ATTACHMENT

ENGINEERING ANALYSIS FOR CONTROL TECHNOLOGY

BRUNSWICK CELLULOSE, INC.

JUNE 2007

1.0 ENGINEERING ANALYSIS METHODOLOGY

Georgia Environmental Protection Division (EPD) has requested an analysis using four factors to determine potential emission reductions that are reasonable for selected emission units at the Brunswick Mill. The fourth factor, "remaining useful life", indicates that a detailed engineering analysis is required if the expected remaining useful life is beyond the year 2018. The Mill believes that the emission units of interest will continue operating beyond 2018. Thus, GP has prepared this engineering analysis.

The control technology engineering analysis in this application follows the "top-down" approach. The "top-down" approach starts with the most stringent control technology alternative that has been applied to same or similar sources and provides a basis for determining if such an alternative is "reasonable". Following are the basic steps of a "top-down" analysis:

1) Identify all control technologies
   a) All typically in use
   b) Determined as BACT and listed in USEPA *RACT/BACT/LAER Clearinghouse*
   c) In use at Georgia-Pacific Corporation facilities
2) Eliminate technically or economically infeasible options
3) Rank remaining control technologies by control effectiveness
4) Evaluate most effective controls and document results (including non-air quality effects)
5) Identify reasonable measures

GP performed the 5 steps for each visibility-affecting pollutant individually. Georgia EPD has determined that sulfur dioxide (SO_2) is the only relevant pollutant.

The following sections provide a detailed engineering analysis for the No. 4 Power Boiler and No. 6 Recovery Boiler.

2.0 ENGINEERING ANALYSIS FOR NO. 4 MULTI-FUEL BOILER (ID F1)

2.1 SOURCE DESCRIPTION

The Mill operates No. 4 Power Boiler to generate supplemental steam for the facility. Along with other boilers, No. 4 Power Boiler work together with other steam sources to supply a mill-wide common header of steam. The No. 4 Power Boiler was constructed in 1961 as a Combustion Engineering combination boiler rated at 400,000 lbs./hr. when firing bark and other fuel, or at 525,000 lbs./hr., when on oil or gas only, all at 1275 psi and 825°. The boiler is equipped to burn natural gas. The boiler was rebuilt in December 2005 to become an over-fire air designed boiler. Bark comes from the Atlas bin in the woodyard, through a metering and blowing system. The bark drops from the cyclone through a distributor into the furnace. The bark burns partially in suspension and partially on the traveling grate. Ash dropping through the grate and from other sources is sluiced to an ash settling pond in the waste treatment area. The gases pass from the boiler to mechanical collectors where the ash is eventually deposited into the sluicing system.

Power Boiler 4 operates independently and exhausts to the atmosphere through a dedicated single stack via a two-chamber electrostatic precipitator (ESP). Table 1 presents the operating and design information for No. 4 Power Boiler.

Table 1. Summary of Design and Existing Pollution Control Parameters, Brunswick Cellulose

Parameter	Boiler 4
Manufacturer	Combustion Engineering
Year Manufactured	1961 with major rebuild 2005
Design	400,000 lbs to 525,000 lbs steam/hr
MMBtu/hr	800
Fuels	Woodwaste/Bark, oil, gas, tire derived fuel, wastewater treatment sludge
Existing Controls	
SO_2	None
NOx	Good Combustion
PM	ESP
Current SO_2 Emission Limit	2002 TPY

The Boiler is currently in compliance with the Boiler MACT PM standard, well ahead of the compliance date of September 13, 2007.

2.2 TECHNOLOGY REVIEW

Step 1a-Identification of Control Technologies-Typical Technologies in Use in the United States

Emission control equipment that may be considered to control sulfur dioxide emissions from boilers includes wet and dry scrubbers and flue gas desulfurization techniques such as lime injection. The use of clean fuels can also be considered as an additional alternative to add-on controls.

Step 1b-Identification of Control Technologies-Review of RACT/BACT/LAER Clearinghouse (RBLC)

Searches of the RBLC were conducted to identify control technologies for the control of SO_2 emissions from combination boilers. The specific category searched was

- External Combustion- -11

The clearinghouse listed the use of clean fuels, wet and dry scrubbers and flue gas desulfurization techniques such as duct sorbent injection as the control technologies.

Step 1c-Identification of Control Technologies-Review of Technologies in Use at Georgia-Pacific Corporation Facilities

Georgia-Pacific operates numerous combination boilers and bark boilers within the US. SO_2 control technologies include wet scrubbing, dry scrubbing, lime injection, and the use of clean fuels.

Step 2-Technical Feasibility Analysis-Eliminate Technically Infeasible Options

All of the technology options are technically feasible. The most significant site-specific issue is the congested nature of the operating area. The Boiler location is very close to the Turtle River which limits the possible locations for installing new equipment for various scenarios.

Step 3 – Ranking the Technically Feasible Alternatives to Establish a Control Hierarchy

The ranking of the technologies and removal rates are:

1. Wet scrubbing with caustic at approximately 95%+
2. Dry scrubbing with limestone injection at greater than 90%
3. In duct sorbent injection at approximately 60-70%
4. Cleaner fuels at approximately 30% to 95%
5. Wet Scrubbing with water alone at approximately 30%.

Step 4-Control Effectiveness Evaluation

Wet Scrubbers

When first considering only wet scrubbing with caustic or dry scrubbing, the analysis only needs to consider the lower cost of the two. GP has worked closely with one scrubber supplier, Turbosonic, to determine high SO_2 removal options for use with wet scrubbers for similar boilers within Georgia-Pacific.

Detailed Design Information Applied in Cost Estimates

The Spray Tower Scrubber, as estimated, reduces the amount of SO_2 from the flue gas stream by passing the gas through a liquid that contains alkali. The flue gas enters radially at the bottom of the unit flowing vertically upward through the vessel, and counter-current to an alkali solution. The clean (scrubbed) flue gas is passed through a chevron-type mist eliminator for removal of large water droplets prior to exiting through the top of the scrubber vessel. The mist eliminator is equipped with an internal water wash header that is activated intermittently to wash away potential formations of reaction salts. The alkali solution, by way of contacting the flue gas surface, promotes the absorption of the acid gas and the reduction of SO_2 from the gas stream. The alkali solution used for this study is dilute caustic. The caustic solution is introduced into the top of the vessel by way of four (4) zoned headers that contain multiple spray nozzles per header. These nozzles are arranged to ensure that the flue gas stream is in complete contact with the downward flowing solution. The solution drains to the bottom of the absorber vessel's reservoir where it is recycled back to the spray headers by pumps. The absorber vessel and all of its associated parts are constructed of 316L stainless steel.

A 50% Caustic solution is used as the scrubbing medium to achieve the required absorption of SO_2. The 50% Caustic is added to the Scrubber's top spray header allowing the exiting flue gas to see the highest pH. The system maintains the appropriate concentration of dissolved solids in the recycle solution by blowing down some of the liquid based on reservoir conductivity. The 50% Caustic is conveyed to the scrubber's upper header by a metering pump initiated by a pH analyzer loop located in the recycle reservoir. In order to account for the evaporation that occurs during the scrubbing cycle, makeup water is provided to the recycle reservoir based on a level control loop located in the recycle reservoir.

The clean flue gas exits the Scrubber and enters a new 12'–3" diameter 316L stainless steel Stack mounted on top of the new Spray Tower Scrubber outlet. The Stack will terminate at an elevation of 199 feet above grade. Aircraft warning lights and a warning light maintenance platform are not expected. The stack is sized for a flue gas velocity of approximately 35 ft/sec. The lower velocity in the

Stack is critical to prevent water carry over from Stack sidewalls (as would occur when operating at higher velocities) or what is referred to as “raining” from the Stack exit. Stainless steel material was chosen to allow for good resistance to acid attack that is possibly present in the saturated flue gas. Placement of the stack on top of the Scrubber is critical to the overall design due to the fact that any water formation on the Stack wall will drain back to the Scrubber located below. Keeping the Stack wet from bottom to top is also a benefit for prevention of material acid attack based on the fact that acid attack occurs mainly in the wet/dry interface in a Stack.

The Scrubber, ID Fan and Stack location would be determined at a future date. This analysis assumes the footprint will be located within 500 feet of the boiler building. A new steel frame structure will support the Scrubber and Stack. An access stairway is included in the factored estimate. The Spray Tower Scrubber has a 30’ by 27’ footprint and the Scrubber absorber vessel is 22’ in diameter and stands approximately 61’ tall. The bottom of the absorber is raised above grade to allow for access to auxiliary equipment located underneath at grade and to raise the scrubber above the site flood plain elevation. The steel structure will terminate at the Stack testing platform level. The scrubber is completely field welded in place due to its large size. New 10’ x 10’ ductwork is added to transfer flue gas from the existing western most roof mounted ESP chamber outlet to a new ID fan inlet and from the ID Fan outlet to the Spray Tower Scrubber’s inlet. Installation of the Spray Tower Scrubber unit will involve modifying the existing ESP chamber outlet from an upward outlet to a horizontal outlet to facilitate better flue gas flow to the new scrubber system. Money is included in the estimate to study the effect of reconfiguring the ESP outlet. Ductwork support steel is also included in the factored estimate. Demolition of the existing ESP chamber’s outlet plenum, stub stack and testing platform are included in the factored estimate. The existing ID Fan and associated drive will also be demolished and a new piece of ductwork will be installed in its place.

In order to account for the increased pressure drop created by the additional ductwork (4” w.c. drop through ductwork) and the Spray Tower Scrubber (3” w.c. drop through Scrubber), a new ID fan will be included. The ID Fan will be sized to overcome all of the pre-existing equipment and ductwork pressure drops and the additional 7” w.c. loss through the Spray Tower Scrubber and the new ductwork. A new variable speed drive will be installed on the fan. The incremental cost of the fan horsepower required for the additional Scrubber and associated ductwork pressure drop is included in the operating cost for the Spray Tower Scrubber. The existing Precipitator will now be under negative draft. The existing Precipitator will have to be evaluated for potential leaks. Money is included in the estimate as an allowance to evaluate and tighten-up the boiler systems to prevent air infiltration.

The 50% Caustic will be pumped from a new 50% Caustic Tank located near the new scrubber area. The tank will be enclosed in a new dike. The tank has multiple in-tank electric heaters installed to maintain appropriate caustic temperature. Two (2) new Caustic Metering Pumps will take suction from the new tank. One (1) Metering Pump will operate at a time and furnish makeup caustic to the new Spray Tower Scrubber's top spray header.

Five (5) new Scrubber Recycle Pumps will be furnished. Four (4) pumps will operate at a time with one (1) on standby. Each pump will be dedicated to a single Scrubber spray header. As the Boiler is turned down or fuel sulfur content is lowered, pumps and their associated spray header can be shutdown to conserve horsepower. No new Make-up Water Booster Pumps are required. The mill water in the new scrubber area is available with pressure in excess of 100 psig. Mill water is used for Scrubber make-up due to evaporation during operation and for supply of water to the mist eliminator water wash header.

A new motor control center (MCC) Room and a new Rack Room was also included in the factored estimate in order to provide an area to house the electrical equipment for the new ID Fan drives and the new pump drives. The MCC Room and the Rack Room are double-decked and raised a minimum of 18 feet above the existing flood plain elevation. A new 13,800 volt/480 volt transformer is also included in the estimate.

The analysis scaled the direct equipment costs from the 190,000 acfm units to the boiler-specific sizes using the $6/10^{th}$ rule for estimating costs for both boiler-specific applications. To estimate total cost of installation, GP applied the same site-specific installation percentage of total job to the preferred arrangement. The following table calculates the total cost of installation by applying one case of scrubber equipment and the installation factors. As the table indicates, the independent scrubber arrangement provides lower costs.

