii-sip-narrative-final.pdf" at 52.

normal fly ash. These wastes will be collected in the ESP and can be transported with conventional pneumatic fly ash handling equipment. The waste from sodium-based sorbents will have relatively high concentrations of soluble salts, which may affect the byproduct handling. With the addition of dry sorbent byproducts fly ash cannot be sold for reuse.

…The sodium byproducts (salts) that are produced when Trona reacts with SO_2 and other acid gases, along with the unreacted sorbent are soluble in water. The resulting waste collected in the particulate collection device will need to be disposed of in a landfill that is lined and has a leachate collection system. With the addition of DSI, White Bluff will no longer be able to sell their fly ash for beneficial re-use due to the solubility of the sodium salts which would be present in the waste

2.7. Costs

Table 2-4 summarizes the estimated costs, including total and annualized capital costs,[17] annual operations and maintenance (O&M) costs, and cost effectiveness based on the emission reduction values from Table 2-3 for the technically feasible SO_2 reduction options.

Table 2-4. Estimated Costs ($2019) of SO_2 Emissions Reduction Options

Emissions Unit	SO_2 Reduction Option	Capital Costs ($MM)	Annualized Capital Costs ($MM/year)	Annual O&M Costs ($MM/year)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton)
Unit 1	WFGD	404.75	137.17	36.82	173.99	19,111
	DFGD	380.44	128.93	9.43	138.36	15,933
	Enhanced DSI	338.03	77.07	29.37	106.44	15,672
	DSI	176.28	40.19	16.72	56.91	21,997
Unit 2	WFGD	404.75	137.17	36.82	173.99	17,780
	DFGD	380.44	128.93	9.43	138.36	14,810
	Enhanced DSI	338.03	77.07	29.37	106.44	14,487
	DSI	176.28	40.19	16.72	56.91	19,534

[17] Capital cost values presented in this report omit the costs known as Allowance for Funds Used During Construction (AFUDC) and Owner's Costs as these costs, despite being significant for long-term projects such as considered in this report, are excluded by EPA's preferred "overnight" costing methodology. This issue is described in detail in multiple previous submittals:
(1) the Q&A document provided with Entergy's October 2013 White Bluff BART report in response to EPA's August 21, 2013 comments on the previously submitted BART report;
(2) Entergy's August 2017 White Bluff BART report, at 4-4;
(3) Entergy's August 7, 2015 *Comments on the Proposed Regional Haze and Interstate Visibility Transport Federal Implementation Plan for Arkansas*, at 10 – 11; and
(4) S&L's July 14, 2015 *Review of EPA's Cost Analysis for Arkansas Regional Haze Proposed Federal Implementation Plan*, SL-012913.

All annualized capital costs, i.e., capital recovery estimates, were calculated using the RULs discussed above and a 7 % social rate of interest, which, as far as Entergy is aware, has been used by EPA for all similar control cost analyses and which follows the EPA Office of Management and Budget (OMB) guidance, as discussed below.

The EPA's Control Cost Manual (CCM or "Manual") states:

> *when performing cost analysis, it is important to ensure that the correct interest rate is being used. Because this Manual is concerned with estimating private costs, the correct interest rate to use is the nominal interest rate, which is the rate firms actually face.*[18]

For this report, which evaluates equipment costs that may take place several years into the future, it is important to ensure that the selected interest rate represents a longer-term view of corporate borrowing rates. The CCM cites the bank prime rate as one indicator of the cost of borrowing as an option for use when the specific nominal interest rate is not available. Over the past 20 years, the annual-average prime rate has varied from 3.25 % to 9.23 %, with an overall average of 4.86 %.[19] The CCM adds the caution that the "base rates used by banks do not reflect entity and project specific characteristics and risks including the length of the project, and credit risks of the borrowers."[20] For this reason, the prime rate should be considered the low end of the range for estimating capital cost recovery. Actual borrowing costs are typically much higher than prime rates. For economic evaluations of the impact of federal regulations, the OMB uses an interest rate of 7 %.

> *As a default position, OMB Circular A-94 states that a real discount rate of 7 percent should be used as a base-case for regulatory analysis. The 7 percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. It is a broad measure that reflects the returns to real estate and small business capital as well as corporate capital. It approximates the opportunity cost of capital, and it is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector.*[21]

2.7.1. WFGD

Costs for WFGD are based on information presented in Entergy's October 2013 White Bluff BART report, at 5-6). The WFGD capital costs were based on a 2012 dollar value ($2012) and the O&M costs were based on $2011. These values are escalated to 2019 (the latest final information available as of July 2020) using the Chemical Engineering Plant Cost Index (CEPCI) values.[22]

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[18] Sorrels, J. and Walton, T. "Cost Estimation: Concepts and Methodology," EPA Air Pollution Control Cost Manual, Section 1, Chapter 2, p. 15. U.S. EPA Air Economics Group, November 2017. https://www.epa.gov/sites/production/files/2017-12/documents/epaccmcostestimationmethodchapter_7thedition_2017.pdf.

[19] Board of Governors of the Federal Reserve System Data Download Program, "H.15 Selected Interest Rates," accessed April 16, 2020. https://www.federalreserve.gov/datadownload/Download.aspx?rel=H15&series=8193c94824192497563a23e3787878ec&filetype=spreadsheetml&label=include&layout=seriescolumn&from=01/01/2000&to=12/31/2020.

[20] Sorrels, J. and Walton, T. "Cost Estimation: Concepts and Methodology," EPA Air Pollution Control Cost Manual, Section 1, Chapter 2, p. 16. U.S. EPA Air Economics Group, November 2017. https://www.epa.gov/sites/production/files/2017-12/documents/epaccmcostestimationmethodchapter_7thedition_2017.pdf.

[21] OMB Circular A-4, https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf.

[22] From https://www.chemengonline.com/pci-home, accessed on February 10, 2020:

2.7.2. DFGD

The capital and annual O&M costs for DFGD are based on information presented in Entergy's February 2018 Independence report, at 3-1, and S&L's January 2018 DFGD Independence report, which is included in Appendix A of this report. All costs for DFGD were based on $2017 and have been escalated to $2019.

2.7.3. DSI and Enhanced DSI

Costs for DSI and Enhanced DSI are based on information presented in Entergy's August 2017 White Bluff BART report, at 4-5, and S&L's August 2017 DSI White Bluff Reports, which are included in Appendix A of this report. The referenced costs for DSI and Enhanced DSI were based on $2016 and have been escalated to $2019.

Year:	2011	2012	2013	2014	2015	2016	2017	2018	2019
CEPCI:	585.7	584.6	567.3	576.1	556.8	541.7	567.5	603.1	607.5

3. NO_X Emissions Reductions Options

The ICR specifically listed for consideration the following two NO_X emissions reduction options: Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR).

3.1. Technical Feasibility

Both SCR and SNCR are technically feasible NO_X emissions reduction options for Independence Unit 1 and Unit 2.

3.2. Control Effectiveness

Table 3-1 summarizes and ranks the control emission rates for the technically feasible NO_X emissions reduction options for Unit 1 and Unit 2. The controlled emission rates are based on information presented in Entergy's October 2013 White Bluff BART report, at 6-3 – 6-4, and S&L's May 16, 2013 *NO_X Control Technology Cost and Performance Study, Entergy Services, Inc. – White Bluff and Lake Catherine*, SL-011439 ("S&L's May 2013 NO_X Study"), which is included in Appendix B of this report.[23]

Table 3-1. Control Effectiveness of NO_X Emissions Reduction Options

NO_X Reduction Option	Controlled Emission Rate (lb/MMBtu)
SCR	0.055
SNCR	0.13

3.3. Emissions Reductions

Table 3-2 summarizes the baseline and controlled emission rates and emission reduction potentials, all in tpy, for the technically feasible NO_X reduction options for Unit 1 and Unit 2. Per the ICR, the baseline actual emission rate for each unit is taken as the maximum monthly value (annualized, i.e., multiplied by 12) from the EPA's AMPD[24] from November 1, 2018 to December 31, 2019 for Unit 1 and from January 1, 2018 to December 31, 2019 for Unit 2 (i.e., the baseline periods). The controlled emission rate for each unit is based on the lb/MMBtu emission rates presented in Table 3-1 and each unit's baseline actual heat input in MMBtu/yr, which is determined in the same manner as the baseline emission rates. The emission reductions are the difference between the baseline and controlled emission rates.

[23] S&L's May 2013 NOx Study had been included as Appendix E of Entergy's October 2013 White Bluff BART report.

[24] https://ampd.epa.gov/ampd, queried on February 10, 2020.

Table 3-2. Baseline Emission Rates (Maximum Month Basis) and Controlled Emission Rates of NO_X Emissions Reduction Options

Emissions Unit	NO_X Reduction Option	Baseline Emission Rate (tpy)	Controlled Emission Rate (tpy)	Emissions Reduction (tpy)
Unit 1	SCR	5,450	1,844	3,606
	SNCR		4,358	1,092
Unit 2	SCR	5,077	1,995	3,082
	SNCR		4,716	361

Table 3-3 provides the same information but based on the average, rather than the maximum, monthly values (annualized, i.e., multiplied by 12) from the baseline periods. Average monthly values are more commonly used for control cost analyses because maximum monthly values result in much higher annual baseline emission rates than have actually occurred in the recent past (and that are expected to occur in the future). Control cost calculations presented later in this report are completed using the average-monthly baseline emission rates.

Table 3-3. Baseline Emission Rates (Average Month Basis) and Controlled Emission Rates of NO_X Emissions Reduction Options

Emissions Unit	NO_X Reduction Option	Baseline Emission Rate (tpy)	Controlled Emission Rate (tpy)	Emissions Reduction (tpy)
Unit 1	SCR	3,423	1,156	2,267
	SNCR		2,733	690
Unit 2	SCR	3,180	1,219	1,961
	SNCR		2,882	298

3.4. Time Necessary for Implementation

A minimum of five (5) years, counting from the effective date of an approved determination, would be needed to implement either SCR or SNCR. This is consistent with the EPA's determinations in the North Dakota FIP and Utah FIP.[25]

3.5. Remaining Useful Life

Assuming an EPA review and approval period of one (1) year following the 2PP SIP proposal deadline of July 31, 2021, the earliest effective date for any control requirements would be July 31, 2022. Thus, based on the time necessary for implementing the control options, SCR or SNCR could be implemented by July 31, 2027.

Entergy plans to cease coal-fired operations of Unit 1 and Unit 2 at Independence by December 31, 2030, as the DEQ noted in Phase II of the 1PP SIP revisions. Entergy has entered into a proposed settlement agreement with Sierra Club and National Parks Conservation Association that is currently pending before the U.S. District Court

[25] 77 Fed. Reg. 20944 (April 6, 2012) and 81 Fed. Reg. 43907 (July 5, 2016), respectively.

for the Eastern District of Arkansas (*Sierra Club, et al. v. Entergy Arkansas, LLC, et al.*, No 4:18-cv-00854 -KGB (E.D. Ark.)). If the court approves the settlement, the cessation of coal-fired operation at the Independence units will become an enforceable commitment. Therefore, for costing purposes, the remaining useful life (RUL) of the Independence units is 3.42 years for SCR and SNCR.

3.6. Energy and Non-air Quality Environmental Impacts

Per Entergy's October 2013 White Bluff BART report, at 6-9, SCR and SNCR have the following impacts:

> SCR and SNCR systems require electricity to operate the ancillary equipment. The need for electricity to help power some of the ancillary equipment creates a demand for energy that currently does not exist.
>
> SCR and SNCR can potentially cause significant environmental impacts. The primary avenue is related to the storage of ammonia. The storage of aqueous ammonia above 10,000 lbs is regulated by a risk management program (RMP), since the accidental release of ammonia has the potential to cause serious injury and death to persons in the vicinity of the release. Additionally, SCR and SNCR will likely also cause the release of unreacted ammonia to the atmosphere. This is referred to as ammonia slip. Ammonia slip from SCR and SNCR systems occurs either from ammonia injection at temperatures too low for effective reaction with NO_X, leading to an excess of unreacted ammonia, or from over injection of reagent leading to uneven distribution; which also leads to an excess of unreacted ammonia. Ammonia released from SCR and SNCR systems will react with sulfates and nitrates in the atmosphere to form ammonium sulfate and ammonium nitrate. Together, ammonium sulfate and ammonium nitrate are the predominant sources of regional haze.
>
> Another environmental impact associated with SCR is the disposal of catalyst waste. To maintain NO_X-removal effectiveness, the catalyst in an SCR system must periodically be cleaned, regenerated, or replaced. Cleaning and regeneration are preferred, but eventually the catalyst reaches the end of its useful life and must be replaced. Ideally the exhausted catalyst can be recycled for reuse, however, if the condition of the spent catalyst does not warrant recycling or a market is unavailable, the old catalyst must be disposed of. Current regulatory interpretations indicate spent SCR catalysts are exempted from hazardous waste regulation via 40 CFR § 261.4(b)(4) (Bevill Exemption) as flue gas emission control wastes. However, ongoing efforts by EPA to increase regulatory oversight of coal combustion residuals could alter that exemption, and create the potential that spent SCR catalysts would be characterized as hazardous wastes, hence increasing the cost of disposal. Regardless of the regulatory treatment of the waste, the disposal creates additional potential financial and environmental impacts associated with an SCR system.

3.7. Costs

Table 3-4 summarizes the estimated costs, including total and annualized capital costs (based on the same capital recovery factor described in Section 2.7), annual O&M costs, and cost effectiveness based on the emission reduction values from Table 3-3, for the technically feasible NO_X reduction options.

The cost values are based on information presented in S&L's May 2013 NO_X Study, which is included in Appendix E of Entergy's October 2013 White Bluff BART report, in Appendix D of Phase II of the 1PP SIP revisions, and in Appendix B of this report. The average of cost values for White Bluff's two units was taken to be representative of both Independence units. All costs were based on $2012 and have been escalated to $2019.

Table 3-4. Estimated Costs ($2019) of NO_X Emissions Reduction Options

Emissions Unit	NO_X Reduction Option	Capital Costs ($)	Annualized Capital Costs ($/year)	Annual O&M Costs ($/year)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton)
Unit 1	SCR	187.68	63.60	3.44	67.05	29,575
	SNCR	8.82	2.99	6.58	9.57	13,863
Unit 2	SCR	187.68	63.60	3.44	67.05	34,194
	SNCR	8.82	2.99	6.58	9.57	32,092

4. Updated IMPROVE Monitoring Data

As stated in Section 1, following is a summary of the most recent IMPROVE network monitoring data for the two Class I areas in Arkansas: Caney Creek Wilderness Area (CACR) and Upper Buffalo Wilderness Area (UPBU). This information is an update to that which was originally submitted on August 7, 2015 and updated previously on November 15, 2016, September 27, 2017, and February 2, 2018. The previous reports should be reviewed for explanations of how the raw data was summarized, how the deciview (dv) metric is calculated, and other background information. The only difference is that now, per EPA guidance,[26] all dv values have been re-calculated as the 20 percent most impaired and 20 percent least impaired values, based on anthropogenic (manmade) impairment only, rather than the 20 percent worst and 20 percent best values, which were based on both anthropogenic and biogenic (natural) impairment.

The most recent summary of annual IMPROVE monitoring data available for CACR and UPBU has been completed through the year 2018. As of February 14, 2020, no raw (non-summarized) data is available for 2019. Table 4-1 presents a summary of the annual-average haze index values for each year from 2002 to 2018.

Table 4-1. Summary of Annual-Average Haze Index Values from 2002 through 2018

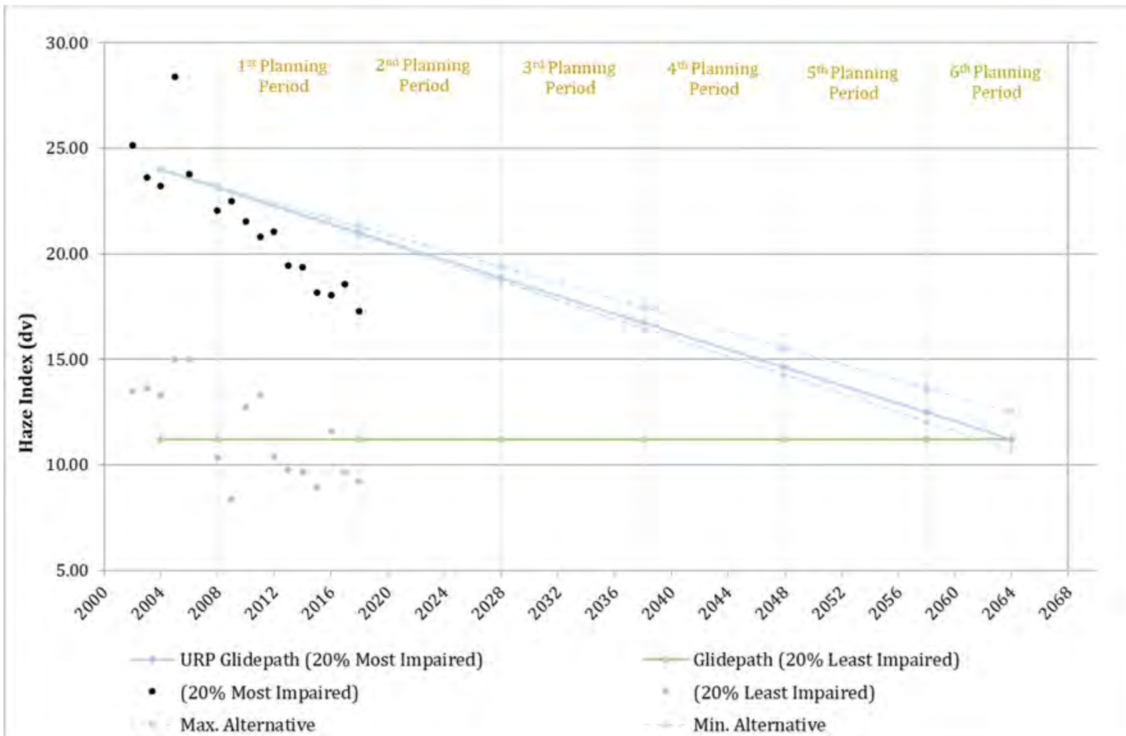
Year	Average of 20 Percent Most Impaired Days		Average of 20 Percent Least Impaired Days	
	CACR	UPBU	CACR	UPBU
2002	25.15	24.97	13.45	14.86
2003	23.61	24.66	13.64	14.22
2004	23.21	24.11	13.33	13.81
2005	28.37	29.29	14.99	14.62
2006	23.77	23.54	15.01	16.13
2007	--[A]	24.04	-- [A]	15.77
2008	22.06	22.80	10.33	12.46
2009	22.48	21.29	8.39	11.35
2010	21.52	-- [A]	12.69	-- [A]
2011	20.83	21.19	13.30	13.73
2012	21.04	20.12	10.37	12.69
2013	19.46	19.29	9.76	9.58
2014	19.37	18.68	9.65	9.58
2015	18.17	17.84	8.94	8.65
2016	18.04	18.29	11.58	11.14
2017	18.57	17.92	9.67	9.84
2018	17.29	17.01	9.21	10.64

[A] Summarized data are not available for CACR for 2007 and UPBU for 2010.

[26] Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program, December 20, 2018. (https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf)

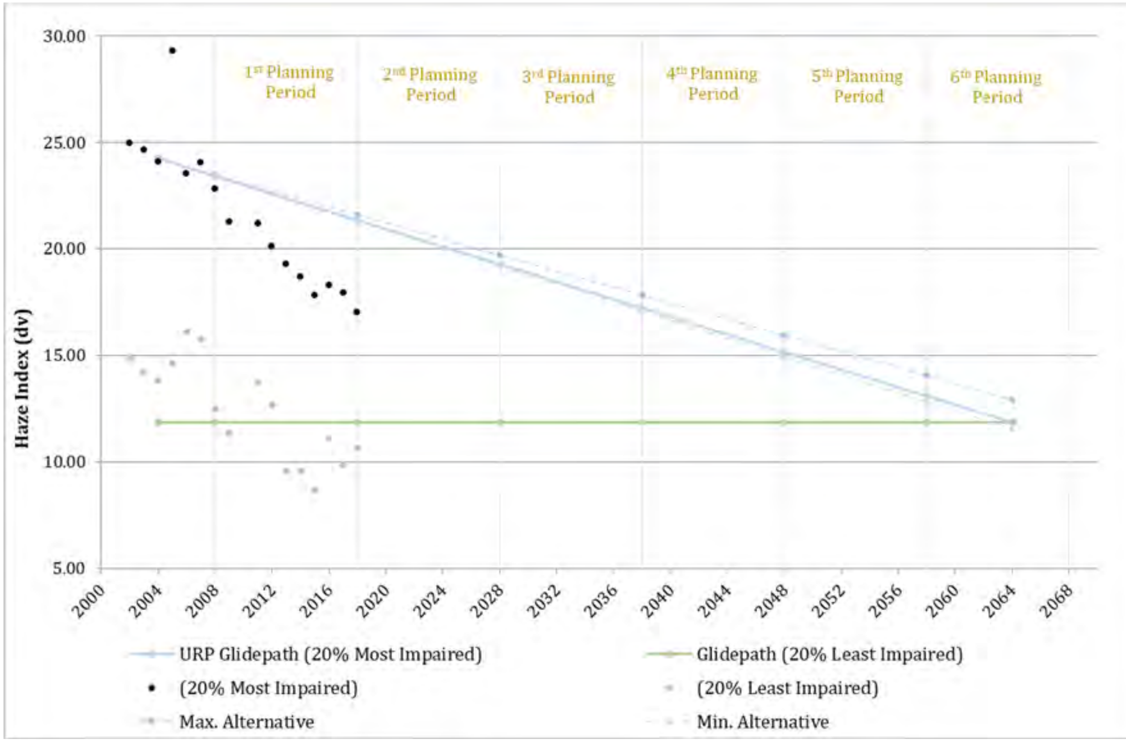
Figure 4-1 and Figure 4-2 present, for CACR and UPBU, respectively, comparisons of the annual-average haze index values from Table 4-1 to the Uniform Rate of Progress (URP) line (i.e., "glidepath") established for each area. The glidepaths presented are based on information published by EPA: 2000-2004 averages (starting points) and default, minimum alternative, and maximum alternative 2064 (end point) values.[27] As seen in the figures, the actual observed visibility impairment at these Class I areas has declined sharply overall, continues to trend downward, and has remained below the glidepaths since 2008.

Figure 4-1. CACR Monitored Observations Compared to Uniform Rate of Progress



[27] Availability of Modeling Data and Associated Technical Support Document for the EPA's Updated 2028 Visibility Air Quality Modeling, September 19, 2019 (https://www.epa.gov/sites/production/files/2019-10/documents/updated_2028_regional_haze_modeling-tsd-2019_0.pdf)

Figure 4-2. UPBU Monitored Observations Compared to Uniform Rate of Progress



APPENDIX A: 1PP SO_2 CONTROLS STUDIES

- S&L's August 3, 2017 *White Bluff Dry FGD Cost Estimate and Technical Basis*, SL-012831
- S&L's January 31, 2018 *Independence Dry FGD Cost Estimate and Technical Basis*, SL-014308
- S&L's August 3, 2017 *White Bluff DSI Cost Estimate Basis Document*, SL-014000
- S&L's August 3, 2017 *White Bluff Enhanced DSI Cost Estimate Basis Document*, SL-014001

ENTERGY ARKANSAS, INC.

WHITE BLUFF DRY FGD

COST ESTIMATE AND TECHNICAL BASIS

SL-012831
Final, Rev. 1
August 3, 2017
Project 13027-002

Prepared by

Sargent & Lundy LLC

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EXECUTIVE SUMMARY

The purpose of this study is to estimate the total capital investment and operating and maintenance (O&M) costs associated with installing dry flue gas desulfurization (FGD) technology on White Bluff Units 1&2 using an Engineer, Procure, Construct (EPC) contracting strategy. A preliminary conceptual design was developed for implementation of dry FGD technology at the White Bluff station to serve as the technical basis of the capital and O&M estimates.

The capital cost estimate includes the following components which comprise the total cost the Owner will incur to install dry FGD technology at White Bluff:

- FGD Island Cost supplied by a Dry FGD System Supplier including the main process equipment
- Balance of Plant Cost including auxiliary equipment and systems, foundations and buildings, site work, demolition and relocation
- Other Direct and Construction Indirect Costs including labor premiums, freight, contractor's G&A and profit
- Indirect Costs including engineering, startup spare parts, technical field advisors, and the additional fee associated with an EPC contracting strategy
- Escalation and Interest During Construction associated with the project duration for implementation of a large air quality control technology
- Owner's Costs including internal labor, insurance, and initial lime reagent fill
- Third Party Services including construction management oversight, start-up and commissioning oversight, Owner's Engineer services, and performance testing
- Project Contingency to cover unknown and undefined scope associated with the project which would result in additional cost to the Owner

The total capital investment to install dry FGD on White Bluff Units 1 and 2 was estimated to be $991,489,000. The project definition and accuracy of the individual components included in this estimate result in an overall accuracy of ±20-25%. In addition, the O&M costs were estimated to be approximately $8,132,000 per year per unit and include the cost of lime (reagent), byproduct disposal, auxiliary power, water, replacement bags and cages, maintenance costs, and operating labor.

1. PURPOSE

The purpose of this study is to estimate the total capital investment and operating and maintenance costs associated with installing dry flue gas desulfurization (FGD) technology on White Bluff Units 1&2. This report documents the conceptual design and technical basis for the dry FGD cost estimate.

2. APPROACH

2.1 TECHNOLOGY SELECTION

Sargent & Lundy (S&L) previously performed an evaluation of wet and dry FGD technology for Entergy's White Bluff Station. The evaluation included development of a preliminary conceptual design for both wet and dry FGD systems at the White Bluff station. The preliminary designs were used as the basis of an evaluation which compared the overall economics of each system, including capital and operating costs. The study concluded that a dry FGD system had an economic advantage over wet FGD when the design coal sulfur is below 3 lb SO_2/MMBtu. Based on the current market and potential future regulations, dry FGD technology would have an economic advantage over wet FGD for SO_2 reduction at the White Bluff station.

2.2 CONTRACTING APPROACH

Many utilities elect to utilize a one contract engineer-procure-construct (EPC) approach for major retrofit projects, such as large FGD projects. The EPC approach allows the Owner to contract with one entity which then manages the overall project. The EPC Contractor procures the material, equipment and services needed to complete the project and the EPC Contractor takes full responsibility for the equipment and work supplied by each of its subcontractors.

With this approach the Owner takes on less risk in the overall management and coordination of the project. However, shifting this risk to the EPC Contractor increases the total price for the EPC contract; "Whilst there are… numerous advantages to using an EPC contract, there are some disadvantages. These include the fact that it can result in a higher contract price than alternative contractual structures. This higher price is a result of a number of factors not least of which is the allocation of almost all the construction risk to the contractor."[1] The additional cost due to an EPC contracting approach is represented in our cost estimate as an EPC Risk Fee.

The Owner's control over design details of the system is limited, using this contracting strategy, to the requirements specified in the contract. This results in an additional upfront effort for the Owner and the Owner's Engineer to thoroughly define the project in the specification. Whatever is not defined will be excluded from the EPC Contractor's scope resulting in potential change orders. The Owner and Owner's Engineer are also responsible for reviewing the EPC Contractor's submitted design drawings and schedules to ensure what has been agreed upon in the final contract is included.

2.3 CAPITAL COST DEVELOPMENT

The capital cost estimate is based on project-specific information, including:

- A preliminary conceptual design developed for implementation of dry FGD technology at the White Bluff station.
- An engineer-procure-construct (EPC) contracting strategy.
- A Dry FGD System Supplier, subcontracted by the EPC Contractor, providing the main process equipment as a complete FGD Island.
- The FGD Island equipment and installation cost is based on a budgetary proposal received from Alstom in September 2013. The budgetary proposal is based on installing SDA technology on both of the White Bluff units.

The capital cost estimate includes the following components which comprise the total price of the EPC Contract to complete the work:

- Equipment and material
- Installation labor
- Demolition and Relocation work
- Indirect field costs and BOP engineering
- Freight on Materials
- General and Administration
- Erection contractor profit

[1] "EPC Contracts in the Power Sector", prepared by DLA Piper, 2011, page 6. See: https://www.dlapiper.com/

- Engineering, Procurement and Project Services
- Spare parts
- EPC Fee
- Escalation

The equipment design basis is summarized in Section 3 of this report and the scope of the estimate is summarized in Section 4. The project definition and accuracy of the individual components included in this estimate result in an overall accuracy of ±20-25%. The costs provided in this report are in 2015 dollars.

In order to estimate the *total plant* capital cost for installation of FGD at White Bluff, the following costs which would be incurred outside of the scope of the EPC contract were included:

- Owner's Costs
- Third Party Services – Construction Management Oversight
- Third Party Services – Startup and Commissioning Oversight
- Third Party Services – Owner's Engineer
- Third Party Services – Performance Testing
- Project Contingency
- Interest During Construction or Allowance for Funds Used During Construction

The cash flow provided in Attachment 2 is based on a monthly progress payment schedule developed using the preliminary execution schedule included in Attachment 3. Specific details regarding the milestones making up the payment schedule are listed in Attachment 4. Below is a summary of those activities that represent major or large payment milestones based on a project start date of January 2015.

Month	Date	Milestone
1	February 2017	Award EPC Contract Execution
5	June 2017	EPC Contractor Procures Major Equipment
7	August 2017	EPC Contractor Procures Major Equipment
10	November 2017	Flue Gas Ductwork Procurement Initiated by EPC Contractor
13	February 2018	SDA and Fabric Filter Design Drawings
15	April 2018	Award Fabric Filter Bags and Cages Flue Gas Ductwork Start of Fabrication

Month	Date	Milestone
17	June 2018	Physical Flow Model Completed
19	August 2018	Mobilize On-Site
20-38	September 2018 to March 2020	Construction Activities
41	June 2020	Unit 1 Substantial Completion
45	October 2020	Unit 2 Substantial Completion
		Demobilization Complete
46	November 2020	Unit 1 Final Acceptance
47	December 2020	Unit 2 Final Acceptance

Each monthly cash outlay in the cash flow is broken down by category (labor, equipment and materials, and indirect costs).

3. DRY FGD CONCEPTUAL DESIGN AND SYSTEM COMPONENTS

A conceptual design for the implementation of Dry FGD at the White Bluff station was developed by Sargent & Lundy LLC (S&L) as a precursor to the development of the cost estimate. A general arrangement drawing showing the conceptual design is included in Attachment 7. The dry FGD conceptual design was developed for each of the following subsystems:

3.1 DRY FGD ISLAND

3.1.1 Reagent Preparation System

Lime will be supplied to the lime day bins from the long-term storage silo located in the Reagent Handling Area and supplied by the EPC Contractor. The lime day bins, located in the Reagent Preparation Area and provided by the Dry FGD System Supplier, will each have a storage capacity to supply the plant with lime reagent for 24 hours when firing 1.2 lb SO_2/mmBtu coal.

Lime from the day bin will be gravity-fed through feeders to a lime slaker, where the lime will be slaked (mixed with low pressure service water and converted from calcium oxide to calcium hydroxide slurry). The plant will have a total of two lime slaking trains (2 x 100%), each sized to process enough lime slurry to supply the entire plant. Each lime slaker will discharge to a lime slurry transfer tank, which is equipped with two lime slurry transfer pumps which will feed into the lime slurry storage tanks. The common lime slurry storage tanks will each be sized for 12 hours of storage for the entire plant when burning a 1.2 lb SO_2/mmBtu coal. The lime day bin, slaking trains, and lime slurry tanks are sized to provide the necessary reagent slurry to both units simultaneously. The lime slurry tanks are built with cross-ties such that either slurry tank can feed either the Unit 1 or Unit 2 FGD systems.

A total of four lime slurry feed pumps (two per unit), each sized for 100% flow to one unit, will pump the lime slurry from the storage tanks to the SDAs through one of 2 x 100% piping loops, and return unused slurry back to the lime slurry storage tank. The closed-loop reagent supply line requires a flow velocity between 4-10 fps to avoid any solids buildup in the piping. Because of this, the pumping requirement is higher than the actual SDA requirement and must be sufficiently greater than the slurry flow that is pumped into the absorbers to allow the returning flow to remain above 4 fps.

3.1.2 Absorbers

Three absorbers, each treating 33⅓% of the flue gas are provided for each unit. Depending on the supplier and the type of atomizer normally used, there may be one rotary atomizer per absorber with a shared spare (B&W), three rotary atomizers per absorber with one or more shared spares (Alstom, basis of the estimate), or multiple dual-fluid atomizers with 15% shared spares (Siemens). The cost estimate includes contingency to capture the possibility of any of these designs.

3.1.3 Baghouse

Each SDA will be paired with a pulse-jet baghouse with a gross air-to-cloth ratio of approximately 3.2-3.4 ft/min. The filter bags in each baghouse are cleaned by pulses of compressed air. The air compressors will be 4 x 33% for the station and are included in the scope of the baghouse supplier.

3.1.4 Byproduct Recycle System

The reaction byproducts from the absorbers will be collected in the baghouses and a portion of the collected material will be recycled. The baghouse hoppers will be emptied through air lock feeders and pneumatically conveyed to two recycle day bins located in the Byproduct Recycle Area and supplied by the Dry FGD System Supplier, which are common for both units. The air-lock feeders are installed without a spare. One recycle day bin is located in the recycle train for each unit. The common byproduct recycle day bins (one per unit) provide 8-hours of storage when burning 1.2 lb SO_2/mmBtu coal.

Each byproduct recycle day bin is equipped with two recycle slurry preparation systems. The byproduct in each recycle day bin is gravimetrically conveyed to one of two systems where the byproduct is slurried with water (cooling tower blowdown). The byproduct recycle slurry is stored in one of four plant wide recycle slurry tanks, two per unit (combined 4-hour storage capacity).

Two recycle water make-up tanks are located in the recycle area with a capacity of 250,000 gallons (to be supplied by the EPC Contractor). The recycled by-product slurry will be combined with fresh lime slurry for feed to the SDA atomizers. Recycle feed slurry pumps (4 x 100%, two installed per unit) will be used to transfer the recycle slurry from the recycle slurry tanks to the atomizers. In addition, all recycle feed lines are provided in a loop configuration as with the reagent system, with a complete redundant loop to allow unhindered operation due to any pluggage of pumps or feed piping.

3.2 REAGENT HANDLING SYSTEM

As part of the conceptual design, several lime delivery methods were evaluated and it was determined that rail delivery provided the best alternative for White Bluff based on ease of implementation, overall plant interface, and lowest evaluated cost (in terms of required capital investment and delivered cost of lime). Therefore, the basis of the estimate is delivery of lime via hopper-bottom railcars with truck unloading as a backup. In order to accommodate rail delivery to the site, a new rail spur will be constructed from the existing track bordering the west side of the plant. Lime trains will enter and exit the station from this spur. A trackmobile car positioner will position railcars, two at a time, in the enclosed delivery shed for unloading. The cost estimate includes the capital cost associated with railcar unloading, including the new rail spur and the renovation of the existing rail spur to handle lime delivery. A vacuum pneumatic system will unload the railcars into either of the two (2) lime storage silos. The lime storage silos will be sized for supply of reagent for 14 days of storage at full load when firing 1.2 lb SO2/mmBtu coal. Lime from the long-term storage silos will be pneumatically transferred to two lime day bins located in the Reagent Preparation Area and supplied by the Dry FGD System Supplier.

3.3 BYPRODUCT HANDLING SYSTEM

Excess FGD byproduct from the recycle system will be pneumatically conveyed to either of the two common long- term FGD byproduct storage silos. The two long-term FGD byproduct storage silos are each sized to handle the byproduct for a total of 7 days of storage when firing the 1.2 lb SO_2/mmBtu coal. The byproduct will be mixed with a small amount of fly ash and water to form a final product which contains approximately 65% FGD byproduct, 5% fly ash, and 30% water. In order to achieve this mixture, a common fly ash blending bin (7-day storage) will be located near the new byproduct silos. The feed rate of fly ash discharged from the blending bin is controlled to maintain the ratio of byproduct to fly ash. A pneumatic airslide conveyor will discharge fly ash directly into an unloading conditioner, simultaneously mixing fly ash with the proper ratios of water and FGD byproduct (discharged from the silo). The wetted byproduct/fly ash mixture is then loading into dump trucks, which will deposit the FGD byproduct in a final storage location in the landfill. A bulldozer will maintain the landfill pile. The capital cost for the silos, conveying system and byproduct/fly ash blending system is included in the cost estimate. As part of the conceptual design, the existing landfill was evaluated and was determined to have sufficient capacity to accommodate the addition of FGD byproduct. Therefore no costs were included in the capital estimate for the (existing) landfill. In addition, it was assumed that the existing haul trucks would be used to transport the FGD byproduct.

3.4 FLUE GAS HANDLING SYSTEM

The flue gas from the existing ID fans will be ducted to the absorbers. The gases from the absorbers will be ducted to the baghouses to collect the reaction by-products and residual fly ash. Two axial booster fans (2 x 50% for each unit) will be located downstream of the absorbers and baghouse; the booster ID fans can be provided by the Dry FGD System Supplier or the EPC Contractor. Due to the dry condition of the scrubbed flue gas, the existing stack and liners will be used for the retrofit case.

The existing chimney and carbon steel liners were evaluated as part of the conceptual design and were deemed to be suitable for a dry FGD application. In addition, the top 50 feet of the existing chimney liners are constructed of 316 stainless steel so an acid resistant coating on the liner is not required. However, downwash may result in acid attack and discoloration on the outer concrete shell of the chimney; it was determined that an acid resistant coating to the top 100 feet of the concrete shell is recommended; therefore, the cost estimate includes the coating of the top 100 feet of the chimney's outer concrete shell.

3.5 ELECTRICAL BOP SYSTEM

The existing auxiliary power system was evaluated as part of the conceptual design for the White Bluff dry FGD system. In order to feed the new dry FGD and other BOP equipment, significant modifications and additions to the existing power system are required. These include installation of new auxiliary transformers, medium- and low-voltage switchgear buses, motor control centers (MCCs) and upgrades to the isolated phase tap-off buses.

3.6 I&C BOP SYSTEM

As part of the conceptual design, the existing control system was evaluated to determine the required modifications necessary to implement dry FGD technology at the White Bluff station. The dry FGD system will be controlled using a new Foxboro I/A system which will integrate with the existing power block Foxboro I/A system. The control processors, I/O cabinets, and other system components will be located in the new electrical equipment building (EEB) for each unit. Two HMIs will be installed in the new EEB for each unit to provide any local controls for the lime preparation and byproduct recycle systems provided by the Dry FGD System Supplier. The baghouse will be controlled through the Allen-Bradley ControlLogix PLC and the ID booster fans will be controlled through the existing Foxboro I/A system controller(s), which are used to control boiler air and furnace pressure.

4. CAPITAL AND O&M COST ESTIMATE TECHNICAL BASIS

The following summarizes the design inputs used as the basis for the White Bluff dry FGD Systems:

- Design SO_2 inlet concentration of 1.2 lb SO_2/MMBtu for equipment design, based on the current coal contract sulfur limit.
- SO_2 inlet concentration of 0.57 lb SO_2/MMBtu for annual operating costs, based on the annual heat input weighted average emission from 2009 through 2013.
- Design SO_2 outlet concentration of 0.06 lb SO_2/MMBtu.
- Annual capacity factor of 72.1% (annual average capacity factor for White Bluff Units 1 and 2 based on historical heat input from 2009 through 2013).
- Compliance deadline of December 2020, based on a project start date of January 2015.

4.1 EPC CONTRACT PRICE

The Dry FGD System Supplier will provide all of the equipment within the FGD Island. The FGD Island will include the Reagent Preparation Equipment, Absorber Area Equipment, Baghouse Area Equipment and the Byproduct Recycle Equipment. The booster ID fans could be provided by either the Dry FGD System Supplier or the EPC Contractor; the basis of this estimate is supply of the booster fans by the Dry FGD System Supplier. The EPC Contractor will provide the remaining BOP scope in order to provide a complete and operable FGD system. In addition, the EPC Contractor will install/construct the entire system including the equipment provided by the DFGD supplier.

The scope of work for the cost estimate is broken out by area below:

1. <u>Dry FGD Island</u>
   a. Reagent Preparation System, common to both units:
      - Two lime day bins, 24-hours storage each
      - Two detention lime slakers at 100% capacity, each with a grit screen, gravimetric feeder
      - Two lime slurry transfer tanks
      - Four slurry transfer centrifugal pumps
      - Two lime slurry storage tanks
      - Four slurry feed centrifugal pumps

- Cost estimate based on budgetary proposal from Alstom; the budgetary proposal is based on a design sulfur of 2.0 lb/MMBtu, cost adjustments were included in the estimate for a lower design sulfur of 1.2 lb/MMBtu. These cost adjustments were developed by estimating the differential equipment cost for the reagent preparation and waste handling equipment. The impacted equipment is identified in Section 4.5 which discusses the sulfur design basis sensitivity.

b. Absorber Area, per unit
   - Three absorber vessels per unit, with access doors
   - Rotary atomizers, two spare atomizers included
   - Vessel material carbon steel, ¼ in. – ⅝ in. carbon steel
   - Heating and ventilation
   - Vacuum piping
   - SDA Superstructure
   - Cost estimate based on budgetary proposal from Alstom

c. Baghouse Area, per unit
   - New baghouse, including pulse jet cleaning system and all appurtenances
   - Cost estimate based on budgetary proposal from Alstom

d. Byproduct Recycle System, per unit (located remotely in common location for both units)
   - One recycle silo with bin vent filter per unit, 8-hour total capacity
   - Two recycle mix tanks per unit
   - Two recycle slurry tanks per unit, with two recycle slurry centrifugal pumps per unit
   - Agitators for each tank
   - Baghouse ash handling system common to both units
   - Rotary air-lock valves from baghouse hopper outlets to pressure pneumatic conveying system (60-degree typical)
   - Pneumatic pressure blowers (8 x 33⅓ %)
   - Cost estimate based on budgetary proposal from Alstom

e. ID Booster Fans, per unit
   - Two approximately 5,200 hp axial booster fans per unit sized to overcome pressure drop associated with FGD and baghouse
   - Includes motors - no spare motor included
   - Cost estimate based on budgetary proposal from Alstom
   - Dampers from ID fan to booster fans (cost estimated separately, not included in Alstom budgetary proposal)

f. Interconnecting Ductwork, per unit
   - ID fan outlet to absorber inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm
   - Absorber outlet to baghouse inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm
   - Baghouse outlet to new booster fans and fan outlet to the stack inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm

2. <u>FGD Island Foundations and Enclosures</u>

   a. Absorber tower foundations including caissons

   b. Baghouse area foundations including 18" auger cast piles 60' long

   c. Booster fan area foundations

   d. 6" insulation with lagging for Absorbers and Baghouses (cost estimated separately, not included in Alstom budgetary proposal)

   e. Penthouse enclosure for Absorbers located in FGD Island (cost estimated separately, not included in Alstom budgetary proposal)

   f. Two elevators (one for each unit) to provide maintenance access to Absorber and Baghouse Areas

   g. Enclosure around hoppers for Baghouses located in FGD Island (cost estimated separately, not included in Alstom budgetary proposal)

   h. Lime preparation building for Reagent Preparation Area in FGD Island, 50' x 50' x 50', including substructure and superstructure (cost estimated separately, not included in Alstom budgetary proposal)

   i. Byproduct recycle building for Byproduct Recycle Area in FGD Island, 60' x 60' x 60', including substructure and superstructure (cost estimated separately, not included in Alstom budgetary proposal)

3. <u>Reagent Storage and Handling, common to both units:</u>

   a. Lime rail car unloader:
      - Lime delivery via 25-car unit train
      - System consists of mobile receiving pan and associated vacuum pneumatic equipment to unload railcar through railcar bottom hoppers
      - Enclosed railcar unloading building
      - One vacuum pneumatic system operating to unload a car
      - Pneumatic vacuum exhausters (2 x 100%)
      - Filter separator with vacuum-to-pressure transfer hopper and valves
      - One lot of pneumatic conveying piping located on an above-grade sleeper pipe rack

- Cost estimate based on vendor quote from United Conveyor Corporation (UCC) for a similar unit

b. Lime storage silos:
   - Two silos, 14-days storage and capable of storing a train load of lime, 2,400-tons storage total, including substructure and superstructure
   - 32’ diameter and 95’ height to top
   - 1,200-tons storage, each
   - Continuous level detection systems
   - Bin vent filters
   - Live bottom hopper outlets
   - Rotary airlock assemblies
   - Lime transfer systems:
     - Pressure pneumatic conveying system from lime storage silos to lime day bins
     - Pneumatic pressure blowers (3 x 100%)
     - One lot of pneumatic conveying piping located on an elevated pipe rack

c. Concrete foundations including caissons for all material silos

d. Concrete foundations for pneumatic conveying blowers and exhausters

4. Byproduct Handling System, common to both units

   a. Two FGD by-product storage silos (7-day capacity each, common to both units) with bin vent filter, fluidizing system, and two unloading conditioners (one operating, one spare per silo)

   b. One common fly ash blending, 7-day storage bin with bin vent filter, fluidizing system, and four pneumatic airslide conveyors

   c. Water pumps and associated piping for unloading conditioners (pin mixers) at both silos

   d. Compressed air system for air operated valves

   e. Storage silo substructure and superstructure

   f. Continuous level detection system

   g. One lot pneumatic conveying piping located on an above grade pipe rack

   h. Two truck scales and substructure

   i. Existing road improvements for truck haulage to existing landfill

   j. Cost estimate based on budgetary proposal from UCC for similar project

   k. Concrete foundations including caissons for all material silos

l. Concrete foundations for pneumatic conveying blowers and exhausters

5. Flue Gas Handling BOP, per unit
   a. ID fan outlet to absorber inlet ductwork insulation; 6" with lagging6" insulation with lagging
   b. Absorber outlet to baghouse inlet ductwork insulation; 6" with lagging
   c. Baghouse outlet to new booster fans and fan outlet to the stack inlet ductwork insulation; 6" with lagging
   d. Concrete foundations for all flue gas ductwork
   e. Epoxy trowel coating on top 100 feet of outside of chimney shell

6. Civil BOP
   a. Roadwork
   b. Site grading
   c. Soil removal earthwork
   d. Excavation, backfill, and compaction for all foundations
   e. Storm sewer work
   f. Two-cell pond for wastewater storage of process water/slurry
   g. Laydown Area
      - Development of a new laydown area, approximately 10 acres, including site preparation, fencing, and temporary power. It was assumed that this area would be located on existing plant property, and does not required land to be purchased.
   h. Highway Intersection Upgrade to provide sufficient plant access for construction period
      - New Bypass Lane on Westside of Highway 365
      - New Southbound Left Turn Lane on Highway 365
      - New Northbound Merge Lane on Highway 365
      - New Northbound Right Turn Lane on Highway 365
      - Extension and upgrade of existing Contractor Haul Road (Highway 46 Spur) to Highway 365
      - Widening of the existing Main Plant Road from the Contractor Haul Road (Highway 46 Spur) to Main Guard House
      - Track crossing signal system at Haul Road (Highway 46 Spur) track crossing
   i. New warehouse building 200' x 75' x 15', including substructure and superstructure.

7. Mechanical BOP System
   a. Interconnecting piping, above-ground and buried
   b. Valves for interconnecting piping, above-ground and buried
   c. Lime slaking water storage tank, 115,000-gallon capacity

d. Slaker water 3" in-line heaters, 475 kW each

e. Recycle make-up water tanks, 2 x 250,000-gallon capacity

f. Pipe Racks, common to both units
- Between lime railcar unloading enclosure and lime silos
- Between lime silos and lime day bins
- From baghouse hoppers to recycle silos and FGD by-product silo
- From lime slurry storage tanks to absorber
- From recycle slurry storage tank to absorber
- Concrete foundations including caissons for all pipe racks
- Shallow concrete foundations for other miscellaneous structures

g. BOP Pumps
- Three by-product recycle water forwarding pumps to recycle slurry, 1000 gpm @ 150' TDH
- Four reagent prep/recycle sump pumps, 120 gpm @ 150' TDH
- Two lime silo and unloading area sump pumps, 120 gpm @ 150' TDH
- Two by-product ash silo area sump pumps, 120 gpm @ 150' TDH
- Two by-product recycle make-up water tank supply pumps, 2600 gpm @ 200' TDH
- Two lime slaking water pumps, 750 gpm @ 100' TDH
- One new Low Pressure Service Water (LPSW) pump, 20,000 gpm @ 100' TDH, including new intake structure, piping and valves
- Two leachate pumps, 50 hp

h. Instrument Air System, common to both units
- Air compressors; 2 x 100%, 250 scfm each @ 100 psig
- IA dryers w/filters; 2 x 100%, 250 net scfm each
- Air receivers; 2 x 100%
- Instrument air piping to every silo or day bin, bin vent and reagent preparation/recycle area
- Heat-traced piping

i. Service Air System, common to both units
- Air compressors; 2 x 100%
- Air receivers; 2 x 100%

j. Field painting
- Multiple coat system used for exposed ductwork only
- Inorganic zinc primer and polyurethane system used for steel

- Allowance for underground piping shop coatings built into piping cost

8. Demolition and Relocation
    a. Hazardous material accumulation building
    b. Ash handling maintenance building
    c. Drainage ditch
    d. Pipe trench
    e. Fabrication shop
    f. Existing contractor electrical hook up
    g. Existing drainage ditches, rerouted with new concrete trenches
    h. Relocation of ACI injection location from the air heater inlet to upstream of the DFGD
    i. Rail Yard Extension, common to both units
        - Extend rail spur to north to allow lime train to be unloaded and cars to be stored on site, designed for 136 lb rail to be consistent with existing coal spurs
    j. Fire Protection System Modifications
        - Deluge system has been included for the new transformers
        - Allowances have been included for fire protection in all of the new buildings; including piping and post indicator valves
        - The new fire protection systems will tie-in to the existing system on-site. It was assumed that the current capacity of the plant fire protections system is sufficient to accommodate the new systems; an evaluation of the current system capacity was not performed.

9. Electrical BOP System
    a. One 115-kV, 1200A isolation disconnect switch
    b. One startup transformer
    c. Two unit auxiliary transformers (UAT)
    d. Three medium-voltage (6.9-kV) switchgear buses (outdoor walk-in type)
    e. Two medium-voltage (6.9-kV) double ended switchgear per unit (total of two)
    f. Two 480-V double ended switchgear buses per unit (total of four)
    g. Six 480-V motor control centers per unit (total of twelve)
    h. Four 6.9-kV/480-V step-down transformers per unit (total of eight)
    i. Two isolated phase UAT tap bus extensions

j. Non-segregated phase bus

k. Medium-voltage cable

l. Low voltage, control and instrumentation cable, as necessary

m. Two electrical equipment buildings

10. <u>Instrumentation and Controls BOP System</u>

a. Controls System based on an estimated number of I/O points:
   - Approximately 1,000 I/O points are required for each unit's DFGD system (including reagent preparation), for a total of 2,000 I/O points the cost of which is included in Alstom budgetary proposal pricing.
   - Approximately 2,000 I/O points for the common areas at the station, located outside of the DFGD Island.

b. CEMS, per unit
   - Existing CEMS analyzers for both units will be recalibrated and recertified; if the existing CEMS analyzers cannot be recalibrated for lower SO_2 emission, new CEMS analyzers will be installed.

11. <u>Labor Costs</u>

Installation/labor costs were included in the base estimate under the direct costs. Manhours are estimated for each item in the base estimate and are based on the type of work and typical estimates for similar work. The labor costs are based on the labor wage rates and labor crews developed by S&L.

a. Labor Wage Rates

Crew labor rates were developed using prevailing craft rates, fringe benefits and state specific worker's compensation rates as published in the 2015 edition of R.S. Means Labor Rates for Pine Bluff, Arkansas area. Costs were added to cover FICA, workers compensation, all applicable taxes, small tools, incidentals, construction equipment, and contractor's overhead. A 1.15 geographic labor productivity multiplier is included based on the Compass International Construction Yearbook for Arkansas. The crew rates do not include an allowance for weather related delays.

b. Labor crews

Construction/erection labor cost is based on the use of applicable construction crews typically required for projects of this type. The construction crew costs were specifically developed for utility industry and are proprietary to S&L. The prevailing craft rates are incorporated into work crews appropriate for the activities, and include costs for small tools, construction equipment, insurance, and site overheads.

12. Other Direct and Construction Indirect Costs

In addition to the base labor costs, other construction indirect costs for the project were broken out in the estimate as well as other contractor direct costs. The following items were included as other direct and construction indirect costs.

a. Scaffolding and Consumables
b. Premiums and per diems ($10 per hour)
c. Overtime is included based on five 10-hour shifts per week work schedule
d. Freight on construction materials
e. Contractor's General & Administration Fees (included at 10% of total direct and construction indirect costs)
f. Contractor's Profit (included at 5% of total direct and construction indirect costs)

13. EPC Indirect Costs

The final contribution to the overall EPC project price are the EPC Contractor's indirect costs; these include the EPC engineering services, startup spare parts and initial fills, technical field advisors, and the EPC risk fee.

a. EPC Engineering Services

The EPC engineering services was estimated based on recent projects with similar scopes and schedules. The total cost of the EPC engineering services was estimated to be $23,000,000 without escalation.

b. Startup Spare Parts and Initial Fills

An allowance has been included for initial fills for equipment, including first fills for lubrication of any motorized equipment. The initial fill of pebble lime was not included in the EPC Contractor's scope, as this is considered to be an operating cost rather than a capital expense. The initial fill of pebble lime is included in the Owner's costs.

c. Technical Field Advisors (Vendors)

Allowances were included for equipment supplier's technical field advisory services based on an estimated 300 man-days. The estimate includes technical field advisors for the FGD system supplier (including FGD system subcontractors) and the DCS supplier.

d. EPC Risk Fee

An EPC approach provides an alternative which is expected to reduce risk for Entergy by placing the responsibility for the project on a single entity, the EPC Contractor. The EPC Risk Fee is a premium included by the contractor which accounts for the additional coordination and management of the project as well as the additional risk assumed by the contractor (See Section 2.2 for a discussion on the contracting strategy and the EPC Risk Fee). Based on S&L's experience with recent EPC projects, an EPC Risk Fee was included at 10% of the total EPC project costs.

14. Escalation

    Escalation was included in the estimate based on the preliminary execution schedule at an escalation rate of 2.15% on equipment and materials and 3.35% on labor and indirects. These escalation rates were developed by S&L based on recent pricing and in-house escalation projections.

    For commodities and equipment related to power plant construction, S&L tracks over 200 U.S. indices from major industrial sources such as BLS, Chemical Engineering, Handy Whitman, and Engineering News Records. S&L reviews the various indices in order to develop an overall average and then evaluates the change in the indices over the last three years and the last five years. Based on this analysis, an annual rate of 2.15%/year escalation is projected for commodities and equipment for the time frame for the project.

    S&L uses RS Means as the basis for estimating labor craft rates. In order to project the escalation rate for the estimate, S&L reviewed five major craft labor types typically used in the power plant industry over the last five years using the average cost of craft labor. Based on this information, S&L projected an annual rate of 3.35%/year escalation on labor and indirects.

15. Sales Tax

    Sales Tax is included in the estimate, and was applied at a rate of 8.125% on all material costs.

4.2 OVERALL PROJECT COSTS FOR CAPITAL ESTIMATE

Outside of the EPC Contractor's total cost, Entergy will incur other costs associated with the project, such as Owner's costs, services procured from third parties (including Owner's engineer, construction management support, startup and commissioning support and performance testing), and other project related costs. The following summarizes the additional project costs to Entergy associated with installing dry FGD at the White Bluff Station:

1. Owner's Costs (by Entergy)

   Owner's Costs are direct costs that the Owner incurs over the life of the project. Entergy estimated the cost for the following items which would be real costs Entergy would incur based on the scope and schedule of this project:

   a. Internal Labor – For all major projects, Entergy assigns internal resources to manage the project from initiation through development, contracting, installation, and commissioning. Internal labor includes personnel from several departments including Capital Project Management & Technology, Engineering, Fossil Operations, Legal, Environmental Services, Supply Chain, Risk Management, Finance, Regulatory, and the Operating Company. The internal labor is estimated based on a proposed staffing plan, developed from the project scope and preliminary schedule using average wage rates. Costs are based on the following anticipated staffing levels:

      - Project Development (through EPC Award) – 25 months, equivalent of 10 people

- Project Execution (beginning at EPC Award) – 53 months, equivalent of 22 people

b. Internal Indirects – Indirect costs incurred by Entergy include a payroll allocation, materials and supplies allocation, a depreciation allocation, and capital suspense allocation. The payroll allocation includes payroll overhead costs for items such as employee benefits. The materials and supplies allocation is used to distribute the overhead costs of managing storerooms that are used to procure, track, and issue material and supplies. The depreciation allocation distributes depreciation and amortization expenses for the new assets. Capital suspense is a distribution of overhead costs associated with administrators, engineers, and supervisors and includes function specific rates and A&G (Corporate Accounting) rates.

c. Travel Expenses –Travel expenses are included to support the oversight of the project, including travel for site-visits, monthly status meetings, critical design reviews, etc. Travel expenses are estimated based on projects with similar schedules and scope.

d. Legal Services – Legal services are contracted from external law firms. These services include contract and regulatory compliance support. Entergy estimated the cost of the legal services based on recent EPC projects.

e. Builders Risk Insurance - Builder's Risk Insurance is included in the estimate and covers the materials, equipment, and labor associated with a large scale construction project in case of physical loss or damage. The estimated is based on estimated project value and schedules.

f. Initial Fills - Entergy will procure a supply contract for pebble lime to the station. Under this contract, Entergy will arrange to provide the initial fill of pebble lime to the station for startup, commissioning, and performance testing. A 120 day supply of pebble lime for both units has been included in the estimate based on the reagent pricing identified in Section 4.3.

2. Third Party Services – Construction Management Oversight

The construction management support was estimated based on the proposed staffing plan shown below, developed from the overall project scope and the preliminary schedule. It was assumed that Entergy will not have the internal support personnel required to perform this task, and therefore it will be outsourced. The cost of labor is based on present day cost, without escalation. Travel and living expenses are based on the current per diem rate for the White Bluff area of $129/day. Costs are based on the following anticipated staffing levels:

a. Home Office Support – 15 months, 1 person

b. On-Site Construction Manager – 35 months, 1 person

c. On-Site Construction Admin/Project Controls Engineer – 35 months, 1 person

d. Construction Field Engineers – 31.5 months, 2 people

The total cost of the Construction Management Support was estimated to be $4,969,000 without escalation.

3. Third Party Services – Startup and Commissioning Oversight

The startup and commissioning support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform this task, and therefore it will be outsourced. Costs are based on the following anticipated staffing levels:

a. Commissioning Support Specialists – 8 months, 2 people

The total cost of the startup and commissioning support was estimated to be $550,000 without escalation.

4. Third Party Services – Owner's Engineer

The Owner's Engineer cost includes scope as summarized below and was estimated based on the preliminary project schedule, including assumptions on manpower requirements, as well as a comparison cost to other projects with similar scope.

The cost of labor is based on present day cost, without escalation. Costs are based on the following scope for the Owner's Engineer work:

a. Conceptual Study Support
b. EPC Specification Supporting Documents
c. Project Schedule Development
d. EPC Specification Development
e. EPC Bid Evaluation and Contract Conformance
f. General Project Support
   - Monthly Project Status Meetings
   - Weekly Teleconferences
   - Overall Coordination
   - Project Administration
   - Site Visits and Travel
g. Permitting (Construction Permits and Modification to Title V and Solid Waste Permits)
h. Design Review of Drawing Submittals
i. Technical support during design, fabrication, construction, commissioning, and testing
j. Equipment vendor QA/QC audits

The total cost of the Owner's Engineer was estimated to be $6,750,000 without escalation.

5. Third Party Services – Performance testing

The cost for performance testing was developed as a factored estimate using costs from projects of similar scope. This cost includes the testing, performed by a third-party contractor hired by the Owner, and also includes the cost for S&L's assistance in the following tasks:

a. Development of the test protocol

b. Procuring the services of the testing contractor

c. Overseeing the performance test campaign

d. Evaluating the results of the testing with respect to guarantee compliance

The estimate for the third party testing contractor is based on the assumption that the contractor would be onsite for up to 3 days for each unit.

The total cost of the Performance Testing was estimated to be $275,000 without escalation.

6. Project Contingency

Project contingency is included in the estimate to cover the uncertainty associated with the project costs, and was developed utilizing Entergy's procedure for developing a project's contingency. The process includes developing three components of contingency:

a. Risk Contingency: This category of contingency is developed with the use of a Risk Register that is used to identify risks that may impact the project. Each risk in the Risk Register is analyzed to determine the probability of the risk and the impacts of the risk to the project.

b. Estimate Uncertainty: This category of contingency uses the estimate accuracy classifications to develop an appropriate level of contingency. Entergy has adopted expected accuracy ranges for estimates with upper and lower boundaries for each class of costs estimate. These ranges recognize the uncertainty that exists in the technical engineering and project management deliverables that define scope.

c. Unknown/Emergent Risks: This category of contingency is used to account for any issues that arise during the project that are not contained within the risk register or to cover any costs associated with unanticipated changes in project scope.

A cost qualitative risk assessment (QRA) was performed using Palisade Corporation's @RISK software. QRAs are used to validate the reasonableness of cost estimates, provide confidence for cost projections, and help establish a reasonable level of contingency based on risk-weighted estimates and project risk profiles. The QRA identifies various confidence levels that the contingency amount is sufficient for the project. For this estimate's cost QRA, an 80% confidence level was selected which means the project is 80% likely to be completed at or below the calculated value. The 80% confidence level results in a contingency value of 15% of the total project cost before escalation and IDC. This level of contingency is within Entergy's guidelines for target contingency range for this class of estimate. The contingency estimate is included in Attachment 8.

7. Escalation on Owner's Costs

Escalation was included in the estimate at an escalation rate 3.35% on the Owner's costs. This escalation rate is based on the rate developed by S&L for labor and indirects above.

8. Interest During Construction

Interest during construction (IDC) accounts for the time value of money associated with the distribution of construction cash flows over the construction period. IDC was applied to the total EPC project costs including contingency. The IDC was calculated based on the milestone payment schedule included in Attachment 4 and a typical interest rate of 7.0% per year which was assumed based on a low interest market environment.

4.3 VARIABLE OPERATING AND MAINTENANCE COSTS

The following unit costs were used to develop the variable Operating and Maintenance (O&M) costs. All of these values, with the exception of the reagent costs, were provided by Entergy and are consistent with typical industry values. The reagent costs are based on recent supplier quotes received for White Bluff.

Table 4-1: Unit Pricing for Utilities (Provided by Entergy)

Unit Cost	Units	Value
Pebble Lime	$/ton	$130.0
High Quality Water	$/1000 gal	$2.00
Low Quality Water	$/1000 gal	$0.53
Byproduct Disposal	$/ton	$7.50
Aux Power Cost[1]	$/MWh	$43.35

Note 1: Entergy provided auxiliary power costs for the first year of operation.

Table 4-2 below summarizes the consumption rates estimated as well as the first year variable O&M costs for the Dry FGD system.

Table 4-2: Variable O&M Rates and First Year Costs, per Unit

	Units	Value
Dry FGD System Parameters		
Reagent Consumption	lb/hr	5,900
Byproduct Waste Production	lb/hr	13,000
Aux Power Consumption	kW	11,000
High Quality Water Consumption	gpm	65
Low Quality Water Consumption	gpm	775
First Year[1] Variable O&M Costs (@CF[2])		
Reagent Cost	$/year	$2,422,000
Byproduct Waste Disposal Cost	$/year	$308,000
Aux Power Cost	$/year	$3,012,000
Water Cost	$/year	$205,000
Bag and Cage Replacement Cost	$/year	$372,000
Total First Year Variable O&M Cost	**$/year**	**$6,319,000**

Note 1: First year costs are provided in $2015.

Note 2: The first year costs are calculated using an annual capacity factor of 72.1%.

4.4 FIXED OPERATING AND MAINTENANCE COSTS

The fixed O&M costs for the systems consist of operating personnel as well as maintenance costs (including material and labor). Based on the conceptual design for the dry FGD system, the estimated staffing additions are 28 personnel for two systems on adjacent units.

The annual maintenance costs are estimated as a percentage of the total capital equipment cost, based on the amount of operating equipment which will require routine maintenance. For this evaluation, the maintenance costs (maintenance and labor) were estimated to be approximately 1.3% of the project capital. This is a lower value than typical because items such as track work and civil work are high capital cost items with little to no maintenance.

Table 4-3 below summarizes the first year fixed O&M costs for the design and typical cases.

Table 4-3: First Year Fixed O&M Costs for Dry FGD, per Unit

First Year[1] Fixed O&M Costs	Units	Value
Operating Labor[2]	$/year	$1,660,000
Maintenance Material	$/year	$975,000
Maintenance Labor	$/year	$650,000
Total First Year Fixed O&M Cost	**$/year**	**$3,285,000**

Note 1: First year costs are provided in $2015.

Note 2: Operating labor costs are based on a labor rate of $56.95, which was provided by Entergy.

Note 3: Installation of systems on both units would require 28 operators total. For accounting purposes, this is considered 14 operators per unit.

4.5 SULFUR DESIGN BASIS SENSITIVITY

The average sulfur content of coal received at the White Bluff station is 0.57 lb SO_2/MMBtu; however, the White Bluff station has the ability to receive coal with sulfur content up to 1.2 lb SO_2/MMBtu. In order to provide a system which is capable of meeting the design SO_2 emission rate on a continuous basis through the range of coals delivered to site, the FGD equipment must be designed for the maximum coal sulfur which could be burned in the units.

S&L evaluated the incremental cost impact of designing the FGD system for an inlet sulfur of 1.2 lb SO_2/MMBtu versus a lower inlet sulfur of 0.57 lb SO_2/MMBtu. It is important to note that the majority of the components within the FGD Island are designed to accommodate the maximum volumetric flue gas flowrate from the unit. The size and cost of these components, primarily the absorber vessels, baghouses, and ID fans, remains the same regardless of the inlet design sulfur. In addition, the majority of the BOP scope items which have been included in the capital cost estimate would remain constant regardless of the inlet design sulfur.

The primary equipment which is impacted by the design inlet sulfur would be the reagent handling, reagent preparation, and the waste handling systems. The inlet sulfur has a direct impact on the quantity of SO_2 which is being removed in the FGD system, and therefore a direct impact on the required lime (reagent) consumption rate as well as the quantity of byproduct produced. The following areas and associated equipment are impacted by adjusting the design inlet sulfur:

a. Reagent Storage and Handling System:
   - Two long-term storage silos

b. Reagent Preparation System (FGD Island):
   - Two lime day bins
   - Two detention lime slakers
   - Two lime slurry storage tanks

c. By-product Handling System:
   - Two FGD by-product storage silos

The quantity of byproduct which is recycled through the system to achieve the required performance will remain relatively constant regardless of inlet design sulfur and is therefore not impacted. In addition, the lime slurry and byproduct recycle are continuously circulated in a loop to the units and back to the storage tanks; therefore, a variation in the design sulfur would not significantly impact the sizing of the recycle storage equipment, pumps or piping systems.

The cost differential was determined by vendor quotes who were requested to provide equipment costs for design capacities at each of the design sulfur levels; this is the same approach used to adjust the Alstom budgetary proposal from a design sulfur of 2.0 lb/MMBtu to 1.2 lb/MMBtu for the cost estimate. The following table summarizes the cost differential for the equipment identified above that is impacted by the sulfur design basis:

Equipment	Design Capacity @ 1.2 lb/MMBtu	Design Capacity @ 0.57 lb/MMBtu	Cost Reduction for 1.2 to 0.57 lb/MMBtu[1]
Two long-term storage silos	2,200 tons each	1,000 tons each	- $4,717,000
Two lime day bins	650 tons each	300 tons each	- $321,000
Two detention lime slakers	13 tons/hour each	6 tons/hour each	- $134,000
Two lime slurry storage tanks	2,000 tons each	1,000 tons each	- $472,000

Two FGD by-product storage silos	3,000 tons each	1,200 tons each	- $3,391,000
One lime slaking water storage tank	175,000 gallons	100,000 gallons	-$34,000
		TOTAL Differential	**- $9,069,000**

Note 1: Cost Reduction shows the reduction in direct installed capital cost including reductions associated with BOP, i.e. reduced foundation sizes.

The reduction in the total direct installed costs associated with reducing the design sulfur level from 1.2 lb SO_2/MMBtu to 0.57 lb SO_2/MMBtu is approximately $9M.

5. SUMMARY

The cost estimate for the White Bluff Units 1&2 Dry FGD systems is based on the addition of two SDA FGD systems for SO_2 removal. The attached capital estimate for the White Bluff Dry FGD system is based on this technical basis.

6. ATTACHMENTS

1. White Bluff DFGD Project Units 1 and 2 Conceptual Capital Cost Estimate, Sargent & Lundy Estimate No. 33387A

2. White Bluff DFGD Project Units 1 and 2 Conceptual Cost Estimate Cash Flow, Sargent & Lundy Estimate No. 33387A

3. White Bluff DFGD Project Units 1 and 2 Level 1 Preliminary Execution Schedule

4. Monthly Progress Payment Schedule for White Bluff DFGD Project

5. S&L Estimating Documentation: Indirects and Construction Equipment included in Crew Rates

6. S&L Estimating Documentation: Escalation Projections

7. White Bluff DFGD Project Units 1 and 2 Conceptual General Arrangement Drawing

8. Entergy Basis of Contingency

ATTACHMENT 1

Conceptual Capital Cost Estimate

ENTERGY ARKANSAS
WHITE BLUFF STATION SDA EPC
CONCEPTUAL COST ESTIMATE

Estimator	A. KOCI
Labor rate table	15ARPBL
Project No.	13027-002
Client	ENTERGY ARKANSAS
Station Name	WHITE BLUFF
Unit	1 & 2
Estimate Date	12/18/2015
Reviewed By	BA
Approved By	MNO
Estimate No.	33387B
Cost index	ARPBL

Estimate Totals

Description	Amount	Totals	Hours
Direct Costs:			
Labor	83,083,008		1,085,764
Material	50,642,339		
Subcontract	313,285,100		
Process Equipment	23,037,000		
	470,047,447	**470,047,447**	
Other Direct & Construction Indirect Costs:			
91-1 Scaffolding	5,816,000		
91-2 Cost Due To OT 5-10's	11,616,000		
91-4 Per Diem	10,858,000		
91-5 Consumables	831,553		
91-6 Freight on Material	2,532,000		
91-8 Sales Tax	7,821,000		
91-9 Contractors G&A	16,696,000		
91-10 Contractors Profit	8,348,000		
	64,518,553	**534,566,000**	
Indirect Costs:			
93-1 Engineering Services	23,000,000		
93-4 SU/S Parts/ Initial Fills	300,000		
93-5 Technical Field Advisors	600,000		
93-8 EPC Fee	55,847,000		
	79,747,000	**614,313,000**	
Escalation:			
96-1 Escalation on Material	6,012,000		
96-2 Escalation on Labor	18,769,000		
96-3 Escalation on Subcontract	37,429,000		
96-4 Escalation on Process Eq	2,115,000		
96-5 Escalation on Indirects	11,600,000		
	75,925,000	**690,238,000**	
Total EPC Cost		***690,238,000***	
Owner's Costs:			
99-1 Owner's Costs	58,546,000		
	58,546,000	**748,784,000**	
Third Party Services:			
100 CM Oversight	4,969,000		
102 Start-up Oversight	550,000		
103 Owner's Engineer	6,750,000		
104 Performance Testing	275,000		
	12,544,000	**761,328,000**	
Project Contingency :			
110 Project Contingency	102,810,000		
	102,810,000	**864,138,000**	
Escalation Addition:			
120 Escalation on Lines 99-110	2,273,000		
	2,273,000	**866,411,000**	
Interest During Construction:			
130 Interest During Constr.	125,078,000		
	125,078,000	**991,489,000**	
Total		***991,489,000***	

ENTERGY ARKANSAS
WHITE BLUFF STATION SDA EPC
CONCEPTUAL COST ESTIMATE

Area	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Total Cost
10	FGD ISLAND	297,904,000	(1,649,000)		-7,814	(680,533)	295,574,467
101	FGD ISLAND FOUNDATIONS AND ENCLOSURES			14,838,628	254,893	18,939,033	33,777,661
102	REAGENT HANDLING SYSTEM	6,000,000	2,046,000	3,162,954	59,192	4,646,650	15,855,604
105	BYPRODUCT HANDLING SYSTEM	7,713,100	6,872,000	1,089,675	107,800	7,935,771	23,610,546
111	FLUE GAS SYSTEM			3,267,828	113,961	7,898,036	11,165,864
121	CIVIL BOP	570,000		8,073,474	106,878	11,535,049	20,178,523
151	MECHANICAL BOP	998,000	1,969,000	6,882,913	115,659	9,189,021	19,038,934
190	DEMOLITION / RELOCATION	100,000		1,578,182	33,735	2,546,302	4,224,484
201	ELECTRICAL BOP SYSTEM		12,299,000	10,665,684	290,576	20,231,688	43,196,372
211	INSTRUMENTATION AND CONTROLS BOP SYSTEM		1,500,000	1,083,000	10,884	841,993	3,424,993
	TOTAL DIRECT	**313,285,100**	**23,037,000**	**50,642,339**	**1,085,764**	**83,083,008**	**470,047,447**

Note: Negative costs included in the cost estimate are due to adjustments to the FGD Budgetary Proposal which was based on a design sulfur of 2.0 lb/MMBTU.
Cost adjustments are included to adjust the design sulfur basis to 1.2 lb/MMBTU.

