relatively higher initial capital costs. Wet FGD processes are also characterized by higher raw water usage than semi-dry FGD systems. This can be a significant disadvantage or even a fatal flaw in areas where raw water availability is in short supply.

A countercurrent spray tower has become one of the most widely used absorber types in wet limestone-based FGD service. Flue gas enters at the bottom of the absorber and flows upward. Slurry with 10 to 15 percent solids is sprayed downward from higher elevations in the absorber and is collected in a reaction tank at its base. The SO_2 in the flue gas is transferred from the flue gas to the recycle slurry. The hot flue gas is also cooled and saturated with water. Recycled slurry is pumped continuously from the reaction tank to the slurry spray headers. Each header has numerous individual spray nozzles that break the slurry flow into small droplets and distribute them evenly across the cross section of the absorber. Prior to leaving the absorber, the treated flue gas passes through a two-stage, chevron-type mist eliminator that removes entrained slurry droplets from the gas. The mist eliminator is periodically washed to keep it free of solids.

In the reaction tank, the SO_2 absorbed from the flue gas reacts with soluble calcium ions in the recycle slurry to form insoluble calcium sulfite and calcium sulfate solids. In forced-oxidization processes, air is bubbled through the slurry to convert all of the solids to calcium sulfate dihydrate (gypsum). A lime or limestone reagent slurry is added to the reaction tank to replace the calcium consumed.

To control the solids content of the recycle slurry, a portion of the slurry is discharged from the reaction tank to the byproduct dewatering equipment. Depending on the ultimate disposal of the byproduct solids, the dewatering equipment may include settling ponds, thickeners, hydrocyclones, vacuum filters, and centrifuges. The liquid that is separated from the byproduct solids slurry is stored in the reclaim water tank. Water in the reclaim water tank is returned to the absorber reaction tank as makeup water and used to prepare the reagent slurry.

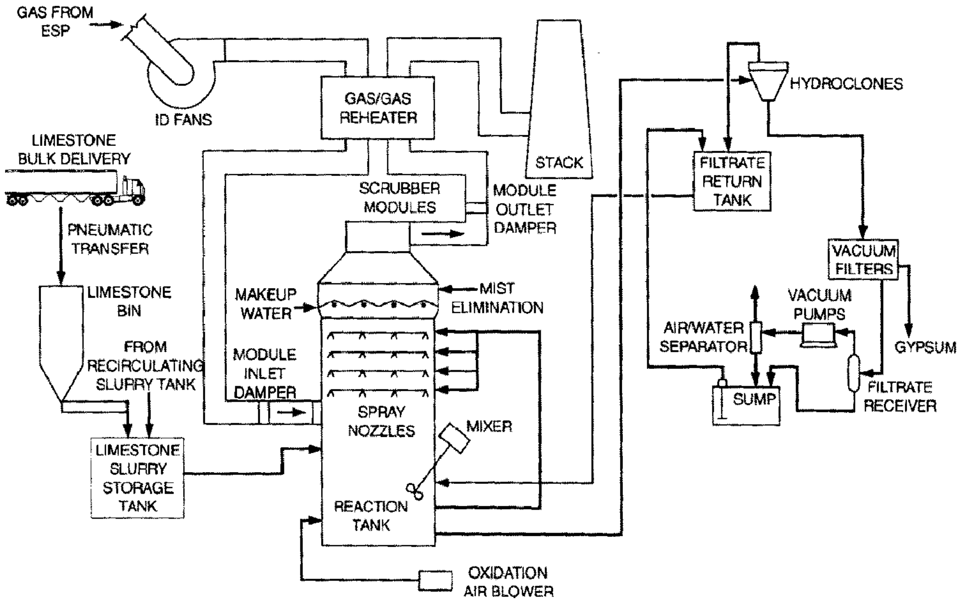

Figure D-6
Process Flow Diagram of FGD Process

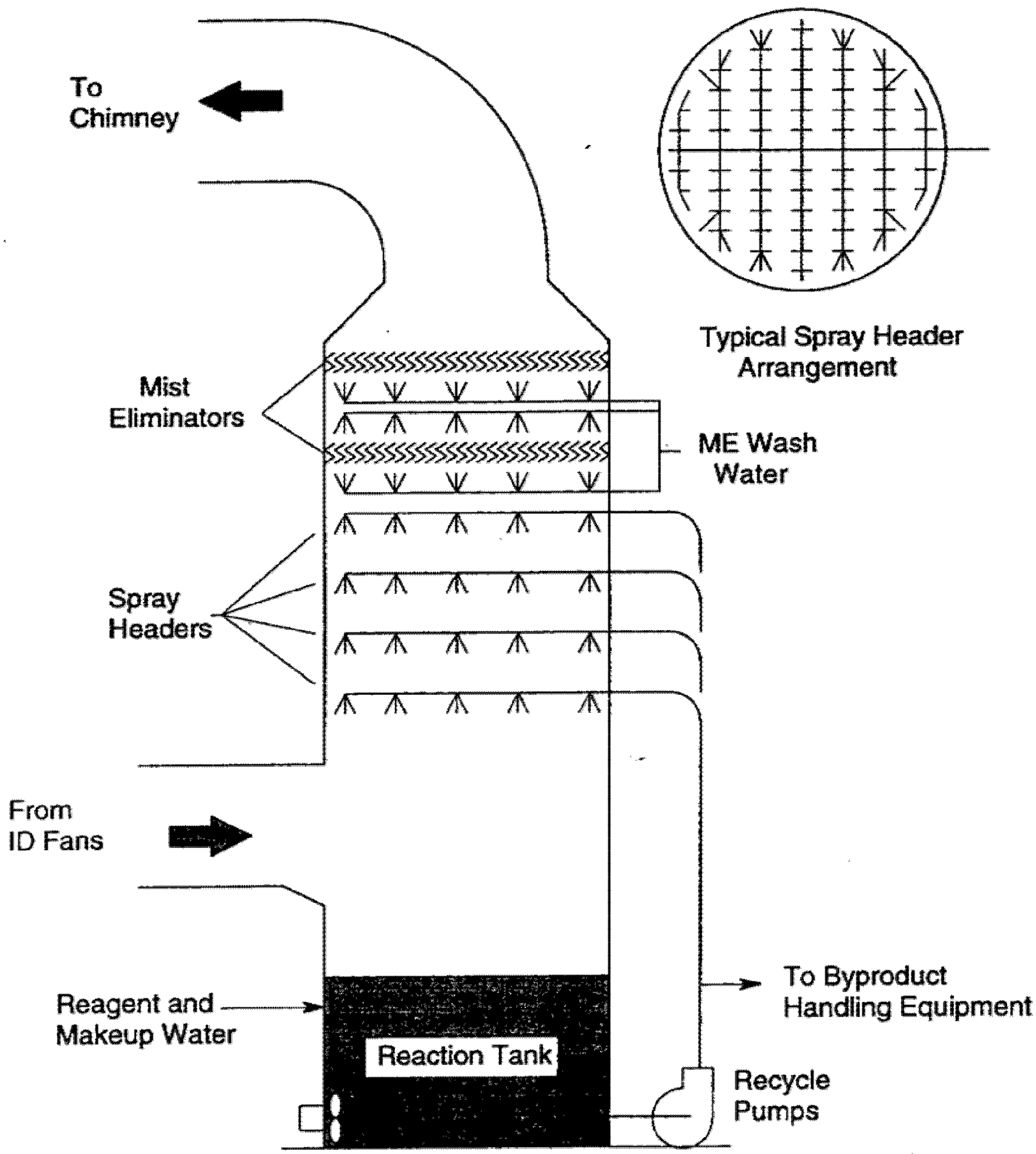

Figure D-7
Countercurrent Spray Tower FGD Process

Spray Dryer Absorber

Spray dryer absorber (SDA) FGD processes have been extensively used. US utilities have installed numerous SDA FGD systems on boilers using low sulfur fuels.

These installations, primarily located in the western United States, use either lignite or subbituminous coals such as PRB as the boiler fuel and generally have spray dryer systems designed for a maximum fuel sulfur content of less than 2 percent. The SDA lime-based FGD system has an inherent removal efficiency limitation of 94 percent from inlet concentration.

The SDA FGD process uses calcium hydroxide [$Ca(OH)_2$] produced from the lime reagent as either a slurry or as a dry powder to the flue gas in a reactor designed to provide good gas-reagent contact. The SO_2 in the flue gas reacts with the calcium in the reagent to produce primarily calcium sulfite hemihydrate ($CaSO_3 \bullet 1/2H_2O$) and a smaller amount of calcium sulfate dihydrate ($CaSO_4 \bullet 2H_2O$) through the following reactions:

$$SO_2 + Ca(OH)_2 \rightarrow CaSO_3 \bullet \tfrac{1}{2}H_2O + \tfrac{1}{2}H_2O$$

$$SO_2 + Ca(OH)_2 + \tfrac{1}{2}O_2 \rightarrow CaSO_4 \bullet 2H_2O$$

Water is also added to the reactor (either as part of the reagent slurry or as a separate stream) to cool and humidify the flue gas, which promotes the reaction and reagent utilization. The amount of water added is typically sufficient to cool the flue gas to within 30° to 40° F of the flue gas adiabatic saturation temperature. Significantly less water is used in these SDA FGD processes compared to wet FGD processes.

The reaction byproducts and excess reagent are dried by the flue gas and removed from the flue gas by a particulate control device (either fabric filter or DESP). Fabric filters are preferred for most systems, because the additional contact of the flue gas with the particulate on the filter bags provides additional SO_2 removal and higher reagent utilization. A portion of the reaction byproducts collected is recycled to the reagent preparation system in order to increase the utilization of the lime.

Because of the large amount of excess lime present in the FGD byproducts, the byproducts (and fly ash, if present) will experience pozzolanic (cementitious) reactions when wetted. When wetted and compacted, the byproduct makes a fill material with low permeability (low lengthening characteristics) and high bearing strength. However, other than as structural fill, this byproduct has limited commercial value and typically must be disposed of as a waste material.

The SDA FGD processes offer benefits in addition to SO_2 removal, including the lack of a visible vapor plume and SO_3 removal. Because the SDA FGD systems do not saturate the flue gas with water, there is no visible plume from the stack under most weather conditions. Environmental concerns with SO_3 emissions are also reduced with the SDA scrubber. SO_3 is formed during combustion and will react with the moisture in the flue gas to form sulfuric acid (H_2SO_4) mist in the atmosphere. An increase in H_2SO_4

emissions will increase PM_{10} emissions. The gas temperature leaving the reactor is lowered below the sulfuric acid dew point, and significant SO_3 removal will be attained as the condensed acid reacts with the alkaline reagent. By removing SO_3 in the flue gas, the condensable particulate matter emissions can be reduced. This will reduce the potential for any SO_3 plume that may cause opacity in stacks. Similar type of SO_3 removal is not achievable with a wet scrubber.

All current SDA designs use a vertical gas flow absorber. These absorbers are designed for co-current or a combination of co-current and countercurrent gas flow. In co-current applications, gas enters the cylindrical vessel near the top of the absorber and flows downward and outward. In combination-flow absorbers, a gas disperser located near the middle of the absorber directs a fraction of the total flue gas flow upward toward the slurry atomizers.

In both cases, the atomizers are located in the roof of the absorber. Both rotary and two-fluid nozzles have been applied to this approach. The atomizer produces an umbrella of atomized reagent slurry through which the flue gas passes. The SO_2 in the flue gas is absorbed into the atomized droplets and reacts with the calcium to form calcium sulfite and calcium sulfate. Before the slurry droplet can reach the absorber wall, the water in the droplet evaporates and a dry particulate is formed.

Some vendors base their designs on a single large rotary atomizer per absorber; others use up to three smaller rotary atomizers per absorber. Two-fluid atomizers are installed as an array of up to 16 nozzles per atomizer; all three approaches to spray atomizers have been successfully applied.

The flue gas, then containing fly ash and FGD byproduct solids, leaves the absorber and is directed to a fabric filter. The fly ash and byproduct solids collected in the fabric filter are pneumatically transferred to a silo for disposal. To improve both reagent utilization and spray solids drying efficiency, a large portion of the solids collected is directed to a recycle system, where it is slurried and re-injected into the spray dryer along with the fresh lime reagent.

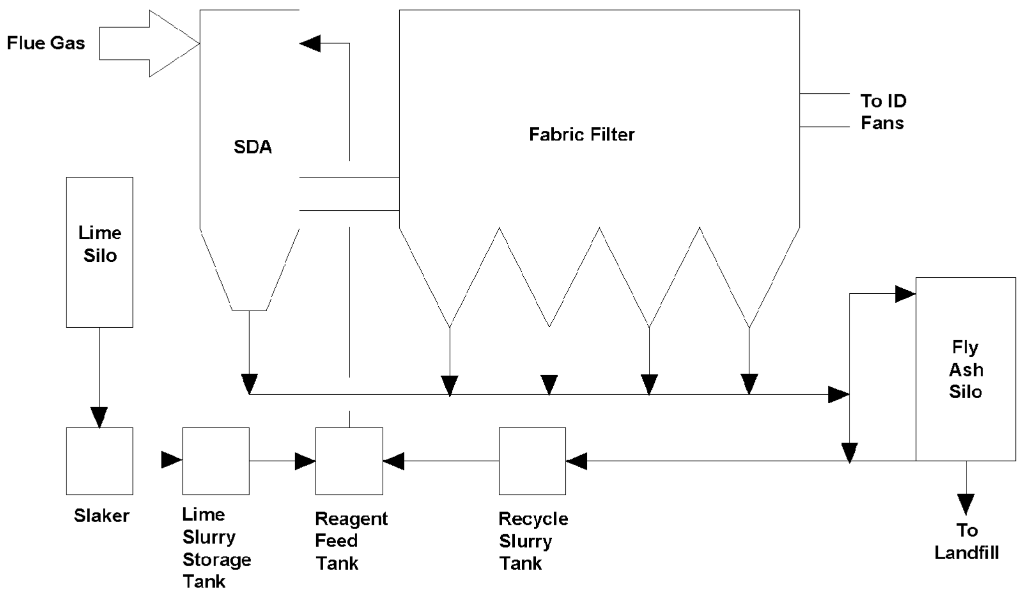

Figure D-8
SDA FGD Process

Circulating Dry Scrubber (CDS)

The CDS FGD process is a semi-dry, lime-based FGD process that uses a circulating fluid bed contactor rather than an SDA. The CDS absorber module is a vertical solid/gas reactor between the unit's air heater and its particulate control device. Water is sprayed into the reactor to reduce the flue gas temperature to the optimum temperature for reaction of SO_2 with the reagent. Hydrated lime [$Ca(OH)_2$] and recirculated dry solids from the particulate control device are injected cocurrently with the flue gas into the base of the reactor just above the water sprays. The gas velocity in the reactor is reduced and a suspended bed of reagent and fly ash is developed. The SO_2 in the flue gas reacts with the reagent to form predominately calcium sulfite. Fine particles of byproduct solids, excess reagent, and fly ash are carried out of the reactor and removed by the particulate removal device (either a fabric filter or electrostatic precipitator [ESP]). Over 90 percent of these solids are returned to the reactor to improve reagent utilization and increase the surface area for SO_2/reagent contact.

The CDS FGD system produces an extremely high solids load on the particulate removal device due to the recycling of the byproduct/fly ash mixture. For this reason, some CDS FGD system vendors prefer to use an ESP rather than a fabric filter. Most of the recycled material can be collected in the first field of an ESP with minimal effect on the overall ESP sizing. On the other hand, a fabric filter in this same service would require special design features to avoid reduced bag life associated with frequent bag cleaning. Figure D-9 provides an illustration of the CDS FGD system.

The CDS can be considered an acceptable FGD removal technology in some applications because of its ability to remove significant amounts of SO_2, the commercial status of the technology, and the use of conventional reagents. It has disadvantages relating to the downstream particulate load imposed on collectors but its implementation schedule and minimal impact on local communities adds to its acceptability.

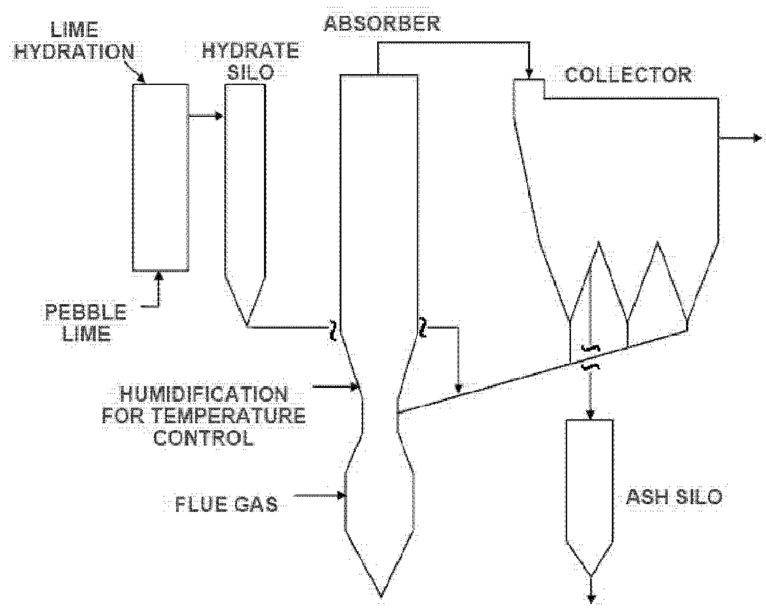

Figure D-9
Circulating Dry Scrubber System (Courtesy: Lurgi Lentjes North America)

Particulate Matter (PM) Reduction Technologies

Dry Electrostatic Precipitator (ESP)

ESPs are the most widely installed utility particulate matter (PM) removal technology. ESPs use transformer/rectifiers (TRs) to energize "discharge electrodes" and to produce a high voltage, direct current electrical field between the discharge electrodes and the grounded collecting plates. PM entering the electrical field acquires a negative charge and migrates to the grounded collecting plates. This migration can be expressed in engineering terms as an empirically determined effective migration velocity, but takes place in a turbulent flow regime with the particulate entrained within the turbulent gas patterns. Thus, the charged particles are actually captured when the combined effect of electrical attraction and gas flow patterns moves the PM close enough for it to attach to the collecting surfaces. A layer of collected particles forms on the collecting plates and is removed periodically by mechanically impacting or "rapping" the plates. The collected particulate matter drops into hoppers below the precipitator and is removed by the ash handling system. Some particulate is also re-entrained and either collected in subsequent electrical fields or emitted from the ESP. A graphic showing the sections of an ESP is shown on Figure D-10.