Table 2. Estimated Total Capital Investment for Caustic Scrubber

Parameter	Value
Base Engineering Case (Alternate Mill)	
Flow Rate (acfm)	190,000
Total Direct Costs ($)	10,820,645
Installation Costs ($)	8,709,355
% Installation of Direct Costs	80.5%
Total Capital Investment ($)	19,530,000
Brunswick Cellulose Case	
Flow Rate (acfm)	420,000
Total Direct Costs ($) - Scaled	9,673,036
% Installation of TCI cost (used default)	80.5%
Installation Costs ($)	7,785,664
Total Capital Investment ($)	17,458,701

Table 2 has errors - revised 10/20/07

17,420,000 ?

these don't jive

Example:

Boiler No 4:

Direct Cost for 420,000 acfm = (420,000 acfm/190,000 acfm) ^0.6 x (Direct Cost for 190,000 acfm)

= (420,000/190,000) ^0.6 x $10,820,645 = $17,420,000

Total Capital Investment = Direct Cost + Installation Cost

Tables 3 and 4 present the unit costs and total annual operating costs, respectively.

Table 3. Site-Specific Unit Costs for Operating Cost Calculations, Brunswick Cellulose

Parameter	Value
Direct Operating Costs	
Operating factor (hr/yr):	8760
Operating labor rate ($/hr):	19
Maintenance labor rate ($/hr):	20.90
Operating labor factor (hr/sh):	0.5
Maintenance labor factor (hr/sh):	0.5
Electricity price($/kWhr):	0.033
Caustic price ($/ton):	468
Solvent (water) price ($/1000 gal):	0.27
Wastewater treatment cost ($/1000 gal):	0.88
Indirect Operating Costs	
Overhead rate (fraction):	0.6
Annual interest rate (fraction):	0.07
Control system life (years):	20
Capital recovery factor (system):	0.0944
Taxes, insurance, admin. factor:	0.04 reasonable?
Total Indirect Cost Multiplier	0.134

Table 4. Calculation of Total Annual Costs for Wet Scrubbers, Brunswick Cellulose

	Boiler 4		
Parameter	Throughput	Annual $	
Operating Labor	547.5 hr	10,403	
Maintenance labor	547.5 hr	11,443	
Electricity : pumps		82,860	
Electricity :NaOH metering		352	
Electricity :Tank Heaters		43,113	
Cost for Fan Pressure Losses		85,830	
Caustic Use	5,890 tons	2,759,074	
Water Use	97,863 kgal	26,423	
Water Treatment	34,521 kgal	30,379	
Total Indirect Costs ($)		~~2,333,756~~	4,225,003
Total Annual Costs ($/yr)		~~5,384,200~~	7,274,880

see 10/20/07 revision

The analysis computed the cost effectiveness by dividing the total annual costs into the actual SO_2 uncontrolled emission rates for 2002 multiplied by the design removal rate.
This equates to: $5,384,200 / (1642 tons x 95%) = 3,451 $/ton

As the boiler is a multi-fuel boiler, the actual uncontrolled emissions reflect the fuel selection. Actual reported emissions to EPD reflect the actual fuels used. While caustic usage would be lower for fuels other than fuel oil, the installed cost would be the same. Thus, to operating with continuous control, the denominator (uncontrolled tons) would be less resulting in a higher value for cost effectiveness.

These high cost effectiveness values reflect a control system designed for 95% removal over an entire year, including peak concentrations.

GP believes that adding a wet control system such as a scrubber may significantly impact the dissolved solid load to the Mill's wastewater treatment system. A non-air quality environmental effect of the wet scrubber will be the increase in total dissolved solids (*e.g.*, sodium salts) to the Turtle River. At this time, GP has not completed a refined engineering analysis or developed a possible chemical profile of blowdown from a wet scrubber. These impacts must be addressed as part of the next phase of engineering design.

<u>Dry Scrubbing</u>

GP commissioned Jacobs Engineering to conduct a detailed engineering cost estimate to install a dry scrubbing system, capable of over 95% at two facilities: Port Hudson, Louisiana and Rincon, Georgia. The Port Hudson equipment was fully installed in 2007 while the Rincon facility estimate was limited to only +/- 30%. The results of the Rincon analysis indicated that the total installed cost and cost effectiveness values were significantly higher than wet scrubbing. The following table summarizes the side-by-side comparison of a multi-fuel boiler rated at approximately 165,000 acfm and 1400 tons SO2 "pre-control" emissions.

The Port Hudson equipment design accommodated approximately 441,000 acfm and is comparable in size to the Brunswick No. 4 Power Boiler. The total installed cost of the Port Hudson equipment (2006 $) is $75MM.

GP believes that the dry scrubbing and wet scrubbing options are comparable in removal efficiency. However, as the costs for dry scrubbing are higher than wet scrubbing, this analysis did not further determine site-specific cost values.

Dry Sorbent Injection

DSI is a post-process SO_2 control system. O'Brien and Gere furnish a DSI system using Trona, as a dry powder, pneumatically injected into the Boiler's outlet ductwork. The Trona is injected into the hot ductwork region where the flue gas temperature is approximately 700°F. O'Brien & Gere's experience shows that this flue gas temperature presents the best environment for SO_2 control for this type of Power Boiler. Trona is a naturally occurring mineral that is chemically known as sodium sesquicarbonate or hydrated sodium bicarbonate ($Na_3HCO_3CO_3{\cdot}2H_2O$). Trona in-duct injection systems may also enhance the capture of mercury (Hg), nitrogen oxides (NO_X) and hydrogen chlorides (HCl) in the flue gas stream. The exact amount of Hg and HCl capture is not quantified by O'Brien and Gere. O'Brien & Gere stated the following in their budgetary quote for a similar GP Boilers at another facility:

"Application specific variables including, but not limited to: fuel blend, flue gas temperature, contaminant loading, duct configuration, Trona residence time, and back-end control device performance all influence Trona duct injection performance."

O'Brien & Gere highly recommends performance of a site-specific duct injection demonstration prior to implementation of a full-scale system design / installation." The cost of this test and study are included in the capital estimate.

Though technically feasible, the Mill does have some concern with this option. First, the use of these systems is very limited. We found one facility in Colorado actively using a trona based DSI system. Second, the available suppliers of trona are very limited. In fact, we only learned of only one US based location for mining trona in Sweetwater County, Wyoming. Use of trona would be more attractive in a water-scarce region and located much closer to the trona supply. It would place the Mill's operations at risk to select a technology with just one supply location so far away and dependent on rail transportation. Third, the literature reports that trona-based DSI has the potential to cause a brownish or orange plume due to a conversion of nitrogen oxide to nitrogen dioxide in the flue gas. When we asked the vendors of DSI technology about this phenomenon, they could not guarantee that under all conditions we would not experience the brownish plume. Given the applicable opacity limits, this would be a major factor against selection of this technology.

Installation of this system includes the addition of a new Trona Storage Silo that has a capacity to store seven (7) days of sorbent. Normally, thirty (30) - to – forty (40) micron sized Trona is stored in the silo, as delivered. A Bin Vent Filter (pulsed jet baghouse type) is installed on the roof of the Silo to capture dust during truck unloading into the Silo. An access and platform system is installed to maintain this installed equipment. The required isolation gate(s), hopper(s), and feeder(s) are furnished along with an installed in-line Mill to re-size the Trona to fifteen (15) microns for injection purposes. A blower system pneumatically conveys the Trona in a dry form directly to the Boiler's outlet duct by way of a pneumatic piping system. Installation of the Silo and associated auxiliary equipment will be in the area of the powerhouse. An injection nozzle is installed in the hot area of the flue gas ductwork to receive and distribute the powdered Trona into the gas stream.

O'Brien and Gere states that approximately two-thirds of the Trona that is injected into the ductwork system will be captured by the particulate matter control system. The remaining one-third passes through the ductwork and out of the stack in a gaseous state. O'Brien and Gere have not determined if the existing ESP can handle the increased solids loading with no change in performance. No money was included in this capital estimate to modify the ESP to accept the Trona injection from the boiler.

(420,000 acfm for Power Boiler 4) /386,000 acfm for base estimate)^0.6 x Total Installed Cost of $12,520,000 for base estimate = 1.05 x $12,520,000 = $13,170,000

The operating costs are Trona usage, operating labor and maintenance. For Power Boiler 4, the uncontrolled baseline emission rate is 1642 tpy (reported in 2002). The removal efficiency of 70% would remove 1150 tpy.

The estimated Trona usage is 5.7 pound of Trona per pound of SO_2. The estimated cost for Trona delivered is $150 per ton. Thus the Trona usage annual cost is approximately $150/ton Trona x 5.7 ton Trona/ton SO_2 x 1642 ton SO_2 = $1.40MM.

The operating labor cost is estimated to be 2 man-hours per shift x 3 shifts per day x 365 days per year and a rate of $16/ hour. This operating cost is = 2 x 3 x 365 x 16 = $35,000.

The annual maintenance cost is estimated at 1.5% of TIC.

Thus the total direct operating cost is: $1.40MM + $35,000 + 1.5% x $13,170,000= $1.63 MM/yr.

The other indirect annual operating costs are capital recovery cost (0.0944 x TIC), administrative, property tax and insurance (2.5% x TIC), or equal to 0.1194 x TIC. The annual indirect cost is thus: Annual Indirect costs = 0.1194 x $13,170,000= $1.57 MM/yr.

Total Annual costs = $1.63 MM + 1.57 MM = $3.2 MM/yr

The cost effectiveness is thus $3.2 MM/yr / 1150 tpy removed = $2,790/ ton SO_2 removed.

GP believes that this is not economically feasible for such an undemonstrated technology.

Clean Fuels

As mentioned above, Power Boiler 4 combusts several fuels and only the residual fuel oil has a significant quantity of sulfur. The actual annual use of oil reflected steam demands and ability to burn cheaper fuels, especially woodwaste. In 1998 and 2002, the annual usage rates were approximately 11.1 MMgal and 6.5 MMgal, respectively. Presently, the Mill is undergoing several changes on this emissions unit to increase its ability to continuously burn design rates of bark and woodwaste. After these changes, the fuel oil usage will be lower than in past years.

Fuel oil with lower sulfur concentration is available from our present supplier. Our supplier has indicated that the #6 oil is available in 1.25%, 1.0%, and 0.70% S concentration. The annual cost for using a cleaner fuel includes direct costs (marginal price difference in oil cost) and indirect costs.

per year?

The existing fuel oil storage system includes one large tank that serves a common distribution system for Power Boiler 4, Recovery Boiler 6 and the Lime Kiln. The total throughput of the tank may reach 13.5 MMgal. If a cleaner fuel oil was to be applied to the Power Boiler 4 alone, then the use of a second tank would be required to avoid a significant annual penalty for cleaner fuel distributed to the Recovery Boiler No. 6 and Lime Kiln. Note that these other emission units capture most of the sulfur in the oil fired and thus a lower sulfur concentration would not significantly reduce emissions from these units.

In 2007, the Mill began construction of a new fuel oil storage tank to replace the existing aging tank directly along the Mill property line. The siting, erection and installation (Total Installed) cost is $3.6MM for the tank alone. A tank for a dedicated Power Boiler 4 tank would be similar in design and cost. The indirect annual costs are: capital recovery cost (0.0944 x TIC), administrative, property tax and insurance (2.5% x TIC), or equal to 0.1194 x TIC. The annual indirect cost is thus:

Annual Indirect costs = 0.1194 x $3.6MM = $0.43 MM/yr.

should not need to be as large?