ENTERGY ARKANSAS
WHITE BLUFF STATION SDA EPC
CONCEPTUAL COST ESTIMATE

Sargent & Lundy

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
10			**FGD ISLAND**									
	23.00.00		**STEEL**									
		23.13.75	**SILO**									
			SILO - LIME DAY BINS 650 TONS - EQUIPMENT ONLY	CREDIT FOR REDUCTION FROM 1200 TONS	-2.00 LS		(273,000)			73.12 /MH		(273,000)
			SILO - LIME DAY BINS 650 TONS - LABOR ONLY	CREDIT FOR REDUCTION FROM 1200 TONS	-2.00 LS				-690	73.12 /MH	(50,428)	(50,428)
			SILO				**(273,000)**		**-690**		**(50,428)**	**(323,428)**
			STEEL				**(273,000)**		**-690**		**(50,428)**	**(323,428)**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.45.00	**FGD EQUIPMENT**									
			DRY FGD -UNITS 1 & 2 FGD ISLAND - EQUIPMENT	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	152,030,000		-		97.28 /MH		152,030,000
			DRY FGD -UNITS 1 & 2 FGD ISLAND - INSTALLATION COST	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	145,874,000		-		97.28 /MH		145,874,000
			DRY FGD - INLUDES ABSORBERS	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES BAGHOUSES	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES REGEANT PREP EQUIPMENT FROM DAY SILOS	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES BYPRODUCT RECYCLE PREPARATION EQUIPMENT	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES ID BOOSTER FANS	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES PROCESS INSTRUMENTATION AND DCS	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES INTERCONNECTING WIRING, PIPING ETC... WITHIN FGD ISLAND	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			DRY FGD - INCLUDES DUCTWORK FROM INLET FLANGE TO OUTLET BOOSTER FAN FLANGE	BASED ON ALSTOM BUDGETARY PROPOSAL AUGUST 8, 2013	1.00 LS	-	-	-		/MH		
			FLOW MODEL	INCLUDED WITH ALSTOM PROPOSAL	1.00 LT	-		-		/MH		
			REAGENT PREPARATION - LIME SLURRY FEED TANKS - EQUIPMENT ONLY	REDUCTION IN SIZE TO 2000 TON FROM 3900 TONS BASED ON ALSTOM SDA BUDGETARY PROPOSAL 8/2013	-2.00 LT	-	(1,300,000)	-		90.81 /MH		(1,300,000)
			REAGENT PREPARATION - LIME SLURRY FEED TANKS - LABOR	REDUCTION IN SIZE TO 2000 TON FROM 3900 TONS BASED ON ALSTOM SDA BUDGETARY PROPOSAL 8/2013	-2.00 LT	-		-	-6,370	90.81 /MH	(578,470)	(578,470)
			FGD EQUIPMENT			**297,904,000**	**(1,300,000)**		**-6,370**		**(578,470)**	**296,025,530**
			MECHANICAL EQUIPMENT			**297,904,000**	**(1,300,000)**		**-6,370**		**(578,470)**	**296,025,530**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.14.00	**MATERIAL HANDLING EQUIPMENT**									
			MATERIAL HANDLING SYSTEM - LIME SLAKING TRAIN - REDUCTION FROM 25 TPH TO 13 TPH - EQUIPMENT ONLY	CREDIT BASED ON ALSTOM SDA BUDGETARY PROPOSAL 8/2013	-2.00 EA	-	(76,000)	-		68.48 /MH		(76,000)
			MATERIAL HANDLING SYSTEM - LIME SLAKING TRAIN - REDUCTION FROM 25 TPH TO 13 TPH - LABOR ONLY	CREDIT BASED ON ALSTOM SDA BUDGETARY PROPOSAL 8/2013	-2.00 EA	-		-	-754	68.48 /MH	(51,635)	(51,635)
			MATERIAL HANDLING EQUIPMENT				**(76,000)**		**-754**		**(51,635)**	**(127,635)**
			MATERIAL HANDLING EQUIPMENT				**(76,000)**		**-754**		**(51,635)**	**(127,635)**
			10 FGD ISLAND			**297,904,000**	**(1,649,000)**		**-7,814**		**(680,533)**	**295,574,467**
101			**FGD ISLAND FOUNDATIONS AND ENCLOSURES**									
	21.00.00		**CIVIL WORK**									
		21.53.00	**PILING**									
			PILE - 18" AUGER CAST X 60' LONG	UNIT 1 BAGHOUSE FDN	252.00 EA	-	-	480,816	6,662	108.46 /MH	722,568	1,203,384
			PILE - 18" AUGER CAST X 60' LONG	UNIT 2 BAGHOUSE FDN	252.00 EA	-	-	480,816	6,662	108.46 /MH	722,568	1,203,384
			PILING					**961,632**	**13,324**		**1,445,136**	**2,406,768**
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	ABSORBER TOWERS FOUNDATIONS	180.00 EA	-	-	334,260	4,552	108.46 /MH	493,680	827,940
			2.5 FT DIA X 30 FT DEEP CAISSON	ABSORBER TOWERS FOUNDATIONS	180.00 EA	-	-	334,260	4,552	108.46 /MH	493,680	827,940
			2.5 FT DIA X 30 FT DEEP CAISSON	REAGENT PREP ENCLOSURE 50'X50' SUBSTRUCTURE	50.00 EA	-	-	92,850	1,264	108.46 /MH	137,133	229,983
			2.5 FT DIA X 30 FT DEEP CAISSON	BYPRODUCTS RECYCLE EQUIPMENT BLDG 60' X 60' SUBSTRUCTURE	72.00 EA	-	-	133,704	1,821	108.46 /MH	197,472	331,176
			2.5 FT DIA X 30 FT DEEP CAISSON	UNIT 1 BOOSTER FAN FOUNDATION	40.00 EA	-	-	74,280	1,011	108.46 /MH	109,707	183,987
			2.5 FT DIA X 30 FT DEEP CAISSON	UNIT 2 BOOSTER FAN FOUNDATION	40.00 EA	-	-	74,280	1,011	108.46 /MH	109,707	183,987
			CAISSON					**1,043,634**	**14,211**		**1,541,379**	**2,585,013**

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CIVIL WORK					**2,005,266**	**27,536**		**2,986,515**	**4,991,781**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	REAGENT PREP ENCLOSURE 50'X50' SUBSTRUCTURE	300.00 CY	-	-	69,000	2,414	59.71 /MH	144,128	213,128
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	BYPRODUCTS RECYCLE EQUIPMENT BLDG 60' X 60' SUBSTRUCTURE	432.00 CY	-	-	99,360	3,476	59.71 /MH	207,544	306,904
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	UNIT 1 BOOSTER FAN FOUNDATION	600.00 CY	-	-	138,000	4,828	59.71 /MH	288,255	426,255
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	UNIT 2 BOOSTER FAN FOUNDATION	600.00 CY	-	-	138,000	4,828	59.71 /MH	288,255	426,255
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ABSORBER TOWER FOUNDATION	1,300.00 CY	-	-	299,000	10,460	59.71 /MH	624,553	923,553
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ABSORBER TOWERS FOUNDATIONS	1,300.00 CY	-	-	299,000	10,460	59.71 /MH	624,553	923,553
			CONCRETE FOUNDATIONS - COMPOSITE RATE	LIME SLURRY FEED TANKS	400.00 CY	-	-	92,000	3,218	59.71 /MH	192,170	284,170
			CONCRETE FOUNDATIONS - COMPOSITE RATE	UNIT 1 BAGHOUSE FDN 3 FDNS 83'X63'X3'	1,743.00 CY	-	-	400,890	14,024	59.71 /MH	837,381	1,238,271
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' UNIT 1 BAGHOUSE AREA, COMPRESSOR BLDG	6.00 CY	-	-	1,380	48	59.71 /MH	2,883	4,263
			CONCRETE FOUNDATIONS - COMPOSITE RATE	UNIT 2 BAGHOUSE FDN 3 FDNS 83'X63'X3'	1,743.00 CY	-	-	400,890	14,024	59.71 /MH	837,381	1,238,271
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' UNIT 2 BAGHOUSE AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	59.71 /MH	2,883	4,263
			CONCRETE					**1,938,900**	**67,828**		**4,049,985**	**5,988,885**
			CONCRETE					**1,938,900**	**67,828**		**4,049,985**	**5,988,885**
	23.00.00		**STEEL**									
		23.17.00	**GALLERY**									
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	4,000.00 SF	-	-	60,000	460	66.07 /MH	30,377	90,377
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	BYPRODUCTS RECYCLE EQUIPMENT BLDG	5,760.00 SF	-	-	86,400	662	66.07 /MH	43,743	130,143
			3" HEAVY DUTY GRATING	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	200.00 SF	-	-	11,200	39	66.07 /MH	2,582	13,782
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	3,000.00 LF	-	-	159,000	621	66.07 /MH	41,009	200,009
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	4,320.00 LF	-	-	228,960	894	66.07 /MH	59,053	288,013
			SELF CLOSING SWING GATE - USER DEFINED	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	40.00 EA	-	-	11,200	184	66.07 /MH	12,151	23,351
			SELF CLOSING SWING GATE - USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	58.00 EA	-	-	16,240	267	66.07 /MH	17,619	33,859
			LADDER	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	800.00 LF	-	-	40,000	368	66.07 /MH	24,302	64,302
			LADDER	BYPRODUCTS RECYCLE EQUIPMENT BLDG	1,100.00 LF	-	-	55,000	506	66.07 /MH	33,415	88,415
			STAIR SYSTEM	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	2,400.00 SF	-	-	218,400	3,172	66.07 /MH	209,601	428,001
			STAIR SYSTEM	BYPRODUCTS RECYCLE EQUIPMENT BLDG	3,500.00 SF	-	-	318,500	4,626	66.07 /MH	305,669	624,169
			GALLERY					**1,204,900**	**11,798**		**779,520**	**1,984,420**
		23.25.00	**ROLLED SHAPE**									
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	REAGENT PREP ENCLOSURE 50'X50' GALLERY SUPPORT	200.00 TN	-	-	716,000	5,057	92.62 /MH	468,423	1,184,423
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	BYPRODUCTS RECYCLE EQUIPMENT BLDG	288.00 TN	-	-	1,031,040	7,283	92.62 /MH	674,529	1,705,569
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	U1 BAGHOUSE SKIRTS STEEL GIRTS	36.00 TN	-	-	138,240	910	92.62 /MH	84,316	222,556
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	U2 BAGHOUSE SKIRTS STEEL GIRTS	36.00 TN	-	-	138,240	910	92.62 /MH	84,316	222,556
			BUILDING MIX, TWO COAT PAINTED		50.00 TN	-	-	128,000	920	92.62 /MH	85,168	213,168
			BUILDING MIX, TWO COAT PAINTED		50.00 TN	-	-	128,000	920	92.62 /MH	85,168	213,168
			BUILDING MIX, TWO COAT PAINTED	REAGENT PREP ENCLOSURE SUPERSTRUCTURE	500.00 TN	-	-	1,280,000	9,195	92.62 /MH	851,678	2,131,678
			BUILDING MIX, TWO COAT PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	720.00 TN	-	-	1,843,200	13,241	92.62 /MH	1,226,417	3,069,617
			ROLLED SHAPE					**5,402,720**	**38,437**		**3,560,015**	**8,962,735**
			STEEL					**6,607,620**	**50,235**		**4,339,534**	**10,947,154**
	24.00.00		**ARCHITECTURAL**									
		24.17.00	**ELEVATOR**									
			PASSENGER, TRACTION, 4 STOPS, 3500LB, 350 FT/MIN	SCHINDLER ELEVATOR BUDGET	1.00 LS	-	-	159,350	943	106.04 /MH	99,946	259,296
			PASSENGER, TRACTION, 4 STOPS, 3500LB, 350 FT/MIN	SCHINDLER ELEVATOR BUDGET	1.00 LS	-	-	159,350	943	106.04 /MH	99,946	259,296

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			ELEVATOR					**318,700**	**1,885**		**199,892**	**518,592**
		24.35.00	**PRE-ENGINEERED BUILDING**									
			PRE-ENGINEERED BUILDING	8' X 10' UNIT 1 BAGHOUSE AREA, COMPRESSOR BLDG	1.00 LT	-	-	20,000	115	92.62 /MH	10,646	30,646
			PRE-ENGINEERED BUILDING	8' X 10' UNIT 2 BAGHOUSE AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	92.62 /MH	10,646	20,646
			PRE-ENGINEERED BUILDING					**30,000**	**230**		**21,292**	**51,292**
		24.37.00	**ROOFING**									
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	U1 SDA TOP ENCLOSURE ROOF	3,318.00 SF	-	-	54,946	339	35.02 /MH	11,887	66,833
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	U2 SDA TOP ENCLOSURE ROOF	3,318.00 SF	-	-	54,946	339	35.02 /MH	11,887	66,833
			METAL, INSULATED- USER DEFINED	REAGENT PREP ENCLOSURE SUPERSTRUCTURE	2,500.00 SF	-	-	19,425	862	35.02 /MH	30,190	49,615
			METAL, INSULATED- USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	3,600.00 SF	-	-	27,972	1,241	35.02 /MH	43,473	71,445
			ROOFING					**157,289**	**2,782**		**97,436**	**254,725**
		24.41.00	**SIDING**									
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	U1 SDA TOP ENCLOSURE SIDING	2,450.00 SF	-	-	40,572	251	79.59 /MH	19,948	60,520
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	U2 SDA TOP ENCLOSURE SIDING	2,450.00 SF	-	-	40,572	251	79.59 /MH	19,948	60,520
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	REAGENT PREP ENCLOSURE	10,000.00 SF	-	-	165,600	1,023	79.59 /MH	81,420	247,020
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	14,400.00 SF	-	-	238,464	1,473	79.59 /MH	117,244	355,708
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	U1 BAGHOUSE SKIRTS 6x(83'+63) x30' tall '	26,260.00 SF	-	-	85,345	1,238	79.59 /MH	98,496	183,841
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	U2 BAGHOUSE SKIRTS 6x(83'+63) x30' tall '	26,280.00 SF	-	-	85,410	1,238	79.59 /MH	98,571	183,981
			SIDING					**655,963**	**5,473**		**435,626**	**1,091,589**
		24.99.00	**ARCHITECTURAL, MISCELLANEOUS**									
			PENTHOUSE HEATING	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	64.10 /MH	4,715	68,715
			PENTHOUSE LIGHTING	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	82.05 /MH	6,036	70,036
			PENTHOUSE FIRE PROTECTION	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	32,000	37	82.05 /MH	3,018	35,018
			PENTHOUSE HEATING	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	64.10 /MH	4,715	68,715
			PENTHOUSE LIGHTING	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	82.05 /MH	6,036	70,036
			PENTHOUSE FIRE PROTECTION	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	32,000	37	82.05 /MH	3,018	35,018
			ARCHITECTURAL, MISCELLANEOUS - USER DEFINED	U1 BAGHOUSE SKIRTS MANDOORS	3.00 EA	-	-	1,500	28	51.10 /MH	1,410	2,910
			ARCHITECTURAL, MISCELLANEOUS - USER DEFINED	U2 BAGHOUSE SKIRTS MANDOORS	3.00 EA	-	-	1,500	28	51.10 /MH	1,410	2,910
			ARCHITECTURAL, MISCELLANEOUS					**323,000**	**423**		**30,358**	**353,358**
			ARCHITECTURAL					**1,484,952**	**10,794**		**784,604**	**2,269,556**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.41.00	**FIRE PROTECTION EQUIPMENT & SYSTEM**									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	REAGENT PREP ENCLOSURE 50'X50' FIRE PROTECTION ALLOWANCE	5,000.00 SF	-	-	27,500	385	68.48 /MH	26,369	53,869
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG' FIRE PROTECTION ALLOWANCE	10,800.00 SF	-	-	59,400	832	68.48 /MH	56,956	116,356
			FIRE PROTECTION EQUIPMENT & SYSTEM					**86,900**	**1,217**		**83,325**	**170,225**
		31.83.00	**TANK**									
			TANK - MOVE OIL TANK FROM USED OIL SHED AND REINSTALL AT WASTE MANAGEMENT FACILITY	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	1.00 EA	-	-	-	345	90.81 /MH	31,314	31,314
			TANK						**345**		**31,314**	**31,314**
			MECHANICAL EQUIPMENT					**86,900**	**1,562**		**114,639**	**201,539**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	REAGENT PREP ENCLOSURE 50'X50' LIGHTING ALLOWANCE	5,000.00 SF	-	-	55,000	57	64.10 /MH	3,684	58,684
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	BYPRODUCTS RECYCLE EQUIPMENT BLDG LIGHTING ALLOWANCE	10,800.00 SF	-	-	118,800	124	64.10 /MH	7,957	126,757
			HVAC, MISCELLANEOUS					**173,800**	**182**		**11,641**	**185,441**
			HVAC					**173,800**	**182**		**11,641**	**185,441**
	36.00.00		**INSULATION**									
		36.13.00	**DUCT**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		36.13.00	DUCT									
			MINERAL WOOL INSULATION, 4 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	U1 BAGHOUSE INSUILATION TOP, SIDES AND HOPPERS	141,831.00 SF	-	-	850,986	35,050	68.76 /MH	2,410,051	3,261,037
			MINERAL WOOL INSULATION, 4 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	U2 BAGHOUSE INSULATIOIN - TOPS, SIDES AND HOPPERS	141,831.00 SF	-	-	850,986	35,050	68.76 /MH	2,410,051	3,261,037
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA SHELL INSULATION	40,167.00 SF	-	-	261,086	10,388	68.76 /MH	714,280	975,366
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA ROOF INSULATION	11,019.00 SF	-	-	71,624	2,850	68.76 /MH	195,948	267,572
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA SHELL INSULATION	40,167.00 SF	-	-	261,086	10,388	68.76 /MH	714,280	975,366
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA ROOF INSULATION	11,019.00 SF	-	-	71,624	2,850	68.76 /MH	195,948	267,572
			DUCT					2,367,390	96,576		6,640,559	9,007,949
			INSULATION					2,367,390	96,576		6,640,559	9,007,949
	41.00.00		ELECTRICAL EQUIPMENT									
		41.37.00	LIGHTING ACCESSORY (FIXTURE)									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	REAGENT PREP ENCLOSURE 50'X50' LIGHTING ALLOWANCE	5,000.00 SF	-	-	55,000	57	63.63 /MH	3,657	58,657
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	BYPRODUCTS RECYCLE EQUIPMENT BLDG LIGHTING ALLOWANCE	10,800.00 SF	-	-	118,800	124	63.63 /MH	7,899	126,699
			LIGHTING ACCESSORY (FIXTURE)					173,800	182		11,556	185,356
			ELECTRICAL EQUIPMENT					173,800	182		11,556	185,356
			101 FGD ISLAND FOUNDATIONS AND ENCLOSURES					**14,838,628**	**254,893**		**18,939,033**	**33,777,661**
102			**REAGENT HANDLING SYSTEM**									
	21.00.00		CIVIL WORK									
		21.53.00	PILING									
			PILE - 18" AUGER CAST X 60' LONG	UNLOADING SHED 200' X 75 WIDE	63.00 EA	-	-	120,204	1,666	108.46 /MH	180,642	300,846
			PILING					120,204	1,666		180,642	300,846
		21.54.00	CAISSON									
			2.5 FT DIA X 30 FT DEEP CAISSON	SUBSTRUCTURE 2200 TON LIME STORAGE SILOS	100.00 EA	-	-	185,700	2,529	108.46 /MH	274,267	459,967
			CAISSON					185,700	2,529		274,267	459,967
		21.71.00	TRACKWORK									
			RAIL, TIE & BALLAST - 136 LB/YD	REAGENT HANDLING SYSTEM UPGRADE AND EXTEND LIME RAIL TRACK TO AVOID BLOCKING ACCESS BY 150 CAR COAL TRAINS	9,060.00 TF	-	-	1,540,200	15,621	81.27 /MH	1,269,493	2,809,693
			TRACKWORK - EXTEND LIME RAIL SPUR AND RELOCATE SWITCH 2060 FT	RELOCATE COAL TRACK SWITCH TO WEST TO AVOID INTERFERENCE WITH 150 CAR COAL TRAINS	1.00 LS	-	-	374,000	7,989	81.27 /MH	649,226	1,023,226
			TRACKWORK					1,914,200	23,609		1,918,719	3,832,919
			CIVIL WORK					2,220,104	27,803		2,373,628	4,593,732
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	SUBSTRUCTURE 2-2200 TON LIME STORAGE SILOS	600.00 CY	-	-	138,000	4,828	59.71 /MH	288,255	426,255
			FOUNDATION, 4500 PSI - COMPOSITE RATE	UNLOADING SHED 200' X 75 WIDE	925.00 CY	-	-	212,750	7,443	59.71 /MH	444,393	657,143
			CONCRETE					350,750	12,270		732,649	1,083,399
			CONCRETE					350,750	12,270		732,649	1,083,399
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	UNLOADING SHED 200' X 75 WIDE x15' TALL	15,000.00 SF	-	-	525,000	4,828	92.62 /MH	447,131	972,131
			PRE-ENGINEERED BUILDING					525,000	4,828		447,131	972,131
			ARCHITECTURAL					525,000	4,828		447,131	972,131
	26.00.00		MISCELLANEOUS STRUCTURAL ITEM									
		26.13.00	CONCRETE SILO									
			CONCRETE SILO - 2200 TON LIME STORAGE SILO	ERECTED - 46' DIA X 154' TALL EA - OPTION 2	2.00 LS	6,000,000				59.71 /MH		6,000,000

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO			**6,000,000**			**0**			**6,000,000**
			MISCELLANEOUS STRUCTURAL ITEM			**6,000,000**			**0**			**6,000,000**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.25.00	**CRANES & HOISTS**									
			CRANES & HOISTS - & TROLLEYS ALLOWANCE	REAGENT HANDLING SYSTEM	1.00 LT	-	275,000	-		68.48 /MH		275,000
			CRANES & HOISTS				**275,000**					**275,000**
			MECHANICAL EQUIPMENT				**275,000**					**275,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.14.00	**MATERIAL HANDLING EQUIPMENT**									
			LIME HANDLING SYSTEM - 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM		1.00 LS	-	500,000	-	3,306	68.48 /MH	226,378	726,378
			LIME HANDLING SYSTEM - VACUUM EXHAUSTER WITH SOUND ENCLOSURES	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	2.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - RECEIVING PANS UNDER RAIL CARS	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - FILTER SEPARATORS ON TOP OF SILO	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - 25 TPH PNEUMATIC TRANSPORT SYSTEM		1.00 LS	-	500,000	-	3,306	68.48 /MH	226,378	726,378
			LIME HANDLING SYSTEM - PRESSURE BLOWERS WITH SOUND ENCLOSURES	INCLUDED WITH 25 TPH PNEUMATIC TRANSPORT SYSTEM	3.00 LS	-		-		/MH		
			LIME HANDLING SYSTEM - PRESSURE FEEDERS	INCLUDED WITH 25 TPH PNEUMATIC TRANSPORT SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - SPARE PARTS FOR STARTUP AND SPECIAL TOOLS		1.00 LS	-	8,000	-		68.48 /MH		8,000
			LIME HANDLING SYSTEM - FREIGHT		1.00 LS	-	50,000	-		68.48 /MH		50,000
			MATERIAL HANDLING EQUIPMENT				**1,058,000**		**6,611**		**452,755**	**1,510,755**
		33.41.00	**MOBILE YARD EQUIPMENT**									
			MOBILE YARD EQUIPMENT - TRACKMOBILE	REAGENT HANDLING SYSTEM	1.00 EA	-	225,000	-		68.48 /MH		225,000
			MOBILE YARD EQUIPMENT				**225,000**					**225,000**
		33.51.00	**RAIL CAR UNLOADER**									
			RAIL CAR UNLOADER -	IN UNLOADING SHED 200'X75' WIDE	1.00 LT	-	225,000	-	3,103	92.62 /MH	287,441	512,441
			RAIL CAR UNLOADER				**225,000**		**3,103**		**287,441**	**512,441**
			MATERIAL HANDLING EQUIPMENT				**1,508,000**		**9,715**		**740,197**	**2,248,197**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	2-2200 TON LIME STORAGE SILOS	3,600.00 SF	-	-	39,600	41	64.10 /MH	2,652	42,252
			HVAC, MISCELLANEOUS					**39,600**	**41**		**2,652**	**42,252**
			HVAC					**39,600**	**41**		**2,652**	**42,252**
	35.00.00		**PIPING**									
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			8 IN DIA, SCH 40, 8" VACUUM CONVEY PIPING WITH 4 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	500.00 LF	-	38,000		540	77.36 /MH	41,792	79,792
			12 IN DIA, 3/8 IN STD- 2500 LF OF 10"/12" TRANSPORT PRESSURE PIPING W 8 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRANSPORT SYSTEM	2,500.00 LF	-	225,000		3,966	77.36 /MH	306,772	531,772
			CARBON STEEL, STRAIGHT RUN				**263,000**		**4,506**		**348,565**	**611,565**
			PIPING				**263,000**		**4,506**		**348,565**	**611,565**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.37.00	**LIGHTING ACCESSORY (FIXTURE)**									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	4200 TON LIME STORAGE SILO	2,500.00 SF	-	-	27,500	29	63.63 /MH	1,828	29,328
			LIGHTING ACCESSORY (FIXTURE)					**27,500**	**29**		**1,828**	**29,328**
			ELECTRICAL EQUIPMENT					**27,500**	**29**		**1,828**	**29,328**
			102 REAGENT HANDLING SYSTEM			**6,000,000**	**2,046,000**	**3,162,954**	**59,192**		**4,646,650**	**15,855,604**
105			**BYPRODUCT HANDLING SYSTEM**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
	21.00.00		**CIVIL WORK**									
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	ASH SILO AND FGD BYPRODUCT SILOS	125.00 EA	-	-	232,125	3,161	108.46 /MH	342,833	574,958
			CAISSON					**232,125**	**3,161**		**342,833**	**574,958**
			CIVIL WORK					**232,125**	**3,161**		**342,833**	**574,958**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FGD BYPRODUCT SILOS	614.00 CY	-	-	141,220	4,940	59.71 /MH	294,981	436,201
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FLY ASH BLENDING SILO	67.00 CY	-	-	15,410	539	59.71 /MH	32,188	47,598
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	FOR TRUCK SCALES	144.00 CY	-	-	33,120	1,159	59.71 /MH	69,181	102,301
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	MISC	100.00 CY	-	-	23,000	805	59.71 /MH	48,043	71,043
			CONCRETE					**212,750**	**7,443**		**444,393**	**657,143**
			CONCRETE					**212,750**	**7,443**		**444,393**	**657,143**
	23.00.00		**STEEL**									
		23.13.75	**SILO**									
			NEW 250 TON FLYASH BLENDING BIN SILO - 24FT DIA X 72 FT HIGH - ERECTION AND FREIGHT INCLUDED	SILO	1.00 EA		275,000		2,839	73.12 /MH	207,594	482,594
			SILO				**275,000**		**2,839**		**207,594**	**482,594**
			STEEL				**275,000**		**2,839**		**207,594**	**482,594**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - 3000 TON FGD BYPRODUCT SILO	ERECTED - 52' DIA X 162' TALL EA	2.00 LS	7,600,000				59.71 /MH		7,600,000
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - SPARE PARTS FOR STARTUP AND SPECIAL TOOLS		1.00 LS	-	10,000			73.12 /MH		10,000
			CONCRETE SILO - FREIGHT		1.00 LS	-	70,000			73.12 /MH		70,000
			CONCRETE SILO			**7,600,000**	**80,000**		**0**			**7,680,000**
			MISCELLANEOUS STRUCTURAL ITEM			**7,600,000**	**80,000**		**0**			**7,680,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.13.00	**BYPRODUCT HANDLING EQUIPMENT**									
			PNEUMATIC ASH CONVEYORS	EQUIPMENT INCLUDES FREIGHT	1.00 LS	-	5,655,000	-		73.12 /MH		5,655,000
			PNEUMATIC ASH CONVEYORS	INSTALLATION COST	1.00 LT	-		-	79,293	73.12 /MH	5,797,912	5,797,912
			BLOWERS, PRESSURE FEEDERS, TRANSPORT PIPING AND VACUUM / PRESSURE RELIEF VALVES	INCLUDED ABOVE	1.00 LT	-		-		73.12 /MH		
			-FOUR PIN MIXERS BELOW CONCRETE SILOS INCL ALL VALVES AND ACCESSORIES		1.00 LT	-	540,000	-	3,347	73.12 /MH	244,742	784,742
			-DRY UNLOADING SPOUT BELOW THE PRODUCT SILO		2.00 EA	-	60,000	-	258	73.12 /MH	18,877	78,877
			AIRSLIDE CONVEYORS FROM BLENDING BIN MIXER/PIPE CONVEYOR, INCL ALL VALVES AND ACCESSORIES		4.00 EA	-	80,000	-	688	73.12 /MH	50,327	130,327
			BYPRODUCT HANDLING EQUIPMENT				**6,335,000**		**83,587**		**6,111,857**	**12,446,857**
		33.57.00	**SCALE**									
			SCALE - NEW TRUCK SCALES	BYPRODUCT HANDLING SYSTEM	2.00 EA	-	182,000	-	460	68.48 /MH	31,485	213,485
			SCALE				**182,000**		**460**		**31,485**	**213,485**
			MATERIAL HANDLING EQUIPMENT				**6,517,000**		**84,046**		**6,143,342**	**12,660,342**
	34.00.00		**HVAC**									
		34.37.00	**DUST COLLECTOR**									
			DUST COLLECTOR - INSTALLED COST		1.00 LS	113,100	-			64.10 /MH		113,100
			DUST COLLECTOR			**113,100**						**113,100**
			HVAC			**113,100**						**113,100**
	35.00.00		**PIPING**									
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			12 IN DIA, 3/8 IN STD	CONVEYOR PIPING	5,000.00 LF	-	-	496,000	7,931	77.36 /MH	613,545	1,109,545
			12 IN DIA, 3/8 IN STD	12" TIE IN PIPING TO BYPRODUCT SILO	1,500.00 LF	-	-	148,800	2,379	77.36 /MH	184,063	332,863

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		35.14.10	CARBON STEEL, STRAIGHT RUN									
			12 IN DIA, 3/8 IN STD	FROM THE EXISTING 50 TPH FLY ASH PRESSURE SYSTEM	1,500.00 LF	-	-	148,800	2,379	77.36 /MH	184,063	332,863
			CARBON STEEL, STRAIGHT RUN					644,800	10,310		797,608	1,442,408
			PIPING					644,800	10,310		797,608	1,442,408
			105 BYPRODUCT HANDLING SYSTEM			**7,713,100**	**6,872,000**	**1,089,675**	**107,800**		**7,935,771**	**23,610,546**
111			**FLUE GAS SYSTEM**									
	21.00.00		CIVIL WORK									
		21.53.00	PILING									
			PILE - 18" AUGER CAST X 60' LONG	UNIT 1 FLUE GAS SYSTEM	138.00 EA	-	-	263,304	3,648	108.46 /MH	395,692	658,996
			PILE - 18" AUGER CAST X 60' LONG	UNIT 2 FLUE GAS SYSTEM	138.00 EA	-	-	263,304	3,648	108.46 /MH	395,692	658,996
			PILING					526,608	7,297		791,384	1,317,992
			CIVIL WORK					526,608	7,297		791,384	1,317,992
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	UNIT 1 FLUE GAS SYSTEM	966.00 CY	-	-	222,180	7,772	59.71 /MH	464,091	686,271
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	UNIT 2 FLUE GAS SYSTEM	966.00 CY	-	-	222,180	7,772	59.71 /MH	464,091	686,271
			CONCRETE					444,360	15,545		928,182	1,372,542
			CONCRETE					444,360	15,545		928,182	1,372,542
	23.00.00		STEEL									
		23.15.00	DUCTWORK									
			PANEL CONSTRUCTION, DUCT PLATE WITH STIFFENERS, INTERNAL TRUSSES, AND TURNING VANES	UNIT 1 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	TN	-	-			97.25 /MH		
			PANEL CONSTRUCTION, DUCT PLATE WITH STIFFENERS, INTERNAL TRUSSES, AND TURNING VANES	UNIT 2 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	TN	-	-			97.25 /MH		
		23.21.00	GIRDER									
			ROLLED SHAPE GIRDER - USER DEFINED	UNIT 1 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	TN	-	-			92.62 /MH		
			ROLLED SHAPE GIRDER - USER DEFINED	UNIT 2 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	TN	-	-			92.62 /MH		
	27.00.00		PAINTING & COATING									
		27.17.00	PAINTING									
			PAINTING - CHIMNEY	UNIT 1 FLUE GAS SYSTEM	1.00 LT	-	-	110,000	4,109	47.61 /MH	195,639	305,639
			PAINTING					110,000	4,109		195,639	305,639
			PAINTING & COATING					110,000	4,109		195,639	305,639
	31.00.00		MECHANICAL EQUIPMENT									
		31.27.00	DAMPERS & ACCESSORIES									
			DAMPERS & ACCESSORIES	UNIT 1 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	SF	-				97.25 /MH		
			DAMPERS & ACCESSORIES	UNIT 2 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	SF	-				97.25 /MH		
		31.33.00	EXPANSION JOINT									
			EXPANSION JOINT	UNIT 1 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	LF	-				97.25 /MH		
			EXPANSION JOINT	UNIT 2 FLUE GAS SYSTEM - INCLUDED IN ALSTOM'S QUOTE	LF	-				97.25 /MH		
	36.00.00		INSULATION									
		36.13.00	DUCT									
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	UNIT 1 FLUE GAS SYSTEM	168,220.00 SF	-	-	1,093,430	43,505	68.76 /MH	2,991,416	4,084,846
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	UNIT 2 FLUE GAS SYSTEM	168,220.00 SF	-	-	1,093,430	43,505	68.76 /MH	2,991,416	4,084,846
			DUCT					2,186,860	87,010		5,982,831	8,169,691
			INSULATION					2,186,860	87,010		5,982,831	8,169,691
			111 FLUE GAS SYSTEM					**3,267,828**	**113,961**		**7,898,036**	**11,165,864**
121			**CIVIL BOP**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
	21.00.00		CIVIL WORK									
		21.14.00	STRIP & STOCKPILE TOPSOIL									
			STRIP & STOCKPILE TOPSOIL - 12"		300,000.00 SF	-	-		690	182.33 /MH	125,745	125,745
			STRIP & STOCKPILE TOPSOIL - ONSITE		40,000.00 CY	-	-		5,287	182.33 /MH	964,044	964,044
			STRIP & STOCKPILE TOPSOIL - 12"	SITE GRADING	600,000.00 SF	-	-		1,379	182.33 /MH	251,490	251,490
			STRIP & STOCKPILE TOPSOIL - ONSITE	SITE GRADING	160,000.00 CY	-	-		21,149	182.33 /MH	3,856,175	3,856,175
			STRIP & STOCKPILE TOPSOIL						28,506		5,197,453	5,197,453
		21.17.00	EXCAVATION									
			MASS EXCAVATION, COMMON EARTH USING 1.5 CY BACKHOE AND (6) 12 CY DUMP TRUCKS, 4 MI ROUNDTRIP	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	7,000.00 CY	-	-		523	182.33 /MH	95,356	95,356
			EXCAVATION - EXCAVATION , BACKFILL & COMPACT ALL FOUNDATIONS		12,600.00 CY	-	-		4,345	79.31 /MH	344,588	344,588
			EXCAVATION						4,868		439,945	439,945
		21.19.00	DISPOSAL									
			DISPOSAL OF EXCESS MATERIAL USING DUMP TRUCK, 4 MI ROUND TRIP	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	7,000.00 CY	-	-		483	79.31 /MH	38,288	38,288
			DISPOSAL						483		38,288	38,288
		21.20.00	BACKFILL									
			FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	1,000.00 CY	-	-		172	79.31 /MH	13,674	13,674
			BACKFILL						172		13,674	13,674
		21.39.00	STORM DRAINAGE UTILITIES									
			STORM SEWER WORK	SITE GRADING	1.00 LT	-	-	110,000	2,299	72.14 /MH	165,839	275,839
			STORM DRAINAGE UTILITIES					110,000	2,299		165,839	275,839
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK		33,334.00 SY	-	-	355,007	1,149	97.31 /MH	111,853	466,860
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	SITE GRADING	66,667.00 SY	-	-	710,004	2,299	97.31 /MH	223,702	933,706
			EROSION AND SEDIMENTATION CONTROL					1,065,011	3,448		335,555	1,400,566
		21.57.00	ROAD, PARKING AREA, & SURFACED AREA									
			BITUMINOUS ROAD - ROAD UPGRADE	BYPRODUCT HAUL ROAD - EAST OF COAL PILE	10,000.00 LF	-	-	500,000	8,046	78.37 /MH	630,563	1,130,563
			BITUMINOUS ROAD - ELIMINATE CHICANE CURVES AT LOW PRESSURE SERVICE WATER PUMPS		1.00 LT	-	-	500,000		78.37 /MH		500,000
			BITUMINOUS ASPHALT (10,000 - 49,999 SF) ROADWORK 24' WIDE 4" ASPHALT	SITE GRADING	1,668.00 LF	-	-	201,828	2,013	78.37 /MH	157,767	359,595
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	HWY 365, NEW BYPASS LANE (ON WEST SIDE)	9,000.00 LF	-	-	603,000	1,655	78.37 /MH	129,716	732,716
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	HWY 365, NEW LEFT TURN LANE (SOUTH BOUND)	3,000.00 LF	-	-	201,000	552	78.37 /MH	43,239	244,239
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	HWY 365, NEW MERGE LANE (NORTH BOUND)	4,175.00 LF	-	-	279,725	768	78.37 /MH	60,174	339,899
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	HWY 365, NEW RIGHT TURN LANE (NORTH BOUND)	4,000.00 LF	-	-	268,000	736	78.37 /MH	57,651	325,651
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	CONTRACTOR HAUL ROAD (HWY 46 SPUR), UPGRADE, REMOVE EXISTING ASPHALT, SUBGRADE PREP NEW BASE AND NEW ASPHALT	4,250.00 LF	-	-	514,250	3,126	78.37 /MH	245,019	759,269
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	CONTRACTOR HAUL ROAD (HWY 46 SPUR), EXTENSION, 24' WIDE	580.00 LF	-	-	84,100	907	78.37 /MH	71,055	155,155
			BITUMINOUS ASPHALT (200,000 SF AND ABOVE)	WIDENING OF EXISTING MAIN PLANT ROAD FROM CONTRACTOR HAUL ROAD (HWY 46 SPUR) TO MAIN GUARD HOUSE	2,900.00 LF	-	-	194,300	1,767	78.37 /MH	138,454	332,754
			ROAD, PARKING AREA, & SURFACED AREA					3,346,203	19,569		1,533,638	4,879,841
		21.71.00	TRACKWORK									
			SIGNAL SYSTEM - RR CROSSING SIGNALS AND GATES	CONTRACTOR HAUL ROAD (HWY 46 SPUR) CROSSING	1.00 LS	220,000	-			/MH		220,000
			TRACKWORK			220,000						220,000
		21.99.00	CIVIL WORK, MISCELLANEOUS									
			CIVIL WORK - CONSTRUCTION LAYDOWN AREAS	FENCING, POWER ETC...	10.00 AC	-	-	780,000	9,195	79.31 /MH	729,287	1,509,287

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CIVIL WORK, MISCELLANEOUS					780,000	9,195		729,287	1,509,287
			CIVIL WORK			220,000		5,301,214	68,540		8,453,679	13,974,892
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	75.00 CY	-	-	17,250	603	59.71 /MH	36,032	53,282
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	555.00 CY	-	-	127,650	4,466	59.71 /MH	266,636	394,286
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	59.71 /MH	2,883	4,263
			CONCRETE FOUNDATIONS	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	1,800.00 CY	-	-	216,000	2,586	59.71 /MH	154,422	370,422
			CONCRETE					362,280	7,703		459,973	822,253
		22.15.00	EMBEDMENT									
			EMBEDMENTS, CARBON STEEL	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	10,000.00 LB	-	-	30,000	575	51.10 /MH	29,368	59,368
			EMBEDMENT					30,000	575		29,368	59,368
		22.17.00	FORMWORK									
			BUILT UP INSTALL & STRIP	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	11,000.00 SF	-	-	27,500	2,529	81.61 /MH	206,370	233,870
			FORMWORK					27,500	2,529		206,370	233,870
		22.25.00	REINFORCING									
			UNCOATED A615 GR60	2 CELL PROCESS WATER RETENTION POND, 220' X 150' X 7'9"	135.00 TN	-	-	138,375	2,793	56.35 /MH	157,391	295,766
			REINFORCING					138,375	2,793		157,391	295,766
			CONCRETE					558,155	13,600		853,102	1,411,257
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			SHELL ONLY, STEEL UNINSULATED 22 GA, 45 FT X 45 FT	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	56,700	791	92.62 /MH	73,298	129,998
			SHELL ONLY, STEEL UNINSULATED 22 GA, 200 FT X 75 FT x 15' TALL	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	420,000	5,862	92.62 /MH	542,945	962,945
			PRE-ENGINEERED BUILDING	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	92.62 /MH	10,646	20,646
			PRE-ENGINEERED BUILDING					486,700	6,768		626,888	1,113,588
		24.41.00	SIDING									
			INSULATION, 2 IN THICK FIBERGLASS,	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	3,240.00 SF	-	-	3,888	37	79.59 /MH	2,964	6,852
			INSULATION, 2 IN THICK FIBERGLASS,	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	8,250.00 SF	-	-	9,900	95	79.59 /MH	7,547	17,447
			SIDING					13,788	132		10,511	24,299
			ARCHITECTURAL					500,488	6,900		637,400	1,137,888
	26.00.00		MISCELLANEOUS STRUCTURAL ITEM									
		26.99.00	MISCELLANEOUS STRUCTURAL ITEM, MISCELLANEOUS									
			MISCELLANEOUS STRUCTURAL ITEM - WATER INTAKE PUMP STRUCTURE - ONE BAY		1.00 LS	-	-	1,110,000	15,537	92.62 /MH	1,439,017	2,549,017
			MISCELLANEOUS STRUCTURAL ITEM, MISCELLANEOUS					1,110,000	15,537		1,439,017	2,549,017
			MISCELLANEOUS STRUCTURAL ITEM					1,110,000	15,537		1,439,017	2,549,017
	27.00.00		PAINTING & COATING									
		27.17.00	PAINTING									
			PAINTING - ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	15,000	172	47.61 /MH	8,209	23,209
			PAINTING					15,000	172		8,209	23,209
			PAINTING & COATING					15,000	172		8,209	23,209
	31.00.00		MECHANICAL EQUIPMENT									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.41.00	FIRE PROTECTION EQUIPMENT & SYSTEM									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	11,138	156	68.48 /MH	10,679	21,817
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	NEW WAREHOUSE BUILDING 200'X75'X15' TALL, FIRE PROTECTION ALLOWANCE	15,000.00 SF	-	-	82,500	1,155	68.48 /MH	79,106	161,606
			FIRE PROTECTION EQUIPMENT & SYSTEM					93,638	1,311		89,786	183,423
			MECHANICAL EQUIPMENT					93,638	1,311		89,786	183,423
	34.00.00		HVAC									
		34.99.00	HVAC, MISCELLANEOUS									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	22,275	23	64.10 /MH	1,492	23,767
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	165,000	172	64.10 /MH	11,052	176,052
			HVAC, MISCELLANEOUS					187,275	196		12,544	199,819
			HVAC					187,275	196		12,544	199,819
	36.00.00		INSULATION									
		36.99.00	INSULATION, MISCELLANEOUS									
			INSULATION - ROOF INSULATION	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	2,430	23	51.10 /MH	1,189	3,619
			INSULATION - ROOF INSULATION	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	18,000	172	51.10 /MH	8,810	26,810
			INSULATION, MISCELLANEOUS					20,430	196		10,000	30,430
			INSULATION					20,430	196		10,000	30,430
	41.00.00		ELECTRICAL EQUIPMENT									
		41.37.00	LIGHTING ACCESSORY (FIXTURE)									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	22,275	23	63.63 /MH	1,481	23,756
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL, LIGHTING ALLOWANCE	15,000.00 SF	-	-	165,000	172	63.63 /MH	10,971	175,971
			LIGHTING ACCESSORY (FIXTURE)					187,275	196		12,452	199,727
		41.99.00	ELECTRICAL EQUIPMENT, MISCELLANEOUS									
			ELECTRICAL EQUIPMENT, MISCELLANEOUS -	ADD BAY TO EXISTING INTAKE STRUCTURE FOR 3RD PUMP	1.00 LT	-	-	100,000	230	82.05 /MH	18,862	118,862
			ELECTRICAL EQUIPMENT, MISCELLANEOUS					100,000	230		18,862	118,862
			ELECTRICAL EQUIPMENT					287,275	426		31,314	318,589
	71.00.00		PROJECT INDIRECT									
		71.25.00	CONSULTANT, THIRD PARTY									
			CONSULTANT - SUBSURFACE INVESTIGATION		1.00 LS	200,000	-			/MH		200,000
			CONSULTANT - GEOTECHNICAL		1.00 LS	150,000	-			/MH		150,000
			CONSULTANT, THIRD PARTY			350,000						350,000
			PROJECT INDIRECT			350,000						350,000
			121 CIVIL BOP			**570,000**		**8,073,474**	**106,878**		**11,535,049**	**20,178,523**
151			**MECHANICAL BOP**									
	11.00.00		DEMOLITION									
		11.21.00	CIVIL WORK									
			CIVIL WORK - DIG AND REFILL PIPE TRENCH	BYPRODUCT PIPE FROM RACK	100.00 LF	-	-		172	79.31 /MH	13,674	13,674
			CIVIL WORK - DIG AND REFILL PIPE TRENCH	REAGENT UNLOADING PIPE FROM RACK	200.00 LF	-	-		345	79.31 /MH	27,348	27,348
			CIVIL WORK						517		41,022	41,022
			DEMOLITION						517		41,022	41,022
	21.00.00		CIVIL WORK									
		21.17.00	EXCAVATION									
			EXCAVATION - 6" PIPE 4' DEEP PIPE TRENCH & BEDDING		1,430.00 LF	-	-	8,680	526	79.31 /MH	41,715	50,395
			EXCAVATION - 6" PIPE 4' DEEP PIPE TRENCH & BEDDING		750.00 LF	-	-	4,553	276	79.31 /MH	21,879	26,431
			EXCAVATION - 3" PIPE 4' DEEP PIPE TRENCH & BEDDING		3,000.00 LF	-	-	12,750	966	79.31 /MH	76,575	89,325
			EXCAVATION - 3" PIPE 4' DEEP PIPE TRENCH & BEDDING		1,000.00 LF	-	-	4,250	322	79.31 /MH	25,525	29,775
			EXCAVATION - 3" PIPE 4' DEEP PIPE TRENCH & BEDDING		5,260.00 LF	-	-	22,355	1,693	79.31 /MH	134,262	156,617
			EXCAVATION - 8" PIPE 4' DEEP PIPE TRENCH & BEDDING		1,340.00 LF	-	-	9,929	539	79.31 /MH	42,754	52,684
			EXCAVATION - 36" PIPE 4' DEEP PIPE TRENCH & BEDDING	RIVER WATER PIPE TIE IN	20.00 LF	-	-	733	21	79.31 /MH	1,677	2,411
			EXCAVATION - 32" PIPE 4' DEEP PIPE TRENCH & BEDDING	LPSW PIPE	2,100.00 LS	-	-	60,375	1,859	79.31 /MH	147,407	207,782

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		21.17.00	**EXCAVATION**									
			EXCAVATION - 10" PIPE 4' DEEP PIPE TRENCH & BEDDING	RECYCLE ASH WATER PIPE DISCHARGE BURIED	1,800.00 LF	-	-	15,930	786	79.31 /MH	62,354	78,284
			EXCAVATION - 4" PIPE 4' DEEP PIPE TRENCH & BEDDING	LEACHATE PIPING	3,500.00 LF	-	-	16,905	1,167	79.31 /MH	92,528	109,433
			EXCAVATION					**156,460**	**8,154**		**646,677**	**803,138**
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	TANK FOUNDATIONS	76.00 EA	-	-	141,132	1,922	108.46 /MH	208,443	349,575
			2.5 FT DIA X 30 FT DEEP CAISSON	COMMON PIPE RACK FOUNDATIONS	186.00 EA	-	-	345,402	4,703	108.46 /MH	510,136	855,538
			2.5 FT DIA X 30 FT DEEP CAISSON	BYPRODUCT PIPE RACK FOUNDATIONS	94.00 EA	-	-	174,558	2,377	108.46 /MH	257,811	432,369
			2.5 FT DIA X 30 FT DEEP CAISSON	REAGENT UNLOADING PIPE RACK FOUNDATIONS	16.00 EA	-	-	29,712	405	108.46 /MH	43,883	73,595
			CAISSON					**690,804**	**9,407**		**1,020,272**	**1,711,076**
			CIVIL WORK					**847,264**	**17,561**		**1,666,949**	**2,514,214**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			SPREAD FOOTING FOUNDATION, 4500 PSI - COMPOSITE RATE	3X 35' DIA TANK FDN	81.00 CY	-	-	18,630	652	59.71 /MH	38,914	57,544
			CONCRETE FOUNDATIONS - COMPOSITE RATE	COMMON PIPE RACK FOUNDATIONS	207.00 CY	-	-	47,610	1,666	59.71 /MH	99,448	147,058
			CONCRETE FOUNDATIONS - COMPOSITE RATE	BYPRODUCT PIPE RACK FOUNDATIONS	105.00 CY	-	-	24,150	845	59.71 /MH	50,445	74,595
			CONCRETE FOUNDATIONS - COMPOSITE RATE	REAGENT UNLOADING PIPE RACK FOUNDATIONS	18.00 CY	-	-	4,140	145	59.71 /MH	8,648	12,788
			CONCRETE					**94,530**	**3,307**		**197,455**	**291,985**
			CONCRETE					**94,530**	**3,307**		**197,455**	**291,985**
	23.00.00		**STEEL**									
		23.21.00	**GIRDER**									
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	COMMON 500'LX20'W, 400'Lx15'W,400'Lx9'W, ALL 20' HIGH	196.00 TN	-	-	531,160	3,830	92.62 /MH	354,724	885,884
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	BYPRODUCT PIPE RACK, 650LF X6 WIDE X 20' HIGH	39.00 TN	-	-	105,690	762	92.62 /MH	70,583	176,273
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	REAGENT UNLOADING PIPE RACK, 100LF X 6' WIDE X 20' HIGH	6.00 TN	-	-	16,260	117	92.62 /MH	10,859	27,119
			GIRDER					**653,110**	**4,709**		**436,166**	**1,089,276**
			STEEL					**653,110**	**4,709**		**436,166**	**1,089,276**
	27.00.00		**PAINTING & COATING**									
		27.13.00	**COATING**									
			COATING - CHIMNEY - ACID RESISTANT COATING TOP 100 FT OUTSIDE SHELL		1.00 LS	270,000	-			47.61 /MH		270,000
			COATING			**270,000**						**270,000**
			PAINTING & COATING			**270,000**						**270,000**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.17.00	**COMPRESSOR & ACCESSORIES**									
			AIR COMPRESSOR, CENTRIFUGAL - 250 SCFM EA @ 200 PSIG	SERVICE AIR	2.00 EA	-	310,000	-	92	68.48 /MH	6,297	316,297
			AIR COMPRESSOR, CENTRIFUGAL - 250 SCFM EA @ 200 PSIG	INSTRUMENT AIR	2.00 EA	-	310,000	-	92	68.48 /MH	6,297	316,297
			AIR DRYER - W/FILTERS, 250 NET SCFM EA	SERVICE AIR	2.00 EA	-	33,400	-	74	68.48 /MH	5,038	38,438
			AIR DRYER - W/FILTERS, 250 NET SCFM EA	INSTRUMENT AIR	2.00 EA	-	33,400	-	74	68.48 /MH	5,038	38,438
			AIR RECEIVER - 1,000 GALLON EA	SERVICE AIR	2.00 EA	-	11,200	-	37	68.48 /MH	2,519	13,719
			AIR RECEIVER - 1,000 GALLON EA	INSTRUMENT AIR	2.00 EA	-	11,200	-	37	68.48 /MH	2,519	13,719
			COMPRESSOR & ACCESSORIES				**709,200**		**405**		**27,707**	**736,907**
		31.41.00	**FIRE PROTECTION EQUIPMENT & SYSTEM**									
			DELUGE - POWER TRANSFORMERS		3.00 EA	-	-	127,500	1,959	77.36 /MH	151,519	279,019
			FIRE PROTECTION EQUIPMENT & SYSTEM					**127,500**	**1,959**		**151,519**	**279,019**
		31.65.00	**HEAT EXCHANGER**									
			HEAT EXCHANGER - SLAKER WATER HEATER 3" IN-LINE, 475 KW		4.00 EA	-	220,000	-	368	63.63 /MH	23,404	243,404
			HEAT EXCHANGER				**220,000**		**368**		**23,404**	**243,404**
		31.75.00	**PUMP**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.75.00	**PUMP**									
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - MAKEUP WATER PUMPS, 2600 GPM, 200 TDH		2.00 EA	-	96,000	-	577	68.48 /MH	39,514	135,514
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - RECYCLE ASH WATER PUMP, 50 HP		3.00 EA	-	72,000	-	221	68.48 /MH	15,113	87,113
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - LIME SLAKING WATER PIUMPS, 50 HP		2.00 EA	-	48,000	-	147	68.48 /MH	10,075	58,075
			CENTRIFUGAL, VERTICAL, CANNED - LEACHATE PUMPS, 50 HP		2.00 EA	-	134,000	-	828	68.48 /MH	56,673	190,673
			CENTRIFUGAL, VERTICAL, WET PIT - LPSW PUMP, 650 HP		1.00 EA	-	188,000	-	690	68.48 /MH	47,228	235,228
			SUMP, CENTRIFUGAL, WET BEARING - REGENT PREP/RECYCLE SUMP, 120GPM, 150 TDH		4.00 EA	-	220,000	-	276	68.48 /MH	18,891	238,891
			SUMP, CENTRIFUGAL, WET BEARING - LIME SILO & UNLOADING AREA SUMP 120 GPM @ 150 TDH		2.00 EA	-	88,000	-	138	68.48 /MH	9,446	97,446
			SUMP, CENTRIFUGAL, WET BEARING - WASTE ASH SILO AREA SUMP 120GPM @150 TDH		2.00 EA	-	88,000	-	138	68.48 /MH	9,446	97,446
			SUMP, CENTRIFUGAL, WET BEARING - WASTEWATER FORWARDING PUMP TO RECYCLED SLURRY, 100 GPM@150 TDH		4.00 EA	-	28,800	-	294	68.48 /MH	20,150	48,950
			SUMP, SUBMERSIBLE - RECYCLE ASH WATER TANK SUPPLY PUMP, 100 HP		2.00 EA	-	77,000	-	690	68.48 /MH	47,228	124,228
			PUMP				**1,039,800**		**3,998**		**273,763**	**1,313,563**
		31.83.00	**TANK**									
			ATMOSPHERIC, FIELD FABRICATED - LIME SLAKING WATER TANK, 175,000 GALLON	35' DIA X 24' HIGH	1.00 EA	220,000		-		90.81 /MH		220,000
			ATMOSPHERIC, FIELD FABRICATED - RECYCLE ASH WATER TANK, 250,000 GALLON	35' DIA X 36' HIGH	2.00 EA	508,000		-		90.81 /MH		508,000
			TANK			**728,000**						**728,000**
			MECHANICAL EQUIPMENT			**728,000**	**1,969,000**	**127,500**	**6,729**		**476,392**	**3,300,892**
	35.00.00		**PIPING**									
		35.13.01	**SS 304, ABOVE GROUND, PROCESS AREA**									
			1 IN DIA, SCH 40S		1,520.00 LF	-	-	32,832	1,974	77.36 /MH	152,728	185,560
			1.5 IN DIA, SCH 40S		1,380.00 LF	-	-	52,302	2,094	77.36 /MH	161,976	214,278
			2 IN DIA, SCH 40S		2,070.00 LF	-	-	113,022	3,426	77.36 /MH	265,051	378,073
			SS 304, ABOVE GROUND, PROCESS AREA					**198,156**	**7,494**		**579,755**	**777,911**
		35.13.10	**CARBON STEEL, ABOVE GROUND, PROCESS AREA**									
			1 IN DIA, SCH 80		260.00 LF	-	-	2,314	305	77.36 /MH	23,581	25,895
			2 IN DIA, SCH 80		2,260.00 LF	-	-	48,138	3,273	77.36 /MH	253,207	301,345
			2.5 IN DIA, SCH 40		1,000.00 LF	-	-	15,400	1,437	77.36 /MH	111,149	126,549
			3 IN DIA, SCH 40		7,160.00 LF	-	-	125,300	11,028	77.36 /MH	853,130	978,430
			3 IN DIA, SCH 80		1,760.00 LF	-	-	38,720	3,055	77.36 /MH	236,313	275,033
			4 IN DIA, SCH 40		1,000.00 LF	-	-	22,600	1,701	77.36 /MH	131,601	154,201
			6 IN DIA, SCH 40		880.00 LF	-	-	28,248	1,629	77.36 /MH	125,981	154,229
			6 IN DIA, SCH 40 VACUUM PIPE		2,260.00 LF	-	-	72,546	4,182	77.36 /MH	323,543	396,089
			8 IN DIA, SCH 80		3,520.00 LF	-	-	256,608	9,832	77.36 /MH	760,582	1,017,190
			CARBON STEEL, ABOVE GROUND, PROCESS AREA					**609,874**	**36,441**		**2,819,087**	**3,428,961**
		35.13.36	**DUCTILE IRON, ABOVE GROUND, PROCESS AREA**									
			12 IN DIA, - ASHCOLITE PIPE		1,620.00 LF	-	-	162,000	3,594	72.14 /MH	259,256	421,256
			DUCTILE IRON, ABOVE GROUND, PROCESS AREA					**162,000**	**3,594**		**259,256**	**421,256**
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			6 IN DIA, SCH 40, LIME SLAKING TANK MAKEUP	LIME SLAKING TANK MAKEUP	1,200.00 LF	-	-	27,480	1,214	77.36 /MH	93,899	121,379
			8 IN DIA, SCH 40, LIME SLAKING TANK MAKEUP	LIME SLAKING TANK MAKEUP	450.00 LF	-	-	13,905	486	77.36 /MH	37,613	51,518
			8 IN DIA, SCH 40, RECYCLE ASH WATER PIPING	RECYCLE ASH WATER PIPING	2,000.00 LF	-	-	61,800	2,161	77.36 /MH	167,169	228,969
			10 IN DIA, SCH 40, RECYCLE ASH TANK MAKEUP	RECYCLE ASH TANK MAKEUP	450.00 LF	-	-	24,660	610	77.36 /MH	47,216	71,876
			CARBON STEEL, STRAIGHT RUN					**127,845**	**4,471**		**345,897**	**473,742**
		35.15.10	**CARBON STEEL, BURIED**									
			3 IN DIA, SCH 40, WRAPPED		3,000.00 LF	-	-	51,000	2,241	77.36 /MH	173,393	224,393
			4 IN DIA, SCH 40, WRAPPED, LEACHATE PIPING	LEACHATE PIPING	3,500.00 LF	-	-	72,800	2,856	77.36 /MH	220,965	293,765
			6 IN DIA, SCH 40, WRAPPED		750.00 LF	-	-	23,925	776	77.36 /MH	60,021	83,946
			10 IN DIA, SCH 40, WRAPPED, RECYCLE ASH WATER PIPE DISCHARGE BURIED	RECYCLE ASH WATER PIPE DISCHARGE BURIED	1,800.00 LF	-	-	119,700	2,441	77.36 /MH	188,865	308,565
			32 IN DIA, 3/8 IN STD, WRAPPED - LPSW PIPE	LPSW PIPE	2,100.00 LF	-	-	638,610	11,079	77.36 /MH	857,095	1,495,705

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		35.15.10	**CARBON STEEL, BURIED**									
			36 IN DIA, 3/8 IN STD, WRAPPED - RIVER WATER PIPE	RIVER WATER PIPE - TIE IN	20.00 LF	-	-	6,772	138	77.36 /MH	10,706	17,478
			CARBON STEEL, BURIED					**912,807**	**19,533**		**1,511,045**	**2,423,852**
		35.15.25	**FRP, BURIED**									
			3 IN DIA, TAPER		1,000.00 LF	-	-	14,800	460	77.36 /MH	35,568	50,368
			3 IN DIA, TAPER FRP/HDPE PIPE		2,380.00 LF	-	-	35,224	1,094	77.36 /MH	84,651	119,875
			FRP, BURIED					**50,024**	**1,554**		**120,219**	**170,243**
		35.15.30	**HDPE, BURIED**									
			6 IN DIA, DR 9		1,430.00 LF	-	-	12,870	1,134	77.36 /MH	87,737	100,607
			8 IN DIA, DR 9		1,340.00 LF	-	-	20,770	1,278	77.36 /MH	98,896	119,666
			HDPE, BURIED					**33,640**	**2,413**		**186,633**	**220,273**
		35.36.00	**PIPE SUPPORTS, RACK**									
			SUPPORT SLEEPERS	BYPRODUCT PIPE, 1750LF	125.00 EA	-	-	43,750	575	77.36 /MH	44,460	88,210
			SUPPORT SLEEPERS	REAGENT UNLOADING PIPE, 1500LF	108.00 EA	-	-	37,800	497	77.36 /MH	38,413	76,213
			PIPE SUPPORTS, RACK					**81,550**	**1,071**		**82,873**	**164,423**
		35.45.00	**VALVES**									
			VALVE - 36" 150 LB CS BUTTERFLY, FLANGED		2.00 EA	-	-	79,920	96	77.36 /MH	7,398	87,318
			VALVE - 12" 150 LB CS KNIFE GATE, FLANGED		6.00 EA	-	-	20,160	195	77.36 /MH	15,099	35,259
			VALVE - 12" 150 LB CS GATE VALVE, FLANGED		2.00 EA	-	-	8,920	65	77.36 /MH	5,033	13,953
			VALVE - 10" 150 LB CS SWING CHECK, FLANGED		2.00 EA	-	-	9,200	55	77.36 /MH	4,268	13,468
			VALVE - 10" 150 LB CS BUTTERFLY, FLANGED		5.00 EA	-	-	22,200	138	77.36 /MH	10,670	32,870
			VALVE - 8" 150 LB CS GATE, FLANGED		20.00 EA	-	-	100,000	425	77.36 /MH	32,900	132,900
			VALVE - 6" 150 LB CS GATE, FLANGED		6.00 EA	-	-	19,800	110	77.36 /MH	8,536	28,336
			VALVE - 6" 150 LB CS AIR OPERATED GATE, FLANGED		4.00 EA	-	-	20,400	74	77.36 /MH	5,691	26,091
			VALVE - 6" 150 LB CS AIR OPERATED GLOBE, FLANGED		4.00 EA	-	-	20,400	74	77.36 /MH	5,691	26,091
			VALVE - 6" 150 LB CS SWING CHECK, FLANGED		2.00 EA	-	-	3,400	37	77.36 /MH	2,845	6,245
			VALVE - 4" 150 LB CS GATE, FLANGED		3.00 EA	-	-	3,825	25	77.36 /MH	1,921	5,746
			VALVE - 3" AND BELOW CS FOR SERVICE WATER ISOLATION		120.00 EA	-	-	1,224,000	1,076	77.36 /MH	83,229	1,307,229
			VALVE - 3" AND BELOW CS FOR SERVICE AIR ISOLATION		120.00 EA	-	-	1,224,000	1,076	77.36 /MH	83,229	1,307,229
			VALVE - 3" 150 LB CS GATE, FLANGED		20.00 EA	-	-	15,000	179	77.36 /MH	13,871	28,871
			VALVE - 3" CS PST IND FOR FP 250 LB		6.00 EA	-	-	6,600	54	77.36 /MH	4,161	10,761
			VALVE - 2" AND ABOVE BRONZE VALVES FOR INSTRUMENT AIR ISOLATION		600.00 EA	-	-	78,000	501	77.36 /MH	38,787	116,787
			VALVE - 1" CS FLANGED		4.00 EA	-	-	880	21	77.36 /MH	1,636	2,516
			VALVE - 6" CI POST INDICATOR 250 LB., MECHANICAL JOINT WITH BOXES BURIED VALVE		6.00 EA	-	-	4,080	28	77.36 /MH	2,134	6,214
			VALVES					**2,860,785**	**4,228**		**327,099**	**3,187,884**
			PIPING					**5,036,681**	**80,799**		**6,231,866**	**11,268,547**
	36.00.00		**INSULATION**									
		36.17.01	**PIPE, CALCIUM SILICATE W/ALUMINUM JACKETING**									
			CALCIUM SILICATE W/ALUMINUM JACKETING - 8" PIPE 1.5" THICK		2,520.00 LF	-	-	16,380	487	68.76 /MH	33,460	49,840
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 3" PIPE		1,260.00 LF	-	-	3,591	155	68.76 /MH	10,655	14,246
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 3" PIPE		5,660.00 LF	-	-	16,131	696	68.76 /MH	47,865	63,996
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 2.5" PIPE		380.00 LS	-	-	1,083	47	68.76 /MH	3,214	4,297
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 2.0" PIPE		4,140.00 LS	-	-	10,309	476	68.76 /MH	32,720	43,029
			PIPE, CALCIUM SILICATE W/ALUMINUM JACKETING					**47,494**	**1,860**		**127,914**	**175,408**
			INSULATION					**47,494**	**1,860**		**127,914**	**175,408**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.33.00	**HEAT TRACING**									
			HEAT TRACING - 8" PIPE		2,520.00 LS	-	-	18,749	43	63.63 /MH	2,765	21,513
			HEAT TRACING - 3" PIPE		1,260.00 LF	-	-	9,374	22	63.63 /MH	1,382	10,757
			HEAT TRACING - 3" PIPE		5,660.00 LF	-	-	42,110	98	63.63 /MH	6,209	48,320
			HEAT TRACING - 2.5" PIPE		380.00 LS	-	-	2,827	7	63.63 /MH	417	3,244
			HEAT TRACING - 2.0" PIPE		440.00 LS	-	-	3,274	8	63.63 /MH	483	3,756
			HEAT TRACING					**76,334**	**177**		**11,256**	**87,590**
			ELECTRICAL EQUIPMENT					**76,334**	**177**		**11,256**	**87,590**
			151 MECHANICAL BOP			**998,000**	**1,969,000**	**6,882,913**	**115,659**		**9,189,021**	**19,038,934**

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
190			**DEMOLITION / RELOCATION**									
	11.00.00		**DEMOLITION**									
		11.21.00	**CIVIL WORK**									
			CIVIL WORK - REMOVE FENCING & GATES	HAZARDOUS MATERIAL ACCUMULATION BLDG	1,133.00 LF	-	-		91	107.10 /MH	9,763	9,763
			CIVIL WORK - DIG AND REFILL PIPE TRENCH	TRENCH N.1784.33 FROM E905' TO 1180'	550.00 LF	-	-		948	79.31 /MH	75,208	75,208
			CIVIL WORK - REMOVE DRAINAGE DITCH	DRAINAGE DITCH E970 FROM N2055 'TO N1350'	705.00 LF	-	-		1,216	79.31 /MH	96,403	96,403
			CIVIL WORK - REMOVE DRAINAGE DITCH	DRAINAGE DITCH e1350 from n970' to n1180'	210.00 LF	-	-		362	79.31 /MH	28,716	28,716
			CIVIL WORK - DEMO AREA PAVEMENT	ASH HANDLING / ELECT BLDG	1.00 LS	-	-		115	107.10 /MH	12,310	12,310
			CIVIL WORK						**2,732**		**222,400**	**222,400**
		11.22.00	**CONCRETE**									
			CONCRETE FOUNDATION - HAZARDOUS MATERIAL ACCUMULATION BLDG	HAZARDOUS MATERIAL ACCUMULATION BLDG, 50'X50'X20'	80.00 CY	-	-		230	107.10 /MH	24,621	24,621
			CONCRETE FOUNDATION - HAZARDOUS MATERIAL ACCUMULATION BLDG	HAZARDOUS MATERIAL ACCUMULATION BLDG, HAZMAT PAVEMENT DEMO	12.00 CY	-	-		61	107.10 /MH	6,574	6,574
			CONCRETE FOUNDATION - ASH HANDLING MAINT BLDG	ASH HANDLING / ELECT BLDG FDN	225.00 CY	-	-		647	107.10 /MH	69,246	69,246
			CONCRETE FOUNDATION - PAVING & FOUNDATION DEMO	FLOURESCENT LIGHT TUBE DISPOSAL SHED FDN	2.00 CY	-	-		10	107.10 /MH	1,096	1,096
			CONCRETE FOUNDATION - PAVING & FOUNDATION DEMO	USED OIL SHED DEMO	35.00 CY	-	-		101	107.10 /MH	10,772	10,772
			CONCRETE						**1,049**		**112,307**	**112,307**
		11.23.00	**STEEL**									
			STRUCTURAL STEEL DISASSEMBLE BLDG STEEL & TOOL CRIB FOR RELOCATION	ASH HANDLING / ELECT BLDG	52.00 TN	-	-		359	107.10 /MH	38,408	38,408
			STEEL						**359**		**38,408**	**38,408**
		11.24.00	**ARCHITECTURAL**									
			ARCHITECTURAL - HAZARDOUS MATERIAL ACCUMULATION BLDG 50'X50'X20'	HAZARDOUS MATERIAL ACCUMULATION BLDG, 50'X50'X20'	50,000.00 CF	-	-		632	107.10 /MH	67,707	67,707
			ARCHITECTURAL - HAZARDOUS MATERIAL ACCUMULATION BLDG 50'X50'X20'	HAZARDOUS MATERIAL ACCUMULATION BLDG, CONTAINER DISPOSAL AREA	1.00 LT	-	-		287	107.10 /MH	30,776	30,776
			ARCHITECTURAL - DEMO EXISTING INSULATED SIDING & ROOFING , DEMO INTERIOR OFFICES	ASH HANDLING / ELECT BLDG	15,000.00 CF	-	-		862	107.10 /MH	92,328	92,328
			ARCHITECTURAL - BLDG DEMO	COAL DUMPER AIR COMPRESSOR DEMOLITION	100.00 SF	-	-		11	107.10 /MH	1,231	1,231
			ARCHITECTURAL - BLDG DEMO	USED OIL SHED DEMO	600.00 SF	-	-		8	107.10 /MH	812	812
			ARCHITECTURAL						**1,801**		**192,854**	**192,854**
		11.31.00	**MECHANICAL EQUIPMENT**									
			MECHANICAL EQUIPMENT - DEMOLISH SEPTIC TANKS	ASH HANDLING / ELECT BLDG	2.00 EA	-	-		0	107.10 /MH	25	25
			MECHANICAL EQUIPMENT - REMOVE 15 TN BRIDGE CRANE (50 FT SPAN) , CRANE SUPPORT STEEL AND 3 JIB CRANES FGOR RELOCATION	ASH HANDLING / ELECT BLDG	21.00 TN	-	-		290	92.62 /MH	26,828	26,828
			MECHANICAL EQUIPMENT						**290**		**26,852**	**26,852**
		11.35.00	**PIPING**									
			PIPING - REMOVE 12" BA PIPE IN PIPE TRENCH	TRENCH N.1784.33 FROM E905' TO 1180'	550.00 LF	-	-		87	107.10 /MH	9,276	9,276
			PIPING - REMOVE 10" FA PIPE	TRENCH N.1784.33 FROM E905' TO 1180'	550.00 LF	-	-		76	107.10 /MH	8,125	8,125
			PIPING						**162**		**17,401**	**17,401**
		11.99.00	**DEMOLITION, MISCELLANEOUS**									
			DEMOLITION - MISC	ALLOWANCE	1.00 LT	-	-		2,299	92.62 /MH	212,920	212,920
			DEMOLITION, MISCELLANEOUS						**2,299**		**212,920**	**212,920**
			DEMOLITION						**8,691**		**823,142**	**823,142**
	21.00.00		**CIVIL WORK**									
		21.16.00	**GENERAL EARTHWORK**									
			EARTHWORK - COVER AREA WITH BACKFILL AND GRADE	HAZARDOUS MATERIAL ACCUMULATION BLDG	300.00 CY	-	-	4,800	138	182.33 /MH	25,149	29,949
			EARTHWORK - COVER AREA WITH BACKFILL AND GRADE	ASH HANDLING / ELECT BLDG	1,000.00 CY	-	-	16,000	460	182.33 /MH	83,830	99,830
			EARTHWORK - COVER AREA WITH BACKFILL AND GRADE 250'X250'X2'	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG) AREA FILL	5,000.00 CY	-	-	80,000	259	182.33 /MH	47,154	127,154
			GENERAL EARTHWORK					**100,800**	**856**		**156,133**	**256,933**
		21.17.00	**EXCAVATION**									
			EXCAVATION - ALLOWANCE FOR NEW DITCHES	WASTE MANAGEMENT FACILITY (	1,200.00 CY	-	-		276	79.31 /MH	21,879	21,879