The required particulate removal efficiency, the expected electrical resistivity of the fly ash to be collected, and the expected electrical characteristics of the energization system determine the physical size of an ESP. Many parameters determine the ESP's capability for particulate collection including the following major items:

- The first parameter is the Specific Collection Area (SCA). ESP size is often measured in terms of SCA. SCA is defined as the total collecting area in square feet (ft^2) divided by the volumetric flue gas flow rate (1,000's of actual cubic feet per minute [acfm]).
- The treatment time of the flue gas within the electric collection fields of the ESP is an important aspect of particulate collection. High efficiency ESPs typically have treatment times between 7 and 20 seconds. Treatment time is becoming a major design parameter as lower particulate emissions are being mandated.
- Flue gas velocity, which is the speed at which the flue gas moves through the ESP, is important in the design and sizing of an ESP. Design gas velocities that range between 3 to 4 fps are common. The aspect ratio of the treatment length to the collection plate height is also important in the design and sizing of the ESP. As the aspect ratio increases, the re-entrainment losses from the ESP are minimized. Many existing ESPs have aspect ratios of approximately 0.8 to 1.2; newer ESPs, especially those meeting new particulate emission limits, have aspect ratios of approximately 1.2 to 2.0.
- The gas distribution for optimum particulate removal requires a uniform gas velocity throughout the entire ESP treatment volume, with minimal gas bypass around the discharge electrodes or collecting plates. If flue gas distribution is uneven, the particulate removal efficiency will decrease, and re-entrainment losses will increase in high velocity areas and reduce overall collection efficiency.
- Fly ash resistivity is a measure of how easily the ash or particulate acquires an electric charge. Typical coal fly ash resistivity values range from 1×10^8 ohm-cm to 1×10^{14} ohm-cm. The ideal resistivity range for electrostatic precipitation of fly ash is 5×10^9 to 5×10^{10} ohm-cm. Operating resistivity varies with flue gas moisture, SO_3 concentration, temperature, and ash chemical composition. As a result of fly ash resistivity being sensitive to these constituents, ESPs can be affected greatly by changes in fuel or operating conditions.

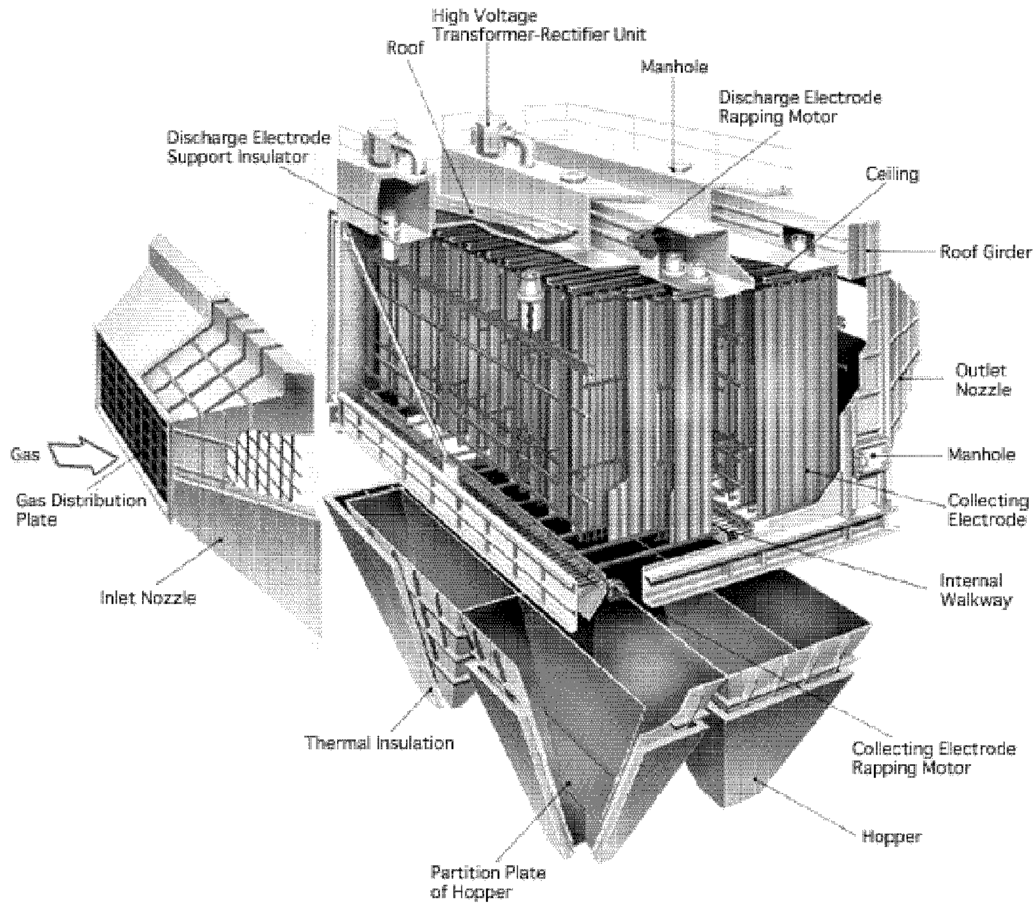

Figure D-10
Electrostatic Precipitator System (MHI)

Pulse Jet Fabric Filter (PJFF)

Fabric filters have been used for over 20 years on existing and new coal fired boilers and are media filters through which flue gas passes to remove the particulate. The success of FFs is predominately due to their ability to economically meet the low particulate emission limits for a wide range of particulate operations and fuel characteristics. Proper application of the FF technology can result in clear stacks (generally less than 5 percent opacity) for a full range of operations. In addition, the FF is relatively insensitive to ash loadings and various ash types, offering superb coal flexibility.

FFs are the current technology of choice when low outlet particulate emissions or Hg reduction is required for coal fired applications. FFs collect particle sizes ranging from submicron to 100 microns in diameter at high removal efficiencies. Provisions can be made for future addition of activated carbon injection to enhance gas phase elemental

Hg removal from coal fired plants. Some types of fly ash filter cakes will also absorb some elemental Hg.

FFs are generally categorized by type of cleaning. The two predominant cleaning methods for utility applications are reverse gas and pulsejet. Initially, utility experience in the United States was almost exclusively with Reverse Gas Fabric Filters (RGFF). Although they are a very reliable and effective emissions control technology, RGFFs have a relatively large footprint, which is particularly difficult for implementations. PJFFs can be operated at higher flue gas velocities and, as a result, have a smaller footprint. The PJFF usually has a lower capital cost than a RGFF and matches the performance and reliability of a RGFF. As a result, only PJFFs will be considered further.

Cloth filter media is typically sewn into cylindrical tubes called bags. Each FF may contain thousands of these filter bags. The filter unit is typically divided into compartments that allow on-line maintenance or bag replacement after a compartment is isolated. The number of compartments is determined by maximum economic compartment size, total gas volume rate, air-to-cloth ratio, and cleaning system design. Extra compartments for maintenance or off-line cleaning not only increase cost, but also increase reliability. Each compartment includes at least one hopper for temporary storage of the collected fly ash. A cutaway view of a PJFF compartment is illustrated on Figure D-11.

Fabric bags vary in composition, length, and cross section (diameter or shape). Bag selection characteristics vary with cleaning technology, emissions limits, flue gas and ash characteristics, desired bag life, capital cost, air-to-cloth ratio, and pressure differential. Fabric bags are typically guaranteed for 3 years but frequently last 5 years or more.

In PJFFs, the flue gas typically enters the compartment hopper and passes from the outside of the bag to the inside, depositing particulate on the outside of the bag. To prevent the collapse of the bag, a metal cage is installed on the inside of the bag. The flue gas passes up through the center of the bag into the outlet plenum. The bags and cages are suspended from a tubesheet.

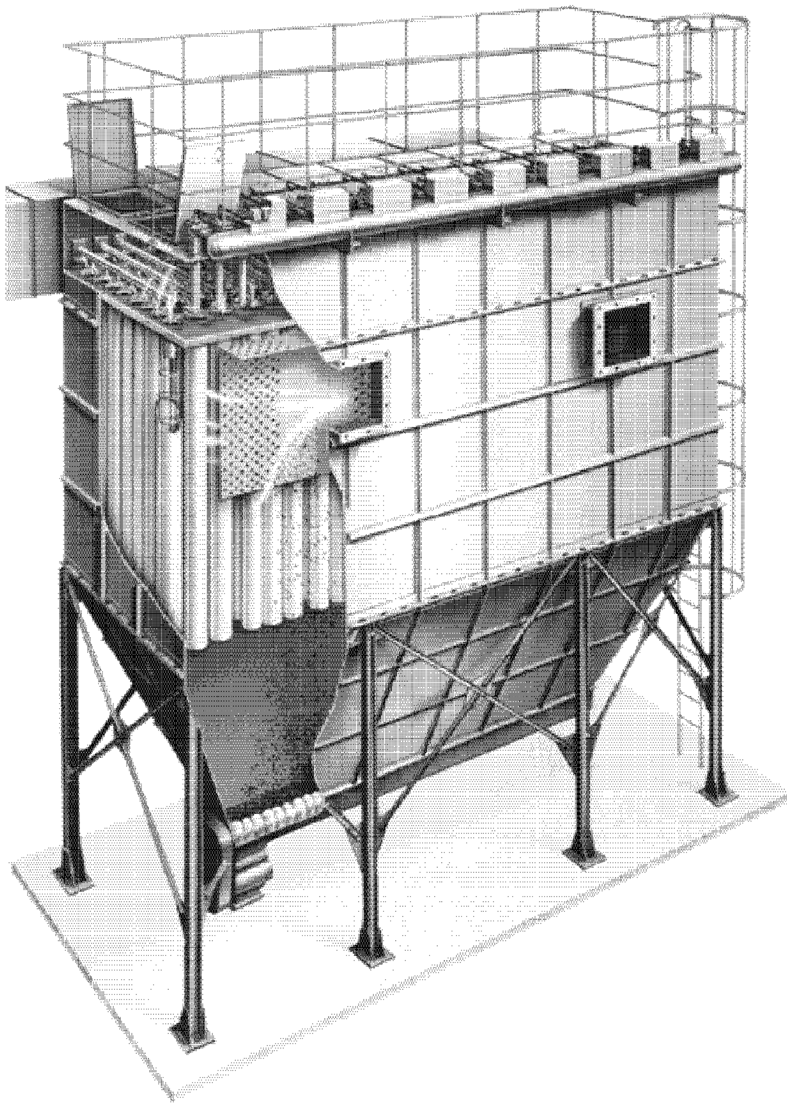

Figure D-11
Pulse Jet Fabric Filter Compartment

Cleaning is performed by initiating a downward pulse of air into the top of the bag. The pulse causes a ripple effect along the length of the bag. This dislodges the dust cake from the bag surface, and the dust falls into the hopper. This cleaning may occur with the compartment on line or off-line. Care must be taken during design to ensure that the upward velocity between bags is minimized so that particulate is not re-entrained during the cleaning process.

The PJFF cleans bags in sequential, usually staggered, rows. During on-line cleaning, part of the dust cake from the row that is being cleaned may be captured by the adjacent rows. Despite this apparent shortcoming, PJFFs have successfully implemented on-line cleaning on many large units.

The PJFF bags are typically made of felted materials that do not rely as heavily on the dust cake's filtering capability as woven fiberglass bags do. This allows the PJFF bags to be cleaned more vigorously. The felted materials also allow the PJFF to operate at a much higher cloth velocity, which significantly reduces the size of the unit and the space required for installation.

Compact Hybrid Particulate Collector (COHPAC™)

Another control technology that is effective in removing particulate matter is a high air-to-cloth ratio fabric filter installed after an existing cold-side ESP. Commonly referred to as a Compact Hybrid Particulate Collector (COHPAC™), this technology was developed and trademarked by the Electric Power Research Institute (EPRI). The COHPAC™ filter typically operates at air-to-cloth ratios ranging from 6 to 8 ft/min. compared to a conventional fabric filter that typically operate at air-to-cloth ratios of about 4 ft/min. For a COHPAC™ system, the majority of the particulate is collected in the upstream ESP. Therefore, the performance requirements of a high air-to-cloth ratio fabric filter is reduced allowing installation of this technology in a smaller footprint area, with less steel and filtration media to substantially lower both capital and operating costs compared to conventional fabric filters.

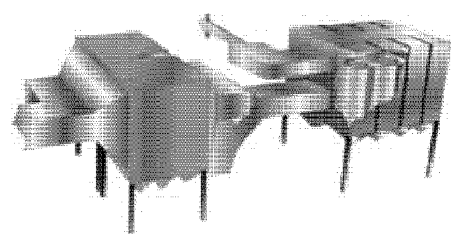

Figure D-12
COHPAC ™ I Arrangement (Courtesy: Hamon Research-Cottrell)

Mercury and Dioxin/Furan Reduction Technologies

Powdered Activated Carbon (PAC) Injection

With reported Hg removals of more than 90 percent for bituminous coal applications, PAC injection is an effective and mature technology in the control of Hg in Municipal Solid Waste (MSW) and Medical Waste Combustors (MWC). Its potential effectiveness on a wide range of coal fired power plant applications is gaining acceptance based on recent pilot and slipstream testing activities sponsored by the Department of

Energy (DOE), Environmental Protection Agency (EPA), Electric Power Research Institute (EPRI), and various research organizations and power generators. However, recent pilot scale test results indicate that the level of Hg control achieved with a PAC injection system is impacted by variables such as the type of fuel, the speciation of Hg in the fuel, operating temperature, fly ash properties, flue gas chloride content, and the mechanical collection device used in the removal of Hg.

PAC injection typically involves the use of a lignite based carbon compound that is injected into the flue gas upstream of a particulate control device as illustrated on Figure D-13. Elemental and oxidized forms of Hg are adsorbed into the carbon and are collected with the fly ash in the particulate control device.

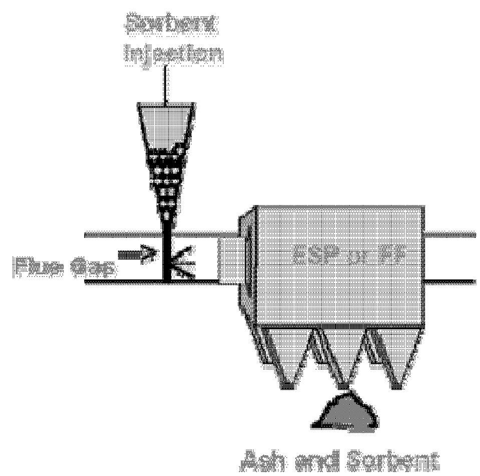

Figure D-13
Activated Carbon Injection System

PAC injection is generally added upstream of either PJFFs or ESPs. For ESPs, the Hg species in the flue gas are removed as they pass through a dust cake of unreacted carbon products on the surface of the collecting plates. Additionally, a significantly higher carbon injection rate is required for PAC injection upstream of a ESP than is required for PAC injection upstream of a high air-to-cloth ratio PJFF or a PJFF that is located downstream of a SDA FGD system. Literature indicates that PAC injection upstream of a cold ESP can reduce Hg emissions up to 60 percent for units that burn a sub-bituminous or lignite coal, and up to 80 percent for units that burn a bituminous coal. The addition of activated carbon does not directly affect the function of the ash handling system. The additional activated carbon in the fly ash does, however, affect the quality of the ash that is produced. For units that currently sell fly ash, this will negatively impact their continued ability to sell the ash.

Since the sale of fly ash depends on the carbon content of the ash, increasing the amount of carbon in the ash also makes it unsuitable for sale. To maintain the ash quality required for sale, the ash must either be removed upstream of the PAC injection system or the activated carbon should be injected into the flue gas so that it is not mixed with all the collected fly ash or is mixed with only a small portion of the total fly ash that is collected in the particulate control device. This can be accomplished by using a high air-to-cloth ratio PJFF downstream of cold ESP.

Numerous testing efforts and studies have shown that most of the Hg resulting from the combustion of coal leaves the boiler in the form of elemental Hg, and that the level of chlorine in the coal has a major impact on the efficiency of Hg removal with PAC injection and the particulate removal system. Low chlorine coals, such as sub-bituminous and lignite coals, typically demonstrate relatively low Hg removal efficiency. Sub-bituminous and lignite coals produce very low levels (approximately 100 parts per million [ppm]) of HCl during combustion and; therefore, normal PAC injection would be anticipated to achieve very low elemental Hg removal.

The removal efficiency that is attained by halogenated PAC injection can be significantly increased by the use of PAC that has been pretreated with halogens, such as iodine or bromine. Recent testing results indicate that halogenated PAC injection upstream of a cold ESP can reduce Hg emissions up to 80 percent for units that burn a sub-bituminous or lignite coal and up to 90 percent for units that burn a bituminous coal. Pretreated PAC is more expensive than untreated PAC: (approximately $5.00/lb of iodine, $1.00/lb of bromine, and $0.50/lb of PAC). However, less pretreated PAC is required to achieve significant removals, if such removal rates are dictated by more stringent Hg control regulations.