The annual direct costs are the marginal price increase (as a function of S%) and new tank maintenance. The analysis estimated annual tank maintenance costs at 1% of TIC, or $0.36MM. no, this is $0.036 MM

Thus, separate from the fuel oil price difference, any fuel scenario will increase annual costs by $0.43MM + 0.36 MM = $0.8 MM/yr.
0.036 = 0.47

Determining marginal costs of fuel oils with different sulfur concentrations is reasonably certain for a short "future". As the period of time for a fuel forecast is extended, uncertainty rapidly increases. The following table presents the present available rates for No. 6 fuel oil at Brunswick:

Unit Costs for Various No. 6 Fuel Oil Grades for Brunswick Cellulose

Sulfur % , No. 6 Fuel Oil	Max $/bbl
2.62 – current for Mill	$46.00
1.25	$46.89
1.00	$51.75
0.70	$54.72

The analysis computed the cost effectiveness for each fuel scenario by determining the difference in sulfur from the current case and computing the difference in SO2 emissions with the USEPA Section 1 AP-42 factor:

Lbs SO2/1000 gallons = [157 x Sulfur %]

The fuel costs and emissions are linear to the amount of gallons used. Thus, the analysis computed cost effectiveness using a common value of 5 MMgal/year.

The following table summarizes the annual marginal fuel costs and emissions reduced for this scenario.

Summary of Fuel Cost Increases for Various No. 6 Fuel Oil Cases, Brunswick Cellulose

Sulfur % , No. 6 Fuel Oil	2.62	1.25	1.00	0.70
Max $/bbl (Colonial Oil 12/06)	$46.00	$46.89	$51.75	$54.72
So2 Emissions for 5 Mmgal/yr	1,028	491	393	275
Emission Change (tpy)	NA	538	636	754
Fuel Cost ($/yr)	$5,476,190	$5,581,827	$6,160,714	$6,514,286
Fuel Cost Increase ($/yr)	NA	$105,636	$684,524	$1,038,095

To compute the cost effectiveness, the analysis added the Direct costs (shown above) with the indirect annual costs of $0.8MM/yr. The following table summarizes the cost effectiveness values for these fuel scenarios.

Summary of Cost Effectiveness Values for Various No. 6 Fuel Oil Cases, Brunswick Cellulose

Sulfur % , No. 6 Fuel Oil	1.25	1.00	0.70
Emission Change (tpy)	538	636	754
Cost Increase ($/yr)	105,636	684,524	1,038,095
Indirect Costs ($/yr)	800,000	800,000	800,000
Total Annual Costs ($/yr)	905,636	1,484,524	1,838,095
Cost Effectiveness ($/ton removed)	1,684	2,335	2,439

The Brunswick believes that all these fuel options are not economically feasible.

Step 5-Identify Reasonable Measures

GP believes that each technically feasible option is not economically feasible. Thus, while the options have the potential to reduce emissions, each option is not reasonable.

3.0 ENGINEERING ANALYSIS FOR NO. 6 RECOVERY BOILER (ID M24)

3.1 SOURCE DESCRIPTION

The recovery boiler is at the heart of the Kraft chemical recovery process. It fulfills the following essential functions:

(1) Evaporates residual moisture from the black liquor solids.
(2) Burns the organic constituents.
(3) Supplies heat for steam generation.
(4) Reduces oxidized sulfur compounds to sulfide.
(5) Recovers inorganic chemicals in molten form.
(6) Conditions the products of combustion to minimize chemical carryover.

Heavy black liquor from the pulping process is sprayed directly into the recovery boiler. The liquor droplets dry and partially pyrolyze before falling onto the char bed. Incomplete combustion in the porous char bed causes carbon and carbon monoxide to act as reducing agents, thus converting sulfate and thiosulfate to sulfide. The heat is sufficient to melt the sodium salts, which filter through the char bed to the floor of the recovery boiler. The “smelt” then flows by gravity through water-cooled spouts to the associated smelt dissolving tanks.

The Recovery Boiler No. 6 is a low odor, non-direct contact evaporator design. The Tampella recovery furnace was started up in September 1990 and designed to process 4.5 x 10^6 lbs. black liquor solids per day. The boiler rating is 740,000 lb. steam per hour at 1250 psig and 72% liquor solids feed. Black liquor is supplied from the 72% storage tank to the saltcake mix tank where saltcake from the precipitator is added. The liquor leaving the mix tank overflows to a retention tank and is heated via an indirect heater to approximately 245°F prior to injection into the boiler. The stationary firing is through 8 liquor guns, 2 on each boiler wall. Smelt discharges from 4 spouts on the north wall of the boiler to a dissolving tank on the bottom floor. In the dissolving tank the smelt is dissolved in weak wash and forms green liquor. The green liquor is then pumped to the green liquor surge tank in the recausticizing area for processing into white liquor. The dissolving tank has a weak wash scrubber to scrub sulfur compounds.

The flue gases leaving the recovery boiler are processed in a 2-chamber Environmental Elements electrostatic precipitator with 4 T/R sets per chamber. One chamber can support 70% of rated capacity. Saltcake collected in the precipitator from the flue gases is returned to the saltcake mix tank.

The exiting flue gases from the precipitator are monitored for opacity and TRS. Current limits on opacity and TRS are 35% for 6 minutes and 5.0 ppm for 8 hours, respectively. Under normal operating conditions the boiler's opacity and TRS run 10% and 1 ppm, respectively.

3.2 TECHNOLOGY REVIEW

Step 1a-Identification of Control Technologies-Typical Technologies in Use in the United States

Emission control equipment that might be considered to control SO_2 emissions from a recovery boiler would include any one of a number of absorption (*i.e.,* scrubbing) processes, a flue gas desulfurization (FGD) system, and combustion controls.

Gas Absorption

Gas absorption systems are designed to maximize contact between the gas and liquid solvent in order to permit interphase diffusion of the SO_2. Absorbers found to adequately disperse the liquid include packed towers, plate or tray towers, and spray chambers. When water is the liquid solvent, absorbers are analogous to wet scrubbers used for the reduction of particulate matter emissions (see discussion above). Thus, this type of equipment can be used to reduce both types of contaminants. SO_2 emission reductions of 90-98% can be expected using gas absorption systems. Packed tower absorbers may achieve efficiencies as high as 99.9%. However, if the pollutant concentration entering the absorber is relatively low, then the SO_2 removal efficiency will be much lower.

The absorbent may be limestone, dual alkali, sodium solutions, ammonia-based solutions, citrate process or magnesium oxide process. These technologies are utilized to control SO_2 emissions in the chemical industry and for some types of combustion-related equipment. Absorption is the process whereby one or more gaseous contaminants are selectively dissolved into a relatively nonvolatile liquid. The liquid contains the equilibrium concentrations of the gaseous component.

The effluent from an absorber would be discharged to a wastewater treatment plant and not reused in the Mill.

Gas absorption systems usually have significant pressure drops, in the range of 6-8 inches w.c. This may require additional expenditures for a new fan that is designed to handle the added pressure drop. These systems also require routine maintenance to clean out or replace the packing material.

Flue Gas Desulfurization

This technology has been used on coal-fired boilers and works in one of two ways. The first method works by injecting fine particles of dry limestone into the combustion chamber of the boiler. The limestone (calcium carbonate) reacts with the sulfur dioxide gases to form calcium sulfate. The calcium sulfate must then be removed from the boiler exhaust gas stream as particulate matter. The second method works by adding wet slurry of limestone into a wet scrubber that is controlling the flue gases from the boiler. The wet limestone also reacts to form calcium sulfate, but as a wet slurry, and not a dry particulate, as is the case with the first method. This second method results in the generation of a sludge (usually as calcium sulfate or gypsum) that must be sent to an off-site landfill (in some cases, there may be a way to reuse the sludge, if impurities are not present such as for making gypsum wall board). Both of these methods provide relatively high removal efficiencies, generally 90% and higher, depending upon the specific application.

Combustion Control and High Black Liquor Solids Content

Proper combustion control is an effective means to control SO_2 emissions from recovery boilers. SO_2 emissions are formed by the oxidation of reduced sulfur compounds in recovery boilers. These emissions vary depending upon the sulfur content of the black liquor being burned, the quantity of oxygen available in the combustion chamber, and the black liquor dry solids content. A separate permit application is under preparation for the No. 3 Recovery Boiler to increase the high black liquor solids content and therefore emit lower quantities of SO_2 than traditional direct contact evaporator (DCE) recovery boilers. In fact, the RBLC lists "high solids firing" as a BACT control technology for recovery boilers.

No. 6?

Combustion control to reduce SO_2 emissions is inherent in the design of a recovery boiler due to the chemical reactions that take place inside of the combustion chamber when black liquor is combusted. Black liquor normally contains a number of sulfur-bearing compounds when it is generated from the Kraft pulping process. When black liquor is oxidized, most of the oxidized sulfur compounds are converted to sulfides. These inorganic compounds, primarily sodium sulfide and sodium sulfate, recovered in molten form at the bottom of the boiler bed, are referred to as "smelt". The smelt is drained through the bottom of the recovery boiler into a smelt dissolving tank. The majority of remaining sulfur compounds that leave the smelt bed as a sodium fume from the reduction process are tied up with the boiler bottom ash as sodium sulfate, thereby reducing SO_2 emissions discharged from the boiler. Likewise, when black liquor is co-fired with oil and its sulfur, the sulfur is bound with the sodium fume.

The capture of SO_2 is primarily dependent upon the boiler bed temperature. Typically, a hot char bed will promote more rapid adsorption of SO_2 into the smelt and generate sufficient amounts of sodium fume to tie up the majority of the remaining SO_2 as sodium sulfate. A properly operated recovery boiler will result in an SO_2 capture efficiency of 99% or better. This is why SO_2 emissions from well-operated recovery boilers usually have an average SO_2 concentration in the exhaust gas well under 100 ppmv.

Step 1b-Identification of Control Technologies-Review of RACT/BACT/LAER Clearinghouse

Searches of the RBLC were conducted to identify control technologies for the control of SO_2 emissions from recovery boilers.

The specific categories searched are listed below:

- External Combustion-Other-11.999
- Kraft Pulp Mills-30.002
- Pulp & Paper Production Other than Kraft-30.004
- Other Wood Products Industry Sources-30.999

The results of the searches are summarized below:

- Boiler design and good engineering practices
- No controls
- High solids firing
- Limit of 30% sulfidity in black liquor
- Combustion control
- Low odor design boiler
- Combustion control
- Good process controls

Step 1c-Identification of Control Technologies-Review of Technologies in Use at Georgia-Pacific Corporation Facilities

With the exception of the Camas, Washington Mill (see related discussion above under particulate matter), all of the Georgia-Pacific recovery boilers utilize combustion control techniques to minimize the generation of SO_2 emissions. An additional benefit of using the wet scrubbers is lower SO_2 emissions. However, the scrubbers were installed primarily to recover heat to generate process water for the Mill, and not to reduce SO_2 emissions.

Step 2-Technical Feasibility Analysis-Eliminate Technically Infeasible Options

Systems that inject chemicals into the combustion chamber as a means to control SO_2 emissions will interfere with the recovery process that is taking place inside of a recovery boiler. For this reason, flue gas desulfurization using the "dry limestone" method is not considered technically feasible or a demonstrated technology to reduce SO_2 emissions from recovery boilers. Additionally, there are no known recovery boilers in the U.S utilizing this particular type of SO_2 control.

The use of a flue gas desulfurization system that employs the wet limestone slurry method (outside of the boiler) would be technically feasible, as would the use of a gas absorption system with a caustic solution (*e.g.,* sodium hydroxide).

However, the inherent design of a recovery boiler and the use of combustion control techniques result in low SO_2 emissions. Because of this fact, the use of additional downstream SO_2 controls, such as a wet adsorption tower, cannot be economically justified since the average inlet SO_2 concentration directed to the control device is usually well under 100 ppmv.