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		21.17.00	EXCAVATION									
			EXCAVATION - ALLOWANCE FOR NEW DITCHES	REPLACES HAZMAT BLDG) AREA FILL	1,200.00 CY	-	-		276	79.31 /MH	21,879	21,879
			EXCAVATION						276		21,879	21,879
		21.20.00	BACKFILL									
			FOUNDATION BACKFILL, PREVIOUSLY EXCAVATED MATERIAL, ALLOWANCE FOR OLD DITCHES	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG) AREA FILL	100.00 CY	-	-		17	79.31 /MH	1,367	1,367
			BACKFILL						17		1,367	1,367
		21.21.00	MASS FILL									
			MASS FILL, COMMON EARTH USING DUMP TRUCK, 2 MI ROUND TRIP, ALLWANCE FOR MISC ADDITIONAL FILL	RELOCATED BLDGS	1.00 LT	-	-	30,000	345	79.31 /MH	27,348	57,348
			MASS FILL					30,000	345		27,348	57,348
		21.39.00	STORM DRAINAGE UTILITIES									
			EXTEND CULVERTS UNDER ROAD	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG) AREA FILL	48.00 LF	-	-	4,800	166	79.31 /MH	13,127	17,927
			STORM DRAINAGE UTILITIES					4,800	166		13,127	17,927
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			EROSION AND SEDIMENTATION CONTROL - ALLOWANCE	RELOCATED BLDGS	1.00 LS	-	-	20,000	345	36.12 /MH	12,455	32,455
			EROSION AND SEDIMENTATION CONTROL					20,000	345		12,455	32,455
		21.43.00	FENCEWORK									
			FABRIC, WIRE & POSTS, CHAIN LINK FENCE, GALVANIZED, 6 FT TALL, 6 GAGE 3 STRANDS OF BARB WIRE, 2 IN POST AT 10 FT O.C.	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	800.00 FT	-	-	18,880	92	36.12 /MH	3,321	22,201
			VEHICLE GATE, 14 FT WIDE BY 7 FT TALL	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	4.00 EA	-	-	4,000	110	36.12 /MH	3,986	7,986
			FENCEWORK					22,880	202		7,307	30,187
		21.47.00	LANDSCAPING									
			LANDSCAPING - ALLOWANCE FOR PAVING GRADING & SEEDING	RELOCATED BLDGS	1.00 LS	-	-	40,000	460	36.12 /MH	16,607	56,607
			LANDSCAPING					40,000	460		16,607	56,607
		21.57.00	ROAD, PARKING AREA, & SURFACED AREA									
			BITUMINOUS ASPHALT (10,000 - 49,999 SF) ASHPALT PAVING FOR TRUCK TURNAROUND , DRIVEWAY AND AROUND BLDG	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	43,000.00 SF	-	-	216,720	1,236	78.37 /MH	96,836	313,556
			ROAD, PARKING AREA, & SURFACED AREA					216,720	1,236		96,836	313,556
			CIVIL WORK					435,200	3,902		353,060	788,260
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	320.00 CY	-	-	73,600	2,575	59.71 /MH	153,736	227,336
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)- CONTAINER DISPOSAL SLAB & APRON	550.00 CY	-	-	126,500	4,425	59.71 /MH	264,234	390,734
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ACI PORT STAIRTOWER FDNS	60.00 CY	-	-	13,800	483	59.71 /MH	28,826	42,626
			CONCRETE					213,900	7,483		446,796	660,696
			CONCRETE					213,900	7,483		446,796	660,696
	23.00.00		STEEL									
		23.17.00	GALLERY									
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	ACI PORT STAIR TOWERS AND PLATFORMS	728.00 SF	-	-	10,920	84	66.07 /MH	5,529	16,449
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	ACI PORT STAIR TOWERS AND PLATFORMS	436.00 LF	-	-	23,108	90	66.07 /MH	5,960	29,068
			STAIR SYSTEM	ACI PORT STAIR TOWERS AND PLATFORMS	896.00 SF	-	-	81,536	1,184	66.07 /MH	78,251	159,787
			GALLERY					115,564	1,358		89,740	205,304
		23.21.00	GIRDER									
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	UNIT 2 ACI PIPE RACK OVER ROADWAY, 35LF X 23 WIDE X 20' HIGH	1.26 TN	-	-	3,415	25	92.62 /MH	2,280	5,695

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			GIRDER					**3,415**	**25**		**2,280**	**5,695**
		23.25.00	**ROLLED SHAPE**									
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	ACI PORT STAIRTOWER FRAMING - 2 TOWERS	4.40 TN	-	-	15,752	111	92.62 /MH	10,305	26,057
			REASSEMBLE ASH HANDLING/ELEC BLDG METAL FRAME, PURLINS & GIRTS AS NEW LABOR SHOP	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	50.00 TN	-	-		1,379	92.62 /MH	127,752	127,752
			ROLLED SHAPE					**15,752**	**1,491**		**138,057**	**153,809**
			STEEL					**134,731**	**2,873**		**230,077**	**364,808**
	24.00.00		**ARCHITECTURAL**									
		24.15.00	**DOOR (INCL. FRAME & HARDWARE)**									
			DOOR (INCL. FRAME & HARDWARE) - ROLL UP DOOR MAN DOOR ETC...	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	1.00 LS	-	-	5,000	92	51.10 /MH	4,699	9,699
			DOOR (INCL. FRAME & HARDWARE)					**5,000**	**92**		**4,699**	**9,699**
		24.27.00	**MASONRY**									
			BLOCK, CONCRETE, 8 IN, HOLLOW REINFORCED, ALTERNATE COURSES	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	850.00 SF	-	-	4,242	106	53.08 /MH	5,601	9,842
			MASONRY					**4,242**	**106**		**5,601**	**9,842**
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	5,000.00 SF	-	-	140,000	1,954	92.62 /MH	180,982	320,982
			PRE-ENGINEERED BUILDING					**140,000**	**1,954**		**180,982**	**320,982**
		24.37.00	**ROOFING**									
			METAL, INSULATED- NEW INSULATED SIDING & ROOFING	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	6,500.00 SF	-	-	50,505	2,241	35.02 /MH	78,493	128,998
			ROOFING					**50,505**	**2,241**		**78,493**	**128,998**
		24.41.00	**SIDING**									
			METAL, INSULATED, NEW INSULATED SIDING & ROOFING	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	8,500.00 SF	-	-	140,760	870	79.59 /MH	69,207	209,967
			SIDING					**140,760**	**870**		**69,207**	**209,967**
		24.99.00	**ARCHITECTURAL, MISCELLANEOUS**									
			ARCHITECTURAL, MISCELLANEOUS - OFFICE ALLOWANCE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	1.00 LS	-	-	100,000	2,299	51.10 /MH	117,471	217,471
			ARCHITECTURAL, MISCELLANEOUS - TOOL CRIB	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	1.00 LS	-	-	5,000	92	51.10 /MH	4,699	9,699
			ARCHITECTURAL, MISCELLANEOUS					**105,000**	**2,391**		**122,170**	**227,170**
			ARCHITECTURAL					**445,507**	**7,653**		**461,151**	**906,658**
	27.00.00		**PAINTING & COATING**									
		27.17.00	**PAINTING**									
			PAINTING - ALLOWANCE	NEW ASH HANDLING MAINT BLDG 45'X45'X18' TALL	2,025.00 SF	-	-	2,025	23	47.61 /MH	1,108	3,133
			PAINTING					**2,025**	**23**		**1,108**	**3,133**
			PAINTING & COATING					**2,025**	**23**		**1,108**	**3,133**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.25.00	**CRANES & HOISTS**									
			BRIDGE CRANE - INSTALL SALVAGED 15 TN BRIDGE CRANE AND 2 JIB CRANES WITH EXISTING SUPPORT STEEL	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	21.00 TN	-	-	-	290	92.62 /MH	26,828	26,828
			BRIDGE CRANE - LOAD TEST & CERTIFY BRIDGE CRANE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	1.00 EA	-	-	-	230	92.62 /MH	21,292	21,292
			MOTORIZED HOIST - 1 TON	RELOCATED FROM PRESENT PORT LOCATIOIN	2.00 EA	-	-	-	138	68.48 /MH	9,446	9,446
			CRANES & HOISTS						**657**		**57,565**	**57,565**
		31.41.00	**FIRE PROTECTION EQUIPMENT & SYSTEM**									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	1.00 LT	-	-	10,000	138	68.48 /MH	9,446	19,446
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	WASTE MANAGEMENT FACILITY (	5,000.00 SF	-	-	27,500	385	68.48 /MH	26,369	53,869

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.41.00	FIRE PROTECTION EQUIPMENT & SYSTEM									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	REPLACES HAZMAT BLDG)	5,000.00 SF	-	-	27,500	385	68.48 /MH	26,369	53,869
			FIRE PROTECTION EQUIPMENT & SYSTEM					37,500	523		35,814	73,314
		31.51.00	MERCURY REMOVAL EQUIPMENT									
			ACTIVATED CARBON INJECTION (ACI) - LANCE RELOCATIONS	RELOCATED FROM PRESENT PORT LOCATIOIN (16 PER UNIT)	32.00 EA	-	-	-	368	68.48 /MH	25,188	25,188
			ACTIVATED CARBON INJECTION (ACI) - 40 HP BLOWERS	NEW BLOWERS (2 PER UNIT)	4.00 EA	-	-	80,000	184	68.48 /MH	12,594	92,594
			ACTIVATED CARBON INJECTION (ACI) - REMOVE EXISTING 20 HP BLOWERS	REMOVE EXISTING	2.00 EA	-	-	-	23	68.48 /MH	1,574	1,574
			MERCURY REMOVAL EQUIPMENT					80,000	575		39,356	119,356
			MECHANICAL EQUIPMENT					117,500	1,755		132,736	250,236
	34.00.00		HVAC									
		34.99.00	HVAC, MISCELLANEOUS									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	2,100.00 SF	-	-	23,100	24	64.10 /MH	1,547	24,647
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	2,100.00 SF	-	-	23,100	24	64.10 /MH	1,547	24,647
			HVAC, MISCELLANEOUS					46,200	48		3,094	49,294
			HVAC					46,200	48		3,094	49,294
	35.00.00		PIPING									
		35.13.25	FRP, ABOVE GROUND, PROCESS AREA									
			1.5 IN DIA, TAPER	INJECTION PORTS	12.00 LF	-	-	353	6	77.36 /MH	437	790
			2 IN DIA, TAPER	INJECTION PORTS	16.00 LF	-	-	421	9	77.36 /MH	697	1,118
			3 IN DIA, TAPER	INJECTION PORTS	40.00 LF	-	-	1,032	31	77.36 /MH	2,383	3,415
			FRP, ABOVE GROUND, PROCESS AREA					1,806	45		3,518	5,323
		35.14.25	FRP, STRAIGHT RUN									
			4 IN DIA, TAPER	NEW ACI PIPING	600.00 LF	-	-	12,660	400	77.36 /MH	30,944	43,604
			FRP, STRAIGHT RUN					12,660	400		30,944	43,604
		35.36.00	PIPE SUPPORTS, RACK									
			U-BOLT FOR 4 IN PIPE	ACI PIPE	27.00 EA	-	-	81	62	77.36 /MH	4,802	4,883
			SUPPORT SLEEPERS	ACI PIPE 330 LF	17.00 EA	-	-	5,950	78	77.36 /MH	6,047	11,997
			SUPPORT FOR 4 IN DIA PIPE - USER DEFINED		2.00 EA	-	-	306	18	77.36 /MH	1,423	1,729
			SUPPORT FOR 3 IN DIA PIPE - USER DEFINED		4.00 EA	-	-	576	32	77.36 /MH	2,490	3,066
			PIPE SUPPORTS, RACK					6,913	191		14,761	21,674
		35.45.00	VALVES									
			VALVE - 4" 150 LB CS GATE, FLANGED	ACI AUTO MATIC ISOLATION VALVES (RELOCATE 4 PER UNIT)	8.00 EA	-	-	160	66	77.36 /MH	5,122	5,282
			VALVES					160	66		5,122	5,282
			PIPING					21,539	702		54,344	75,883
	41.00.00		ELECTRICAL EQUIPMENT									
		41.37.00	LIGHTING ACCESSORY (FIXTURE)									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	NEW LABOR SHOP METAL BLDG (WAS ASH HANDLING / ELECTRICAL BLDG)	6,500.00 SF	-	-	71,500	75	63.63 /MH	4,754	76,254
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	5,000.00 SF	-	-	55,000	57	63.63 /MH	3,657	58,657
			LIGHTING ACCESSORY (FIXTURE)					126,500	132		8,411	134,911
		41.46.00	MOTOR CONTROL CENTER (MCC), COMPONENT									
			FVN STARTER - #4,	NEW BLOWERS	3.00 EA	-	-	14,700	55	63.63 /MH	3,511	18,211
			MOTOR CONTROL CENTER (MCC), COMPONENT					14,700	55		3,511	18,211
			ELECTRICAL EQUIPMENT					141,200	187		11,921	153,121
	42.00.00		RACEWAY, CABLE TRAY & CONDUIT									
		42.15.23	CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
			1-1/2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS	NEW BLOWERS	3.00 EA	-	-	258	4	61.79 /MH	266	524
			CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					258	4		266	524
		42.15.37	CONDUIT, RGS									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		42.15.37	**CONDUIT, RGS**									
			3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	HOIST	450.00 LF	-	-	1,319	100	61.79 /MH	6,200	7,519
			1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	NEW BLOWERS	400.00 LF	-	-	2,688	131	61.79 /MH	8,068	10,756
			CONDUIT, RGS					**4,007**	**231**		**14,269**	**18,275**
			RACEWAY, CABLE TRAY & CONDUIT					**4,264**	**235**		**14,535**	**18,799**
	43.00.00		**CABLE**									
		43.10.00	**CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION**									
			CONTROL/INSTRUMENTATION/COMMUNICATION TERMINATION - MISC	ACI RELOCATION	600.00 LF	-	-	1,920	55	82.05 /MH	4,527	6,447
			CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**1,920**	**55**		**4,527**	**6,447**
		43.20.00	**600V CABLE & TERMINATION**									
			600V #8 3/C CU EPR TS-CPE	HOIST	500.00 LF	-	-	3,280	14	82.05 /MH	1,179	4,459
			600V #4/0 3/C W/G CU EPR TS-CPE	NEW BLOWERS	450.00 LF	-	-	10,728	72	82.05 /MH	5,942	16,670
			TERMINATION - COMPRESSION LUG, #8, 2 HOLE, COPPER	HOIST	12.00 EA	-	-	78	4	82.05 /MH	340	418
			TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER	NEW BLOWERS	12.00 EA	-	-	111	7	82.05 /MH	566	677
			600V CABLE & TERMINATION					**14,197**	**98**		**8,026**	**22,223**
			CABLE					**16,117**	**153**		**12,553**	**28,670**
	44.00.00		**CONTROL & INSTRUMENTATION**									
		44.21.00	**INSTRUMENT**									
			ACCOUSTIC MONITOR	RELOCATE TO NEW INJECTION LANCES	6.00 EA	-	-		28	64.68 /MH	1,784	1,784
			INSTRUMENT						**28**		**1,784**	**1,784**
			CONTROL & INSTRUMENTATION						**28**		**1,784**	**1,784**
	71.00.00		**PROJECT INDIRECT**									
		71.25.00	**CONSULTANT, THIRD PARTY**									
			COMPUTATIONAL FLUID DYNAMIC ANALYSIS (CFD)	ACI SYSTEM	1.00 LS	100,000	-			/MH		100,000
			CONSULTANT, THIRD PARTY			**100,000**						**100,000**
			PROJECT INDIRECT			**100,000**						**100,000**
			190 DEMOLITION / RELOCATION			**100,000**		**1,578,182**	**33,735**		**2,546,302**	**4,224,484**
201			**ELECTRICAL BOP SYSTEM**									
	21.00.00		**CIVIL WORK**									
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	U1 MAIN ELECT BLDG 40'X100'	23.00 EA	-	-	42,711	582	108.46 /MH	63,081	105,792
			2.5 FT DIA X 30 FT DEEP CAISSON	2 UAT AND 1 SST TRANSFORMER SUBSTRUCTURE	36.00 EA	-	-	66,852	910	108.46 /MH	98,736	165,588
			2.5 FT DIA X 30 FT DEEP CAISSON	BUS DUCT SUPPORTS	167.00 EA	-	-	310,119	4,223	108.46 /MH	458,025	768,144
			2.5 FT DIA X 30 FT DEEP CAISSON	OVERHEAD TRANSMISSION LINE STRUCTURAL - INCLUDES 115 KV DISCONNECT SWITCH FOUNDATION	10.00 EA	-	-	18,570	253	108.46 /MH	27,427	45,997
			2.5 FT DIA X 30 FT DEEP CAISSON	U2 MAIN ELECT BLDG 40'X100'	23.00 EA	-	-	42,711	582	108.46 /MH	63,081	105,792
			CAISSON					**480,963**	**6,549**		**710,351**	**1,191,314**
			CIVIL WORK					**480,963**	**6,549**		**710,351**	**1,191,314**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			CONCRETE FOUNDATIONS - COMPOSITE RATE	U1 MAIN ELECT BLDG 40'X100'	300.00 CY	-	-	69,000	2,414	59.71 /MH	144,128	213,128
			CONCRETE FOUNDATIONS - COMPOSITE RATE	2 UAT AND 1 SST TRANSFORMER SUBSTRUCTURE	600.00 CY	-	-	138,000	4,828	59.71 /MH	288,255	426,255
			CONCRETE FOUNDATIONS - COMPOSITE RATE	BUS DUCT SUPPORTS	333.00 CY	-	-	76,590	2,679	59.71 /MH	159,982	236,572
			CONCRETE FOUNDATIONS - COMPOSITE RATE	OVERHEAD TRANSMISSION LINE STRUCTURAL	50.00 CY	-	-	11,500	402	59.71 /MH	24,021	35,521
			CONCRETE FOUNDATIONS - COMPOSITE RATE	U2 MAIN ELECT BLDG 40'X100'	300.00 CY	-	-	69,000	2,414	59.71 /MH	144,128	213,128
			CONCRETE					**364,090**	**12,737**		**760,513**	**1,124,603**
			CONCRETE					**364,090**	**12,737**		**760,513**	**1,124,603**
	23.00.00		**STEEL**									
		23.99.00	**STEEL, MISCELLANEOUS**									
			STEEL, MISCELLANEOUS - AUX SUPPORT STEEL	AUX SUPPORT STEEL	100.00 TN	-	-	271,000	1,954	92.62 /MH	180,982	451,982

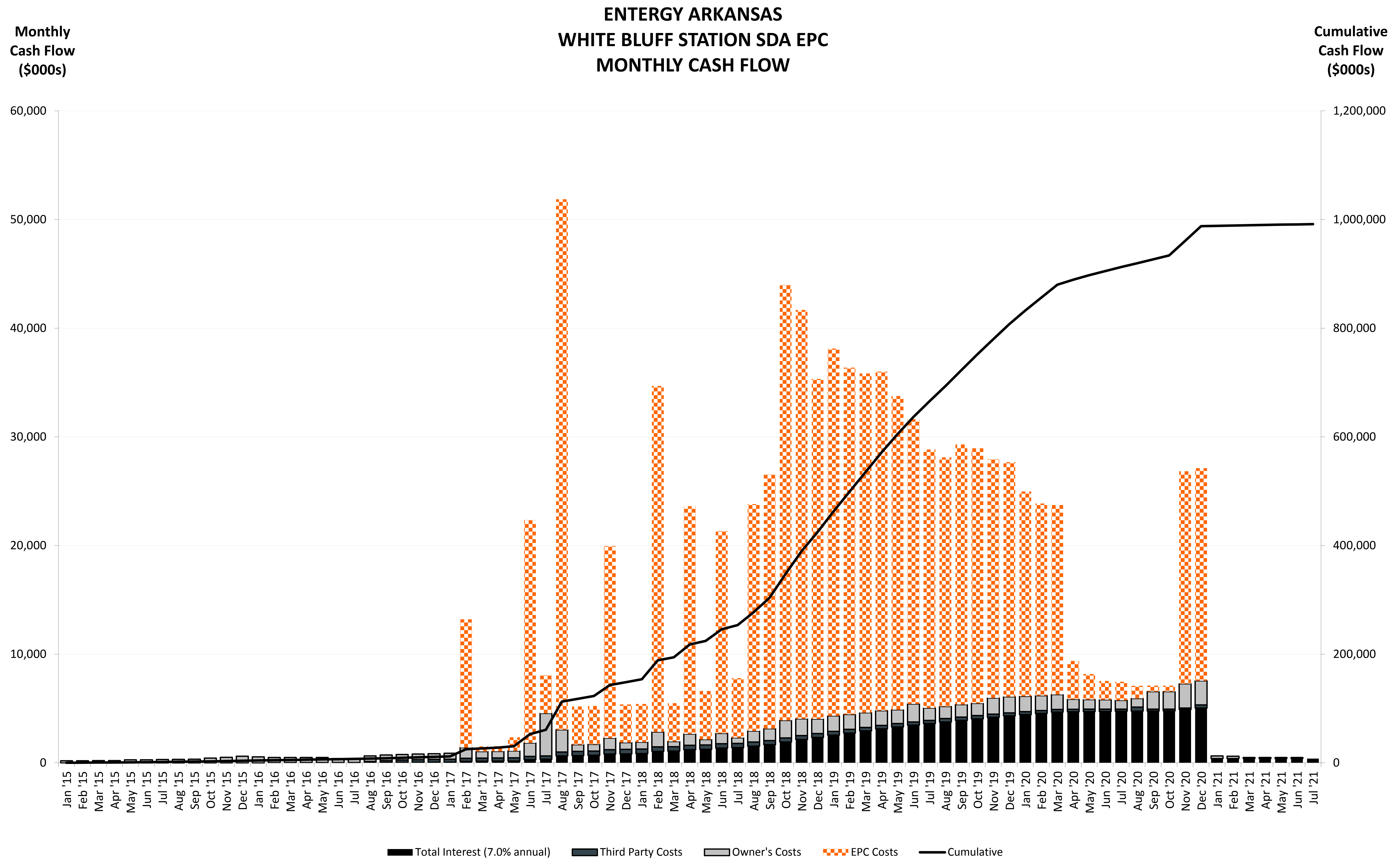
Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		23.99.00	STEEL, MISCELLANEOUS									
			STEEL, MISCELLANEOUS -	BUS DUCT SUPPORTS	167.00 TN	-	-	452,570	3,263	92.62 /MH	302,239	754,809
			STEEL, MISCELLANEOUS -	OVERHEAD TRANSMISSION LINE STRUCTURAL	15.00 TN	-	-	40,650	293	92.62 /MH	27,147	67,797
			STEEL, MISCELLANEOUS					764,220	5,510		510,368	1,274,588
			STEEL					764,220	5,510		510,368	1,274,588
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			PRE-ENGINEERED BUILDING - MAIN ELECT BLDG 40'X100'	U1 MAIN ELECT BLDG 40'X100' FURNISH ONLY	1.00 EA	-	504,000		4,598	51.10 /MH	234,943	738,943
			PRE-ENGINEERED BUILDING - MAIN ELECT BLDG 40'X100'	U1 MAIN ELECT BLDG 40'X100' INSTALLATION	1.00 EA	-			414	92.62 /MH	38,326	38,326
			PRE-ENGINEERED BUILDING - MAIN ELECT BLDG 40'X100'	U2 MAIN ELECT BLDG 40'X100' FURNISH ONLY	1.00 EA	-	504,000		4,598	51.10 /MH	234,943	738,943
			PRE-ENGINEERED BUILDING - MAIN ELECT BLDG 40'X100'	U2 MAIN ELECT BLDG 40'X100' INSTALLATION	1.00 EA	-			414	92.62 /MH	38,326	38,326
			PRE-ENGINEERED BUILDING				1,008,000		10,023		546,536	1,554,536
			ARCHITECTURAL				1,008,000		10,023		546,536	1,554,536
	41.00.00		ELECTRICAL EQUIPMENT									
		41.13.00	BUS DUCT									
			ISO PHASE, SELF COOLED	TAP BUS EXTENSIONS	200.00 LF	-	315,000		4,828	63.63 /MH	307,179	622,179
			NON SEGREGATED - (600V) (2000A) FGD ONLY		800.00 LF	-	588,000		5,517	63.63 /MH	351,062	939,062
			BUS DUCT				903,000		10,345		658,241	1,561,241
		41.45.00	MOTOR CONTROL CENTER (MCC), COMPLETE									
			MOTOR CONTROL CENTER (MCC), COMPLETE - 480V FGD		12.00 EA	-	636,000		5,931	63.63 /MH	377,392	1,013,392
			MOTOR CONTROL CENTER (MCC), COMPLETE				636,000		5,931		377,392	1,013,392
		41.51.00	POWER TRANSFORMER									
			STARTUP, RESERVE AUXILIARY (RAT) - 36/48 MVA 115/6.9/6.9 KV	LABOR INCLUDES DRESS OUT AND FILL	1.00 EA	-	875,000		1,379	63.63 /MH	87,766	962,766
			STARTUP, RESERVE AUXILIARY (RAT) - 36/48 MVA 115/6.9/6.9 KV	HEAVY HAUL FROM RAIL TO PAD	1.00 EA	-	95,000			/MH		95,000
			UNIT AUXILIARY - 36/48 MVA 25/6.9/6.9 KV	LABOR INCLUDES DRESS OUT AND FILL	2.00 EA	-	1,700,000		2,759	63.63 /MH	175,531	1,875,531
			UNIT AUXILIARY - 36/48 MVA 25/6.9/6.9 KV	HEAVY HAUL FROM RAIL TO PAD	2.00 EA	-	190,000			/MH		190,000
			POWER TRANSFORMER - 6.9-.48 kV UNIT SUBSTATION X FMRS - 2000 KVA		4.00 EA	-	360,000		667	63.63 /MH	42,420	402,420
			POWER TRANSFORMER - 6.9-.48 kV UNIT SUBSTATION X FMRS - 1500 KVA		4.00 EA	-	300,000		598	63.63 /MH	38,032	338,032
			POWER TRANSFORMER				3,520,000		5,402		343,748	3,863,748
		41.55.00	SWITCHGEAR, COMPLETE									
			480 V - REAGENT SWITCHGEAR		4.00 EA	-	212,000		1,977	63.63 /MH	125,797	337,797
			480 V - 480V FGD SWITCHGEAR		4.00 EA	-	840,000		4,138	63.63 /MH	263,297	1,103,297
			6.9 KV - SWITCHGEAR FGD		4.00 EA	-	1,680,000		14,713	63.63 /MH	936,166	2,616,166
			6.9 KV - SWITCHGEAR WALK IN TYPE		3.00 EA	-	660,000		5,810	63.63 /MH	369,712	1,029,712
			SWITCHGEAR, COMPLETE				3,392,000		26,638		1,694,972	5,086,972
		41.99.00	ELECTRICAL EQUIPMENT, MISCELLANEOUS									
			ELECTRICAL EQUIPMENT, MISCELLANEOUS AUX POWER EQUIPMENT		1.00 LT	-	2,840,000		11,494	63.63 /MH	731,379	3,571,379
			ELECTRICAL EQUIPMENT, MISCELLANEOUS				2,840,000		11,494		731,379	3,571,379
			ELECTRICAL EQUIPMENT				11,291,000		59,810		3,805,732	15,096,732
	42.00.00		RACEWAY, CABLE TRAY & CONDUIT									
		42.13.00	CABLE TRAY									
			CABLE TRAY - ALLOTMENT		1.00 LT	-	-	505,000	33,333	61.79 /MH	2,059,667	2,564,667
			CABLE TRAY					505,000	33,333		2,059,667	2,564,667
		42.15.37	CONDUIT, RGS									
			XX IN DIA - CONDUIT ALLOTMENT		1.00 LT	-	-	90,000	74,138	61.79 /MH	4,580,983	4,670,983
			CONDUIT, RGS					90,000	74,138		4,580,983	4,670,983
		42.18.00	DUCT BANK									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		42.18.00	**DUCT BANK**									
			DUCT BANK - UNDERGROUND DUCT BANKS NOT APPLICABLE		LT	-	-			61.79 /MH		
			RACEWAY, CABLE TRAY & CONDUIT					**595,000**	**107,471**		**6,640,649**	**7,235,649**
	43.00.00		**CABLE**									
		43.10.00	**CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION**									
			CONTROL/INSTRUMENTATION/COMMUNICATION TERMINATION - MISC		201,600.00 LF	-	-	645,120	18,538	82.05 /MH	1,521,037	2,166,157
			CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					**645,120**	**18,538**		**1,521,037**	**2,166,157**
		43.20.00	**600V CABLE & TERMINATION**									
			600V CABLE - MISC		218,000.00 LF	-	-	1,881,340	30,069	82.05 /MH	2,467,159	4,348,499
			600V CABLE & TERMINATION					**1,881,340**	**30,069**		**2,467,159**	**4,348,499**
		43.40.00	**5/8KV CABLE & TERMINATION**									
			5/8KV #750 KCMIL 1/C CU EPR TS-CPE , FEEDS TO 8KV SWGR BLDG		225,000.00 LF	-	-	5,415,750	23,276	82.05 /MH	1,909,784	7,325,534
			5/8KV MISC		40,200.00 LF	-	-	297,480	10,628	82.05 /MH	871,993	1,169,473
			5/8KV CABLE & TERMINATION					**5,713,230**	**33,903**		**2,781,778**	**8,495,008**
		43.50.00	**15KV CABLE & TERMINATION**									
			15KV CABLE - MISC		22,300.00 LF	-	-	206,721	5,895	82.05 /MH	483,718	690,439
			15KV CABLE & TERMINATION					**206,721**	**5,895**		**483,718**	**690,439**
			CABLE					**8,446,411**	**88,406**		**7,253,692**	**15,700,103**
	51.00.00		**SUBSTATION, SWITCHYARD & TRANSMISSION LINE**									
		51.15.27	**CIRCUIT BREAKER**									
			CIRCUIT BREAKER - SWITCHYARD BAY AND 3 BREAKERS	ADDITION OF A SWITCHYARD BAY IS AVOIDED BY PLACING THE NEW SST NEXT TO THE EXISTING SST AND USING THE SAME OVERHEAD LINE.	0.00 LT	-				55.78 /MH		
		51.15.53	**DISCONNECT SWITCH**									
			115KV, 1200A, VERTICAL BREAK SWITCH WITH INSULATORS,INCLUDING GROUND SWITCH AND WITHOUT MOTORIZED OPERATOR	FOR ISOLATION OF RAT	1.00 EA	-	-	15,000	69	55.78 /MH	3,847	18,847
			DISCONNECT SWITCH					**15,000**	**69**		**3,847**	**18,847**
			SUBSTATION, SWITCHYARD & TRANSMISSION LINE					**15,000**	**69**		**3,847**	**18,847**
			201 ELECTRICAL BOP SYSTEM				**12,299,000**	**10,665,684**	**290,576**		**20,231,688**	**43,196,372**
211			**INSTRUMENTATION AND CONTROLS BOP SYSTEM**									
	44.00.00		**CONTROL & INSTRUMENTATION**									
		44.13.00	**CONTROL SYSTEM**									
			DISTRIBUTED CONTROL SYSTEM (DCS) - I/O POINTS	ESTIMATED BOP 2000 I/O POINTS, (ANOTHER 1000 POINTS PER UNIT ARE INCLUDED IN THE DFGD PROPOSAL PRICES AND ARE NOT INCLUDED HERE)	1.00 LT	-	1,500,000		2,299	64.68 /MH	148,690	1,648,690
			CONTROL SYSTEM				**1,500,000**		**2,299**		**148,690**	**1,648,690**
		44.21.00	**INSTRUMENT**									
			INSTRUMENT - BOP INSTRUMENTS		1.00 LT	-	-	478,000	7,946	82.05 /MH	651,967	1,129,967
			INSTRUMENT - THERMOCOUPLES IN STACK ENTRANCE W ALARM		1.00 LT	-	-	100,000		82.05 /MH		100,000
			INSTRUMENT					**578,000**	**7,946**		**651,967**	**1,229,967**
		44.25.00	**MONITORING EQUIPMENT**									
			CONTINUOUS EMISSION MONITORING SYSTEM (CEMS) - REFURBISHING		2.00 EA	-	-	460,000	625	64.68 /MH	40,444	500,444
			MONITORING EQUIPMENT - LOCAL HMI		3.00 EA	-	-	45,000	14	64.68 /MH	892	45,892

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			MONITORING EQUIPMENT					505,000	639		41,336	546,336
			CONTROL & INSTRUMENTATION				1,500,000	1,083,000	10,884		841,993	3,424,993
			211 INSTRUMENTATION AND CONTROLS				**1,500,000**	**1,083,000**	**10,884**		**841,993**	**3,424,993**
			BOP SYSTEM									

ATTACHMENT 2

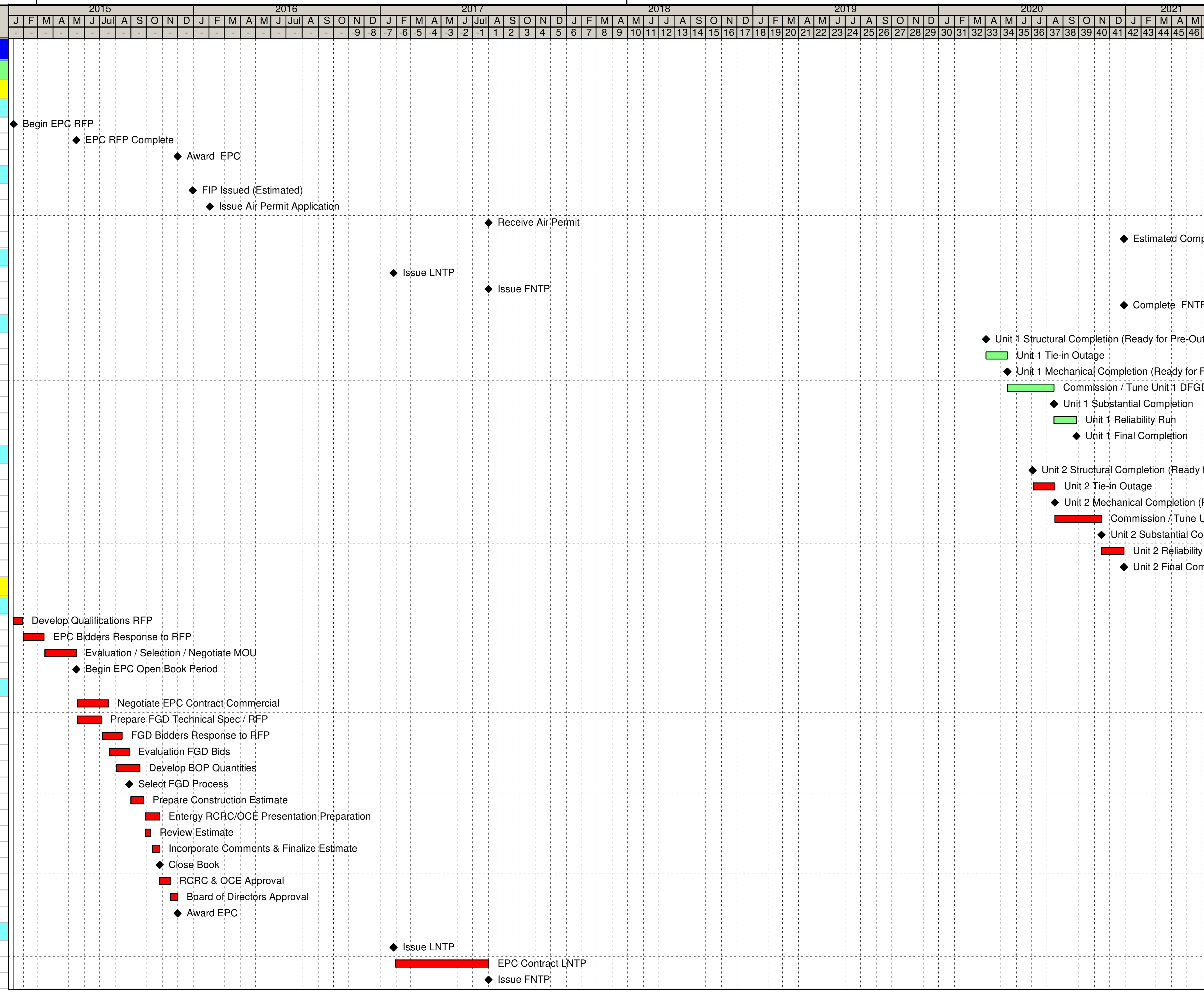
Conceptual Capital Cost Estimate Cash Flow


ENTERGY ARKANSAS
WHITE BLUFF STATION SDA EPC
MONTHLY CASH FLOW
Monthly Cash Flow ($000s)
Cumulative Cash Flow ($000s)
60,000
50,000
40,000
30,000
20,000
10,000
0
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Jan '15
Jul '21
Total Interest (7.0% annual)
Third Party Costs
Owner's Costs
EPC Costs
Cumulative

ATTACHMENT 3

Level 1 Preliminary Execution Schedule

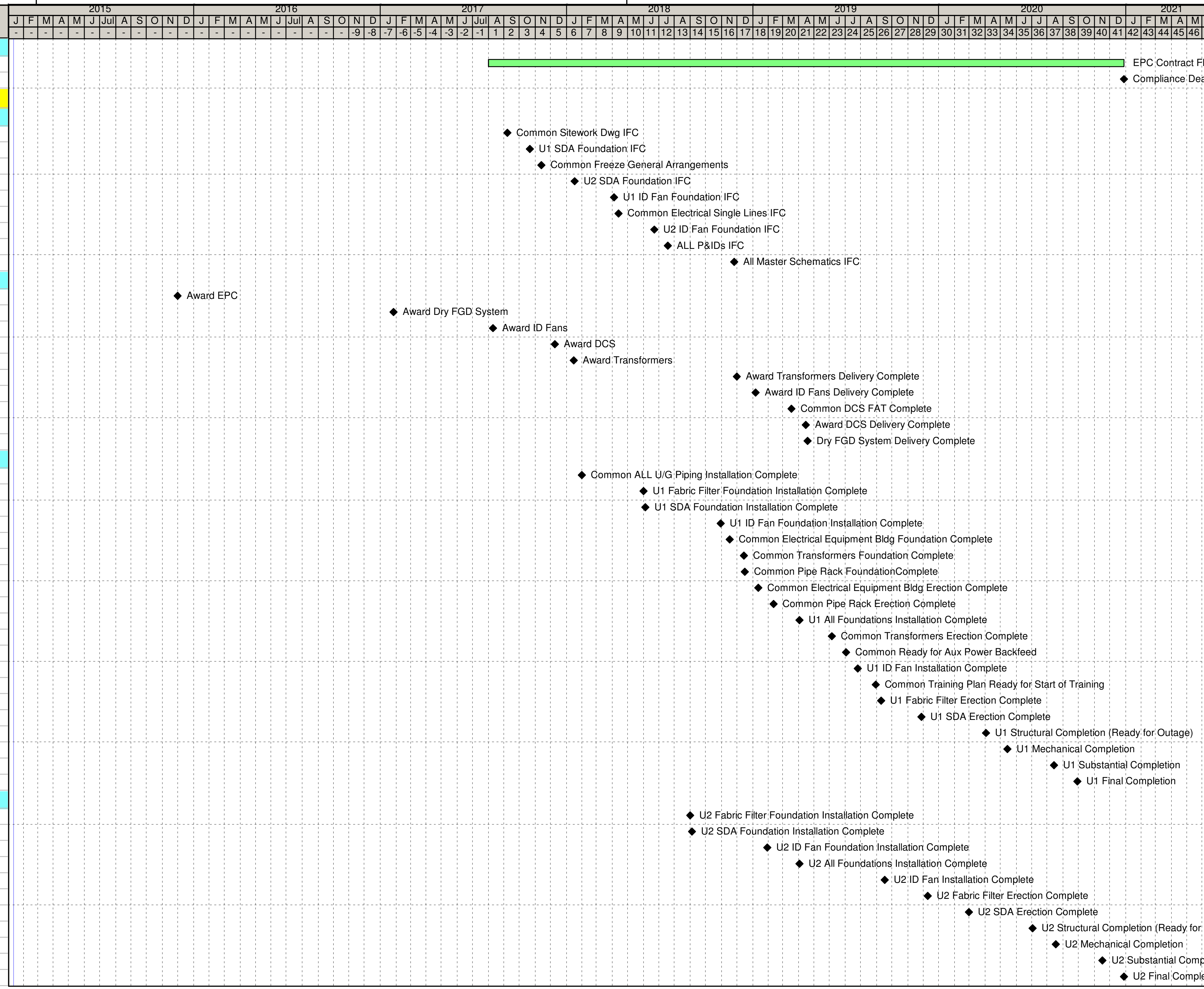
Activity ID	Activity Name	Ori Dur	Start	Finish
WHITE BLUFF FGD SCHEDULE (December 2020)		1556	13-Jan-15	29-Dec-20
Milestones		1556	13-Jan-15	29-Dec-20
Project Milestones		1556	13-Jan-15	29-Dec-20
EPC RFP		225	13-Jan-15	30-Nov-15
MS010	Begin EPC RFP	0	13-Jan-15	
MS100	EPC RFP Complete	0		15-May-15
MS225	Award EPC	0		30-Nov-15
Permitting		1272	30-Dec-15	29-Dec-20
MS275	FIP Issued (Estimated)	0		30-Dec-15
MS015	Issue Air Permit Application	0		02-Feb-16
MS020	Receive Air Permit	0		31-Jul-17
MS285	Estimated Compliance Date	0		29-Dec-20
LNTP/FNTP		998	27-Jan-17	28-Dec-20
MS260	Issue LNTP	0		27-Jan-17
MS030	Issue FNTP	0		31-Jul-17
MS265	Complete FNTP Period	0		28-Dec-20
Unit 1 & Common Outage, Start-Up & Commissioning		178	02-Apr-20	27-Sep-20
MS0100	Unit 1 Structural Completion (Ready for Pre-Outage)	0		02-Apr-20
MS0110	Unit 1 Tie-in Outage	42	03-Apr-20	14-May-20
MS0120	Unit 1 Mechanical Completion (Ready for Flue Gas)	0		14-May-20
MS0130	Commission / Tune Unit 1 DFGD System	91	15-May-20	13-Aug-20
MS0140	Unit 1 Substantial Completion	0		13-Aug-20
MS0150	Unit 1 Reliability Run	45	14-Aug-20	27-Sep-20
MS0160	Unit 1 Final Completion	0		27-Sep-20*
Unit 2 Outage, Start-Up & Commissioning		179	03-Jul-20	29-Dec-20
MS0200	Unit 2 Structural Completion (Ready for Pre-Outage)	0		03-Jul-20
MS0210	Unit 2 Tie-in Outage	43	04-Jul-20	15-Aug-20
MS0220	Unit 2 Mechanical Completion (Ready for Flue Gas)	0		15-Aug-20
MS0230	Commission / Tune Unit 2 DFGD System	91	16-Aug-20	14-Nov-20
MS0240	Unit 2 Substantial Completion	0		14-Nov-20
MS0250	Unit 2 Reliability Run	45	15-Nov-20	29-Dec-20
MS0260	Unit 2 Final Completion	0		29-Dec-20
Project Overview		1556	13-Jan-15	29-Dec-20
EPC RFP		89	13-Jan-15	15-May-15
OV1000	Develop Qualifications RFP	14	13-Jan-15	30-Jan-15
OV1010	EPC Bidders Response to RFP	30	02-Feb-15	13-Mar-15
OV1020	Evaluation / Selection / Negotiate MOU	45	16-Mar-15	15-May-15
OV1040	Begin EPC Open Book Period	0		15-May-15
EPC Development Phase		141	18-May-15	30-Nov-15
OV1030	Negotiate EPC Contract Commercial	45	18-May-15	17-Jul-15
OV1050	Prepare FGD Technical Spec / RFP	35	18-May-15	03-Jul-15
OV1060	FGD Bidders Response to RFP	30	06-Jul-15	14-Aug-15
OV1070	Evaluation FGD Bids	30	20-Jul-15	28-Aug-15
OV1090	Develop BOP Quantities	35	03-Aug-15	18-Sep-15
OV1080	Select FGD Process	0		28-Aug-15
OV1100	Prepare Construction Estimate	20	31-Aug-15	25-Sep-15
OV1110	Entergy RCRC/OCE Presentation Preparation	21	28-Sep-15	26-Oct-15
OV1103	Review Estimate	10	28-Sep-15	09-Oct-15
OV1105	Incorporate Comments & Finalize Estimate	11	12-Oct-15	26-Oct-15
OV1120	Close Book	0		26-Oct-15
OV1130	RCRC & OCE Approval	15	27-Oct-15	16-Nov-15
OV1140	Board of Directors Approval	10	17-Nov-15	30-Nov-15
OV1145	Award EPC	0		30-Nov-15
LNTP		132	27-Jan-17	01-Aug-17
OV1150	Issue LNTP	0		27-Jan-17
OV1160	EPC Contract LNTP	132	30-Jan-17	01-Aug-17
OV1170	Issue FNTP	0		01-Aug-17



Remaining Work — Actual Work — WBS Summary
Critical Remaining Work — Milestone

TASK filter: Exclude WBS Activities_1.

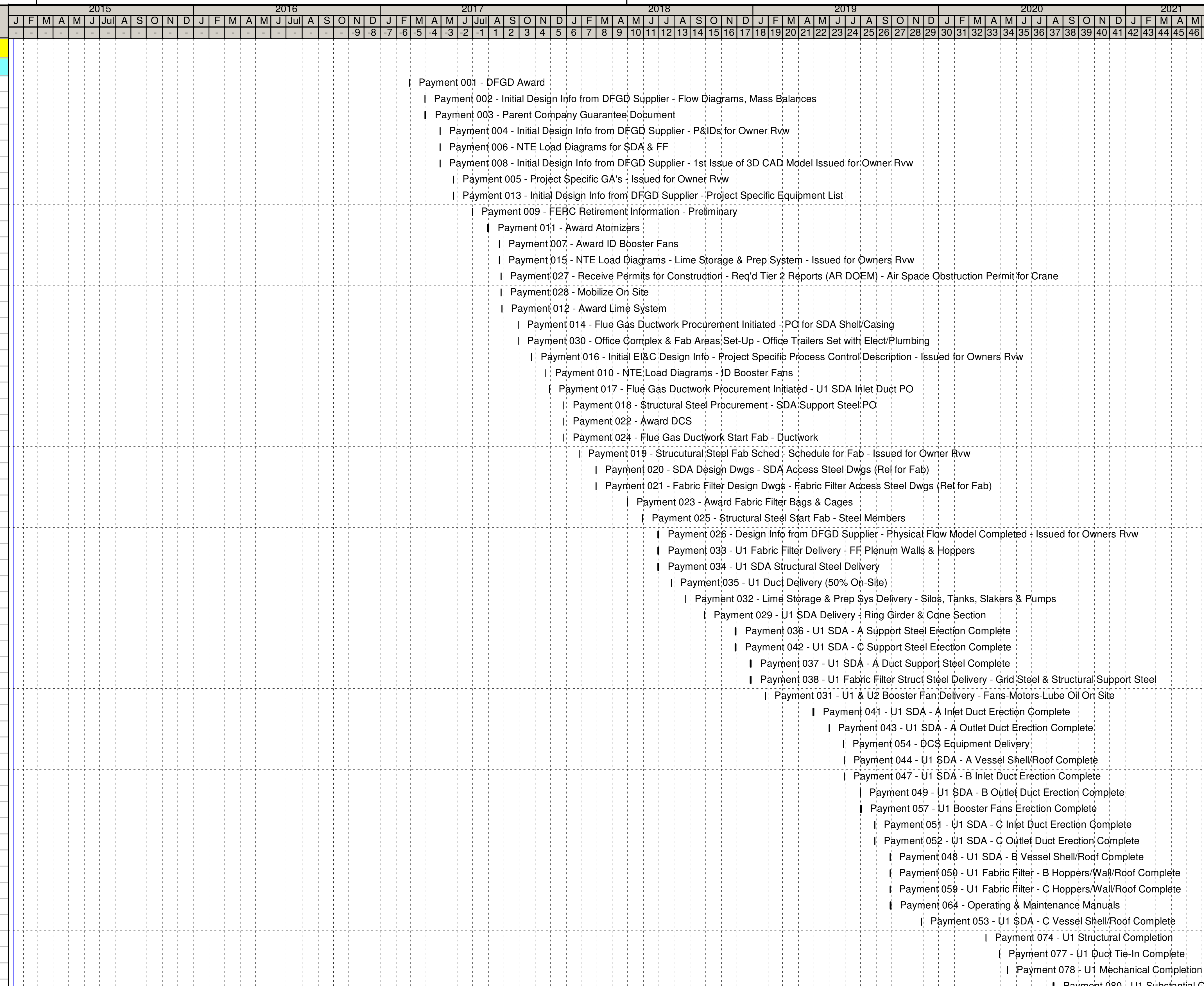
Activity ID	Activity Name	Ori Dur	Start	Finish
FNTP		890	02-Aug-17	29-Dec-20
OV1180	EPC Contract FNTP Period	889	02-Aug-17	28-Dec-20
OV1230	Compliance Deadline	0		29-Dec-20*
EPC Milestones		1292	30-Nov-15	29-Dec-20
Engineering		308	07-Sep-17	26-Nov-18
EPC325	Common Sitework Dwg IFC	0		07-Sep-17
EPC345	U1 SDA Foundation IFC	0		20-Oct-17
EPC340	Common Freeze General Arrangements	0		13-Nov-17
EPC510	U2 SDA Foundation IFC	0		16-Jan-18
EPC350	U1 ID Fan Foundation IFC	0		03-Apr-18
EPC320	Common Electrical Single Lines IFC	0		13-Apr-18
EPC485	U2 ID Fan Foundation IFC	0		22-Jun-18
EPC355	ALL P&IDs IFC	0		18-Jul-18
EPC240	All Master Schematics IFC	0		26-Nov-18
Procurement		858	30-Nov-15	19-Apr-19
EPC010	Award EPC	0		30-Nov-15
EPC100	Award Dry FGD System	0		27-Jan-17
EPC110	Award ID Fans	0		09-Aug-17
EPC335	Award DCS	0		08-Dec-17
EPC315	Award Transformers	0		15-Jan-18
EPC545	Award Transformers Delivery Complete	0		30-Nov-18
EPC535	Award ID Fans Delivery Complete	0		07-Jan-19
EPC415	Common DCS FAT Complete	0		18-Mar-19
EPC540	Award DCS Delivery Complete	0		15-Apr-19
EPC530	Dry FGD System Delivery Complete	0		19-Apr-19
Unit 1 & Common Construction & Commissioning		677	30-Jan-18	28-Sep-20
EPC425	Common ALL U/G Piping Installation Complete	0		30-Jan-18
EPC370	U1 Fabric Filter Foundation Installation Complete	0		01-Jun-18
EPC360	U1 SDA Foundation Installation Complete	0		05-Jun-18
EPC365	U1 ID Fan Foundation Installation Complete	0		30-Oct-18
EPC395	Common Electrical Equipment Bldg Foundation Complete	0		16-Nov-18
EPC405	Common Transformers Foundation Complete	0		14-Dec-18
EPC460	Common Pipe Rack FoundationComplete	0		17-Dec-18
EPC400	Common Electrical Equipment Bldg Erection Complete	0		11-Jan-19
EPC390	Common Pipe Rack Erection Complete	0		11-Feb-19
EPC310	U1 All Foundations Installation Complete	0		02-Apr-19
EPC410	Common Transformers Erection Complete	0		05-Jun-19
EPC435	Common Ready for Aux Power Backfeed	0		02-Jul-19
EPC380	U1 ID Fan Installation Complete	0		25-Jul-19
EPC420	Common Training Plan Ready for Start of Training	0		29-Aug-19
EPC385	U1 Fabric Filter Erection Complete	0		09-Sep-19
EPC375	U1 SDA Erection Complete	0		28-Nov-19
EPC440	U1 Structural Completion (Ready for Outage)	0		02-Apr-20
EPC445	U1 Mechanical Completion	0		14-May-20
EPC450	U1 Substantial Completion	0		13-Aug-20
EPC455	U1 Final Completion	0		28-Sep-20
Unit 2 Construction & Commissioning		593	31-Aug-18	29-Dec-20
EPC475	U2 Fabric Filter Foundation Installation Complete	0		31-Aug-18
EPC515	U2 SDA Foundation Installation Complete	0		04-Sep-18
EPC490	U2 ID Fan Foundation Installation Complete	0		29-Jan-19
EPC465	U2 All Foundations Installation Complete	0		02-Apr-19
EPC495	U2 ID Fan Installation Complete	0		16-Sep-19
EPC470	U2 Fabric Filter Erection Complete	0		09-Dec-19
EPC505	U2 SDA Erection Complete	0		28-Feb-20
EPC520	U2 Structural Completion (Ready for Outage)	0		03-Jul-20
EPC500	U2 Mechanical Completion	0		17-Aug-20
EPC525	U2 Substantial Completion	0		16-Nov-20
EPC480	U2 Final Completion	0		29-Dec-20



Remaining Work | Actual Work | WBS Summary
Critical Remaining Work | Milestone

TASK filter: Exclude WBS Activities_1.

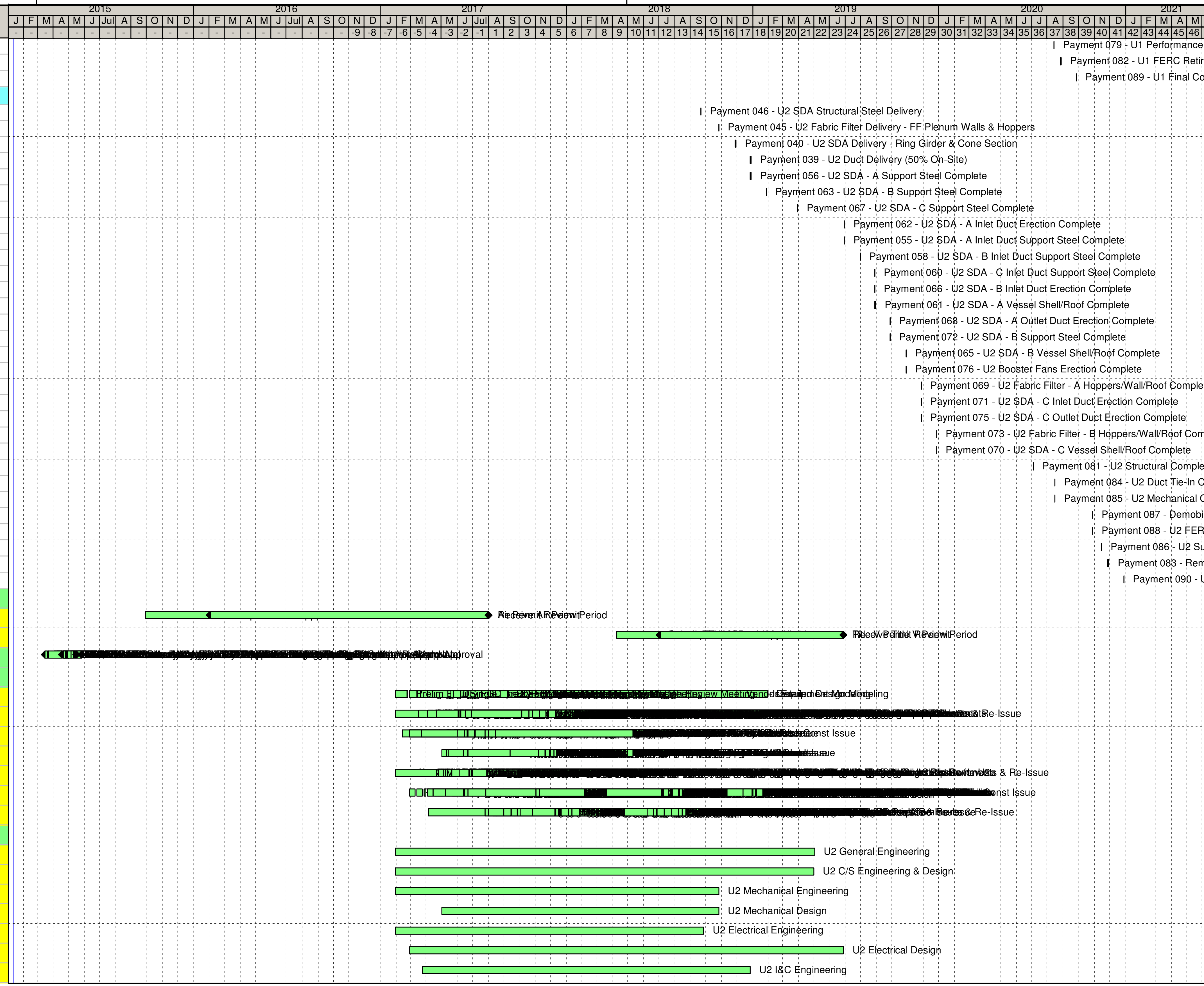
Activity ID	Activity Name	Ori Dur	Start	Finish
Payment Milestones		1401	28-Feb-17	29-Dec-20
Unit 1 & Common		1308	28-Feb-17	27-Sep-20
PAY001	Payment 001 - DFGD Award	1	28-Feb-17	28-Feb-17
PAY002	Payment 002 - Initial Design Info from DFGD Supplier - Flow ...	1	29-Mar-17	29-Mar-17
PAY003	Payment 003 - Parent Company Guarantee Document	1	30-Mar-17	30-Mar-17
PAY004	Payment 004 - Initial Design Info from DFGD Supplier - P&IDs...	1	28-Apr-17	28-Apr-17
PAY006	Payment 006 - NTE Load Diagrams for SDA & FF	1	28-Apr-17	28-Apr-17
PAY008	Payment 008 - Initial Design Info from DFGD Supplier - 1st Iss...	1	28-Apr-17	28-Apr-17
PAY005	Payment 005 - Project Specific GA's - Issued for Owner Rvw	1	25-May-17	25-May-17
PAY013	Payment 013 - Initial Design Info from DFGD Supplier - Projec...	1	25-May-17	25-May-17
PAY009	Payment 009 - FERC Retirement Information - Preliminary	1	30-Jun-17	30-Jun-17
PAY011	Payment 011 - Award Atomizers	1	31-Jul-17	31-Jul-17
PAY007	Payment 007 - Award ID Booster Fans	1	22-Aug-17	22-Aug-17
PAY015	Payment 015 - NTE Load Diagrams - Lime Storage & Prep Sy...	1	22-Aug-17	22-Aug-17
PAY027	Payment 027 - Receive Permits for Construction - Req'd Tier ...	1	25-Aug-17	25-Aug-17
PAY028	Payment 028 - Mobilize On Site	1	26-Aug-17	26-Aug-17
PAY012	Payment 012 - Award Lime System	1	28-Aug-17	28-Aug-17
PAY014	Payment 014 - Flue Gas Ductwork Procurement Initiated - PO...	1	28-Sep-17	28-Sep-17
PAY030	Payment 030 - Office Complex & Fab Areas Set-Up - Office Tr...	1	28-Sep-17	28-Sep-17
PAY016	Payment 016 - Initial EI&C Design Info - Project Specific Proc...	1	24-Oct-17	24-Oct-17
PAY010	Payment 010 - NTE Load Diagrams - ID Booster Fans	1	22-Nov-17	22-Nov-17
PAY017	Payment 017 - Flue Gas Ductwork Procurement Initiated - U1 ...	1	28-Nov-17	28-Nov-17
PAY018	Payment 018 - Structural Steel Procurement - SDA Support St...	1	26-Dec-17	27-Dec-17
PAY022	Payment 022 - Award DCS	1	26-Dec-17	27-Dec-17
PAY024	Payment 024 - Flue Gas Ductwork Start Fab - Ductwork	1	26-Dec-17	27-Dec-17
PAY019	Payment 019 - Strucutural Steel Fab Sched - Schedule for Fa...	1	26-Jan-18	26-Jan-18
PAY020	Payment 020 - SDA Design Dwgs - SDA Access Steel Dwgs (...	1	28-Feb-18	28-Feb-18
PAY021	Payment 021 - Fabric Filter Design Dwgs - Fabric Filter Acces...	1	28-Feb-18	28-Feb-18
PAY023	Payment 023 - Award Fabric Filter Bags & Cages	1	30-Apr-18	30-Apr-18
PAY025	Payment 025 - Structural Steel Start Fab - Steel Members	1	30-May-18	30-May-18
PAY026	Payment 026 - Design Info from DFGD Supplier - Physical Flo...	1	30-Jun-18	30-Jun-18
PAY033	Payment 033 - U1 Fabric Filter Delivery - FF Plenum Walls & ...	1	30-Jun-18	30-Jun-18
PAY034	Payment 034 - U1 SDA Structural Steel Delivery	1	30-Jun-18	30-Jun-18
PAY035	Payment 035 - U1 Duct Delivery (50% On-Site)	1	25-Jul-18	25-Jul-18
PAY032	Payment 032 - Lime Storage & Prep Sys Delivery - Silos, Tan...	1	23-Aug-18	23-Aug-18
PAY029	Payment 029 - U1 SDA Delivery - Ring Girder & Cone Section	1	28-Sep-18	28-Sep-18
PAY036	Payment 036 - U1 SDA - A Support Steel Erection Complete	1	28-Nov-18	28-Nov-18
PAY042	Payment 042 - U1 SDA - C Support Steel Erection Complete	1	28-Nov-18	28-Nov-18
PAY037	Payment 037 - U1 SDA - A Duct Support Steel Complete	1	28-Dec-18	28-Dec-18
PAY038	Payment 038 - U1 Fabric Filter Struct Steel Delivery - Grid Ste...	1	28-Dec-18	28-Dec-18
PAY031	Payment 031 - U1 & U2 Booster Fan Delivery - Fans-Motors-L...	1	26-Jan-19	26-Jan-19
PAY041	Payment 041 - U1 SDA - A Inlet Duct Erection Complete	1	30-Apr-19	30-Apr-19
PAY043	Payment 043 - U1 SDA - A Outlet Duct Erection Complete	1	30-May-19	30-May-19
PAY054	Payment 054 - DCS Equipment Delivery	1	28-Jun-19	28-Jun-19
PAY044	Payment 044 - U1 SDA - A Vessel Shell/Roof Complete	1	29-Jun-19	29-Jun-19
PAY047	Payment 047 - U1 SDA - B Inlet Duct Erection Complete	1	29-Jun-19	29-Jun-19
PAY049	Payment 049 - U1 SDA - B Outlet Duct Erection Complete	1	31-Jul-19	31-Jul-19
PAY057	Payment 057 - U1 Booster Fans Erection Complete	1	01-Aug-19	01-Aug-19
PAY051	Payment 051 - U1 SDA - C Inlet Duct Erection Complete	1	28-Aug-19	28-Aug-19
PAY052	Payment 052 - U1 SDA - C Outlet Duct Erection Complete	1	28-Aug-19	28-Aug-19
PAY048	Payment 048 - U1 SDA - B Vessel Shell/Roof Complete	1	27-Sep-19	27-Sep-19
PAY050	Payment 050 - U1 Fabric Filter - B Hoppers/Wall/Roof Complete	1	27-Sep-19	27-Sep-19
PAY059	Payment 059 - U1 Fabric Filter - C Hoppers/Wall/Roof Complete	1	27-Sep-19	27-Sep-19
PAY064	Payment 064 - Operating & Maintenance Manuals	1	28-Sep-19	28-Sep-19
PAY053	Payment 053 - U1 SDA - C Vessel Shell/Roof Complete	1	28-Nov-19	28-Nov-19
PAY074	Payment 074 - U1 Structural Completion	1	02-Apr-20	02-Apr-20
PAY077	Payment 077 - U1 Duct Tie-In Complete	1	29-Apr-20	29-Apr-20
PAY078	Payment 078 - U1 Mechanical Completion	1	15-May-20	15-May-20
PAY080	Payment 080 - U1 Substantial Completion	1	13-Aug-20	13-Aug-20



Remaining Work
Actual Work
WBS Summary
Critical Remaining Work
Milestone

TASK filter: Exclude WBS Activities_1.

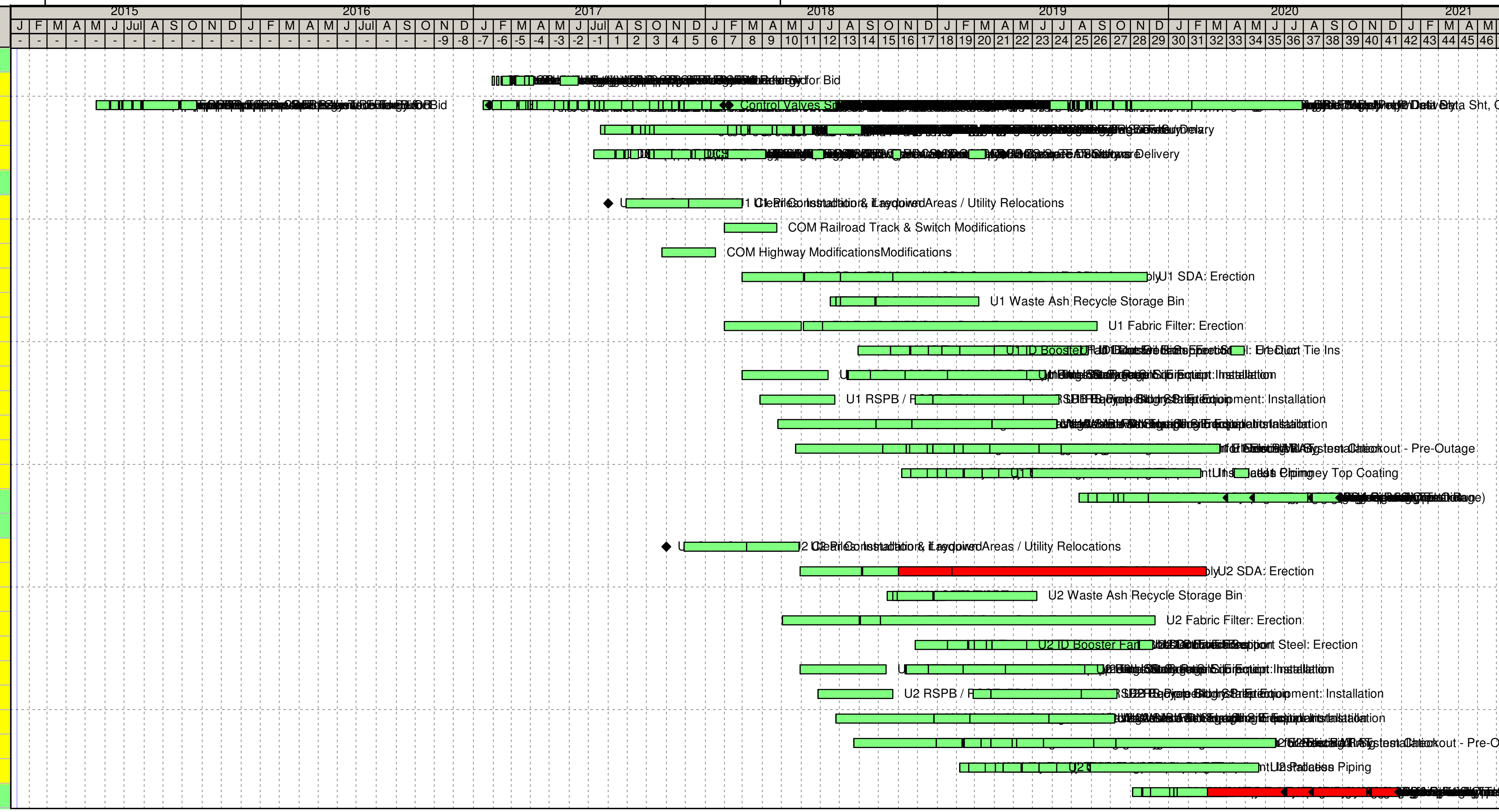
Activity ID	Activity Name	Orig Dur	Start	Finish
PAY079	Payment 079 - U1 Performance Test Report	1	14-Aug-20	14-Aug-20
PAY082	Payment 082 - U1 FERC Retirement Information	1	27-Aug-20	27-Aug-20
PAY089	Payment 089 - U1 Final Completion	1	27-Sep-20	27-Sep-20
Unit 2		830	22-Sep-18	29-Dec-20
PAY046	Payment 046 - U2 SDA Structural Steel Delivery	1	22-Sep-18	22-Sep-18
PAY045	Payment 045 - U2 Fabric Filter Delivery - FF Plenum Walls & ...	1	27-Oct-18	27-Oct-18
PAY040	Payment 040 - U2 SDA Delivery - Ring Girder & Cone Section	1	28-Nov-18	28-Nov-18
PAY039	Payment 039 - U2 Duct Delivery (50% On-Site)	1	28-Dec-18	28-Dec-18
PAY056	Payment 056 - U2 SDA - A Support Steel Complete	1	28-Dec-18	28-Dec-18
PAY063	Payment 063 - U2 SDA - B Support Steel Complete	1	28-Jan-19	28-Jan-19
PAY067	Payment 067 - U2 SDA - C Support Steel Complete	1	30-Mar-19	30-Mar-19
PAY062	Payment 062 - U2 SDA - A Inlet Duct Erection Complete	1	29-Jun-19	29-Jun-19
PAY055	Payment 055 - U2 SDA - A Inlet Duct Support Steel Complete	1	30-Jun-19	30-Jun-19
PAY058	Payment 058 - U2 SDA - B Inlet Duct Support Steel Complete	1	31-Jul-19	31-Jul-19
PAY060	Payment 060 - U2 SDA - C Inlet Duct Support Steel Complete	1	28-Aug-19	28-Aug-19
PAY066	Payment 066 - U2 SDA - B Inlet Duct Erection Complete	1	28-Aug-19	28-Aug-19
PAY061	Payment 061 - U2 SDA - A Vessel Shell/Roof Complete	1	29-Aug-19	29-Aug-19
PAY068	Payment 068 - U2 SDA - A Outlet Duct Erection Complete	1	27-Sep-19	27-Sep-19
PAY072	Payment 072 - U2 SDA - B Support Steel Complete	1	27-Sep-19	27-Sep-19
PAY065	Payment 065 - U2 SDA - B Vessel Shell/Roof Complete	1	29-Oct-19	29-Oct-19
PAY076	Payment 076 - U2 Booster Fans Erection Complete	1	29-Oct-19	29-Oct-19
PAY069	Payment 069 - U2 Fabric Filter - A Hoppers/Wall/Roof Complete	1	28-Nov-19	28-Nov-19
PAY071	Payment 071 - U2 SDA - C Inlet Duct Erection Complete	1	28-Nov-19	28-Nov-19
PAY075	Payment 075 - U2 SDA - C Outlet Duct Erection Complete	1	28-Nov-19	28-Nov-19
PAY073	Payment 073 - U2 Fabric Filter - B Hoppers/Wall/Roof Complete	1	27-Dec-19	27-Dec-19
PAY070	Payment 070 - U2 SDA - C Vessel Shell/Roof Complete	1	28-Dec-19	28-Dec-19
PAY081	Payment 081 - U2 Structural Completion	1	04-Jul-20	04-Jul-20
PAY084	Payment 084 - U2 Duct Tie-In Complete	1	16-Aug-20	16-Aug-20
PAY085	Payment 085 - U2 Mechanical Completion	1	16-Aug-20	16-Aug-20
PAY087	Payment 087 - Demobilization Complete	1	28-Oct-20	28-Oct-20
PAY088	Payment 088 - U2 FERC Retirement Information	1	28-Oct-20	28-Oct-20
PAY086	Payment 086 - U2 Substantial Completion	1	15-Nov-20	15-Nov-20
PAY083	Payment 083 - Removal of Fabrication Tables Complete	1	28-Nov-20	28-Nov-20
PAY090	Payment 090 - U2 Final Completion	1	29-Dec-20	29-Dec-20
Permitting		949	29-Sep-15	27-Jun-19
Air Permit		465	29-Sep-15	31-Jul-17
Title V Operating Permit		310	09-Apr-18	27-Jun-19
TRAX Boiler Pressure Analysis		81	16-Mar-15	08-Jul-15
U1 Engineering		540	30-Jan-17	15-Mar-19
U1 General Engineering & Design		507	30-Jan-17	29-Jan-19
U1 C/S/A Engineering and Design		500	30-Jan-17	18-Jan-19
U1 Mechanical Engineering		364	13-Feb-17	18-Jul-18
U1 Mechanical Design		309	01-May-17	18-Jul-18
U1 Electrical Engineering		344	30-Jan-17	05-Jun-18
U1 Electrical Design		520	27-Feb-17	15-Mar-19
U1 I&C Engineering		368	06-Apr-17	17-Sep-18
U2 Engineering		630	30-Jan-17	28-Jun-19
U2 General Engineering & Design		590	30-Jan-17	03-May-19
U2 C/S/A Engineering and Design		587	30-Jan-17	30-Apr-19
U2 Mechanical Engineering		455	30-Jan-17	26-Oct-18
U2 Mechanical Design		389	02-May-17	26-Oct-18
U2 Electrical Engineering		434	30-Jan-17	27-Sep-18
U2 Electrical Design		610	27-Feb-17	28-Jun-19
U2 I&C Engineering		460	24-Mar-17	27-Dec-18



Remaining Work
Actual Work
WBS Summary
Critical Remaining Work
Milestone

TASK filter: Exclude WBS Activities_1.