PAC can also be injected upstream of a PJFF located downstream of a semi-dry lime FGD. When a semi-dry lime FGD and a PJFF is injected with PAC upstream of the FGD, the activated carbon absorbs most of the oxidized Hg. This is a result of the additional residence time in the FGD and will basically allow greater contact between the Hg particles and the activated carbon. Because of the accumulated solids cake on the bags, the activated carbon is given another opportunity to interact with the Hg prior to disposal or recycle. Since the ash and reagent collected in the PJFF are already contaminated, the additional carbon collected in the PJFF will not affect ash sales or disposal. Recent literature indicates that PAC injection upstream of a semi-dry FGD and PJFF can reduce Hg emissions by 60 to 80 percent.

Halogenated PAC injection upstream of a semi-dry lime FGD and PJFF is basically similar in design to standard PAC, as described previously. Halogenated PAC includes halogens such as bromine or iodine. Literature indicates that halogenated sorbents require significantly lower injection rates (in some cases the difference is as much as a factor of 3) upstream of a semi-dry lime FGD and PJFF combination, as compared to an ESP, and can reduce Hg emissions of up to 95 percent.

CO Reduction Technologies

Good Combustion Controls

As products of incomplete combustion, CO and VOC emissions are very effectively controlled by ensuring the complete and efficient combustion of the fuel in the boiler (i.e., good combustion controls). Typically, measures taken to minimize the formation of NO_x during combustion inhibit complete combustion, which increases the emissions of CO and VOC. High combustion temperatures, adequate excess air, and good air/fuel mixing during combustion minimize CO and VOC emissions. These parameters also increase NO_x generation, in accordance with the conflicting goals of optimum combustion to limit CO and VOC, but lower combustion temperatures to limit NO_x. The products of incomplete combustion are substantially different and often less pronounced when the unit is firing high sulfur bituminous coals, which is the rationale for the slightly higher BACT emissions limits found on units permitted to burn low sulfur PRB subbituminous coals. In addition, depending on the manufacturer, good combustion controls vary in terms of meeting CO emissions limits.

Neural Networks

Neural networks utilize a DCS based computer system that obtains plant data such as load, firing rate, burner position, air flow, CO emissions, etc. The computer system analyzes the impact of various combustion parameters on CO emissions. The system then provides feedback to the control system to improve operation for lower CO emissions. With this combustion system performance monitoring equipment in place, it is expected that sufficient information would be available to maintain the performance of each burner at optimum conditions to enable operations personnel to maintain the most economical balance of peak fuel efficiency and emissions of NOx, and CO. In addition to burner performance these monitoring systems also allow continuous indication of pulverizer, classifier and fuel delivery system performance to provide early indication of impending component failures or maintenance requirements. This system is also used to improve heat rate and often provides operational cost savings along with CO control. It is commercially proven and has demonstrated CO reductions. However, CO emission reductions due to installation of NN vary from unit to unit based on each unit's specific equipment configuration and operation.

It is recommended that detailed studies be performed to determine the potential benefit from NN installation.

Appendix E
Approved Air Quality Control Technology Options

E.W. Brown

Comments on Brown AQC study by Black and Veatch
Brad Pabian

B&V recommended either a SNCR or SCR on Brown units 1 and 2 in their initial assessment of Brown station. This was due to their assertion that NOx limits would be imposed on a unit by unit basis. If this is the case, then their recommendations are valid. If, however, the NOx limits are imposed on a plant wide basis, then there may be a cheaper alternative. Brown 3 will be fitted with an SCR capable of 0.07 lbs/MMBTU NOx output. If Brown 2 was fitted with a similar SCR, Brown 1 may be able to come into compliance simply with better low NOx burners and over fired air. The rough calculations below show how this may be possible. These are not detailed and accurate numbers, only rough approximations.

Current Unit 3 Full Load Heat Input: ~4700 MMBTU/hr
Current Unit 2 Full Load Heat Input: ~1730 MMBTU/hr
Current Unit 1 Full Load Heat Input: ~1070 MMBTU/hr
Total Plant Full Load Heat Input: ~7500 MMBTU/hr
Maximum Plant Full Load NOx Emissions (at 0.11 lb/MMBTU): 825 lb/hr
Maximum Unit 3 NOx Emissions with 0.07 lb/MMBTU SCR in service: 329 lb/hr
Maximum Unit 2 NOx Emissions with 0.07 lb/MMBTU SCR in service: 121 lb/hr

Maximum allowable Unit 1 NOx Emissions with Unit 2 and 3 SCR in service: 375 lb/hr
Maximum allowable Unit 1 NOx Emission rate: 0.35 lb/MMBTU

Unit 1 currently runs between 0.4 and 0.5 lb/MMBTU, which is the reason that it seemed possible to attain 0.35 lb/MMBTU with less costly means. In addition, when capacity factor is considered, the allowable NOx emission rate on Unit 1 would be higher, since it has historically had a lower capacity factor than the other two units at Brown. I would suggest that capacity factor be treated as safety margin with respect to meeting the limits and that B&V propose a cost to upgrade burner equipment on Unit 1 to achieve approximately 0.3 to 0.32 lb/MMBTU emissions. The only time that this would not be a practical solution would be if the NOx limits were applied on a continuous basis, rather than by year. If so, then a Unit 3 outage would put the plant over the limit. This could be managed, possibly, with overlapping outages, etc. If the NOx regulations are applied on a unit by unit basis, NOx removal of 30-40% by an SNCR as described by B&V would not be capable of bringing Unit 1 into compliance, and a full SCR would be required.

The second major question I had was relative to disposal of material captured by a future baghouse, particularly considering heavy metals that would be captured. Please be sure B&V identifies costs that may be associated with construction of facilities to handle the waste. It should also be made clear in their final document that the potential baghouse requirements for Units 1 and 2 could be met by a single combined baghouse.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***E.W. Brown***
Unit: ***1***

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NOx compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***No new technology is required****. Existing common WFGD to units 1, 2 and 3 can meet the new SO_2 compliance limit of 0.25 lb/MBtu*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBtu (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected.*** *Existing common WFGD to units 1, 2 and 3 can meet the new HCl compliance limit of 0.002 lb/MBtu*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	□ Yes □ No

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***E.W. Brown***
Unit: ***1***

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

E.ON Comments:

Please clarify if the PJFF is shared between Units 1&2. Also, the plant would prefer B&V to estimate the option of using low NOx burners and overfire air on Unit 1 and put the SCR on Unit 2 and 3 in order to achieve Plant compliance. According to the sheet titled, "Estimated Requirements Under Future New Environmental Regulations" provided to B&V by E.ON, the revised CAIR section 4.9 calls for Plant wide compliance. The Brown Team does not believe that an SCR should be the first option for compliance for this Unit. Please see the attached document prepared by Brad Pabian for further details.

Therefore, B&V should explore this option for the basis of the estimate. Eileen Saunders will discuss with management if E.ON would like B&V to provide costs associated with adding an SCR to Unit 1.

Is an SNCR feasible for the Brown Station? If not, please explain.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***E.W. Brown***
Unit: ***1***

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *E.W. Brown*
Unit: *1*

Pollutant: NO_x

Feasible Control Options:
- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:
- SNCR/SCR Hybrid systems may be able to achieve the new NO_x compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NO_x emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NO_x emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NO_x emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NO_x reduction including future requirements.
- Likely require SO_3 mitigate system.
- New booster and/or ID fan installation as needed.
- Location: SCR would be located downstream of the existing economizer and upstream of the air heater.
- Real Estate Constraints – No space is available outside the boiler building on the north side to install the SCR. Therefore, the new SCR needs to be constructed on the east side of the boiler building. Potentially at an elevated level.
- Construction Issues – Tight space for tie-in and connection of ductwork between economizer outlet and SCR.
    - Soot blower air compressor tanks, service water piping and circulating water piping needs to be demolished and relocated.
    - Demineralization system building, which is currently not in use and is located on the north side of the boiler building, needs to be demolished.
    - Secondary air duct may need to be raised to clear the space.

Pollutant: SO_2

Feasible Control Options:
- **No new SO_2 control technology is required**. The unit is currently equipped with a shared/common wet FGD technology that can meet future target SO_2 emissions level of 0.25 lb/MBtu.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *E.W. Brown*
Unit: *1*

Pollutant: Particulate (PM)

Feasible Control Options:

- Compact Hybrid Particulate Collector (COHPAC™).
- Pulse Jet Fabric Filter (PJFF)

Special Considerations:

- COHPAC may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New booster and/or ID fan installation as needed.
- Existing ESP to be kept for additional PM filtration.
- Location: A new PJFF for Unit 1 will be located downstream of the ductwork exiting the ID fans of Unit 1 and upstream of new booster fans for Unit 1.
- Real Estate Constraints – No space is available at grade level to install the new PJFF. Therefore the new PJFF will need to be constructed at an elevation above grade level, probably above the existing ESP with Booster fan or ID fan upgrades.
- Construction Issues – Heavy foundations and supports.
    - New PJFF will be installed at a higher elevation above the existing ESP, needing heavy support columns that need to be landing outside the existing ESP foundations.

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.*

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *E.W. Brown*
Unit: *1*

Pollutant: Mercury (Hg)

Feasible Control Options:

- Powdered Activated Carbon (PAC) Injection in conjunction with new full size PJFF can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- Full size PJFF for Unit 1.
- *PAC to be injected downstream of the existing ESP but upstream of new full size PJFF for Unit 1.*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCL emissions with an existing Wet FGD.

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *E.W. Brown*
Unit: *2*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***No new technology is required****. Existing common WFGD to units 1, 2 and 3 can meet the new SO_2 compliance limit of 0.25 lb/MBtu*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBtu (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected.*** *Existing common WFGD to units 1, 2 and 3 can meet the new HCl compliance limit of 0.002 lb/MBtu*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	□ Yes □ No

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***E.W. Brown***
Unit: ***2***

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

E.ON Comments:

Please clarify if the PJFF is shared between Units 1&2. If so, B&V needs to make sure that the cost estimate only reflects one baghouse.

See comments on Unit 1 regarding the SCR estimate.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***E.W. Brown***
Unit: ***2***

Pollutant: NO_x

Feasible Control Options:

- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:

- SNCR/SCR Hybrid systems may be able to achieve the new NO_x compliance limit of 0.11 lb/MBtu but not a long term solution for NO_x emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NO_x emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NO_x emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NOx reduction including future requirements.
- Likely require SO_3 mitigate system.
- New booster and/or ID fan installation as needed.
- Location: SCR would be required downstream of the existing economizer and upstream of the air heater.
- Real Estate Constraints – Limited space available at grade level outside the boiler building on the north side to install the SCR. Therefore the new SCR will need to be constructed at an elevation above grade level.
- Construction Issues – Unit 2 abandoned dry stack and main auxiliary transformer on the north side outside the boiler building.
  - Demolition and relocation of main auxiliary transformer of Unit 2.
  - Demolition of existing pre-dust collectors.
  - SCR will need to be constructed on a dance floor.

Pollutant: SO_2

Feasible Control Options:

- **No new SO_2 control technology is required**. The unit is currently equipped with a shared/common wet FGD technology that can meet future target SO_2 emissions level of 0.25 lb/MBtu.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *E.W. Brown*
Unit: *2*

Pollutant: Particulate (PM)

<u>Feasible Control Options</u>:

- Compact Hybrid Particulate Collector (COHPAC™).
- Pulse Jet Fabric Filter (PJFF)

Special Considerations:

- COHPAC may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but not a long term solution for PM emissions less than 0.03 lb/MBtu.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New booster and/or ID fan installation as needed.
- Existing ESP to be kept for additional PM filtration.
- <u>Location</u>: A new PJFF for Unit 2 will be located downstream of the ductwork exiting the ID fans of Unit 2 and upstream of new booster fans for Unit 2.
- <u>Real Estate Constraints</u> – No space is available at grade level to install the new PJFF. Therefore the new PJFF will need to be constructed at an elevation above grade level, probably above the existing ESP with Booster fan or ID fan upgrades.
- <u>Construction Issues</u> – Heavy foundations and supports.
    - New PJFF will be installed at a higher elevation above the existing ESP, needing heavy support columns that need to be landing outside the existing ESP foundations.

Pollutant: CO

<u>Feasible Control Options</u>:

- <u>***No feasible and proven technology is available for this type and size of unit***</u> <u>to meet the 0.02 lb/MBtu emission limit.</u>
- *Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.*

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *E.W. Brown*
Unit: *2*

Pollutant: Mercury (Hg)

Feasible Control Options:

- Powdered Activated Carbon (PAC) Injection in conjunction with new full size PJFF can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- Full size PJFF for Unit 2.
- *PAC to be injected downstream of the existing ESP but upstream of new full size PJFF for Unit 2.*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCL emissions with an existing Wet FGD.

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15 x 10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *E.W. Brown*
Unit: *3*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***No new technology is required***. *The new SCR which will be constructed in 2012 can meet the new NO_x compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***No new technology is required***. *Existing common WFGD to units 1, 2 and 3 can meet the new SO_2 compliance limit of 0.25 lb/MBtu*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBtu (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected.*** *Existing common WFGD to units 1, 2 and 3 can meet the new HCl compliance limit of 0.002 lb/MBtu*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	□ Yes □ No

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***E.W. Brown***
Unit: ***3***

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

E.ON Comments:

No additional comments

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***E.W. Brown***
Unit: ***3***

Pollutant: NO_x

Feasible Control Options:

- **No new NOx control technology is required**. The unit will be equipped with SCR in 2012 that can meet the future target NO_x emissions level of 0.11 lb/MBtu.

Special Considerations:

- Plant is currently planning injection technology to mitigate SO_3 from the SCR.

Pollutant: SO_2

Feasible Control Options:

- **No new SO_2 control technology is required**. The unit is currently equipped with wet FGD technology that can meet future target SO_2 emissions level of 0.25 lb/MBtu.

Pollutant: Particulate (PM)

Feasible Control Options:

- Compact Hybrid Particulate Collector (COHPAC™).
- Pulse Jet Fabric Filter (PJFF)

Special Considerations:

- COHPAC may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but not a long term solution for PM emissions less than 0.03 lb/MBtu.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New booster and/or ID fan installation as needed.
- Existing ESP to be kept for additional PM filtration.
- Location: A new PJFF for Unit 3 will be located downstream of the existing ID fans of Unit 3 and upstream of common wet FGD scrubber.
- Real Estate Constraints – No real estate constraints.
- Construction Issues – Possible underground service water pipelines interference.
    - May require relocation of underground service water pipelines

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***E.W. Brown***
Unit: ***3***

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.*

Pollutant: Mercury (Hg)

Feasible Control Options:

- Powdered Activated Carbon (PAC) Injection in conjunction with new full size PJFF can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- Full size PJFF for Unit 3.
- *PAC to be injected downstream of the existing ESP but upstream of new full size PJFF for Unit 3.*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCL emissions with an existing Wet FGD.

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *E.W. Brown*
Unit: *3*

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

Ghent

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***1***

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***No new technology is required***. *Existing SCR can meet the new NO_x compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***No new technology is required***. *Existing WFGD can meet the new SO_2 compliance limit of 0.25 lb/MBtu*	□ Yes □ No
PM	***No new technology is required*** *for PM as current ESP is capable of meeting 0.03 lb/MBtu emissions.*	□ Yes □ No (See Qualifier in Comments Section)
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBtu (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected***. *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15 x 10^{-18} lb/MBtu.*	□ Yes □ No

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***1***

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

E.ON Comments:

General Comments for ALL Units:

- In the document, where "South" is used for location, it should be "West"
- For Units 1, 3 and 4, under the section "Special Considerations", please use the phrase, "The plant currently uses an SO3 mitigation system" instead of saying they are "planning injection technology".
- For Unit 2, under the section "Special Considerations", please us the phrase, "The plant will be installing an SO3 mitigation system" instead of saying, "Likely require SO3 mitigation system".
- Please make it clear in the document that the PJFF system must be under negative pressure.
- For SO2, the existing technology can meet the new 0.25 requirements but if the limit becomes more stringent, modifications may have to be made to **consistently** meet the requirements. Please include this clarification in the descriptions of SO2 for all units.
- For various locations cited by B&V as potential locations for PJFF systems, another project run by B&V has plans to locate equipment in those locations (Ash Handling Project). B&V needs to coordinate discussions within their company to ensure that the basis of estimate is accurate. The other project has a 2013 date.

Unit 1 specific comments:

For PM: if this unit is required to meet a new PM limit of .03 lb/MBtu and the Hg Reg does not materialize, the ESP will need to be replaced or upgraded. It does not meet the limit of .03 lb/MBtu on a consistent basis. As long as a PAC/PJFF system is installed to take care of Hg and Dioxin/Furan, then PM will be fine. Please insert this comment on the

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E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***1***

description on the first page. (And include estimate to replace/upgrade.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***1***

Pollutant: NO_x

Feasible Control Options:

- **No new NOx control technology is required**. The unit is currently equipped with SCR that can meet the future target NOx emissions level of 0.11 lb/MBtu.

Special Considerations:

- Plant is currently planning injection technology to mitigate SO_3 from the SCR.

Pollutant: SO_2

Feasible Control Options:

- **No new SO_2 control technology is required**. The unit is currently equipped with wet FGD technology that can meet future target SO_2 emissions level of 0.25 lb/MBtu.

Pollutant: Particulate (PM)

Feasible Control Options:

- **No new PM control technology is required.** The unit is currently equipped with an ESP technology that can meet the future target PM emission level of 0.03 lb/MBTU.

Special Considerations:

- A new PJFF will be required to meet mercury control using PAC. The existing ESP alone will not be capable of meeting the mercury compliance emissions using PAC.