Annual SO_2 concentrations for the No. 6 Recovery Boiler during based on stack testing performed between 1999 to 2003 averaged less than 38 ppmv. EPA BART guidelines specify that emissions from start-up are not subject to review. While it is technically feasible to use a scrubber to control SO_2 emissions from a recovery boiler, it would not be economically feasible to install SO_2 controls on a source that has such a low exhaust gas stream concentration during normal operations.

Combustion control and gas absorption system with a caustic solution are technically feasible for use in reducing SO_2 emissions in recovery boilers.

Step 3-Ranking the Technically Feasible Control Alternatives to Establish a Control Hierarchy

Dry flue gas desulfurization systems were eliminated due to technical infeasibility. The only remaining control technologies are the use of an SO_2 adsorption device (scrubber) and the inherent design of a recovery boiler that also employs combustion control techniques.

A conventional SO_2 scrubber can reduce SO_2 emissions from 90-98%, depending upon the degree of control required. Higher control efficiencies (99+%) require larger and more expensive scrubbers. As discussed above, the inherent design of recovery boilers already results in SO_2 removal efficiencies of 99+%.

Step 4-Control Effectiveness Evaluation

The No. 6 Recovery Boiler at the Brunswick Cellulose Mill utilizes a non-direct contact evaporator (NDCE), low odor design, and staged combustion control techniques. Furthermore, as discussed above, SO_2 emissions, based on stack tests conducted during 1999 through 2003 averaged less than 38 ppmv when burning only black liquor.

When a recovery boiler is only burning black liquor, the inherent design of the unit results in a control efficiency that is roughly equivalent to the control efficiency achieved through the use of an SO_2 scrubber. Further, SO_2 scrubber can not remove additional SO_2 emissions in applications with a loading at 38 ppm.

The remaining technology, combustion control, is therefore considered to be the most effective control technology for reducing sulfur dioxide emissions from recovery boilers. Combustion control is part of the inherent design of the No. 6 Recovery Boiler.

Step 5-SelectReasonable Measures

There is no NSPS limit for SO_2 emissions from recovery boilers. Typical SO_2 emissions from recovery boilers operating in the United States range from 100 to 300 ppmv.

Brunswick Cellulose believes the only reasonable measures for the No. 6 Recovery Boiler is Boiler Design and Combustion Control.

4.0 SUMMARY OF REASONABLE MEASURES FOR BRUNSWICK MILL

The analysis presented a "top-down" analysis for the Power Boiler No. 4 and Recovery Boiler No .6. While there are several technically feasible options, each option above current technology in place is not economically feasible and thus not reasonable.

The following table summary presents the summary of the technically feasible options.

Summary of Engineering Analysis, Brunswick Cellulose, Inc.

Emission Unit	Existing Controls	Evaluated Technology	$/ton
No. 6 Recovery Boiler	Combustion Control	Combustion Control	0
No. 4 Power Boiler	ESP	Caustic Scrubber (95%)	3,450
No. 4 Power Boiler	ESP	Duct Sorbent Injection	2,740
No. 4 Power Boiler	ESP	Low Sulfur Oil	1,684 -2,439

APPENDIX

EPA FACT Sheets

Capital Cost Calculations for Wet Scrubber Options by Jacobs Engineering Group (2007)

TOTAL COST SUMMARY - JE PRIME CODE

JE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4

ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

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PRIME CODE	DESCRIPTION	W-H	QTY	UNIT	LABOR	EQUIPMENT	MATERIAL	SUBCONTRACT	TOTAL COST
	DIRECT COSTS								
50	MAJOR EQUIPMENT	14,585	0	0	$773,825	$3,069,455	$2,606	$1,350,000	$5,195,686
51	DEMOLITION	1,550	0	0	$82,235	$0	$0	$0	$82,235
52	SITE EARTHMOVING	0	0	0	$0	$0	$0	$0	$0
53	SITE IMPROVEMENTS	0	0	0	$0	$0	$0	$311,753	$311,753
54	PILING, CAISSONS	0	3,637	LF	$0	$0	$0	$363,712	$363,712
55	BUILDINGS	0	1	LOT	$0	$0	$0	$630,000	$630,000
56	CONCRETE	1,967	164	CY	$88,373	$0	$81,886	$0	$170,259
57	MASONRY, REFRACTORY	0	0	0	$0	$0	$0	$0	$0
58	STRUCTURAL STEEL	7,362	210	TN	$361,114	$0	$709,238	$0	$1,070,353
59	ROOFING AND SIDING	0	0	0	$0	$0	$0	$0	$0
60	FIRE PROOFING	0	0	0	$0	$0	$0	$0	$0
61	PROCESS DUCTWORK (NON-BUILDING)	0	0	0	$0	$0	$0	$0	$0
62	PIPING	11,752	3,917	LF	$623,506	$0	$623,506	$0	$1,247,013
63	INSULATION - PIPE, EQUIPMENT & DUCTWORK	0	1	LOT	$0	$0	$0	$792,827	$792,827
64	INSTRUMENTATION	1,084	54	EA	$51,959	$129,897	$109,114	$0	$290,970
65	ELECTRICAL	2,273	9,093	LF	$108,950	$296,894	$207,835	$0	$613,680
66	PAINTING, PROTECTIVE COATINGS	578	20,784	SF	$25,979	$0	$25,979	$0	$51,959
67	FURNITURE, LAB & SHOP EQUIPMENT	0	0	0	$0	$0	$0	$0	$0
	TOTAL DIRECT COSTS	41,152			$2,115,941	$3,496,247	$1,760,165	$3,448,292	$10,820,645
	$ / WH	$51.42							
	CONSTRUCTION INDIRECT COSTS								
75	CONSTRUCTION SUPPORT LABOR	8,230	34.0%	BL	$325,005	$0	$0	$0	$325,005
76	TEMPORARY CONSTRUCTION FACILITIES (IN WAGE RATES)				$0	$0	$0	$0	$0
78	PREMIUM TIME		13.8%	BL	$131,682	$0	$0	$0	$131,682
79	CRAFT FRINGE BENEFITS (IN WAGE RATES)				$0	$0	$0	$0	$0
	CRAFT PER DIEM ($5 PER HOUR ON 100 % OF THE HOURS)				$0	$0	$0	$320,983	$320,983
80	PAYROLL TAXES & INSURANCE (IN WAGE RATES)				$0	$0	$0	$0	$0
83	SMALL TOOLS (IN WAGE RATES)				$0	$0	$0	$0	$0
84	CONSUMABLE SUPPLIES (IN WAGE RATES)				$0	$0	$0	$0	$0
85	CONSTRUCTION EQUIPMENT (IN WAGE RATES)				$0	$0	$0	$0	$0
87	FIELD STAFF (IN WAGE RATES)				$0	$0	$0	$0	$0
81	NON-PAYROLL TAX, INSURANCE & PERMITS				$0	$174,812	$88,008	$86,207	$349,028
93	CONSTRUCTION HOME OFFICE COST (INC. WITH CONTRACTOR'S CONSTRUCTION FEE)				$0	$0	$0	$0	$0
71	CRAFT START-UP ASSISTANCE	450			$31,500	$0	$0	$0	$31,500
99	CONTRACTOR'S CONSTRUCTION HOME OFFICE & FEE		10.1%	TCC LESS EQ.	$266,159	$0	$277,226	$385,548	$928,933
	TOTAL CONSTRUCTION INDIRECT COSTS	8,680			$754,346	$174,812	$365,234	$792,739	$2,087,131
	TOTAL CONSTRUCTION COSTS (TCC)	49,832			$2,870,287	$3,671,059	$2,125,400	$4,241,031	$12,907,776
	$ / WH	$77.34							
	PROJECT INDIRECT COSTS								
88	CONSTRUCTION MANAGEMENT		4.5%	TIC	$0	$0	$0	$876,980	$876,980
90	ENGINEERING PROFESSIONAL SERVICES		10.0%	TIC	$0	$0	$0	$1,943,247	$1,943,247
90	STUDY COST		0.3%	TIC	$0	$0	$0	$50,000	$50,000
96	OUTSIDE CONSULTANT SERVICES				$0	$0	$0	$100,000	$100,000
91	OWNER'S COST		3.3%	TIC	$0	$0	$0	$645,389	$645,389
70	SPARE PARTS				$0	$174,812	$0	$0	$174,812
71	NON-CRAFT START-UP ASSISTANCE				$49,950	$0	$0	$69,200	$119,150
98	ALLOWANCE FOR UNFORESEEN		8.6%	TIC	$292,024	$384,587	$212,540	$787,585	$1,676,735
98	ESCALATION		4.8%	TIC	$0	$384,587	$299,119	$252,781	$936,487
	ROUND OFF				($260)	($46)	($59)	($212)	($577)
	TOTAL PROJECT COSTS	49,832			$3,212,000	$4,615,000	$2,637,000	$8,966,000	$19,430,000
	$ / WH	$77.34							

DETAIL DIRECT COST

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
G:\ESTIMAT\GEORPAC\VIRGINIA\BIG ISLAND\16DC9000 - BART BOILER PROGRAM\BIG ISLAND - #4 PB - SPRAY TOWER SCRUBBER\[16DC9000 - TCS - BIG ISLAND - #4 PB SPRAY TOWER SCRUBBER - BART BOILER PROGRAM_R1.xls]PRIME CODE TCS

ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

LINE NO.	JE PRIME CODE	01 BIG ISLAND - #4 PB SPRAY TOWER SCRUBBER DESCRIPTION	QTY.	UNIT	W.H./ UNIT	TOTAL W.H.'s	COST/ W.H.	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	UNIT COST	TOTAL ALL COSTS
		DIRECT COST - DETAILS														
1		MAJOR EQUIPMENT														
2																
5	50	DUCTWORK - FILL IN FOR EXISTING ID FAN, 1/4" THICK DUCT, 8' X 8', 320 SF	4,800	LB	0.04	192	$53.05	$10,187	$2.50	$12,000	$0.00	$0	$0.00	$0	$4.62	$22,187
7	50															
8	50	LOUVER DAMPER - EXISTING ID FAN LOCATION	1	EA	80.00	80	$53.05	$4,244	$27,000	$27,000	$0.00	$0	$0.00	$0	$31,244	$31,244
14	50															
15	50	PRECIPITATOR OUTLET NOZZLE (CONE SHAPED), 1/4" DUCT, 100' IN AIR, 890 SF	13,350	LB	0.04	534	$53.05	$28,331	$2.50	$33,375	$0.00	$0	$0.00	$0	$4.62	$61,706
17	50															
18	50	EXPANSION JOINT - PRECIPITATOR OUTLET	1	EA	80.00	80	$53.05	$4,244	$7,600	$7,600	$0.00	$0	$0.00	$0	$11,844	$11,844
19	50															
20	50	ISOLATION DAMPER NO. 1	1	EA	160.00	160	$53.05	$8,489	$44,000	$44,000	$0.00	$0	$0.00	$0	$52,489	$52,489
21	50	SEAL AIR BLOWER FOR ISOLATION DAMPER NO. 1	1	EA	36.00	36	$53.05	$1,910	$7,000	$7,000	$0.00	$0	$0.00	$0	$8,910	$8,910
22	50	MOTOR, SEAL AIR BLOWER FOR ISOLATION DAMPER NO. 1, 25 HP	1	EA	14.00	14	$53.05	$743	$5,000	$5,000	$0.00	$0	$0.00	$0	$5,743	$5,743
23	50															
24	50	ISOLATION DAMPER NO. 2	1	EA	160.00	160	$53.05	$8,489	$44,000	$44,000	$0.00	$0	$0.00	$0	$52,489	$52,489
25	50	SEAL AIR BLOWER FOR ISOLATION DAMPER NO. 2	1	EA	36.00	36	$53.05	$1,910	$7,000	$7,000	$0.00	$0	$0.00	$0	$8,910	$8,910
26	50	MOTOR, SEAL AIR BLOWER FOR ISOLATION DAMPER NO. 2, 25 HP	1	EA	14.00	14	$53.05	$743	$5,000	$5,000	$0.00	$0	$0.00	$0	$5,743	$5,743
27	50															
28	50	CROSS-OVER ISOLATION DAMPER NO. 3	1	EA	160.00	160	$53.05	$8,489	$44,000	$44,000	$0.00	$0	$0.00	$0	$52,489	$52,489
29	50	SEAL AIR BLOWER FOR CROSS-OVER ISOLATION DAMPER NO. 3	1	EA	36.00	36	$53.05	$1,910	$7,000	$7,000	$0.00	$0	$0.00	$0	$8,910	$8,910
30	50	MOTOR, SEAL AIR BLOWER FOR CROSS-OVER ISOLATION DAMPER NO. 3, 25 HP	1	EA	14.00	14	$53.05	$743	$5,000	$5,000	$0.00	$0	$0.00	$0	$5,743	$5,743
31	50															
32	50	DUCTWORK - PRECIPITATOR OUTLET TO INLET OF ID FAN, 1/4" THICK DUCT, 10' X 10'	123,750	LB	0.04	4,950	$53.05	$262,621	$2.50	$309,375	$0.00	$0	$0.00	$0	$4.62	$571,996
34	50															
35	50	EXPANSION JOINT - ID FAN INLET	2	EA	80.00	160	$53.05	$8,489	$4,000	$8,000	$0.00	$0	$0.00	$0	$8,244	$16,489
36	50															
37	50	NEW ID FAN	1	EA	600.00	600	$53.05	$31,833	$341,000	$341,000	$0.00	$0	$0.00	$0	$372,833	$372,833
38	50	MOTOR, ID FAN, 2000 HP @ 1200 RPM	1	EA	264.00	264	$53.05	$14,006	$160,000	$160,000	$0.00	$0	$0.00	$0	$174,006	$174,006
39	50	LCI DRIVE	1	EA	250.00	250	$53.05	$13,264	$120,000	$120,000	$0.00	$0	$0.00	$0	$133,264	$133,264
40	50															
41	50	EXPANSION JOINT - ID FAN OUTLET	1	EA	80.00	80	$53.05	$4,244	$20,000	$20,000	$0.00	$0	$0.00	$0	$24,244	$24,244
42	50															
43	50	DUCTWORK - ID FAN TO SPRAY TOWER SCRUBBER INLET, 1/4" THICK DUCT, 10' X 10'	31,185	LB	0.04	1,247	$53.05	$66,180	$2.50	$77,963	$0.00	$0	$0.00	$0	$4.62	$144,143
45	50															
46	50	EXPANSION JOINT - SPRAY TOWER SCRUBBER INLET	1	EA	80.00	80	$53.05	$4,244	$7,600	$7,600	$0.00	$0	$0.00	$0	$11,844	$11,844
47	50															
48	50	SPRAY TOWER SCRUBBER - 22' DIAMETER X 81'-3" TALL, 316L SS - FOUR SPRAY ZONES	1	EA	4,500.00	4,500	$53.05	$238,746	$1,385,500	$1,385,500	$0.00	$0	$0.00	$0	$1,624,246	$1,624,246
49	50															
50	50	SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 1, 2062 GPM @ 150 FT TDH	1	EA	56.00	56	$53.05	$2,971	$18,000	$18,000	$0.00	$0	$0.00	$0	$20,971	$20,971
51	50	MOTOR, SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 1, 100 HP @ 1750 RPM	1	EA	30.00	30	$53.05	$1,592	INCLUDED	$0	$0.00	$0	$0.00	$0	$1,592	$1,592
52	50															
53	50	SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 2, 2062 GPM @ 150 FT TDH	1	EA	56.00	56	$53.05	$2,971	$18,000	$18,000	$0.00	$0	$0.00	$0	$20,971	$20,971
54	50	MOTOR, SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 2, 100 HP @ 1750 RPM	1	EA	30.00	30	$53.05	$1,592	INCLUDED	$0	$0.00	$0	$0.00	$0	$1,592	$1,592
55	50															
56	50	SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 3, 2062 GPM @ 150 FT TDH	1	EA	56.00	56	$53.05	$2,971	$18,000	$18,000	$0.00	$0	$0.00	$0	$20,971	$20,971
57	50	MOTOR, SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 3, 100 HP @ 1750 RPM	1	EA	30.00	30	$53.05	$1,592	INCLUDED	$0	$0.00	$0	$0.00	$0	$1,592	$1,592
58	50															
59	50	SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 4, 2062 GPM @ 150 FT TDH	1	EA	56.00	56	$53.05	$2,971	$18,000	$18,000	$0.00	$0	$0.00	$0	$20,971	$20,971
60	50	MOTOR, SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 4, 100 HP @ 1750 RPM	1	EA	30.00	30	$53.05	$1,592	INCLUDED	$0	$0.00	$0	$0.00	$0	$1,592	$1,592
61	50															
62	50	SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 5, 2062 GPM @ 150 FT TDH	1	EA	56.00	56	$53.05	$2,971	$18,000	$18,000	$0.00	$0	$0.00	$0	$20,971	$20,971
63	50	MOTOR, SPRAY TOWER SCRUBBER RECYCLE PUMP NO. 5, 100 HP @ 1750 RPM	1	EA	30.00	30	$53.05	$1,592	INCLUDED	$0	$0.00	$0	$0.00	$0	$1,592	$1,592
64	50															
65	50	50% CAUSTIC DAY TANK - 13' DIAMETER X 18' STRAIGHT SIDE, CARBON STEEL, 215,000 LBS FULL	1	EA	200.00	200	$53.05	$10,611	$50,000	$50,000	$0.00	$0	$0.00	$0	$60,611	$60,611
68	50															
69	50	BAYONET TANK HEATER NO. 1, 150 KW	1	EA	30.00	30	$53.05	$1,592	$10,400	$10,400	$0.00	$0	$0.00	$0	$11,992	$11,992
70	50															
71	50	BAYONET TANK HEATER NO. 2, 150 KW	1	EA	30.00	30	$53.05	$1,592	$10,400	$10,400	$0.00	$0	$0.00	$0	$11,992	$11,992
72	50															
73	50	BAYONET TANK HEATER NO. 3, 150 KW	1	EA	30.00	30	$53.05	$1,592	$10,400	$10,400	$0.00	$0	$0.00	$0	$11,992	$11,992
74	50															
75	50	BAYONET TANK HEATER NO. 4, 150 KW	1	EA	30.00	30	$53.05	$1,592	$10,400	$10,400	$0.00	$0	$0.00	$0	$11,992	$11,992
76	50															
77	50	50% CAUSTIC METERING PUMP NO. 1, 4 GPM @ 230 FT TDH	1	EA	32.00	32	$53.05	$1,698	$6,850	$6,850	$0.00	$0	$0.00	$0	$8,548	$8,548
78	50	MOTOR, 50% CAUSTIC METERING PUMP NO. 1, 2 HP @ 1800 RPM	1	EA	4.00	4	$53.05	$212	INCLUDED	$0	$0.00	$0	$0.00	$0	$212	$212
79	50	VFD, 50% CAUSTIC METERING PUMP NO. 1	1	EA	8.00	8	$53.05	$424	$4,000	$4,000	$0.00	$0	$0.00	$0	$4,424	$4,424
80	50															
81	50	50% CAUSTIC METERING PUMP NO. 2, 4 GPM @ 230 FT TDH	1	EA	32.00	32	$53.05	$1,698	$6,850	$6,850	$0.00	$0	$0.00	$0	$8,548	$8,548
82	50	MOTOR, 50% CAUSTIC METERING PUMP NO. 2, 2 HP @ 1800 RPM	1	EA	4.00	4	$53.05	$212	INCLUDED	$0	$0.00	$0	$0.00	$0	$212	$212
83	50	VFD, 50% CAUSTIC METERING PUMP NO. 2	1	EA	8.00	8	$53.05	$424	$4,000	$4,000	$0.00	$0	$0.00	$0	$4,424	$4,424
84	50															

DETAIL DIRECT COST

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
G:\ESTIMAT\GEORPAC\VIRGINIA\BIG ISLAND\16DC9000 - BART BOILER PROGRAM\BIG ISLAND - #4 PB - SPRAY TOWER SCRUBBER\[16DC9000 - TCS - BIG ISLAND - #4 PB SPRAY TOWER SCRUBBER - BART BOILER PROGRAM_R1.xls]PRIME CODE TCS

ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

LINE NO.	JE PRIME CODE	01 BIG ISLAND - #4 PB SPRAY TOWER SCRUBBER DESCRIPTION	QTY	UNIT	W.H./ UNIT	TOTAL W.H.'s	COST/ W.H.	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	UNIT COST	TOTAL ALL COSTS
		DIRECT COST - DETAILS														
85	50	SPRAY TOWER SCRUBBER INSTRUMENTATION	1	LOT	INC. W/ SPRAY TOWER SCRUBBER	0	$53.05	$0	INCLUDED	$0	$0.00	$0	$0.00	$0	$0	$0
86	50															
87	50	SPRAY TOWER SCRUBBER OVERFLOW SEAL POT	1	EA	20.00	20	$53.05	$1,061	$3,000	$3,000	$0.00	$0	$0.00	$0	$4,061	$4,061
88	50															
89	50	EXPANSION JOINT - SPRAY TOWER SCRUBBER OUTLET	1	EA	80.00	80	$53.05	$4,244	$12,000	$12,000	$0.00	$0	$0.00	$0	$16,244	$16,244
90	50															
91	50	STACK - 12'-3" DIAMETER, 316L SS, 118' SECTION, 199' TOP ELEVATION	1	EA	S / C	0	$53.05	$0	$0	$0	$0.00	$0	$750,000	$750,000	$750,000	$750,000
92	50															
93	50															
94	50															
95	50	FREIGHT	1	LOT	N / A	0	$53.05	$0	$173,743	$173,743	$0.00	$0	$0.00	$0	$173,743	$173,743
96	50	SHIMS AND GROUT	1	LOT	0.00	0	$53.05	$0	$0	$0	$2,606	$2,606	$0.00	$0	$2,606	$2,606
98	50	RIGGING AND HEAVY LIFTS	1	LOT	S / C	0	$53.05	$0	$0	$0	$0.00	$0	$600,000	$600,000	$600,000	$600,000
101																
102	50	TOTAL - MAJOR EQUIPMENT				14,585	$53.05	$773,825		$3,069,455		$2,606		$1,350,000		$5,195,886
117																
118																
119		DEMOLITION														
120																
122	51	DEMO EXISTING ID FAN, MOTOR, & FLUID DRIVE	1	LOT	250.00	250	$53.05	$13,264	$0	$0	$0.00	$0	$0.00	$0	$13,264	$13,264
123	51															
124	51	DEMO EXISTING STUB STACK - PRECIPITATOR OUTLET, 7' DIAMETER	35	LF	11.43	400	$53.05	$21,222	$0	$0	$0.00	$0	$0.00	$0	$606.34	$21,222
125	51															
126	51	DEMO EXISTING PRECIPITATOR OUTLET PLENUM, 1/4" DUCT, 100' IN AIR	27,000	LB	0.02	540	$53.05	$28,650	$0	$0	$0.00	$0	$0.00	$0	$1.06	$28,650
127	51	DEMO INSULATION & LAGGING - EXISTING PRECIPITATOR OUTLET PLENUM (ASSUMED NO ASBESTOS INSULATION TO BE REMOVED)	1,800	SF	0.20	360	$53.05	$19,100	$0	$0	$0.00	$0	$0.00	$0	$10.61	$19,100
139																
140	51	TOTAL - DEMOLITION				1,550	$53.05	$82,235		$0		$0		$0		$82,235
152																
153																
154		SITE IMPROVEMENTS														
155																
160	53	*FACTORED FROM INSTALLED PROCESS EQUIPMENT COST*	1	LOT	0.00	0	$44.93	$0	$0	$0	$0	$0	$311,753	$311,753	$311,753	$311,753
161																
162	53	TOTAL - SITE IMPROVEMENTS				0	$0.00	$0		$0		$0		$311,753		$311,753
163																
164																
165		PILING, CAISSONS														
166																
171	54	*FACTORED FROM INSTALLED PROCESS EQUIPMENT COST*	1	LOT	0.00	0	$44.93	$0	$0	$0	$0	$0	$363,712	$363,712	$363,712	$363,712
172																
173	54	TOTAL - PILING, CAISSONS	3,637	LF		0	$0.00	$0		$0		$0	$100.00	$363,712		$363,712
174																
175																
176	55	BUILDINGS														
177																
211		SPECIAL CONSTR. (SEISMIC CONTROL, PRE-ENGR BUILDINGS, ETC.)														
212																
213	55.380	MCC BUILDING / RACK ROOM - 30' X 30' X 2 STORY (18' ABOVE GRADE)	1,800	SF	S / C	0	$44.93	$0	$0.00	$0	$0.00	$0	$350.00	$630,000	$350.00	$630,000
218																
219	55.380	TOTAL - SPECIAL CONSTRUCTION				0	$0.00	$0		$0		$0		$630,000		$630,000
257																
258																
259		CONCRETE														
260																
261	56	DIKE (INCLUDED IN FACTOR)														
263	56															
264	56															
267	56	*FACTORED FROM INSTALLED PROCESS EQUIPMENT COST*	1	LOT	1,734.57	1,735	$44.93	$77,938	$0	$0	$77,938	$77,938	$0	$0	$155,877	$155,877
268																
269	56	TOTAL - CONCRETE	164	CY	12.0	1,967	$44.93	$88,373		$0		$81,886		$0		$170,259
281																
282																
283		STRUCTURAL STEEL														
284																
308	58	*FACTORED FROM INSTALLED PROCESS EQUIPMENT COST*	1	LOT	7,361.93	7,362	$49.05	$361,114	$0	$0	$709,238	$709,238	$0	$0	$1,070,353	$1,070,353
309																
310	58	TOTAL - STRUCTURAL STEEL	210	TN	35.0	7,362	$49.05	$361,114		$0		$709,238		$0		$1,070,353