Activity ID	Activity Name	Ori Dur	Start	Finish
Procurement		1357	18-May-15	28-Jul-20
C/S/A Procurement		98	30-Jan-17	15-Jun-17
Mechanical Procurement		1357	18-May-15	28-Jul-20
Electrical Procurement		347	20-Jul-17	30-Nov-18
I&C Procurement		448	10-Jul-17	15-Apr-19
U1 Construction		720	02-Aug-17	05-May-20
U1 Sitework		150	02-Aug-17	27-Feb-18
U1 Railroad Track & Switch Mods		60	31-Jan-18	24-Apr-18
U1 Highway Mods		60	25-Oct-17	16-Jan-18
U1 SDA		457	28-Feb-18	28-Nov-19
U1 Field Fabricated Tanks		170	16-Jul-18	08-Mar-19
U1 Fabric Filter		419	31-Jan-18	09-Sep-19
U1 ID Booster Fans / Ductwork		436	29-Aug-18	29-Apr-20
U1 Lime Slurry		343	28-Feb-18	21-Jun-19
U1 Recycle Slurry		337	29-Mar-18	12-Jul-19
U1 Byproduct Handling		314	25-Apr-18	08-Jul-19
U1 Auxiliary Power		478	23-May-18	20-Mar-20
U1 Balance of Plant		390	07-Nov-18	05-May-20
U1 System Testing and Commissioning		294	13-Aug-19	27-Sep-20
U2 Construction		686	01-Nov-17	17-Jun-20
U2 Sitework		150	01-Nov-17	29-May-18
U2 SDA		458	30-May-18	28-Feb-20
U2 Field Fabricated Tanks		170	15-Oct-18	07-Jun-19
U2 Fabric Filter		419	02-May-18	09-Dec-19
U2 ID Booster Fans / Ductwork		268	28-Nov-18	07-Dec-19
U2 Lime Slurry		343	30-May-18	20-Sep-19
U2 Recycle Slurry		337	28-Jun-18	11-Oct-19
U2 Byproduct Handling		314	25-Jul-18	07-Oct-19
U2 Auxiliary Power		476	22-Aug-18	17-Jun-20
U2 Balance of Plant		337	06-Feb-19	21-May-20
U2 System Testing and Commissioning		301	05-Nov-19	29-Dec-20



Remaining Work | Actual Work | WBS Summary
Critical Remaining Work | Milestone

TASK filter: Exclude WBS Activities_1.

ATTACHMENT 4

Milestone Progress Payment Schedule

Attachment 4

MONTHLY PROGRESS PAYMENT SCHEDULE

Month	Date	Milestone	Individual Payment (%)	Cumulative Payment (%)
1	Feb-17	Award Dry FGD Contract Execution	1.51	1.51
2	Mar-17	DFGD Supplier - Process Flow Diagrams and Mass Balances	0.06	1.57
3	Apr-17	DFGD Supplier - P&ID Drawings	0.06	1.63
4	May-17	DFGD Supplier - General Arrangement Drawings NTE Load Diagrams	0.16	1.79
5	Jun-17	DFGD Supplier - Preliminary 3D CAD Model Award Booster Fans	2.62	4.41
6	Jul-17	NTE Load Diagrams Award Atomizers	0.45	4.86
7	Aug-17	DFGD Supplier - Equipment Lists Award Lime System	6.24	11.10
8	Sep-17	Flue Gas Ductwork Procurement Initiated	0.45	11.55
9	Oct-17	Initial EI&C Design Information NTE Load Diagrams	0.45	12.00
10	Nov-17	Flue Gas Ductwork Procurement Initiated	2.26	14.26
11	Dec-17	Structural Steel Procurement Initiated	0.45	14.71
12	Jan-18	Structural Steel Fabrication Schedule Complete	0.45	15.16
13	Feb-18	SDA and Fabric Filter Design Drawings	4.07	19.23
14	Mar-18	Award DCS	0.45	19.68
15	Apr-18	Award Fabric Filter Bags and Cages Flue Gas Ductwork Start of Fabrication	2.68	22.36
16	May-18	Structural Steel Start of Fabrication	0.57	22.93
17	Jun-18	Physical Flow Model Completed	2.38	25.31
18	Jul-18	Receive Permits for Construction	0.70	26.01
19	Aug-18	Mobilize On-Site	2.67	28.68
20	Sep-18	Unit 1 SDA Delivery Office Complex and Fabrication Areas Set-Up	2.99	31.67
21	Oct-18	Unit 1 and Unit 2 Booster Fan Delivery Lime Storage and Preparation System Delivery Unit 1 Fabric Filter Delivery	5.12	36.79
22	Nov-18	Unit 1 SDA Structural Steel Delivery Unit 1 Duct Delivery Unit 1 SDA-A Support Steel Erection Complete	4.81	41.60
23	Dec-18	Unit 1 SDA-A Inlet Duct Support Steel Complete Unit 1 Fabric Filter Structural Steel Delivery Unit 2 Duct Delivery	4.00	45.60
24	Jan-19	Unit 2 SDA Delivery Unit 1 SDA-A Inlet Duct Erection Complete Unit 1 SDA-C Support Steel Erection Complete	4.32	49.92
25	Feb-19	Unit 1 SDA-A Outlet Duct Erection Complete Unit 1 SDA-A Vessel Shell/Roof Complete Unit 2 Fabric Filter Delivery	4.08	54.00
26	Mar-19	Unit 2 Structural Steel Delivery Unit 1 SDA-B Inlet Duct Erection Complete Unit 1 Fabric Filter-B Hoppers/Wall/Roof Complete	3.99	57.99

Attachment 4

MONTHLY PROGRESS PAYMENT SCHEDULE

Month	Date	Milestone	Individual Payment (%)	Cumulative Payment (%)
27	Apr-19	Unit 1 SDA-B Vessel Shell/Roof Complete	3.99	61.98
		Unit 1 SDA-B Outlet Duct Erection Complete		
		Unit 1 Fabric Filter-B Hoppers/Wall/Roof Complete		
28	May-19	Unit 1 SDA-C Inlet Duct Erection Complete	3.69	65.67
		Unit 1 SDA-C Outlet Duct Erection Complete		
29	Jun-19	Unit 1 SDA-C Vessel Shell/Roof Complete	3.35	69.02
		DCS Equipment Delivery		
		Unit 2 SDA-A Inlet Duct Support Steel Complete		
		Unit 2 SDA-A Support Steel Complete		
30	Jul-19	Unit 1 Booster Fans Erection Complete	3.04	72.06
		Unit 2 SDA-B Inlet Duct Support Steel Complete		
		Unit 1 Fabric Filter-C Hoppers/Wall/Roof Complete		
31	Aug-19	Unit 2 SDA-C Inlet Duct Support Steel Complete	2.93	74.99
		Unit 2 SDA-A Vessel Shell/Roof Complete		
		Unit 2 SDA-A Inlet Duct Erection Complete		
32	Sep-19	Unit 2 SDA-B Support Steel Complete	3.06	78.05
		Operating and Maintenance Manuals		
33	Oct-19	Unit 2 SDA-B Vessel Shell/Roof Complete	3.00	81.05
		Unit 2 SDA-B Inlet Duct Erection Complete		
		Unit 2 SDA-C Support Steel Complete		
34	Nov-19	Unit 2 SDA-A Outlet Duct Erection Complete	2.81	83.86
		Unit 2 Fabric Filter-A Hoppers/Wall/Roof Complete		
35	Dec-19	Unit 2 SDA-C Vessel Shell/Roof Complete	2.76	86.62
		Unit 2 SDA-C Inlet Duct Erection Complete		
36	Jan-20	Unit 2 SDA-B Outlet Duct Erection Complete	2.41	89.03
		Unit 2 Fabric Filter-B Hoppers/Wall/Roof Complete		
		Unit 1 Structural Completion		
37	Feb-20	Unit 2 SDA-C Outlet Duct Erection Complete	2.26	91.29
		Unit 2 Booster Fans Erection Complete		
38	Mar-20	Unit 1 Duct Tie-In Complete	2.23	93.52
39	Apr-20	Unit 1 Mechanical Completion	0.45	93.97
40	May-20	Unit 1 Performance Test Report	0.30	94.27
41	Jun-20	Unit 1 Substantial Completion	0.22	94.49
		Unit 2 Structural Completion		
42	Jul-20	Removal of Fabrication Tables Complete	0.22	94.71
43	Aug-20	Unit 2 Duct Tie-In Complete	0.15	94.86
44	Sep-20	Unit 2 Mechanical Completion	0.07	94.93
45	Oct-20	Unit 2 Substantial Completion	0.07	95.00
		Demobilization Complete		
46	Nov-20	Unit 1 Final Acceptance	2.50	97.50
47	Dec-20	Unit 2 Final Acceptance	2.50	100.00

ATTACHMENT 5

S&L Estimating Documentation:

Indirects and Construction Equipment included in Crew Rates

Indirects and Construction Equipment included in Crew Rates

Typical Construction Equipment included in our Crew Rates

- Air compressor
- Air tugger
- Crane, 5 ton
- Crane, 15 ton mobile
- Crane, 35 ton
- Crane, 50 ton
- Crane, 60 ton
- Dozer
- Finishing machine
- Flat bed trailer
- Fork lift
- Front end loader
- Generator
- Grader
- Pickup truck
- Powdered riding buggy
- Roller, sheepsfoot
- Roller, vibratory
- Radial saw
- Scraper
- Stress relieving machine
- Tremie
- Truck mounted concrete pump
- Vibrator
- Water wagon
- Welding machine
- Wire puller

Site Indirects included in Crew Rates

- Job Supervision-Field Staff
- Administration-Field Staff
- Personnel Hiring
- Craft Superintendents
- Safety / Purchasing/Expediting-Field Staff
- Material Control-Field Staff
- Engineering Liaison-Field Staff
- Project Controls-Field Staff
- Cost/Schedule Controls-Field Staff
- Quality Control Inspection-Field Staff
- Project Office Supplies-Field Staff
- Computer Expenses
- Service Trucks/Supplies
- Field and Shop Mechanics and Supplies
- Subcontract Administration
- Warehousing-Field Staff
- Field Surveying
- Water & Ice
- Sanitation and Cleanup
- Move In/Move Out
- Detours/Barricades/Flags
- Security
- Temp. Utilities/Distr/Hookup
- Temporary Site Improvement
- Temporary Facilities/Buildings
- Utilities Consumption
- Employee Expenses
- Legal Expenses/Claims
- Permits and Fees
- Timekeeping

ATTACHMENT 6

S&L Estimating Documentation:

Escalation Projections

Entergy
White Bluff DGFD Project
Escalation Projections

Basis: Pine Bluff Arkansas Labor rates as published in RS Means	Yearly Base Rates + Fringes										
Craft Description	2009	2010	2011	2012	2013	2014	% increase in past 1 year	% increase in past 2 years	% increase in past 3 years	% increase in past 5 years	Projected Potential overall % labor increase next 5 years.
Boilermaker	$38.59	$41.59	$41.59	$41.59	$43.10	$44.39	2.99%	6.73%	6.73%	15.03%	
Iron worker	$28.06	$30.44	$30.44	$30.44	$32.05	$34.00	6.08%	11.70%	11.70%	21.17%	
Pipe Fitter	$25.28	$31.65	$31.65	$31.65	$35.56	$35.56	0.00%	12.35%	12.35%	40.66%	
Electrician	$35.74	$35.74	$35.74	$35.74	$36.95	$36.95	0.00%	3.39%	3.39%	3.39%	
Common Laborer	$16.83	$17.47	$17.47	$17.47	$17.47	$17.47	0.00%	0.00%	0.00%	3.80%	
Average increase in five major crafts							1.82%	6.83%	6.83%	16.81%	**18%**

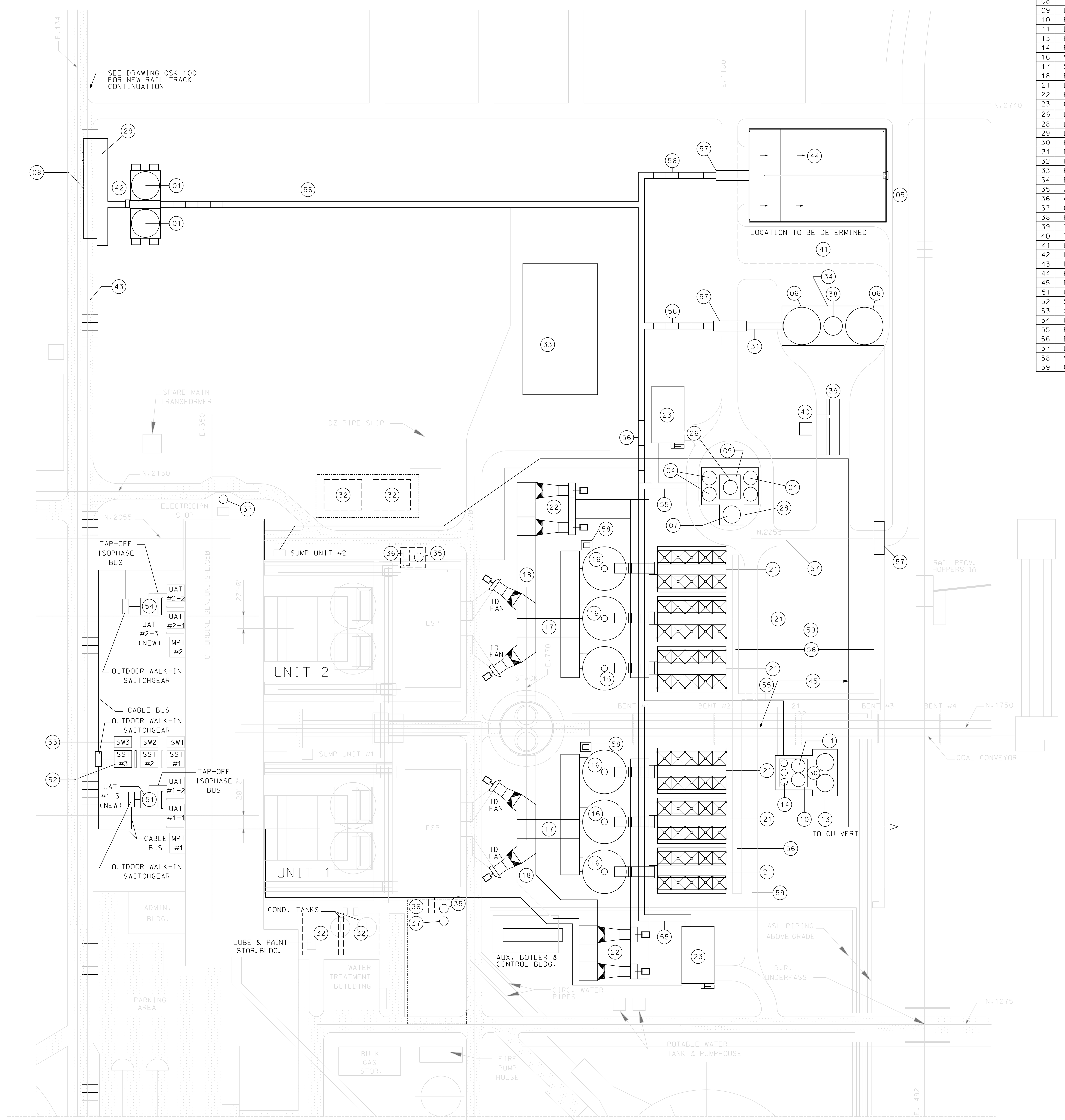
Misc Material and Equipment (Please see Note 1)	% increase in past 3 years	% increase in past 5 years	Projected Potential overall % increase next 5 years.
Construction & Building Index	8%	15%	17.00%
Material Price, Construction Mat.	8%	7%	10.00%
Plant Cost Index	no increase	slightly negative	5.00%
Civil Work	8%	14%	15.00%
Steel - ductwork	no increase	slightly negative	8.00%
Steel - rolled shape	8%	no increase	10.00%
Architectural	5%	4%	8.00%
Overall mechanical equipment	4%	1%	7.00%
Overall piping	6%	11%	12.00%
Overall electrical equipment	9%	17%	18.00%
Raceway, Cable Tray, & Conduit	8%	slightly negative	10.00%
Electrical cable	14%	7%	15.00%
Controls & Instrumentation	1%	1%	5.00%
Average overall increase for Power back-fit projects	**7%**	**9%**	**11%**

Note 1: From major industrial sources such as BLS, Chemical Engineering, Handy Whitman, ENR Commodity pricing (20 city average),

Sargent & Lundy

ATTACHMENT 7

Conceptual General Arrangement Drawing



LEGEND	
01	LIME STORAGE SILOS
03	NOT USED
04	LIME SLURRY FEED TANKS
05	BYPRODUCT HAUL ROAD
06	BYPRODUCT STORAGE SILOS
07	SLAKING WATER STORAGE TANK
08	TRAIN UNLOADING SHED
09	LIME PREPARATION BUILDING
10	BYPRODUCT RECYCLE EQUIPMENT BUILDING
11	BYPRODUCT RECYCLE DAY BINS
13	BYPRODUCT RECYCLE MAKE-UP WATER TANKS
14	BYPRODUCT RECYCLE SLURRY TANKS
16	SPRAY DRYER ABSORBERS
17	SDA FLUE GAS INLET DUCTS
18	BOOSTER FAN DISCHARGE
21	BAG HOUSES
22	BOOSTER FANS
23	COMPRESSOR / ELECTRICAL BUILDINGS
26	LIME DAY BIN
28	LIME PREPARATION AREA
29	LIME UNLOADING EQUIPMENT ROOM
30	BYPRODUCT RECYCLE AREA
31	ELEVATED BOP CONTRACTOR UTILITY RACK
32	FUTURE PROVISION SPACE FOR SCRS
33	FGD SPARE PARTS WAREHOUSE
34	BYPRODUCT HANDLING AREA
35	ACI SILOS
36	ACI ELECTRICAL BUILDINGS
37	CHI TANK
38	FLY ASH SILO
39	TRUCK SCALES
40	TRUCK SCALE HOUSE
41	BYPRODUCT TRUCK PARKING
42	LIME UNLOADING AND STORAGE AREA
43	RAIL SPUR
44	PROCESS WATER RETENTION PONDS
45	PROPOSED GRATED CONCRETE TRENCH
51	UNIT AUX. TRANSFORMER UNIT 1
52	STARTUP / STANDBY TRANSFORMER COMMON (UNITS 1&2)
53	SWITCH
54	UNIT AUX. TRANSFORMER UNIT 2
55	ELEVATED FGD CONTRACTOR UTILITY RACK
56	BOP SLEEPER RACK
57	BOP TRENCH
58	SDA PENTHOUSE ELEVATOR
59	CRANE MAINTENANCE AISLE

HOLD INFORMATION

NO.	DATE	DESCRIPTION
△		

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION

REV.	DATE	DESCRIPTION

ISSUE PURPOSE: ISSUED FOR STUDY

SPECIFICATION: -

PROJECT NO.: 13138-001

I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF ARKANSAS.

ENTER NAME
ENTER DATE

MY LICENSE RENEWAL DATE IS: ENTER DATE
PAGES OR SHEETS COVERED BY THIS SEAL:
THIS DOCUMENT ONLY.

CAD FILE NAME: M-GA-001.DGN

PREPARED BY: D.J.MERRICK

REVIEWED BY: G.A.RIVERA

APPROVED BY: S.C.MCHONE

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.

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CHICAGO, ILLINOIS 60603-5780
WWW.SARGENTLUNDY.COM
CERTIFICATE OF AUTHORIZATION NO. 6938

Entergy

PROJECT

WHITE BLUFF STATION
UNITS 1 & 2
ENTERGY

DRAWING TITLE

GENERAL ARRANGEMENT
SDA SITE DEVELOPMENT

PRELIMINARY
NOT FOR
CONSTRUCTION

NORTH

60' 0 60' 120' 180'
GRAPHIC SCALE

DRAWING SCALE
1" = 60'-0"

DRAWING NUMBER	REVISION
M-GA-001	N/A

SHEET 1 OF 1

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ATTACHMENT 8

Entergy Basis of Contingency

WB FGD Project
Risk Register

Contingency Estimate					
Estimate Total w/o Contingency, IDC, Escalation	**$ 740,968,200**				
	P90	**P80**	**P70**	**P60**	**P50**
Risk Contingency	**$ 35,870,000**	**$ 27,220,000**	**$ 20,550,000**	**$ 16,210,000**	**$ 13,090,000**
Estimate Uncertainty Contingency	**$ 95,350,000**	**$ 66,600,000**	**$ 41,540,000**	**$ 21,330,000**	**$ (290,000)**
Unknown Risk Contingency	**$ 18,560,000**	**$ 17,380,000**	**$ 16,450,000**	**$ 15,610,000**	**$ 14,810,000**
Total Contingency	$ 149,780,000	$ 111,200,000	$ 78,540,000	$ 53,150,000	$ 27,610,000
Percentage of Total	20%	15%	11%	7%	4%
Total Estimate w/ Contingency	$ 890,748,200	$ 852,168,200	$ 819,508,200	$ 794,118,200	$ 768,578,200

Project Delivery Standard

	Estimate Characteristic			Resulting Range	
Estimate class	**Maturity level of project definition** **expressed as % of complete engineering**	**End usage** **typical purpose of estimate**	**Methodology** **typical estimating method**	**Estimate accuracy range** **typical variation in low & high ranges**	**Target contingency range**
Class 5	0 to 2%	Rough Order of Magnitude (ROM)	Capacity factored, parametric models, judgment, or analogy	-50 to +100%	30 to 50%
Class 4	1 to 15%	Feasibility	Equipment factored or parametric models	-30 to +50%	25 to 40%
Class 3	10 to 50%	Funding Authorization	Semi-detailed unit costs with assembly level line items	-20 to +30%	15 to 30%
Class 2	30 to 90%	Control	Detailed unit costs with forced detailed take-off	-15 to +20%	5 to 20%
Class 1	50 to 100%	Check Estimate	Detailed unit cost with detailed take-off	-10 to +15%	2 to 7%

ESTIMATE UNCERTAINTY

Risk Category	Description of Risk	Quantitative Risk Analysis					Status / Comments
		Estimate Total w/out Contingency	Min ($)	Expected	Max ($)	QRA Comments	
Estimate Uncertainty	**EPC Contract**	$ 752,912,300	($188,228,075)	$0	$188,228,075	From S&L estimate report, the project definition and accuracy of the individual components in this estimate result in an overall accuracy of +/- 25%.	
Estimate Uncertainty	**Owner's Costs**	$ 58,546,000	($11,709,200)	$0	$17,563,800	Estimate from Entergy, estimate is considered a Class 3 (+30% to -20%).	Entergy Indirects were calculated utilizing the Entergy FVET tool. The risk associated with the individual rates will be included in the estimate uncertainty of the internal loaders estimate.
Estimate Uncertainty	**Third Party Services**	$ 12,544,000	($3,136,000)	$0	$3,136,000	From S&L estimate report, estimate is considered a Class 3 (+25% to -25%)	

UNKNOWN RISK							
		Quantitative Risk Analysis					
Risk Category	Description of Risk	Estimate Total w/out Contingency	Min ($)	Expected	Max ($)	QRA Comments	Status / Comments
Unknown Risks	**UNKNOWN RISKS:** This is part of the calculation for the overall contingency to include in the project budget.	$ 740,968,200	$ 7,409,682	$ 14,819,364	$ 22,229,046	Estimating standard guidance. Min = 1%, Exp = 2%, Max = 3%	Due to lack of historical data and current project development, there are a range of potential impacts from unknown risks not yet captured in the estimate uncertainty and identified risks, Entergy contingency guidance is to use 1% - 3% of the total estimate without contingency. This item can be captured in the risk register and modeled with the identified risks when estimating contingency.

IDENTIFIED RISKS

Risk ID	Risk Category	Description of Risk	Unit	SCORING: Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Quantitative Risk Analysis: Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-007	Budget	**PROJECT BUDGET - CRAFT LABOR - PER DIEM RATE RISK:** This risk is related to the required craft labor per diem increasing due to the high demand of craft labor, at a percentage greater than the estimated rate.	ALL	3	2	0	0	**6**	Low	An increase to per diem to attract labor will increase the project total estimate.	45%	$0	$0	$4,290,000	Yes	The estimated Per Diem is $13M. Assume a 33% increase as a max.	
2014-002	Budget	**PROJECT BUDGET - CRAFT LABOR - WAGE RATE ESCALATION:** This risk is related to wage rates rising, at a rate greater than the rate used in the estimate, due to the high demand for craft labor.	ALL	3	3	0	0	**9**	Low	Received rates over 10-year period from S&L. Range has fluctuated from 0% to 21.23% during that period. Current economic conditions indicate a high probability of craft labor rates increasing beyond the current projection of 3.35% provided by S&L.	45%	($19,700,000)	$0	$42,300,000	Yes	Received rates over 10-year period from S&L. Looked at range and average high and low rates. Expected escalation rate is 3.35%. Assumed Min rate of 1.675% and Max rate of 6.7%. Results in potential increase of $42.3M over current escalation estimate and potential decrease of $19.7M.	
2014-001	Budget	**PROJECT BUDGET - IDC:** This risk is related to the cost of capital increasing over the life of the project, at a rate different than the current estimated escalation rate.	ALL	1	5	0	2	**7**	Low	The EPA Cost Control Manual uses a rate of 7% which was used for the estimate. Historical EAI AFUDC rates have been under 7%.	5%	$0	$0	$25,000,000	Yes	Assumes an index rate of 7.5%; this results in an increase of ~$25M over current IDC estimate.	
2014-006	Budget	**PROJECT BUDGET - CAPITAL SUSPENSE ADJUSTMENTS:** The risk is related to Capital Suspense increasing over the life of the project from the current Entergy forecasted rate.	ALL	2	3	1	1	**10**	Low	Adjustment of rates impact the project total estimate.	25%	$0	$0	$0	No	Entergy Indirects will be calculated utilizing the Entergy FVET tool. The risk associated with the individual rates will be included in the estimate uncertainty of the internal loaders estimate.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-005	Budget	**PROJECT BUDGET - EPC MATERIAL ESCALATION:** Project material cost may be subject to escalation	ALL	1	3	0	1	**4**	Low	Material escalation is included in the project estimate.	5%	$0	$0	$0	No	Material escalation is included in the project estimate. The estimate uncertainty addresses the risk of the amount of material and the material escalation rate being different than the current forecasted rates.	
2014-003	Budget	**PROJECT BUDGET - LIME ESCALATION:** Project lime cost may be subject to escalation different than the estimated rate.	ALL	3	1	0	0	**3**	Low	Assume that lime escalation rate will increase during project.	45%	$0	$0	$0	No	Budgeted Lime escalation rate is 2.15%. The estimate uncertainty addresses the risk of the amount of material and the escalation rate being different than the current forecasted escalation rate.	
2014-005	Budget	**PROJECT BUDGET - MATERIAL LOADER ADJUSTMENTS:** The risk is related to the material loaders increasing over the life of the project from the current Entergy forecasted loaders.	ALL	4	1	0	0	**4**	Low	Probability that Material Loaders will change over life of the project.	20%	$0	$0	$0	No	Entergy Indirects will be calculated utilizing the Entergy FVET tool. The risk associated with the individual rates will be included in the estimate uncertainty of the internal loaders estimate.	
2014-004	Budget	**PROJECT BUDGET - PAYROLL LOADER ADJUSTMENTS:** The risk is related to the payroll loaders increasing over the life of the project from the current Entergy forecasted loaders.	ALL	4	2	0	0	**8**	Low	Probability that Payroll Loaders will change over the life of the project.	70%	$0	$0	$0	No	Entergy Indirects will be calculated utilizing the Entergy FVET tool. The risk associated with the individual rates will be included in the estimate uncertainty of the Entergy Payroll estimate.	
2014-006	Budget	**SALES TAX:** Risk that the sales tax rate will change and add additional costs to the project.	ALL	2	1	0	0	**2**	Low	Probability that the Sales Tax will change order the life of the project.	20%	$0	$0	$0	No	The risk associated with a Sales Tax change will be included in the estimate uncertainty, which also includes the risk of the quantity of materials subject to sales tax.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING: Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Quantitative Risk Analysis: Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-010	Eng	**DESIGN CRITERIA:** Design criteria is missing information, or information is incorrect resulting in changes to the technical specifications and requirements during the project. The risk would result in re-engineering / re-work.	ALL	2	3	3	1	**14**	Medium Low	The Owner's Engineer (S&L) has performed Engineering Studies in 2009 and 2013. The revised Design Criteria document reflects the current project requirements.	20%	$0	$5,000,000	$25,000,000	Yes	Assumption that the design criteria accurately reflects the requirements of the project, any corrections will have minimal impact to detailed design. Min is 0%, Expected is 1%, Max is 5% of EPC Direct Costs $500M.	
2014-011	Eng	**ENGINEERING SUPPORT:** Inadequate support to review EPC contractor's design to ensure it meets Entergy requirements. The risk would result in re-engineering / re-work.	ALL	1	3	3	2	**8**	Low	The Project will use an Owner's Engineer to augment staff requirements to mitigate this risk. This risk is the potential for redesign based on inadequate reviews.	5%	$0	$5,000,000	$25,000,000	Yes	Assumption that there will be minimal rework based on inadequate Entergy review of EPC contractor design. Min is 0%, Expected is 1%, Max is 5% of EPC Direct Costs $500M.	
2014-012	Eng	**SCOPE GAP OR CHANGES:** Work scope not defined in EPC contract, and not identified/unforeseen conditions in project budget. Risk would result in additional scope to EPC contract.	ALL	2	4	3	2	**18**	Medium Low	Low probability due to 2009 and 2013 studies. BOP scope not as defined as FGD island. There is only minimal engineering complete at this stage. Also, risk covers the potential for additional design requirements over base FGD design to meet Entergy standard designs.	20%	$5,000,000	$15,000,000	$45,000,000	Yes	Assumption that any missed scope will not be significant, there is an Open Book period for development. Assume minimum of 1% of the $500M FGD direct costs, 3% expected, 9% max.	
2014-013	Eng	**TECHNOLOGY - BAGHOUSE**: The baghouse on each of the units fails to meet the PM emissions limits.	ALL	1	3	5	5	**13**	Medium Low	Low probability due to proven technologies will be specified, and EPC contract will have vendor guarantees.	5%	$0	$0	$0	No	Not included in QRA. Final payment of EPC contract will be based on successful demonstration of performance.	
2014-014	Eng	**TECHNOLOGY - Dry FGD**: The selection of the technology to meet the emission limits with margin is insufficient to meet the required limits.	ALL	1	3	5	5	**13**	Medium Low	Low probability due to proven technologies will be specified, and EPC contract will have vendor guarantees.	5%	$0	$0	$0	No	Not included in QRA. Final payment of EPC contract will be based on successful demonstration of performance.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING: Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Quantitative Risk Analysis: Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-015	Env	**AIR PERMIT (AR) - DELAY**: Delay in receiving the permit, for an additional 6 months (24 total).	ALL	1	2	3	3	**8**	Low	Cost impact to expedite project to stay on schedule as a result in the delay. The current timeline of 18 months accounts for some expected delay.	5%	$0	$0	$3,000,000	Yes	Assume $500k/month for up to 6 mo of delay. This would be prior to FNTP.	In the current timeline, there is some schedule float that could be used. Entergy could release FNTP prior to receipt of the air permit.
2014-016	Env	**ASH DISPOSAL:** EPA determines that combustion byproducts are a hazardous waste resulting in need to utilize other material to stabilize scrubber byproduct.	ALL	1	1	0	3	**4**	Low	Cost impact: possible HAZMAT training and treatment of ash. Still would landfill on site. Loss of ash sales.	5%	$0	$0	$150,000	Yes	Assume some additional training, and minimal equipment modifications.	Most ash will be collected in the ESP. This risk would be addressed by a separate project.
2014-018	Env	**COMPLIANCE RULE - Vacated or Delayed:** If the rule is vacated or delayed, what is the impact?	ALL	1	2	0	0	**2**	Low	Assume delay prior to project approval but same compliance period to comply. Cost impact: engineering, payroll, AFUDC during delay period.	5%	$0	$0	$3,000,000	Yes	Project delayed prior to LNTP. Assume $500k/month for 6 months.	
2014-017	Env	**ASH DISPOSAL:** The ADEQ might impose the same permit restriction as it did at the Flint Creek Plant and not allow WB to route landfill leachate directly to the surge pond.	ALL	3	0	0	1	**3**	Low	Project will not increase probablility to occurrence; plant O&M risk. Cost impact: treatment of leachate prior to sending to surge pond.	45%	$0	$0	$0	No	Plant O&M risk.	
2014-019	EPC	**CONSTRUCTION DELAYS:** Construction delays could negatively affect the project and ability to meet a compliance date target. It includes the following contractor identified risks: 1) Damage or late delivery of equipment and materials 2) Weather impact to craft productivity and full or partial site shutdown 3) Craft productivity 4) Labor availability of pipefitters, welders, and electricians	WB1	2	2	3	2	**14**	Medium Low	The contracting strategy will use schedule incentives to maintain the schedule. The labor availability risk will be shared with the contractor, craft labor escalation is a separate risk item.	20%	$0	$4,000,000	$16,000,000	Yes	These delay estimates represent Owner's costs due to the delay (AFUDC, labor) 0-8 mo delay at $2M/month. Current schedule reflects adequate available time for the EPC contractor to account for these delays. Escalation is a separate risk.	Identified risks will be assigned to the EPC contractor.

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-021	EPC	**Delay in FNTP:** Delay in Entergy issuing FNTP	ALL	2	2	2	3	**14**	Medium Low	Delay in issuing FNTP. Delays for receipt of the air permit or regulatory approval are separately identified risks.	20%	$0	$3,000,000	$6,000,000	Yes	Assume EPC contractor request compensation for the FNTP delay (equipment contracts, etc). ($1M/month delay)	
2014-022	EPC	**Delay in LNTP:** Delay in Entergy issuing LNTP	ALL	2	2	2	3	**14**	Medium Low	Delay in receiving internal approvals.	20%	$0	$1,500,000	$3,000,000	Yes	Assume EPC contractor request compensation for the LNTP delay (equipment contracts, etc). ($0.5M/month delay)	
2014-023	EPC	**EPC CONTRACT EQUIPMENT VALUE:** Equipment estimate uncertainty during the period from when the contract price is developed to the LNTP.	ALL	2	4	0	1	**10**	Low	The time between the Open Book Period and LNTP is approximately 14 months.	20%	$0	$8,000,000	$20,000,000	Yes	Risk of price changes for $400M of the EPC contract, subject to 14 months between negotiation and award. Min = 0%, Exp = 2%, Max = 5%	
2014-024	EPC	**EPC CONTRACT:** Negotiated EPC fee	ALL	2	4	0	2	**12**	Medium Low	EPC Fee assumed to be in the 8%-15% range.	20%	($12,000,000)	$0	$12,000,000	Yes	Estimate includes a 10% fee or ~$60M. Min = 8% fee, Max = 12% fee.	
2014-069	EPC	**EPC CREDIT RISK:** EPC contractor default on contractor (EPC procurement costs)	ALL	1	1	1	3	**5**	Low	Entergy will work with qualified vendors that have had a credit risk review.	5%	$0	$0	$7,500,000	Yes	Estimate of EPC procurement costs, negotiating, and potential incrase on contract value. To account for procurement activities, Max 1% of EPC value	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-070	EPC	**EPC CREDIT RISK:** EPC contractor default on contractor (schedule delay)	ALL	1	5	5	5	**15**	Low	Entergy will work with qualified vendors that have had a credit risk review.	5%	$0	$0	$36,000,000	Yes	Default of the EPC contractor would result in delay of project to procure and onboard a new contractor. For this calculation, the EPC contractor is assumed to default during construction. Apply amount of IDC ($4M/mo) plus carrying costs of Entergy costs ($500k/mo) at this date through end of project to the expected delays (max: 8 mo).	
2014-032	EPC	**SCHEDULE - Delayed:** Change in project schedule due to longer compliance timeline.	ALL	1	1	1	1	**3**	Low	Assume that, if compliance date is delayed, then all costs will shift accordingly. Incremental costs would be maintaining internal staff in the interim, IDC.	5%	$0	$0	$12,000,000	Yes	Assume delay would be known before contract award, when the FIP or SIP is issued. Delay of min = 0 mo, exp = 0 mo, max = 24 mo @ $500k/mo	
2014-033	EPC	**SCHEDULE - Shorter Compliance Timeline:** Change in project schedule that shortens compliance timeline.	ALL	1	4	0	3	**7**	Low	Assume that labor costs and costs to expidite equipment would increase to comply with earlier timeline.	5%	$0	$0	$30,000,000	Yes	Assumption that current schedule has some float, add $ for premium time, less IDC costs. Assume 15% increase of estimated craft labor of ~$200M.	
2014-035	EPC	**UN-IDENTIFIED UNDERGROUND OBSTRUCTION:** Claims for extra work for un-identified underground pipe, etc.	ALL	2	3	2	2	**14**	Medium Low	Project plans to perform exploration work to identify unknown underground obstructions during the Open Book period. This risk if realized will increase the EPC contract price.	20%	$0	$500,000	$3,000,000	Yes	Assumption that any missed scope will not be significant. Schedule delays of $500k/month.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-036	EPC	**WEATHER-RELATED DELAYS:** Extreme weather can greatly affect craft productivity and result in partial or complete site shutdown. Such weather conditions can increase the risk and provide the basis for a contractor claim for a change order.	ALL	1	1	3	2	**6**	Low	The project is subject to extreme weather events. This risk will be further developed during the Open Book period.	5%	$0	$4,000,000	$12,000,000	Yes	These delay estimates represent Owner's costs due to the delay (AFUDC, labor) 0-6 mo delay at $2M/month. Assumption that the current schedule has sufficient float to mitigate this risk. The Open Book period will be used to develop a more detailed schedule.	The project execution plan is to perform a majority of the construction prior to any outage. Weather risks will be assigned to the EPC contractor.
2014-020	EPC	**CONSTRUCTION DELAYS:** Construction delays could negatively affect the project and ability to meet a compliance date target. It includes the following contractor identified risks: 1) Damage or late delivery of equipment and materials 2) Weather impact to craft productivity and full or partial site shutdown 3) Craft productivity 4) Labor availability of pipefitters, welders, and electricians	WB2	2	2	3	2	**14**	Medium Low	The contracting strategy will use schedule incentives to maintain the schedule. The labor availability risk will be shared with the contractor, craft labor escalation is a separate risk item.	20%	$0	$0	$0	No	Risk QRA combined with EPC Construction Delays for WB1. Current schedule reflects adequate available time for the EPC contractor to account for these delays. Escalation is a separate risk.	Identified risks will be assigned to the EPC contractor.
2014-008	EPC	**LABOR:** Schedule delays due to union labor disputes.	ALL	1	2	2	2	**6**	Low	Using non-union labor.	5%	$0	$0	$0	No	Using non-union labor.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-027	EPC	**OPEN BOOK PERIOD**: Change in contract terms (Limitiation of Liability) during EPC contract negotiations.	ALL	1	3	0	1	**4**	Low	The RFP process to select the EPC contractor will require the contractor to state required terms for an EPC contractor prior to their selection. The Open Book period should not increase their project risk profile, which would be a driver for a change in their terms.	5%	$0	$0	$0	No	Not included in QRA. Project estimate includes estimate uncertainty for this risk.	
2014-028	EPC	**OPEN BOOK PERIOD**: Change in rates from EPC contractor during open book period.	ALL	1	1	0	1	**2**	Low	The EPC contractor's labor and equipment rates will be negotiated during the Open Book period to develop the contract price.	5%	$0	$0	$0	No	Not included in QRA. Project estimate includes estimate uncertainty for this risk.	
2014-029	EPC	**OPEN BOOK PERIOD**: Unable to negotiate a fixed price contract.	ALL	1	0	0	0	**0**	Low	The scope and schedule of this project are sufficient to meet the project goals. There is no indication that this risk is probable.	5%	$0	$0	$0	No	Not included in QRA.	
2014-030	EPC	**POOR PERFORMANCE BY CONTRACTOR ON PROJECT:** Risk of claims and change orders increases if contractor expects and/or experiences loss on the project.	ALL	1	1	2	1	**4**	Low	Risk exists for contractor claims, project controls will be in-place to support Entergy. Risk is for total claims greater than the amount of contingency.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	
2014-031	EPC	**POOR QUALITY OF CONTRACTOR WORK**: Schedule impact due to rework and adverse affect on long-term plant operation.	ALL	1	1	2	1	**4**	Low	EPC bidders will be selected based on Entergy experience and previous work experience.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING: Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Quantitative Risk Analysis: Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-034	EPC	**SCOPE OR DESIGN PROBLEMS:** Poor scope, technical design, or unclear technical requirements could result in change orders with added cost and/or schedule delay or an end product that does meet customer needs	ALL	3	3	3	2	**24**	Medium Low	Complicated project with many interfaces to exisitng facility. Assume multiple small change orders.	45%	$0	$0	$0	No	Not included in QRA. This risk is similar to Engineering risks. Project estimate includes estimate uncertainty for this risk.	
2014-037	EPC	**POOR PERFORMANCE:** Contractor does not meet schedule or performance requirements.	ALL	2	1	2	1	**8**	Low	Risk exists for contractor claims, project controls will be in-place to support Entergy.	20%	$0	$0	$12,000,000	Yes	These delay estimates represent Owner's costs due to the delay (AFUDC, labor) 0-6 mo delay at $2M/month.	
2014-038	Goal	**COMPLIANCE - NON-COMPLIANCE**: The new emission standards cannot be met by the units.	ALL	1	5	5	5	**15**	Medium Low	Industry information shows that the emission compliance levels can be met with the available tecnologies.	5%	$0	$0	$0	No	Cost estimate is beyond project value.	
2014-053	Ops	**LONG TERM OPERATION - CAPACITY:** Unit derate or capacity restriction resulting from control technologies.	ALL	1	1	1	1	**3**	Low	Unit capacity will be affected by this project. It will be defined and a guarantee will be negotiated with the EPC contractor.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	Review this risk after Open Book Period to determine capacity impact of project.
2014-054	Ops	**LONG TERM OPERATION - INCREASED O&M:** Increases to the unit's O&M due to control technology.	ALL	1	1	1	1	**3**	Low	Additional O&M will be required by this project. It will be defined when the technology is selected during the Open Book period.	5%	$0	$0	$0	No	Not a project risk.	Review this risk after Open Book Period to determine O&M impact of project.
2014-055	Ops	**LONG TERM OPERATION - OPERATOR INTERFACE:** An increase in training requirements due to control technology.	ALL	1	1	1	1	**3**	Low	Additional Operator interface will be required by this project.	5%	$0	$0	$0	No	Not a project risk.	Additional Operations staff is included in the project estimate. Review this risk after Open Book Period to determine impact of project.

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING: Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Quantitative Risk Analysis: Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	Status / Comments
2014-056	Ops	**LONG TERM OPERATION - RELIABILITY:** Impacts to the unit's reliability.	ALL	1	1	1	1	**3**	Low	The EPC contract will require equipment guarantees and system redundancy to provide reliability.	5%	$0	$0	$0	No	Not a project risk.	Review this risk after Open Book Period to determine O&M impact of project.
2014-057	Permiting	**Department of Transportation:** Impact of schedule delay due to permitting the road modification.	ALL	1	1	1	0	**2**	Low	Unable to determine risk until Open Book Period to understand permit time required and date when road modification must be in place.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	Review this risk after Open Book Period to determine O&M impact of project.
2014-058	Permitting	**REGULATION CHANGE:** Change in future regulation to lower emission limits or 30-day rolling average.	ALL	1	1	0	0	**1**	Low	Need additional information, this would be a future project. Technology for FGD has not been determined	5%	$0	$0	$0	No	Risk will be mitigated during technology selection.	
2014-040	PM	**INTERNAL APPROVALS:** Possible delays due to delay of internal approval of contracts	ALL	2	1	1	2	**8**	Low	Risk exists with the challenges of obtaining internal approvals.	20%	$0	$0	$1,500,000	Yes	Assume internal project team continues to support Board approval during the regulatory and permitting periods. (Assume $500k/mo).	
2014-041	PM	**ISSUE RESOLUTION:** Possible schedule delays due to non-resolution of issues as they arise.	ALL	2	2	3	2	**14**	Medium Low	Risk exists for undefined issues.	20%	$4,500,000	$9,000,000	$13,500,000	Yes	Undefined issues may impact schedule & project scope. (Assume AFUDC ($4M) + Owner's costs ($500k) per month) Min = 1 mo, expected = 2 mo, max = 3 mo)	
2014-039	PM	**COMMUNICATIONS:** Possible schedule delays and costs increases due to poor communication between all parties	ALL	1	1	2	2	**5**	Low	Risk exists for contractor claims. The contracting strategy using only one EPC contractor should minimize this risk.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $. Adequate staffing of project is a separate risk.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
				Prob. Rating & History	Cost Impact Rating	Schedule Impact Rating	Other Impact Rating	Total Risk Score	Risk Rating	Justification of Ratings	Probability	Min ($)	Expected	Max ($)	Include in QRA	QRA Comments	
2014-042	PM	**MANAGEMENT - INSUFFICIENT INTERNAL PROJECT STAFF:** Insufficient Internal project resources - unable to meet schedule. Project costs increase.	ALL	2	2	0	2	**8**	Low	Internal labor costs would be higher than budgeted.	20%	$0	$0	$0	No	Project will plan to use outside contractors to staff project.	
2014-043	PM	**MANAGEMENT - PRUDENCY DETERMINATION:** The project team is unable to justify and document project decisions and the related costs to defend decisions as prudent in future rate cases. Mitigation includes processes for contemporaneous documentation.	ALL	1	1	1	3	**5**	Low	The project will follow project delivery standards, risk should be minimal.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	
2014-044	PM	**PROJECT CONTROLS:** Project has insufficient project controls / oversight / documentation to manage and control cost.	ALL	1	3	0	4	**7**	Low	Stage Gate process requires project controls. Generic project costs would be higher than budgeted.	5%	$0	$0	$0	No	Additional staff included in the project estimate to cover PEI oversight of project.	
2014-045	PM	**RECORDS MANAGEMENT:** Document control is insufficient leading to inability to support Regulatory Recovery	ALL	1	1	1	3	**5**	Low	The project will follow project delivery standards, risk should be minimal.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	
2014-048	PM	**SCOPE CHANGES:** Possible delays or increased cost due to improperly managed project scope changes.	ALL	1	2	2	2	**6**	Low	Potential delays due to internal decisions in a timely manner.	5%	$0	$0	$0	No	Not included in QRA. Missed scope part of the Engineering risks.	

WB FGD Project
Risk Register

Risk ID	Risk Category	Description of Risk	Unit	SCORING							Quantitative Risk Analysis						Status / Comments
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2014-059	Reg	**REGULATORY - DELAY:** Regulatory delays could negatively affect the project schedule. The expected duration is estimated to be 18 months.	ALL	2	2	5	4	**22**	Medium Low	Project schedule assumes 18 mo to receive approval. If additional time is required, Entergy may choose to issue FNTP prior to receipt to avoid potential costs.	20%	$0	$0	$3,000,000	Yes	Assumption that current schedule has some float, add $ for premium time, less AFUDC costs. ($0.5M/month delay)	
2014-068	Schedule	**SCHEDULE - FORCE MAJEURE** - Increase in cost of project due to force majeure	ALL	1	1	1	1	**3**	Low	BAR insurance will be in place.	5%	$0	$0	$10,000,000	Yes	Insurance deductible is expected to be structured similar to other projects. $500,000 deductible for flood, 5% of insured value for Named Windstorm with min of $1,000,000 and max of $10,000,000.	
2014-062	Schedule	**COMPLIANCE - DEADLINE**: Risk that the project will not meet the deadline?	ALL	1	3	4	3	**10**	Low	Current timeline has sufficient time to develop project.	5%	$0	$0	$0	No	Current schedule reflects adequate available time to complete the project. EPC contract will include schedule requirements.	
2014-063	Schedule	**OUTAGE SCHEDULE:** Outage schedule moves from current schedule dates.	WB1	2	1	1	1	**6**	Low	Project expects the current scheduled outages to move to meet project requirements.	20%	$0	$0	$0	No	Schedule flexibility is expected.	
2014-064	Schedule	**OUTAGE SCHEDULE:** Outage schedule moves from current schedule dates.	WB2	2	1	1	1	**6**	Low	Project expects the current scheduled outages to move to meet project requirements.	20%	$0	$0	$0	No	Schedule flexibility is expected.	
2014-066	Schedule	**SCHEDULE INSUFFICIENT:** EPC Contractor does not provide schedule with sufficient level of detail to coordinate activities	ALL	1	1	1	1	**3**	Low	EPC contract will require detailed project schedule. Entergy project controls will be in-place to support schedule development and maintenance.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	
2014-067	Supply Chain	**LIME AVAILABILITY:** Will the required lime for the long term operation be available?	ALL	1	1	1	1	**3**	Low	S&L study did not identify lime availability concerns.	5%	$0	$0	$0	No	Insufficient information to provide QRA risk $.	

Probability and Impact Definition

Probability Rating	Probability Definition (Likelihood of Occurrence)	Discreet Value for QRA
1	Less than or equal to 10 % Probability of Occurrence	5%
2	Greater than 10% but less that 30 % Probability of Occurrence	20%
3	Greater than 30% but less that 60 % Probability of Occurrence	45%
4	Greater than 60% but less that 80 % Probability of Occurrence	70%
5	Greater than 80% Probability of Occurrence	90%

Cost Impact Rating	Cost Impact Value (Impact to Entergy Cost only) (Project Cost = $500M)	Min Cost Impact (QRA)	Most Likely Cost Impact (QRA)	Max Cost Impact (QRA)
1	(<0.5% of project cost)	$ 100,000	$ 1,000,000	$ 2,500,000
2	(0.5% - 1.4% of project cost)	$ 2,500,000	$ 4,750,000	$ 7,000,000
3	(1.5% - 2.9% of project cost)	$ 7,000,000	$ 11,000,000	$ 15,000,000
4	(3% - 4.9% of project cost)	$ 15,000,000	$ 20,000,000	$ 25,000,000
5	(>5% of project cost)	$ 25,000,000	$ 37,500,000	$ 50,000,000

Schedule Impact Rating	Schedule Impact Value (Impact to Affected Summary Activity)	Min Schedule Impact (QRA)	Most Likely Schedule Impact (QRA)	Max Schedule Impact (QRA)
1	Less than 30 days	0	15	30
2	Between 30 and 60 Calendar days	30	45	60
3	Between 60 and 90 Calendar days	60	75	90
4	Between 90 and 150 calendar days	90	120	150
5	Between 150 and 210 calendar days	150	180	210

Other Impact Rating	Other Effect on Project (Regulatory/Legal, Safety, Company Reputation and Quality) - more details below
1	No impact
2	Minimal Impact
3	Moderate Impact
4	Significant Impact
5	Severe Impact

Other Impact Value	IMPACT (Effect on Project)
1	Has no impact on (**Company Reputation**)
	Has no impact on quality (**Quality**)
	Not likely to result in injury or illness (**Safety**)
	No impact on timely CPCN or full cost recovery (**Regulatory/Legal**)
2	Has limited impact on (**Company Reputation**)
	Quality issue has minimal impact on project (**Quality**)
	Has a direct, minor impact on a near miss driver, an OSHA RA driver, or human error mechanism. Is an emerging
	CPCN delayed by less than 1 month and/or cost disallowance up to $7,500,000 (**Regulatory/Legal**)
3	Has moderate impact on (**Company Reputation**)
	Quality issue affects work activities and requires application of the corrective action program (**Quality**)
	Will create a near miss driver, an OSHA RA driver, or human error mechanism. An emerging safety issue where a
	CPCN delayed between 1-3 months and/or cost disallowance between $7,500,000 and $12,500,000
4	Has significant impact on (**Company Reputation**)
	Quality issue requires immediate management attention (**Quality**)
	Will create a near miss driver, an OSHA RA driver, or human error mechanism. No workaround is present.
	CPCN delayed between 3-5 months and/or cost disallowance between $12,500,000 and $20,000,000
5	Has severe impact on (**Company Reputation**)
	Quality issue requires work stoppage (**Quality**)
	Likely to cause one or more deaths (**Safety**)
	CPCN delayed more than 5 months and/or cost disallowance greater than $20,000,000 (**Regulatory/Legal**)

* The Project manager should establish clear thresholds for financial impact at the outset of the project. These should be articulated in the Project Execution Plan and be approved in accordance with the provisions of the Project Management Manual.

ENTERGY ARKANSAS, INC.

INDEPENDENCE DRY FGD

COST ESTIMATE AND TECHNICAL BASIS

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Prepared by

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1. PURPOSE

The purpose of this study is to estimate the total capital investment and operating and maintenance costs associated with installing dry flue gas desulfurization (FGD) technology on Independence Units 1&2. This report documents the conceptual design and technical basis for the dry FGD cost estimate.

2. TECHNOLOGY DESCRIPTION

2.1.1. Reagent Preparation System

Lime will be supplied to the lime day bins from the long-term storage silo located in the Reagent Handling Area and supplied by the EPC Contractor. The lime day bins, located in the Reagent Preparation Area and provided by the Dry FGD System Supplier, will each have a storage capacity to supply the plant with lime reagent for 24 hours when firing 1.2 lb SO_2/mmBtu coal.

Lime from the day bin will be gravity-fed through feeders to a lime slaker, where the lime will be slaked (mixed with low pressure service water and converted from calcium oxide to calcium hydroxide slurry). The plant will have a total of two lime slaking trains (2 x 100%), each sized to process enough lime slurry to supply the entire plant. Each lime slaker will discharge to a lime slurry transfer tank, which is equipped with two lime slurry transfer pumps which will feed into the lime slurry storage tanks. The common lime slurry storage tanks will each be sized for 12 hours of storage for the entire plant when burning a 1.2 lb SO_2/mmBtu coal. The lime day bin, slaking trains, and lime slurry tanks are sized to provide the necessary reagent slurry to both units simultaneously. The lime slurry tanks are built with cross-ties such that either slurry tank can feed either the Unit 1 or Unit 2 FGD systems.

A total of four lime slurry feed pumps (two per unit), each sized for 100% flow to one unit, will pump the lime slurry from the storage tanks to the SDAs through one of 2 x 100% piping loops, and return unused slurry back to the lime slurry storage tank. The closed-loop reagent supply line requires a flow velocity between 4-10 fps to avoid any solids buildup in the piping. Because of this, the pumping requirement is higher than the actual SDA requirement and must be sufficiently greater than the slurry flow that is pumped into the absorbers to allow the returning flow to remain above 4 fps.

2.1.2. Absorbers

Three absorbers, each treating 33⅓% of the flue gas are provided for each unit. Depending on the supplier and the type of atomizer normally used, there may be one rotary atomizer per absorber with a shared spare (B&W), three rotary atomizers per absorber with one or more shared spares (Alstom, basis of the estimate), or multiple dual-fluid atomizers with 15% shared spares (Siemens). The cost estimate includes contingency to capture the possibility of any of these designs.

2.1.3. Baghouse

Each SDA will be paired with a pulse-jet baghouse with a gross air-to-cloth ratio of approximately 3.2-3.4 ft/min. The filter bags in each baghouse are cleaned by pulses of compressed air. The air compressors will be 4 x 33% for the station and are included in the scope of the baghouse supplier.

2.1.4. Byproduct Recycle System

The reaction byproducts from the absorbers will be collected in the baghouses and a portion of the collected material will be recycled. The baghouse hoppers will be emptied through air lock feeders and pneumatically conveyed to two recycle day bins located in the Byproduct Recycle Area and supplied by the Dry FGD System Supplier, which are common for both units. The air-lock feeders are installed without a spare. One recycle day bin is located in the recycle train for each unit. The common byproduct recycle day bins (one per unit) provide 8-hours of storage when burning 1.2 lb SO_2/mmBtu coal.

Each byproduct recycle day bin is equipped with two recycle slurry preparation systems. The byproduct in each recycle day bin is gravimetrically conveyed to one of two systems where the byproduct is slurried with water (cooling tower blowdown). The byproduct recycle slurry is stored in one of four plant wide recycle slurry tanks, two per unit (combined 4-hour storage capacity).

Two recycle water make-up tanks are located in the recycle area. The recycled by-product slurry will be combined with fresh lime slurry for feed to the SDA atomizers. Recycle feed slurry pumps (4 x 100%, two installed per unit) will be used to transfer the recycle slurry from the recycle slurry tanks to the atomizers. In addition, all recycle feed lines are provided in a loop configuration as with the reagent system, with a complete redundant loop to allow unhindered operation due to any pluggage of pumps or feed piping.

2.1.5. Reagent Handling System

The basis of the estimate is delivery of lime via hopper-bottom railcars with truck unloading as a backup. In order to accommodate rail delivery to the site, a new rail spur will be constructed from the existing track on the plant site for unloading. A trackmobile car positioner will position railcars, two at a time, in the enclosed delivery shed for unloading. A vacuum pneumatic system will unload the railcars into either of the two (2) lime storage silos. The lime storage silos will be sized for supply of reagent for 14 days of storage at full load when firing 1.2 lb SO2/mmBtu coal. Lime from the long-term storage silos will be pneumatically transferred to two lime day bins located in the Reagent Preparation Area and supplied by the Dry FGD System Supplier.

2.1.6. Byproduct Handling System

Excess FGD byproduct from the recycle system will be pneumatically conveyed to either of the two common long- term FGD byproduct storage silos. The two long-term FGD byproduct storage silos are each sized to handle the byproduct for a total of 7 days of storage when firing the 1.2 lb SO_2/mmBtu coal. The byproduct will be mixed with a small amount of fly ash and water to form a final product which contains approximately 65% FGD byproduct, 5% fly ash, and 30% water. In order to achieve this mixture, a common fly ash blending bin (7-day storage) will be located near the new byproduct silos. The wetted byproduct/fly ash mixture is then loading into dump trucks, which will deposit the FGD byproduct in a final storage location in the landfill. It is assumed that the existing landfill will have sufficient capacity to accommodate the addition of FGD byproduct. Therefore no costs were included in the capital estimate for the (existing) landfill.

2.1.7. Flue Gas Handling System

The flue gas from the existing ID fans will be ducted to the absorbers. The gases from the absorbers will be ducted to the baghouses to collect the reaction by-products and residual fly ash. Two axial booster fans (2 x 50% for each unit) will be located downstream of the absorbers and baghouse; the booster ID fans can be provided by the Dry FGD System Supplier or the EPC Contractor. Due to the dry condition of the scrubbed flue gas, the existing stack and liners will be used for the retrofit case.

2.1.8. Electrical BOP System

In order to feed the new dry FGD and other BOP equipment, significant modifications and additions to the existing power system would be required. These include, at a minimum, installation of new auxiliary transformers, medium- and low-voltage switchgear buses, motor control centers (MCCs) and upgrades to the isolated phase tap-off buses. As a detailed conceptual design was not developed an allowance was included for the Electrical BOP Scope.

2.1.9. I&C BOP System

The dry FGD system will be integrated into the existing DCS system. The baghouse will be controlled through a PLC and the ID booster fans will be integrated into the existing DCS system. As a detailed conceptual design was not developed an allowance was included for the I&C BOP Scope.

3. APPROACH

The project capital and O&M cost estimates are based on project-specific information, including:

- An engineer-procure-construct (EPC) contracting strategy with the Dry FGD technology supplier providing the main process equipment as a complete FGD Island.
- On-site disposal of Dry FGD byproduct using new ash handling equipment. The byproduct will be collected in the new fabric filter and blended with fly ash prior to disposal.
- Reagent injection rates based on achieving an outlet SO_2 emission rate of 0.06 lb SO_2/MMBtu from a design inlet concentration of 1.20 lb SO_2/MMBtu, based on the sulfur limit in the fuel supply contracts.
    - Annual operating costs will be based on an uncontrolled SO_2 rate of 0.49 lb SO_2/MMBtu, based on the annual heat input weighted average emission from 2009 through 2013.
    - The system will be designed to control emissions to meet a permit limit of 0.06 SO_2/MMBtu, based on the required permit limits in the EPA Arkansas FIP.

- A high level conceptual system design was used as input to the Dry FGD cost estimate. The following were estimated based on previous projects and scaled for the predicted dry sorbent injection rate for Independence:
  - Auxiliary power consumption
  - Annual reagent consumption
  - Equipment Sparing and Quantities
  - BOP Allowances (Mechanical, Electrical and I&C)

The total plant capital cost estimate includes the following:

- Equipment and material
- Installation labor
- Demolition and Relocation work
- Indirect field costs and BOP engineering
- Freight on Materials
- General and Administration
- Erection contractor profit
- Engineering, Procurement and Project Services
- Spare parts/initial fills (other than reagent)
- EPC Fee

As part of this project, S&L estimated the costs for Owner's services and costs outside of the EPC contract including the following:

- Owner's Costs
- Owner's Engineer
- Construction Management Support
- Startup and Commissioning Support
- Performance Testing
- Contingency
- Escalation
- Interest During Construction

Cost Estimate 34261 provided in Attachment 1 represents the total cost to Entergy to install Dry FGD technology on both units at Independence (Unit 1 and 2) including the EPC Contract price and all additional Owner's costs and third party services.

The total unit O&M cost estimate includes the following:

- Waste disposal (Dry FGD waste)
- Reagent consumption
- Auxiliary power consumption
- Water consumption for reagent and byproduct handling
- Operating labor
- Maintenance material
- Maintenance labor

The O&M Cost Estimate and Capital Cost Estimate were developed using the assumptions and scope provided in this document. The project definition and accuracy corresponds to a study level estimate as defined in U.S.EPA's Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual. The costs provided in this report are in 2017 dollars.

4. CAPITAL AND O&M COST ESTIMATE TECHNICAL BASIS

4.1. DESIGN INPUTS AND ASSUMPTIONS

The following summarizes the design inputs used as the basis for the Independence dry FGD Systems:

- Design SO_2 inlet concentration of 1.2 lb SO_2/MMBtu for equipment design, based on the current coal contract sulfur limit.
- SO_2 inlet concentration of 0.49 lb SO_2/MMBtu for annual operating costs, based on the annual heat input weighted average emission from 2009 through 2013.
- Design SO_2 outlet concentration of 0.06 lb SO_2/MMBtu.
- Annual capacity factor of 75.0% (annual average capacity factor for Independence Units 1 and 2 based on historical heat input from 2009 through 2013).
- Project duration of five years.

4.2. TOTAL INSTALLED CAPITAL INVESTMENT

The Dry FGD System Supplier will provide all of the equipment within the FGD Island. The FGD Island will include the Reagent Preparation Equipment, Absorber Area Equipment, Baghouse Area Equipment and the Byproduct Recycle Equipment. The booster ID fans could be provided by either the Dry FGD System Supplier or the EPC Contractor; the basis of this estimate is supply of the booster fans by the Dry FGD System Supplier. The EPC Contractor will provide the remaining BOP scope in order to provide a complete and operable FGD system. In addition, the EPC Contractor will install/construct the entire system including the equipment provided by the DFGD supplier. The scope of work for the cost estimate is broken out by the following areas:

4.2.1. Dry FGD Island

a. Reagent Preparation System, common to both units:
- Two lime day bins, 24-hours storage each
- Two detention lime slakers at 100% capacity, each with a grit screen, gravimetric feeder
- Two lime slurry transfer tanks
- Four slurry transfer centrifugal pumps
- Two lime slurry storage tanks
- Four slurry feed centrifugal pumps
- Cost estimate based on budgetary proposal from Alstom; the budgetary proposal is based on a design sulfur of 2.0 lb/MMBtu, cost adjustments were included in the estimate for a lower design sulfur of 1.2 lb/MMBtu. These cost adjustments were developed by estimating the differential equipment cost for the reagent preparation and waste handling equipment. The impacted equipment is identified in Section 4.5 which discusses the sulfur design basis sensitivity.

b. Absorber Area, per unit
- Three absorber vessels per unit, with access doors
- Rotary atomizers, two spare atomizers included
- Vessel material carbon steel, ¼ in. – ⅝ in. carbon steel
- Heating and ventilation
- Vacuum piping
- SDA Superstructure
- Cost estimate based on budgetary proposal from Alstom

c. Baghouse Area, per unit
   - New baghouse, including pulse jet cleaning system and all appurtenances
   - Cost estimate based on budgetary proposal from Alstom

d. Byproduct Recycle System, per unit (located remotely in common location for both units)
   - One recycle silo with bin vent filter per unit, 8-hour total capacity
   - Two recycle mix tanks per unit
   - Two recycle slurry tanks per unit, with two recycle slurry centrifugal pumps per unit
   - Agitators for each tank
   - Baghouse ash handling system common to both units
   - Rotary air-lock valves from baghouse hopper outlets to pressure pneumatic conveying system (60-degree typical)
   - Pneumatic pressure blowers (8 x 33⅓ %)
   - Cost estimate based on budgetary proposal from Alstom

e. ID Booster Fans, per unit
   - Two approximately 5,200 hp axial booster fans per unit sized to overcome pressure drop associated with FGD and baghouse
   - Includes motors - no spare motor included
   - Cost estimate based on budgetary proposal from Alstom
   - Dampers from ID fan to booster fans (cost estimated separately, not included in Alstom budgetary proposal)

f. Interconnecting Ductwork, per unit
   - ID fan outlet to absorber inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm
   - Absorber outlet to baghouse inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm
   - Baghouse outlet to new booster fans and fan outlet to the stack inlet ductwork and supports; carbon steel, ¼ in, design velocity, 3,600 fpm

4.2.2. FGD Island BOP

a. Absorber tower foundations including caissons

b. Baghouse area foundations including 18” auger cast piles 60’ long

c. Booster fan area foundations

d. Concrete foundations for all flue gas ductwork

e. 6" insulation with lagging for Absorbers, Baghouses and Ductwork

f. Penthouse enclosure for Absorbers located in FGD Island

g. Two elevators (one for each unit) to provide maintenance access to Absorber and Baghouse Areas

h. Enclosure around hoppers for Baghouses located in FGD Island

i. Lime preparation building for Reagent Preparation Area in FGD Island, including substructure and superstructure

j. Byproduct recycle building for Byproduct Recycle Area in FGD Island, including substructure and superstructure

4.2.3. <u>Reagent Storage and Handling, common to both units:</u>

a. Lime rail car unloader:
   - Lime delivery via 25-car unit train
   - System consists of mobile receiving pan and associated vacuum pneumatic equipment to unload railcar through railcar bottom hoppers
   - Enclosed railcar unloading building
   - One vacuum pneumatic system operating to unload a car
   - Pneumatic vacuum exhausters (2 x 100%)
   - Filter separator with vacuum-to-pressure transfer hopper and valves
   - Cost estimate based on vendor quote for a similar unit

b. Lime storage silos:
   - Two lime storage silos, (14-day capacity each, common to both units) with bin vent filter, including substructure and superstructure
   - 1,000-tons storage, each
   - Continuous level detection systems
   - Live bottom hopper outlets
   - Rotary airlock assemblies
   - Lime transfer systems:
     - Pressure pneumatic conveying system from lime storage silos to lime day bins
     - Pneumatic pressure blowers
     - One lot of pneumatic conveying piping located on an elevated pipe rack

c. Concrete foundations including caissons for all material silos

d. Concrete foundations for pneumatic conveying blowers and exhausters

4.2.4. Byproduct Handling System, common to both units

a. Two FGD by-product storage silos (7-day capacity each, common to both units) with bin vent filter, fluidizing system, and two unloading conditioners (one operating, one spare per silo), including substructure and superstructure

b. One common fly ash blending, 7-day storage bin with bin vent filter, fluidizing system, and four pneumatic airslide conveyors

c. Water pumps and associated piping for unloading conditioners (pin mixers) at both silos

d. Continuous level detection system

e. Two truck scales and substructure

f. Concrete foundations including caissons for all material silos

g. Concrete foundations for pneumatic conveying blowers and exhausters

h. Allowance for existing road improvements for truck haulage to existing landfill

4.2.5. Civil BOP

a. Site grading

b. Soil removal earthwork

c. Excavation, backfill, and compaction for all foundations

d. Development of a new laydown area, approximately 10 acres, including site preparation, fencing, and temporary power. It was assumed that this area would be located on existing plant property, and does not require land to be purchased.

4.2.6. Mechanical BOP System

a. Interconnecting piping, above-ground and buried

b. Valves for interconnecting piping, above-ground and buried

c. Lime slaking water storage tank, 175,000-gallon capacity

d. Recycle make-up water tanks, 2 x 200,000-gallon capacity

e. Pipe Racks, common to both units
   - Between lime railcar unloading enclosure and lime silos
   - Between lime silos and lime day bins
   - From baghouse hoppers to recycle silos and FGD by-product silo
   - From lime slurry storage tanks to absorber
   - From recycle slurry storage tank to absorber
   - Concrete foundations including caissons for all pipe racks
   - Shallow concrete foundations for other miscellaneous structures

f. BOP Pumps
  - Three by-product recycle water forwarding pumps to recycle slurry
  - Four reagent prep/recycle sump pumps
  - Two lime silo and unloading area sump pumps
  - Two by-product ash silo area sump pumps
  - Two by-product recycle make-up water tank supply pumps
  - Two lime slaking water pumps

g. Instrument Air System, common to both units
  - Air compressors; 2 x 100%,
  - IA dryers w/filters; 2 x 100%,
  - Air receivers; 2 x 100%
  - Instrument air piping to every silo or day bin, bin vent and reagent preparation/recycle area
  - Heat-traced piping

h. Service Air System, common to both units
  - Air compressors; 2 x 100%
  - Air receivers; 2 x 100%

i. Field painting
  - Multiple coat system used for exposed ductwork only
  - Inorganic zinc primer and polyurethane system used for steel
  - Allowance for underground piping shop coatings built into piping cost

4.2.7. Demolition and Relocation

a. Allowance of $1,800,000, plus labor costs, is included for demolition and relocation of existing equipment and infrastructure which may interfere with the new Dry FGD system. This allowance is based on recent in-house cost estimates for similar projects.