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.*

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***1***

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction with new full size PJFF can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- PJFF for Unit 1.
- *PAC to be injected downstream of the existing ID fans but upstream of new full size PJFF for Unit 1.*
- New booster and/or ID fan installation as needed.
- Existing ESP to be kept for additional PM filtration.
- Location: A new PJFF for Unit 1 will be located downstream of the existing ID fans of Unit 1 and upstream of the new booster fans for Unit 1.
- Real Estate Constraints – No space is available at grade level to install the new PJFF. Therefore the new PJFF will need to be constructed at an elevation above grade level, with Booster fan or ID fan upgrades.
- Construction Issues – Ductwork and abandoned stack interference. Access for heavy cranes may be a possible issue
    - Require demolition of ductwork
    - May require demolition of existing abandoned dry stack of Unit 1
    - Demolition and relocation of pipe rack for access

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCL emissions with an existing Wet FGD.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***1***

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***2***

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***No new technology is required***. *Existing WFGD can meet the new SO_2 compliance limit of 0.25 lb/MBtu*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBtu (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected***. *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15 x 10^{-18} lb/MBtu.*	□ Yes □ No

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***2***

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

E.ON Comments:

If the Mercury requirement ultimately is by plant and not unit, can Ghent meet the PM requirement without installing a PJFF system on Unit 2?

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E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***2***

Pollutant: NO_x

Feasible Control Options:

- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:

- SNCR/SCR Hybrid systems may be able to achieve the new NO_x compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NO_x emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NO_x emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NO_x emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NO_x reduction including future requirements.
- Likely require SO_3 mitigate system.
- New booster and/or ID fan installation as needed.
- Location: SCR would be required downstream of the existing economizer and upstream of the air heater.
- Real Estate Constraints – Space is available outside the boiler building on the south side to install the SCR. The SCR will be elevated above grade.
- Construction Issues – Access for heavy equipment and cranes is not available.
    - Demolition and relocation of overhead walkway from Unit 2 to Unit 3 boiler building.
    - Demolition and relocation of some of the overhead power lines.
    - Tower cranes are required for access of heavy equipment and construction of SCR.

Pollutant: SO_2

Feasible Control Options:

- **No new SO_2 control technology is required**. The unit is currently equipped with wet FGD technology that can meet future target SO_2 emissions level of 0.25 lb/MBtu.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Ghent*
Unit: *2*

Pollutant: Particulate (PM)

Feasible Control Options:

- Compact Hybrid Particulate Collector (COHPAC™).
- Pulse Jet Fabric Filter (PJFF)

Special Considerations:

- COHPAC may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New booster and/or ID fan installation as needed.
- Existing ESP to be kept for additional PM filtration.
- Location: A new PJFF for Unit 2 will be located downstream of the existing ID fans of Unit 2 and upstream of the new booster fans for Unit 2.
- Real Estate Constraints – No space is available at grade level to install the new PJFF. Therefore the new PJFF will need to be constructed at an elevation above grade level, with Booster fan or ID fan upgrades.
- Construction Issues – Ductwork interference. Access for heavy cranes may be a possible issue
    - Requires demolition of ductwork
    - Demolition and relocation of pipe rack for access

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.*

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***2***

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction with new full size PJFF can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing hot-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- Full size PJFF for Unit 2.
- *PAC to be injected downstream of the existing ID fans but upstream of new full size PJFF for Unit 2.*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCL emissions with an existing Wet FGD.

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Ghent*
Unit: *3*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***No new technology is required***. *Existing SCR can meet the new NO_x compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***No new technology is required***. *Existing WFGD can meet the new SO_2 compliance limit of 0.25 lb/MBtu*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBtu (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	□ Yes □ No
Note: If E.ON does not approve a specific technology, an explanation can be included in		

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***3***

the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

E.ON Comments:

For the Mercury section, page 4, under "Special Considerations", the wording should be changed to reflect this unit is a hot-side ESP not a cold-side ESP.

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Technology Options

Plant: *Ghent*
Unit: *3*

Pollutant: NO_x

Feasible Control Options:

- **No new NO_x control technology is required**. The unit is currently equipped with SCR that can meet the future target NOx emissions level of 0.11 lb/MBtu.

Special Considerations:

- Plant is currently planning injection technology to mitigate SO_3 from the SCR.

Pollutant: SO_2

Feasible Control Options:

- **No new SO_2 control technology is required**. The unit is currently equipped with wet FGD technology that can meet future target SO_2 emissions level of 0.25 lb/MBtu.

Pollutant: Particulate (PM)

Feasible Control Options:

- Compact Hybrid Particulate Collector (COHPAC™).
- Pulse Jet Fabric Filter (PJFF)

Special Considerations:

- COHPAC may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New booster and/or ID fan installation as needed.
- Existing ESP to be kept for additional PM filtration.
- Location: A new PJFF for Unit 3 will be located downstream of the existing ID fans of Unit 3 and upstream of the new booster fans for Unit 3.

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Plant: *Ghent*
Unit: *3*

- Real Estate Constraints – There is very limited space available between the ID fan outlet and wet scrubber inlet on the west side. The new PJFF will be installed on the south side of Unit 4 ESP, with Booster fan or ID fan upgrades.
- Construction Issues – Electrical manhole, electrical duct banks and circulating water and storm water drain piping running underground on the south side of Unit 4 ESP will need to be relocated to make real estate available.
  - Warehouse needs to be demolished
  - Well water pumps needs to be relocated

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.*

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction with new full size PJFF can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- PJFF for Unit 3.
- *PAC to be injected downstream of the existing ID fans but upstream of new full size PJFF for Unit 3.*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCL emissions with an existing Wet FGD.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***3***

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Ghent*
Unit: *4*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***No new technology is required***. *Existing SCR can meet the new* NO_x *compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***No new technology is required***. *Existing WFGD can meet the new* SO_2 *compliance limit of 0.25 lb/MBtu*	□ Yes □ No
PM	***No new technology is required*** *for PM as current ESP is capable of meeting 0.03 lb/MBtu emissions.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBtu (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of* 1×10^{-6} *lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of* 15×10^{-18} *lb/MBtu.*	□ Yes □ No
Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment		

E.ON US
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Technology Options

Plant: ***Ghent***
Unit: ***4***

and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

E.ON Comments:

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Technology Options

Plant: ***Ghent***
Unit: ***4***

Pollutant: NO_x

Feasible Control Options:

- **No new NOx control technology is required**. The unit is currently equipped with SCR that can meet the future target NOx emissions level of 0.11 lb/MBtu.

Special Considerations:

- Plant is currently planning injection technology to mitigate SO_3 from the SCR.

Pollutant: SO_2

Feasible Control Options:

- **No new SO_2 control technology is required**. The unit is currently equipped with wet FGD technology that can meet future target SO_2 emissions level of 0.25 lb/MBtu.

Pollutant: Particulate (PM)

Feasible Control Options:

- **No new PM control technology is required** to meet the 0.03 lb/MBTU emissions limit.

Special Considerations:

- A new PJFF will be required to meet mercury control using PAC. The existing ESP alone will not be capable of meeting the mercury compliance emissions using PAC.

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.*

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Plant: ***Ghent***
Unit: ***4***

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction with new full size PJFF can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing hot-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- PJFF for Unit 4.
- *PAC to be injected downstream of the existing ID fans but upstream of new full size PJFF for Unit 4.*
- New booster and/or ID fan installation as needed.
- Existing ESP to be kept for additional PM filtration.
- Location: A new PJFF for Unit 4 will be located downstream of the existing ID fans of Unit 4 and upstream of the new booster fans for Unit 4.
- Real Estate Constraints – There is very limited space available between the ID fan outlet and wet scrubber inlet on the west side. The new PJFF will be installed on the south side of Unit 4 ESP, with Booster fan or ID fan upgrades.
- Construction Issues – Electrical manhole, electrical duct banks and circulating water and storm water drain piping running underground on the south side of Unit 4 ESP will need to be relocated to make real estate available.
  - Warehouse needs to be demolished
  - Well water pumps needs to be relocated

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCL emissions with an existing Wet FGD.

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Air Quality Control Technology Assessment
Technology Options

Plant: ***Ghent***
Unit: ***4***

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

Cane Run

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Cane Run*
Unit: *4*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu.*	☐ Yes ☐ No
SO_2	***New Wet Flue Gas Desulfurization (WFGD) is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	☐ Yes ☐ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	☐ Yes ☐ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	☐ Yes ☐ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	☐ Yes ☐ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu*	☐ Yes ☐ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	☐ Yes ☐ No

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Technology Options

Plant: *Cane Run*
Unit: *4*

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

Special Considerations Summary:

- Complete demolition of everything behind the boiler.
- Demolish and Build in Phases; requires ~20-30 month of construction outage for Unit 4.
- New ID Fans and wet liner/stack required for Unit 4 which will be a common concrete shell for units 4, 5 and 6 with separate wet flue liners.
- Relocate existing overhead power lines towards the backend equipment to minimize construction hazards.
- New common stack located near unit 5.
- Existing stacks demolished.
- Construction sequence starts with unit 5.

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Plant: ***Cane Run***
Unit: ***4***

E.ON Comments:

General Comments:

- During the site visits and in subsequent discussions with EON personnel, the outage timeframes were depicted in the 18-20 month range not 20-30 month range. Please explain the discrepancy.
- For the SCR's, an SO3 mitigation system is described as likely needed. To ultimately understand the total cost impact for Cane Run, EON will need to know those costs. Please contact Eileen Saunders regarding this item.

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Technology Options

Plant: ***Cane Run***
Unit: ***4***

Pollutant: NO_x

Feasible Control Options:

- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:

- SNCR/SCR Hybrid systems may be able to achieve the new NO_x compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NO_x emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NO_x emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NO_x emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NOx reduction including future requirements.
- Likely require SO_3 mitigation system.
- New ID fan installation as needed.
- New air heater needed.
- Existing air heater demolished.
- <u>Location</u>: SCR would be required downstream of the existing economizer and upstream of the new air heater.

Pollutant: SO_2

Feasible Control Options:

- Semi-Dry Flue Gas Desulfurization (FGD)
- Wet Flue Gas Desulfurization (WFGD)

Special Considerations:

- Semi-Dry FGD systems may be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu but it will not provide a long term consistent solution for SO_2 emissions less than 0.25 lb/MBtu on high sulfur fuels. The O&M costs economics could favor use of a wet FGD technology when scrubbing high sulfur coals expected to be burned at Cane Run units.
- WFGD can consistently achieve SO_2 emissions of 0.25 lb/MBtu on a continuous basis and has a capability to expand to meet the SO_2 emissions even lower than

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Technology Options

Plant: *Cane Run*
Unit: *4*

0.25 lb/MBtu burning high sulfur content coals. Hence WFGD is the most feasible and expandable control technology considered for SO_2 reduction including future requirements.

- New ID fan installation as needed.
- Existing WFGD will be demolished.
- Existing ID fans will be demolished
- Location: WFGD would be required downstream of the new ID fans and upstream of the new stack.
- To minimize outage time, Unit 4 Scrubbers will be installed in parallel with SCR. and installation of baghouse.

Pollutant: Particulate (PM)

Feasible Control Options:

- Cold-side Dry ESP
- Compact Hybrid Particulate Collector (COHPAC™).
- Pulse Jet Fabric Filter (PJFF) .

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New ID fan installation as needed.
- Existing ESP will be demolished (no additional PM filtration proposed for ash sales).
- New air heater needed.
- Existing air heater demolished.
- Location: A new PJFF for Unit 4 will be located downstream of the new air heater and upstream of the new ID fans.
- Existing ID fans will be demolished.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Cane Run*
Unit: *4*

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note* : Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP will not be capable to removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- A Full size PJFF in conjunction with PAC injection for Unit 4 is recommended to remove 90% mercury emissions.
- *PAC to be injected downstream of the new air heater but upstream of new full size PJFF for Unit 4*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCl emissions with an existing Wet FGD and similarly it is expected to meet the same target emission level of 0.002 lb/MBtu with new Wet FGD recommended.

Special Considerations:

- New WFGD proposed as control technology for SO_2 reduction for future requirements will also meet HCl target emission level.

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Technology Options

Plant: ***Cane Run***
Unit: ***4***

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

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Air Quality Control Technology Assessment
Technology Options

Plant: *Cane Run*
Unit: *5*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu.*	□ Yes □ No
SO_2	***New Wet Flue Gas Desulfurization (WFGD) is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15 x10^{-18} lb/MBtu.*	□ Yes □ No

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Technology Options

Plant: ***Cane Run***
Unit: ***5***

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

Special Considerations Summary:

- Complete demolition of everything behind the boiler.
- Demolish and Build in Phases; requires ~20-30 month of construction outage for Unit 5.
- New ID Fans and wet liner/stack required for Unit 5 which will be a common concrete shell for units 4, 5 and 6 with separate wet flue liners.
- Relocate existing overhead power lines towards the backend equipment to minimize construction hazards.
- New common stack located near unit 5.
- Existing stacks demolished.
- Construction sequence starts with unit 5.

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Technology Options

Plant: ***Cane Run***
Unit: ***5***

E.ON Comments:

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Technology Options

Plant: *Cane Run*
Unit: *5*

Pollutant: NO_x

Feasible Control Options:

- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:

- SNCR/SCR Hybrid systems may be able to achieve the new NO_x compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NO_x emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NO_x emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NO_x emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NO_x reduction including future requirements.
- Likely require SO_3 mitigation system.
- New ID fan installation as needed.
- New air heater needed.
- Existing air heater demolished.
- Location: SCR would be required downstream of the existing economizer and upstream of the new air heater.

Pollutant: SO_2

Feasible Control Options:

- Semi-Dry Flue Gas Desulfurization (FGD)
- Wet Flue Gas Desulfurization (WFGD)

Special Considerations:

- Semi-Dry FGD systems may be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu but it will not provide a long term consistent solution for SO_2 emissions less than 0.25 lb/MBtu on high sulfur fuels. The O&M costs economics could favor use of a wet FGD technology when scrubbing high sulfur coals expected to be burned at Cane Run units.
- WFGD can consistently achieve SO_2 emissions of 0.25 lb/MBtu on a continuous basis and has a capability to expand to meet the SO_2 emissions even lower than

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Cane Run*
Unit: *5*

0.25 lb/MBtu burning high sulfur content coals. Hence WFGD is the most feasible and expandable control technology considered for SO_2 reduction including future requirements.

- New ID fan installation as needed.
- Existing WFGD will be demolished.
- Existing ID fans will be demolished
- Location: WFGD would be required downstream of the new ID fans and upstream of the new stack.
- To minimize outage time, Unit 5 Scrubbers will be installed in parallel with SCR. and installation of baghouse.

Pollutant: Particulate (PM)

Feasible Control Options:

- Cold-side Dry ESP
- Compact Hybrid Particulate Collector (COHPAC^{TM}).
- Pulse Jet Fabric Filter (PJFF) .

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New ID fan installation as needed.
- Existing ESP will be demolished (no additional PM filtration proposed for ash sales).
- New air heater needed.
- Existing air heater demolished.
- Location: A new PJFF for Unit 5 will be located downstream of the new air heater and upstream of the new ID fans.
- Existing ID fans will be demolished.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Cane Run***
Unit: ***5***

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note* : Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP will not be capable to removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- A Full size PJFF in conjunction with PAC injection for Unit 5 is recommended to remove 90% mercury emissions.
- *PAC to be injected downstream of the new air heater but upstream of new full size PJFF for Unit 5*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCl emissions with an existing Wet FGD and similarly it is expected to meet the same target emission level of 0.002 lb/MBtu with new Wet FGD recommended.

Special Considerations:

- New WFGD proposed as control technology for SO_2 reduction for future requirements will also meet HCl target emission level.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Cane Run***
Unit: ***5***

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Cane Run*
Unit: *6*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu.*	☐ Yes ☐ No
SO_2	***New Wet Flue Gas Desulfurization (WFGD) is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	☐ Yes ☐ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	☐ Yes ☐ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	☐ Yes ☐ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu.*	☐ Yes ☐ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu*	☐ Yes ☐ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15 x10^{-18} lb/MBtu.*	☐ Yes ☐ No

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Technology Options

Plant: ***Cane Run***
Unit: ***6***

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

Special Considerations Summary:

- Complete demolition of everything behind the boiler.
- Demolish and Build in Phases; requires ~20-30 month of construction outage for Unit 6.
- New ID Fans and wet liner/stack required for Unit 6 which will be a common concrete shell for units 4, 5 and 6 with separate wet flue liners.
- Relocate existing overhead power lines towards the backend equipment to minimize construction hazards.
- New common stack located near unit 5.
- Existing stacks demolished.
- Construction sequence starts with unit 5.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Cane Run***
Unit: ***6***

E.ON Comments:

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Cane Run***
Unit: ***6***

Pollutant: NO_x

Feasible Control Options:

- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:

- SNCR/SCR Hybrid systems may be able to achieve the new NOx compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NOx emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NOx emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NOx emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NOx reduction including future requirements.
- Likely require SO_3 mitigation system.
- New ID fan installation as needed.
- New air heater needed.
- Existing air heater demolished.
- <u>Location</u>: SCR would be required downstream of the existing economizer and upstream of the new air heater.

Pollutant: SO_2

Feasible Control Options:

- Semi-Dry Flue Gas Desulfurization (FGD)
- Wet Flue Gas Desulfurization (WFGD)

Special Considerations:

- Semi-Dry FGD systems may be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu but it will not provide a long term consistent solution for SO_2 emissions less than 0.25 lb/MBtu on high sulfur fuels. The O&M costs economics could favor use of a wet FGD technology when scrubbing high sulfur coals expected to be burned at Cane Run units.
- WFGD can consistently achieve SO_2 emissions of 0.25 lb/MBtu on a continuous basis and has a capability to expand to meet the SO_2 emissions even lower than

E.ON US
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Air Quality Control Technology Assessment
Technology Options

Plant: *Cane Run*
Unit: *6*

0.25 lb/MBtu burning high sulfur content coals. Hence WFGD is the most feasible and expandable control technology considered for SO_2 reduction including future requirements.