DETAIL DIRECT COST

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

LINE NO.	JE PRIME CODE	01 BIG ISLAND - #4 PB SPRAY TOWER SCRUBBER DESCRIPTION	QTY.	UNIT	W.H./ UNIT	TOTAL W.H.'s	COST/ W.H.	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	UNIT COST	TOTAL ALL COSTS
		DIRECT COST - DETAILS														
344																
345																
346		PIPING														
347																
384	62	*FACTORED FROM INSTALLED PROCESS EQUIPMENT COST*	1	LOT	11,752.13	11,752	$53.05	$623,506	$0	$0	$623,506	$623,506	$0	$0	$1,247,013	$1,247,013
385																
386	62	TOTAL - PIPING	3,917	LF	3.00	11,752	$53.05	$623,506		$0		$623,506		$0		$1,247,013
387																
388																
389		INSULATION - PIPE, EQUIPMENT & DUCTWORK														
390																
391	63	REINSULATE - FILL IN FOR EXISTING ID FAN	320	SF	S/C	0	$44.93	$0	$0.00	$0	$0.00	$0	$50.00	$16,000	$50.00	$16,000
392	63	REINSULATE - PRECIPITATOR OUTLET NOZZLE	890	SF	S/C	0	$44.93	$0	$0.00	$0	$0.00	$0	$50.00	$44,500	$50.00	$44,500
393	63	INSULATION - PRECIPITATOR OUTLET TO INLET OF ID FAN	8,250	SF	S/C	0	$44.93	$0	$0.00	$0	$0.00	$0	$50.00	$412,500	$50.00	$412,500
394	63	INSULATION - ID FAN TO SPRAY TOWER SCRUBBER INLET	2,079	SF	S/C	0	$44.93	$0	$0.00	$0	$0.00	$0	$50.00	$103,950	$50.00	$103,950
395	63	INSULATION - 50% CAUSTIC DAY TANK - 13' DIAMETER X 16' STRAIGHT SIDE PLUS TOP & BOTTOM	1,200	SF	S/C	0	$44.93	$0	$0.00	$0	$0.00	$0	$50.00	$60,000	$50.00	$60,000
400	63															
405	63	*FACTORED FROM INSTALLED PROCESS EQUIPMENT COST*	1	LOT	S/C	0	$44.93	$0	$0	$0	$0	$0	$155,877	$155,877	$155,877	$155,877
406																
407	63	TOTAL - INSULATION - PIPE, EQUIPMENT & DUCTWORK	1	LOT		0	$0.00	$0		$0		$0		$792,827		$792,827
408																
409																
410		INSTRUMENTATION														
411																
423	64	*FACTORED FROM INSTALLED PROCESS EQUIPMENT COST*	1	LOT	1,084.09	1,084	$47.93	$51,959	$129,897	$129,897	$109,114	$109,114	$0	$0	$290,970	$290,970
424																
425	64	TOTAL - INSTRUMENTATION	54	EA	20.00	1,084	$47.93	$51,959		$129,897		$109,114		$0		$290,970
426																
427																
428		ELECTRICAL														
429																
430	65	TRANSFORMER - 13,800 V TO 480 V, RATED FOR 400 HP CONNECTED LOAD	1	EA	100.00	100	$47.93	$4,793	$35,000	$35,000	$0.00	$0	$0.00	$0	$39,793	$39,793
431	65															
440	65	TESTING AND STARTUP	1	LOT	5.00	5	$47.93	$240	$0.00	$0	$0.00	$0	$0.00	$0	$240	$240
441	65	FREIGHT	1	LOT	N/A	0	$47.93	$0	$2,100	$2,100	$0	$0	$0.00	$0	$2,100	$2,100
442	65															
445	65	*FACTORED FROM INSTALLED PROCESS EQUIPMENT COST*	1	LOT	2,168.18	2,168	$47.93	$103,918	$259,794	$259,794	$207,835	$207,835	$0	$0	$571,547	$571,547
446																
447	65	TOTAL - ELECTRICAL	9,093	LF	0.25	2,273	$47.93	$108,950		$296,894		$207,835		$0		$613,680
448																
449																
450		PAINTING, PROTECTIVE COATINGS														
451																
456	66	*FACTORED FROM INSTALLED PROCESS EQUIPMENT COST*	1	LOT	578.19	578	$44.93	$25,979	$0	$0	$25,979	$25,979	$0	$0	$51,959	$51,959
457																
458	66	TOTAL - PAINTING, PROTECTIVE COATINGS	20,764	SF	0.03	578	$44.93	$25,979		$0		$25,979		$0	$2.50	$51,959
471																
472																
473																
474																
475																
476		TOTAL - DIRECT COST				41,152	$51.42	$2,115,941		$3,496,247		$1,760,165		$3,448,292		$10,820,645

CONTRACTOR'S CONSTRUCTION INDIRECT COST - CONSTRUCTION SUPPORT LABOR

JE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	W.H./ UNIT	TOTAL W.H.'s	COST/ W.H.	TOTAL DIRECT LABOR	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	TOTAL ALL COSTS
75	**CONSTRUCTION SUPPORT LABOR**											
	(LABOR COST ONLY)											
	CAPITAL - CONSTRUCTION SUPPORT LABOR - ALLOWANCE @ 20 % OF DIRECT LABOR HOURS FOR BELOW LISTED ITEMS	41,152	WH	0.20	8,230	$39.49	$325,005	$0	$0	$0	$0	$325,005
	CONS EQUIP OPERATION - CRANE				0	$39.49	$0	$0	$0	$0	$0	$0
	WELDER QUALIFICATIONS				0	$39.49	$0	$0	$0	$0	$0	$0
	RAINED OUT LABOR				0	$39.49	$0	$0	$0	$0	$0	$0
	SAFETY TRAINING				0	$39.49	$0	$0	$0	$0	$0	$0
	SCAFFOLDING (Rental Incl. W/ Constr. Eq. Rental)				0	$39.49	$0	$0	$0	$0	$0	$0
	UNLOAD AND STORE BULK MATERIAL				0	$39.49	$0	$0	$0	$0	$0	$0
	WAREHOUSEMAN				0	$39.49	$0	$0	$0	$0	$0	$0
	TOOL MAN				0	$39.49	$0	$0	$0	$0	$0	$0
	FIRE WATCH				0	$39.49	$0	$0	$0	$0	$0	$0
	YARD CREWS				0	$39.49	$0	$0	$0	$0	$0	$0
	SPECIAL HAULING / RIGGING				0	$39.49	$0	$0	$0	$0	$0	$0
	STARTUP - CRAFTSMEN				0	$39.49	$0	$0	$0	$0	$0	$0
	CLEAN UP				0	$39.49	$0	$0	$0	$0	$0	$0
	EMPLOYMENT & RANDOM DRUG TESTS				0	$39.49	$0	$0	$0	$0	$0	$0
	MOVE IN / MOVE OUT LABOR				0	$39.49	$0	$0	$0	$0	$0	$0
	WATER / ICE				0	$39.49	$0	$0	$0	$0	$0	$0
75	**TOTAL - CONSTRUCTION SUPPORT LABOR**				8,230		$325,005		$0		$0	$325,005

CONTRACTOR'S CONSTRUCTION INDIRECT COST - PREMIUM TIME

JE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HEN
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION		TOTAL WEEKLY W.H.'S	TOTAL PREMIUM W.H.'S		PREMIUM COST ADDER	TOTAL COST
78	**PREMIUM & EFFICIENCY LOSS TIME CALCULATION WORKSHEET**						
	CAPITAL PREMIUM TIME COST: BASED ON BARE WAGE RATE OF:					$23.25	
	TOTAL CRAFT HOURS:			49,382	HRS		
	CRAFT HOURS WORKED ON 40 HR WEEK (**0 HRS PT**)	0.0%	0	0	HRS		
	CRAFT HOURS WORKED ON 50 HR WEEK (**10 HRS PT**)	100.0%	49,382	9,876	HRS	$13.33	$131,682
	CRAFT HOURS WORKED ON 60 HR WEEK (**20 HRS PT**)	0.0%	0	0	HRS	$13.33	$0
	CRAFT HOURS WORKED ON 70 HR WEEK (**30 HRS PT**)	0.0%	0	0	HRS	$13.33	$0
	CRAFT HOURS WORKED ON 84 HR WEEK (**44 HRS PT**)	0.0%	0	0	HRS	$13.33	$0
		100.0%	49,382	9,876	HRS		
	TOTAL CAPITAL PREMIUM TIME COST						**$131,682**
78	**T O T A L**						**$131,682**