4.2.8. Electrical BOP System

a. Allowances of $13,900,000, $8,500,000 and $1,400,000, plus labor costs, are included for electrical equipment upgrades and modifications, cables and conduits/raceway, respectively. These allowances are based on recent in-house cost estimates for similar projects.

4.2.9. Instrumentation and Controls BOP System

a. Allowance of $1,585,000, plus labor costs, is include for DCS upgrades and added instrumentation. This allowance is based on recent in-house cost estimates for similar projects.

4.2.10. Labor Costs

Installation/labor costs were included in the base estimate under the direct costs. Manhours are estimated for each item in the base estimate and are based on the type of work and typical estimates for similar work. The labor costs are based on the labor wage rates and labor crews developed by S&L.

a. Labor Wage Rates

   Crew labor rates were developed using prevailing craft rates, fringe benefits and state specific worker's compensation rates as published in the 2017 edition of R.S. Means Labor Rates for Pine Bluff, Arkansas area. Costs were added to cover FICA, workers compensation, all applicable taxes, small tools, incidentals, construction equipment, and contractor's overhead. A 1.15 geographic labor productivity multiplier is included based on the Compass International Construction Yearbook for Arkansas. The crew rates do not include an allowance for weather related delays.

b. Labor crews

   Construction/erection labor cost is based on the use of applicable construction crews typically required for projects of this type. The construction crew costs were specifically developed for utility industry and are proprietary to S&L. The prevailing craft rates are incorporated into work crews appropriate for the activities, and include costs for small tools, construction equipment, insurance, and site overheads.

4.2.11. Other Direct and Construction Indirect Costs

In addition to the base labor costs, other construction indirect costs for the project were broken out in the estimate as well as other contractor direct costs. The following items were included as other direct and construction indirect costs.

a. Scaffolding and Consumables
b. Premiums and per diems ($10 per hour)
c. Overtime is included based on five 10-hour shifts per week work schedule
d. Freight on construction materials
e. Contractor's General & Administration Fees (included at 10% of total direct and construction indirect costs)
f. Contractor's Profit (included at 5% of total direct and construction indirect costs)

4.2.12. EPC Indirect Costs

The final contribution to the overall EPC project price are the EPC Contractor's indirect costs; these include the EPC engineering services, startup spare parts and initial fills, technical field advisors, and the EPC risk fee.

a. EPC Engineering Services

The EPC engineering services was estimated based on recent projects with similar scopes and schedules. The total cost of the EPC engineering services was estimated to be $23,000,000.

b. Startup Spare Parts and Initial Fills

An allowance has been included for initial fills for equipment, including first fills for lubrication of any motorized equipment. The initial fill of pebble lime was not included in the EPC Contractor's scope, as this is considered to be an operating cost rather than a capital expense. The initial fill of pebble lime is included in the Owner's costs. The total cost of the initial fills was estimated to be $300,000.

c. Technical Field Advisors (Vendors)

Allowances were included for equipment supplier's technical field advisory services based on an estimated 600 man-days. The estimate includes technical field advisors for the FGD system supplier (including FGD system subcontractors) and the DCS supplier. The total cost of the technical field advisors was estimated to be $600,000.

d. EPC Risk Fee

An EPC approach provides an alternative which is expected to reduce risk for Entergy by placing the responsibility for the project on a single entity, the EPC Contractor. The EPC risk fee is a premium charged by the contractor which accounts for the additional coordination and management of the project as well as the additional risk assumed by the contractor. Based on S&L's experience with recent EPC projects, an EPC risk fee was included at 10% of the total EPC project costs.

4.2.13. Owner's Costs and Services

Outside of the EPC Contractor's total cost, Entergy will incur other costs associated with the project, such as services procured from third parties (including Owner's engineer, construction management support, startup and commissioning support and performance testing), and other project related costs.

a. Owner's Costs

Owner's Costs are direct costs that the Owner incurs over the life of the project. The following items are real costs Entergy will incur to install DSI at Independence based on the scope and schedule of this project:

- Internal Labor
- Internal Indirects

- Travel Expenses
- Legal Services
- Builders Risk Insurance
- Initial Fills (Reagent)

Owner's costs were included in the estimate at 8% of the total project cost.

b. Construction Management Support

The construction management support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The cost of labor is based on present day cost. The total cost of the construction management support was estimated to be $4,969,000.

c. Startup and Commissioning Support

The startup and commissioning support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The total cost of the startup and commissioning support was estimated to be $550,000.

d. Owner's Engineer

The Owner's Engineer cost was developed as a high level estimate based on a typical scope for Owner's Engineer work for this type of project; including the following tasks:

- Conceptual Study Support
- EPC Specification Supporting Documents
- Project Schedule Development
- EPC Specification Development
- EPC Bid Evaluation and Contract Conformance
- General Project Support
    - Monthly Project Status Meetings
    - Weekly Teleconferences
    - Overall Coordination
    - Project Administration
    - Site Visits and Travel
- Permitting Support
- Design Review of Drawing Submittals
- Technical support during design, fabrication, construction, commissioning, and testing

- Equipment vendor QA/QC audits

The total cost of the Owner's Engineer was estimated to be $6,500,000.

e. Performance testing

The cost for performance testing was developed as a factored estimate using costs from projects of similar scope. This cost includes the testing, performed by a third-party contractor hired by the Owner, and also includes the cost for S&L's assistance in the following tasks:

- Development of the test protocol
- Procuring the services of the testing contractor
- Overseeing the performance test campaign
- Evaluating the results of the testing with respect to guarantee compliance

The estimate for the third party testing contractor is based on the assumption that the contractor would be onsite for up to 5 days. The total cost of the Performance Testing was estimated to be $275,000.

f. Contingency

Contingency is included in the estimate to cover the uncertainty associated with the project costs. The cost estimate includes a recommended contingency of 15% (due to a greater extent of project definition), which is consistent with cost estimating guidelines for a conceptual design and the current level of project definition. Contingency was applied to the total project costs before escalation.

g. Escalation

Escalation was included in the estimate based on a typical schedule for implementation of a Dry FGD system at an escalation rate of 2.15% on equipment and materials and 3.35% on labor and indirects. These escalation rates were developed by S&L based on recent pricing and in-house escalation projections.

h. Interest During Construction

Interest during construction (IDC) accounts for the time value of money associated with the distribution of construction cash flows over the construction period. IDC was applied to the total EPC project costs including contingency. The IDC was calculated based on a typical schedule for implementation of a DSI system and a typical interest rate of 7.8% per year which was assumed based on a low interest market environment.

4.3. VARIABLE OPERATING AND MAINTENANCE COSTS

The following unit costs were used to develop the variable Operating and Maintenance (O&M) costs. All of these values, with the exception of the reagent costs, were provided by Entergy or are typical industry values confirmed by Entergy. The reagent costs are based on recent supplier quotes for the area.

Table 4-1: Unit Pricing for Utilities (Provided by Entergy)

Unit Cost	Units	Value
Pebble Lime	$/ton	$130.0
High Quality Water	$/1000 gal	$2.00
Low Quality Water	$/1000 gal	$0.50
Byproduct Disposal	$/ton	$7.50
Aux Power Cost[1]	$/MWh	$43.35

Note 1: Entergy provided auxiliary power costs for the first year of operation.

Table 4-2 below summarizes the consumption rates estimated as well as the first year variable O&M costs for the Dry FGD system.

Table 4-2: Variable O&M Rates and First Year Costs, per Unit

	Units	Value
Dry FGD System Parameters		
Reagent Consumption	lb/hr	4,800
Byproduct Waste Production	lb/hr	10,600
Aux Power Consumption	kW	10,000
High Quality Water Consumption	gpm	50
Low Quality Water Consumption	gpm	880
First Year[1] Variable O&M Costs (@CF[2])		
Reagent Cost	$/year	$2,050,000
Byproduct Waste Disposal Cost	$/year	$261,000
Aux Power Cost	$/year	$2,628,000
Water Cost	$/year	$213,000
Bag and Cage Replacement Cost	$/year	$372,000
Total First Year Variable O&M Cost	**$/year**	**$5,524,000**

Note 1: First year costs are provided in $2017.

Note 2: The first year costs are calculated using an annual capacity factor of 75.0%.

4.4. FIXED OPERATING AND MAINTENANCE COSTS

The fixed O&M costs for the systems consist of operating personnel as well as maintenance costs (including material and labor). Based on the conceptual design for the dry FGD system, the estimated staffing additions are 28 personnel for two systems on adjacent units.

The annual maintenance costs are estimated as a percentage of the total capital equipment cost, based on the amount of operating equipment which will require routine maintenance. For this evaluation, the maintenance costs (maintenance and labor) were estimated to be approximately 1.3% of the project capital. This is a lower value than typical because items such as track work and civil work are high capital cost items with little to no maintenance.

Table 4-3 below summarizes the first year fixed O&M costs for the design and typical cases.

Table 4-1: First Year Fixed O&M Costs for Dry FGD, per Unit

First Year[1] Fixed O&M Costs	Units	Value
Operating Labor[2]	$/year	$1,660,000
Maintenance Material	$/year	$975,000
Maintenance Labor	$/year	$650,000
Total First Year Fixed O&M Cost	**$/year**	**$3,285,000**

Note 1: First year costs are provided in $2017.

Note 2: Operating labor costs are based on a labor rate of $56.95, which was provided by Entergy.

Note 3: Installation of systems on both units would require 28 operators total. For accounting purposes, this is considered 14 operators per unit.

5. SUMMARY

The cost estimate for the Independence Units 1&2 Dry FGD systems is based on the addition of two SDA FGD systems for SO_2 removal. The attached capital estimate for the Independence Dry FGD system is based on this technical basis and is presented in 2017 dollars.

6. ATTACHMENTS

1. Independence DFGD Project Units 1 and 2 Conceptual Capital Cost Estimate, Sargent & Lundy Estimate No. 34261

ENTERGY ARKANSAS
INDEPENDENCE STATION DRY (SDA) FGD
CONCEPTUAL COST ESTIMATE

Estimator	A. KOCI
Labor rate table	17ARPBL
Project No.	13027-004
Estimate Date	10/04/2017
Reviewed By	GA
Approved By	BA
Estimate No.	34261A
Cost index	ARPBL

ENTERGY ARKANSAS
INDEPENDENCE STATION DRY (SDA) FGD
CONCEPTUAL COST ESTIMATE

Area	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Total Cost
101	FGD ISLAND	147,908,000	150,000,000	16,508,216	343,779	26,553,044	340,969,260
102	REAGENT HANDLING SYSTEM	5,830,400	2,591,000	1,325,175	39,706	3,315,997	13,062,572
105	BYPRODUCT HANDLING SYSTEM	6,120,000	6,810,000	792,075	103,041	8,417,500	22,139,575
121	CIVIL BOP	350,000		3,731,841	63,706	8,336,292	12,418,133
151	MECHANICAL BOP	720,000	1,647,000	5,962,113	88,963	8,343,711	16,672,824
190	DEMOLITION / RELOCATION			1,800,000	33,333	3,276,667	5,076,667
201	ELECTRICAL BOP SYSTEM		12,300,000	11,500,000	284,184	22,691,518	46,491,518
211	INSTRUMENTATION AND CONTROLS BOP SYSTEM		1,500,000	1,085,000	10,920	789,374	3,374,374
	TOTAL DIRECT	**160,928,400**	**174,848,000**	**42,704,420**	**967,632**	**81,724,103**	**460,204,922**

Estimate Totals

Description	Amount	Totals	Hours
Direct Costs:			
Labor	81,724,103		967,632
Material	42,704,420		
Subcontract	160,928,400		
Process Equipment	174,848,000		
	460,204,923	**460,204,923**	
Other Direct & Construction Indirect Costs:			
91-1 Scaffolding	5,721,000		
91-2 Cost Due To OT 5-10's	11,337,000		
91-4 Per Diem	9,676,000		
91-5 Consumables	817,077		
91-6 Freight on Material	2,135,000		
91-8 Sales Tax	7,566,000		
91-9 Contractors G&A	15,776,000		
91-10 Contractors Profit	7,888,000		
	60,916,077	**521,121,000**	
Indirect Costs:			
93-1 Engineering Services	23,000,000		
93-4 SU/S Parts/ Initial Fills	300,000		
93-5 Technical Field Advisors	600,000		
93-8 EPC Fee	54,502,000		
	78,402,000	**599,523,000**	
Escalation:			
96-1 Escalation on Material	5,731,000		
96-2 Escalation on Labor	20,520,000		
96-3 Escalation on Subcontract	26,919,000		
96-4 Escalation on Process Eq	17,974,000		
96-5 Escalation on Indirects	12,802,000		
	83,946,000	**683,469,000**	
Total EPC Cost		***683,469,000***	
Owner's Costs:			
99-1 Owner's Costs	47,962,000		
	47,962,000	**731,431,000**	
Third Party Services:			
100 CM Oversight	4,969,000		
102 Start-up Oversight	550,000		
103 Owner's Engineer	6,500,000		
104 Performance Testing	275,000		
	12,294,000	**743,725,000**	
Project Contingency :			
110 Project Contingency	98,966,000		
	98,966,000	**842,691,000**	
Escalation Addition:			
120 Escalation on Lines 99-110	8,897,000		
	8,897,000	**851,588,000**	
Interest During Construction:			
130 Interest During Constr.	132,199,000		
	132,199,000	**983,787,000**	
Total		***983,787,000***	

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
101			**FGD ISLAND**									
	21.00.00		**CIVIL WORK**									
		21.53.00	**PILING**									
			PILE - MOB/DEMOB		1.00 LS	100,000	-			115.48 /MH		100,000
			PILE - 18" AUGER CAST X 60' LONG	UNIT 1 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	138.00 EA	496,800	-			115.48 /MH		496,800
			PILE - 18" AUGER CAST X 60' LONG	UNIT 2 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	138.00 EA	496,800	-			115.48 /MH		496,800
			PILE - 18" AUGER CAST X 60' LONG	UNIT 1 BAGHOUSE FDN	252.00 EA	907,200	-			115.48 /MH		907,200
			PILE - 18" AUGER CAST X 60' LONG	UNIT 2 BAGHOUSE FDN	252.00 EA	907,200	-			115.48 /MH		907,200
			PILING			**2,908,000**						**2,908,000**
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	ABSORBER TOWERS FOUNDATIONS	180.00 EA	-	-	334,260	4,552	115.48 /MH	525,633	859,893
			2.5 FT DIA X 30 FT DEEP CAISSON	ABSORBER TOWERS FOUNDATIONS	180.00 EA	-	-	334,260	4,552	115.48 /MH	525,633	859,893
			2.5 FT DIA X 30 FT DEEP CAISSON	REAGENT PREP ENCLOSURE 50'X50' SUBSTRUCTURE	50.00 EA	-	-	92,850	1,264	115.48 /MH	146,009	238,859
			2.5 FT DIA X 30 FT DEEP CAISSON	BYPRODUCTS RECYCLE EQUIPMENT BLDG 60' X 60' SUBSTRUCTURE	72.00 EA	-	-	133,704	1,821	115.48 /MH	210,253	343,957
			2.5 FT DIA X 30 FT DEEP CAISSON	UNIT 1 BOOSTER FAN FOUNDATION	40.00 EA	-	-	74,280	1,011	115.48 /MH	116,807	191,087
			2.5 FT DIA X 30 FT DEEP CAISSON	UNIT 2 BOOSTER FAN FOUNDATION	40.00 EA	-	-	74,280	1,011	115.48 /MH	116,807	191,087
			CAISSON					**1,043,634**	**14,211**		**1,641,143**	**2,684,777**
			CIVIL WORK			**2,908,000**		**1,043,634**	**14,211**		**1,641,143**	**5,592,777**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	REAGENT PREP ENCLOSURE 50'X50' SUBSTRUCTURE	300.00 CY	-	-	69,000	2,414	68.52 /MH	165,393	234,393
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	BYPRODUCTS RECYCLE EQUIPMENT BLDG 60' X 60' SUBSTRUCTURE	432.00 CY	-	-	99,360	3,476	68.52 /MH	238,166	337,526
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	UNIT 1 BOOSTER FAN FOUNDATION	600.00 CY	-	-	138,000	4,828	68.52 /MH	330,786	468,786
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	UNIT 2 BOOSTER FAN FOUNDATION	600.00 CY	-	-	138,000	4,828	68.52 /MH	330,786	468,786
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	UNIT 1 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	966.00 CY	-	-	222,180	7,772	68.52 /MH	532,566	754,746
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	UNIT 2 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	966.00 CY	-	-	222,180	7,772	68.52 /MH	532,566	754,746
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ABSORBER TOWER FOUNDATION	1,300.00 CY	-	-	299,000	10,460	68.52 /MH	716,703	1,015,703
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ABSORBER TOWERS FOUNDATIONS	1,300.00 CY	-	-	299,000	10,460	68.52 /MH	716,703	1,015,703
			CONCRETE FOUNDATIONS - COMPOSITE RATE	LIME SLURRY FEED TANKS	400.00 CY	-	-	92,000	3,218	68.52 /MH	220,524	312,524
			CONCRETE FOUNDATIONS - COMPOSITE RATE	UNIT 1 BAGHOUSE FDN 3 FDNS 83'X63'X3'	1,743.00 CY	-	-	400,890	14,024	68.52 /MH	960,934	1,361,824
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' UNIT 1 BAGHOUSE AREA, COMPRESSOR BLDG	6.00 CY	-	-	1,380	48	68.52 /MH	3,308	4,688
			CONCRETE FOUNDATIONS - COMPOSITE RATE	UNIT 2 BAGHOUSE FDN 3 FDNS 83'X63'X3'	1,743.00 CY	-	-	400,890	14,024	68.52 /MH	960,934	1,361,824
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' UNIT 2 BAGHOUSE AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	68.52 /MH	3,308	4,688
			CONCRETE					**2,383,260**	**83,372**		**5,712,678**	**8,095,938**
			CONCRETE					**2,383,260**	**83,372**		**5,712,678**	**8,095,938**
	23.00.00		**STEEL**									
		23.17.00	**GALLERY**									
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	4,000.00 SF	-	-	60,000	460	72.48 /MH	33,324	93,324
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	BYPRODUCTS RECYCLE EQUIPMENT BLDG	5,760.00 SF	-	-	86,400	662	72.48 /MH	47,987	134,387
			3" HEAVY DUTY GRATING	WASTE MANAGEMENT FACILITY (REPLACES HAZMAT BLDG)	200.00 SF	-	-	11,200	39	72.48 /MH	2,833	14,033
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	3,000.00 LF	-	-	159,000	621	72.48 /MH	44,988	203,988
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	4,320.00 LF	-	-	228,960	894	72.48 /MH	64,782	293,742
			SELF CLOSING SWING GATE - USER DEFINED	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	40.00 EA	-	-	11,200	184	72.48 /MH	13,330	24,530
			SELF CLOSING SWING GATE - USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	58.00 EA	-	-	16,240	267	72.48 /MH	19,328	35,568
			LADDER	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	800.00 LF	-	-	40,000	368	72.48 /MH	26,659	66,659
			LADDER	BYPRODUCTS RECYCLE EQUIPMENT BLDG	1,100.00 LF	-	-	55,000	506	72.48 /MH	36,657	91,657
			STAIR SYSTEM	REAGENT PREP ENCLOSURE 50'X50' SUPERSTRUCTURE	2,400.00 SF	-	-	218,400	3,172	72.48 /MH	229,937	448,337

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		23.17.00	GALLERY									
			STAIR SYSTEM	BYPRODUCTS RECYCLE EQUIPMENT BLDG	3,500.00 SF	-	-	318,500	4,626	72.48 /MH	335,324	653,824
			GALLERY					1,204,900	11,798		855,147	2,060,047
		23.25.00	ROLLED SHAPE									
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	REAGENT PREP ENCLOSURE 50'X50' GALLERY SUPPORT	200.00 TN	-	-	716,000	5,057	98.30 /MH	497,149	1,213,149
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	BYPRODUCTS RECYCLE EQUIPMENT BLDG	288.00 TN	-	-	1,031,040	7,283	98.30 /MH	715,895	1,746,935
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	U1 BAGHOUSE SKIRTS STEEL GIRTS	36.00 TN	-	-	138,240	910	98.30 /MH	89,487	227,727
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, GALVANIZED	U2 BAGHOUSE SKIRTS STEEL GIRTS	36.00 TN	-	-	138,240	910	98.30 /MH	89,487	227,727
			BUILDING MIX, TWO COAT PAINTED		50.00 TN	-	-	128,000	920	98.30 /MH	90,391	218,391
			BUILDING MIX, TWO COAT PAINTED		50.00 TN	-	-	128,000	920	98.30 /MH	90,391	218,391
			BUILDING MIX, TWO COAT PAINTED	REAGENT PREP ENCLOSURE SUPERSTRUCTURE	500.00 TN	-	-	1,280,000	9,195	98.30 /MH	903,908	2,183,908
			BUILDING MIX, TWO COAT PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	720.00 TN	-	-	1,843,200	13,241	98.30 /MH	1,301,628	3,144,828
			ROLLED SHAPE					5,402,720	38,437		3,778,336	9,181,056
			STEEL					6,607,620	50,235		4,633,483	11,241,103
	24.00.00		ARCHITECTURAL									
		24.17.00	ELEVATOR									
			PASSENGER, TRACTION, 4 STOPS, 3500LB, 350 FT/MIN	SCHINDLER ELEVATOR BUDGET	2.00 LS	-	-	318,700	1,885	114.46 /MH	215,764	534,464
			ELEVATOR					318,700	1,885		215,764	534,464
		24.35.00	PRE-ENGINEERED BUILDING									
			PRE-ENGINEERED BUILDING	8' X 10' UNIT 1 BAGHOUSE AREA, COMPRESSOR BLDG	1.00 LT	-	-	20,000	115	98.30 /MH	11,299	31,299
			PRE-ENGINEERED BUILDING	8' X 10' UNIT 2 BAGHOUSE AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	98.30 /MH	11,299	21,299
			PRE-ENGINEERED BUILDING					30,000	230		22,598	52,598
		24.37.00	ROOFING									
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	U1 SDA TOP ENCLOSURE ROOF	3,318.00 SF	-	-	54,946	339	60.10 /MH	20,400	75,346
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	U2 SDA TOP ENCLOSURE ROOF	3,318.00 SF	-	-	54,946	339	60.10 /MH	20,400	75,346
			METAL, INSULATED- USER DEFINED	REAGENT PREP ENCLOSURE SUPERSTRUCTURE	2,500.00 SF	-	-	19,425	862	60.10 /MH	51,810	71,235
			METAL, INSULATED- USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	3,600.00 SF	-	-	27,972	1,241	60.10 /MH	74,607	102,579
			ROOFING					157,289	2,782		167,216	324,506
		24.41.00	SIDING									
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	U1 SDA TOP ENCLOSURE SIDING	2,450.00 SF	-	-	40,572	251	87.92 /MH	22,036	62,608
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	U2 SDA TOP ENCLOSURE SIDING	2,450.00 SF	-	-	40,572	251	87.92 /MH	22,036	62,608
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	REAGENT PREP ENCLOSURE	10,000.00 SF	-	-	165,600	1,023	87.92 /MH	89,941	255,541
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	BYPRODUCTS RECYCLE EQUIPMENT BLDG	14,400.00 SF	-	-	238,464	1,473	87.92 /MH	129,515	367,979
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	U1 BAGHOUSE SKIRTS 6x(83'+63) x30' tall '	26,260.00 SF	-	-	85,345	1,238	87.92 /MH	108,805	194,150
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	U2 BAGHOUSE SKIRTS 6x(83'+63) x30' tall '	26,280.00 SF	-	-	85,410	1,238	87.92 /MH	108,887	194,297
			SIDING					655,963	5,473		481,220	1,137,183
		24.99.00	ARCHITECTURAL, MISCELLANEOUS									
			PENTHOUSE HEATING	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	73.32 /MH	5,394	69,394
			PENTHOUSE LIGHTING	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	84.60 /MH	6,223	70,223
			PENTHOUSE FIRE PROTECTION	U1 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	32,000	37	84.60 /MH	3,112	35,112
			PENTHOUSE HEATING	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	73.32 /MH	5,394	69,394
			PENTHOUSE LIGHTING	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	64,000	74	84.60 /MH	6,223	70,223
			PENTHOUSE FIRE PROTECTION	U2 SDA SUPERSTRUCTURE	6,400.00 SF	-	-	32,000	37	84.60 /MH	3,112	35,112
			ARCHITECTURAL, MISCELLANEOUS - USER DEFINED	U1 BAGHOUSE SKIRTS MANDOORS	3.00 EA	-	-	1,500	28	58.15 /MH	1,604	3,104
			ARCHITECTURAL, MISCELLANEOUS - USER DEFINED	U2 BAGHOUSE SKIRTS MANDOORS	3.00 EA	-	-	1,500	28	58.15 /MH	1,604	3,104
			ARCHITECTURAL, MISCELLANEOUS					323,000	423		32,666	355,666
			ARCHITECTURAL					1,484,952	10,794		919,463	2,404,415
	31.00.00		MECHANICAL EQUIPMENT									
		31.41.00	FIRE PROTECTION EQUIPMENT & SYSTEM									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.41.00	FIRE PROTECTION EQUIPMENT & SYSTEM									
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	REAGENT PREP ENCLOSURE 50'X50' FIRE PROTECTION ALLOWANCE	5,000.00 SF	-	-	27,500	385	75.53 /MH	29,083	56,583
			FIRE PROTECTION EQUIPMENT & SYSTEM - USER DEFINED	BYPRODUCTS RECYCLE EQUIPMENT BLDG' FIRE PROTECTION ALLOWANCE	10,800.00 SF	-	-	59,400	832	75.53 /MH	62,820	122,220
			FIRE PROTECTION EQUIPMENT & SYSTEM					86,900	1,217		91,904	178,804
		31.45.00	FGD EQUIPMENT									
			DRY FGD ISLAND -UNITS 1 & 2 FGD SYSTEMS	INCLUDES ABSORBERS, BAGHOUSES, REAGENT PREP, BYPRODUCT RECYCLE, ID BOOSTER FANS, CONTROLS, PIPING, DUCTWORK, AND WIRING WITHIN FGD ISLAND (BASED ON RECENT BUDGETARY QUOTE FROM SIMILARLY SIZED PROJECT)	1.00 LS		150,000,000	-		100.38 /MH		150,000,000
			DRY FGD ISLAND -UNITS 1 & 2 FGD SYSTEMS	INSTALLATION COST FOR DRY FGD ISLAND INCLUDING ITEMS LISTED ABOVE	1.00 LS	145,000,000		-		100.38 /MH		145,000,000
			FGD EQUIPMENT			145,000,000	150,000,000					295,000,000
			MECHANICAL EQUIPMENT			145,000,000	150,000,000	86,900	1,217		91,904	295,178,804
	34.00.00		HVAC									
		34.99.00	HVAC, MISCELLANEOUS									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	REAGENT PREP ENCLOSURE 50'X50' LIGHTING ALLOWANCE	5,000.00 SF	-	-	55,000	57	73.32 /MH	4,214	59,214
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	BYPRODUCTS RECYCLE EQUIPMENT BLDG LIGHTING ALLOWANCE	10,800.00 SF	-	-	118,800	124	73.32 /MH	9,102	127,902
			HVAC, MISCELLANEOUS					173,800	182		13,316	187,116
			HVAC					173,800	182		13,316	187,116
	36.00.00		INSULATION									
		36.13.00	DUCT									
			MINERAL WOOL INSULATION, 4 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	U1 BAGHOUSE INSUILATION TOP, SIDES AND HOPPERS	141,831.00 SF	-	-	850,986	35,050	73.69 /MH	2,582,848	3,433,834
			MINERAL WOOL INSULATION, 4 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	U2 BAGHOUSE INSULATIOIN - TOPS, SIDES AND HOPPERS	141,831.00 SF	-	-	850,986	35,050	73.69 /MH	2,582,848	3,433,834
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA SHELL INSULATION	40,167.00 SF	-	-	261,086	10,388	73.69 /MH	765,493	1,026,578
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA ROOF INSULATION	11,019.00 SF	-	-	71,624	2,850	73.69 /MH	209,997	281,621
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA SHELL INSULATION	40,167.00 SF	-	-	261,086	10,388	73.69 /MH	765,493	1,026,578
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	SDA ROOF INSULATION	11,019.00 SF	-	-	71,624	2,850	73.69 /MH	209,997	281,621
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	UNIT 1 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	168,220.00 SF	-	-	1,093,430	43,505	73.69 /MH	3,205,896	4,299,326
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	UNIT 2 DUCTWORK (NOT INCLUDED IN FGD ISLAND SCOPE)	168,220.00 SF	-	-	1,093,430	43,505	73.69 /MH	3,205,896	4,299,326
			DUCT					4,554,250	183,586		13,528,470	18,082,720
			INSULATION					4,554,250	183,586		13,528,470	18,082,720
	41.00.00		ELECTRICAL EQUIPMENT									
		41.37.00	LIGHTING ACCESSORY (FIXTURE)									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	REAGENT PREP ENCLOSURE 50'X50' LIGHTING ALLOWANCE	5,000.00 SF	-	-	55,000	57	69.31 /MH	3,983	58,983
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	BYPRODUCTS RECYCLE EQUIPMENT BLDG LIGHTING ALLOWANCE	10,800.00 SF	-	-	118,800	124	69.31 /MH	8,604	127,404
			LIGHTING ACCESSORY (FIXTURE)					173,800	182		12,587	186,387
			ELECTRICAL EQUIPMENT					173,800	182		12,587	186,387
			101 FGD ISLAND			**147,908,000**	**150,000,000**	**16,508,216**	**343,779**		**26,553,044**	**340,969,260**
102			**REAGENT HANDLING SYSTEM**									
	21.00.00		CIVIL WORK									
		21.14.00	STRIP & STOCKPILE TOPSOIL									
			STRIP & STOCKPILE TOPSOIL - 12"	EXTEND REAGENT RAIL TRACK	22,500.00 SF	-	-		52	185.95 /MH	9,618	9,618
			STRIP & STOCKPILE TOPSOIL						52		9,618	9,618
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	EXTEND REAGENT RAIL TRACK	2,500.00 SY	-	-	26,625	86	103.37 /MH	8,911	35,536

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			EROSION AND SEDIMENTATION CONTROL					**26,625**	**86**		**8,911**	**35,536**
		21.53.00	**PILING**									
			PILE - 18" AUGER CAST X 60' LONG	UNLOADING SHED 200' X 75 WIDE	64.00 EA	230,400	-			115.48 /MH		230,400
			PILING			**230,400**						**230,400**
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	SUBSTRUCTURE 2200 TON LIME STORAGE SILOS	100.00 EA	-	-	185,700	2,529	115.48 /MH	292,018	477,718
			CAISSON					**185,700**	**2,529**		**292,018**	**477,718**
		21.71.00	**TRACKWORK**									
			LIME RAILCAR UNLOADING SPUR	ALLOWANCE	1,000.00 LF	-	-	170,000	1,724	87.32 /MH	150,552	320,552
			TRACKWORK					**170,000**	**1,724**		**150,552**	**320,552**
			CIVIL WORK			**230,400**		**382,325**	**4,391**		**461,099**	**1,073,824**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	SUBSTRUCTURE 2-2,000 TON LIME STORAGE SILOS	600.00 CY	-	-	138,000	4,828	68.52 /MH	330,786	468,786
			FOUNDATION, 4500 PSI - COMPOSITE RATE	UNLOADING SHED 200' X 75 WIDE	925.00 CY	-	-	212,750	7,443	68.52 /MH	509,962	722,712
			CONCRETE					**350,750**	**12,270**		**840,748**	**1,191,498**
			CONCRETE					**350,750**	**12,270**		**840,748**	**1,191,498**
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	UNLOADING SHED 200' X 75 WIDE x15' TALL	15,000.00 SF	-	-	525,000	4,828	98.30 /MH	474,552	999,552
			PRE-ENGINEERED BUILDING					**525,000**	**4,828**		**474,552**	**999,552**
			ARCHITECTURAL					**525,000**	**4,828**		**474,552**	**999,552**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - 2,000 TON LIME STORAGE SILO	SUBCONTRACT - ERECTED	2.00 LS	5,600,000				68.52 /MH		5,600,000
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO			**5,600,000**			**0**			**5,600,000**
			MISCELLANEOUS STRUCTURAL ITEM			**5,600,000**			**0**			**5,600,000**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.25.00	**CRANES & HOISTS**									
			CRANES & HOISTS & TROLLEYS	REAGENT HANDLING SYSTEM ALLOWANCE	1.00 LT	-	275,000	-		75.53 /MH		275,000
			CRANES & HOISTS				**275,000**					**275,000**
			MECHANICAL EQUIPMENT				**275,000**					**275,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.14.00	**MATERIAL HANDLING EQUIPMENT**									
			LIME HANDLING SYSTEM - 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM		1.00 LS	-	500,000	-	3,306	75.53 /MH	249,683	749,683
			LIME HANDLING SYSTEM - VACUUM EXHAUSTER WITH SOUND ENCLOSURES	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	2.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - RECEIVING PANS UNDER RAIL CARS	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - FILTER SEPARATORS ON TOP OF SILO	INCLUDED WITH 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - 25 TPH PNEUMATIC TRANSPORT SYSTEM		2.00 LS	-	1,000,000	-	6,611	75.53 /MH	499,366	1,499,366
			LIME HANDLING SYSTEM - PRESSURE BLOWERS WITH SOUND ENCLOSURES	INCLUDED WITH 25 TPH PNEUMATIC TRANSPORT SYSTEM	3.00 LS	-		-		/MH		
			LIME HANDLING SYSTEM - PRESSURE FEEDERS	INCLUDED WITH 25 TPH PNEUMATIC TRANSPORT SYSTEM	1.00 LS	-	-	-		/MH		
			LIME HANDLING SYSTEM - SPARE PARTS FOR STARTUP AND SPECIAL TOOLS		1.00 LS	-	8,000	-		75.53 /MH		8,000
			LIME HANDLING SYSTEM - FREIGHT		1.00 LS	-	50,000	-		75.53 /MH		50,000
			MATERIAL HANDLING EQUIPMENT				**1,558,000**		**9,917**		**749,049**	**2,307,049**
		33.41.00	**MOBILE YARD EQUIPMENT**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		33.41.00	**MOBILE YARD EQUIPMENT**									
			MOBILE YARD EQUIPMENT - TRACKMOBILE	REAGENT HANDLING SYSTEM	1.00 EA	-	225,000	-		75.53 /MH		225,000
			MOBILE YARD EQUIPMENT				**225,000**					**225,000**
		33.51.00	**RAIL CAR UNLOADER**									
			RAIL CAR UNLOADER -	IN UNLOADING SHED 200'X75' WIDE	2.00 LT	-	270,000	-	3,724	98.30 /MH	366,083	636,083
			RAIL CAR UNLOADER				**270,000**		**3,724**		**366,083**	**636,083**
			MATERIAL HANDLING EQUIPMENT				**2,053,000**		**13,641**		**1,115,132**	**3,168,132**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	2-2000 TON LIME STORAGE SILOS	3,600.00 SF	-	-	39,600	41	73.32 /MH	3,034	42,634
			HVAC, MISCELLANEOUS					**39,600**	**41**		**3,034**	**42,634**
			HVAC					**39,600**	**41**		**3,034**	**42,634**
	35.00.00		**PIPING**									
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			8 IN DIA, SCH 40, 8" VACUUM CONVEY PIPING WITH 4 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	500.00 LF	-	38,000		540	93.09 /MH	50,290	88,290
			12 IN DIA, 3/8 IN STD- 2500 LF OF 10"/12" TRANSPORT PRESSURE PIPING W 8 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRANSPORT SYSTEM	2,500.00 LF	-	225,000		3,966	93.09 /MH	369,150	594,150
			CARBON STEEL, STRAIGHT RUN				**263,000**		**4,506**		**419,440**	**682,440**
			PIPING				**263,000**		**4,506**		**419,440**	**682,440**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.37.00	**LIGHTING ACCESSORY (FIXTURE)**									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	2-2000 TON LIME STORAGE SILO	2,500.00 SF	-	-	27,500	29	69.31 /MH	1,992	29,492
			LIGHTING ACCESSORY (FIXTURE)					**27,500**	**29**		**1,992**	**29,492**
			ELECTRICAL EQUIPMENT					**27,500**	**29**		**1,992**	**29,492**
			102 REAGENT HANDLING SYSTEM			**5,830,400**	**2,591,000**	**1,325,175**	**39,706**		**3,315,997**	**13,062,572**
105			**BYPRODUCT HANDLING SYSTEM**									
	21.00.00		**CIVIL WORK**									
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON	ASH SILO AND FGD BYPRODUCT SILOS	125.00 EA	-	-	232,125	3,161	115.48 /MH	365,023	597,148
			CAISSON					**232,125**	**3,161**		**365,023**	**597,148**
			CIVIL WORK					**232,125**	**3,161**		**365,023**	**597,148**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FGD BYPRODUCT SILOS	614.00 CY	-	-	141,220	4,940	68.52 /MH	338,505	479,725
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FLY ASH BLENDING SILO	67.00 CY	-	-	15,410	539	68.52 /MH	36,938	52,348
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	FOR TRUCK SCALES	144.00 CY	-	-	33,120	1,159	68.52 /MH	79,389	112,509
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	MISC	100.00 CY	-	-	23,000	805	68.52 /MH	55,131	78,131
			CONCRETE					**212,750**	**7,443**		**509,962**	**722,712**
			CONCRETE					**212,750**	**7,443**		**509,962**	**722,712**
	23.00.00		**STEEL**									
		23.13.75	**SILO**									
			NEW 250 TON FLYASH BLENDING BIN SILO - 24FT DIA X 72 FT HIGH - ERECTION AND FREIGHT INCLUDED	SILO	1.00 EA		275,000		2,839	80.89 /MH	229,653	504,653
			SILO				**275,000**		**2,839**		**229,653**	**504,653**
			STEEL				**275,000**		**2,839**		**229,653**	**504,653**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - 2-2,200 TON FGD BYPRODUCT SILO	SUBCONTRACTED - ERECTED	2.00 LS	6,000,000				68.52 /MH		6,000,000
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CONCRETE SILO			**6,000,000**			**0**			**6,000,000**
			MISCELLANEOUS STRUCTURAL ITEM			**6,000,000**			**0**			**6,000,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.13.00	**BYPRODUCT HANDLING EQUIPMENT**									
			PNEUMATIC ASH CONVEYORS	EQUIPMENT INCLUDES FREIGHT	1.00 LS	-	5,655,000	-		80.89 /MH		5,655,000
			PNEUMATIC ASH CONVEYORS	INSTALLATION COST	1.00 LT	-		-	79,293	80.89 /MH	6,414,019	6,414,019
			BLOWERS, PRESSURE FEEDERS, TRANSPORT PIPING AND VACUUM / PRESSURE RELIEF VALVES	INCLUDED ABOVE	1.00 LT	-		-		80.89 /MH		
			-FOUR PIN MIXERS BELOW CONCRETE SILOS INCL ALL VALVES AND ACCESSORIES		1.00 LT	-	540,000	-	3,347	80.89 /MH	270,749	810,749
			-DRY UNLOADING SPOUT BELOW THE PRODUCT SILO		2.00 EA	-	60,000	-	258	80.89 /MH	20,883	80,883
			AIRSLIDE CONVEYORS FROM BLENDING BIN MIXER/PIPE CONVEYOR, INCL ALL VALVES AND ACCESSORIES		4.00 EA	-	80,000	-	688	80.89 /MH	55,675	135,675
			BYPRODUCT HANDLING EQUIPMENT				**6,335,000**		**83,587**		**6,761,325**	**13,096,325**
		33.57.00	**SCALE**									
			SCALE - NEW TRUCK SCALES	BYPRODUCT HANDLING SYSTEM	2.00 EA	-	200,000	-	460	75.53 /MH	34,726	234,726
			SCALE				**200,000**		**460**		**34,726**	**234,726**
			MATERIAL HANDLING EQUIPMENT				**6,535,000**		**84,046**		**6,796,052**	**13,331,052**
	34.00.00		**HVAC**									
		34.37.00	**DUST COLLECTOR**									
			DUST COLLECTOR - INSTALLED COST		1.00 LS	120,000	-			73.32 /MH		120,000
			DUST COLLECTOR			**120,000**						**120,000**
			HVAC			**120,000**						**120,000**
	35.00.00		**PIPING**									
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			12 IN DIA, 3/8 IN STD	CONVEYOR PIPING	2,000.00 LF	-	-	198,400	3,172	93.09 /MH	295,320	493,720
			12 IN DIA, 3/8 IN STD	12" TIE IN PIPING TO BYPRODUCT SILO FROM THE EXISTING 50 TPH FLY ASH PRESSURE SYSTEM	1,500.00 LF	-	-	148,800	2,379	93.09 /MH	221,490	370,290
			CARBON STEEL, STRAIGHT RUN					**347,200**	**5,552**		**516,810**	**864,010**
			PIPING					**347,200**	**5,552**		**516,810**	**864,010**
			105 BYPRODUCT HANDLING SYSTEM			**6,120,000**	**6,810,000**	**792,075**	**103,041**		**8,417,500**	**22,139,575**
121			**CIVIL BOP**									
	21.00.00		**CIVIL WORK**									
		21.14.00	**STRIP & STOCKPILE TOPSOIL**									
			STRIP & STOCKPILE TOPSOIL - 12"		300,000.00 SF	-	-		690	185.95 /MH	128,241	128,241
			STRIP & STOCKPILE TOPSOIL - ONSITE		40,000.00 CY	-	-		5,287	185.95 /MH	983,184	983,184
			STRIP & STOCKPILE TOPSOIL - 12"	SITE GRADING	600,000.00 SF	-	-		1,379	185.95 /MH	256,483	256,483
			STRIP & STOCKPILE TOPSOIL - ONSITE	SITE GRADING	160,000.00 CY	-	-		21,149	185.95 /MH	3,932,736	3,932,736
			STRIP & STOCKPILE TOPSOIL						**28,506**		**5,300,644**	**5,300,644**
		21.17.00	**EXCAVATION**									
			EXCAVATION - EXCAVATION , BACKFILL & COMPACT	ALL FOUNDATIONS	12,600.00 CY	-	-		4,345	84.40 /MH	366,703	366,703
			EXCAVATION						**4,345**		**366,703**	**366,703**
		21.39.00	**STORM DRAINAGE UTILITIES**									
			STORM SEWER WORK	SITE GRADING	1.00 LT	-	-	110,000	2,299	86.33 /MH	198,460	308,460
			STORM DRAINAGE UTILITIES					**110,000**	**2,299**		**198,460**	**308,460**
		21.41.00	**EROSION AND SEDIMENTATION CONTROL**									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK		33,334.00 SY	-	-	355,007	1,149	103.37 /MH	118,818	473,826
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	SITE GRADING	66,667.00 SY	-	-	710,004	2,299	103.37 /MH	237,633	947,637
			EROSION AND SEDIMENTATION CONTROL					**1,065,011**	**3,448**		**356,452**	**1,421,462**
		21.57.00	**ROAD, PARKING AREA, & SURFACED AREA**									
			ONSITE ROAD UPGRADES	ALLOWANCE	1.00 LS	-	-	700,000	3,483	86.08 /MH	299,796	999,796
			ROAD, PARKING AREA, & SURFACED AREA					**700,000**	**3,483**		**299,796**	**999,796**
		21.99.00	**CIVIL WORK, MISCELLANEOUS**									
			CIVIL WORK - CONSTRUCTION LAYDOWN AREAS	FENCING, POWER ETC...	10.00 AC	-	-	842,400	9,195	84.40 /MH	776,092	1,618,492

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CIVIL WORK, MISCELLANEOUS					**842,400**	**9,195**		**776,092**	**1,618,492**
			CIVIL WORK					**2,717,411**	**51,276**		**7,298,147**	**10,015,557**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	555.00 CY	-	-	127,650	4,466	68.52 /MH	305,977	433,627
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	68.52 /MH	3,308	4,688
			CONCRETE					**129,030**	**4,514**		**309,285**	**438,315**
			CONCRETE					**129,030**	**4,514**		**309,285**	**438,315**
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL ONLY, STEEL UNINSULATED 22 GA, 200 FT X 75 FT x 15' TALL	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	420,000	5,862	98.30 /MH	576,241	996,241
			PRE-ENGINEERED BUILDING	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	98.30 /MH	11,299	21,299
			PRE-ENGINEERED BUILDING					**430,000**	**5,977**		**587,540**	**1,017,540**
		24.41.00	**SIDING**									
			INSULATION, 2 IN THICK FIBERGLASS,	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	8,250.00 SF	-	-	9,900	95	87.92 /MH	8,337	18,237
			SIDING					**9,900**	**95**		**8,337**	**18,237**
			ARCHITECTURAL					**439,900**	**6,072**		**595,877**	**1,035,777**
	27.00.00		**PAINTING & COATING**									
		27.17.00	**PAINTING**									
			PAINTING - ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	15,000	172	64.47 /MH	11,116	26,116
			PAINTING					**15,000**	**172**		**11,116**	**26,116**
			PAINTING & COATING					**15,000**	**172**		**11,116**	**26,116**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.41.00	**FIRE PROTECTION EQUIPMENT & SYSTEM**									
			FIRE PROTECTION EQUIPMENT & SYSTEM	NEW WAREHOUSE BUILDING 200'X75'X15' TALL, FIRE PROTECTION ALLOWANCE	15,000.00 SF	-	-	82,500	1,155	75.53 /MH	87,250	169,750
			FIRE PROTECTION EQUIPMENT & SYSTEM					**82,500**	**1,155**		**87,250**	**169,750**
			MECHANICAL EQUIPMENT					**82,500**	**1,155**		**87,250**	**169,750**
	34.00.00		**HVAC**									
		34.99.00	**HVAC, MISCELLANEOUS**									
			HVAC, MISCELLANEOUS - HVAC ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	165,000	172	73.32 /MH	12,641	177,641
			HVAC, MISCELLANEOUS					**165,000**	**172**		**12,641**	**177,641**
			HVAC					**165,000**	**172**		**12,641**	**177,641**
	36.00.00		**INSULATION**									
		36.99.00	**INSULATION, MISCELLANEOUS**									
			INSULATION - ROOF INSULATION	NEW WAREHOUSE BUILDING 200'X75'X15' TALL	15,000.00 SF	-	-	18,000	172	58.15 /MH	10,026	28,026
			INSULATION, MISCELLANEOUS					**18,000**	**172**		**10,026**	**28,026**
			INSULATION					**18,000**	**172**		**10,026**	**28,026**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.37.00	**LIGHTING ACCESSORY (FIXTURE)**									
			LIGHTING ACCESSORY (FIXTURE) - ALLOWANCE	NEW WAREHOUSE BUILDING 200'X75'X15' TALL, LIGHTING ALLOWANCE	15,000.00 SF	-	-	165,000	172	69.31 /MH	11,950	176,950
			LIGHTING ACCESSORY (FIXTURE)					**165,000**	**172**		**11,950**	**176,950**
			ELECTRICAL EQUIPMENT					**165,000**	**172**		**11,950**	**176,950**
	71.00.00		**PROJECT INDIRECT**									
		71.25.00	**CONSULTANT, THIRD PARTY**									
			CONSULTANT - SUBSURFACE INVESTIGATION		1.00 LS	200,000	-			/MH		200,000
			CONSULTANT - GEOTECHNICAL		1.00 LS	150,000	-			/MH		150,000

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CONSULTANT, THIRD PARTY			350,000						350,000
			PROJECT INDIRECT			350,000						350,000
			121 CIVIL BOP			350,000		3,731,841	63,706		8,336,292	12,418,133
151			MECHANICAL BOP									
	21.00.00		CIVIL WORK									
		21.54.00	CAISSON									
			2.5 FT DIA X 30 FT DEEP CAISSON	TANK FOUNDATIONS	76.00 EA	-	-	141,132	1,922	115.48 /MH	221,934	363,066
			2.5 FT DIA X 30 FT DEEP CAISSON	COMMON PIPE RACK FOUNDATIONS	223.00 EA	-	-	414,111	5,639	115.48 /MH	651,201	1,065,312
			2.5 FT DIA X 30 FT DEEP CAISSON	BYPRODUCT PIPE RACK FOUNDATIONS	57.00 EA	-	-	105,849	1,441	115.48 /MH	166,450	272,299
			2.5 FT DIA X 30 FT DEEP CAISSON	REAGENT UNLOADING PIPE RACK FOUNDATIONS	32.00 EA	-	-	59,424	809	115.48 /MH	93,446	152,870
			CAISSON					720,516	9,811		1,133,031	1,853,547
			CIVIL WORK					720,516	9,811		1,133,031	1,853,547
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			SPREAD FOOTING FOUNDATION, 4500 PSI - COMPOSITE RATE	3X 35' DIA TANK FDN	81.00 CY	-	-	18,630	652	68.52 /MH	44,656	63,286
			CONCRETE FOUNDATIONS - COMPOSITE RATE	COMMON PIPE RACK FOUNDATIONS	250.00 CY	-	-	57,500	2,011	68.52 /MH	137,828	195,328
			CONCRETE FOUNDATIONS - COMPOSITE RATE	BYPRODUCT PIPE RACK FOUNDATIONS	65.00 CY	-	-	14,950	523	68.52 /MH	35,835	50,785
			CONCRETE FOUNDATIONS - COMPOSITE RATE	REAGENT UNLOADING PIPE RACK FOUNDATIONS	36.00 CY	-	-	8,280	290	68.52 /MH	19,847	28,127
			CONCRETE					99,360	3,476		238,166	337,526
			CONCRETE					99,360	3,476		238,166	337,526
	23.00.00		STEEL									
		23.21.00	GIRDER									
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	COMMON 750'LX20'W, 550'Lx15'W, ALL 20' HIGH	235.00 TN	-	-	636,850	4,592	98.30 /MH	451,389	1,088,239
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	BYPRODUCT PIPE RACK, 200'LX12'W X 20' HIGH	24.00 TN	-	-	65,040	469	98.30 /MH	46,099	111,139
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	REAGENT UNLOADING PIPE RACK, 200'LX6' WIDE X 20' HIGH	12.00 TN	-	-	32,520	234	98.30 /MH	23,050	55,570
			GIRDER					734,410	5,295		520,538	1,254,948
			STEEL					734,410	5,295		520,538	1,254,948
	31.00.00		MECHANICAL EQUIPMENT									
		31.17.00	COMPRESSOR & ACCESSORIES									
			AIR COMPRESSOR, CENTRIFUGAL - 250 SCFM EA @ 200 PSIG	SERVICE AIR	2.00 EA	-	310,000	-	92	75.53 /MH	6,945	316,945
			AIR COMPRESSOR, CENTRIFUGAL - 250 SCFM EA @ 200 PSIG	INSTRUMENT AIR	2.00 EA	-	310,000	-	92	75.53 /MH	6,945	316,945
			AIR DRYER - W/FILTERS, 250 NET SCFM EA	SERVICE AIR	2.00 EA	-	33,400	-	74	75.53 /MH	5,556	38,956
			AIR DRYER - W/FILTERS, 250 NET SCFM EA	INSTRUMENT AIR	2.00 EA	-	33,400	-	74	75.53 /MH	5,556	38,956
			AIR RECEIVER - 1,000 GALLON EA	SERVICE AIR	2.00 EA	-	11,200	-	37	75.53 /MH	2,778	13,978
			AIR RECEIVER - 1,000 GALLON EA	INSTRUMENT AIR	2.00 EA	-	11,200	-	37	75.53 /MH	2,778	13,978
			COMPRESSOR & ACCESSORIES				709,200		405		30,559	739,759
		31.41.00	FIRE PROTECTION EQUIPMENT & SYSTEM									
			DELUGE - POWER TRANSFORMERS		3.00 EA	-	-	127,500	1,959	93.09 /MH	182,328	309,828
			FIRE PROTECTION EQUIPMENT & SYSTEM					127,500	1,959		182,328	309,828
		31.65.00	HEAT EXCHANGER									
			HEAT EXCHANGER - SLAKER WATER HEATER 3" IN-LINE, 475 KW		4.00 EA	-	220,000	-	368	69.31 /MH	25,493	245,493
			HEAT EXCHANGER				220,000		368		25,493	245,493
		31.75.00	PUMP									
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - MAKEUP WATER PUMPS, 2600 GPM, 200 TDH		2.00 EA	-	96,000	-	577	75.53 /MH	43,582	139,582
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - RECYCLE ASH WATER PUMP, 50 HP		3.00 EA	-	72,000	-	221	75.53 /MH	16,669	88,669
			CENTRIFUGAL, HORIZONTAL, SINGLE STAGE - LIME SLAKING WATER PIUMPS, 50 HP		2.00 EA	-	48,000	-	147	75.53 /MH	11,112	59,112
			SUMP, CENTRIFUGAL, WET BEARING - REGENT PREP/RECYCLE SUMP, 120GPM, 150 TDH		4.00 EA	-	220,000	-	276	75.53 /MH	20,836	240,836
			SUMP, CENTRIFUGAL, WET BEARING - LIME SILO & UNLOADING AREA SUMP 120 GPM @ 150 TDH		2.00 EA	-	88,000	-	138	75.53 /MH	10,418	98,418

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		31.75.00	**PUMP**									
			SUMP, CENTRIFUGAL, WET BEARING - WASTE ASH SILO AREA SUMP 120GPM @150 TDH		2.00 EA	-	88,000	-	138	75.53 /MH	10,418	98,418
			SUMP, CENTRIFUGAL, WET BEARING - WASTEWATER FORWARDING PUMP TO RECYCLED SLURRY, 100 GPM@150 TDH		4.00 EA	-	28,800	-	294	75.53 /MH	22,225	51,025
			SUMP, SUBMERSIBLE - RECYCLE ASH WATER TANK SUPPLY PUMP, 100 HP		2.00 EA	-	77,000	-	690	75.53 /MH	52,090	129,090
			PUMP				**717,800**		**2,480**		**187,349**	**905,149**
		31.83.00	**TANK**									
			ATMOSPHERIC, FIELD FABRICATED - LIME SLAKING WATER TANK, 175,000 GALLON	35' DIA X 24' HIGH	1.00 EA	220,000		-		94.32 /MH		220,000
			ATMOSPHERIC, FIELD FABRICATED - RECYCLE ASH WATER TANK, 200,000 GALLON	35' DIA X 30' HIGH	2.00 EA	500,000		-		94.32 /MH		500,000
			TANK			**720,000**						**720,000**
			MECHANICAL EQUIPMENT			**720,000**	**1,647,000**	**127,500**	**5,211**		**425,730**	**2,920,230**
	35.00.00		**PIPING**									
		35.13.01	**SS 304, ABOVE GROUND, PROCESS AREA**									
			1 IN DIA, SCH 40S		1,520.00 LF	-	-	32,832	1,974	93.09 /MH	183,783	216,615
			1.5 IN DIA, SCH 40S		1,380.00 LF	-	-	52,302	2,094	93.09 /MH	194,911	247,213
			2 IN DIA, SCH 40S		2,070.00 LF	-	-	113,022	3,426	93.09 /MH	318,946	431,968
			SS 304, ABOVE GROUND, PROCESS AREA					**198,156**	**7,494**		**697,640**	**895,796**
		35.13.10	**CARBON STEEL, ABOVE GROUND, PROCESS AREA**									
			1 IN DIA, SCH 80		260.00 LF	-	-	2,314	305	93.09 /MH	28,376	30,690
			2 IN DIA, SCH 80		2,260.00 LF	-	-	48,138	3,273	93.09 /MH	304,693	352,831
			2.5 IN DIA, SCH 40		1,000.00 LF	-	-	15,400	1,437	93.09 /MH	133,750	149,150
			3 IN DIA, SCH 40		7,160.00 LF	-	-	125,300	11,028	93.09 /MH	1,026,601	1,151,901
			3 IN DIA, SCH 80		1,760.00 LF	-	-	38,720	3,055	93.09 /MH	284,363	323,083
			4 IN DIA, SCH 40		1,000.00 LF	-	-	22,600	1,701	93.09 /MH	158,360	180,960
			6 IN DIA, SCH 40		880.00 LF	-	-	28,248	1,629	93.09 /MH	151,598	179,846
			6 IN DIA, SCH 40 VACUUM PIPE		2,260.00 LF	-	-	72,546	4,182	93.09 /MH	389,330	461,876
			8 IN DIA, SCH 80		3,520.00 LF	-	-	256,608	9,832	93.09 /MH	915,235	1,171,843
			CARBON STEEL, ABOVE GROUND, PROCESS AREA					**609,874**	**36,441**		**3,392,307**	**4,002,181**
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			6 IN DIA, SCH 40, LIME SLAKING TANK MAKEUP	LIME SLAKING TANK MAKEUP	1,200.00 LF	-	-	27,480	1,214	93.09 /MH	112,992	140,472
			8 IN DIA, SCH 40, LIME SLAKING TANK MAKEUP	LIME SLAKING TANK MAKEUP	450.00 LF	-	-	13,905	486	93.09 /MH	45,261	59,166
			8 IN DIA, SCH 40, RECYCLE ASH WATER PIPING	RECYCLE ASH WATER PIPING	2,000.00 LF	-	-	61,800	2,161	93.09 /MH	201,160	262,960
			10 IN DIA, SCH 40, RECYCLE ASH TANK MAKEUP	RECYCLE ASH TANK MAKEUP	450.00 LF	-	-	24,660	610	93.09 /MH	56,817	81,477
			CARBON STEEL, STRAIGHT RUN					**127,845**	**4,471**		**416,230**	**544,075**
		35.15.10	**CARBON STEEL, BURIED**									
			3 IN DIA, SCH 40, WRAPPED		3,000.00 LF	-	-	51,000	2,241	93.09 /MH	208,650	259,650
			6 IN DIA, SCH 40, WRAPPED		750.00 LF	-	-	23,925	776	93.09 /MH	72,225	96,150
			10 IN DIA, SCH 40, WRAPPED, RECYCLE ASH WATER PIPE DISCHARGE BURIED	RECYCLE ASH WATER PIPE DISCHARGE BURIED	1,800.00 LF	-	-	119,700	2,441	93.09 /MH	227,268	346,968
			CARBON STEEL, BURIED					**194,625**	**5,459**		**508,143**	**702,768**
		35.15.25	**FRP, BURIED**									
			3 IN DIA, TAPER		1,000.00 LF	-	-	14,800	460	93.09 /MH	42,800	57,600
			3 IN DIA, TAPER FRP/HDPE PIPE		2,380.00 LF	-	-	35,224	1,094	93.09 /MH	101,864	137,088
			FRP, BURIED					**50,024**	**1,554**		**144,664**	**194,688**
		35.15.30	**HDPE, BURIED**									
			6 IN DIA, DR 9		1,430.00 LF	-	-	12,870	1,134	93.09 /MH	105,577	118,447
			8 IN DIA, DR 9		1,340.00 LF	-	-	20,770	1,278	93.09 /MH	119,005	139,775
			HDPE, BURIED					**33,640**	**2,413**		**224,582**	**258,222**
		35.36.00	**PIPE SUPPORTS, RACK**									
			SUPPORT SLEEPERS	BYPRODUCT PIPE, 1750LF	125.00 EA	-	-	43,750	575	93.09 /MH	53,500	97,250
			SUPPORT SLEEPERS	REAGENT UNLOADING PIPE, 1500LF	108.00 EA	-	-	37,800	497	93.09 /MH	46,224	84,024
			PIPE SUPPORTS, RACK					**81,550**	**1,071**		**99,724**	**181,274**
		35.45.00	**VALVES**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		35.45.00	**VALVES**									
			VALVE - 36" 150 LB CS BUTTERFLY, FLANGED		2.00 EA	-	-	79,920	96	93.09 /MH	8,902	88,822
			VALVE - 12" 150 LB CS KNIFE GATE, FLANGED		6.00 EA	-	-	20,160	195	93.09 /MH	18,169	38,329
			VALVE - 12" 150 LB CS GATE VALVE, FLANGED		2.00 EA	-	-	8,920	65	93.09 /MH	6,056	14,976
			VALVE - 10" 150 LB CS SWING CHECK, FLANGED		2.00 EA	-	-	9,200	55	93.09 /MH	5,136	14,336
			VALVE - 10" 150 LB CS BUTTERFLY, FLANGED		5.00 EA	-	-	22,200	138	93.09 /MH	12,840	35,040
			VALVE - 8" 150 LB CS GATE, FLANGED		20.00 EA	-	-	100,000	425	93.09 /MH	39,590	139,590
			VALVE - 6" 150 LB CS GATE, FLANGED		6.00 EA	-	-	19,800	110	93.09 /MH	10,272	30,072
			VALVE - 6" 150 LB CS AIR OPERATED GATE, FLANGED		4.00 EA	-	-	20,400	74	93.09 /MH	6,848	27,248
			VALVE - 6" 150 LB CS AIR OPERATED GLOBE, FLANGED		4.00 EA	-	-	20,400	74	93.09 /MH	6,848	27,248
			VALVE - 6" 150 LB CS SWING CHECK, FLANGED		2.00 EA	-	-	3,400	37	93.09 /MH	3,424	6,824
			VALVE - 4" 150 LB CS GATE, FLANGED		3.00 EA	-	-	3,825	25	93.09 /MH	2,311	6,136
			VALVE - 3" AND BELOW CS FOR SERVICE WATER ISOLATION		120.00 EA	-	-	1,224,000	1,076	93.09 /MH	100,152	1,324,152
			VALVE - 3" AND BELOW CS FOR SERVICE AIR ISOLATION		120.00 EA	-	-	1,224,000	1,076	93.09 /MH	100,152	1,324,152
			VALVE - 3" 150 LB CS GATE, FLANGED		20.00 EA	-	-	15,000	179	93.09 /MH	16,692	31,692
			VALVE - 3" CS PST IND FOR FP 250 LB		6.00 EA	-	-	6,600	54	93.09 /MH	5,008	11,608
			VALVE - 2" AND ABOVE BRONZE VALVES FOR INSTRUMENT AIR ISOLATION		600.00 EA	-	-	78,000	501	93.09 /MH	46,673	124,673
			VALVE - 1" CS FLANGED		4.00 EA	-	-	880	21	93.09 /MH	1,969	2,849
			VALVE - 6" CI POST INDICATOR 250 LB., MECHANICAL JOINT WITH BOXES BURIED VALVE		6.00 EA	-	-	4,080	28	93.09 /MH	2,568	6,648
			VALVES					**2,860,785**	**4,228**		**393,610**	**3,254,395**
			PIPING					**4,156,499**	**63,131**		**5,876,900**	**10,033,399**
	36.00.00		**INSULATION**									
		36.17.01	**PIPE, CALCIUM SILICATE W/ALUMINUM JACKETING**									
			CALCIUM SILICATE W/ALUMINUM JACKETING - 8" PIPE 1.5" THICK		2,520.00 LF	-	-	16,380	487	73.69 /MH	35,859	52,239
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 3" PIPE		1,260.00 LF	-	-	3,591	155	73.69 /MH	11,419	15,010
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 3" PIPE		5,660.00 LF	-	-	16,131	696	73.69 /MH	51,297	67,428
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 2.5" PIPE		380.00 LS	-	-	1,083	47	73.69 /MH	3,444	4,527
			1" CALCIUM SILICATE W/ALUMINUM JACKETING - 2.0" PIPE		4,140.00 LS	-	-	10,309	476	73.69 /MH	35,066	45,375
			PIPE, CALCIUM SILICATE W/ALUMINUM JACKETING					**47,494**	**1,860**		**137,085**	**184,579**
			INSULATION					**47,494**	**1,860**		**137,085**	**184,579**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.33.00	**HEAT TRACING**									
			HEAT TRACING - 8" PIPE		2,520.00 LS	-	-	18,749	43	69.31 /MH	3,011	21,760
			HEAT TRACING - 3" PIPE		1,260.00 LF	-	-	9,374	22	69.31 /MH	1,506	10,880
			HEAT TRACING - 3" PIPE		5,660.00 LF	-	-	42,110	98	69.31 /MH	6,764	48,874
			HEAT TRACING - 2.5" PIPE		380.00 LS	-	-	2,827	7	69.31 /MH	454	3,281
			HEAT TRACING - 2.0" PIPE		440.00 LS	-	-	3,274	8	69.31 /MH	526	3,799
			HEAT TRACING					**76,334**	**177**		**12,261**	**88,595**
			ELECTRICAL EQUIPMENT					**76,334**	**177**		**12,261**	**88,595**
			151 MECHANICAL BOP			**720,000**	**1,647,000**	**5,962,113**	**88,963**		**8,343,711**	**16,672,824**
190			**DEMOLITION / RELOCATION**									
	11.00.00		**DEMOLITION**									
		11.99.00	**DEMOLITION, MISCELLANEOUS**									
			DEMOLITION - MISC	ALLOWANCE	1.00 LT	-	-	1,800,000	33,333	98.30 /MH	3,276,667	5,076,667
			DEMOLITION, MISCELLANEOUS					**1,800,000**	**33,333**		**3,276,667**	**5,076,667**
			DEMOLITION					**1,800,000**	**33,333**		**3,276,667**	**5,076,667**
			190 DEMOLITION / RELOCATION					**1,800,000**	**33,333**		**3,276,667**	**5,076,667**
201			**ELECTRICAL BOP SYSTEM**									
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.99.00	**ELECTRICAL EQUIPMENT, MISCELLANEOUS**									
			ELECTRICAL EQUIPMENT AND MISCELLANEOUS COMPONENTS	ALLOWANCE	1.00 LT	-	12,300,000	1,600,000	88,322	69.31 /MH	6,121,587	20,021,587
			ELECTRICAL COMMODITIES - CABLE	ALLOWANCE	1.00 LT	-		8,500,000	88,391	84.60 /MH	7,477,862	15,977,862
			ELECTRICAL COMMODITIES - CONDUITS, RACEWAY, ETC.	ALLOWANCE	1.00 LT	-		1,400,000	107,471	84.60 /MH	9,092,069	10,492,069
			ELECTRICAL EQUIPMENT, MISCELLANEOUS				**12,300,000**	**11,500,000**	**284,184**		**22,691,518**	**46,491,518**
			ELECTRICAL EQUIPMENT				**12,300,000**	**11,500,000**	**284,184**		**22,691,518**	**46,491,518**

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			201 ELECTRICAL BOP SYSTEM				**12,300,000**	**11,500,000**	**284,184**		**22,691,518**	**46,491,518**
211			**INSTRUMENTATION AND CONTROLS BOP SYSTEM**									
	44.00.00		**CONTROL & INSTRUMENTATION**									
		44.99.00	**CONTROL & INSTRUMENTATION, MISCELLANEOUS**									
			CONTROL & INSTRUMENTATION - MISC	ALLOWANCE	1.00 LT	-	1,500,000	1,085,000	10,920	72.29 /MH	789,374	3,374,374
			CONTROL & INSTRUMENTATION, MISCELLANEOUS				**1,500,000**	**1,085,000**	**10,920**		**789,374**	**3,374,374**
			CONTROL & INSTRUMENTATION				**1,500,000**	**1,085,000**	**10,920**		**789,374**	**3,374,374**
			211 INSTRUMENTATION AND CONTROLS BOP SYSTEM				**1,500,000**	**1,085,000**	**10,920**		**789,374**	**3,374,374**

ENTERGY ARKANSAS, INC.

WHITE BLUFF

DSI COST ESTIMATE BASIS DOCUMENT

SL-014000
Final, Rev. 0
August 3, 2017
Project 13027-002

Prepared by

Sargent & Lundy LLC

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CONTENTS

Section **Page**

1. PURPOSE

Entergy has requested that Sargent & Lundy (S&L) evaluate installation of a new dry sorbent injection (DSI) system on the units at White Bluff to control sulfur dioxide (SO_2) emissions. The purpose of this document is to define the project scope and identify the assumptions that were used as the basis for the operating and maintenance (O&M) and the capital cost estimates.

2. TECHNOLOGY DESCRIPTION

DSI is a proven technology, which has only recently been implemented, for moderate removal of SO_2 and other acid gases from coal-fired power plants. It involves injection of sodium-based sorbents into the ductwork after the boiler and prior to the particulate collection device. DSI is a relatively low capital cost, moderate SO_2 removal alternative to wet or dry FGD systems. No slurry equipment or separate reactor vessel is required with a DSI system. With the proper temperature profile and stoichiometry, the sorbent can effectively react with $SO_2$and other acid gases in the flue gas. The resulting particulate matter is removed from the flue gas by a particulate collection device, typically an existing electrostatic precipitator (ESP).

The typical DSI sorbents include sodium bicarbonate ($NaHCO_3$) and Trona ($Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$). Sorbent injection into the ductwork (downstream of the boiler and upstream of the ESP) has been tested in the industry using sodium-based sorbents. The process works through neutralization of SO_2 and other acid gases with the caustic sorbent; the neutralization occurs as long as the sorbent remains in contact with the gas. Sorbent injection has been proven effective on a variety of pulverized coal-fired boilers using a range of low to high sulfur coals. It is considered a commercial technology although with a limited supplier base due to the historically limited interest.

The DSI process produces a dry byproduct which can be landfilled. The waste products will contain sodium sulfate and sulfite ($NaSO_3$/$NaSO_4$) along with the unused sorbent and the normal fly ash. These wastes will be collected in the ESP and can be transported with conventional pneumatic fly ash handling equipment. The waste from sodium-based sorbents will have relatively high concentrations of soluble salts, which may affect the byproduct handling. With the addition of dry sorbent byproducts fly ash cannot be sold for reuse.

3. APPROACH

The project capital and O&M cost estimates are based on project-specific information, including:

- An engineer-procure-construct (EPC) contracting strategy with the DSI technology supplier providing the main process equipment, including reagent storage, milling, conveyance, and injection lances.
- Reagent injection at the air preheater (APH) outlet, upstream of the existing ESP. The cost to rebuild/upgrade the ESP was included to ensure there is no increase in PM emissions as a significant quantity of reagent will be added upstream of the existing ESP.
- On-site disposal of DSI byproduct using upgraded ESP ash handling equipment. The byproduct will be collected in the existing ESP in conjunction with the fly ash from the units; no additional blending equipment is required.
- Reagent injection rates based on 50% SO_2 removal from a design inlet concentration of 0.76 lb SO_2/MMBtu, based on the highest 5% of SO_2 emissions from 2009 through 2013.
    - Annual operating costs will be based on 50% SO_2 removal from an uncontrolled SO_2 rate of 0.57 lb SO_2/MMBtu, based on the annual heat input weighted average emission from 2009 through 2013.
    - The system will be designed to control emissions to meet a permit limit of 0.35 lb/MMBtu on a 30-boiler day rolling average, based on a maximum 30-day average SO_2 emission rate of 0.66 lb/MMBtu from 2014 through 2016.
- Trona was used as the DSI reagent for the purposes of this estimate.
- Increase in carbon consumption by 1 lb/mmacf to mitigate any impacts on mercury performance associated with ACI/DSI interference and mitigate potential for a brown plume.
- A high level conceptual system design, based on the estimated injection rate, was used as input to the DSI cost estimate. The following were estimated based on previous projects and scaled for the predicted dry sorbent injection rate for White Bluff:
    - Auxiliary power consumption
    - Annual reagent consumption
    - Additional carbon consumption
    - Additional water consumption
    - Additional waste production
    - Reagent storage silos
    - Quantity of mills
    - Quantity of blower trains

The total plant capital cost estimate includes the following:

- Equipment and material
- Installation labor
- Indirect field costs
- Freight
- General and Administration
- Erection contractor profit
- Engineering, Procurement and Project Services
- Spare parts/initial fills (other than reagent)
- EPC Fee

As part of this project, S&L estimated the costs for Owner's services and costs outside of the EPC contract including the following:

- Owner's Costs
- Owner's Engineer
- Construction Management Support
- Startup and Commissioning Support
- Performance Testing
- Contingency
- Escalation
- Interest During Construction

Cost Estimate 34018A provided in Attachment 1 represents the total cost to Entergy to install DSI technology on a single unit at White Bluff (Unit 1 or 2) including the EPC Contract price and all additional Owner's costs and third party services.