- New ID fan installation as needed.
- Existing WFGD will be demolished.
- Existing ID fans will be demolished
- Location: WFGD would be required downstream of the new ID fans and upstream of the new stack.
- To minimize outage time, Unit 6 Scrubbers will be installed in parallel with SCR. and installation of baghouse.

Pollutant: Particulate (PM)

Feasible Control Options:

- Cold-side Dry ESP
- Compact Hybrid Particulate Collector (COHPAC^{TM}).
- Pulse Jet Fabric Filter (PJFF) .

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New ID fan installation as needed.
- Existing ESP will be demolished (no additional PM filtration proposed for ash sales).
- New air heater needed.
- Existing air heater demolished.
- Location: A new PJFF for Unit 6 will be located downstream of the new air heater and upstream of the new ID fans.
- Existing ID fans will be demolished.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Cane Run*
Unit: *6*

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note* : Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:

- **New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF** can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP will not be capable to removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- A Full size PJFF in conjunction with PAC injection for Unit 6 is recommended to remove 90% mercury emissions.
- *PAC to be injected downstream of the new air heater but upstream of new full size PJFF for Unit 6*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCl emissions with an existing Wet FGD and similarly it is expected to meet the same target emission level of 0.002 lb/MBtu with new Wet FGD recommended.

Special Considerations:

- New WFGD proposed as control technology for SO_2 reduction for future requirements will also meet HCl target emission level.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Cane Run***
Unit: ***6***

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

Mill Creek

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *1*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu.*	☐ Yes ☐ No
SO_2	***New Wet Flue Gas Desulfurization (WFGD) is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	☐ Yes ☐ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu. Plus, new cold-side dry ESP for pre-filtration for ash sales.*	☐ Yes ☐ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	☐ Yes ☐ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	☐ Yes ☐ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu.*	☐ Yes ☐ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	☐ Yes ☐ No

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *1*

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

Special Considerations Summary:

- Erection of new pre-filter ESP/ and new PJFF and ID fans prior to demolition of existing ESP required in meeting recommended phased approach to create real estate for new SCR.
- SCR will be installed in same physical location as existing ESP.
- Existing wet stack will be reused.
- Phased erection is required to minimize unit outage for tie-in to existing components.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***1***

E.ON Comments:

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***1***

Pollutant: NO_x

Feasible Control Options:

- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:

- SNCR/SCR Hybrid systems may be able to achieve the new NOx compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NOx emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NOx emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NOx emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NOx reduction including future requirements.
- Likely require SO_3 mitigation system.
- New ID fan installation as needed.
- Existing air heater will be retained
- Existing ESP will be demolished.
- New economizer bypass will be provided
- <u>Location</u>: SCR would be required downstream of the existing economizer and upstream of the existing air heater.

Pollutant: SO_2

Feasible Control Options:

- Semi-Dry Flue Gas Desulfurization (FGD)
- Wet Flue Gas Desulfurization (WFGD)

Special Considerations:

- Semi-Dry FGD systems may be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu but it will not provide a long term consistent solution for SO_2 emissions less than 0.25 lb/MBtu on high sulfur fuels. The O&M costs economics could favor use of a wet FGD technology when scrubbing high sulfur coals expected to be burned at Mill Creek units.
- WFGD can consistently achieve SO_2 emissions of 0.25 lb/MBtu on a continuous basis and has a capability to expand to meet the SO_2 emissions even lower than 0.25 lb/MBtu burning high sulfur content coals. Hence WFGD is the most feasible

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Technology Options

Plant: ***Mill Creek***
Unit: ***1***

and expandable control technology considered for SO_2 reduction including future requirements.
- New ID fans installation is needed.
- Existing WFGD will be demolished in a phased approach.
- Existing ID fans will be demolished
- Location: WFGD would be required downstream of the new ID fans and upstream of the existing stack. The existing wet stack liner and breaching including the connecting ductwork will be reused as is.

Pollutant: Particulate (PM)

Feasible Control Options:
- Cold-Side Dry ESP
- Compact Hybrid Particulate Collector (COHPAC™).
- Pulse Jet Fabric Filter (PJFF).

Special Considerations:
- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New ID fans installation is needed.
- Existing ESP will be demolished.
- A new cold-side dry ESP will be used as a pre-filter to remove 80-85% fly ash that can be sold to the cement plant to lower the ash land filling liability. A new down stream full size PJFF will be used for mercury, acid and some PM control.
- Location: A new PJFF for Unit 1 will be located downstream of the existing air heater and upstream of the new ID fans. The PJFF will possibly be installed on the top of the pre-filter ESP due to site real estate constraints.
- Existing ID fans will be demolished.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***1***

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note*: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP or new proposed cold-side dry ESP will not be capable to removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- A full size PJFF is recommended for Unit 1 in conjunction with PAC injection.
- *PAC to be injected downstream of the new pre-filter ESP but upstream of new full size PJFF for Unit 1*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCl emissions with an existing Wet FGD and similarly it is expected to meet the same target emission level of 0.002 lb/MBtu with new Wet FGD recommended.

Special Considerations:

- New WFGD proposed as control technology for SO_2 reduction for future requirements will also meet HCl target emission level.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***1***

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *2*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu.*	☐ Yes ☐ No
SO_2	***New Wet Flue Gas Desulfurization (WFGD) is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	☐ Yes ☐ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu. Plus, new cold-side dry ESP for pre-filtration for ash sales.*	☐ Yes ☐ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	☐ Yes ☐ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	☐ Yes ☐ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu.*	☐ Yes ☐ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	☐ Yes ☐ No

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *2*

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail. *E.ON to return written approval and comments sections to B&V.*

Special Considerations Summary:

- Erection of new pre-filter ESP/ and new PJFF and ID fans prior to demolition of existing ESP required in meeting recommended phased approach to create real estate for new SCR.
- SCR will be installed in same physical location as existing ESP.
- Existing wet stack will be reused.
- Phased erection is required to minimize unit outage for tie-in to existing components.

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Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***2***

E.ON Comments:

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***2***

Pollutant: NO_x

Feasible Control Options:

- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:

- SNCR/SCR Hybrid systems may be able to achieve the new NOx compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NOx emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NOx emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NOx emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NOx reduction including future requirements.
- Likely require SO_3 mitigation system.
- New ID fan installation as needed.
- Existing air heater will be retained
- Existing ESP will be demolished.
- New economizer bypass will be provided
- <u>Location</u>: SCR would be required downstream of the existing economizer and upstream of the existing air heater.

Pollutant: SO_2

Feasible Control Options:

- Semi-Dry Flue Gas Desulfurization (FGD)
- Wet Flue Gas Desulfurization (WFGD)

Special Considerations:

- Semi-Dry FGD systems may be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu but it will not provide a long term consistent solution for SO_2 emissions less than 0.25 lb/MBtu on high sulfur fuels. The O&M costs economics could favor use of a wet FGD technology when scrubbing high sulfur coals expected to be burned at Mill Creek units.
- WFGD can consistently achieve SO_2 emissions of 0.25 lb/MBtu on a continuous basis and has a capability to expand to meet the SO_2 emissions even lower than 0.25 lb/MBtu burning high sulfur content coals. Hence WFGD is the most feasible

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Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *2*

and expandable control technology considered for SO_2 reduction including future requirements.

- New ID fans installation is needed.
- Existing WFGD will be demolished in a phased approach.
- Existing ID fans will be demolished
- Location: WFGD would be required downstream of the new ID fans and upstream of the existing stack. The existing wet stack liner and breaching including the connecting ductwork will be reused as is.

Pollutant: Particulate (PM)

Feasible Control Options:

- Cold-Side Dry ESP
- Compact Hybrid Particulate Collector (COHPAC™).
- Pulse Jet Fabric Filter (PJFF).

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New ID fans installation is needed.
- Existing ESP will be demolished.
- A new cold-side dry ESP will be used as a pre-filter to remove 80-85% fly ash that can be sold to the cement plant to lower the ash land filling liability. A new down stream full size PJFF will be used for mercury, acid and some PM control.
- Location: A new PJFF for Unit 2 will be located downstream of the existing air heater and upstream of the new ID fans. The PJFF will possibly be installed on the top of the pre-filter ESP due to site real estate constraints.
- Existing ID fans will be demolished.

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Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***2***

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note*: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP or new proposed cold-side dry ESP will not be capable to removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- A full size PJFF is recommended for Unit 2 in conjunction with PAC injection.
- *PAC to be injected downstream of the new pre-filter ESP but upstream of new full size PJFF for Unit 2*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCl emissions with an existing Wet FGD and similarly it is expected to meet the same target emission level of 0.002 lb/MBtu with new Wet FGD recommended.

Special Considerations:

- New WFGD proposed as control technology for SO_2 reduction for future requirements will also meet HCl target emission level.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *2*

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *3*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***No new technology is required***. *Existing SCR can meet the new NO_x compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***New Wet Flue Gas Desulfurization (WFGD) is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu.*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	□ Yes □ No
Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment		

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***3***

and a decision to approve a technology should be described in detail. *E.ON to return written approval and comments sections to B&V.*

Special Considerations Summary:

- New booster fans required following PJFF.
- New ductwork will bypass existing FGD equipment that will be demolished following installation of new equipment.
- Existing stack can be reused with new FGD and PJFF elevated above existing road and rails.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***3***

E.ON Comments:

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***3***

Pollutant: NO_x

Feasible Control Options:
- **No new NOx control technology is required**. The unit is currently equipped with SCR that can meet the future target NOx emissions level of 0.11 lb/MBtu.

Special Considerations:
- Plant is currently planning injection technology to mitigate SO_3 from the SCR.

Pollutant: SO_2

Feasible Control Options:
- Semi-Dry Flue Gas Desulfurization (FGD)
- Wet Flue Gas Desulfurization (WFGD)

Special Considerations:
- Semi-Dry FGD systems may be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu but it will not provide a long term consistent solution for SO_2 emissions less than 0.25 lb/MBtu on high sulfur fuels. The O&M costs economics could favor use of a wet FGD technology when scrubbing high sulfur coals expected to be burned at Mill Creek units.
- WFGD can consistently achieve SO_2 emissions of 0.25 lb/MBtu on a continuous basis and has a capability to expand to meet the SO_2 emissions even lower than 0.25 lb/MBtu burning high sulfur content coals. Hence WFGD is the most feasible and expandable control technology considered for SO_2 reduction including future requirements.
- New booster and/or ID fan installation as needed.
- Existing WFGD will be demolished.
- Location: WFGD would be required downstream of the new booster fans and upstream of the existing stack.
- New wet FGD absorber and reaction tank to be installed over the existing main access way on elevated steel supports and hence heavy duty steel support and foundations are expected. *Existing railroad tracks as well as pipe racks are kept intact by elevating the new PJFF and the WFGD absorber.*

Pollutant: Particulate (PM)

Feasible Control Options:
- Cold-Side Dry ESP

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *3*

- Compact Hybrid Particulate Collector (COHPAC^{TM}).
- Pulse Jet Fabric Filter (PJFF).

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New booster and/or ID fan installation is needed.
- Existing ESP to be kept for additional PM filtration and lime injection for SO_3 mitigation to be located upstream of existing ESP.
- Location: A new PJFF for Unit 3 will be located over the main access way downstream of the existing ID fans and upstream of the new booster fans.
- Real Estate Constraints – No space is available at grade level to install the new PJFF because the existing access way is critical to plant operation. Therefore the new PJFF will need to be constructed at an elevation above grade level, with new Booster fans.

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note*: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:

- **New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF** can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *3*

Special Considerations:

- The existing cold-side dry ESP will not be capable to removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- A new full size PJFF in conjunction with PAC injection is recommended for Unit 3.
- *PAC to be injected downstream of the existing ID fans but upstream of new full size PJFF for Unit 3*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCl emissions with an existing Wet FGD and expected to meet the same target emission level of 0.002 lb/MBtu with new Wet FGD.

Special Considerations:

- New WFGD proposed as control technology for SO_2 reduction for future requirements will also meet HCl target emission level.

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15 x 10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *4*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***No new technology is required***. *Existing SCR can meet the new NO_x compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***New Wet Flue Gas Desulfurization (WFGD) is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu.*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new full size Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	□ Yes □ No
Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment		

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***4***

and a decision to approve a technology should be described in detail. *E.ON to return written approval and comments sections to B&V.*

Special Considerations Summary:

- New booster fans required following PJFF.
- New ductwork will bypass existing FGD equipment that will be demolished following installation of new equipment.
- Existing stack can be reused with new FGD and PJFF elevated above existing road and rails.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***4***

E.ON Comments:

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Mill Creek***
Unit: ***4***

Pollutant: NO_x

Feasible Control Options:

- **No new NOx control technology is required**. The unit is currently equipped with SCR that can meet the future target NOx emissions level of 0.11 lb/MBtu.

Special Considerations:

- Plant is currently planning injection technology to mitigate SO_3 from the SCR.

Pollutant: SO_2

Feasible Control Options:

- Semi-Dry Flue Gas Desulfurization (FGD)
- Wet Flue Gas Desulfurization (WFGD)

Special Considerations:

- Semi-Dry FGD systems may be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu but it will not provide a long term consistent solution for SO_2 emissions less than 0.25 lb/MBtu on high sulfur fuels. The O&M costs economics could favor use of a wet FGD technology when scrubbing high sulfur coals expected to be burned at Mill Creek units.
- WFGD can consistently achieve SO_2 emissions of 0.25 lb/MBtu on a continuous basis and has a capability to expand to meet the SO_2 emissions even lower than 0.25 lb/MBtu burning high sulfur content coals. Hence WFGD is the most feasible and expandable control technology considered for SO_2 reduction including future requirements.
- New booster and/or ID fan installation as needed.
- Existing WFGD will be demolished.
- Location: WFGD would be required downstream of the new booster fans and upstream of the existing stack.
- New wet FGD absorber and reaction tank to be installed over the existing main access way on elevated steel supports and hence heavy duty steel support and foundations are expected. *Existing railroad tracks as well as pipe racks are kept intact by elevating the new PJFF and the WFGD absorber.*

Pollutant: Particulate (PM)

Feasible Control Options:

- Cold-Side Dry ESP

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *4*

- Compact Hybrid Particulate Collector (COHPAC™).
- Pulse Jet Fabric Filter (PJFF).

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New booster and/or ID fan installation is needed.
- Existing ESP to be kept for additional PM filtration and lime injection for SO_3 mitigation to be located upstream of existing ESP.
- <u>Location</u>: A new PJFF for Unit 4 will be located over the main access way downstream of the existing ID fans and upstream of the new booster fans.
- <u>Real Estate Constraints</u> – No space is available at grade level to install the new PJFF because the existing access way is critical to plant operation. Therefore the new PJFF will need to be constructed at an elevation above grade level, with new Booster fans.

Pollutant: CO

Feasible Control Options:

- <u>***No feasible and proven technology is available for this type and size of unit***</u> to meet the 0.02 lb/MBtu emission limit.
- <u>*Note*</u>: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Mill Creek*
Unit: *4*

Special Considerations:

- The existing cold-side dry ESP will not be capable to removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- A new full size PJFF in conjunction with PAC injection is recommended for Unit 4.
- *PAC to be injected downstream of the existing ID fans but upstream of new full size PJFF for Unit 4*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCl emissions with an existing Wet FGD and expected to meet the same target emission level of 0.002 lb/MBtu with new Wet FGD.

Special Considerations:

- New WFGD proposed as control technology for SO_2 reduction for future requirements will also meet HCl target emission level.

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

Trimble County

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Trimble County*
Unit: *1*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***No new technology is required***. *Existing SCR can meet the new NOx compliance limit of 0.11 lb/MBtu*	□ Yes □ No
SO_2	***No new technology is required***. *Existing WFGD can meet the new SO_2 compliance limit of 0.25 lb/MBtu*	□ Yes □ No
PM	***No new technology is required*** *for PM as current ESP is capable of meeting 0.03 lb/MBTU emissions.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size PJFF.***	□ Yes □ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection*** *and new Pulse Jet Fabric Filter (PJFF) required to meet the compliance requirements.*	□ Yes □ No
Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail. *E.ON to return written approval and comments sections to B&V.*		

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Trimble County***
Unit: ***1***

E.ON Comments:

Under the "Special Considerations" section for Hg, B&V discusses the use of adding a booster fan or upgrading the ID fan. The plant would prefer to upgrade the existing ID Fan motors which will need to be replaced or rewound. Modifications will need to be made to the ID Fans which may include replacement of the fans.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Trimble County***
Unit: ***1***

Pollutant: NO_x

Feasible Control Options:

- **No new NO_x control technology is required**. The unit is currently equipped with state of the art SCR that can meet future target NOx emissions level of 0.11 lb/MBtu.

Pollutant: SO_2

Feasible Control Options:

- **No new SO_2 control technology is required**. The unit is currently equipped with wet FGD technology that can meet future target SO2 emissions level of 0.25 lb/MBtu.

Pollutant: Particulate (PM)

Feasible Control Options:

- **No new PM control technology is required** to meet the 0.03 lb/MBTU emissions limit.

Special Considerations:

- A new PJFF will be required to meet mercury control using PAC. The existing ESP alone will not be capable of meeting the mercury compliance emissions using PAC.

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.*

Pollutant: Mercury (Hg)

Feasible Control Options:

- **New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF** can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a

E.ON US
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Air Quality Control Technology Assessment
Technology Options

Plant: *Trimble County*
Unit: *1*

continuous basis and hence is the most feasible control technology. The existing cold-side dry ESP will not be capable to removing 90% mercury with PAC injection and hence not recommended for cost considerations.