CONTRACTOR'S CONSTRUCTION INDIRECT COST - NON-PAYROLL TAX, INSURANCE AND PERMITS

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	LABOR UNIT COST	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	TOTAL ALL COSTS
81	NON-PAYROLL TAX, INSURANCE AND PERMITS											
	. SALES & USE TAX											
	5% OF EQUIPMENT	$3,496,247	EQ $	$0.00	$0	5.00%	$174,812					$174,812
	5% OF MATERIAL	$1,760,165	MAT'L $	$0.00	$0			5.00%	$88,008			$88,008
	5% ON 50% OF SUBCONTRACT	$1,724,146	SUB $	$0.00	$0					5.00%	$86,207	$86,207
81	TOTAL NON-PAYROLL TAX, INSURANCE AND PERMITS				$0		$174,812		$88,008		$86,207	$349,028

CONTRACTOR'S CONSTRUCTION INDIRECT COST - CRAFT START-UP ASSISTANCE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HE
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	W.H./ UNIT	TOTAL W.H.'s	COST/ W.H.	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	TOTAL ALL COSTS
71	CRAFT START-UP ASSISTANCE													
	CRAFT START-UP SERVICES (3 CRAFT PERSONNEL @ 50 HOURS EACH)	3	WK	150.00	450	$70.00	$31,500	$0	$0	$0	$0	$0	$0	$31,500
71	TOTAL CRAFT START-UP ASSISTANCE						$31,500		$0		$0		$0	$31,500

CONTRACTOR'S CONSTRUCTION INDIRECT COST - CONTRACTOR'S CONSTRUCTION FEE

JE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HE
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	LABOR UNIT COST	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	TOTAL ALL COSTS
99	CONTRACTOR'S CONSTRUCTION FEE											
	LABOR (INCLUDED IN WAGE RATES)	$2,604,128	LAB$	10.2%	$266,159							$266,159
	EQUIPMENT	$3,671,059	EQ$			0.00%	$0					$0
	MATERIAL	$1,848,174	MAT$					15.00%	$277,226			$277,226
	SUBCONTRACT	$3,855,482	SUB$							10.00%	$385,548	$385,548
99	TOTAL CONTRACTOR'S CONSTRUCTION FEE				$266,159		$0		$277,226		$385,548	$928,933

TOTAL CONTRACTOR'S CONSTRUCTION FEE AS A % OF TOTAL CONSTRUCTION COST - EQUIP. =	10.1%

TOTAL CONSTRUCTION COST LESS PROCESS EQUIPMENT = $9,236,717

PROJECT INDIRECT COST - CONSTRUCTION MANAGEMENT

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	W.H./ UNIT	TOTAL W.H.'s	COST/ W.H.	TOTAL DIRECT LABOR	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	UNIT COST	TOTAL ALL COSTS
88	**TOTAL CONSTRUCTION MANAGEMENT**												
	TOTAL - CONSTRUCTION MANAGEMENT	1	LOT		0	$0.00	$0	$0.00	$0	$876,980	$876,980	$876,980	$876,980
88	**TOTAL - CONSTRUCTION MANAGEMENT**				0		$0		$0		$876,980		$876,980

PROJECT INDIRECT COST - ENGINEERING PROFESSIONAL SERVICES

JE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	W.H./ UNIT	TOTAL W.H.'s	COST/ W.H.	LABOR UNIT COST	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	UNIT COST	TOTAL ALL COSTS
90	ENGINEERING PROFESSIONAL SERVICES															
	JACOBS	1	LOT		0	$0.00	$0.00	$0	$0	$0	$0	$0	$1,943,247	$1,943,247	$1,943,247	$1,943,247
90	TOTAL ENGINEERING PROFESSIONAL SERVICES							$0		$0		$0		$1,943,247		$1,943,247

PROJECT INDIRECT COST - STUDY COST

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	TOTAL ALL COSTS
90	**STUDY COST**										
	STUDY COST	1	LOT	$0	$0	$0	$0	$0	$50,000	$50,000	$50,000
90	**STUDY COST**			**$0**		**$0**		**$0**		**$50,000**	**$50,000**

PROJECT INDIRECT COST - OUTSIDE CONSULTANT SERVICES

JE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HE
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	TOTAL ALL COSTS
96	OUTSIDE CONSULTANT SERVICES										
	OUTSIDE CONSULTANT SERVICES	1	LOT	$0	$0	$0	$0	$0	$100,000	$100,000	$100,000
96	TOTAL OUTSIDE CONSULTANT SERVICES			$0		$0		$0		$100,000	$100,000

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HE
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	TOTAL ALL COSTS
91	OWNER'S COST										
	OWNER'S COST	1	LOT	$0	$0	$0	$0	$0	$645,389	$645,389	$645,389
91	TOTAL OWNER'S COST			$0		$0		$0		$645,389	$645,389

PROJECT INDIRECT COST - SPARE PARTS

JE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB
SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HE
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	TOTAL ALL COSTS
70	**SPARE PARTS**										
	SPARE PARTS - ALLOWANCE OF 5% OF EQUIPMENT COST	1	LOT	$0	$174,812	$174,812	$0	$0	$0	$0	$174,812
70	**TOTAL SPARE PARTS**			$0		$174,812		$0		$0	$174,812

PROJECT NDIRECT COST - NON-CRAFT START-UP ASSISTANCE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4
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ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HE
EST. FILE #: 06157

JE PRIME CODE	DESCRIPTION	QTY.	UNIT	W.H./ UNIT	TOTAL W.H.'s	COST/ W.H.	TOTAL DIRECT LABOR	PROCESS EQUIPMENT UNIT COST	TOTAL PROCESS EQUIPMENT	MATERIAL UNIT COST	TOTAL MATERIAL	SUB CONTRACT UNIT COST	TOTAL SUB CONTRACTS	TOTAL ALL COSTS
71	NON-CRAFT START-UP ASSISTANCE													
	PROFESSIONAL SERVICES START-UP	4	WK	150.00	600	$83.25	$49,950	$0	$0	$0	$0	$0	$0	$49,950
	PROFESSIONAL SERVICES START-UP - EXPENSES	4	WK	0.00	0	$0.00	$0	$0	$0	$0	$0	$4,800	$19,200	$19,200
	VENDOR START-UP SERVICES	1	LOT		0	$0.00	$0	$0	$0	$0	$0	$50,000	$50,000	$50,000
71	TOTAL NON-CRAFT START-UP ASSISTANCE						$49,950		$0		$0		$69,200	$119,150

PROJECT INDIRECT COSTS - ALLOWANCE FOR UNFORESEEN

JE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4

ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

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AFU PRIME CODE	PRIME CODE	DESCRIPTION	LABOR	EQUIPMENT	MATERIAL	SUBCONT.	TOTAL COST	PERCENTAGES LABOR	EQUIP.	MAT'L	S/C	DOLLARS LABOR	EQUIPMENT	MATERIAL	SUBCONT.	TOTAL COST
		DIRECT COSTS														
98	50	MAJOR EQUIPMENT	$773,625	$3,066,455	$2,606	$1,350,000	$5,195,886	10.0%	10.0%	10.0%	10.0%	$77,382	$306,946	$261	$135,000	$519,589
98	51	DEMOLITION	$82,235	$0	$0	$0	$82,235	10.0%	10.0%	10.0%	10.0%	$8,223	$0	$0	$0	$8,223
98	52	SITE EARTHMOVING	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	53	SITE IMPROVEMENTS	$0	$0	$0	$311,753	$311,753	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$31,175	$31,175
98	54	PILING, CAISSONS	$0	$0	$0	$383,712	$383,712	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$38,371	$38,371
98	55	BUILDINGS	$0	$0	$0	$630,000	$630,000	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$63,000	$63,000
98	56	CONCRETE	$88,373	$0	$81,886	$0	$170,259	10.0%	10.0%	10.0%	10.0%	$8,837	$0	$8,189	$0	$17,026
98	57	MASONRY, REFRACTORY	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	58	STRUCTURAL STEEL	$361,114	$0	$709,238	$0	$1,070,353	10.0%	10.0%	10.0%	10.0%	$36,111	$0	$70,924	$0	$107,035
98	59	ROOFING AND SIDING	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	60	FIRE PROOFING	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	61	PROCESS DUCTWORK (NON-BUILDING)	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	62	PIPING	$623,506	$0	$623,506	$0	$1,247,013	10.0%	10.0%	10.0%	10.0%	$62,351	$0	$62,351	$0	$124,701
98	63	INSULATION - PIPE, EQUIPMENT & DUCTWORK	$0	$0	$0	$792,827	$792,827	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$79,283	$79,283
98	64	INSTRUMENTATION	$51,958	$129,897	$109,114	$0	$290,970	10.0%	10.0%	10.0%	10.0%	$5,196	$12,990	$10,911	$0	$29,097
98	65	ELECTRICAL	$106,950	$296,894	$207,835	$0	$613,680	10.0%	10.0%	10.0%	10.0%	$10,695	$29,689	$20,784	$0	$61,368
98	66	PAINTING, PROTECTIVE COATINGS	$25,979	$0	$25,979	$0	$51,959	10.0%	10.0%	10.0%	10.0%	$2,598	$0	$2,598	$0	$5,196
98	67	FURNITURE, LAB & SHOP EQUIPMENT	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
		TOTAL DIRECT COSTS	$2,115,941	$3,496,247	$1,760,165	$3,448,292	$10,820,645					$211,594	$349,825	$176,017	$344,829	$1,082,064
		CONSTRUCTION INDIRECT COSTS														
98	75	CONSTRUCTION SUPPORT LABOR	$325,005	$0	$0	$0	$325,005	10.0%	10.0%	10.0%	10.0%	$32,501	$0	$0	$0	$32,501
98	76	TEMPORARY CONSTRUCTION FACILITIES (IN WAGE RATE	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	78	PREMIUM TIME	$131,682	$0	$0	$0	$131,682	10.0%	10.0%	10.0%	10.0%	$13,168	$0	$0	$0	$13,168
98	79	CRAFT FRINGE BENEFITS (IN WAGE RATES)	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98		CRAFT PER DIEM ($5 PER HOUR ON 100 % OF THE HOURS	$0	$0	$0	$320,983	$320,983	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$32,098	$32,098
98	80	PAYROLL TAXES & INSURANCE (IN WAGE RATES)	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	83	SMALL TOOLS (IN WAGE RATES)	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	84	CONSUMABLE SUPPLIES (IN WAGE RATES)	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	85	CONSTRUCTION EQUIPMENT (IN WAGE RATES)	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	87	FIELD STAFF (IN WAGE RATES)	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	81	NON-PAYROLL TAX, INSURANCE & PERMITS	$0	$174,812	$88,008	$86,207	$349,028	10.0%	10.0%	10.0%	10.0%	$0	$17,481	$8,801	$8,621	$34,903
98	93	CONSTRUCTION HOME OFFICE COST (INC. WITH CONTRA	$0	$0	$0	$0	$0	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$0	$0
98	71	CRAFT START-UP ASSISTANCE	$31,500	$0	$0	$0	$31,500	10.0%	10.0%	10.0%	10.0%	$3,150	$0	$0	$0	$3,150
98	99	CONTRACTOR'S CONSTRUCTION HOME OFFICE & FEE	$266,159	$0	$277,226	$385,548	$928,933	10.0%	10.0%	10.0%	10.0%	$26,616	$0	$27,723	$38,555	$92,893
		TOTAL CONSTRUCTION INDIRECT COSTS										$75,435	$17,481	$36,523	$79,274	$208,713
		TOTAL CONSTRUCTION COSTS (TCC)	$2,870,287	$3,671,059	$2,125,400	$4,241,031	$12,907,776					$287,029	$367,106	$212,540	$424,103	$1,290,776
98	88	CONSTRUCTION MANAGEMENT	$0	$0	$0	$876,980	$876,980	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$87,698	$87,698
98	90	ENGINEERING PROFESSIONAL SERVICES	$0	$0	$0	$1,943,247	$1,943,247	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$194,325	$194,325
98	90	STUDY COST	$0	$0	$0	$50,000	$50,000	10.0%	10.0%	10.0%	0.0%	$0	$0	$0	$0	$0
98	96	OUTSIDE CONSULTANT SERVICES	$0	$0	$0	$100,000	$100,000	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$10,000	$10,000
98	91	OWNER'S COST	$0	$0	$0	$645,389	$645,389	10.0%	10.0%	10.0%	10.0%	$0	$0	$0	$64,539	$64,539
98	70	SPARE PARTS	$0	$174,812	$0	$0	$174,812	10.0%	10.0%	10.0%	10.0%	$0	$17,481	$0	$0	$17,481
98	71	NON-CRAFT START-UP ASSISTANCE	$49,950	$0	$0	$69,200	$119,150	10.0%	10.0%	10.0%	10.0%	$4,995	$0	$0	$6,920	$11,915
98	98	ALLOWANCE FOR UNFORESEEN N/A														
98	98	ESCALATION N/A														
98	99	EPC FEE N/A														
		CAPITAL INTEREST N/A														
		ROUND OFF N/A														
98		**TOTAL PROJECT COSTS**	$2,920,237	$3,845,871	$2,125,400	$7,925,847	$16,817,355					$292,024	$384,587	$212,540	$787,585	$1,676,735