The total unit O&M cost estimate includes the following:

- Waste disposal (DSI waste + increased carbon + unsold fly ash)
- Loss of revenue from fly ash sales
- Reagent consumption (including increased carbon consumption)
- Auxiliary power consumption
- Low quality water consumption for mill cleaning
- Operating labor
- Maintenance material
- Maintenance labor

The O&M Cost Estimate and Capital Cost Estimate 34018A were developed using the assumptions and scope provided in this document. The project definition and accuracy corresponds to a study level estimate as defined in U.S.EPA's Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual. The costs provided in this report are in 2016 dollars.

4. CAPITAL AND O&M COST ESTIMATE TECHNICAL BASIS

4.1 DESIGN INPUTS AND ASSUMPTIONS

The following assumptions were made for the design basis for the White Bluff DSI Systems:

- Design SO_2 inlet concentration of 0.76 lb SO_2/MMBtu.
- SO_2 inlet concentration of 0.57 lb SO_2/MMBtu for annual operating costs.
- Design SO_2 removal efficiency of 50% (defined by injection rate, described in Section 4.1.1)
- Annual capacity factor of 71.2% (annual average capacity factor for White Bluff Units 1 and 2 based on historical heat input from 2009 through 2013).
- Reagent injection at the APH outlet, upstream of the existing ESP.
- Reagent delivery by rail.
- Existing activated carbon silo storage time will be reduced, rather than adding additional or larger storage silos to the system.
- Compliance deadline of three years from the effective date of the rule.

Before proceeding with a DSI project, a demonstration test should be completed at White Bluff to confirm the feasibility of DSI technology at White Bluff and quantify the potential BOP impacts associated with the project, such as impacts to the ESP performance, interference with mercury control technologies, and leachability of the byproduct.

4.1.1 ESP/Ash Handling Modifications

The DSI system, as defined in this report would require an estimated Trona injection rate of approximately 22,000 lb/hour to achieve 50% reduction at the design SO_2 inlet concentration. This injection rate would result in an increase in the particulate loading to the ESP of almost 40% from the current ash loading, due to the DSI byproducts and unreacted DSI reagent.

The addition of sodium compounds to the fly ash lowers the overall resistivity of the particulate being captured as well as shifting the particle size distribution. These changes have been shown to improve the removal efficiency of an ESP; in some cases this increase has been shown to offset the increased particulate loading to the ESP.

ESP performance can also be negatively impacted by a significant increase in particulate loading associated with the high reagent injection rates required for SO_2 control. It is uncertain whether modifications to the ESPs and ash handling systems would be required to accommodate the addition of DSI at White Bluff. However, at the very high injection rates expected for this project, an ESP rebuild will likely be required to ensure the PM emissions stay below the PSD threshold. Therefore, the capital cost estimate includes the costs to completely rebuild the existing ESPs and ash handling systems at White Bluff.

The size and condition of the existing ESP can play a critical role in the overall performance of DSI. In order to evaluate the existing White Bluff ESP with respect to future operation with DSI, S&L used the EPA program ESPVI 4.0W Performance Prediction Model (ESPVI 4.0W) to simulate the baseline and future operating scenarios, as described below. In addition, S&L contacted an ESP vendor to provide input relating to installation of DSI upstream of the existing ESPs at White Bluff.

The baseline operation was established using various design inputs for the units (as needed by the ESPVI 4.0W model), recent operating data and stack emissions to estimate the efficiency at which the ESP is currently operating. ESPVI 4.0W showed that at the baseline operating conditions the White Bluff ESP operates at approximately 99.7% removal of the total inlet loading, corresponding to a filterable PM emission limit of 0.0155 lb/MMBtu.

ESPs operate at a constant efficiency assuming the operating conditions (such as temperature, ash resistivity, or flue gas velocity) stay the same. DSI can impact some of the operating conditions, specifically ash resistivity and particle size distribution. The addition of DSI thus could result in a higher efficiency than the same ESP, without DSI, could achieve.

The ESPVI 4.0W model was developed prior to the introduction of DSI technology and has not been updated to account for the impacts of adding sorbents upstream of the ESP. However, the model was used to predict the high level impact and/or limitations of installing DSI technology by modifying some of the inputs to simulate the characteristics of a fly ash/sodium sorbent mixture.

Based on the modified ash resistivity and adjusted particle sizes associated with the addition of DSI, the baseline ESPVI 4.0W model was used to estimate the predicted removal efficiency for the White Bluff ESP with DSI, as defined in this report, and assuming all other operating conditions remained the same. ESPVI 4.0W showed an overall removal efficiency which was very similar to the current ESP removal efficiency and resulted in an increase in particulate emissions with the additional loading from the DSI system.

Based on the results from ESPVI 4.0W, the White Bluff ESP may be operating at a marginally higher reduction efficiency with the installation of DSI; however, the loading to the ESP is also increasing significantly. Therefore, the modeling showed that even though the ESP efficiency may increase, the overall PM emissions will still be higher than the current level. This evaluation supports the conclusion that improvement of the existing ESP in conjunction with the DSI project is necessary to avoid increasing PM emissions.

In addition to the modeling that was performed using ESPVI 4.0W, S&L also engaged a vendor experienced with ESP retrofits to provide costs and expertise associated with injection of DSI on an existing ESP. As part of their budgetary quote, the supplier indicated that "while the ESPs are large they are still an efficiency machine and overcoming the new total inlet loading of over 73,000 lb/hr[1] will be extremely difficult to achieve the requested 0.015 lbs/MMBtu outlet PM emissions, without retrofitting the entire ESPs to BART technology. Essentially, the ESPs will need to be rebuilt to 'as-new' condition with the most state-of-the-art technology options" (see Attachment 2).

Finally, in addition to the performance of the ESP, the increased loading will also have an impact on the ash handling system. Therefore, for the purposes of this cost estimate, based on the significant increase in loading, modifications to the ash handling equipment were included in the cost estimate.

4.1.2 Landfill Modifications

The sodium byproducts (salts) that are produced when Trona reacts with SO_2 and other acid gases, along with the unreacted sorbent are soluble in water. The resulting waste collected in the particulate collection device will need to be disposed of in a landfill that is lined and has a leachate collection system. With the addition of DSI, White Bluff will no longer be able to sell their fly ash for beneficial re-use due to the solubility of the sodium salts which would be

[1] The 73,000 lb/hr loading reflects the design fly ash loading plus the additional loading from the DSI injection (byproduct/unreacted sorbent).

present in the waste. The cost to maintain a landfill and open new cells is included in the typical maintenance budget of a plant. It was assumed, that any future landfill cells would include lining and leachate collection; therefore, no landfill modifications will be required to accommodate the addition of DSI and no costs were included in this estimate.

4.2 TOTAL INSTALLED CAPITAL INVESTMENT

The DSI system supplier will provide all of the equipment related to storing, milling, conveying and injecting the reagent; in this case, the system is designed for Trona. The remaining BOP scope will be provided by the EPC Contractor. In addition, the EPC Contractor will install/construct the entire system including the equipment provided by the DSI system supplier.

Quantities were developed based on limited project design effort, project experience of a plant of comparable size and then adjusted based on actual size and capacity differences and also taking into consideration the specific site layout based on the general arrangement. In most cases, the costs for bulk materials and equipment were derived from S&L database and recent vendor or manufacturer's quote for similar items on other projects. The scope of work for the capital cost estimate is broken out by the following areas:

4.2.1 DSI Area (Single Unit)

a. Reagent Storage Silos:
- Twelve silos capable of storing approximately 14 days of sorbent per unit, 4,200-tons storage total, including substructure
- 14' diameter and 125' high, each
- 350-tons working storage, each
- Continuous level detection systems
- One bin vent filter per silo
- Live bottom hopper outlets
- Rotary airlock assemblies

b. Reagent conveying systems:
- 4 trains (4 x 50%)
- Pneumatic pressure blowers (1 x100% per train)
- One dehumidifier and chiller per train

c. Reagent Milling
- One 7-tph mill per train
- One set of bypass piping per mill

d. Reagent Injection
- Splitters with piping to two APH outlets
- Six injection lances per injection location

e. Concrete foundations including piles for all reagent silo, blower, and mill areas; the approximate footprint for DSI Area is 165' x 125'

f. Buildings, enclosures, and roofs, including:
   - Blower Building, approximately 25' x 100'
   - Electrical Building; approximately 15' x 20'
   - Mill Building; approximately 40 x 80'
   - Dehumidifier Roof; approximately 30' x 125'
   - Heat Exchanger Roof; approximately 10' x 80'

g. Geotechnical and subsurface investigation contractor work, including hydro excavation

h. Equipment pricing based on recent vendor pricing for a similar project.

4.2.2 Reagent Handling System

The conceptual design basis for the reagent handling system is to unload two cars at a time. Based on the estimated injection rate and typical railcar capacities, it is anticipated that approximately 20 railcars will be required each week per unit assuming a 100% capacity factor. The reagent handling system includes modification to the existing rail spur on-site to accommodate storage and handling of the reagent railcars. It was assumed that the reagent will be delivered via a 25-car unit train as a maximum. The following equipment and components are included in the cost estimate as part of the reagent handling system:

a. Reagent rail car unloader:
   - System consists of mobile receiving pad and associated vacuum pneumatic connection equipment to unload railcar
   - Enclosed railcar unloading building; approximately 200' x 75'
   - Trackmobile used to haul and queue the rail cars before and after unloading; capable of moving approximately 25 cars at once.

b. Reagent unloading systems:
   - Two trains (2 x 100%)
   - Pneumatic pressure blowers (1 x 100%) per train
   - One conveying air dehumidifier and chiller per train
   - Pneumatic conveying piping located on an above-grade sleeper pipe rack
   - The equipment pricing included in this estimate is based on recent firm pricing for similar projects. The basis of the conceptual design is a typical UCC arrangement and equipment.

c. Rail track spur extension to north to allow reagent train to be unloaded and cars to be stored on site, designed for 136 lb rail to be consistent with existing coal spurs

4.2.3 ESP/Ash Handling Modifications

a. ESP Rebuild – Based on the budgetary quote provided in Attachment 2.

b. Ash Handling Modifications – Equipment pricing based on recent vendor pricing for a similar project.

4.2.4 Civil Work

a. Site grading

b. Soil removal earthwork

c. Excavation, backfill, and compaction for all foundations

d. Development of a new laydown area, approximately 2 acres, including site preparation, fencing, and temporary power. It was assumed that this area would be located on existing plant property, and does not require land to be purchased.

4.2.5 Mechanical Work

a. Allowance of $975,000 provided for mechanical system including transport piping, pipe rack, instrument/service air and other miscellaneous items based on recent in-house cost estimates for similar projects.

4.2.6 Demolition/Relocation

a. Allowance of $650,000 is provided for demolition and relocation of existing equipment and infrastructure which may interfere with the new DSI system based on recent in-house cost estimates for similar projects.

4.2.7 Electrical

a. Allowance of $3,575,000 is provided for electrical equipment upgrades and modifications based on recent in-house cost estimates for similar projects.

4.2.8 Instrumentation

a. Allowance of $520,000 provided for DCS upgrades and added instrumentation based on recent in-house cost estimates for similar projects.

4.2.9 Labor Costs

Installation/labor costs were included in the base estimate under the direct costs. Manhours are estimated for each item in the base estimate and are based on the type of work and typical estimates for similar work. The labor costs are based on the labor wage rates and labor crews developed by S&L.

a. Labor Wage Rates

Crew labor rates were developed using prevailing craft rates and fringe benefits and state specific worker's compensation rates as published in the 2016 edition of R.S. Means Labor Rates for Pine Bluff, Arkansas area. Costs were added to cover FICA, workers compensation, all applicable taxes, small tools, incidentals, construction equipment, and contractor's overhead. State specific workman's compensation rates are from R.S. Means. A 1.15 geographic labor productivity multiplier is included based on the Compass International Construction Yearbook for Arkansas. The crew rates do not include an allowance for weather related delays.

b. Labor crews

Construction/erection labor cost is based on the use of applicable construction crews typically required for projects of this type. The construction crew costs were specifically developed for utility industry and are proprietary to S&L. The prevailing craft rates are incorporated into work crews appropriate for the activities; and include costs for small tools, construction equipment, insurance, and site overheads.

4.2.10 Other Direct and Construction Indirect Costs

In addition to the base labor costs, other construction indirect costs for the project were broken out in the estimate as well as other contractor direct costs. The following items were included as other direct and construction indirect costs.

a. Scaffolding and Consumables

b. Premiums and per diems ($10 per hour)

c. Overtime at five 10-hour shifts per week

d. Freight on construction materials

e. Contractor's General & Administration Fees (included at 10% of total direct costs)

f. Contractor's Profit (included at 5% of total direct costs)

g. Sales tax was included in the cost estimate at 8.125%.

Freight on the DSI System equipment was not included in the cost estimate.

4.2.11 EPC Indirect Costs

The final contribution to the overall EPC project price are the EPC Contractor's indirect costs; these include the EPC engineering services, startup spare parts and initial fills, technical field advisors, and the EPC risk fee.

a. EPC Engineering Services

The EPC engineering services was estimated based on recent projects with similar scopes and schedules. The total cost of the EPC engineering services was estimated to be $4,000,000.

b. Startup Spare Parts and Initial Fills

An allowance has been included for initial fills for equipment, including first fills for lubrication of any motorized equipment. The initial fill of Trona was not included in the EPC Contractor's scope, as this will be supplied by the Owner and is covered as part of the Owner's Costs. The total cost of the initial fills was estimated to be $75,000.

c. Technical Field Advisors (Vendors)

Allowances were included for equipment supplier's technical field advisory services based on an estimated 150 man-days. The estimate includes technical field advisors for the DSI system supplier (including DSI system subcontractors) and the DCS supplier. The total cost of the technical field advisors was estimated to be $300,000.

d. EPC Risk Fee

An EPC approach provides an alternative which is expected to reduce risk for Entergy by placing the responsibility for the project on a single entity, the EPC Contractor. The EPC risk fee is a premium charged by the contractor which accounts for the additional coordination and management of the project as well as the additional risk assumed by the contractor. Based on S&L's experience with recent EPC projects, an EPC risk fee was included at 10% of the total EPC project costs.

4.2.12 Owner's Costs and Services

Outside of the EPC Contractor's total cost, Entergy will incur other costs associated with the project, such as services procured from third parties (including Owner's engineer, construction management support, startup and commissioning support and performance testing), and other project related costs.

a. Owner's Costs

Owner's Costs are direct costs that the Owner incurs over the life of the project. The following items are real costs Entergy will incur to install DSI at White Bluff based on the scope and schedule of this project:

- Internal Labor
- Internal Indirects
- Travel Expenses
- Legal Services
- Builders Risk Insurance
- Initial Fills (Reagent)

Owner's costs were included in the estimate at 8% of the total project cost.

b. Construction Management Support

The construction management support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The cost of labor is based on present day cost. The total cost of the construction management support was estimated to be $1,500,000.

c. Startup and Commissioning Support

The startup and commissioning support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The total cost of the startup and commissioning support was estimated to be $300,000.

d. Owner's Engineer

The Owner's Engineer cost was developed as a high level estimate based on a typical scope for Owner's Engineer work for this type of project; including the following tasks:

- Conceptual Study Support
- EPC Specification Supporting Documents
- Project Schedule Development
- EPC Specification Development
- EPC Bid Evaluation and Contract Conformance
- General Project Support
  - Monthly Project Status Meetings
  - Weekly Teleconferences
  - Overall Coordination
  - Project Administration
  - Site Visits and Travel
- Permitting Support
- Design Review of Drawing Submittals
- Technical support during design, fabrication, construction, commissioning, and testing
- Equipment vendor QA/QC audits

The total cost of the Owner's Engineer was estimated to be $1,750,000.

e. Performance testing

The cost for performance testing was developed as a factored estimate using costs from projects of similar scope. This cost includes the testing, performed by a third-party contractor hired by the Owner, and also includes the cost for S&L's assistance in the following tasks:

- Development of the test protocol
- Procuring the services of the testing contractor
- Overseeing the performance test campaign
- Evaluating the results of the testing with respect to guarantee compliance

The estimate for the third party testing contractor is based on the assumption that the contractor would be onsite for up to 3 days. The total cost of the Performance Testing was estimated to be $175,000.

f. Contingency

Contingency is included in the estimate to cover the uncertainty associated with the project costs. The cost estimate includes a recommended contingency of 25%, which is consistent with cost estimating guidelines for a conceptual design and the current level of project definition. Contingency was applied to the total project costs before escalation.

g. Escalation

Escalation was included in the estimate based on a typical schedule for implementation of a DSI system at an escalation rate of 2.15% on equipment and materials and 3.35% on labor and indirects. These escalation rates were developed by S&L based on recent pricing and in-house escalation projections.

h. Interest During Construction

Interest during construction (IDC) accounts for the time value of money associated with the distribution of construction cash flows over the construction period. IDC was applied to the total EPC project costs including contingency. The IDC was calculated based on a typical schedule for implementation of a DSI system and a typical interest rate of 7.8% per year which was assumed based on a low interest market environment.

4.3 VARIABLE OPERATING AND MAINTENANCE COSTS

The following unit costs were used to develop the variable O&M costs for each reagent specific system. All of these values, with the exception of the reagent costs, were provided by Entergy. The reagent costs are based on recent pricing received by S&L for another project.

Table 4-1: Unit Pricing for Utilities (Provided by Entergy)

Unit Cost	Units	Value
Trona	$/ton	$205
Activated Carbon	$/ton	$1,700
Low Quality Water	$/1000 gal	$0.53
Byproduct Disposal	$/ton	$7.50
Fly Ash Revenue	$/ton	$5.85
Aux Power Cost [1]	$/MWh	$41.02

Note 1: Entergy provided auxiliary power costs for the first year of operation.

Table 4-2 below summarizes the consumption rates estimated as well as the first year variable O&M costs for each case. The reagent consumption rate was developed using a normalized stoichiometric ratio (NSR) of 1.3 which is consistent with test data for similar projects.

Table 4-2: Variable O&M Rates and First Year Costs

	Units	Value
DSI System Parameters		
Reagent Consumption	lb/hr	16,500
Increased Carbon Consumption	lb/hr	210
DSI Waste Production + Increased Carbon + Unsold Fly Ash[3]	lb/hr	40,700
Aux Power Consumption	kW	1,700
Low Quality Water Consumption	gpm	4

	Units	Value
First Year[1] Variable O&M Costs (@CF[2])		
Reagent Cost	$/year	$10,548,500
Waste Disposal Cost (DSI Waste + Increased Carbon + Unsold Fly Ash)	$/year	$951,900
Increased Carbon Consumption Cost	$/year	$1,113,000
Aux Power Cost	$/year	$434,900
Low Quality Water Cost	$/year	$800
Loss of Fly Ash Sales[3]	$/year	$496,000
Total First Year Variable O&M Cost	**$/year**	**$13,545,100**

Note 1: First year costs are provided in $2016.

Note 2: The first year costs are calculated using an annual capacity factor of 71.2%.

Note 3: Assumes 57% of the station's fly ash was being sold on an annual basis for an average of approximately $5.85 per ton (based on historical data from Entergy).

4.4 FIXED O&M COSTS

The fixed O&M costs for the systems consist of operating personnel as well as maintenance costs (including material and labor). The recommended staffing additions for the DSI system are 9 personnel for one system.

The annual maintenance costs are estimated as a percentage of the total capital equipment cost, based on the amount of operating equipment which will require routine maintenance. For this evaluation, the maintenance costs (maintenance and labor) were estimated to be approximately 0.3% of the project capital. Items such as track work and civil work would be considered high capital cost items with little to no maintenance. Table 4-3 below summarizes the first year fixed O&M costs for the design and typical cases.

Table 4-3: First Year Fixed O&M Costs

First Year[1] Fixed O&M Costs	Units	Value
Operating Labor[2]	$/year	$1,066,000
Maintenance Material	$/year	$180,000
Maintenance Labor	$/year	$120,000
Total First Year Fixed O&M Cost	**$/year**	**$1,366,000**

Note 1: First year costs are provided in $2016.

Note 2: Operating labor costs are based on a labor rate of $56.95, which was provided by Entergy.

Note 3: Installation of systems on a single unit would require 9 operators total.

5. ATTACHMENTS

1. White Bluff Station DSI System EPC Conceptual Cost Estimate, Sargent & Lundy Estimate No. 34018A
2. ESP Rebuild Budgetary Quote

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
DSI SYSTEM EPC

Estimator	A. KOCI
Labor rate table	16ARPBL
Project No.	13027-004
Estimate Date	10/20/2016
Reviewed By	MNO
Approved By	MNO
Estimate No.	34018A
Cost index	ARPBL

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
DSI SYSTEM EPC

Area	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Total Cost
101	UNIT 1 OR 2 (SINGLE UNIT) DSI AREA	3,359,550	15,000,000	527,160	18,441	11,107,036	29,993,746
102	REAGENT HANDLING SYSTEM	1,505,400	1,360,000	1,218,523	26,487	1,956,963	6,040,885
103	ESP/ASH HANDLING MODIFICATIONS	50,000,000	1,050,000		9,885	680,982	51,730,982
104	EARTHWORK			79,496	2,169	183,755	263,251
105	UPGRADE PLANT ENTRANCE						
106	LAYDOWN AREAS			156,000	1,839	146,722	302,722
107	MECHANICAL MISCELLANEOUS	975,000					975,000
108	DEMOLITION / RELOCATION COSTS	650,000					650,000
109	ELECTRICAL	3,575,000					3,575,000
110	INSTRUMENTATION	520,000					520,000
	TOTAL DIRECT	60,584,950	17,410,000	1,981,179	58,822	14,075,457	94,051,586

Estimate Totals

Description	Amount	Totals	Hours
Direct Costs:			
Labor	14,075,457		58,822
Material	1,981,179		
Subcontract	60,584,950		
Process Equipment	17,410,000		
	94,051,586	**94,051,586**	
Other Direct & Construction Indirect Costs:			
91-1 Scaffolding	985,000		
91-2 Cost Due To OT 5-10's	1,859,000		
91-4 Per Diem	588,000		
91-5 Consumables	141,414		
91-6 Freight on Material	99,000		
91-8 Sales Tax	2,384,000		
91-9 Contractors G&A	1,990,000		
91-10 Contractors Profit	994,000		
	9,040,414	**103,092,000**	
Indirect Costs:			
93-1 Engineering Services	4,000,000		
93-4 SU/S Parts/ Initial Fills	75,000		
93-5 Technical Field Advisors	300,000		
93-8 EPC Fee	10,747,000		
	15,122,000	**118,214,000**	
Escalation:			
96-1 Escalation on Material	137,000		
96-2 Escalation on Labor	1,693,000		
96-3 Escalation on Subcontract	5,238,000		
96-4 Escalation on Process Eq	926,000		
96-5 Escalation on Indirects	1,261,000		
	9,255,000	**127,469,000**	
Total EPC Cost		***127,469,000***	
Owner's Costs:			
99-1 Owner's Costs	9,457,000		
	9,457,000	**136,926,000**	
Third Party Services:			
100 CM Oversight	1,500,000		
101 Start-Up Oversight	300,000		
102 Owner's Engineer	1,750,000		
103 Performance Testing	175,000		
	3,725,000	**140,651,000**	
Project Contingency :			
110 Project Contingency	32,851,000		
	32,851,000	**173,502,000**	
Escalation Addition:			
120 Escalation on Lines 99-110	960,000		
	960,000	**174,462,000**	
Interest During Construction:			
130 Interest During Constr.	15,649,000		
	15,649,000	**190,111,000**	
Total		***190,111,000***	

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
101			UNIT 1 OR 2 (SINGLE UNIT) DSI AREA									
	21.00.00		CIVIL WORK									
		21.53.00	PILING									
			AUGER CAST GROUT PILE, 18 IN DIA BY 80 FT LONG	DSI AREA FOUNDATIONS INCLUDING REAGENT SILOS	323.00 EA	1,162,800	-	-		108.88 /MH		1,162,800
			PILE - MOB/DEMOB		1.00 LS	100,000	-			108.88 /MH		100,000
			PILING			1,262,800						1,262,800
		21.98.00	CIVIL WORK,TESTING									
			AUGER CAST GROUT PILE - TESTING		1.00 LS	65,000	-	-		-	-	65,000
			CIVIL WORK,TESTING			65,000						65,000
			CIVIL WORK			1,327,800						1,327,800
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			CONCRETE FOUNDATIONS - COMPOSITE RATE	DSI AREA FOUNDATIONS INCLUDING REAGENT SILOS	2,292.00 CY	-	-	527,160	18,441	60.03 /MH	1,107,036	1,634,196
			CONCRETE					527,160	18,441		1,107,036	1,634,196
			CONCRETE					527,160	18,441		1,107,036	1,634,196
	23.00.00		STEEL									
		23.25.00	ROLLED SHAPE									
			BUILDING MIX, TWO COAT PAINTED		TN	-	-			93.00 /MH		
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	BLOWER BUILDING 25 FT X 100 FT	2,500.00 SF	500,000	-			93.00 /MH		500,000
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	ELECTRICAL BUILDING 15 FT X 20 FT	300.00 SF	105,000	-			93.00 /MH		105,000
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	MILL BUILDING 40 FT X 80 FT	3,200.00 SF	640,000	-			93.00 /MH		640,000
			SHELL - ROOF ONLY AREA	DEHUMIDIFIER - 30 FT X 125 FT	3,750.00 SF	318,750	-			93.00 /MH		318,750
			SHELL - ROOF ONLY AREA	HEAT EXCHANGER - 10 FT X 80 FT	800.00 SF	68,000	-			93.00 /MH		68,000
			PRE-ENGINEERED BUILDING			1,631,750						1,631,750
		24.37.00	ROOFING									
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	DSI AREA ENCLOSURE ROOF	SF	-	-			35.25 /MH		
		24.41.00	SIDING									
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	DSI AREA ENCLOSURE SIDING	SF	-	-			79.98 /MH		
		24.99.00	ARCHITECTURAL, MISCELLANEOUS									
			HEATING	DSI AREA	SF	-	-			64.51 /MH		
			LIGHTING	DSI AREA	SF	-	-			82.56 /MH		
			FIRE PROTECTION	DSI AREA	SF	-	-			82.56 /MH		
			ARCHITECTURAL			1,631,750						1,631,750
	31.00.00		MECHANICAL EQUIPMENT									
		31.99.00	MECHANICAL EQUIPMENT, MISCELLANEOUS									
			DSI SYSTEM EQUIPMENT	EQUIPMENT COST FOR UNIT 1 OR 2 (SINGLE UNIT)	1.00 LS		15,000,000	-		/MH	10,000,000	25,000,000
			STORAGE SILOS WITH BIN VENT FILTERS (~14 DAYS STORAGE)	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			BLOWERS, HEAT EXCHANGERS, DEHUMIDIFIERS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			MILLING EQUIPMENT	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			PIPING SYSTEMS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			COMPRESSORS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			FLOW MODELING	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			MECHANICAL EQUIPMENT, MISCELLANEOUS				15,000,000				10,000,000	25,000,000
			MECHANICAL EQUIPMENT				15,000,000				10,000,000	25,000,000
	71.00.00		PROJECT INDIRECT									
		71.25.00	CONSULTANT, THIRD PARTY									
			CONSULTANT - SUBSURFACE INVESTIGATION		1.00 LS	250,000	-			/MH		250,000
			CONSULTANT - GEOTECHNICAL		1.00 LS	150,000	-			/MH		150,000

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CONSULTANT, THIRD PARTY			400,000						400,000
			PROJECT INDIRECT			400,000						400,000
			101 UNIT 1 OR 2 (SINGLE UNIT) DSI AREA			3,359,550	15,000,000	527,160	18,441		11,107,036	29,993,746
102			REAGENT HANDLING SYSTEM									
	21.00.00		CIVIL WORK									
		21.14.00	STRIP & STOCKPILE TOPSOIL									
			STRIP & STOCKPILE TOPSOIL - 12"	EXTEND REAGENT RAIL TRACK	90,000.00 SF	-	-		207	182.87 /MH	37,835	37,835
			STRIP & STOCKPILE TOPSOIL						207		37,835	37,835
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	EXTEND REAGENT RAIL TRACK	10,000.00 SY	-	-	106,500	345	97.70 /MH	33,690	140,190
			EROSION AND SEDIMENTATION CONTROL					106,500	345		33,690	140,190
		21.53.00	PILING									
			AUGER CAST GROUT PILE, 18 IN DIA BY 80 FT LONG	UNLOADING SHED 200' X 75' WIDE	64.00 EA	230,400	-	-	0	108.88 /MH	1	230,401
			PILING			230,400			0		1	230,401
		21.71.00	TRACKWORK									
			RAIL, TIE & BALLAST - 136 LB/YD	EXTEND REAGENT RAIL TRACK	4,500.00 TF	-	-	765,000	7,759	81.75 /MH	634,267	1,399,267
			TRACKWORK					765,000	7,759		634,267	1,399,267
			CIVIL WORK			230,400		871,500	8,310		705,793	1,807,693
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			FOUNDATION, 4500 PSI - COMPOSITE RATE	UNLOADING SHED 200' X 75' WIDE	926.00 CY	-	-	212,980	7,451	60.03 /MH	447,258	660,238
			CONCRETE					212,980	7,451		447,258	660,238
			CONCRETE					212,980	7,451		447,258	660,238
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	UNLOADING SHED 200' X 75' WIDE x 20' TALL	15,000.00 SF	1,275,000	-			93.00 /MH		1,275,000
			PRE-ENGINEERED BUILDING			1,275,000						1,275,000
			ARCHITECTURAL			1,275,000						1,275,000
	33.00.00		MATERIAL HANDLING EQUIPMENT									
		33.14.00	MATERIAL HANDLING EQUIPMENT									
			REAGENT PNEUMATIC TRAIN UNLOADING EQUIPMENT		2.00 LS	-	1,000,000	-	6,611	68.89 /MH	455,466	1,455,466
			MATERIAL HANDLING EQUIPMENT				1,000,000		6,611		455,466	1,455,466
		33.41.00	MOBILE YARD EQUIPMENT									
			MOBILE YARD EQUIPMENT - TRACKMOBILE	REAGENT HANDLING SYSTEM	1.00 EA	-	225,000	-		68.89 /MH		225,000
			MOBILE YARD EQUIPMENT				225,000					225,000
		33.51.00	RAIL CAR UNLOADER									
			RAIL CAR UNLOADER	IN UNLOADING SHED 200' X 75' WIDE	1.00 LT	-	135,000	-	1,862	93.00 /MH	173,172	308,172
			RAIL CAR UNLOADER				135,000		1,862		173,172	308,172
			MATERIAL HANDLING EQUIPMENT				1,360,000		8,474		628,638	1,988,638
	35.00.00		PIPING									
		35.14.10	CARBON STEEL, STRAIGHT RUN									
			8 IN DIA, SCH 40, 8" VACUUM CONVEY PIPING WITH 4 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	250.00 LF	-	-	10,043	270	77.80 /MH	21,015	31,057
			12 IN DIA, 3/8 IN STD- 2500 LF OF 10"/12" TRANSPORT PRESSURE PIPING W 8 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRANSPORT SYSTEM	1,250.00 LF	-	-	124,000	1,983	77.80 /MH	154,259	278,259
			CARBON STEEL, STRAIGHT RUN					134,043	2,253		175,274	309,316
			PIPING					134,043	2,253		175,274	309,316
			102 REAGENT HANDLING SYSTEM			1,505,400	1,360,000	1,218,523	26,487		1,956,963	6,040,885
103			ESP/ASH HANDLING MODIFICATIONS									
	33.00.00		MATERIAL HANDLING EQUIPMENT									
		33.99.00	MATERIAL HANDLING EQUIPMENT, MISCELLANEOUS									
			ESP EQUIPMENT MODIFICATION	FULL REBUILD OF ESP, INCLUDING INSTALLATION COST	1.00 LS	50,000,000	-	-		68.89 /MH		50,000,000

Estimate No..: 34018A
Project No.: 13027-004
Estimate Date: 10/20/2016
Prep/Rev/App: A. KOCI/MNO/MNO

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
DSI SYSTEM EPC

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		33.99.00	**MATERIAL HANDLING EQUIPMENT, MISCELLANEOUS**									
			ASH HANDLING COMPONENT MODIFICATION	ALLOWANCE	1.00 LS		1,050,000	-	9,885	68.89 /MH	680,982	1,730,982
			MATERIAL HANDLING EQUIPMENT, MISCELLANEOUS			**50,000,000**	**1,050,000**		**9,885**		**680,982**	**51,730,982**
			MATERIAL HANDLING EQUIPMENT			**50,000,000**	**1,050,000**		**9,885**		**680,982**	**51,730,982**
			103 ESP/ASH HANDLING MODIFICATIONS			**50,000,000**	**1,050,000**		**9,885**		**680,982**	**51,730,982**
104			**EARTHWORK**									
	21.00.00		**CIVIL WORK**									
		21.14.00	**STRIP & STOCKPILE TOPSOIL**									
			STRIP & STOCKPILE TOPSOIL - 12"	SITE GRADING ALLOWANCE	30,000.00 SF	-	-		69	182.87 /MH	12,612	12,612
			STRIP & STOCKPILE TOPSOIL - ONSITE	BUILDINGS	600.00 CY	-	-		79	182.87 /MH	14,503	14,503
			STRIP & STOCKPILE TOPSOIL						**148**		**27,115**	**27,115**
		21.17.00	**EXCAVATION**									
			EXCAVATION - EXCAVATION , BACKFILL & COMPACT ALL FOUNDATIONS	BUILDINGS	2,860.00 CY	-	-		986	79.78 /MH	78,680	78,680
			EXCAVATION						**986**		**78,680**	**78,680**
		21.39.00	**STORM DRAINAGE UTILITIES**									
			STORM SEWER WORK	SITE GRADING ALLOWANCE	1.00 LT	-	-	44,000	920	72.57 /MH	66,731	110,731
			STORM DRAINAGE UTILITIES					**44,000**	**920**		**66,731**	**110,731**
		21.41.00	**EROSION AND SEDIMENTATION CONTROL**									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	SITE GRADING ALLOWANCE	3,333.00 SY	-	-	35,496	115	97.70 /MH	11,229	46,725
			EROSION AND SEDIMENTATION CONTROL					**35,496**	**115**		**11,229**	**46,725**
			CIVIL WORK					**79,496**	**2,169**		**183,755**	**263,251**
			104 EARTHWORK					**79,496**	**2,169**		**183,755**	**263,251**
105			**UPGRADE PLANT ENTRANCE**									
	21.00.00		**CIVIL WORK**									
		21.57.00	**ROAD, PARKING AREA, & SURFACED AREA**									
			UPGRADE PLANT ENTRANCE	WORK NOT REQUIRED	0.00 LF	-	-			78.79 /MH		
106			**LAYDOWN AREAS**									
	21.00.00		**CIVIL WORK**									
		21.99.00	**CIVIL WORK, MISCELLANEOUS**									
			CIVIL WORK - CONSTRUCTION LAYDOWN AREAS	FENCING, POWER ETC...	2.00 AC	-	-	156,000	1,839	79.78 /MH	146,722	302,722
			CIVIL WORK, MISCELLANEOUS					**156,000**	**1,839**		**146,722**	**302,722**
			CIVIL WORK					**156,000**	**1,839**		**146,722**	**302,722**
			106 LAYDOWN AREAS					**156,000**	**1,839**		**146,722**	**302,722**
107			**MECHANICAL MISCELLANEOUS**									
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.99.00	**MECHANICAL EQUIPMENT, MISCELLANEOUS**									
			MECHANICAL EQUIPMENT	INCLUDES PIPE RACK - ALLOWANCE SUBCONTRACT COST	1.00 LS	975,000	-	-		68.89 /MH		975,000
			MECHANICAL EQUIPMENT, MISCELLANEOUS			**975,000**						**975,000**
			MECHANICAL EQUIPMENT			**975,000**						**975,000**
			107 MECHANICAL MISCELLANEOUS			**975,000**						**975,000**
108			**DEMOLITION / RELOCATION COSTS**									
	11.00.00		**DEMOLITION**									
		11.99.00	**DEMOLITION, MISCELLANEOUS**									
			DEMOLITION AND RELOCATION	ALLOWANCE - SUBCONTRACT COST	1.00 LS	650,000	-			107.47 /MH		650,000
			DEMOLITION, MISCELLANEOUS			**650,000**						**650,000**
			DEMOLITION			**650,000**						**650,000**
			108 DEMOLITION / RELOCATION COSTS			**650,000**						**650,000**
109			**ELECTRICAL**									
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.99.00	**ELECTRICAL EQUIPMENT, MISCELLANEOUS**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		41.99.00	**ELECTRICAL EQUIPMENT, MISCELLANEOUS**									
			ELECTRICAL EQUIPMENT, MISCELLANEOUS	ALLOWANCE - SUBCONTRACT COST	1.00 LS	3,575,000	-			64.04 /MH		3,575,000
			ELECTRICAL EQUIPMENT, MISCELLANEOUS			**3,575,000**						**3,575,000**
			ELECTRICAL EQUIPMENT			**3,575,000**						**3,575,000**
			109 ELECTRICAL			**3,575,000**						**3,575,000**
110			**INSTRUMENTATION**									
	44.00.00		**CONTROL & INSTRUMENTATION**									
		44.99.00	**CONTROL & INSTRUMENTATION, ALLOWANCE**									
			CONTROL & INSTRUMENTATION	ALLOWANCE - SUBCONTRACT COST	1.00 LS	520,000	-			65.15 /MH		520,000
			CONTROL & INSTRUMENTATION, ALLOWANCE			**520,000**						**520,000**
			CONTROL & INSTRUMENTATION			**520,000**						**520,000**
			110 INSTRUMENTATION			**520,000**						**520,000**

27881 Clemens Road
Westlake, OH 44145
Phone: 440.899.3888
Fax: 440.899.3890

October 17, 2016

Sargent & Lundy
Attention: Danielle Flagg
55 East Monroe Street
Chicago, IL 60603

Subject: Fuel Tech, Inc. (FTI) Estimate #16-B-111 Rev1
Confidential Client ESP Retrofit
High Level Estimate

Dear Ms. Flagg,

In response to Sargent & Lundy's (S&L)'s recent request, Fuel Tech, Inc. (FTI), has assembled a high level estimate for the materials and installation necessary to retrofit Sargent & Lundy's "Confidential Client" Electrostatic Precipitators. Please consider the pricing as +/- 30% for high level budgetary estimation purposes.

The ESPs have been evaluated by our engineering staff and the estimate includes the most comprehensive improvements possible. Improvements that we have included in the estimate to increase performance and reliability include all new internals; collecting plates at 16" wide plate spacing, rigid discharge electrodes, top-rapped MIGI rapper conversion with increased rapping sectionalization, increased high voltage frame electrical sectionalization, and the addition of high frequency power supplies.

The estimates and information provided above are based upon FTI's historical information and experience, and should be used for accounting purposes ONLY. Should S&L want to move forward with a more in-depth budgetary proposal, FTI can provide such a document with additional lead-time. Thank you for your interest in our products and services, and we will continue to support Sargent & Lundy's efforts in any way practical for this and other opportunities. Should you require any additional information regarding this submittal, please contact me directly.

Respectfully,

Dustin Ekey
Regional Sales Manager

FTI Budgetary Proposal #16-B-111
Rev 1

Sargent & Lundy
Confidential Client ESP Retrofit

Submitted by:

27881 Clemens Road
Westlake, Ohio 44145
P: 440.539.8792
www.ftek.com

EXECUTIVE SUMMARY

<u>Sargent & Lundy – Confidential Client ESP Rebuild Budgetary Request:</u>

In accordance with Sargent & Lundy's RFQ dated September 30, 2016, Fuel Tech, Inc. (FTI) has provided a high level estimate based on historical data to engineer, design, supply, and deliver an ESP Retrofit based on the provided information as follows;

A confidential client is currently evaluating the costs associated with rebuilding an existing ESP. As part of this project, the client will potentially be installing dry sorbent injection (DSI) upstream of the upgraded ESP.

The following summarizes the ESP design of the unit being evaluated:

- PC Walther original OEM installed in the early 1980s.
- Consists of four (4) identical ESP casings, with two (2) casings on top of the other two (2) casings; AKA "Piggybacked".
- Each ESP casing has eight (8) mechanical fields, two (2) mechanical fields wide by four (4) mechanical fields deep.
- Each field is 14' in length and contains forty-four (44) collecting electrodes with forty-three (43) gas passages.
- The collecting electrodes are 48' in height with 12" plate spacing.
- The total collecting surface area is 1,900,000 ft^2.
- Design flue gas flowrate is approximately 3,500,000 acfm, and a design velocity of 5 feet per second.
- The SCA of the existing ESP is approximately 540 ft^2/MMacfm.
- The overall dimension for each ESP is approximately 85'L x 90'W x 50'H.
- Each gas passage has discharge frame electrodes.
- The system is equipped with a Walther tumbling hammer rapper system.
- There are eight (8) T/R sets on each ESP, with a total of thirty-two (32).

ESP rebuild design and performance considerations:

- Achieve an outlet PM emissions rate of 0.015 lb/MMBtu or lower.
- Design inlet ash loading of 55,000 lb/hr.
- Non-halogenated PAC is injected at 150 lb/hr.
- Trona will be injected at 22,500 lb/hr, resulting in an increased particulate loading of 18,200 lb/hr to the ESP.
- Inlet flue gas temperature up to 315 deg F.

Fuel Tech, Inc. – Retrofitted ESP Arrangement and Summary:

While the existing ESPs are considered to be relatively large by industry standards, the design information provided shows that 22,500 lb/hr of Trona will be injected in addition to the existing inlet ash loading is 55,000 lb/hr. With this being said, while the ESPs are large they are still an efficiency machine and overcoming the new total inlet loading of over 73,000 lb/hr will be extremely difficult to achieve the requested 0.015 lbs/MMbtu outlet PM emissions, without retrofitting the entire ESPs to BART technology. Essentially, the ESPs will need to be rebuilt to "as-new" condition with the most state-of-the-art technology options. At the very least, new internals and electrical control systems would require new:

- Assembled Panel Collecting Electrodes
- Rigid Discharge Electrodes
- Top-Rapped MIGI Style Rapper Conversion
- All new Hot Roof, Cold Roof, and Penthouse
- Heated Purge Air Systems
- High Frequency Switch-Mode Power Supplies (SMPS)
- New Access Doors
- All new 3-Phase Electrical Supply Wiring
- New Controllers
- New Hopper Arrangement

Retrofit ESP Arrangement; Quantities are for one (1) ESP, there are four (4) ESPs total:

Number of ESP's / Unit:	4
Mechanical Fields & Size / ESP:	6 @ 9'
Electrical Fields & Size / ESP:	12 @ 4.5'
Chambers / ESP:	2
Gas Passages / Chamber:	33
Collecting Plates / Chamber:	32
Collecting Plate Height:	44'
Plate Spacing:	16"
RDE's / ESP:	1,536
Rapping Arrangment:	Top Rapped – MIGI
Collecting System Rappers / ESP:	176
Discharge System Rappers / ESP:	48
High Frequency Power Supplies / ESP:	16

The amount of planning, engineering, material supply, installation, and installation oversight necessary for a project listed above will be very significant. Pricing estimation can be found below.

High-Level Pricing Estimation for one (1) Confidential Unit including all four (4) ESPs:

Pricing estimate is based upon +/- 30%

The total budgetary estimate to provide ESP materials and engineering: **$ 20,000,000.00**

The total budgetary estimate to provide non-union installation: **$ 30,000,000.00**

*Note: The estimates and information provided above are based upon FTI's historical information and experience, and should be used for accounting purposes ONLY. Should S&L want to move forward with a more in-depth budgetary proposal, FTI can provide such a document with additional lead-time.

ENTERGY ARKANSAS, INC.

WHITE BLUFF

ENHANCED DSI COST ESTIMATE BASIS DOCUMENT

SL-014001
Final, Rev. 0
August 3, 2017
Project 13027-002

Prepared by

Sargent & Lundy LLC

55 East Monroe Street • Chicago, IL 60603 USA • 312-269-2000

CONTENTS

Section **Page**

1. PURPOSE

Entergy has requested that Sargent & Lundy (S&L) evaluate installation of an enhanced dry sorbent injection (DSI) system utilizing a baghouse in conjunction with the DSI system at White Bluff to control sulfur dioxide (SO_2) emissions. The purpose of this document is to define the project scope and identify the assumptions that were used as the basis for the operating and maintenance (O&M) and the capital cost estimates.

2. TECHNOLOGY DESCRIPTION

DSI is a proven technology, which has only recently been implemented, for moderate removal of $SO_2$and other acid gases from coal-fired power plants. It involves injection of sodium-based sorbents into the ductwork after the boiler and prior to the particulate collection device. DSI is considered a relatively low capital cost, moderate SO_2 removal alternative to wet or dry FGD systems. No slurry equipment or separate reactor vessel is required with a DSI system. With the proper temperature profile and stoichiometry, the sorbent can effectively react with $SO_2$and other acid gases in the flue gas. The resulting particulate matter is removed from the flue gas by a particulate collection device, typically an existing electrostatic precipitator (ESP). The performance of DSI technology has been shown to be enhanced by implementation with a downstream fabric filter or baghouse. A baghouse increases the overall residence time due to longer ductwork and additional contact through the filter cake which builds up on the bags. The additional residence time improves performance and in some applications has resulted in much higher achievable removal efficiencies than traditional DSI technology upstream of an existing ESP.

The typical DSI sorbents include sodium bicarbonate ($NaHCO_3$) and Trona ($Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$). Sorbent injection into the ductwork (downstream of the boiler and upstream of the ESP or baghouse) has been tested in the industry using sodium-based sorbents. The process works through neutralization of SO_2 and other acid gases with the caustic sorbent; the neutralization occurs as long as the sorbent remains in contact with the gas. Sorbent injection has been proven effective on a variety of pulverized coal-fired boilers using a range of low to high sulfur coals. It is considered a commercial technology although with a limited supplier base due to the historically limited interest.

The DSI process produces a dry byproduct which can be landfilled. The waste products will contain sodium sulfate and sulfite ($NaSO_3$/$NaSO_4$) along with the unused sorbent and the normal fly ash. These wastes will be collected in a baghouse and can be transported with conventional pneumatic fly ash handling equipment. The waste from sodium-based sorbents will have relatively high concentrations of soluble salts, which may affect the byproduct handling. With the addition of dry sorbent byproducts fly ash cannot be sold for reuse.

3. APPROACH

The project capital and O&M cost estimates are based on project-specific information, including:

- An engineer-procure-construct (EPC) contracting strategy with the DSI technology supplier providing the main process equipment, including reagent storage, milling, conveyance, injection lances, baghouse, and booster fans.
- Installation of a pulse jet fabric filter (PJFF) downstream of the existing ESPs to assist in SO_2 removal efficiency and capture of the DSI byproduct.
- Installation of new booster fans to account for increased draft pressure loss mainly due to the baghouse.
- Reagent injection at the ESP outlet, upstream of a new baghouse to collect flyash separately and preserve flyash sales
- On-site disposal of DSI byproduct, including flyash blending equipment for stabilization.
- Reagent injection rates based on 80% SO_2 removal from a design inlet concentration of 0.76 lb SO_2/MMBtu, based on the highest 5% of SO_2 emissions from 2009 through 2013.
    - Annual operating costs will be based on 80% SO_2 removal from an uncontrolled SO_2 rate of 0.57 lb SO_2/MMBtu, based on the annual heat input weighted average emission from 2009 through 2013.
    - The system will be designed to control emissions to meet a permit limit of 0.15 lb/MMBtu on a 30-boiler day rolling average, based on a maximum 30-day average SO_2 emission rate of 0.66 lb/MMBtu from 2009 through 2013.
- Trona was used as the DSI reagent for the purposes of this estimate.

- A high level conceptual system design, based on the estimated injection rate, was used as input to the Enhanced DSI cost estimate. The following were estimated based on previous projects and scaled for the predicted dry sorbent injection rate for White Bluff:
    - Auxiliary power consumption
    - Annual reagent consumption
    - Additional carbon consumption
    - Additional water consumption
    - Additional waste production
    - Reagent storage silos
    - Quantity of mills
    - Quantity of blower trains

The fabric filter and ID fan equipment costs are scaled based on flue gas volume in comparison to industry data and recent budgetary cost estimates.

The total plant capital cost estimate includes the following:

- Equipment and material
- Installation labor
- Indirect field costs
- Freight
- General and Administration
- Erection contractor profit
- Engineering, Procurement and Project Services
- Spare parts/initial fills (other than reagent)
- EPC Fee

As part of this project, S&L estimated the costs for Owner's services and costs outside of the EPC contract including the following:

- Owner's Costs
- Owner's Engineer
- Construction Management Support
- Startup and Commissioning Support
- Performance Testing
- Contingency
- Escalation
- Interest During Construction

Cost Estimate 34019A provided in Attachment 1 represents the total cost to Entergy to install Enhanced DSI technology on a single unit at White Bluff (Unit 1 or 2) including the EPC Contract price and all additional Owner's costs and third party services.

The total unit O&M cost estimate includes the following:

- Waste disposal (DSI waste)
- Reagent consumption
- Auxiliary power consumption
- Low quality water consumption for mill cleaning
- PJFF bag and cage replacement
- Operating labor
- Maintenance material
- Maintenance labor

The O&M Cost Estimate and Capital Cost Estimate 34019A were developed using the assumptions and scope provided in this document. The project definition and accuracy corresponds to a study level estimate as defined in U.S.EPA's Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual. The costs provided in this report are in 2016 dollars.

4. CAPITAL AND O&M COST ESTIMATE TECHNICAL BASIS

4.1 DESIGN INPUTS AND ASSUMPTIONS

The following assumptions were made for the design basis for the White Bluff DSI Systems:

- Design SO_2 inlet concentration of 0.76 lb SO_2/MMBtu.
- SO_2 inlet concentration of 0.57 lb SO_2/MMBtu for annual operating costs.
- Design SO_2 removal efficiency of 80%
- Annual capacity factor of 72.1% (annual average capacity factor for White Bluff Units 1 and 2 based on historical heat input from 2009 through 2013).
- Reagent injection at the ESP outlet, upstream of the new baghouse.
- Reagent delivery by rail.
- Compliance deadline of three years from the effective date of the rule.

Before proceeding with a DSI project, a demonstration test should be completed at White Bluff to confirm the feasibility of DSI technology at White Bluff and quantify the potential BOP impacts associated with the project, such as leachability of the byproduct.

4.1.1 Landfill Modifications

The sodium byproducts (salts) that are produced when Trona reacts with SO_2 and other acid gases, along with the unreacted sorbent are soluble in water. The resulting waste collected in the particulate collection device will need to be disposed of in a landfill that is lined and has a leachate collection system. With the addition of DSI, White Bluff will no longer be able to sell their fly ash for beneficial re-use due to the solubility of the sodium salts which would be present in the waste. The cost to maintain a landfill and open new cells is included in the typical maintenance budget of a plant. It was assumed, that any future landfill cells would include lining and leachate collection; therefore, no landfill modifications will be required to accommodate the addition of DSI and no costs were included in this estimate.

4.2 TOTAL INSTALLED CAPITAL INVESTMENT

The DSI system supplier will provide all of the equipment related to storing, milling, conveying and injecting the reagent; in this case, the system is designed for Trona. The baghouse area equipment, ID fan equipment, and the remaining BOP scope will be provided by the EPC Contractor. In addition, the EPC Contractor will install/construct the entire system including the equipment provided by the DSI system supplier.

Quantities were developed based on limited project design effort, project experience of a plant of comparable size and then adjusted based on actual size and capacity differences and also taking into consideration the specific site layout based on the general arrangement. In most cases, the costs for bulk materials and equipment were derived from S&L database and recent vendor or manufacturer's quote for similar items on other projects. The scope of work for the capital cost estimate is broken out by the following areas:

4.2.1 DSI Area (Single Unit)

a. Reagent Storage Silos:
   - Twenty silos capable of storing approximately 14 days of sorbent per unit, 7,000-tons storage total, including substructure
   - 14' diameter and 125' high, each
   - 350-tons working storage, each
   - Continuous level detection systems
   - One bin vent filter per silo
   - Live bottom hopper outlets
   - Rotary airlock assemblies

b. Reagent conveying systems:
   - 5 trains (5 x 33%)
   - Pneumatic pressure blowers (1 x100% per train)
   - One dehumidifier and chiller per train

c. Reagent Milling
   - One 7-tph mill per train
   - One set of bypass piping per mill

d. Reagent Injection
   - Splitters with piping to two ESP outlets
   - Six injection lances per injection location

e. Concrete foundations including piles for all reagent silo, blower, and mill areas; the approximate footprint for DSI Area is 160’ x 200’

f. Buildings, enclosures, and roofs, including:
   - Blower Building, approximately 25’ x 125’
   - Electrical Building; approximately 30’ x 20’
   - Mill Building; approximately 50’ x 100’
   - Dehumidifier Roof; approximately 30’ x 160’
   - Heat Exchanger Roof; approximately 10’ x 100’

g. Geotechnical and subsurface investigation contractor work, including hydro excavation

h. Equipment pricing based on recent vendor pricing for a similar project.

4.2.2 Reagent Handling System

The conceptual design basis for the reagent handling system is to unload three cars at a time. Based on the estimated injection rate and typical railcar capacities, it is anticipated that approximately 35 railcars will be required each week per unit assuming a 100% capacity factor. The reagent handling system includes modification to the existing rail spur on-site to accommodate storage and handling of the reagent railcars. It was assumed that the reagent will be delivered via a 25-car unit train as a maximum. The following equipment and components are included in the cost estimate as part of the reagent handling system:

a. Reagent rail car unloader:
   - System consists of mobile receiving pad and associated vacuum pneumatic connection equipment to unload railcar
   - Enclosed railcar unloading building; approximately 300’ x 75’
   - Trackmobile used to haul and queue the rail cars before and after unloading; capable of moving approximately 25 cars at once.

b. Reagent unloading systems:
   - Three trains (3 x 100%)
   - Pneumatic pressure blowers (1 x 100%) per train
   - One conveying air dehumidifier and chiller per train

- Pneumatic conveying piping located on an above-grade sleeper pipe rack
- The equipment pricing included in this estimate is based on recent firm pricing for similar projects. The basis of the conceptual design is a typical UCC arrangement and equipment.

c. Rail track spur extension to north to allow reagent train to be unloaded and cars to be stored on site, designed for 136 lb rail to be consistent with existing coal spurs

4.2.3 Byproduct Handling

a. Two DSI by-product storage silos (approximately 7-day capacity) with bin vent filter, fluidizing system, and four unloading conditioners (pin mixers)
b. One common fly ash blending bin with bin vent filter, fluidizing system, and four pneumatic airslide conveyors
c. Water pumps and associated piping for unloading conditioners at both silos
d. Compressed air system for air operated valves
e. Storage silo substructure and superstructure
f. Concrete foundations including piles for silos
g. Continuous level detection system
h. One lot pneumatic conveying piping located on an above grade pipe rack
i. Two truck scales and substructure
j. Cost estimate based on a recent budgetary proposal for similar project

4.2.4 Baghouse Area

a. New baghouse, including pulse jet cleaning system and all appurtenances
b. Two casings with 8 compartments
c. 10 meter bags and cages
d. 6” insulation with lagging
e. Enclosure around hopper area
f. Baghouse area foundations including 18” auger cast piles 60’ long
g. Equipment pricing based on recent pricing for similar projects

4.2.5 Ductwork and Supports

a. ID fan outlet to Baghouse inlet:
   - Two ID fan outlet ducts, combine to a single duct to carry flue gas to the new baghouse
   - Carbon steel, ¼ in.
   - Velocity, 3,600 fpm

b. Baghouse outlet to Booster fans
   - A single baghouse outlet duct which splits into two booster fan inlets.
   - Carbon steel, ¼ in.
   - Velocity, 3,600 fpm

c. Booster fan outlet to the stack inlet ductwork and supports:
   - Two booster fan inlets, combine to a single duct which connects to the existing chimney breeching duct.
   - Carbon steel, ¼ in.
   - Velocity, 3,600 fpm

d. Dampers and expansion joints

e. 6" insulation and lagging

f. Steel support structure and concrete mat foundations for all new flue gas ductwork

4.2.6 ID Booster Fans

a. Two, approximately 4,000 hp, axial booster fans sized to overcome pressure drop associated with baghouse

b. Includes motors - no spare motor included

c. Booster fan area foundations

4.2.7 Civil Work

a. Site grading

b. Soil removal earthwork

c. Excavation, backfill, and compaction for all foundations

d. Development of a new laydown area, approximately 4 acres, including site preparation, fencing, and temporary power. It was assumed that this area would be located on existing plant property, and does not require land to be purchased.

4.2.8 Mechanical Work

a. Allowance of $2,600,000 provided for mechanical system including transport piping, pipe rack, instrument/service air and other miscellaneous items based on recent in-house cost estimates for similar projects.

4.2.9 Demolition/Relocation

a. Allowance of $975,000 is provided for demolition and relocation of existing equipment and infrastructure which may interfere with the new DSI system based on recent in-house cost estimates for similar projects.

4.2.10 Electrical

a. Allowance of $16,250,000 is provided for electrical equipment upgrades and modifications based on recent in-house cost estimates for similar projects.

4.2.11 Instrumentation

a. Allowance of $2,210,000 provided for DCS upgrades and added instrumentation based on recent in-house cost estimates for similar projects.

4.2.12 Labor Costs

Installation/labor costs were included in the base estimate under the direct costs. Manhours are estimated for each item in the base estimate and are based on the type of work and typical estimates for similar work. The labor costs are based on the labor wage rates and labor crews developed by S&L.

a. Labor Wage Rates

Crew labor rates were developed using prevailing craft rates and fringe benefits and state specific worker's compensation rates as published in the 2016 edition of R.S. Means Labor Rates for Pine Bluff, Arkansas area. Costs were added to cover FICA, workers compensation, all applicable taxes, small tools, incidentals, construction equipment, and contractor's overhead. State specific workman's compensation rates are from R.S. Means. A 1.15 geographic labor productivity multiplier is included based on the Compass International Construction Yearbook for Arkansas. The crew rates do not include an allowance for weather related delays.

b. Labor crews

Construction/erection labor cost is based on the use of applicable construction crews typically required for projects of this type. The construction crew costs were specifically developed for utility industry and are proprietary to S&L. The prevailing craft rates are incorporated into work crews appropriate for the activities; and include costs for small tools, construction equipment, insurance, and site overheads.

4.2.13 Other Direct and Construction Indirect Costs

In addition to the base labor costs, other construction indirect costs for the project were broken out in the estimate as well as other contractor direct costs. The following items were included as other direct and construction indirect costs.

a. Scaffolding and Consumables

b. Premiums and per diems ($10 per hour)

c. Overtime at five 10-hour shifts per week

d. Freight on construction materials

e. Contractor's General & Administration Fees (included at 10% of total direct costs)

f. Contractor's Profit (included at 5% of total direct costs)

g. Sales tax was included at 8.125%.

Freight on the DSI System equipment was not included in the cost estimate.

4.2.14 EPC Indirect Costs

The final contribution to the overall EPC project price are the EPC Contractor's indirect costs; these include the EPC engineering services, startup spare parts and initial fills, technical field advisors, and the EPC risk fee.

a. EPC Engineering Services

The EPC engineering services was estimated based on recent projects with similar scopes and schedules. The total cost of the EPC engineering services was estimated to be $10,000,000.

b. Startup Spare Parts and Initial Fills

An allowance has been included for initial fills for equipment, including first fills for lubrication of any motorized equipment. The initial fill of Trona was not included in the EPC Contractor's scope, as this will be supplied by the Owner and is covered as part of the Owner's Costs. The total cost of the initial fills was estimated to be $150,000.

c. Technical Field Advisors (Vendors)

Allowances were included for equipment supplier's technical field advisory services based on an estimated 200 man-days. The estimate includes technical field advisors for the DSI system supplier (including DSI system subcontractors) and the DCS supplier. The total cost of the technical field advisors was estimated to be $400,000.

d. EPC Risk Fee

An EPC approach provides an alternative which is expected to reduce risk for Entergy by placing the responsibility for the project on a single entity, the EPC Contractor. The EPC risk fee is a premium charged by the contractor which accounts for the additional coordination and management of the project as well as the additional risk assumed by the contractor. Based on S&L's experience with recent EPC projects, an EPC risk fee was included at 10% of the total EPC project costs.

4.2.15 Owner's Costs and Services

Outside of the EPC Contractor's total cost, Entergy will incur other costs associated with the project, such as services procured from third parties (including Owner's engineer, construction management support, startup and commissioning support and performance testing), and other project related costs.

a. Owner's Costs

Owner's Costs are direct costs that the Owner incurs over the life of the project. The following items are real costs Entergy will incur to install DSI at White Bluff based on the scope and schedule of this project:

- Internal Labor
- Internal Indirects
- Travel Expenses
- Legal Services
- Builders Risk Insurance
- Initial Fills (Reagent)

Owner's costs were included in the estimate at 8% of the total project cost.

b. Construction Management Support

The construction management support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The cost of labor is based on present day cost. The total cost of the construction management support was estimated to be $2,500,000.

c. Startup and Commissioning Support

The startup and commissioning support was estimated based on similar project scopes. It was assumed that Entergy will not have the internal support personnel required to perform the tasks, and therefore it will be outsourced. The total cost of the startup and commissioning support was estimated to be $350,000.

d. Owner's Engineer

The Owner's Engineer cost was developed as a high level estimate based on a typical scope for Owner's Engineer work for this type of project; including the following tasks:

- Conceptual Study Support
- EPC Specification Supporting Documents
- Project Schedule Development
- EPC Specification Development
- EPC Bid Evaluation and Contract Conformance
- General Project Support
    - Monthly Project Status Meetings
    - Weekly Teleconferences
    - Overall Coordination
    - Project Administration
    - Site Visits and Travel

- Permitting Support
- Design Review of Drawing Submittals
- Technical support during design, fabrication, construction, commissioning, and testing
- Equipment vendor QA/QC audits

The total cost of the Owner's Engineer was estimated to be $2,750,000.

e. Performance testing

The cost for performance testing was developed as a factored estimate using costs from projects of similar scope. This cost includes the testing, performed by a third-party contractor hired by the Owner, and also includes the cost for S&L's assistance in the following tasks:

- Development of the test protocol
- Procuring the services of the testing contractor
- Overseeing the performance test campaign
- Evaluating the results of the testing with respect to guarantee compliance

The estimate for the third party testing contractor is based on the assumption that the contractor would be onsite for up to 3 days. The total cost of the Performance Testing was estimated to be $175,000.

f. Contingency

Contingency is included in the estimate to cover the uncertainty associated with the project costs. The cost estimate includes a recommended contingency of 25%, which is consistent with cost estimating guidelines for a conceptual design and the current level of project definition. Contingency was applied to the total project costs before escalation.

g. Escalation

Escalation was included in the estimate based on a typical schedule for implementation of a DSI system at an escalation rate of 2.15% on equipment and materials and 3.35% on labor and indirects. These escalation rates were developed by S&L based on recent pricing and in-house escalation projections.

h. Interest During Construction

Interest during construction (IDC) accounts for the time value of money associated with the distribution of construction cash flows over the construction period. IDC was applied to the total EPC project costs including contingency. The IDC was calculated based on a typical schedule for implementation of a DSI system and a typical interest rate of 7.8% per year which was assumed based on a low interest market environment.

4.3 VARIABLE OPERATING AND MAINTENANCE COSTS

The following unit costs were used to develop the variable O&M costs for each reagent specific system. All of these values, with the exception of the reagent costs, were provided by Entergy. The reagent costs are based on recent pricing received by S&L for another project.

Table 4-1: Unit Pricing for Utilities (Provided by Entergy)

Unit Cost	Units	Value
Trona	$/ton	$205
Low Quality Water	$/1000 gal	$0.53
Bag Cost [1]	$/bag	100.00
Cage Cost [1]	$/cage	30.00
Waste Disposal	$/ton	$7.50
Aux Power Cost [2]	$/MWh	$41.02

Note 1: Bags will be replaced every 3 years and cages will be replaced every 9 years.

Note 2: Entergy provided auxiliary power costs for the first year of operation.

Table 4-2 below summarizes the consumption rates estimated as well as the first year variable O&M costs for each case. The reagent consumption rate was developed using a normalized stoichiometric ratio (NSR) of 2.4 which is consistent with test data for similar projects.

Table 4-2: Variable O&M Rates and First Year Costs

	Units	Value
DSI System Parameters		
Reagent Consumption	lb/hr	30,400
DSI Waste Production	lb/hr	24,100
Aux Power Consumption	kW	8,800
Low Quality Water Consumption	gpm	6
First Year[1] Variable O&M Costs (@CF[2])		
Reagent Cost	$/year	$19,434,900
Waste Disposal Cost	$/year	$563,700
Aux Power Cost	$/year	$2,251,500
Low Quality Water Cost	$/year	$1,200
Bag and Cage Replacement Cost	$/year	$1,796,000
Total First Year Variable O&M Cost	**$/year**	**$24,047,300**

Note 1: First year costs are provided in $2016.

Note 2: The first year costs are calculated using an annual capacity factor of 72.1%.

4.4 FIXED O&M COSTS

The fixed O&M costs for the systems consist of operating personnel as well as maintenance costs (including material and labor). The recommended staffing additions for the DSI system are 9 personnel for one system.

The annual maintenance costs are estimated as a percentage of the total capital equipment cost, based on the amount of operating equipment which will require routine maintenance. For this evaluation, the maintenance costs (maintenance and labor) were estimated to be approximately 0.5% of the project capital. Items such as track work and civil work would be considered high capital cost items with little to no maintenance.

Table 4-3 below summarizes the first year fixed O&M costs for the design and typical cases.

Table 4-3: First Year Fixed O&M Costs

First Year[1] Fixed O&M Costs	Units	Value
Operating Labor[2]	\$/year	\$1,066,000
Maintenance Material	\$/year	\$645,000
Maintenance Labor	\$/year	\$430,000
Total First Year Fixed O&M Cost	**\$/year**	**\$2,141,000**

Note 1: First year costs are provided in \$2016.

Note 2: Operating labor costs are based on a labor rate of \$56.95, which was provided by Entergy.

Note 3: Installation of systems on a single unit would require 9 operators total.