Special Considerations:

- Full size PJFF.
- *PAC to be injected downstream of the existing ESP but upstream of new PJFF.*
- Location: A PJFF would be required downstream of the PAC injection system.
- Real Estate Constraints – No space is available at grade level to install the new PJFF. Therefore the new PJFF will need to be constructed at an elevation above grade level, probably above the existing ESP with Booster fan or ID fan upgrades.
- Construction Issues – Electrical manhole and electrical duct banks running underground between the existing ID fans and scrubber inlet duct will need to be avoided or relocated to make real estate available.
    - Array of I-beam structures (currently supporting no equipment) located between the existing ID fans and scrubber inlet needs to be demolished.
    - New PJFF will be installed at a higher elevation needing heavy support columns that need to be landing outside the existing ESP foundations.

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- **No new control technology is required** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCL emissions with an existing Wet FGD.

Pollutant: Dioxin/Furan

Feasible Control Options:

- The **new PAC injection with new PJFF considered for mercury control** can meet the dioxin/furan compliance limit of 15 x 10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Trimble County***
Unit: ***1***

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

Green River

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Green River*
Unit: *3*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu.*	□ Yes □ No
SO_2	***New Circulating Dry Scrubber (CDS) Desulfurization is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) which is part of the CDS technology for SO_2 removal is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new CDS and Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***New CDS technology*** *can meet the new HCl compliance limit of 0.002 lb/MBtu.*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new CDS and Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	□ Yes □ No
Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment		

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Green River***
Unit: ***3***

and a decision to approve a technology should be described in detail. *E.ON to return written approval and comments sections to B&V.*

Special Considerations Summary:
- New ID Fans, Air Heater and dry carbon steel Stack required for Unit 3.
- Underground aux electric duct banks need to be avoided during foundations for future AQC equipment.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Green River***
Unit: ***3***

E.ON Comments:

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Green River***
Unit: ***3***

Pollutant: NO_x

Feasible Control Options:
- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:
- SNCR/SCR Hybrid systems may be able to achieve the new NO_x compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NO_x emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NOx emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NO_x emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NO_x reduction including future requirements.
- Likely require SO_3 mitigate system.
- New ID fan installation is needed.
- Existing air heater will be demolished and used as SCR ductwork.
- New air heater.
- New economizer bypass will be built
- Location: SCR would be required downstream of the existing economizer and upstream of the new air heater. New air heater to be located straight under the new SCR.

Pollutant: SO_2

Feasible Control Options:
- Wet Flue Gas Desulfurization (WFGD)
- Semi-Dry Flue Gas Desulfurization (FGD)
- Circulating Dry Scrubber (CDS)

Special Considerations:
- Both WFGD and Semi-Dry FGD systems will be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu on a continuous basis on high sulfur fuels. However for small size boilers like Unit 3, it would be economically feasible to build a semi-dry FGD or CDS system than Wet FGD system. The CDS system will offer more operational flexibility compared to the two other technologies when load flexibility is an issue. The CDS technology will incorporate an internal flue

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Green River*
Unit: *3*

gas recycle to maintain the lime bed during low load operations. Hence CDS is the most feasible control technology considered for SO_2 reduction based on the size of the unit.

- New ID fan installation is needed.
- Existing ID fans will be demolished
- Location: CDS would be required downstream of the new air heater and upstream of the new ID fans.

Pollutant: Particulate (PM)

Feasible Control Options:

- Cold Side Dry ESP
- COHPAC™.
- Pulse Jet Fabric Filter (PJFF).

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New ID fan installation is needed.
- Existing ESP will be retired in place. This will not be demolished. Exhaust gas stream will bypass the existing ESP.
- Location: A new PJFF for Unit 3 will be located downstream of the new CDS and upstream of the new ID fans.
- Existing ID fans will be demolished.
- New Air Heater will be installed straight under the new SCR.

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Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Green River***
Unit: ***3***

Pollutant: CO

Feasible Control Options:
- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:
- New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:
- The existing cold-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- A new full size PJFF for Unit 3 is recommended in conjunction with PAC injection.
- PAC to be injected downstream of the new air heater but upstream of CDS FGD system for Unit 3

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:
- Wet Flue Gas Desulfurization (WFGD)
- Semi-Dry Flue Gas Desulfurization (FGD)
- Circulating Dry Scrubber (CDS)

Special Considerations:
- WFGD, Semi-Dry FGD, and CDS systems will be able to achieve the new HCl compliance limit of 0.002 lb/MBtu on a continuous basis.
- However, since a new CDS system will be installed for SO_2 control, it will also control HCl. Therefore, no new HCl control technology is required beyond the proposed CDS. The new CDS technology with PJFF will remove the HCl to the compliance levels of 0.002 lb/MBtu.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Green River***
Unit: ***3***

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new CDS and PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Green River*
Unit: *4*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu.*	□ Yes □ No
SO_2	***New Circulating Dry Scrubber (CDS) Desulfurization is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	□ Yes □ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) which is part of the CDS technology for SO_2 removal is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	□ Yes □ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	□ Yes □ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new CDS and Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1×10^{-6} lb/MBtu.*	□ Yes □ No
HCl	***New CDS technology*** *can meet the new HCl compliance limit of 0.002 lb/MBtu.*	□ Yes □ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new CDS and Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15×10^{-18} lb/MBtu.*	□ Yes □ No
Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment		

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Green River*
Unit: *4*

and a decision to approve a technology should be described in detail. *E.ON to return written approval and comments sections to B&V.*

Special Considerations Summary:

- New ID Fans and dry carbon steel Stack required for Unit 4. Booster fans options to be evaluated.
- Relocate existing power lines and tower.
- Will require demolition of abandoned Unit 1 and Unit 2 ID fans, scrubber and stack to make room for Unit 4 new AQC equipment.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Green River***
Unit: ***4***

E.ON Comments:

- Under Special Considerations Summary, the Unit 1 and Unit 2 ID fan statement is incorrect. There is only one fan and it is a booster fan that was originally used for the scrubber.
- For the entire station, there is no extra Aux Power. Any estimate has to include and upgrade to that system as the current system cannot handle any additional power requirements.
- For the SCR considerations for Units 3 and 4, the estimate should include new, enamel air heater baskets as discussed during the site visits.
- The estimate should include ductwork replacement as the current ductwork is in poor condition.
- In the Green River Unit 4 template, on page 4 of 7, it should read, “Unit 4” instead of “Unit 3” under the Special Consideration’s section.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Green River*
Unit: *4*

Pollutant: NO_x

Feasible Control Options:
- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:
- SNCR/SCR Hybrid systems may be able to achieve the new NOx compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NOx emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NOx emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NOx emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NOx reduction including future requirements.
- Likely require SO_3 mitigate system.
- New ID fan installation is needed if booster fans do not make sense.
- Existing air heater will be used
- New economizer bypass will be built
- Location: SCR would be required downstream of the existing hot-side ESP and upstream of the existing air heater.

Pollutant: SO_2

Feasible Control Options:
- Wet Flue Gas Desulfurization (WFGD)
- Semi-Dry Flue Gas Desulfurization (FGD)
- Circulating Dry Scrubber (CDS)

Special Considerations:
- Both WFGD and Semi-Dry FGD systems will be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu on a continuous basis on high sulfur fuels. However for small size boilers like Unit 3, it would be economically feasible to build a semi-dry FGD or CDS system than Wet FGD system. The CDS system will offer more operational flexibility compared to the two other technologies when load flexibility is an issue. The CDS technology will incorporate an internal flue gas recycle to maintain the lime bed during low load operations. Hence CDS is

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Green River*
Unit: *4*

the most feasible control technology considered for SO_2 reduction based on the size of the unit.

- New ID fan installation is needed if booster fans do not make sense.
- Existing ID fans will be retired in place if new ID fans are used in lieu of booster fans.
- Location: CDS would be required downstream of the existing air heater and upstream of the new ID fans. Existing ID fans located at higher elevation will either be retired in place if new ID fans are selected or reused when new booster fans are added CDS with new dry carbon steel stack.

Pollutant: Particulate (PM)

Feasible Control Options:

- Cold Side Dry ESP
- COHPAC^{TM}.
- Pulse Jet Fabric Filter (PJFF).

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New ID fan installation is needed if booster fans do not make sense.
- Existing hot side ESP to be kept to minimize the arrangement challenges for new SCR. The existing ESP will remain functional (energized) and used for additional PM filtration.
- Location: A new PJFF for Unit 4 will be located downstream of the new CDS and upstream of the new ID fans.
- Existing ID fans will be retired in place if new ID fans are used in lieu of booster fans.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Green River***
Unit: ***4***

Pollutant: CO

Feasible Control Options:
- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:
- New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:
- The existing hot-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- Full size PJFF for Unit 4.
- *PAC to be injected downstream of the existing air heater but upstream of CDS FGD system for Unit 4*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:
- Wet Flue Gas Desulfurization (WFGD)
- Semi-Dry Flue Gas Desulfurization (FGD)
- Circulating Dry Scrubber (CDS)

Special Considerations:
- WFGD, Semi-Dry FGD, and CDS systems will be able to achieve the new HCl compliance limit of 0.002 lb/MBtu on a continuous basis.
- However, since a new CDS system will be installed for SO_2 control, it will also control HCl. Therefore, no new HCl control technology is required beyond the proposed CDS. The new CDS technology with PJFF will remove the HCl to the compliance levels of 0.002 lb/MBtu.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: ***Green River***
Unit: ***4***

Pollutant: Dioxin/Furan

Feasible Control Options:

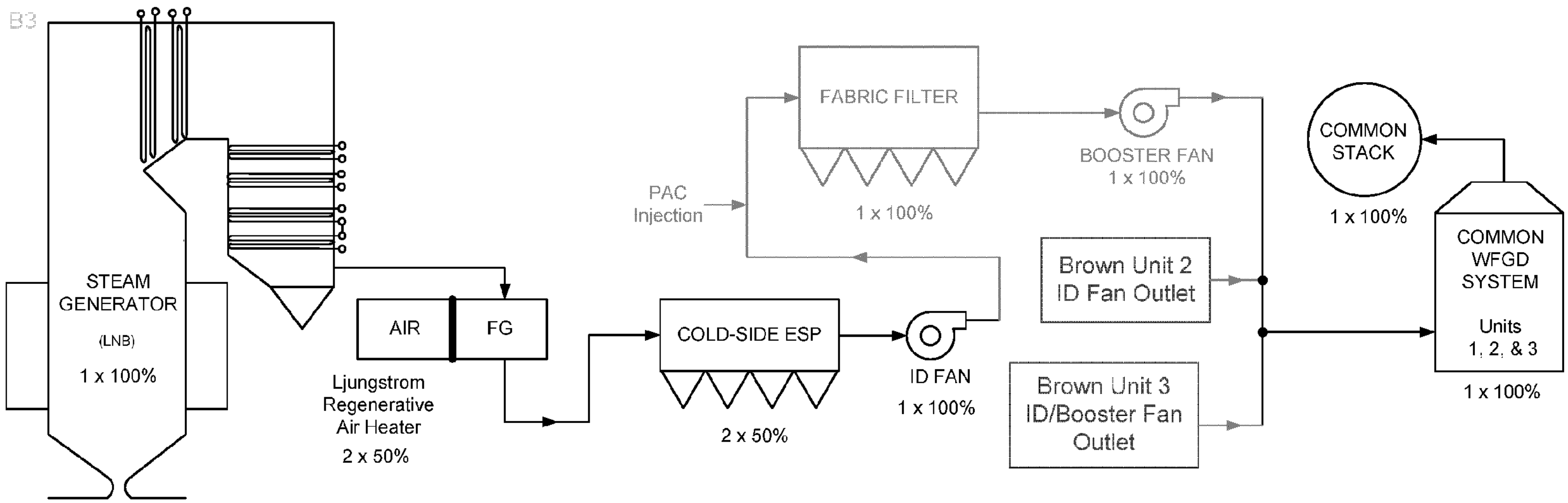
- PAC injection with new CDS and PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15×10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

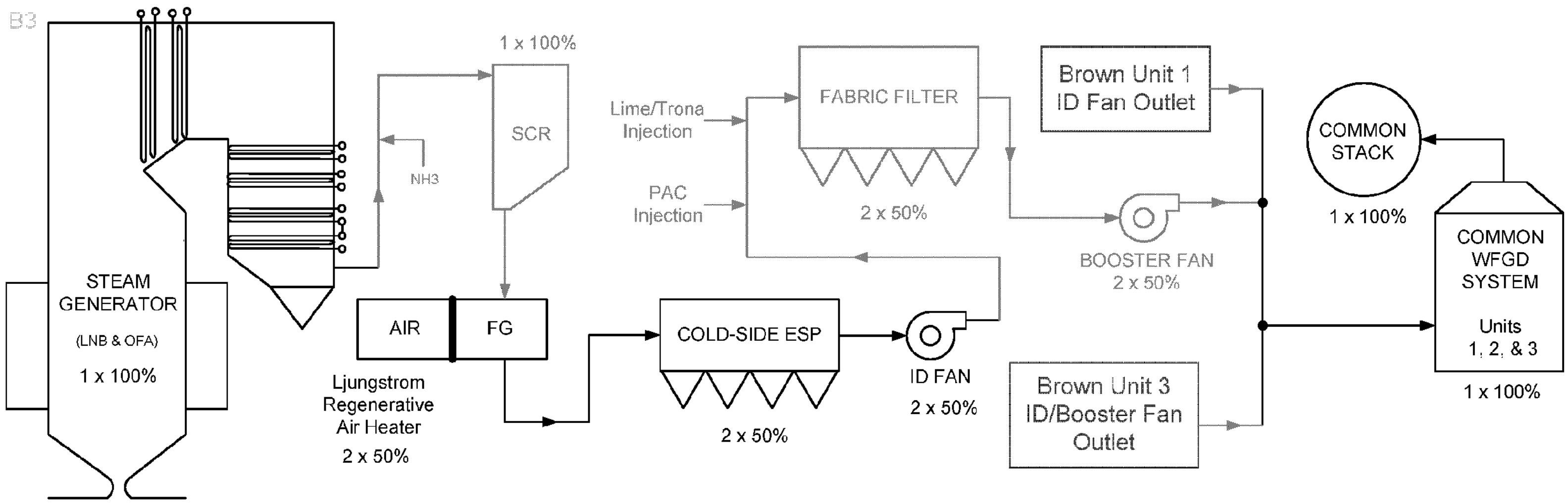
- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