PROJECT INDIRECT COSTS - ESCALATION

JE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000
CONSTRUCTION DURATION: TBD
ESTIMATE TYPE: CLASS 4

ESCALATION IS BASED ON THE ASSUMPTION THAT ALL WORK WILL BE COMPLETED BY DECEMBER 31, 2006

ESTIMATE DATE: 09/05/06
REVISION NO.: 1
ESTIMATOR: WSJ
PROJECT MANAGER: LELAND HENSON
EST. FILE #: 06157

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ESC PRIME CODE	PRIME CODE	DESCRIPTION	LABOR	EQUIPMENT	MATERIAL	SUBCONT.	TOTAL COST	PERCENTAGES LABOR	PERCENTAGES EQUIP.	PERCENTAGES MAT'L	PERCENTAGES S/C	DOLLARS LABOR	DOLLARS EQUIPMENT	DOLLARS MATERIAL	DOLLARS SUBCONT.	DOLLARS TOTAL COST
		DIRECT COSTS														
98	50	MAJOR EQUIPMENT	$773,825	$3,069,455	$2,606	$1,350,000	$5,195,886	0.0%	10.0%	10.0%	5.0%	$0	$306,946	$261	$67,500	$374,706
98	51	DEMOLITION	$82,235	$0	$0	$0	$82,235	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	52	SITE EARTHMOVING	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	53	SITE IMPROVEMENTS	$0	$0	$0	$311,753	$311,753	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$15,588	$15,588
98	54	PILING, CAISSONS	$0	$0	$0	$363,712	$363,712	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$18,186	$18,186
98	55	BUILDINGS	$0	$0	$0	$630,000	$630,000	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$31,500	$31,500
98	56	CONCRETE	$88,373	$0	$81,886	$0	$170,259	0.0%	10.0%	15.0%	5.0%	$0	$0	$12,283	$0	$12,283
98	57	MASONRY, REFRACTORY	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	58	STRUCTURAL STEEL	$361,114	$0	$709,238	$0	$1,070,353	0.0%	10.0%	15.0%	5.0%	$0	$0	$106,386	$0	$106,386
98	59	ROOFING AND SIDING	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	60	FIRE PROOFING	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	61	PROCESS DUCTWORK (NON-BUILDING)	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	62	PIPING	$623,506	$0	$623,506	$0	$1,247,013	0.0%	10.0%	15.0%	5.0%	$0	$0	$93,526	$0	$93,526
98	63	INSULATION - PIPE, EQUIPMENT & DUCTWORK	$0	$0	$0	$792,827	$792,827	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$39,641	$39,641
98	64	INSTRUMENTATION	$51,959	$129,897	$109,114	$0	$290,970	0.0%	10.0%	15.0%	5.0%	$0	$12,990	$16,367	$0	$29,357
98	65	ELECTRICAL	$108,950	$296,894	$207,835	$0	$613,680	0.0%	10.0%	15.0%	5.0%	$0	$29,689	$31,175	$0	$60,865
98	66	PAINTING, PROTECTIVE COATINGS	$25,979	$0	$25,979	$0	$51,959	0.0%	10.0%	10.0%	5.0%	$0	$0	$2,598	$0	$2,598
98	67	FURNITURE, LAB & SHOP EQUIPMENT	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
		TOTAL DIRECT COSTS	$2,115,941	$3,496,247	$1,760,165	$3,448,292	$10,820,645					$0	$349,625	$262,596	$172,415	$784,635
		CONSTRUCTION INDIRECT COSTS														
98	75	CONSTRUCTION SUPPORT LABOR	$325,005	$0	$0	$0	$325,005	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	76	TEMPORARY CONSTRUCTION FACILITIES (IN WAGE RATE	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	78	PREMIUM TIME	$131,682	$0	$0	$0	$131,682	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	79	CRAFT FRINGE BENEFITS (IN WAGE RATES)	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98		CRAFT PER DIEM ($5 PER HOUR ON 100 % OF THE HOURS	$0	$0	$0	$320,983	$320,983	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$16,049	$16,049
98	80	PAYROLL TAXES & INSURANCE (IN WAGE RATES)	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	83	SMALL TOOLS (IN WAGE RATES)	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	84	CONSUMABLE SUPPLIES (IN WAGE RATES)	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	85	CONSTRUCTION EQUIPMENT (IN WAGE RATES)	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	87	FIELD STAFF (IN WAGE RATES)	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	81	NON-PAYROLL TAX, INSURANCE & PERMITS	$0	$174,812	$88,008	$86,207	$349,028	0.0%	10.0%	10.0%	5.0%	$0	$17,481	$8,801	$4,310	$30,592
98	93	CONSTRUCTION HOME OFFICE COST (INC. WITH CONTRA	$0	$0	$0	$0	$0	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	71	CRAFT START-UP ASSISTANCE	$31,500	$0	$0	$0	$31,500	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$0	$0
98	99	CONTRACTOR'S CONSTRUCTION HOME OFFICE & FEE	$266,159	$0	$277,226	$385,548	$928,933	0.0%	10.0%	10.0%	5.0%	$0	$0	$27,723	$19,277	$47,000
		TOTAL CONSTRUCTION INDIRECT COSTS										$0	$17,481	$36,523	$39,637	$93,642
		TOTAL CONSTRUCTION COSTS (TCC)	$2,870,287	$3,671,059	$2,125,400	$4,241,031	$12,907,776					$0	$367,106	$299,119	$212,052	$878,276
98	88	CONSTRUCTION MANAGEMENT	$0	$0	$0	$876,980	$876,980	0.0%	10.0%	10.0%	0.0%	$0	$0	$0	$0	$0
98	90	ENGINEERING PROFESSIONAL SERVICES	$0	$0	$0	$1,943,247	$1,943,247	0.0%	10.0%	10.0%	0.0%	$0	$0	$0	$0	$0
98	90	STUDY COST	$0	$0	$0	$50,000	$50,000	0.0%	10.0%	10.0%	0.0%	$0	$0	$0	$0	$0
98	96	OUTSIDE CONSULTANT SERVICES	$0	$0	$0	$100,000	$100,000	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$5,000	$5,000
98	91	OWNER'S COST	$0	$0	$0	$645,389	$645,389	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$32,269	$32,269
98	70	SPARE PARTS	$0	$174,812	$0	$0	$174,812	0.0%	10.0%	10.0%	5.0%	$0	$17,481	$0	$0	$17,481
98	71	NON-CRAFT START-UP ASSISTANCE	$49,950	$0	$0	$69,200	$119,150	0.0%	10.0%	10.0%	5.0%	$0	$0	$0	$3,460	$3,460
98	98	ALLOWANCE FOR UNFORESEEN	N / A													
98	98	ESCALATION	N / A													
98	99	EPC FEE	N / A													
		CAPITAL INTEREST	N / A													
		ROUND OFF	N / A													
98		**TOTAL PROJECT COSTS**	$2,920,237	$3,845,871	$2,125,400	$7,925,847	$16,817,355					$0	$384,587	$299,119	$252,781	$936,487

CONSTRUCTION "ALL-IN" WAGE RATE

JOB: BART BOILER PROGRAM - BIG ISLAND #4 PB SPRAY TOWER SCRUBBER
CLIENT: GEORGIA PACIFIC
LOCATION: BIG ISLAND VIRGINIA
JOB NUMBER: 16DC9000

	CRAFT			CRAFT			CRAFT			CRAFT			CRAFT			CRAFT		
	CONCRETE / MASONRY			STRUCTURAL STEEL			PIPING & MECHANICAL			INSTRUMENTATION			ELECTRICAL			SUPPORT (INC. OPERATORS)		
ITEM	NOTES	%	COST	NOTES	%	COST	NOTES	%	COST	NOTES	%	COST	NOTES	%	COST	NOTES	%	COST
BASE JOURNEYMAN			$22.50			$22.50			$22.50			$22.50			$22.50			$21.50
COMPOSITE RATE		87.35%	$19.65		96.41%	$21.69		99.86%	$22.47		95.25%	$21.43		95.25%	$21.43		97.37%	$20.93
PAYROLL TAXES & INSURANCES:	28.63%																	
WORKMEN'S COMPENSATION		10.00%	$1.97		10.00%	$2.17		10.00%	$2.25		10.00%	$2.14		10.00%	$2.14		10.00%	$2.09
GENERAL LIABILITY		3.95%	$0.78		3.95%	$0.86		3.95%	$0.89		3.95%	$0.85		3.95%	$0.85		3.95%	$0.83
EXCESS LIABILITY		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00
FICA		7.65%	$1.50		7.65%	$1.66		7.65%	$1.72		7.65%	$1.64		7.65%	$1.64		7.65%	$1.60
FUI		0.80%	$0.16		0.80%	$0.17		0.80%	$0.18		0.80%	$0.17		0.80%	$0.17		0.80%	$0.17
SUI		6.23%	$1.22		6.23%	$1.35		6.23%	$1.40		6.23%	$1.34		6.23%	$1.34		6.23%	$1.30
OTHER		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00
FRINGES		12.50%	$2.46		12.50%	$2.71		12.50%	$2.81		12.50%	$2.68		12.50%	$2.68		12.50%	$2.62
PREMIUM TIME		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00
CONSTRUCTION SUPPORT LABOR		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00
TEMPORARY FACILITIES		7.50%	$1.47		7.50%	$1.63		7.50%	$1.69		7.50%	$1.61		7.50%	$1.61		7.50%	$1.57
SMALL TOOLS		7.50%	$1.47		7.50%	$1.63		7.50%	$1.69		7.50%	$1.61		7.50%	$1.61		7.50%	$1.57
CONSUMABLES		7.50%	$1.47		10.00%	$2.17		10.00%	$2.25		7.50%	$1.61		7.50%	$1.61		7.50%	$1.57
FIELD STAFF		25.00%	$4.91		25.00%	$5.42		35.00%	$7.86		35.00%	$7.50		35.00%	$7.50		25.00%	$5.23
EQUIPMENT RENTAL		40.00%	$7.86		35.00%	$7.59		35.00%	$7.86		25.00%	$5.36		25.00%	$5.36		0.00%	$0.00
CONSTRUCTION HOME OFFICE (ON TCS SHEET)		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00
PER DIEM		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00
CONTRACTOR FEE (ON TCS SHEET)		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00		0.00%	$0.00
TOTAL WAGE RATE WITH W / O OH & FEE		228.63%	$44.93		226.13%	$49.05		236.13%	$53.05		223.63%	$47.93		223.63%	$47.93		188.63%	$39.49