5. ATTACHMENTS

1. White Bluff Station Enhanced DSI System EPC Conceptual Cost Estimate, Sargent & Lundy Estimate No. 34019A

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
ENHANCED DSI SYSTEM W/BAGHOUSE EPC

Estimator	A. KOCI
Labor rate table	16ARPBL
Project No.	13027-004
Estimate Date	10/20/2016
Reviewed By	MNO
Approved By	MNO
Estimate No.	34019A
Cost index	ARPBL

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
ENHANCED DSI SYSTEM W/BAGHOUSE EPC

Area	Description	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Labor Cost	Total Cost
101	UNIT 1 OR 2 (SINGLE UNIT) DSI AREA	4,693,000	20,500,000	817,880	28,611	15,417,548	41,428,428
102	REAGENT HANDLING SYSTEM	2,258,100	2,445,000	1,325,013	35,380	2,581,496	8,609,609
103	BYPRODUCT HANDLING SYSTEM	7,713,100	6,872,000	853,055	76,615	5,670,075	21,108,230
104	UNIT 1 OR 2 FLUE GAS SYSTEM	496,800	240,000	8,136,840	162,932	14,173,748	23,047,388
105	UNIT 1 OR 2 BOOSTER FANS		5,400,000	212,595	27,391	1,888,104	7,500,699
106	UNIT 1 OR 2 BAGHOUSE	1,173,600	20,000,000	3,638,113	85,175	19,008,734	43,820,447
107	EARTHWORK			2,021,832	44,398	5,879,245	7,901,077
108	LAYDOWN AREAS			312,000	3,678	293,444	605,444
109	MECHANICAL MISCELLANEOUS	2,600,000					2,600,000
110	DEMOLITION/RELOCATION	975,000					975,000
111	ACI RELOCATION	100,000		146,775	1,954	135,859	382,635
112	ELECTRICAL	16,250,000					16,250,000
113	INSTRUMENTATION	2,210,000					2,210,000
	TOTAL DIRECT	38,469,600	55,457,000	17,464,103	466,134	65,048,253	176,438,956

Estimate Totals

Description	Amount	Totals	Hours
Direct Costs:			
Labor	65,048,253		466,134
Material	17,464,103		
Subcontract	38,469,600		
Process Equipment	55,457,000		
	176,438,956	**176,438,956**	
Other Direct & Construction Indirect Costs:			
91-1 Scaffolding	4,553,000		
91-2 Cost Due To OT 5-10's	8,760,000		
91-4 Per Diem	4,661,000		
91-5 Consumables	650,044		
91-6 Freight on Material	873,000		
91-8 Sales Tax	2,897,000		
91-9 Contractors G&A	10,350,000		
91-10 Contractors Profit	5,175,000		
	37,919,044	**214,358,000**	
Indirect Costs:			
93-1 Engineering Services	10,000,000		
93-4 SU/S Parts/ Initial Fills	150,000		
93-5 Technical Field Advisors	400,000		
93-8 EPC Fee	22,491,000		
	33,041,000	**247,399,000**	
Escalation:			
96-1 Escalation on Material	1,212,000		
96-2 Escalation on Labor	8,026,000		
96-3 Escalation on Subcontract	3,326,000		
96-4 Escalation on Process Eq	2,948,000		
96-5 Escalation on Indirects	2,756,000		
	18,268,000	**265,667,000**	
Total EPC Cost		***265,667,000***	
Owner's Costs:			
99-1 Owner's Costs	19,792,000		
	19,792,000	**285,459,000**	
Third Party Services:			
100 CM Oversight	2,500,000		
101 Start-Up Oversight	350,000		
102 Owner's Engineer	2,750,000		
103 Performance Testing	175,000		
	5,775,000	**291,234,000**	
Project Contingency :			
110 Project Contingency	68,242,000		
	68,242,000	**359,476,000**	
Escalation Addition:			
120 Escalation on Lines 99-110	1,893,000		
	1,893,000	**361,369,000**	
Interest During Construction:			
130 Interest During Constr.	32,375,000		
	32,375,000	**393,744,000**	
Total		***393,744,000***	

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
101			**UNIT 1 OR 2 (SINGLE UNIT) DSI AREA**									
	21.00.00		**CIVIL WORK**									
		21.53.00	**PILING**									
			AUGER CAST GROUT PILE, 18 IN DIA BY 60 FT LONG	DSI AREA FOUNDATIONS INCLUDING REAGENT SILOS	500.00 EA	1,800,000	-	-		108.88 /MH		1,800,000
			PILE - MOB/DEMOB		1.00 LS	100,000	-			108.88 /MH		100,000
			PILING			**1,900,000**						**1,900,000**
		21.98.00	**CIVIL WORK,TESTING**									
			AUGER CAST GROUT PILE - TESTING		1.00 LS	65,000	-	-		-	-	65,000
			CIVIL WORK,TESTING			**65,000**						**65,000**
			CIVIL WORK			**1,965,000**						**1,965,000**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			CONCRETE FOUNDATIONS - COMPOSITE RATE	DSI AREA FOUNDATIONS INCLUDING REAGENT SILOS	3,556.00 CY	-	-	817,880	28,611	60.03 /MH	1,717,548	2,535,428
			CONCRETE					**817,880**	**28,611**		**1,717,548**	**2,535,428**
			CONCRETE					**817,880**	**28,611**		**1,717,548**	**2,535,428**
	23.00.00		**STEEL**									
		23.25.00	**ROLLED SHAPE**									
			BUILDING MIX, TWO COAT PAINTED		TN	-	-			93.00 /MH		
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	BLOWER BUILDING 25 FT X 125 FT	3,125.00 SF	625,000	-			93.00 /MH		625,000
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	ELECTRICAL BUILDING 30 FT X 20 FT	600.00 SF	210,000	-			93.00 /MH		210,000
			SHELL INCLUDING ELECTRICAL & HVAC-STEEL INSULATED 22 GA	MILL BUILDING 50 FT X 100 FT	5,000.00 SF	1,000,000	-			93.00 /MH		1,000,000
			SHELL - ROOF ONLY AREA	DEHUMIDIFIER - 30 FT X 160 FT	4,800.00 SF	408,000	-			93.00 /MH		408,000
			SHELL - ROOF ONLY AREA	HEAT EXCHANGER - 10 FT X 100 FT	1,000.00 SF	85,000	-			93.00 /MH		85,000
			PRE-ENGINEERED BUILDING			**2,328,000**						**2,328,000**
		24.37.00	**ROOFING**									
			METAL, INSULATED, 2 IN GALVANIZED, PAINTED, 22 GA	DSI AREA ENCLOSURE ROOF	SF	-	-			35.25 /MH		
		24.41.00	**SIDING**									
			METAL, INSULATED, 2 IN THICK FIBERGLASS, 22 GA, GALVANIZED PAINTED	DSI AREA ENCLOSURE SIDING	SF	-	-			79.98 /MH		
		24.99.00	**ARCHITECTURAL, MISCELLANEOUS**									
			HEATING	DSI AREA	SF	-	-			64.51 /MH		
			LIGHTING	DSI AREA	SF	-	-			82.56 /MH		
			FIRE PROTECTION	DSI AREA	SF	-	-			82.56 /MH		
			ARCHITECTURAL			**2,328,000**						**2,328,000**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.99.00	**MECHANICAL EQUIPMENT, MISCELLANEOUS**									
			DSI SYSTEM EQUIPMENT	EQUIPMENT COST FOR UNIT 1 OR 2 (SINGLE UNIT)	1.00 LS		20,500,000	-		/MH	13,700,000	34,200,000
			STORAGE SILOS WITH BIN VENT FILTERS (~14 DAYS STORAGE)	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			BLOWERS, HEAT EXCHANGERS, DEHUMIDIFIERS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			MILLING EQUIPMENT	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			PIPING SYSTEMS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			COMPRESSORS	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			FLOW MODELING	INCLUDED ABOVE	1.00 LS		-	-		68.89 /MH		
			MECHANICAL EQUIPMENT, MISCELLANEOUS				**20,500,000**				**13,700,000**	**34,200,000**
			MECHANICAL EQUIPMENT				**20,500,000**				**13,700,000**	**34,200,000**
	71.00.00		**PROJECT INDIRECT**									
		71.25.00	**CONSULTANT, THIRD PARTY**									
			CONSULTANT - SUBSURFACE INVESTIGATION		1.00 LS	250,000	-			/MH		250,000
			CONSULTANT - GEOTECHNICAL		1.00 LS	150,000	-			/MH		150,000

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
ENHANCED DSI SYSTEM W/BAGHOUSE EPC

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CONSULTANT, THIRD PARTY			400,000						400,000
			PROJECT INDIRECT			400,000						400,000
			101 UNIT 1 OR 2 (SINGLE UNIT) DSI AREA			**4,693,000**	**20,500,000**	**817,880**	**28,611**		**15,417,548**	**41,428,428**
102			**REAGENT HANDLING SYSTEM**									
	21.00.00		CIVIL WORK									
		21.14.00	STRIP & STOCKPILE TOPSOIL									
			STRIP & STOCKPILE TOPSOIL - 12"	EXTEND REAGENT RAIL TRACK	90,000.00 SF	-	-		207	182.87 /MH	37,835	37,835
			STRIP & STOCKPILE TOPSOIL						207		37,835	37,835
		21.41.00	EROSION AND SEDIMENTATION CONTROL									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	EXTEND REAGENT RAIL TRACK	10,000.00 SY	-	-	106,500	345	97.70 /MH	33,690	140,190
			EROSION AND SEDIMENTATION CONTROL					106,500	345		33,690	140,190
		21.53.00	PILING									
			AUGER CAST GROUT PILE, 18 IN DIA BY 60 FT LONG	UNLOADING SHED 300' X 75' WIDE	96.00 EA	345,600	-	-		108.88 /MH		345,600
			PILING			345,600						345,600
		21.71.00	TRACKWORK									
			RAIL, TIE & BALLAST - 136 LB/YD	EXTEND REAGENT RAIL TRACK	4,500.00 TF	-	-	765,000	7,759	81.75 /MH	634,267	1,399,267
			TRACKWORK					765,000	7,759		634,267	1,399,267
			CIVIL WORK			345,600		871,500	8,310		705,792	1,922,892
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			FOUNDATION, 4500 PSI - COMPOSITE RATE	UNLOADING SHED 300' X 75' WIDE	1,389.00 CY	-	-	319,470	11,176	60.03 /MH	670,887	990,357
			CONCRETE					319,470	11,176		670,887	990,357
			CONCRETE					319,470	11,176		670,887	990,357
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			SHELL ONLY, STEEL UNINSULATED 22 GA,	UNLOADING SHED 300' X 75' WIDE x 20' TALL	22,500.00 SF	1,912,500	-			93.00 /MH		1,912,500
			PRE-ENGINEERED BUILDING			1,912,500						1,912,500
			ARCHITECTURAL			1,912,500						1,912,500
	33.00.00		MATERIAL HANDLING EQUIPMENT									
		33.14.00	MATERIAL HANDLING EQUIPMENT									
			REAGENT PNEUMATIC TRAIN UNLOADING EQUIPMENT		3.00 LS	-	1,500,000	-	9,917	68.89 /MH	683,199	2,183,199
			MATERIAL HANDLING EQUIPMENT				1,500,000		9,917		683,199	2,183,199
		33.41.00	MOBILE YARD EQUIPMENT									
			MOBILE YARD EQUIPMENT - TRACKMOBILE	REAGENT HANDLING SYSTEM	3.00 EA	-	675,000	-		68.89 /MH		675,000
			MOBILE YARD EQUIPMENT				675,000					675,000
		33.51.00	RAIL CAR UNLOADER									
			RAIL CAR UNLOADER	IN UNLOADING SHED 300' X 75' WIDE	2.00 LT	-	270,000	-	3,724	93.00 /MH	346,345	616,345
			RAIL CAR UNLOADER				270,000		3,724		346,345	616,345
			MATERIAL HANDLING EQUIPMENT				2,445,000		13,641		1,029,544	3,474,544
	35.00.00		PIPING									
		35.14.10	CARBON STEEL, STRAIGHT RUN									
			8 IN DIA, SCH 40, 8" VACUUM CONVEY PIPING WITH 4 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRAIN UNLOADING SYSTEM	250.00 LF	-	-	10,043	270	77.80 /MH	21,015	31,057
			12 IN DIA, 3/8 IN STD- 2500 LF OF 10"/12" TRANSPORT PRESSURE PIPING W 8 ELBOWS	TO SUPPORT 25 TPH PNEUMATIC TRANSPORT SYSTEM	1,250.00 LF	-	-	124,000	1,983	77.80 /MH	154,259	278,259
			CARBON STEEL, STRAIGHT RUN					134,043	2,253		175,274	309,316
			PIPING					134,043	2,253		175,274	309,316
			102 REAGENT HANDLING SYSTEM			**2,258,100**	**2,445,000**	**1,325,013**	**35,380**		**2,581,496**	**8,609,609**
103			**BYPRODUCT HANDLING SYSTEM**									
	21.00.00		CIVIL WORK									
		21.54.00	CAISSON									
			2.5 FT DIA X 30 FT DEEP CAISSON	ASH SILO AND DSI BYPRODUCT SILOS	125.00 EA	-	-	232,125	3,161	108.88 /MH	344,161	576,286
			CAISSON					232,125	3,161		344,161	576,286

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
ENHANCED DSI SYSTEM W/BAGHOUSE EPC

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			CIVIL WORK					**232,125**	**3,161**		**344,161**	**576,286**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	DSI BYPRODUCT SILOS	614.00 CY	-	-	141,220	4,940	60.03 /MH	296,562	437,782
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE	FLY ASH BLENDING SILO	67.00 CY	-	-	15,410	539	60.03 /MH	32,361	47,771
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	FOR TRUCK SCALES	144.00 CY	-	-	33,120	1,159	60.03 /MH	69,552	102,672
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE	MISC	100.00 CY	-	-	23,000	805	60.03 /MH	48,300	71,300
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	6.00 CY	-	-	1,380	48	60.03 /MH	2,898	4,278
			CONCRETE					**214,130**	**7,491**		**449,673**	**663,803**
			CONCRETE					**214,130**	**7,491**		**449,673**	**663,803**
	23.00.00		**STEEL**									
		23.13.75	**SILO**									
			NEW 250 TON FLYASH BLENDING BIN SILO - 24FT DIA X 72 FT HIGH - ERECTION AND FREIGHT INCLUDED	SILO	1.00 EA		275,000		2,839	73.51 /MH	208,701	483,701
			SILO				**275,000**		**2,839**		**208,701**	**483,701**
			STEEL				**275,000**		**2,839**		**208,701**	**483,701**
	24.00.00		**ARCHITECTURAL**									
		24.35.00	**PRE-ENGINEERED BUILDING**									
			PRE-ENGINEERED BUILDING	8' X 10' BYPRODUCT AREA, TRUCK SCALE HOUSE	1.00 LT	-	-	10,000	115	93.00 /MH	10,690	20,690
			PRE-ENGINEERED BUILDING					**10,000**	**115**		**10,690**	**20,690**
			ARCHITECTURAL					**10,000**	**115**		**10,690**	**20,690**
	26.00.00		**MISCELLANEOUS STRUCTURAL ITEM**									
		26.13.00	**CONCRETE SILO**									
			CONCRETE SILO - DSI BYPRODUCT SILO	ERECTED - 52' DIA	2.00 LS	7,600,000				60.03 /MH		7,600,000
			CONCRETE SILO - BIN VENT FILTERS	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - LEVEL INDICATOR	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - VACUUM PRESSURE RELIEF VALVE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - MANHOLE	INCLUDED W/ SILO	1.00 LS	-	-		0	/MH		
			CONCRETE SILO - SPARE PARTS FOR STARTUP AND SPECIAL TOOLS		1.00 LS	-	10,000			73.51 /MH		10,000
			CONCRETE SILO - FREIGHT		1.00 LS	-	70,000			73.51 /MH		70,000
			CONCRETE SILO			**7,600,000**	**80,000**		**0**			**7,680,000**
			MISCELLANEOUS STRUCTURAL ITEM			**7,600,000**	**80,000**		**0**			**7,680,000**
	33.00.00		**MATERIAL HANDLING EQUIPMENT**									
		33.13.00	**BYPRODUCT HANDLING EQUIPMENT**									
			PNEUMATIC ASH CONVEYORS	EQUIPMENT INCLUDES FREIGHT	1.00 LS	-	5,655,000	-		73.51 /MH		5,655,000
			PNEUMATIC ASH CONVEYORS	INSTALLATION COST	1.00 LT	-		-	51,910	73.51 /MH	3,815,929	3,815,929
			BLOWERS, PRESSURE FEEDERS, TRANSPORT PIPING AND VACUUM / PRESSURE RELIEF VALVES	INCLUDED ABOVE	1.00 LT	-		-		73.51 /MH		
			-DRY UNLOADING SPOUT BELOW THE PRODUCT SILO		2.00 EA	-	60,000	-	258	73.51 /MH	18,977	78,977
			AIRSLIDE CONVEYORS FROM BLENDING BIN MIXER/PIPE CONVEYOR, INCL ALL VALVES AND ACCESSORIES		4.00 EA	-	80,000	-	688	73.51 /MH	50,595	130,595
			-FOUR PIN MIXERS BELOW CONCRETE SILOS INCL ALL VALVES AND ACCESSORIES		1.00 LT	-	540,000	-	3,347	73.51 /MH	246,047	786,047
			BYPRODUCT HANDLING EQUIPMENT				**6,335,000**		**56,204**		**4,131,549**	**10,466,549**
		33.57.00	**SCALE**									
			SCALE - NEW TRUCK SCALES	BYPRODUCT HANDLING SYSTEM	2.00 EA	-	182,000	-	460	68.89 /MH	31,674	213,674
			SCALE				**182,000**		**460**		**31,674**	**213,674**
			MATERIAL HANDLING EQUIPMENT				**6,517,000**		**56,664**		**4,163,223**	**10,680,223**
	34.00.00		**HVAC**									
		34.37.00	**DUST COLLECTOR**									
			DUST COLLECTOR - INSTALLED COST		1.00 LS	113,100	-			64.51 /MH		113,100
			DUST COLLECTOR			**113,100**						**113,100**

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
			HVAC			**113,100**						**113,100**
	35.00.00		**PIPING**									
		35.14.10	**CARBON STEEL, STRAIGHT RUN**									
			12 IN DIA, 3/8 IN STD	CONVEYOR PIPING	2,500.00 LF	-	-	248,000	3,966	77.80 /MH	308,517	556,517
			12 IN DIA, 3/8 IN STD	12" TIE IN PIPING TO BYPRODUCT SILO FROM THE EXISTING 50 TPH FLY ASH PRESSURE SYSTEM	1,500.00 LF	-	-	148,800	2,379	77.80 /MH	185,110	333,910
			CARBON STEEL, STRAIGHT RUN					**396,800**	**6,345**		**493,628**	**890,428**
			PIPING					**396,800**	**6,345**		**493,628**	**890,428**
			103 BYPRODUCT HANDLING SYSTEM			**7,713,100**	**6,872,000**	**853,055**	**76,615**		**5,670,075**	**21,108,230**
104			**UNIT 1 OR 2 FLUE GAS SYSTEM**									
	21.00.00		**CIVIL WORK**									
		21.53.00	**PILING**									
			AUGER CAST GROUT PILE, 18 IN DIA BY 60 FT LONG		138.00 EA	496,800	-	-		108.88 /MH		496,800
			PILING			**496,800**						**496,800**
			CIVIL WORK			**496,800**						**496,800**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									
			SLAB FOUNDATION LESS THAN 2 FT THICK, 4500 PSI, - COMPOSITE RATE		966.00 CY	-	-	222,180	7,772	60.03 /MH	466,578	688,758
			CONCRETE					**222,180**	**7,772**		**466,578**	**688,758**
			CONCRETE					**222,180**	**7,772**		**466,578**	**688,758**
	23.00.00		**STEEL**									
		23.15.00	**DUCTWORK**									
			PANEL CONSTRUCTION, DUCT PLATE WITH STIFFENERS, INTERNAL TRUSSES, AND TURNING VANES		867.40 TN	-	-	2,819,050	59,821	97.70 /MH	5,844,481	8,663,531
			DUCTWORK					**2,819,050**	**59,821**		**5,844,481**	**8,663,531**
		23.21.00	**GIRDER**									
			ROLLED SHAPE STEEL		1,308.00 TN	-	-	3,544,680	45,103	93.00 /MH	4,194,621	7,739,301
			GIRDER					**3,544,680**	**45,103**		**4,194,621**	**7,739,301**
			STEEL					**6,363,730**	**104,924**		**10,039,102**	**16,402,832**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.27.00	**DAMPERS & ACCESSORIES**									
			DAMPERS & ACCESSORIES		800.00 SF	-	240,000		1,471	97.70 /MH	143,743	383,743
			DAMPERS & ACCESSORIES				**240,000**		**1,471**		**143,743**	**383,743**
		31.33.00	**EXPANSION JOINT**									
			EXPANSION JOINTS		1,830.00 LF	-		457,500	5,259	97.70 /MH	513,767	971,267
			EXPANSION JOINT					**457,500**	**5,259**		**513,767**	**971,267**
			MECHANICAL EQUIPMENT				**240,000**	**457,500**	**6,730**		**657,510**	**1,355,010**
	36.00.00		**INSULATION**									
		36.13.00	**DUCT**									
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE		168,220.00 SF	-	-	1,093,430	43,505	69.20 /MH	3,010,558	4,103,988
			DUCT					**1,093,430**	**43,505**		**3,010,558**	**4,103,988**
			INSULATION					**1,093,430**	**43,505**		**3,010,558**	**4,103,988**
			104 UNIT 1 OR 2 FLUE GAS SYSTEM			**496,800**	**240,000**	**8,136,840**	**162,932**		**14,173,748**	**23,047,388**
105			**UNIT 1 OR 2 BOOSTER FANS**									
	21.00.00		**CIVIL WORK**									
		21.54.00	**CAISSON**									
			2.5 FT DIA X 30 FT DEEP CAISSON		40.00 EA	-	-	74,280	1,011	108.88 /MH	110,131	184,411
			CAISSON					**74,280**	**1,011**		**110,131**	**184,411**
			CIVIL WORK					**74,280**	**1,011**		**110,131**	**184,411**
	22.00.00		**CONCRETE**									
		22.13.00	**CONCRETE**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		22.13.00	CONCRETE									
			MAT FOUNDATION LESS THAN 5FT THICK, 4500 PSI - COMPOSITE RATE		600.00 CY	-	-	138,000	4,828	60.03 /MH	289,800	427,800
			CONCRETE					138,000	4,828		289,800	427,800
			CONCRETE					138,000	4,828		289,800	427,800
	31.00.00		MECHANICAL EQUIPMENT									
		31.35.00	FANS & ACCESSORIES (EXCL HVAC)									
			BOOSTER FAN 1.8 MACFM, 4000 HP MOTOR		2.00 EA	-	5,400,000	-	10,345	68.89 /MH	712,655	6,112,655
			FANS & ACCESSORIES (EXCL HVAC)				5,400,000		10,345		712,655	6,112,655
			MECHANICAL EQUIPMENT				5,400,000		10,345		712,655	6,112,655
	36.00.00		INSULATION									
		36.15.00	EQUIPMENT									
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED ON GROUND		1,500.00 SF	-	-	315	11,207	69.20 /MH	775,517	775,832
			EQUIPMENT					315	11,207		775,517	775,832
			INSULATION					315	11,207		775,517	775,832
			105 UNIT 1 OR 2 BOOSTER FANS				**5,400,000**	**212,595**	**27,391**		**1,888,104**	**7,500,699**
106			**UNIT 1 OR 2 BAGHOUSE**									
	21.00.00		CIVIL WORK									
		21.53.00	PILING									
			AUGER CAST GROUT PILE, 18 IN DIA BY 60 FT LONG		326.00 EA	1,173,600	-	-		108.88 /MH		1,173,600
			PILING			1,173,600						1,173,600
			CIVIL WORK			1,173,600						1,173,600
	22.00.00		CONCRETE									
		22.13.00	CONCRETE									
			CONCRETE FOUNDATIONS - COMPOSITE RATE		2,260.00 CY	-	-	519,800	18,184	60.03 /MH	1,091,580	1,611,380
			CONCRETE FOUNDATIONS - COMPOSITE RATE	8' X 10' COMPRESSOR BLDG	6.00 CY	-	-	1,380	48	60.03 /MH	2,898	4,278
			CONCRETE					521,180	18,232		1,094,478	1,615,658
			CONCRETE					521,180	18,232		1,094,478	1,615,658
	23.00.00		STEEL									
		23.25.00	ROLLED SHAPE									
			BUILDING MIX, GALVANIZED	UNIT 1 BAGHOUSE	560.00 TN	-	-	1,534,400	10,299	93.00 /MH	957,793	2,492,193
			ROLLED SHAPE					1,534,400	10,299		957,793	2,492,193
			STEEL					1,534,400	10,299		957,793	2,492,193
	24.00.00		ARCHITECTURAL									
		24.35.00	PRE-ENGINEERED BUILDING									
			PRE-ENGINEERED BUILDING	8' X 10' COMPRESSOR BLDG	1.00 LT	-	-	20,000	115	93.00 /MH	10,690	30,690
			PRE-ENGINEERED BUILDING					20,000	115		10,690	30,690
		24.41.00	SIDING									
			METAL, UNINSULATED, 24 GA, GALVANIZED CORROGATED	BAGHOUSE SKIRTS	68,112.00 SF	-	-	221,364	3,210	79.98 /MH	256,726	478,090
			SIDING					221,364	3,210		256,726	478,090
		24.99.00	ARCHITECTURAL, MISCELLANEOUS									
			MISCELLANEOUS	BAGHOUSE SKIRTS MANDOORS	4.00 EA	-	-	2,000	37	51.46 /MH	1,893	3,893
			ARCHITECTURAL, MISCELLANEOUS					2,000	37		1,893	3,893
			ARCHITECTURAL					243,364	3,362		269,308	512,672
	31.00.00		MECHANICAL EQUIPMENT									
		31.57.00	PARTICULATE REMOVAL									
			BAGHOUSE SYSTEM - INCLUDES PENTHOUSE, BYPASS, DAMPERS, EXP. JOINTS, TUBESHEETS, BAGS, CAGES, CLEANING PIPING, VALVES, BLOWERS, ETC.		1.00 LS	-	20,000,000	-		/MH	13,000,000	33,000,000
			PARTICULATE REMOVAL				20,000,000				13,000,000	33,000,000
			MECHANICAL EQUIPMENT				20,000,000				13,000,000	33,000,000
	36.00.00		INSULATION									
		36.13.00	DUCT									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		36.13.00	**DUCT**									
			MINERAL WOOL INSULATION, 6 IN THICK, 8 LB/CF DENSITY, ALUMINUM LAGGING, INSTALLED IN PLACE	BAGHOUSE INSUILATION TOP, SIDES AND HOPPERS	206,026.00 SF	-	-	1,339,169	53,283	69.20 /MH	3,687,155	5,026,324
			DUCT					**1,339,169**	**53,283**		**3,687,155**	**5,026,324**
			INSULATION					**1,339,169**	**53,283**		**3,687,155**	**5,026,324**
			106 UNIT 1 OR 2 BAGHOUSE			**1,173,600**	**20,000,000**	**3,638,113**	**85,175**		**19,008,734**	**43,820,447**
107			**EARTHWORK**									
	21.00.00		**CIVIL WORK**									
		21.14.00	**STRIP & STOCKPILE TOPSOIL**									
			STRIP & STOCKPILE TOPSOIL - 12"	SITE GRADING	600,000.00 SF	-	-		1,379	182.87 /MH	252,234	252,234
			STRIP & STOCKPILE TOPSOIL - ONSITE	SITE GRADING	160,000.00 CY	-	-		21,149	182.87 /MH	3,867,595	3,867,595
			STRIP & STOCKPILE TOPSOIL						**22,529**		**4,119,830**	**4,119,830**
		21.17.00	**EXCAVATION**									
			EXCAVATION - EXCAVATION , BACKFILL & COMPACT ALL FOUNDATIONS		20,917.00 CY	-	-		7,213	79.78 /MH	575,434	575,434
			EXCAVATION						**7,213**		**575,434**	**575,434**
		21.39.00	**STORM DRAINAGE UTILITIES**									
			STORM SEWER WORK	SITE GRADING	1.00 LT	-	-	110,000	2,299	72.57 /MH	166,828	276,828
			STORM DRAINAGE UTILITIES					**110,000**	**2,299**		**166,828**	**276,828**
		21.41.00	**EROSION AND SEDIMENTATION CONTROL**									
			CRUSHED ROCK SURFACING, 12" DEEP WHITE ROCK	SITE GRADING	66,667.00 SY	-	-	710,004	2,299	97.70 /MH	224,599	934,602
			EROSION AND SEDIMENTATION CONTROL					**710,004**	**2,299**		**224,599**	**934,602**
		21.57.00	**ROAD, PARKING AREA, & SURFACED AREA**									
			BITUMINOUS ROAD - ROAD UPGRADE	BYPRODUCT HAUL ROAD - EAST OF COAL PILE	10,000.00 LF	-	-	500,000	8,046	78.79 /MH	633,943	1,133,943
			BITUMINOUS ROAD - ELIMINATE CHICANE CURVES AT LOW PRESSURE SERVICE WATER PUMPS		1.00 LT	-	-	500,000		78.79 /MH		500,000
			BITUMINOUS ASPHALT (10,000 - 49,999 SF) ROADWORK 24' WIDE 4" ASPHALT	SITE GRADING	1,668.00 LF	-	-	201,828	2,013	78.79 /MH	158,612	360,440
			ROAD, PARKING AREA, & SURFACED AREA					**1,201,828**	**10,059**		**792,555**	**1,994,383**
			CIVIL WORK					**2,021,832**	**44,398**		**5,879,245**	**7,901,077**
			107 EARTHWORK					**2,021,832**	**44,398**		**5,879,245**	**7,901,077**
108			**LAYDOWN AREAS**									
	21.00.00		**CIVIL WORK**									
		21.99.00	**CIVIL WORK, MISCELLANEOUS**									
			CIVIL WORK - CONSTRUCTION LAYDOWN AREAS	FENCING, POWER ETC...	4.00 AC	-	-	312,000	3,678	79.78 /MH	293,444	605,444
			CIVIL WORK, MISCELLANEOUS					**312,000**	**3,678**		**293,444**	**605,444**
			CIVIL WORK					**312,000**	**3,678**		**293,444**	**605,444**
			108 LAYDOWN AREAS					**312,000**	**3,678**		**293,444**	**605,444**
109			**MECHANICAL MISCELLANEOUS**									
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.99.00	**MECHANICAL EQUIPMENT, MISCELLANEOUS**									
			MECHANICAL EQUIPMENT	INCLUDES PIPE RACK - ALLOWANCE	1.00 LS	2,600,000	-	-		68.89 /MH		2,600,000
			MECHANICAL EQUIPMENT, MISCELLANEOUS			**2,600,000**						**2,600,000**
			MECHANICAL EQUIPMENT			**2,600,000**						**2,600,000**
			109 MECHANICAL MISCELLANEOUS			**2,600,000**						**2,600,000**
110			**DEMOLITION/RELOCATION**									
	11.00.00		**DEMOLITION**									
		11.99.00	**DEMOLITION, MISCELLANEOUS**									
			DEMOLITION AND RELOCATION	ALLOWANCE	1.00 LS	975,000	-			107.47 /MH		975,000
			DEMOLITION, MISCELLANEOUS			**975,000**						**975,000**
			DEMOLITION			**975,000**						**975,000**
			110 DEMOLITION/RELOCATION			**975,000**						**975,000**
111			**ACI RELOCATION**									
	22.00.00		**CONCRETE**									

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		22.13.00	**CONCRETE**									
			CONCRETE FOUNDATIONS - COMPOSITE RATE	ACI PORT STAIRTOWER FDNS	30.00 CY	-	-	6,900	241	60.03 /MH	14,490	21,390
			CONCRETE					**6,900**	**241**		**14,490**	**21,390**
			CONCRETE					**6,900**	**241**		**14,490**	**21,390**
	23.00.00		**STEEL**									
		23.17.00	**GALLERY**									
			GALVANIZED GRATING, 1 1/4" DEEP x 3/16" BEARING BAR WITH HOLD DOWN CLIPS	ACI PORT STAIR TOWERS AND PLATFORMS	364.00 SF	-	-	5,460	42	66.40 /MH	2,778	8,238
			DOUBLE PIPE HANDRAIL WITH POSTS AND GUARD PLATES, PAINTED	ACI PORT STAIR TOWERS AND PLATFORMS	218.00 LF	-	-	11,554	45	66.40 /MH	2,995	14,549
			STAIR SYSTEM -	ACI PORT STAIR TOWERS AND PLATFORMS	448.00 SF	-	-	40,768	592	66.40 /MH	39,321	80,089
			GALLERY					**57,782**	**679**		**45,094**	**102,876**
		23.21.00	**GIRDER**									
			ROLLED SHAPE GIRDER - MEDIUM WEIGHT MEMBER 20# TO 40# / LF, 2 COAT PAINTED	ACI PIPE RACK OVER ROADWAY, 35LF X 23 WIDE X 20' HIGH	1.26 TN	-	-	3,415	25	93.00 /MH	2,290	5,704
			GIRDER					**3,415**	**25**		**2,290**	**5,704**
		23.25.00	**ROLLED SHAPE**									
			LIGHT WEIGHT MEMBERS, LESS THAN 20 LB/LF, TWO COAT PAINT	ACI PORT STAIRTOWER FRAMING - 1 TOWER	2.20 TN	-	-	7,876	56	93.00 /MH	5,174	13,050
			ROLLED SHAPE					**7,876**	**56**		**5,174**	**13,050**
			STEEL					**69,073**	**759**		**52,558**	**121,630**
	31.00.00		**MECHANICAL EQUIPMENT**									
		31.25.00	**CRANES & HOISTS**									
			MOTORIZED HOIST - 1 TON	RELOCATED FROM PRESENT PORT LOCATIOIN	1.00 EA	-	-	-	69	68.89 /MH	4,751	4,751
			CRANES & HOISTS						**69**		**4,751**	**4,751**
		31.51.00	**MERCURY REMOVAL EQUIPMENT**									
			ACTIVATED CARBON INJECTION (ACI) - LANCE RELOCATIONS	RELOCATED FROM PRESENT PORT LOCATIOIN (16 PER UNIT)	16.00 EA	-	-	-	184	68.89 /MH	12,669	12,669
			ACTIVATED CARBON INJECTION (ACI) - 40 HP BLOWERS	NEW BLOWERS (2 PER UNIT)	2.00 EA	-	-	40,000	92	68.89 /MH	6,335	46,335
			ACTIVATED CARBON INJECTION (ACI) - REMOVE EXISTING 20 HP BLOWERS	REMOVE EXISTING	1.00 EA	-	-	-	11	68.89 /MH	792	792
			MERCURY REMOVAL EQUIPMENT					**40,000**	**287**		**19,796**	**59,796**
			MECHANICAL EQUIPMENT					**40,000**	**356**		**24,547**	**64,547**
	35.00.00		**PIPING**									
		35.13.25	**FRP, ABOVE GROUND, PROCESS AREA**									
			1.5 IN DIA, TAPER	INJECTION PORTS	6.00 LF	-	-	176	3	77.80 /MH	220	396
			2 IN DIA, TAPER	INJECTION PORTS	8.00 LF	-	-	210	5	77.80 /MH	351	561
			3 IN DIA, TAPER	INJECTION PORTS	20.00 LF	-	-	516	15	77.80 /MH	1,198	1,714
			FRP, ABOVE GROUND, PROCESS AREA					**903**	**23**		**1,769**	**2,672**
		35.14.25	**FRP, STRAIGHT RUN**									
			4 IN DIA, TAPER	NEW ACI PIPING	300.00 LF	-	-	6,330	200	77.80 /MH	15,560	21,890
			FRP, STRAIGHT RUN					**6,330**	**200**		**15,560**	**21,890**
		35.36.00	**PIPE SUPPORTS, RACK**									
			U-BOLT FOR 4 IN PIPE	ACI PIPE	13.50 EA	-	-	41	31	77.80 /MH	2,414	2,455
			SUPPORT SLEEPERS	ACI PIPE	8.50 EA	-	-	2,975	39	77.80 /MH	3,040	6,015
			SUPPORT FOR 4 IN DIA PIPE - USER DEFINED		1.00 EA	-	-	153	9	77.80 /MH	715	868
			SUPPORT FOR 3 IN DIA PIPE - USER DEFINED		2.00 EA	-	-	288	16	77.80 /MH	1,252	1,540
			PIPE SUPPORTS, RACK					**3,457**	**95**		**7,422**	**10,879**
		35.45.00	**VALVES**									
			VALVE - 4" 150 LB CS GATE, FLANGED	ACI AUTO MATIC ISOLATION VALVES (RELOCATE 4 PER UNIT)	4.00 EA	-	-	80	33	77.80 /MH	2,575	2,655
			VALVES					**80**	**33**		**2,575**	**2,655**
			PIPING					**10,769**	**351**		**27,327**	**38,096**
	41.00.00		**ELECTRICAL EQUIPMENT**									
		41.46.00	**MOTOR CONTROL CENTER (MCC), COMPONENT**									

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Project No.: 13027-004
Estimate Date: 10/20/2016
Prep/Rev/App: A. KOCI/MNO/MNO

ENTERGY ARKANSAS
WHITE BLUFF STATION UNITS 1 OR 2 (SINGLE UNIT)
ENHANCED DSI SYSTEM W/BAGHOUSE EPC

Area	Group	Phase	Description	Notes	Quantity	Subcontract Cost	Process Equipment Cost	Material Cost	Man Hours	Crew Rate	Labor Cost	Total Cost
		41.46.00	MOTOR CONTROL CENTER (MCC), COMPONENT									
			FVN STARTER - #4,	NEW BLOWERS	2.00 EA	-	-	9,800	37	64.04 /MH	2,355	12,155
			MOTOR CONTROL CENTER (MCC), COMPONENT					9,800	37		2,355	12,155
			ELECTRICAL EQUIPMENT					9,800	37		2,355	12,155
	42.00.00		RACEWAY, CABLE TRAY & CONDUIT									
		42.15.23	CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY									
			1-1/2 IN DIA, 3 FT LONG INCLUDING (2) CONNECTORS	NEW BLOWERS	2.00 EA	-	-	172	3	62.27 /MH	179	351
			CONDUIT, FLEXIBLE SEALTIGHT ASSEMBLY					172	3		179	351
		42.15.37	CONDUIT, RGS									
			3/4 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	HOIST	225.00 LF	-	-	659	50	62.27 /MH	3,124	3,783
			1-1/2 IN DIA INCLUDING ELBOWS, UNISTRUT SUPPORTS, AND MISC HARDWARE	NEW BLOWERS	200.00 LF	-	-	1,344	65	62.27 /MH	4,065	5,409
			CONDUIT, RGS					2,003	115		7,190	9,193
			RACEWAY, CABLE TRAY & CONDUIT					2,175	118		7,369	9,544
	43.00.00		CABLE									
		43.10.00	CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION									
			CONTROL/INSTRUMENTATION/COMMUNICATION TERMINATION - MISC	ACI RELOCATION	300.00 LF	-	-	960	28	82.56 /MH	2,278	3,238
			CONTROL/INSTRUMENTATION/COMMUNICATION CABLE & TERMINATION					960	28		2,278	3,238
		43.20.00	600V CABLE & TERMINATION									
			600V #8 3/C CU EPR TS-CPE	HOIST	250.00 LF	-	-	1,640	7	82.56 /MH	593	2,233
			600V #4/0 3/C W/G CU EPR TS-CPE	NEW BLOWERS	225.00 LF	-	-	5,364	36	82.56 /MH	2,989	8,353
			TERMINATION - COMPRESSION LUG, #8, 2 HOLE, COPPER	HOIST	6.00 EA	-	-	39	2	82.56 /MH	171	210
			TERMINATION - COMPRESSION LUG, #4, 2 HOLE, COPPER	NEW BLOWERS	6.00 EA	-	-	56	3	82.56 /MH	285	340
			600V CABLE & TERMINATION					7,099	49		4,038	11,136
			CABLE					8,059	76		6,315	14,374
	44.00.00		CONTROL & INSTRUMENTATION									
		44.21.00	INSTRUMENT									
			ACCOUSTIC MONITOR	RELOCATE TO NEW INJECTION LANCES	3.00 EA	-	-		14	65.15 /MH	899	899
			INSTRUMENT						14		899	899
			CONTROL & INSTRUMENTATION						14		899	899
	71.00.00		PROJECT INDIRECT									
		71.25.00	CONSULTANT, THIRD PARTY									
			COMPUTATIONAL FLUID DYNAMIC ANALYSIS (CFD)	ACI SYSTEM	1.00 LS	100,000	-			/MH		100,000
			CONSULTANT, THIRD PARTY			100,000						100,000
			PROJECT INDIRECT			100,000						100,000
			111 ACI RELOCATION			**100,000**		**146,775**	**1,954**		**135,859**	**382,635**
112			**ELECTRICAL**									
	41.00.00		ELECTRICAL EQUIPMENT									
		41.99.00	ELECTRICAL EQUIPMENT, MISCELLANEOUS									
			ELECTRICAL EQUIPMENT, MISCELLANEOUS	ALLOWANCE	1.00 LS	16,250,000	-			64.04 /MH		16,250,000
			ELECTRICAL EQUIPMENT, MISCELLANEOUS			16,250,000						16,250,000
			ELECTRICAL EQUIPMENT			16,250,000						16,250,000
			112 ELECTRICAL			**16,250,000**						**16,250,000**
113			**INSTRUMENTATION**									
	44.00.00		CONTROL & INSTRUMENTATION									
		44.99.00	CONTROL & INSTRUMENTATION, ALLOWANCE									
			CONTROL & INSTRUMENTATION	ALLOWANCE	1.00 LS	2,210,000	-			65.15 /MH		2,210,000
			CONTROL & INSTRUMENTATION, ALLOWANCE			2,210,000						2,210,000
			CONTROL & INSTRUMENTATION			2,210,000						2,210,000
			113 INSTRUMENTATION			**2,210,000**						**2,210,000**

APPENDIX B: 1PP NO_X CONTROLS STUDIES

- S&L's May 16, 2013 *NO_X Control Technology Cost and Performance Study, Entergy Services, Inc. – White Bluff and Lake Catherine*, SL-011439

Prepared for
Gill Elrod Ragon Owen & Sherman, P.A.

NOx Control Technology Cost and Performance Study

Entergy Services, Inc.
White Bluff & Lake Catherine

SL-011439
Final Report
Rev. 4

May 16, 2013
Project No.: 13027-001

Prepared by

Sargent & Lundy LLC

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White Bluff & Lake Catherine
NOx Control Technology Cost and Performance Study

ISSUE SUMMARY AND APPROVAL PAGE

This is to certify that this report has been prepared, reviewed and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0405, which is based on ANSI/ISO/ASSQC Q9001 Quality Management Systems.

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ENTERGY SERVICES, INC.

WHITE BLUFF AND LAKE CATHERINE

NO_X CONTROL TECHNOLOGY COST AND PERFORMANCE STUDY

CERTIFICATION PAGE

Sargent & Lundy, L.L.C. is registered in the State of Arkansas to practice engineering.
The registration number is 620.

I certify that this study was prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Arkansas.

Certified By: Sean C. McHone Date: 5/16/2013

Seal:

STATE OF ARKANSAS
LICENSED PROFESSIONAL ENGINEER
No. 15308
SEAN C. McHONE

Sean C. McHone
5/16/2013

Issue:	Date:	Certified By:	Pages Certified:

1. INTRODUCTION

1.1. OBJECTIVE

The intent of this study is to provide Gill Elrod Ragon Owen & Sherman, P.A. with a technology evaluation and cost estimates for available methods of NOx control at two Entergy stations including: White Bluff – Units 1 & 2, the White Bluff Auxiliary Boiler, and Lake Catherine – Unit 4. The information developed in this study will be used to create a BART analysis, for compliance with Arkansas DEQ regulations.

1.2. UNIT DESCRIPTIONS

1.2.1. White Bluff - Units 1 & 2

White Bluff - Units 1 & 2 are Alstom-designed, tangentially-fired, pulverized-coal fueled units, rated at 815 MWnet and 844 MWnet respectively. Powder River Basin coal is the primary fuel source for Units 1 & 2. Currently, the units have no NOx controls installed.

1.2.2. White Bluff Auxiliary Boiler

The White Bluff Auxiliary boiler is a small industrial boiler capable of producing 140,000 lb/hr of steam, used for startup of the White Bluff coal units. The auxiliary boiler combusts No. 2 Diesel Oil, and does not have any existing NOx controls.

1.2.3. Lake Catherine - Unit 4

Lake Catherine - Unit 4 is an Alstom-designed, tangentially-fired, natural gas fueled unit, capable of generating 558 MWnet. The unit was originally designed as a dual-fuel unit, able to use natural gas or No. 2 Fuel Oil as fuel. This evaluation will be for natural gas firing only. If No. 2 Fuel Oil is to be combusted in the future, a separate BART analysis will be submitted. The unit currently has no NOx controls.

1.3. ESTIMATE METHODOLOGY

1.3.1. Capital Cost Estimates

S&L's capital cost estimates for retrofit NOx control technologies for White Bluff Units 1&2, White Bluff Auxiliary Boiler and Lake Catherine – Unit 4 encompass the equipment, material, labor, and all other required direct costs. The underlying assumption is that the project will be implemented on a multiple-contracting basis. The capital cost estimates provided herein are "total plant cost," and include the following:

- Equipment and material
- Installation labor
- Indirect field costs and BOP engineering
- Contingency (percentage varies with project size)
- Erection contractor profit (at 10% of material and labor)
- General and administration (at 5% of material and labor)
- Freight on material (at 5% of material)
- Freight on equipment (included with equipment costs)
- Sales/use tax (not included)
- Startup and commissioning (at 1% of construction cost)
- Spare parts (included with equipment costs)
- Consumables (0.5% of material and labor)

Owner's engineering and other Owner's costs were not included. Engineering, Procurement & Project Services and Contingency varied depending on the size of the project. License fees and royalties are not expected for the proposed control strategies. The Basis of Estimate and capital costs are summarized in Appendix A.

Capital cost estimates were calculated in one of three ways. In some cases, vendors were contacted to provide budgetary estimates for equipment and labor. These vendor's costs were used to create Total Installed Cost Estimates. In situations where Sargent & Lundy had performed cost estimates for these units previously, the existing cost estimates were updated to reflect current equipment, labor, and currency values. Remaining cost estimates were developed from similar projects that Sargent & Lundy has completed and adjusted for unit size.

1.3.2. Operating and Maintenance Cost Estimates

Operating and Maintenance Costs for White Bluff - Units 1 & 2 and Lake Catherine – Unit 4 were developed from similar projects Sargent & Lundy has completed. Costs were applied to the units on a $/kW basis, and assuming a 10% capacity factor for Lake Catherine – Unit 4, and 76% for White Bluff—Units 1 & 2. Operating and Maintenance Costs include the following costs:

- Fixed Operating and Maintenance
- Variable Operating and Maintenance
- Fuel Impact Costs

For the White Bluff Auxiliary boiler, costs were developed using Office of Air Quality Planning and Standards (OAQPS) calculations, assuming a 10% capacity factor.

1.4. DESIGN TARGET vs. COMPLIANCE NO_X EMISSION RATES

NOx control systems retrofit onto existing coal or gas-fired boilers are typically designed to achieve varying levels of NOx removal efficiencies from 10%-94%, depending on the control technologies selected. Controlled NOx emissions fluctuate during normal boiler operation in response to a number of design/operating parameters including, but not necessarily limited to: inlet NOx concentrations, boiler load, load changes, particulate matter loading, flue gas temperatures, flue gas velocities and mixing, catalyst volume and surface area, NH_3:NOx stoichiometric ratio, catalyst age and activity, and the quantity of ammonia slip deemed to be acceptable.

The "design target" NOx emission rate is the rate that a NOx control technology vendor would be willing to guarantee. Based on engineering judgment, and taking into consideration emissions data from existing coal- and gas-fired sources, a compliance margin above the design target is recommended for high removal efficiency/low emission rate technologies (such as SCR) to establish an enforceable permit limit based on long-term (e.g., annual average) emissions. Additional compliance margin would be required to establish enforceable permit limits based on shorter-term averaging times. For example, S&L recommends a compliance margin of 0.02 to 0.03 lb/MMBtu for coal units and 0.01 to 0.02 lb/MMBtu for gas units above the design target emission rate for permit limits based on a 30-day rolling average for control strategies including SCR. The NOx control technology emission rates for strategies including SCR in this report have been adjusted to include margin for compliance. The permit level NOx emission rates for SCR are higher by 0.02 to 0.03 lb/MMBtu for coal units and 0.01 to 0.02 lb/MMBtu for gas units.

2. WHITE BLUFF - UNITS 1 & 2

2.1. FUEL SWITCHING OPTIONS

2.1.1. Natural Gas

For White Bluff Units 1 & 2, fuel switching is not a feasible option. Typically, units could be switched from coal to natural gas or propane for NOx reductions. The nearest natural gas pipeline to the White Bluff facility is approximately 20 miles away. Construction of a pipeline is currently estimated at $2M per mile resulting in a cost of $40M to bring natural gas to the site, not including the additional upgrades the boiler would require to burn natural gas instead of coal.

2.1.2. Propane

White Bluff – Units 1 & 2 are each over 800 MWnet. Units of this size require more heat input than can practically be achieved with a propane delivery and storage system. Since a propane pipeline is not available, fuel switching to propane is not a feasible option.

2.2. COMBUSTION CONTROLS

2.2.1. Low NOx Burners and Over-Fire Air

Low NOx burners (LNB) limit NOx formation by controlling both the stoichiometric and temperature profiles of the combustion flame in each burner flame envelope. Control is achieved with design features that regulate the aerodynamic distribution and mixing of the fuel and air, yielding reduced oxygen (O_2) in the primary combustion zone, reduced flame temperature, and reduced residence time at peak combustion temperatures. The combination of these techniques produces lower NOx emissions during the combustion process.

OFA involves injecting combustion air downstream of the fuel-rich primary combustion zone by using over-fire air or side-fired air ports. The fuel-rich mixture that is fed to the burners reduces the flame temperature and oxygen concentration thus reducing the formation of thermal NOx. Generally, OFA is more effective when used with low nitrogen content fuels such as natural gas and propane, since OFA is more effective in controlling thermal NOx rather than fuel NOx.

LNB + OFA is a technically feasible retrofit solution for White Bluff - Units 1 & 2. The combination of LNB + OFA is capable of achieving a NOx emission rate of 0.15 lb/MMBtu. From Unit 1's baseline emissions of 0.33 lb/MMBtu, this is approximately 54.5% NOx removal efficiency. A removal efficiency of 61.5% can be expected for Unit 2, with a baseline NOx of 0.39 lb/MMBtu.

2.2.2. Flue Gas Recirculation (FGR)

NOx reduction efficiency data for coal-fired units with FGR are limited. The amount of NOx reduction achievable with FGR depends primarily on the fuel nitrogen content and amount of FGR used. Generally, FGR is more effective when used with low nitrogen content fuels such as natural gas and propane, since FGR is more effective in controlling thermal NOx rather than fuel NOx. Industry experience with FGR on coal-fired units for steam temperature control has shown very high maintenance on the gas recirculation fans due to erosion and corrosion. Many of the units with FGR for steam temperature control have removed the recirculation fans from service. The NOx control achievable on tangentially fired units like White Bluff – Units 1&2 with LNB+OFA has been comparable to that of FGR at lower capital and O&M cost. Currently, FGR technology is not offered by OEMs for coal-fired units. For these reasons, FGR is not a feasible technology for the White Bluff coal-fired units.

2.2.3. Neural Network

Neural Network (NN) systems are on-line enhancements to digital control systems (DCS) and plant information systems that improve boiler performance parameters such as heat rate, NOx emissions, and CO levels. The Neural Network model is based on historical data and parametric test data. The software applies an optimizing procedure to identify the best set points for the boiler, which are implemented without operator intervention (closed loop), or, at the plant's discretion, conveyed to the plant operators for implementation (open loop).

A Neural Network system is a technically feasible retrofit option for the White Bluff units. A NN is already installed for monitoring and controlling heat rate at White Bluff – Units 1&2. The reprogrammed

NN would be optimized first for minimizing NOx emissions and second for heat rate. It is possible that heat rate may increase as a result. Based on information available from vendors, it is expected that Neural Network technology on a coal-fired boiler can maintain the guaranteed performance of low NOx burners and potentially can achieve approximately 10% NOx reduction over a period of years, resulting in NOx emission rates of 0.30 lb/MMBtu, at max load for Unit 1, and of 0.35 lb/MMBtu for Unit 2. The cost for modifying the existing NNs at White Bluff is estimated to be approximately $250,000 per unit.

2.3. POST COMBUSTION CONTROLS

2.3.1. Selective Non-Catalytic Reduction

Selective non-catalytic reduction (SNCR) involves the direct injection of ammonia (NH_3) or urea ($(CO(NH_2)_2)$) into the furnace at high flue gas temperatures (approximately 1600 ºF – 2000 ºF). The ammonia or urea reacts with NOx in the flue gas to produce N_2 and water as shown in the following equations:

$$(CO(NH_2)_2) + 2NO + \frac{1}{2}O_2 \rightarrow 2H_2O + CO_2 + 2N_2$$

$$2NH_3 + 2NO + \frac{1}{2}O_2 \rightarrow 2N_2 + 3H_2O$$

Flue gas temperature at the point of reactant injection can greatly affect NOx removal efficiencies and the quantity of NH_3 or urea that will pass through the furnace unreacted (referred to as NH_3 slip). In general, SNCR reactions are effective at a temperature range of 1600 ºF – 2000 ºF. At temperatures below the desired operating range, the NOx reduction reactions diminish and unreacted NH_3 emissions increase. Above the desired temperature range, NH_3 is oxidized to NOx resulting in low NOx reduction efficiencies.

Mixing of the reactant and flue gas within the reaction zone is also an important factor to SNCR performance. In large boilers, the physical distance over which reagent must be dispersed increases, and the surface area/volume ratio of the convective pass decreases. Both of these factors make it difficult to achieve good mixing of reagent and flue gas, delivery of reagent in the proper temperature window, and sufficient residence time of the reactant and flue gas in that temperature window.

The temperatures and residence times required for an SNCR system make it a feasible option for NOx reduction for White Bluff - Units 1 & 2. Based on vendor input, a unit with no additional controls and a baseline NOx of 0.33 lb/MMBtu could see a 26.5% NOx reduction, for an outlet rate of 0.24 lb/MMBtu on Unit 1. For Unit 2, with a baseline NOx of 0.39 lb/MMBtu could see a 26.5% reduction to an outlet rate of 0.29 lb/MMBtu.

SNCR systems can also be installed in conjunction with LNB + OFA controls. On these coupled systems, the starting NOx of approximately 0.15 lb/MMBtu can be reduced to 0.13 lb/MMBtu, for a total reduction (LNB + OFA + SNCR) of around 61% for Unit 1 and 67% for Unit 2. In addition to the SNCR equipment, the process requires additional demineralized water at a rate of 170 gpm. An additional water treatment system capable of providing the required flows is included in the capital cost. The cost of the SNCR equipment for the combination technology would be approximately 10% lower based on the lower starting NOx rate with LNB/OFA.

2.3.2. Selective Catalytic Reduction

Selective Catalytic Reduction (SCR) involves injecting ammonia into boiler flue gas in the presence of a catalyst to reduce NOx to N_2 and water. The overall SCR reactions are:

$$4NH_3 + 4NO + O_2 \rightarrow 4N_2 + 6H_2O$$
$$8NH_3 + 4NO_2 + 2O_2 \rightarrow 6N_2 + 12H_2O$$

The optimal temperature range depends on the type of catalyst used, but is typically between 560 °F and 800 °F to maximize NOx reduction efficiency and minimize ammonium sulfate formation. Below this range, ammonium sulfate is formed resulting in catalyst deactivation. Above the optimum temperature, the catalyst will sinter and thus deactivate rapidly. Another factor affecting SCR performance is the condition of the catalyst material. As the catalyst degrades over time or is damaged, NOx removal decreases which is typically compensated by increased ammonia slip.

SCR has been installed on many large coal-fired and some gas-fired boilers and is considered a feasible technology. Because of the expense of the reagent, SCR systems are usually installed on units with existing LNB + OFA systems, or the upgrades are done simultaneously. At White Bluff, an SCR+LNB/OFA system is capable of removing approximately 90% of NOx emissions on a continuous long-term basis. With a starting NOx of 0.33 lb/MMBtu (Unit 1) to 0.39 lb/MMBtu (Unit 2), an SCR can be expected to achieve permitted emissions compliance at 0.055 lb/MMBtu.

2.4. CAPITAL COSTS

Capital costs for the technically feasible control options for the White Bluff coal units are listed in Table 2.1. The cost of SCR on White Bluff – Unit 1 is higher than for White Bluff – Unit 2 because the ductwork arrangement is different and there is more total ductwork, support steel, and foundations for Unit 1.

Table 2.1: Expected NOx Emissions and Capital Costs, White Bluff Units 1 & 2

Technology	**Controlled NOx (lb/MMBTU)**		**Unit 1 Total Installed Capital Cost (2012$)**	**Unit 2 Total Installed Capital Cost (2012$)**
	Unit 1	Unit 2		
Baseline	0.33	0.39	NA	NA
LNB + OFA	0.15	0.15	7,804,000[1]	11,831,000
Neural Network	0.30	0.35	250,000[2]	250,000[2]
SNCR	0.24	0.29	9,372,000	9,372,000
SNCR (+ LNB/OFA)	0.13	0.13	16,290,000[1]	20,317,000
SCR (+ LNB/OFA)	0.055	0.055	202,601,000	178,240,000

1. LNB/OFA material already purchased for Unit 1. The total cost to Entergy would be the same for Unit 1 as shown for Unit 2.
2. The cost for modifying the existing neural networks on Units 1 & 2.

2.5. OPERATING AND MAINTENANCE COSTS

Annual Operating and Maintenance costs for each of the feasible technologies for White Bluff Units 1 & 2 are shown in Table 2.2. Costs were calculated assuming full load operation, and a capacity factor (C.F.) of 76%.

Table 2.2: Operating and Maintenance Costs, White Bluff – Units 1 & 2 (Based on a C.F. of 76%)

	Unit 1			Unit 2		
Technology	**Variable O&M[1] Costs (2012$)**	**Fixed O&M Costs (2012$)**	**Total O&M Costs (2012$)**	**Variable O&M[1] Costs (2012$)**	**Fixed O&M Costs (2012$)**	**Total O&M Costs (2012$)**
LNB + OFA	--	142,000	142,000	--	142,000	142,000
Neural Network	--	50,000	50,000	--	50,000	50,000
SNCR	5,658,000	169,000	5,827,000	6,671,000	169,000	6,840,000
SNCR (+ LNB/OFA)	4,538,000	311,000	4,849,000	4,542,000	311,000	4,853,000
SCR (+ LNB/OFA)	2,836,000	608,000	3,444,000	2,858,000	608,000	3,466,000

Note 1: Variable O&M includes fuel cost impacts.

Note 2: The current costs of ammonia and urea are highly volatile and may exceed the values used in this report.

3. WHITE BLUFF AUXILIARY BOILER

3.1. FUEL SWITCHING

The White Bluff auxiliary boiler is a B&W, single burner boiler, firing No. 2 diesel oil, rated at 140,000 lb/hr of steam. Fuel switching to natural gas or propane is not practical because the nearest natural gas pipeline is 20 miles from the site. The costs to convert the White Bluff aux boiler to either natural gas or propane would not be justified based on the low capacity factor.

3.2. COMBUSTION CONTROLS

3.2.1. Low NOx Burners + Over-Fire Air

For an auxiliary boiler such as the one at White Bluff, NOx reduction can be achieved with a combination of technologies. LNB + OFA for aux boilers achieve NOx reduction under the same principles as a coal boiler. By modifying temperatures and fuel-rich areas, less NOx is generated. LNB + OFA are feasible technologies for auxiliary boilers, and vendor data indicates that the White Bluff Aux Boiler could achieve 35% reduction with LNB + OFA, for a final emission of 0.11 lb/MMBtu. The baseline NOx emissions from the White Bluff aux boiler are calculated using US EPA's AP-42 emissions factors.

3.2.2. Flue Gas Recirculation

NOx reduction efficiency data for oil-fired units with FGR are limited. The amount of NOx reduction achievable with FGR depends primarily on the fuel nitrogen content and amount of FGR used. Generally, FGR is more effective when used with low nitrogen content fuels such as natural gas and propane, since FGR is more effective in controlling thermal NOx rather than fuel NOx. FGR is a feasible technology for the White Bluff auxiliary boiler. With a recirculation of 15% of the flue gas, the unit could expect to see 13% NOx removal, for an outlet of 0.149 lb/MMBtu.

3.2.3. Low NOx Burners + Over-fire Air + Flue Gas Recirculation

These three technologies are often installed simultaneously for greater NOx reduction. A vendor has proposed that for the White Bluff aux boiler, a combination of LNB + OFA + FGR will reduce the NOx from 0.171 lb/MMBtu to 0.100 lb/MMBtu when burning No. 2 Fuel Oil. This reduction of 42% will come from a new LNB and OFA system and the recirculation of 15% of the flue gas flow.

3.2.4. Neural Network

The White Bluff Auxiliary Boiler is not a candidate for a neural network (NN) because there are few controllable variables to be optimized. The aux boiler also uses a relatively new PLC control system.

3.3. POST COMBUSTION CONTROLS

3.3.1. Selective Non-Catalytic Reduction

SNCR control has proven to be difficult to apply to industrial boilers because of the temperature and mixing requirements, especially industrial boilers that modulate or cycle frequently. In order to effectively reduce NOx emissions, the reactant (ammonia or urea) must be injected into the flue gas within a specific flue gas temperature window, and must remain within that temperature window for a sufficient residence time. In industrial boilers that cycle frequently, the location of the specific exhaust gas temperature window is constantly changing. Thus, SNCR has not been effective on industrial boilers that have high turndown capabilities and modulate or cycle frequently. Based on the temperature and residence time requirements associated with effective NOx reduction, the planned use of the auxiliary boiler, and the limited availability of SNCR control systems for industrial boilers, it has been determined that SNCR is not technically feasible for the White Bluff auxiliary boiler.

3.3.2. Selective Catalytic Reduction

SCR for NOx control on auxiliary boilers is not common, because of their cycling operation, and the use of fuel oil. SCRs have critical operating temperature ranges, which are difficult to achieve and maintain in short periods of time. Because of the sulfur content of diesel oil, the SCR catalyst can become poisoned, resulting in a lower NOx removal efficiency. With this lower efficiency and high cost, an SCR is not considered a feasible technology.

3.4. CAPITAL COST ESTIMATES

Capital costs for the technically feasible control options for the White Bluff Auxiliary Boiler are listed in Table 3.1.

Table 3.1: Expected NOx Emissions and Capital Costs, White Bluff Units 1 & 2

Technology	Controlled NOx	Total Installed Capital Cost (2012$)
Baseline	0.171	--
LNB	0.111	255,000
OFA	0.137	231,000
FGR	0.149	366,000
LNB + OFA + FGR	0.100	852,000

3.5. OPERATING AND MAINTENANCE COST ESTIMATES

Annual Operating and Maintenance costs for each of the feasible technologies for White Bluff Units 1 & 2 are shown in Table 3.2. Costs were calculated assuming full load operation and a capacity factor (C.F.) of 10%.

Table 3.2: White Bluff Auxiliary Boiler Operating and Maintenance Costs (Based on a C.F. of 10%)

Technology	**Variable O&M Costs (2012$)**	**Fixed O&M Costs (2012$)**	**Total O&M Costs (2012$)**
LNB	4,000	4,000	8,000
OFA	5,000	4,000	9,000
FGR	0	7,000	7,000
LNB + OFA + FGR	9,000	15,000	24,000

4. LAKE CATHERINE - UNIT 4

4.1. FUEL SWITCHING

Lake Catherine - Unit 4 already combusts natural gas, which has the lowest NOx formation of potential fuels. Because fuel switching would not result in a lower NOx emission rate, it is not a feasible option for NOx control.

4.2. COMBUSTION CONTROLS

4.2.1. Burners-Out-Of-Service

Burners-Out-Of-Service (BOOS) allows operators to stop fuel flow to certain burners in the boiler (typically the top level of burners), while air flow is maintained. By removing fuel from the top row of burners, the combustion air becomes over-fire air and the production of thermal NOx is reduced. While the reduction of NOx can be significant, the tradeoff is a reduced generating capacity, if no further modifications to the firing system are made. BOOS is a feasible technology for Lake Catherine - Unit 4. Testing of BOOS at Lake Catherine by Entropy Technology & Environmental Consultants, Inc. (ETEC) with the top levels of burners out resulted in a maximum load of 405 MW, a 28% reduction in capacity, and NOx levels of 0.12 lb/MMBtu, a reduction of 55% from the baseline while using the existing burners.

Recovery of the lost unit capacity is possible by increasing the fuel fired in the three levels of burners that remain in service. The burners remaining in service would have to increase fuel throughput by 25%. The natural gas piping to each burner may also have to be increased in size for the higher fuel flow rates. ETEC, Inc. has experience with several units similar in design to Lake Catherine – Unit 4 that have been able to achieve full capacity by increasing the original “high” burner header pressure (BHP) to increase fuel flow to the burners (See Appendix D). The increase in BHP from 42 to 50 psig at Lake Catherine – Unit 4 would increase fuel flow by 25% and the burners would be operated “fuel rich”, lowering NOx formation. Using this approach would reduce NOx emissions at a small capital cost. The costs for BOOS with recovery of full unit capacity were based on vendor cost information for a previous project adjusted on a $/kW basis to Lake Catherine – Unit 4 and escalated to 2012. The cost provided does not include any modifications to the boiler. A boiler OEM or consultant would need to evaluate the existing fuel piping, superheat and reheat attemperation sprays, tube metal temperatures and burner tilt positions for the new operating conditions. The expected NOx reduction would range from 40% at low load to 50% at full load and NOx levels of 0.24 lb/MMBtu.

4.2.2. Low NOx Burners + Over-Fire Air

Low NOx Burners and Over-Fire Air for a gas-fired unit function similarly to coal-fired boilers, as discussed for White Bluff - Units 1 & 2. By controlling the temperature and stoichiometric profiles, the NOx produced as a result of thermal processes is reduced.

LNB + OFA are commonly installed on gas-fired units of this size, and are a feasible retrofit technology for Lake Catherine - Unit 4. With the installation of LNB + OFA, Lake Catherine could expect a 60% reduction in NOx, from 0.4825 lb/MMBtu to 0.19 lb/MMBtu.

4.2.3. Flue Gas Recirculation

Flue Gas Recirculation (FGR) reduces NOx by recirculating flue gas to the furnace. This recirculated gas has lower oxygen content than ambient air usually used for combustion. Lower oxygen and lower flame temperatures reduces thermal NOx formation. FGR can be installed on a unit in two ways. Traditional FGR installations require a new recirculation fan. Induced FGR, or IFGR, installs ductwork from the air preheater outlet to the suction of the existing forced draft fan. IFGR does not require a separate fan, but due to FD fan capacity restrictions, IFGR is not available at higher loads, because the forced draft fans were not designed for the higher air and gas flow rate.

FGR is technically feasible on Lake Catherine - Unit 4 and can result in reductions of 60%. For Unit 4, this would be equivalent to NOx emissions of 0.19 lb/MMBtu.

4.2.4. Water Injection

Water injection operates on similar principles to LNB + OFA and FGR. By injecting water into the furnace, the temperature of the flue gas is reduced, thereby reducing the amount of thermal NOx formed.

Water injection is a feasible technology for Lake Catherine - Unit 4, and can reduce NOx emissions by 9% at full load. Water injection is typically used as a trimming technology at high load. On Unit 4, the emissions would be lowered from the baseline of 0.4825 lb/MMBtu to 0.44 lb/MMBtu.

4.2.5. Neural Network

Lake Catherine – Unit 4 could also install a neural network (NN) but for the low capacity factor and current lack of NOx CEMS, a NN would not be practical. Several of the other technologies would provide greater NOx reductions.

4.3. POST COMBUSTION CONTROLS

4.3.1. Selective Non-Catalytic Reduction

Selective Non-Catalytic Reduction for gas-fired units operates under the same principles as SNCR for coal-fired units, with a few design changes. One of the keys of SNCR design is adequate chemical distribution at the right temperature for the reaction. Lake Catherine - Unit 4 has horizontal superheat platens, which requires multiple-nozzle lances to distribute the urea; the gas pattern does not provide adequate distribution. The reaction and temperature requirements are the same for gas-fired boilers as they are for coal-fired units.

SNCR has been installed on boilers such as Lake Catherine 4 and is considered a feasible technology, although the residence time in the desired temperature zone is lower for a gas-fired unit and the temperature window moves as unit load changes. The unit could expect to see reductions in NOx from the baseline of 0.4825 lb/MMBtu to 0.29 lb/MMBtu, or approximately 40% reduction at full load. In addition to the SNCR equipment, the process requires additional demineralized water at a rate of 85 gpm. An additional water treatment system capable of providing the required flows is included in the capital cost.

SNCR can be combined with LNB/OFA to achieve a combined NOx removal efficiency of 70% for an outlet emission of approximately 0.14 lb/MMBtu,

4.3.2. Selective Catalytic Reduction

Selective Catalytic Reduction units are similar for gas and coal-fired units. Ammonia or urea reagent reacts with NOx to form nitrogen and water, in the presence of a catalyst. Because gas boilers do not have particulate control or sulfur dioxide control, they typically have a shorter distance from the economizer outlet to the stack, which may result in long ductwork runs to and from the SCR.

SCR is a feasible technology for Lake Catherine - Unit 4. Combined with a LNB + OFA installation, which is typical of SCR installations, the unit could achieve a combined NOx removal efficiency of 94%, for a permitted outlet NOx of 0.03 lb/MMBtu at full load. This includes a margin for compliance as discussed in Section 1.4. Without the LNB + OFA installed, the SCR can also be designed to achieve 90% removal efficiency for an outlet emission of approximately 0.05 lb/MMBtu.

4.4. CAPITAL COST ESTIMATES

Capital costs for the technically feasible control options for Lake Catherine - Unit 4 are listed in Table 4.1.

Table 4.1: Expected NOx Emissions and Capital Costs, Lake Catherine Unit 4

Technology	**Controlled NOx (lb/MMBtu)**	**Total Installed Capital Cost (2012$)**
Baseline	0.4825[1]	--
BOOS (at full capacity)	0.24	893,000
LNB / OFA	0.19	8,762,000
IFGR (below 500 MW)	0.39	2,166,000
FGR	0.19	11,489,000
Water Injection	0.44	2,177,000
SNCR	0.29	15,507,000
SNCR (+ LNB/OFA)	0.14	24,269,000
SCR	0.05	59,587,000
SCR (+ LNB/OFA)	0.03	68,349,000

Note 1: The baseline NOx rate is the maximum daily emission rate from the 2001-2003 baseline period.

4.5. OPERATING AND MAINTENANCE COST ESTIMATES

Annual Operating and Maintenance costs for each of the feasible technologies for Lake Catherine - Unit 4 are shown in Table 4.2. Costs were calculated assuming full load operation, and a capacity factor (C.F. of 10%).

Table 4.2: Annual Operating and Maintenance Costs, Lake Catherine Unit 4 (Based on C.F. of 10%)

Technology	**Variable O&M[1,2] Costs (2012$)**	**Fixed O&M Costs (2012$)**	**Total O&M Costs (2012$)**
BOOS	--	21,000	21,000
LNB + OFA	--	210,000	210,000
IFGR	--	52,000	52,000
FGR	142,000	207,000	349,000
Water Injection	486,000	52,000	538,000
SNCR	1,640,000	279,000	1,919,000
SNCR (+ LNB/OFA)	462,000	489,000	951,000
SCR	254,000	358,000	612,000
SCR (+ LNB/OFA)	268,000	568,000	836,000

Note 1: Variable O&M includes fuel cost impacts.

Note 2: The current costs of ammonia and urea are highly volatile and may exceed the values used in this report.

APPENDIX A: CAPITAL COST ESTIMATE

1. BASIS OF ESTIMATES

2. CONCEPTUAL COST ESTIMATE SUMMARY SHEETS

Basis of Estimate

Estimates:
31813A – Lake Catherine, Unit 4 - Low NOx Burners and Over Fired Air
31814A – Lake Catherine, Unit 4 - SCR
31815A – Lake Catherine, Unit 4 - SNCR
31816A – White Bluff, Unit 1 - Low NOx Burners and Over Fired Air
31817A – White Bluff, Unit 1 – SCR
31818A – White Bluff, Unit 2 – SCR
31819A – White Bluff, Units 1 and 2 – SNCR
31820A – White Bluff, Auxiliary Boiler – Low NOx Burners, Over Fired Air, and Flue Gas Recirculation
31832A – White Bluff, Unit 2 - Low NOx Burners and Over Fired Air

General Information

Project Type – Compliance study for Lake Catherine Unit 4 and White Bluff Station Units 1&2.
Type of estimates – Conceptual Cost Estimate for the SCR Case and Order of Magnitude Cost Estimates for all other cases.
Project location – White Bluff: Close to Pine Bluff, Arkansas; Lake Catherine: Close to Mahern, AR
MW rating: White Bluff Unit 1: 815 MW, Unit 2: 844 MW; Lake Catherine Unit 4: 558 MW
Unique site issues – Existing Site.
Contracting strategy – Multiple Lump Sum.

The major components of the capital cost consist of equipment, field materials and supplies, direct labor, indirect field labor, and indirect construction costs. The capital cost was determined through the process of estimating the cost of equipment, components and bulk quantity.

The cost estimates are based largely on Sargent & Lundy LLC experience on similar projects. Detailed engineering has not been performed to firm up the project details, and specific site characteristics have not been fully analyzed. We have attempted to assign allowances where necessary to cover issues that are likely to arise but are not clearly quantified at this time.

Estimate Development

The cost estimates for the Low NOx Burners/Over Fired Air cases were based on a previous estimate prepared in 2011. Equipment costs were escalated to current pricing level. Also, material and labor have been updated to 2012 pricing.
Cost estimates for the SNCR technology (two cases) were based on budgetary quotes received from engineering and on previous estimates.
The cost estimates for the White Bluff SCR was mainly based on similar size and scope cost estimates from other projects and structural takeoffs from engineering. All equipment common to both Units was divided evenly between the two estimates.
The cost estimate for Lake Catherine SCR was adjusted from another cost estimate for a gas fired power station.
White Bluff's auxiliary boiler cost estimate for Low NOx Burners/Over Fired Air/Flue Gas Recirculation was also adjusted from a similar project.

Pricing and Quantities

The data used to develop these estimates is based on using material and equipment types and sizes typically used in a power plant.
Equipment and material costs were estimated on the basis of S&L in house data, vendor catalogs, industry publications and other related projects. In most cases, the costs for bulk materials and equipment were derived from recent vendor or manufacturer's quote for similar items on other projects. Where actual or specific information regarding equipment specifications was available, that information was used to size and quantify material and equipment requirements. Where information was not furnished or was not adequate, requirements were assumed and estimated based on information available from project estimates of similar type and size.

Quantities contained herein are intended to be reasonable and representative of projects of this type. All quantity data was developed internally by S&L. Quantities were developed based on project experience of a plant of comparable size and then adjusted based on actual size and capacity differences and also taking into consideration the specific site layout based on the general arrangement drawing. While project specifics will certainly have an impact on these quantities, we feel they are appropriate for a study at this level.

Labor Wage Rates

Labor Profile – Union

Labor wage rate selected for the estimate - 2012 Union rates for Pine Bluff, Arkansas. Base craft rates are as published in RS Means Labor Rates for the Construction Industry, 2012 Edition. The craft rates are then incorporated into work crews appropriate for the activities by adding allowances for small tools, construction equipment, insurance, and site overheads to arrive at crew rates detailed in the cost estimate. A 1.15 regional labor productivity multiplier is included based on the Compass International Global Construction Yearbook.

Labor Work Schedule and Incentives - Assumed 5x10 work week for regular work and 7x10 work week for outage work. 10% of the work is assumed to be outage related.

Project Direct & Construction Indirect Costs

The estimate is constructed in such a manner where most of the direct construction costs are determined directly and several direct construction cost accounts are determined indirectly by taking a percentage of the directly determined costs and are identified as “Variable Accounts”. These percentages are based on our experience with similar type and size projects. Sales tax is specific to location. Listed below are the variable accounts.

- Cost of overtime – 5-10’s Hour Days and Outage Work at a 7-10 Schedule
- Subsistence (per diem) – not included
- Consumables – 0.5% of material and labor
- Freight on Equipment - included with equipment cost
- Freight on Material @ 5% of material
- Spare Parts – included with equipment costs
- Contractors G&A Expense @ 10%
- Contractors Profit @ 5%

Project Indirect Costs

Included are the following:

- Engineering, Procurement & Project Services varied depending on the size of the project estimated.
    - 31813A @ 19% of construction cost
    - 31814A @ 8% of construction cost
    - 31815A @ 8% of construction cost
    - 31816A @ 16% of construction cost
    - 31817A @ 6% of construction cost
    - 31818A @ 6% of construction cost
    - 31819A @ 8% of construction cost
    - 31820A @ 12% of construction cost
    - 31832A @ 16% of construction cost
- Construction Management varied depending on the size of the project estimated.
    - 31813A @ 6% of construction cost
    - 31814A @ 3% of construction cost
    - 31815A @ 2% of construction cost
    - 31816A @ 6% of construction cost
    - 31817A @ 2% of construction cost

  - 31818A @ 2% of construction cost
  - 31819A @ 2% of construction cost
  - 31820A @ 0% of construction cost
  - 31832A @ 6% of construction cost
- Craft start-up and commission support @ 1% of construction cost
- General Owner's Costs, including Owners Engineering & Bond Fees – not included
- EPC Fee – not included

These percentages are based on our experience with similar type and size projects.

Escalation

Not included.

Contingency

The contingency rates vary for each project based on the project's size. The rates are based on past history of similar projects. This rate relates to pricing and quantity variation in the specific scope estimated. The contingency does not cover new scope outside of what has been estimated, only the variation in the defined scope. This is a composite rate and already takes into account the plus and minuses of expected actual costs. The rate does not represent the high range of all costs, nor is it expected that the project will experience all actual costs be realized at the maximum value of their range of variation.

Exclusions

There are items that have been specifically excluded from the estimate. In order to establish the overall project costs, the following items must also be accounted for. This list is for information only and is not intended to be all inclusive.