Appendix F
Process Flow Diagrams

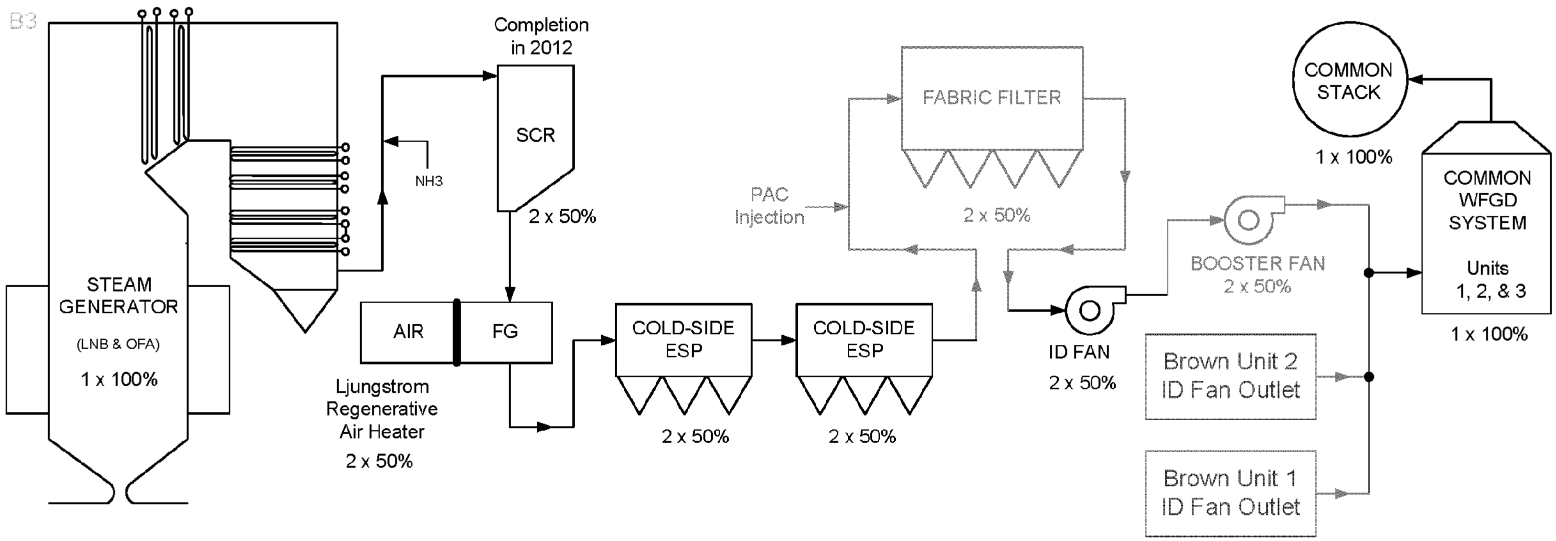
E.W. Brown



Brown Unit 1: Future
110 MW

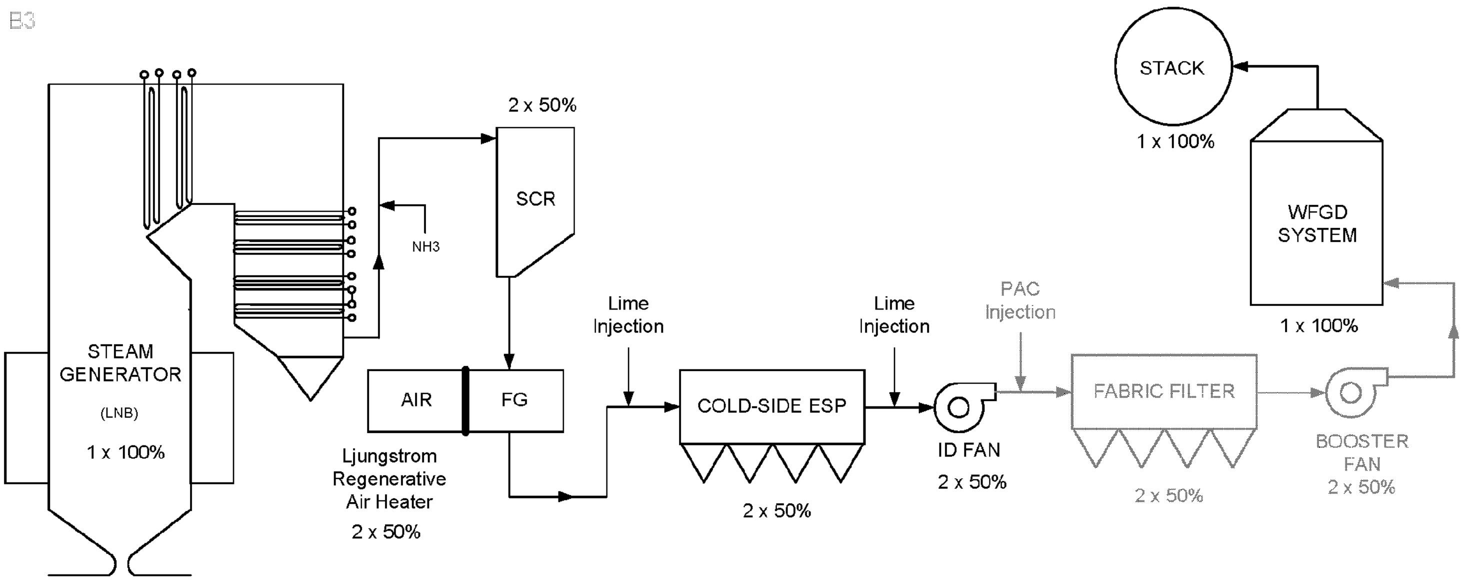


Brown Unit 2: Future
180 MW

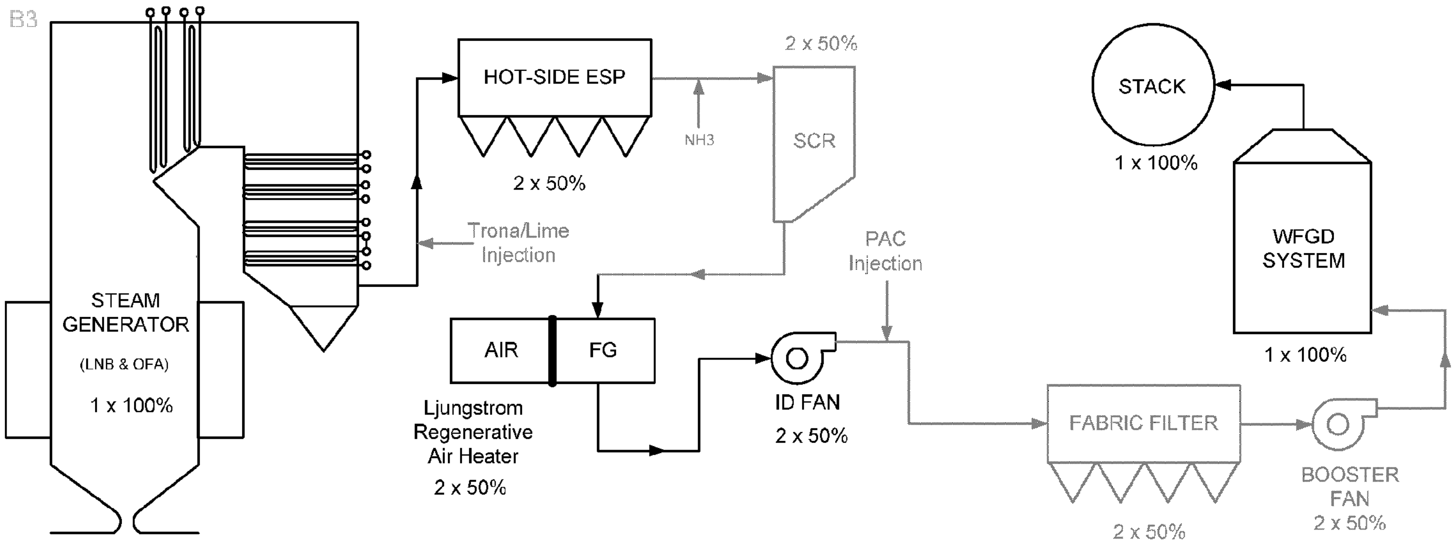


Brown Unit 3: Future
457 MW

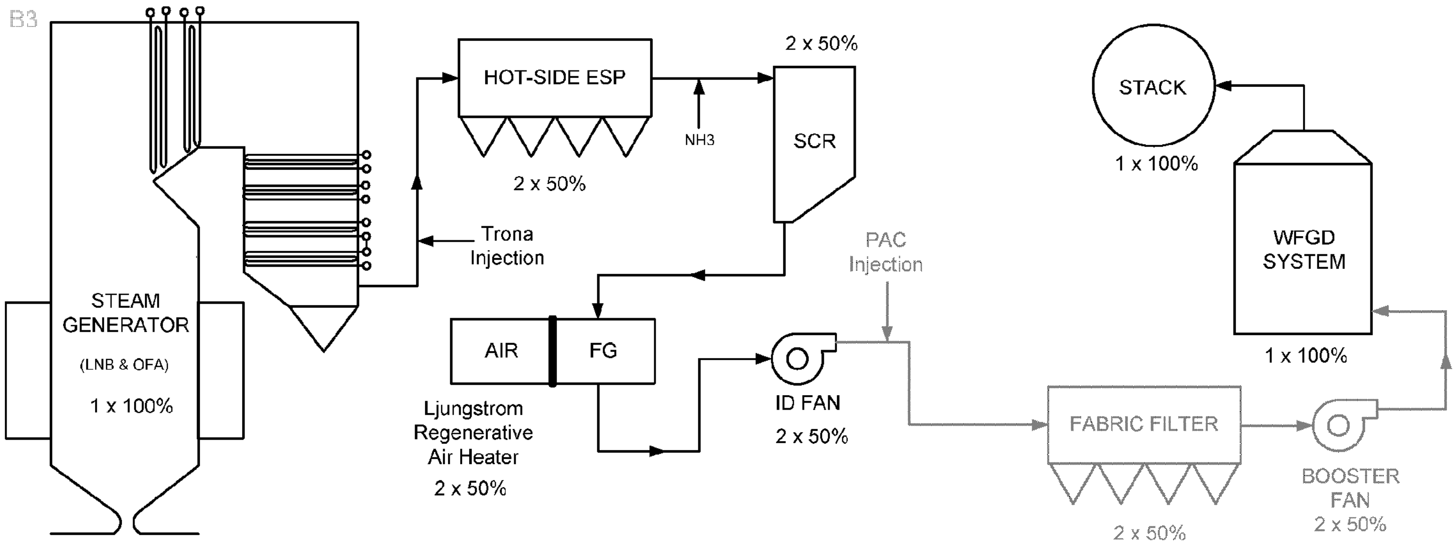
Ghent



Ghent Unit 1: Future

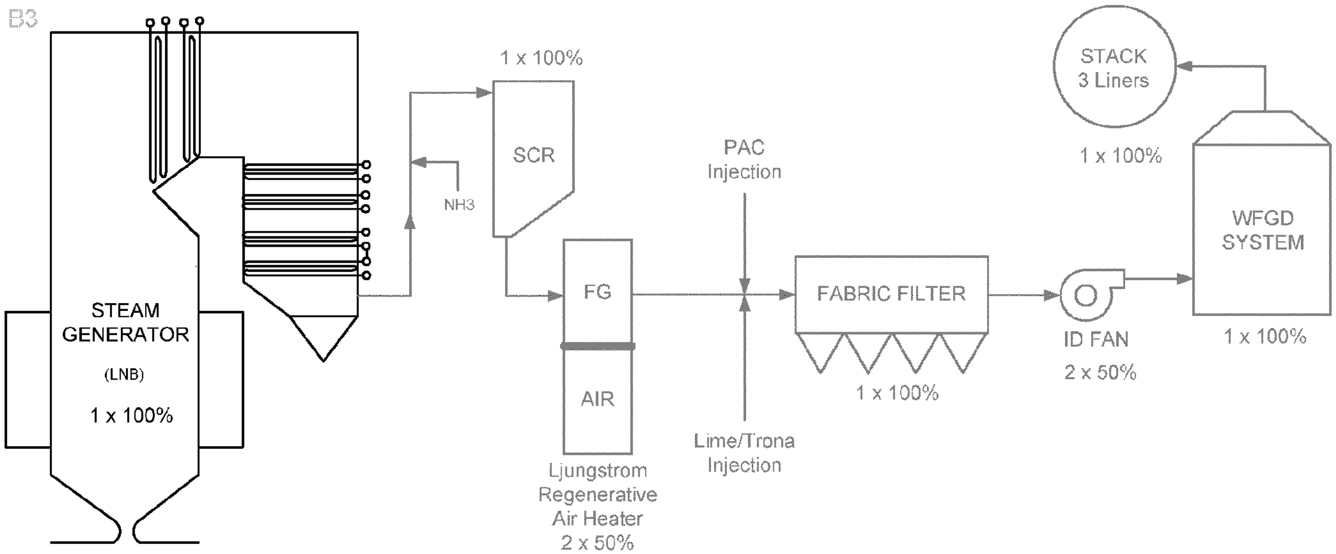


Ghent Unit 2: Future

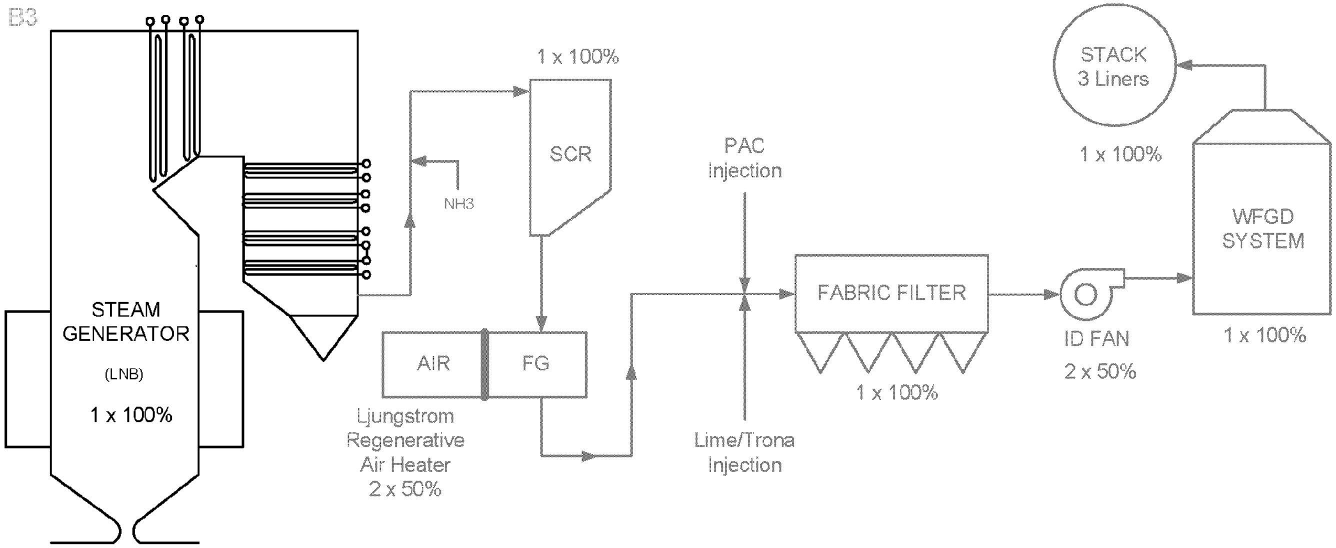


Ghent Unit 3/4: Future

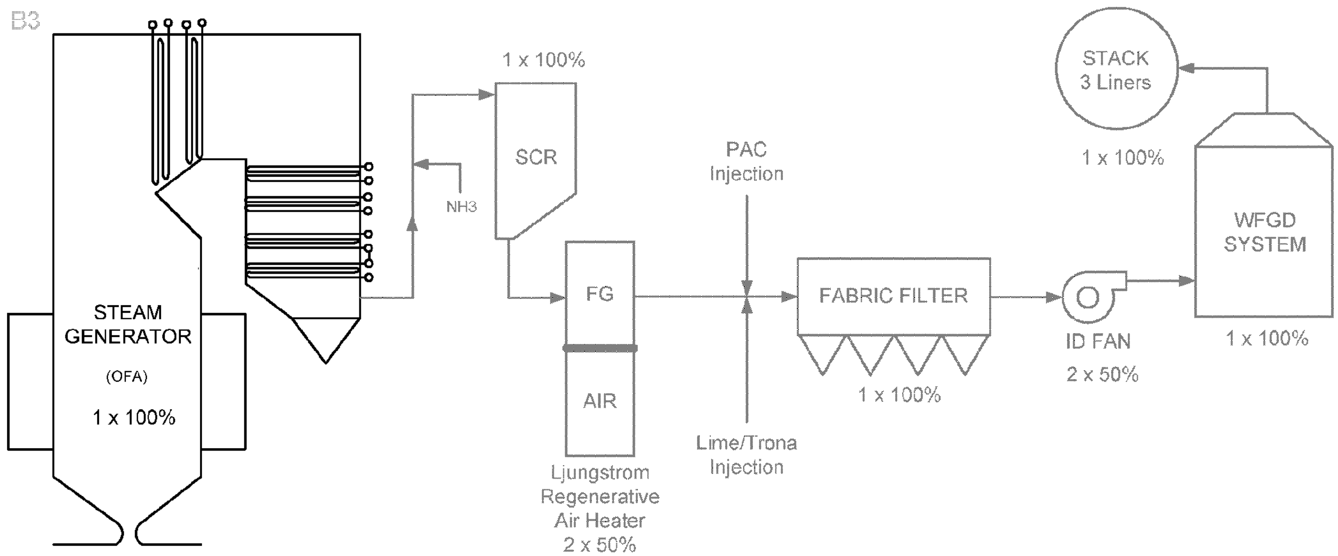
Cane Run



Cane Run Unit 4: Future
168 MW

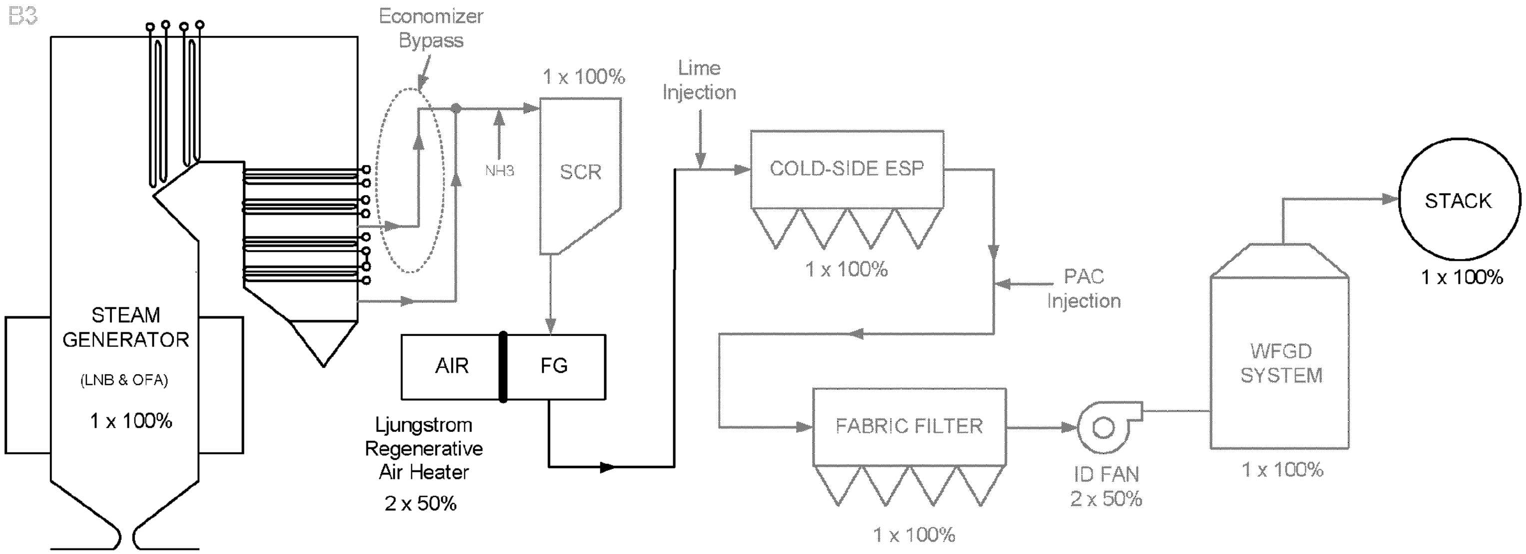


Cane Run Unit 5: Future
181 MW

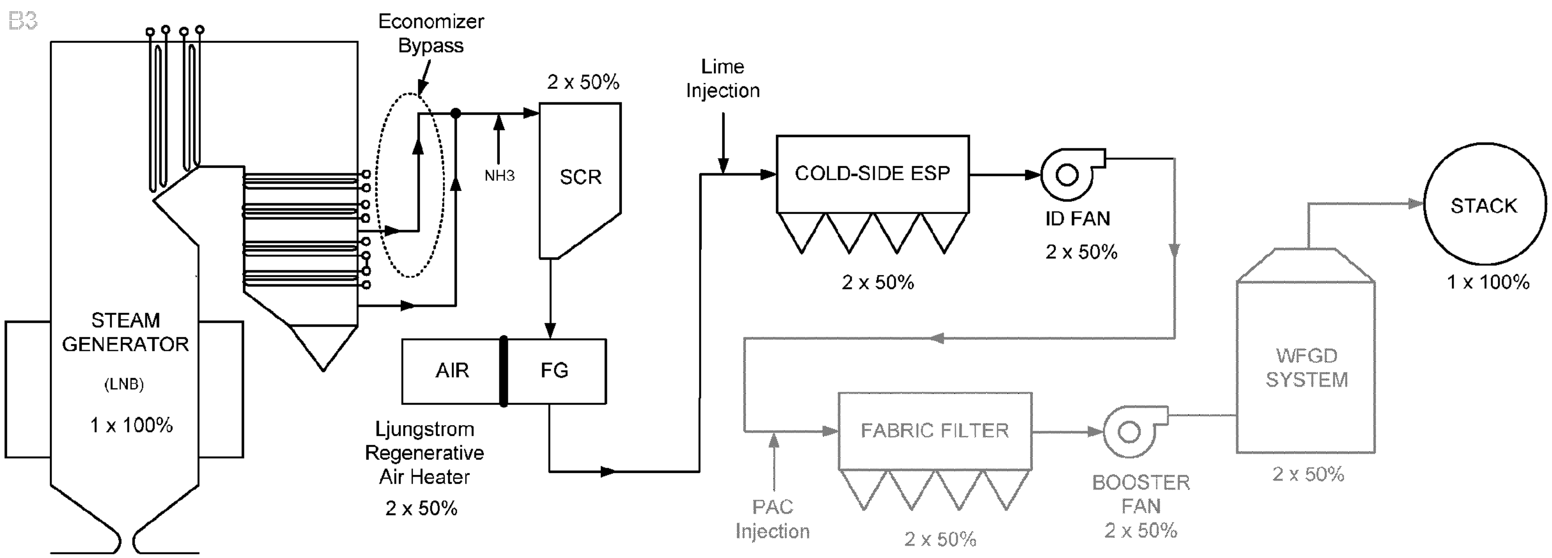


Cane Run Unit 6: Future
261 MW

Mill Creek

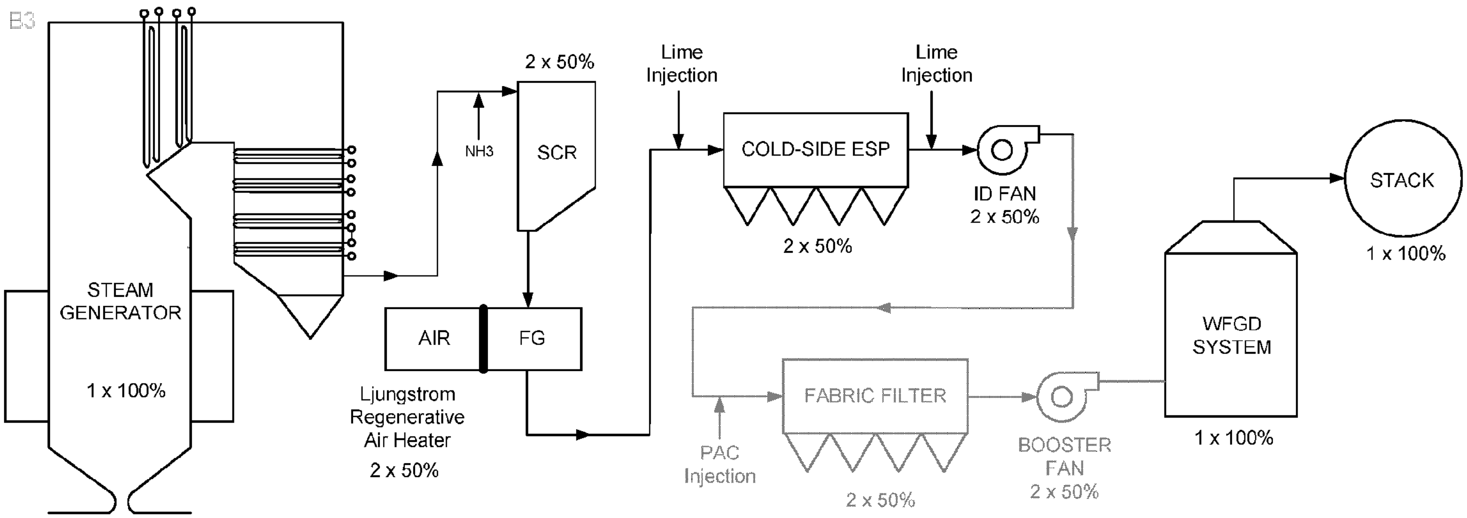


Mill Creek Unit 1/2: Future
Unit 1: 330 MW
Unit 2: 330 MW



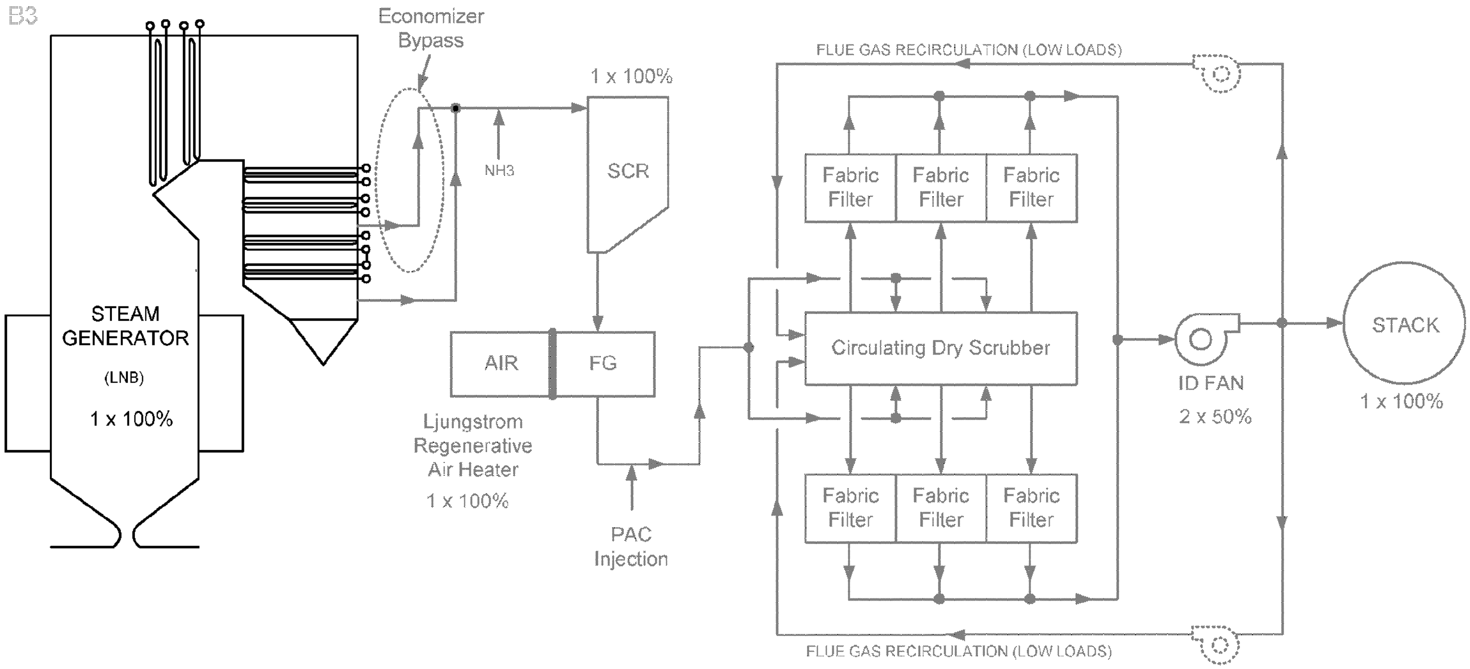
Mill Creek Unit 3/4: Future
Unit 3: 423 MW
Unit 4: 525 MW

Trimble County

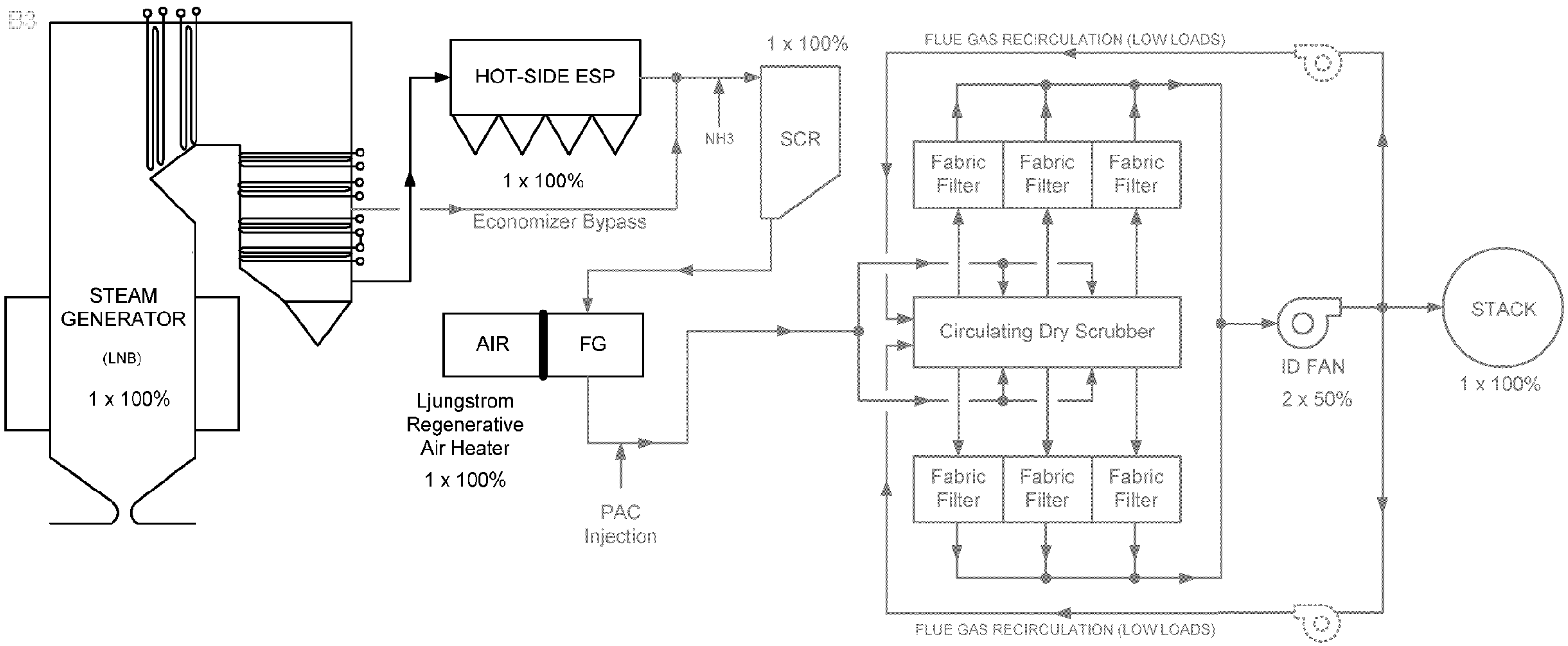


Trimble County Unit 1: Future

Green River



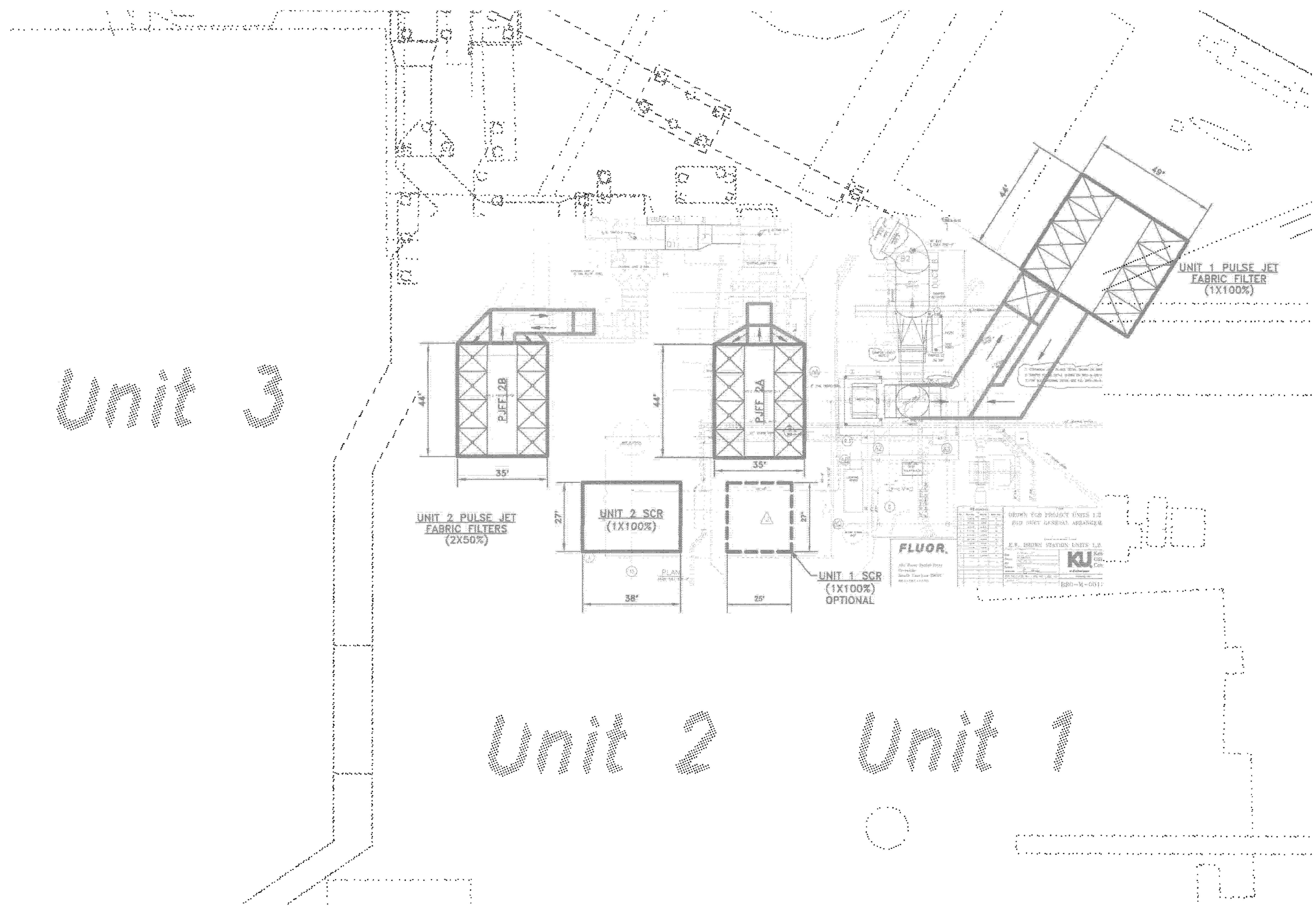
Green River Unit 3: Future
71 MW



Green River Unit 4: Future
109 MW

Appendix G
Air Quality Control Equipment Arrangement Drawings

E.W. Brown



E.W. Brown Units 1 & 2
Constructability Challenges

SCR Constructability Challenges

- Real estate constraints for Unit 1 & Unit 2 SCR
- The new SCR duct tie-ins to the existing Unit 1 Air Heater inlet duct will require extensive relocation of existing plant components:
  1. Rotate Secondary Air Heater Duct
  2. Modify boiler building structural steel bracing and girts to accommodate ductwork
  3. Relocate 440V Switchgear 1A and 1B
- The new SCR duct tie-ins to the existing Unit 2 Air Heater inlet duct will require boiler building structural steel bracing and girts to be modified to accommodate ductwork
- The new Unit 2 SCR support structure and reactor box will require extensive relocation/demolition of existing plant components:
  1. Relocate or protect field fabricated tank located in base of abandoned Unit 2 chimney shell
  2. Demolish Unit 2 chimney