- Permitting costs
- Rock excavation
- Remediation of soil for hazardous materials
- Power outage cost during construction

Assumptions

- No rock excavation, no dewatering
- Assumed that asbestos removal or lead paint abatement will not be required.
- No obstruction for the ammonia pipe routing. 6" clearing & grubbing of existing terrain is included, no tree removal.
- Directional boring underneath the existing railroad tracks is included, but with no major interferences or obstructions.
- Electrical equipment and wiring installation is based on non-hazardous location.
- Adjustments for plant unit size were made based on good engineering practice. Actual design and quantities may be significantly different than the quantities shown in the estimates.

Estimate Totals

Description	Amount	Totals	
Labor	331,677		
Material	125,263		
Subcontract	2,850,000		
Equipment			
Other	2,000,000		
	5,306,940	5,306,940	USD
91-1 Scaffolding	46,000		
91-2 OT Working 5-10 Hour Days	41,000		
91-3 OT Working 7-10 Hr Days			
91-4 Per Diem			
91-5 Consumables	2,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	6,000		
91-9 Freight on Process Equip.	100,000		
91-10 Sales Tax			
91-11 Contractor's G&A Expense	65,000		
91-12 Contractor's Profit	32,000		
	292,000	5,598,940	USD
93-1 EP&P Services	1,064,000		
93-2 CM Support	168,000		
93-3 Start-Up/Commissioning	56,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	1,288,000	6,886,940	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	50,000		
94-4 Contingency on Labor	145,000		
94-5 Contingency on Sub.	713,000		
94-6 Contingency on Equipment	525,000		
94-7 Contingency on Indirect	386,000		
	1,819,000	8,705,940	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		8,705,940	USD
98 - Interest During Constr			
		8,705,940	USD
Total		8,705,940	USD

Estimate Totals

Description	Amount	Totals	
Labor	19,780,000		
Material	15,815,652		
Subcontract	2,590,000		
Equipment			
Other	8,290,000		
	46,475,652	46,475,652	USD
91-1 Scaffolding			
91-2 OT Working 5-10 Hour Days			
91-3 OT Working 7-10 Hr Days			
91-4 Per Diem			
91-5 Consumables			
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material			
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense			
91-12 Contractor's Profit			
		46,475,652	USD
93-1 EP&P Services	3,718,100		
93-2 CM Support	1,394,300		
93-3 Start-Up/Commissioning	464,800		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	5,577,200	52,052,852	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	2,372,400		
94-4 Contingency on Labor	2,967,000		
94-5 Contingency on Sub.	388,500		
94-6 Contingency on Equipment	1,243,500		
94-7 Contingency on Indirect	836,600		
	7,808,000	59,860,852	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		59,860,852	USD
98 - Interest During Constr			
		59,860,852	USD
Total		59,860,852	USD

Estimate Totals

Description	Amount	Totals	
Labor	2,629,958		
Material	1,083,165		
Subcontract	80,600		
Equipment			
Other	6,193,056		
	9,986,779	9,986,779	USD
91-1 Scaffolding	445,600		
91-2 OT Working 5-10 Hour Days	311,700		
91-3 OT Working 7-10 Hr Days	99,200		
91-4 Per Diem			
91-5 Consumables	18,600		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	54,200		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	458,800		
91-12 Contractor's Profit	229,500		
	1,617,600	11,604,379	USD
93-1 EP&P Services	928,400		
93-2 CM Support	232,100		
93-3 Start-Up/Commissioning	116,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	1,276,500	12,880,879	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	390,000		
94-4 Contingency on Labor	1,209,300		
94-5 Contingency on Sub.	24,200		
94-6 Contingency on Equipment	619,300		
94-7 Contingency on Indirect	383,000		
	2,625,800	15,506,679	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		15,506,679	USD
98 - Interest During Constr			
		15,506,679	USD
Total		15,506,679	USD

Estimate Totals

Description	Amount	Totals	
Labor	653,648		
Material	306,347		
Subcontract	3,700,000		
Equipment			
Other			
	4,659,995	4,659,995	USD
91-1 Scaffolding	48,000		
91-2 OT Working 5-10 Hour Days	77,000		
91-3 OT Working 7-10 Hr Days	24,000		
91-4 Per Diem			
91-5 Consumables	5,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	15,000		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	112,000		
91-12 Contractor's Profit	55,000		
	336,000	4,995,995	USD
93-1 EP&P Services	799,000		
93-2 CM Support	300,000		
93-3 Start-Up/Commissioning	50,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	1,149,000	6,144,995	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	110,000		
94-4 Contingency on Labor	279,000		
94-5 Contingency on Sub.	925,000		
94-6 Contingency on Equipment			
94-7 Contingency on Indirect	345,000		
	1,659,000	7,803,995	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		7,803,995	USD
98 - Interest During Constr			
		7,803,995	USD
Total		7,803,995	USD

Estimate Totals

Description	Amount	Totals	
Labor	2,255,791		
Material	1,089,242		
Subcontract	68,100		
Equipment			
Other	1,948,100		
	5,361,233	5,361,233	USD
91-1 Scaffolding	368,000		
91-2 OT Working 5-10 Hour Days	267,300		
91-3 OT Working 7-10 Hr Days	85,100		
91-4 Per Diem			
91-5 Consumables	16,700		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	54,500		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	408,200		
91-12 Contractor's Profit	204,100		
	1,403,900	6,765,133	USD
93-1 EP&P Services	541,200		
93-2 CM Support	135,300		
93-3 Start-Up/Commissioning	67,700		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	744,200	7,509,333	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	392,100		
94-4 Contingency on Labor	1,032,500		
94-5 Contingency on Sub.	20,400		
94-6 Contingency on Equipment	194,800		
94-7 Contingency on Indirect	223,300		
	1,863,100	9,372,433	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		9,372,433	USD
98 - Interest During Constr			
		9,372,433	USD
Total		9,372,433	USD

Estimate Totals

Description	Amount	Totals	
Labor	56,778,212		
Material	34,013,262		
Subcontract	8,156,000		
Equipment			
Other	21,324,260		
	120,271,734	120,271,734	USD
91-1 Scaffolding	2,270,000		
91-2 OT Working 5-10 Hour Days	6,730,000		
91-3 OT Working 7-10 Hr Days	2,142,000		
91-4 Per Diem			
91-5 Consumables	454,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	1,701,000		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	10,238,000		
91-12 Contractor's Profit	5,120,000		
	28,655,000	148,926,734	USD
93-1 EP&P Services	8,936,000		
93-2 CM Support	2,979,000		
93-3 Start-Up/Commissioning	1,489,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	13,404,000	162,330,734	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	8,163,000		
94-4 Contingency on Labor	15,726,000		
94-5 Contingency on Sub.	1,631,000		
94-6 Contingency on Equipment	4,265,000		
94-7 Contingency on Indirect	2,681,000		
	32,466,000	194,796,734	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		194,796,734	USD
98 - Interest During Constr			
		194,796,734	USD
Total		194,796,734	USD

Estimate Totals

Description	Amount	Totals	
Labor	653,648		
Material	306,347		
Subcontract	3,700,000		
Equipment			
Other	2,600,000		
	7,259,995	7,259,995	USD
91-1 Scaffolding	48,000		
91-2 OT Working 5-10 Hour Days	77,000		
91-3 OT Working 7-10 Hr Days	24,000		
91-4 Per Diem			
91-5 Consumables	5,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	15,000		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	112,000		
91-12 Contractor's Profit	55,000		
	336,000	7,595,995	USD
93-1 EP&P Services	1,215,000		
93-2 CM Support	456,000		
93-3 Start-Up/Commissioning	76,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	1,747,000	9,342,995	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	110,000		
94-4 Contingency on Labor	279,000		
94-5 Contingency on Sub.	925,000		
94-6 Contingency on Equipment	650,000		
94-7 Contingency on Indirect	524,000		
	2,488,000	11,830,995	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		11,830,995	USD
98 - Interest During Constr			
		11,830,995	USD
Total		11,830,995	USD

Estimate Totals

Description	Amount	Totals	
Labor	2,255,791		
Material	1,089,242		
Subcontract	68,100		
Equipment			
Other	1,948,100		
	5,361,233	5,361,233	USD
91-1 Scaffolding	368,000		
91-2 OT Working 5-10 Hour Days	267,300		
91-3 OT Working 7-10 Hr Days	85,100		
91-4 Per Diem			
91-5 Consumables	16,700		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	54,500		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	408,200		
91-12 Contractor's Profit	204,100		
	1,403,900	6,765,133	USD
93-1 EP&P Services	541,200		
93-2 CM Support	135,300		
93-3 Start-Up/Commissioning	67,700		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	744,200	7,509,333	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	392,100		
94-4 Contingency on Labor	1,032,500		
94-5 Contingency on Sub.	20,400		
94-6 Contingency on Equipment	194,800		
94-7 Contingency on Indirect	223,300		
	1,863,100	9,372,433	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		9,372,433	USD
98 - Interest During Constr			
		9,372,433	USD
Total		9,372,433	USD

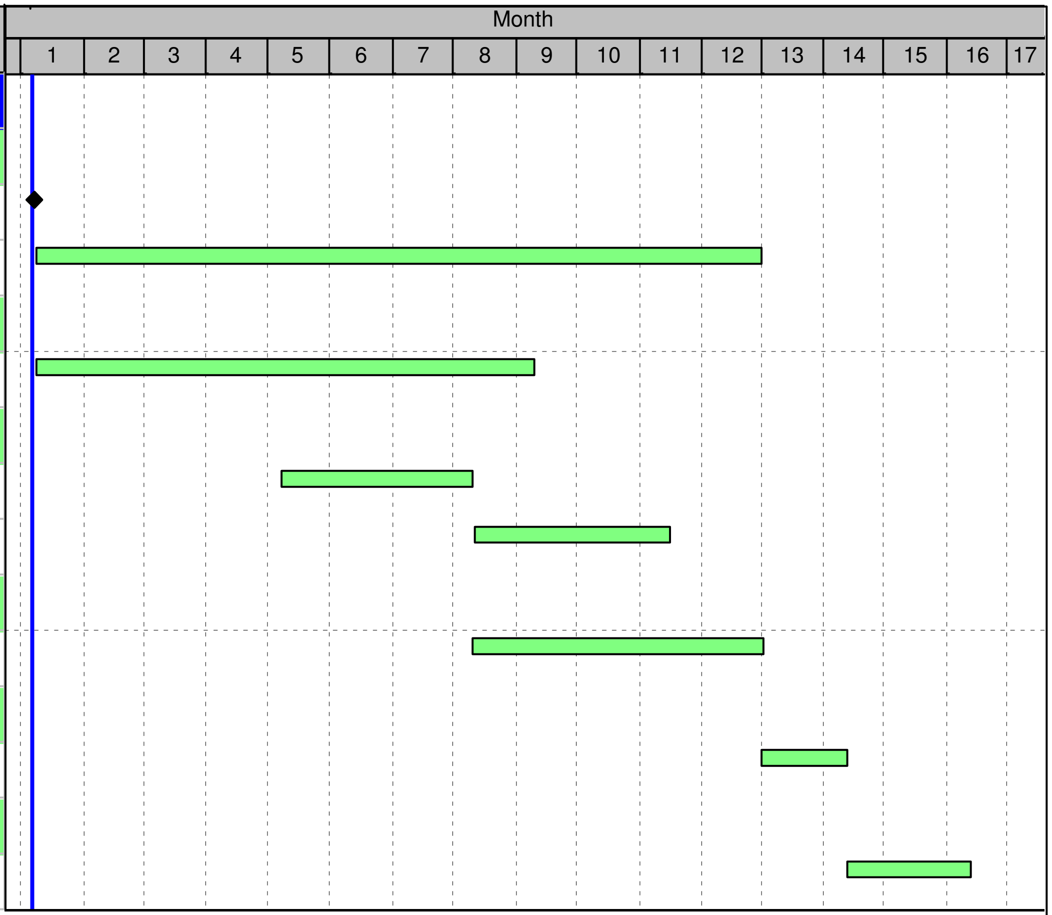
Estimate Totals

Description	Amount	Totals	
Labor	48,597,255		
Material	26,751,692		
Subcontract	6,577,640		
Equipment			
Other	21,324,260		
	103,250,847	103,250,847	USD
91-1 Scaffolding	1,884,000		
91-2 OT Working 5-10 Hour Days	5,759,000		
91-3 OT Working 7-10 Hr Days	1,834,000		
91-4 Per Diem			
91-5 Consumables	377,000		
91-6 Freight on Equipment			
91-7 Freight on Special Equip.			
91-8 Freight on Material	1,338,000		
91-9 Freight on Process Equip.			
91-10 Sales Tax			
91-11 Contractor's G&A Expense	8,520,000		
91-12 Contractor's Profit	4,261,000		
	23,973,000	127,223,847	USD
93-1 EP&P Services	7,633,000		
93-2 CM Support	2,544,000		
93-3 Start-Up/Commissioning	1,272,000		
93-4 Start-Up/Spare Parts			
93-5 Excess Liability Insur.			
93-6 Sales Tax On Indirects			
93-7 Owners Cost			
93-8 EPC Fee			
	11,449,000	138,672,847	USD
94-1 Contingency on Equipment			
94-2 Contingency on Engr Equip			
94-3 Contingency on Material	6,421,000		
94-4 Contingency on Labor	13,444,000		
94-5 Contingency on Sub.	1,316,000		
94-6 Contingency on Equipment	4,265,000		
94-7 Contingency on Indirect	2,290,000		
	27,736,000	166,408,847	USD
96-1 Escalation on Equipment			
96-2 Escalation on Engr Equip			
96-3 Escalation on Material			
96-4 Escalation on Labor			
96-5 Escalation on Sub.			
96-6 Escalation on Process Equ			
96-7 Escalation on Indirect			
		166,408,847	USD
98 - Interest During Constr			
		166,408,847	USD
Total		166,408,847	USD

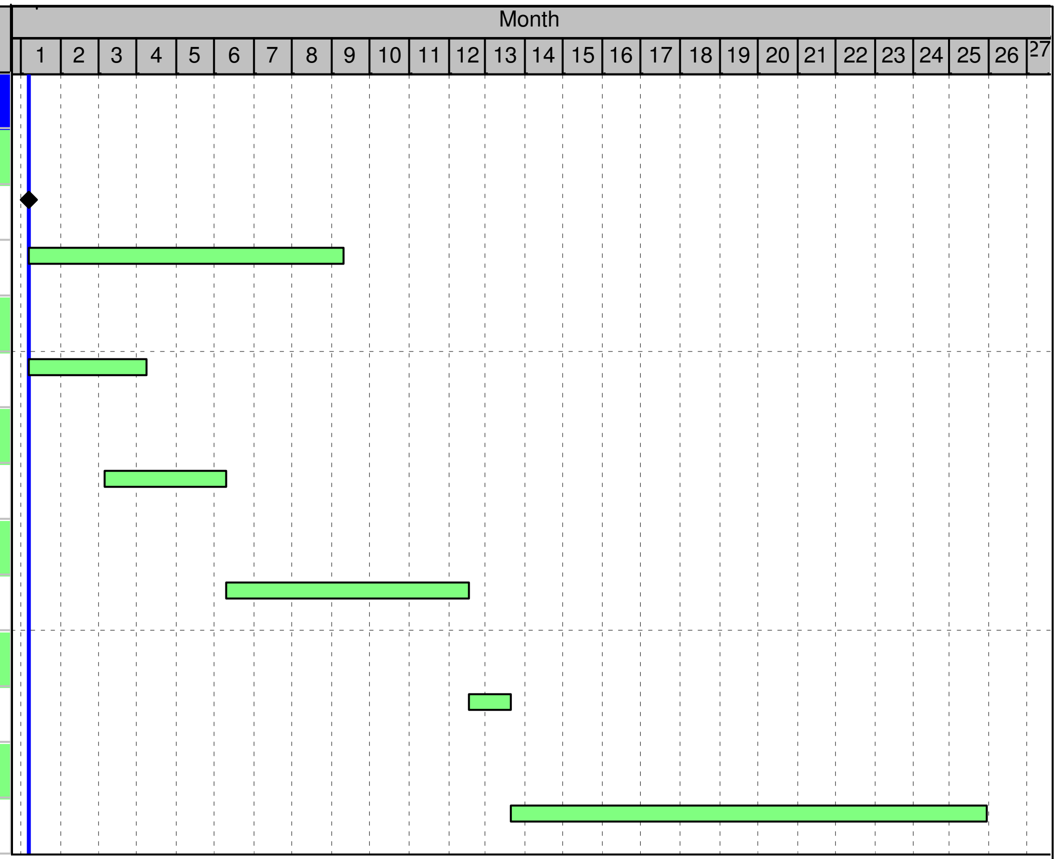
APPENDIX B

1. ESTIMATED PROJECT SCHEDULES

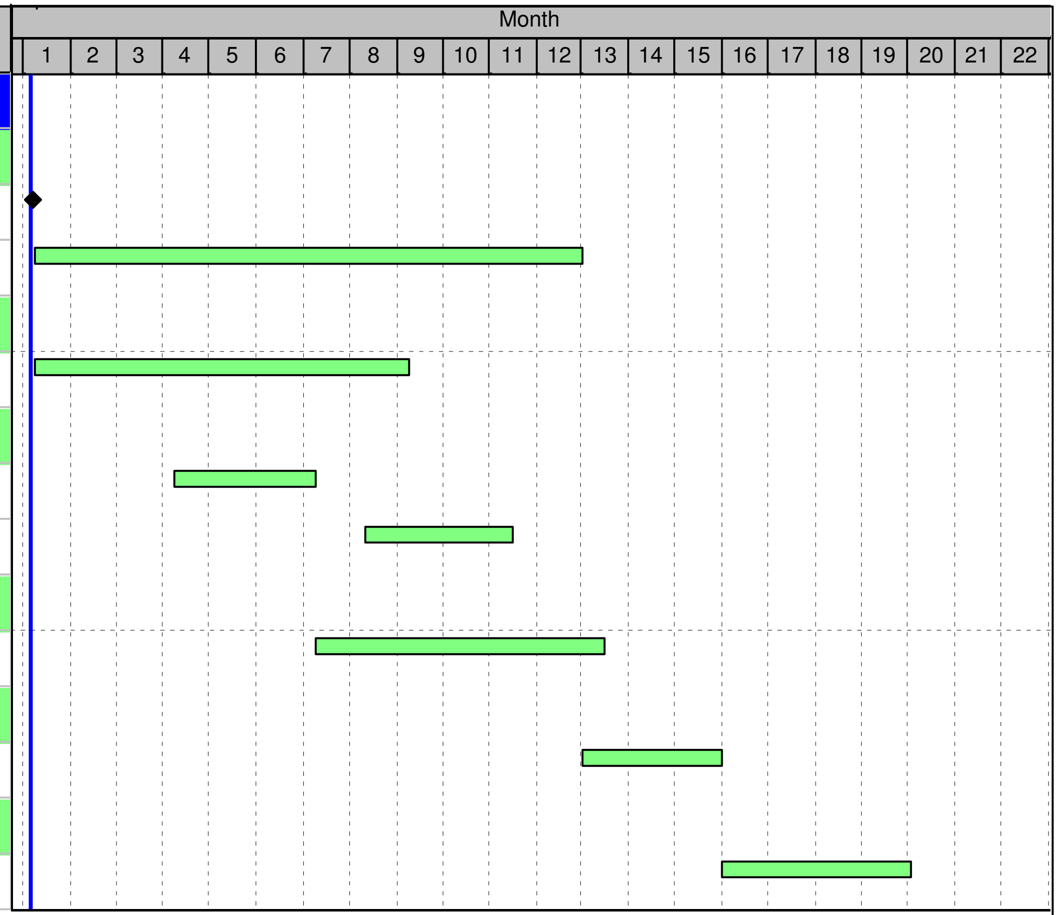
Activity ID	Activity Name	Org Dur (months)
	Entergy - NOx Strategy Study - Aux Boiler (LNB/OFA/F...	15m
	Permitting	12m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	12m
	Engineering	8m
A1020	Engineering	8m
	Procurement of Major Equipment	6m
A1030	LNB/OFA Spec - Prep/Bid/Eval/Award	3m
A1070	GWC Spec - Prep/Bid/Eval/Award	3m
	Vendor Engineering/Fab/Delivery	5m
A1040	LNB/OFA Vendor Engineering/Fabrication/Delivery	5m
	Installation	1m
A1050	Installation	1m
	Commissioning & Start-Up	2m
A1060	Commissioning & Start-Up	2m



Activity ID	Activity Name	Org Dur (months)
Entergy - NOx Strategy Study - Neural Network		24m
Permitting		8m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	8m
Engineering		3m
A1020	Engineering	3m
Procurement of Major Equipment		3m
A1030	Neural Network Spec - Prep/Bid/Eval/Award	3m
Vendor Engineering/Fab/Delivery		6m
A1040	NN Vendor Engineering/Fabrication/Delivery	6m
Installation		1m
A1050	Installation	1m
Commissioning & Start-Up		12m
A1060	Commissioning & Start-Up	12m



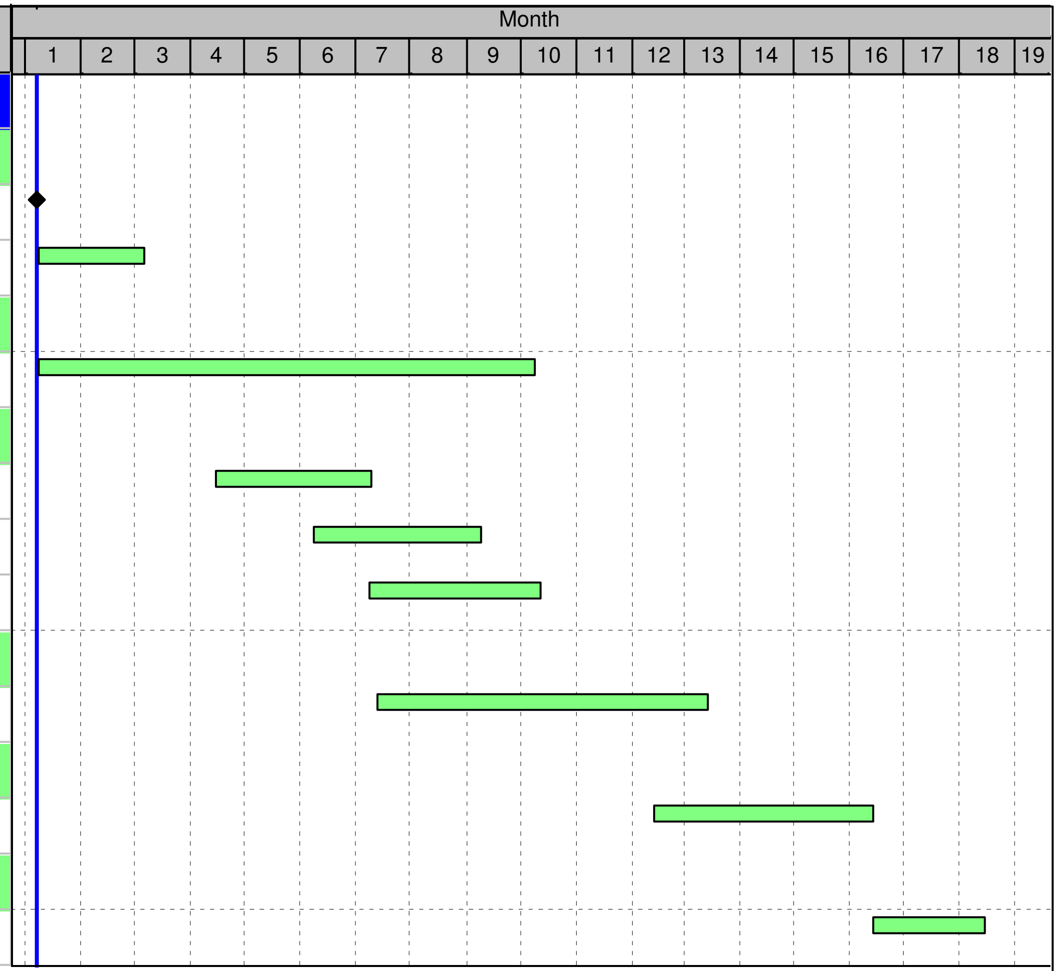
Activity ID	Activity Name	Org Dur (months)
Entergy - NOx Strategy Study - Low NOx Burners/Over ...		19m
Permitting		12m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	12m
Engineering		8m
A1020	Engineering	8m
Procurement of Major Equipment		7m
A1030	LNB/OFA Spec - Prep/Bid/Eval/Award	3m
A1070	GWC Spec - Prep/Bid/Eval/Award	3m
Vendor Engineering/Fab/Delivery		6m
A1040	LNB/OFA Vendor Engineering/Fabrication/Delivery	6m
Installation		3m
A1050	Installation	3m
Commissioning & Start-Up		4m
A1060	Commissioning & Start-Up	4m



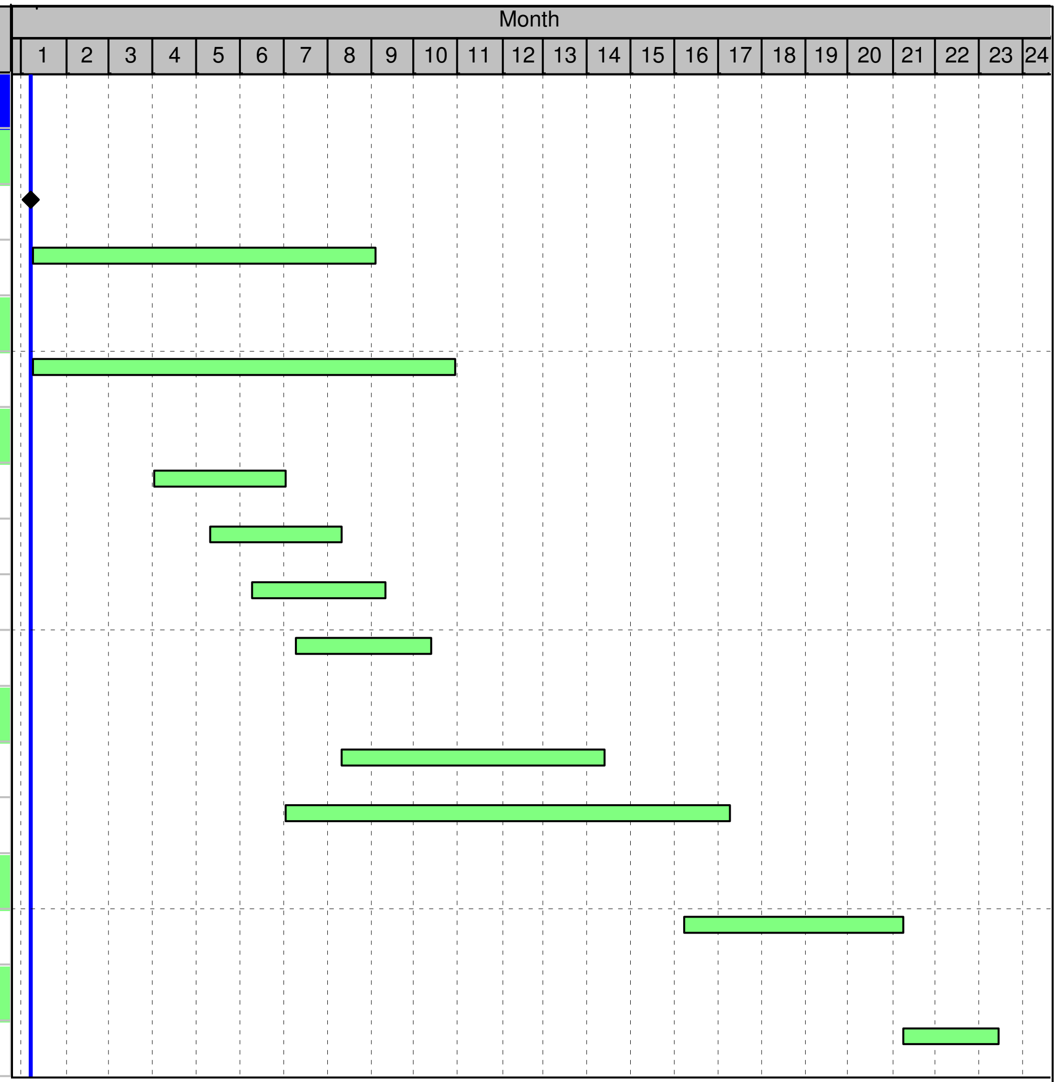
Run Date: 09-17-12

NOx Control Technology Cost and Performance Study for
Entergy Services, Inc. White Bluff and Lake Catherine
Low NOx Burners/Over-Fire Air (LNB/OFA)

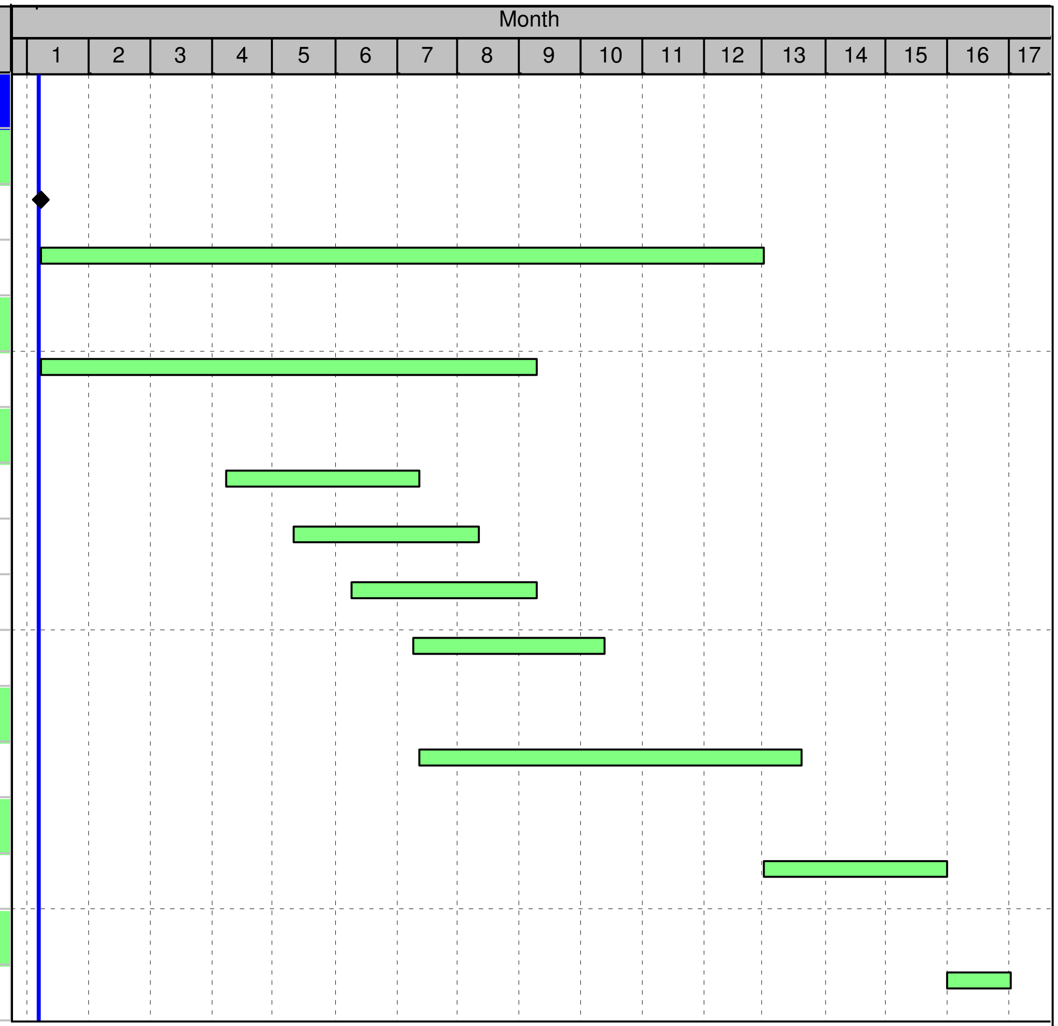
Activity ID	Activity Name	Org Dur (months)
	Entergy - NOx Strategy Study - Induced Flue Gas Recir...	17m
	Permitting	2m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	2m
	Engineering	9m
A1020	BOP Engineering	9m
	Procurement of Major Equipment	6m
A1140	FGR Duct Procurement Spec - Prep/Bid/Eval/Award	3m
A1030	Mech Install Spec - Prep/Bid/Eval/Award	3m
A1120	Elec Install Spec - Prep/Bid/Eval/Award	3m
	Vendor Engineering/Fab/Delivery	6m
A1040	FGR Duct Vendor Engineering/Fabrication/Delivery	6m
	Installation	4m
A1050	Installation	4m
	Commissioning & Start-Up	2m
A1060	Commissioning & Start-Up	2m



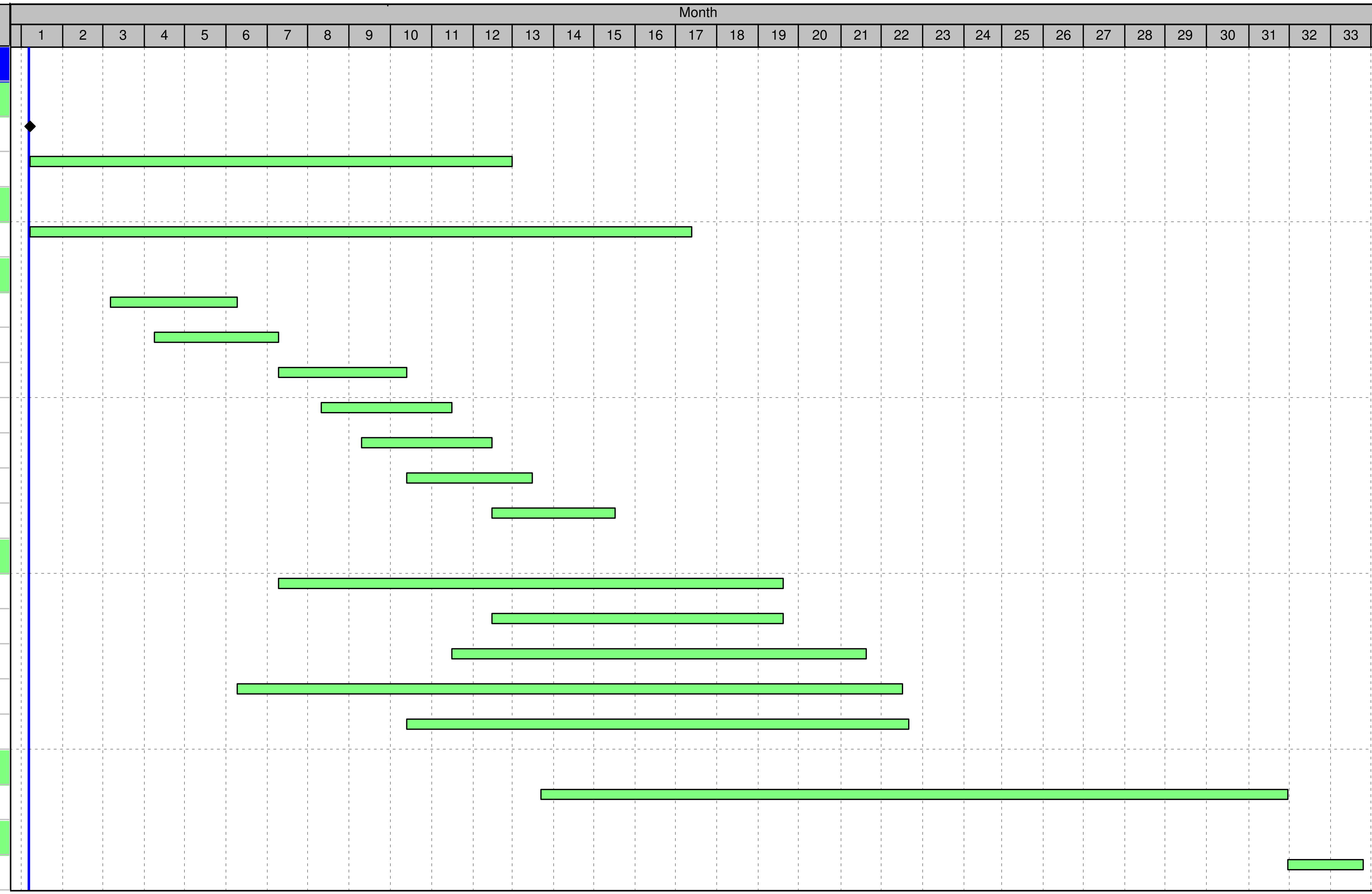
Activity ID	Activity Name	Org Dur (months)
Entergy - NOx Strategy Study - Flue Gas Recirculation ...		22m
Permitting		8m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	8m
Engineering		10m
A1020	BOP Engineering	10m
Procurement of Major Equipment		6m
A1150	FGR Fan Procurement Spec - Prep/Bid/Eval/Award	3m
A1140	FGR Duct Procurement Spec - Prep/Bid/Eval/Award	3m
A1030	Mech Install Spec - Prep/Bid/Eval/Award	3m
A1120	Elec Install Spec - Prep/Bid/Eval/Award	3m
Vendor Engineering/Fab/Delivery		10m
A1040	FGR Duct Vendor Engineering/Fabrication/Delivery	6m
A1160	FGR Fan Vendor Engineering/Fabrication/Delivery	10m
Installation		5m
A1050	Installation	5m
Commissioning & Start-Up		2m
A1060	Commissioning & Start-Up	2m



Activity ID	Activity Name	Org Dur (months)
	Entergy - NOx Strategy Study - Selective Non-Catalytic ...	16m
	Permitting	12m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	12m
	Engineering	8m
A1020	BOP Engineering	8m
	Procurement of Major Equipment	6m
A1030	SNCR Spec - Prep/Bid/Eval/Award	3m
A1070	Civil/Structural Installation Spec - Prep/Bid/Eval/Award	3m
A1080	Mech Installation Spec - Prep/Bid/Eval/Award	3m
A1090	Elec/I&C Installation Spec - Prep/Bid/Eval/Award	3m
	Vendor Engineering/Fab/Delivery	6m
A1040	SNCR Vendor Engineering/Fabrication/Delivery	6m
	Installation	3m
A1050	Installation	3m
	Commissioning & Start-Up	1m
A1060	Commissioning & Start-Up	1m



Activity ID	Activity Name	Org Dur (months)
	Entergy - NOx Strategy Study - Selective Catalytic Red...	32m
	Permitting	12m
A1000	Project Authorization	0m
A1010	Air Permit - Prepare/Review/Approve	12m
	Engineering	16m
A1020	BOP Engineering	16m
	Procurement of Major Equipment	12m
A1140	Ammonia Injection System Procurement Spec - Prep/Bid/Eval/Award	3m
A1150	Catalyst Procurement Spec - Prep/Bid/Eval/Award	3m
A1170	Fan Spec - Prep/Bid/Eval/Award	3m
A1190	Ductwork Spec - Prep/Bid/Eval/Award	3m
A1130	Structural Steel Spec - Prep/Bid/Eval/Award	3m
A1030	Mech Install Spec - Prep/Bid/Eval/Award	3m
A1120	Elec Install Spec - Prep/Bid/Eval/Award	3m
	Vendor Engineering/Fab/Delivery	16m
A1160	Catalyst Vendor Engineering/Fabrication/Delivery	12m
A1210	Structural Steel Vendor Engineering/Fabrication/Delivery	7m
A1200	Ductwork Vendor Engineering/Fabrication/Delivery	10m
A1040	Ammonia Injection System Vendor Engineering/Fabrication/Delivery	16m
A1180	Fan Vendor Engineering/Fabrication/Delivery	12m
	Installation	18m
A1050	Installation	18m
	Commissioning & Start-Up	2m
A1060	Commissioning & Start-Up	2m



APPENDIX C

1. OPERATING AND MAINTENANCE COST ESTIMATES

NO_X Compliance Costs

Unit Name White Bluff 1

Unit Data		Reagent Costs	
Size (Gross kW)	815,000	Aq.Ammonia $/t	$700
Average NOx Emission Rate (lb/MMBtu at full load)	**0.33**	An.Ammonia $/t	$400
Nominal Max. Boiler Heat Input (mmBtu/hr)	8,950.0	Urea $/t	$350
Avg. Heat Rate (Btu/kwh)	10,981.6	N/F-T Urea $/t	$618
Aux. Power (kw)	-	Coal Cost, $/Mbtu	2.650
Est. Capacity Factor (%)	76.00		
Boiler Type	T/F	Water Cost, $/1000 gal (3)	2
Boiler Eff. (%)	84	Electricity, $/MWh	41.50
Estimated NOx, tons/day Max	**26.936**		
Emission Limit, tons	-		
NOx Sales/Buy rate, $/ton	-		
Fuel -	PRB		
Seasonal Days	153		
Basis	0		
Analysis - Enter "0" for Annual and 1 for Seasonal			
CF For Variable O&M	76.00		

Technology	Estimated Reduction from Baseline	Emission Rate After Control	Tons of NOx Emission, Seasonal/Annual	Tons of NOx Removed, season/annual	Estimated Capital Cost		Operating & Maintenance Cost: Fixed O&M	Variable O&M, season or yr	Fuel Impact, season or yr
	%	(lb/mmBtu)	tons	tons	$/kW	$/unit	$/yr	$/@CF	$/@CF
LNB + OFA (Note 5)	54.5	0.15	4,469	5,363	9.6	$7,804,000	$142,000	$0	$0
Neural Net	10.0	0.30	8,848	983	0.3	$250,000	$50,000	$0	$0
Full SNCR	26.5	0.24	7,229	2,602	11.5	$9,372,000	$169,000	$5,377,000	$281,000
LNB+OFA+Full SNCR	61.4	0.13	3,799	6,033	20.0	$16,290,000	$311,000	$4,154,000	$384,000
LNB+OFA+Full SCR	83.3	0.055	1,639	8,193	248.6	$202,601,000	$608,000	$2,836,000	$0

(1) Aux. Power cost is calculated based on variation in capacity factor
(2) Assumed water cost of $2/1000 gallons.
(3) Assumed that 15% urea will be used for SNCR technology.
(4) Assumed that initial catalyst life is 12,000 hours
(5) LNB/OFA material already purchased for Unit 1. The total cost to Entergy would be the same for Unit 1 as shown for Unit 2.
(6) For SCR technology, the variable O&M costs are based on operating at NOx outlet emissions marginally below the compliance emission rate.

Unit Name White Bluff 2

Unit Data		Reagent Costs	
Size (Gross kW)	844,000	Aq.Ammonia $/t	$700
Average NOx Emission Rate (lb/MMBtu at full load)	**0.39**	An.Ammonia $/t	$400
Nominal Max. Boiler Heat Input (mmBtu/hr)	8,950.0	Urea $/t	$350
Avg. Heat Rate (Btu/kwh)	10,604.3	N/F-T Urea $/t	$618
Aux. Power (kw)	-	Coal Cost, $/Mbtu	2.650
Est. Capacity Factor (%)	76.00		
Boiler Type	T/F	Water Cost, $/1000 gal (3)	2
Boiler Eff. (%)	84	Electricity, $/MWh	41.50
Estimated NOx, tons/day Max	**31.833**		
Emission Limit, tons	-		
NOx Sales/Buy rate, $/ton	-		
Fuel -	PRB		
Seasonal Days	153		
Basis	0		
Analysis - Enter "0" for Annual and 1 for Seasonal			
CF For Variable O&M	76.00		

Technology	Estimated Reduction from Baseline	Emission Rate After Control	Tons of NOx Emission, Seasonal/Annual	Tons of NOx Removed, season/annual	Estimated Capital Cost		Operating & Maintenance Cost: Fixed O&M	Variable O&M, season or yr	Fuel Impact, season or yr
	%	(lb/mmBtu)	tons	tons	$/kW	$/unit	$/yr	$/@CF	$/@CF
LNB + OFA	61.5	0.15	4,469	7,150	14.0	$11,831,000	$142,000	$0	$0
Neural Net	10.0	0.35	10,457	1,162	0.3	$250,000	$50,000	$0	$0
Full SNCR	26.5	0.29	8,544	3,076	11.1	$9,372,000	$169,000	$6,338,000	$333,000
LNB+OFA+Full SNCR	67.3	0.13	3,799	7,821	24.1	$20,317,000	$311,000	$4,158,000	$384,000
LNB+OFA+Full SCR	85.9	0.055	1,639	9,981	211.2	$178,240,000	$608,000	$2,858,000	$0

(1) Aux. Power cost is calculated based on variation in capacity factor
(2) Assumed water cost of $2/1000 gallons.
(3) Assumed that 15% urea will be used for SNCR technology.
(4) Assumed that initial catalyst life is 12,000 hours
(5) For SCR technology, the variable O&M costs are based on operating at NOx outlet emissions marginally below the compliance emission rate.

NO_X Compliance Costs

Unit name Lake Catherine Unit 4

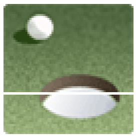
Unit Data		Reagent Costs	
Size (Gross kW)	558,000	Aq.Ammonia $/t	$700
Average NOx Emission Rate (lb/MMBtu)	0.4825	An.Ammonia $/t	$400
Nominal Max. Boiler Heat Input (mmBtu/hr)	5,850.0	Urea $/t	$350
Avg. Heat Rate (Btu/kwh)	10,483.9	N/F-T Urea $/t	$618
Aux. Power (kw)	-	Gas Cost, $/MBtu	4.900
Est. Capacity Factor (%)	10.00	Water Cost, $/1000 gal (3)	2
Boiler Type	T/F	Electricity, $/MWh	41.50
Boiler Eff. (%)	82		
Estimated NOx, tons/day Max	3.387		
Emission Limit, tons	-		
NOx Sales/Buy rate, $/ton	2500.0		
Fuel	Gas		
Seasonal Days	153		
Basis	0		
Analysis - Enter "0" for Annual and 1 for Seasonal			
CF For Variable O&M	10.00		

Technology	Estimated Reduction from Baseline	Emission Rate After Control	Tons of NOx Emission, Seasonal/Annual	Tons of NOx Removed, season/annual	Estimated Capital Cost		Operating & Maintenance Cost: Fixed O&M	Variable O&M, season or yr	Fuel Impact, season or yr
	%	(lb/mmBtu)	tons	tons	$/kW	$/unit	$/yr	$/@CF	$/@CF
Baseline	0	0.4825							
BOOS (at 558 MW)	50.0	0.24	618	618	1.6	$893,000	$21,000	$0	$0
LNB + OFA	60.0	0.19	495	742	15.7	$8,762,000	$210,000	$0	$0
SCR	90.0	0.05	124	1,113	106.8	$59,587,000	$358,000	$254,000	$0
SNCR	40.0	0.29	742	495	27.8	$15,507,000	$279,000	$1,542,000	$98,000
Water Injection	9.1	0.44	1,124	113	3.9	$2,177,000	$52,000	$18,000	$468,000
IFGR (below 500 MW)	19.0	0.39	1,001	235	3.9	$2,166,000	$52,000	$0	$0
FGR	60.0	0.19	495	742	20.6	$11,489,000	$207,000	$142,000	$0
LNB/OFA + SNCR	70.0	0.14	371	865	43.5	$24,269,000	$489,000	$393,000	$69,000
LNB/OFA + SCR	94.0	0.03	74	1,162	122.5	$68,349,000	$568,000	$268,000	$0

(1) Aux. Power cost is calculated based on variation in capacity factor
(2) Assumed water cost of $2/1000 gallons.
(3) Assumed that 15% urea will be used for SNCR technology.
(4) Assumed that initial catalyst life is 40,000 hours.
(5) Water Injection is used only for trimming at high load. Approximately 66% of Hours are affected.
(6) For SCR technology, the variable O&M costs are based on operating at NOx outlet emissions marginally below the compliance emission rate.

APPENDIX D

1. BOOS AT FULL UNIT LOAD



To: DAVID H PARK/Sargentlundy@Sargentlundy,
Cc:
Bcc:
Subject: Fw: BOOS for NOx Control
From: STEVE M KATZBERGER/Sargentlundy - Thursday 03/28/2013 03:32 PM

From: Stephen Wood [mailto:swood@etecinc.net]
Sent: Monday, March 25, 2013 2:20 PM
To: HANTZ, JOSEPH
Subject: BOOS for NOx Control

Joe,

The attached PDF file contains background information on utilizing burners out of service for NOx control, as well as, predicted Lake Catherine Unit 4 burner header pressures and NOx emissions, utilizing the top burner elevation out of service (4BOOS). If you have any questions, please let me know.

Regards,

Steve Wood
Principal Officer
Entropy Technology & Environmental Consultants, Inc. (ETEC Inc.)
12337 Jones Rd. Suite 414
Houston, TX 77070
Ph: 281-807-7007
Cell: 713-253-8230
Fax: 281-807-1414
Website: www.etecinc.net

 BOOS for NOx Control.pdf

Combustion Modification (BOOS) for NOx Control

Implementation of Burner Out Of Service (BOOS) operation is a practical and cost-effective means for achieving staged combustion (i.e., modifying burner stoichoimetry to reduce NOx emissions formation) on an existing gas/oil fired electric utility boiler. Utilizing BOOS operation for NOx control is well documented in the literature, e.g., EPA 456/F-99-006R "Nitrogen Oxides (NOx), Why And How They Are Controlled", November 1999, and EPRI TR-108181 "Retrofit NOx Control Guidelines for Gas- and Oil-Fired Boilers, Version 2.0", June 1997, among numerous others.

The technique of BOOS operation involves terminating the fuel flow to selected burners on the top elevation while leaving the air registers open. The remaining burners operate fuel-rich, thereby limiting oxygen availability, lowering peak flame temperatures, and reducing NOx formation. The un-reacted products combine with the air from the above terminated-fuel burners to complete burnout before exiting the furnace. I have personally been involved with implementing BOOS operation on virtually every gas fired electric utility boiler design across the country since the mid 1970's. In almost every case, the original "high" burner header pressure (BHP) set point had to be increased to accommodate BOOS operation. No adverse operational or maintenance problems corresponding to BOOS implementation have been reported.

BOOS operation can be a very effective NOx reduction technology, depending on the degree of staging, as shown for Ninemile Unit 4 (750 mw CE Tangential Fired) in Figure 1. The corresponding BOOS pattern is shown in Figure 2. The BHP corresponding to 4BOOS operation on Lake Catherine Unit 4 is shown in Figure 3. The "High" BHP set point would need to be increased from 42 to 50 psig. The predicted NOx emissions corresponding to 4BOOS operation are presented in Figure 4.

Figure 1- Stoichiometry Modification (BOOS) NOx Reduction

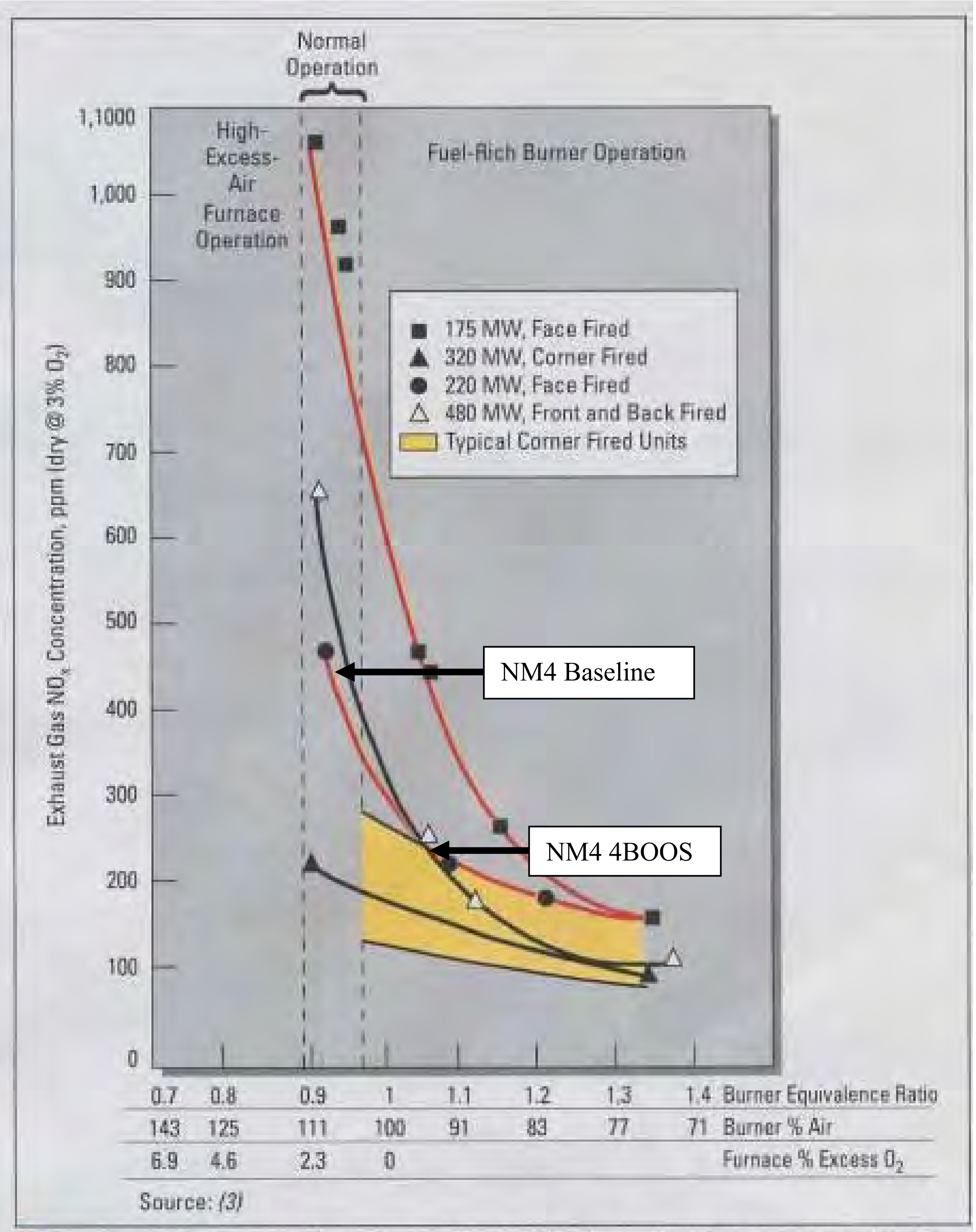


Figure 2. Burners-out-of-service can be an effective combustion staging technique.

Figure 2- Ninemile Units 4 and 5 BOOS Pattern
(Top Elevation Out of Service & Air Registers Open)

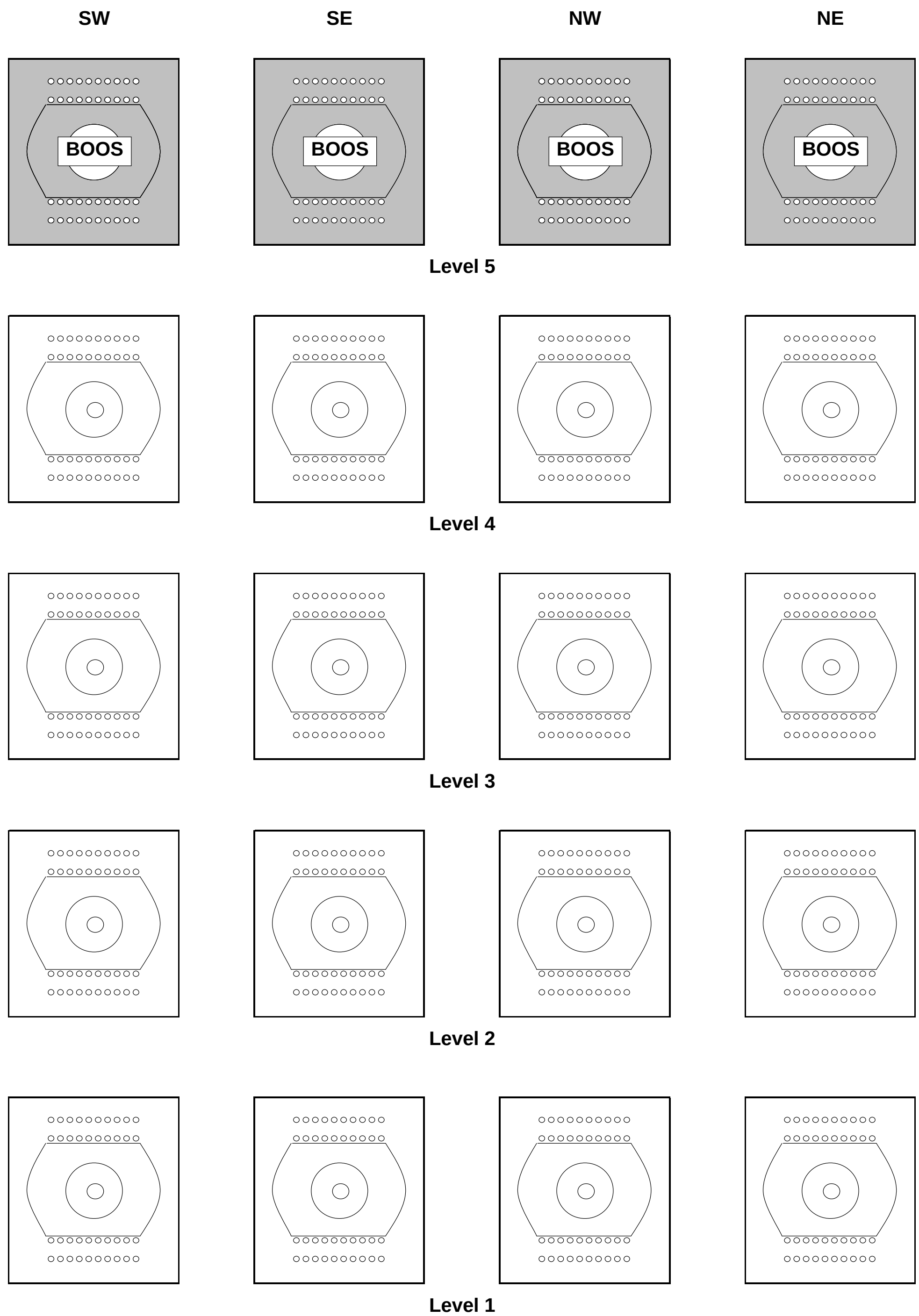


Figure 3- Lake Catherine Unit 4 Burner Header Pressure

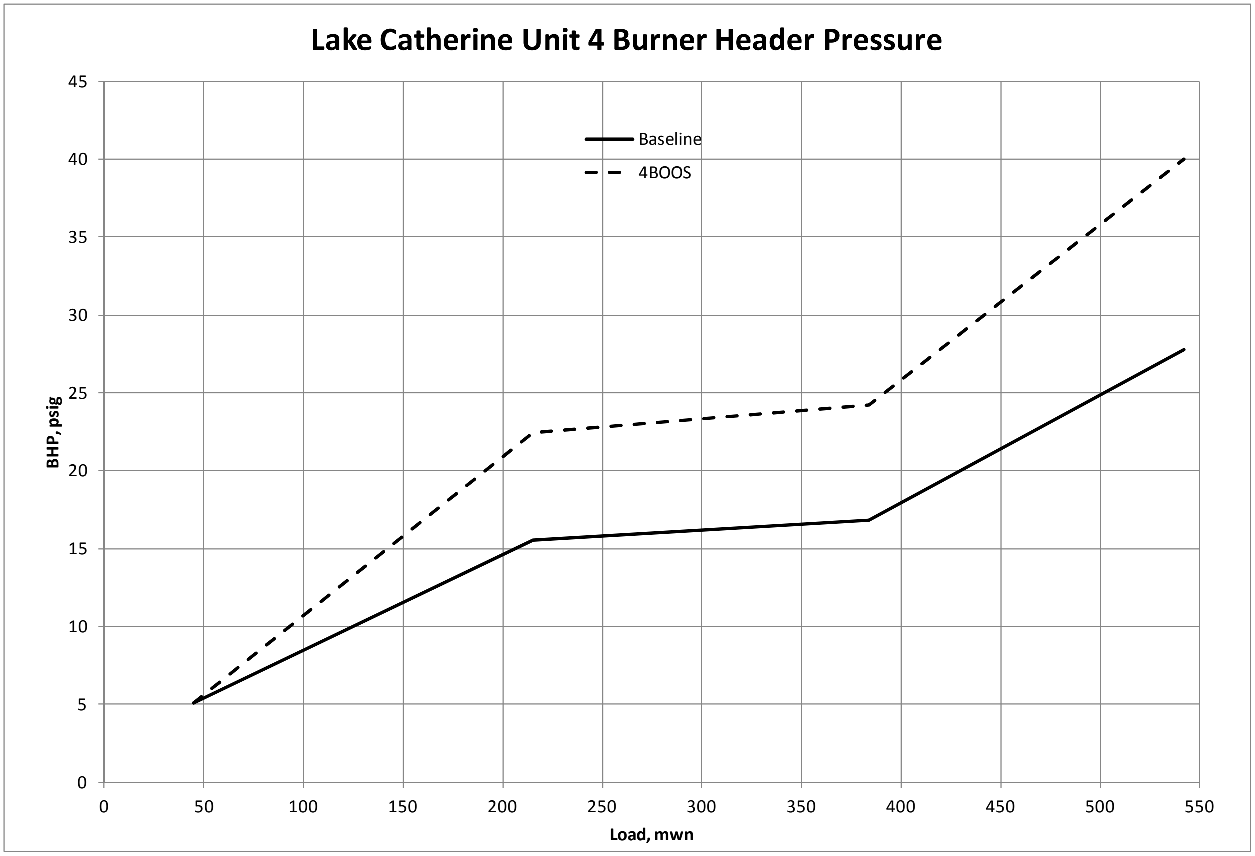
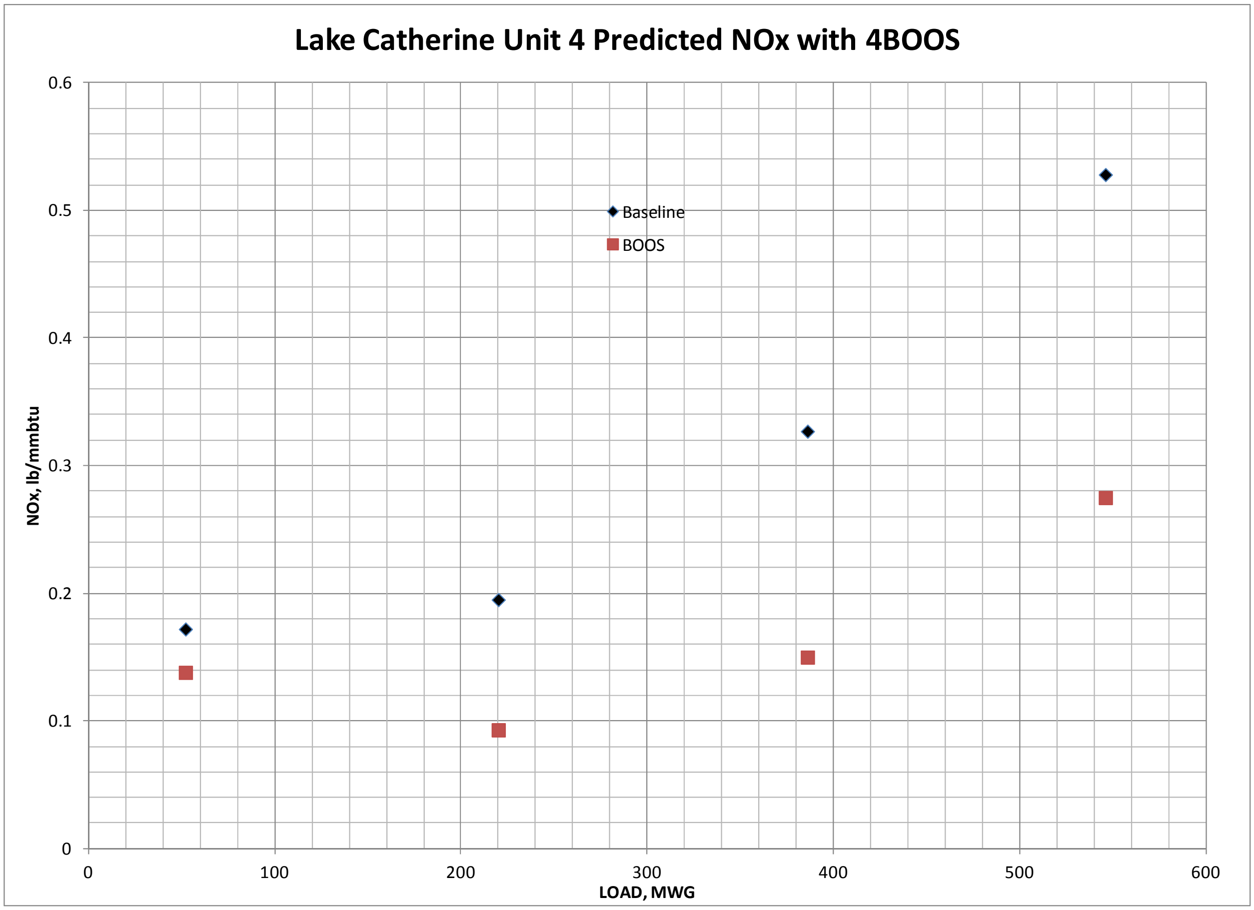


Figure 4- Lake Catherine Unit 4 NOx Emissions Prediction



APPENDIX F-5

Entergy Independence Cost Calculations

(see spreadsheet of the same name)

Division of Environmental Quality

Office of Air Quality

APPENDIX F-6

Entergy Independence Draft Administrative Agreement

Division of Environmental Quality

Office of Air Quality

ARKANSAS DEPARTMENT OF ENERGY AND ENVIRONMENT
DIVISION ENVIRONMENTAL QUALITY

In the Matter of:

LIS No. ___________

Entergy Arkansas, Inc. – Independence Plant
555 Point Ferry Rd.
Newark, AR 72203
AFIN: 32-00042

ADMINISTRATIVE ORDER

This Administrative Order (AO) is issued pursuant to the authority delegated under the federal Clean Air Act, 42 U.S.C. § 7401 *et seq*., and the federal regulations issued thereunder. In addition, this AO is issued pursuant to the authority of the Arkansas Water and Air Pollution Control Act, Act 472 of 1949, as amended, codified at Ark Code Ann. § 8-4-101 *et seq*., including Ark. Code Ann. § 8-4-311.

The issues herein having been settled by agreement of Entergy Arkansas, Inc. (Entergy) and the Division of Environmental Quality[1] (DEQ), it is hereby stipulated that the following STATEMENT OF BASIS and ORDER AND AGREEMENT be entered. DEQ and Entergy hereby agree to the entry of this AO in order to satisfy second planning period requirements associated with the Regional Haze Rule, 40 C.F.R. Part 51 Subpart P.

STATEMENT OF BASIS

1. Entergy is an Arkansas Corporation with its principal headquarters in Little Rock, Arkansas.

2. Entergy's Independence Plant (Independence) operates as a two-unit electric generating station in Independence County that generates electric energy for sale.

3. On July 1, 1999, the United States Environmental Protection Agency (EPA) published regulations to address visibility impairment in the nation's Class I areas. 64 Fed. Reg. 35714. These regulations were amended on July 6, 2005 (70 Fed. Reg. 39156), October 13, 2005 (71 Fed. Reg. 60631), June 7, 2012 (77 Fed Reg. 33656), and January 10, 2017 (82 Fed. Reg. 3124). Collectively, these regulations are commonly known as the "Regional Haze Rule," codified at 40 C.F.R. §§ 51.300–51.309.

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[1] Pursuant to Act 910 of 2019, the Arkansas Transformation and Efficiencies Act, the former Arkansas Department of Environmental Quality is now the Division of Environmental Quality in the Department of Energy and Environment.

4. To meet the requirements of the Regional Haze Rule, each state must submit a state implementation plan (SIP) implementing the requirements of the Regional Haze Rule to the U.S. EPA for approval. Each state must submit a revised SIP in 2021 and every ten (10) years thereafter that includes a long-term strategy to "address regional haze visibility impairment for each mandatory Class I Federal area within the State and for each mandatory Class I Federal area located outside that State that may be affected by emissions from the State." 40 C.F.R. §51.308(f)(2).

5. In developing the long-term strategy for each SIP revision, each state "must evaluate and determine the emission reduction measures that are necessary to make reasonable progress by considering the cost of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any potentially affected anthropogenic source of visibility impairment," collectively referred to as the four-factors. 40 C.F.R. §51.308(f)(2)(i).

6. DEQ identified the following emission units operated by Entergy as reasonably anticipated to contribute to visibility impairment at Class I Federal areas in Arkansas and Missouri:

   a. Independence Unit 1 (SN-01); and
   b. Independence Unit 2 (SN-02).

7. The Missouri Department of Natural Resources, the Oklahoma Department of Environmental Quality, and the Visibility Improvement State and Tribal Association of the Southeast identified Independence as a facility that may affect visibility impairment at Class I Federal areas located in Missouri, Oklahoma, and North Carolina.

8. On January 8, 2020, DEQ issued an information collection request (ICR) to Entergy soliciting information about potential control strategies for reducing emissions from Independence Unit 1 (SN-01) and Independence Unit 2 (SN-02).

9. On April 7, 2020, Entergy provided information to DEQ pursuant to the ICR. In the ICR response, Entergy indicated plans to cease coal-fired operations at Independence by no later than December 31, 2030. On March 11, 2021, (Case No. 4:18cv854), the United States District Court-Eastern District of Arkansas entered an order that required Entergy to cease coal-fired operations at Independence.

10. Based on the information provided by Entergy, the court order requiring cessation of coal-fired operations, and consideration of the four factors, DEQ determined that no additional controls are reasonable for that unit to address Regional Haze Rule requirements for Independence for the second planning period (2021–2028).

11. Inclusion of the requirement to cease coal-fired operations by December 31, 2030, at Independence Unit 1 (SN-01) and Independence Unit 2 (SN-02) in this AO constitutes an applicable requirement under Title V of the Clean Air Act. The addition of these applicable requirements necessitates the reopening of the permit. 40 C.F.R. § 70.7(f)(1)(i).

ORDER AND AGREEMENT

WHEREFORE, DEQ and Entergy do hereby stipulate and agree as follows:

1. Entergy shall comply with all requirements set forth in this Order and Agreement.

2. No later than December 31, 2030, Entergy shall permanently cease the combustion of coal at Independence Unit 1 (SN-01) and Independence Unit 2 (SN-02).

3. DEQ has the authority to enforce this AO under Ark. Code Ann. § 8-4-103 and any violations to this AO will be subject to the penalties set forth in Ark. Code Ann § 8-4-103(c).

4. Entergy shall submit a permit modification application to DEQ to incorporate the applicable requirements of this AO no later than eighteen (18) months after the effective date of this AO.

5. Prior to the execution of any agreement for the transfer of ownership or operation of Independence, Entergy shall provide notice of and a copy of this AO to the proposed transferee. Transfer of ownership or operation of any portion of the Independence facility, including Independence Unit 1 (SN-01) and Independence Unit 2 (SN-02), shall not relieve Entergy of its obligation to ensure that the terms of the AO are implemented unless, at least 30 days prior to such transfer, Entergy provides written notice of the prospective transfer to EPA Region 6 and DEQ, and the prospective transferee executes an AO with DEQ prior to the effective date of the transfer providing for continued compliance with the terms set forth in the AO. The Notice of Transfer shall clearly identify the parties responsible for any existing violations of this AO. Any attempt to transfer ownership or operation of the Entergy facility without complying with this Paragraph constitutes a violation of this AO.

6. Nothing contained in this AO shall relieve Entergy of any obligations imposed by any other applicable local, state, or federal laws, nor, except as specifically provided herein, shall this AO be deemed in any way to relieve Entergy of responsibilities contained in the permit.

7. If federal legislation or a federal court takes action on the Arkansas Regional Haze SIP revision or Regional Haze Rule resulting in a stay of compliance requirements of the AO including deadlines or the alteration of other federal regional haze requirements, in whole or in part, then the AO shall be enforceable only to the extent it is federally enforceable.

8. If any provision or requirement of this AO is disapproved by EPA, all provisions or requirements shall be rendered inoperative.

9. This AO is effective upon execution by the Chief Administrator for Environment.

10. By virtue of the signature appearing below, the individual represents that he or she is either an Officer or authorized representative of Entergy.

SO ORDERED THIS _____ DAY OF __________, 2022.

____
Julie Linck
Chief Administrator, Environment

APPROVED AS TO FORM AND CONTENT:

Entergy Arkansas, Incorporated

BY:__________________________(Signature)

_____________________________(Typed or printed name)

TITLE: _______________________

DATE: _______________________