  3. Demolish the dust collection ductwork located along the northeast exterior wall of Unit 2 boiler building
  4. Relocate Unit 2 Auxiliary Transformer located outside of the northeast exterior wall of Unit 2 boiler building
- The existing coal conveyor and ductwork block crane access to the northeast side of Unit 2 boiler house. This will require Unit 2 SCR structure to be constructed using a large tonnage crane with extended reach capabilities, or by extending the structural support frame system to the east and using a pick and slide execution method to erect the SCR and fabric filter modules

PJFF Constructability Challenges

- Real estate constraints for Unit 2 PJFF
- Elevated PJFF for Unit 2
- Extensive underground investigation will be required to identify operating utilities prior to installing new foundations for Unit 2 fabric filter structural steel support frame.
- The existing coal conveyor and ductwork block crane access to the northeast side of Unit 2 boiler house. This will require Unit Fabric Filter structure to be constructed using a large tonnage crane with extended reach capabilities, or by extending the structural support frame system to the east and using a pick and slide execution method to erect the SCR and fabric filter modules
- Heavy foundations required on the outer ends of Unit 2 ESP's for construction of Unit 2 PJFF.
- Difficult to stage construction equipment for ductwork support frame & associated foundations near ID fans of Unit 1 & Unit 2

LEGEND:
NEW EQUIPMENT=
NEW DUCTWORK=

NOT TO BE USED
FOR CONSTRUCTION
THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
0	16/JUN/10	INITIAL ISSUE	MLW				

200' 100' 0 200' 400'
1"=200'

BLACK & VEATCH CORPORATION
ENGINEER | DRAWN MLW
CHECKED | DATE

E.ON.
E W BROWN UNITS 1 & 2 SCR
FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT DRAWING NUMBER: 167987-CAQC-M1006
REV: 0
CODE
AREA

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E.W. Brown Unit 3

Constructability Challenges

- Relocate ductwork and associated support steel for tie-in.
- Relocate underground utilities

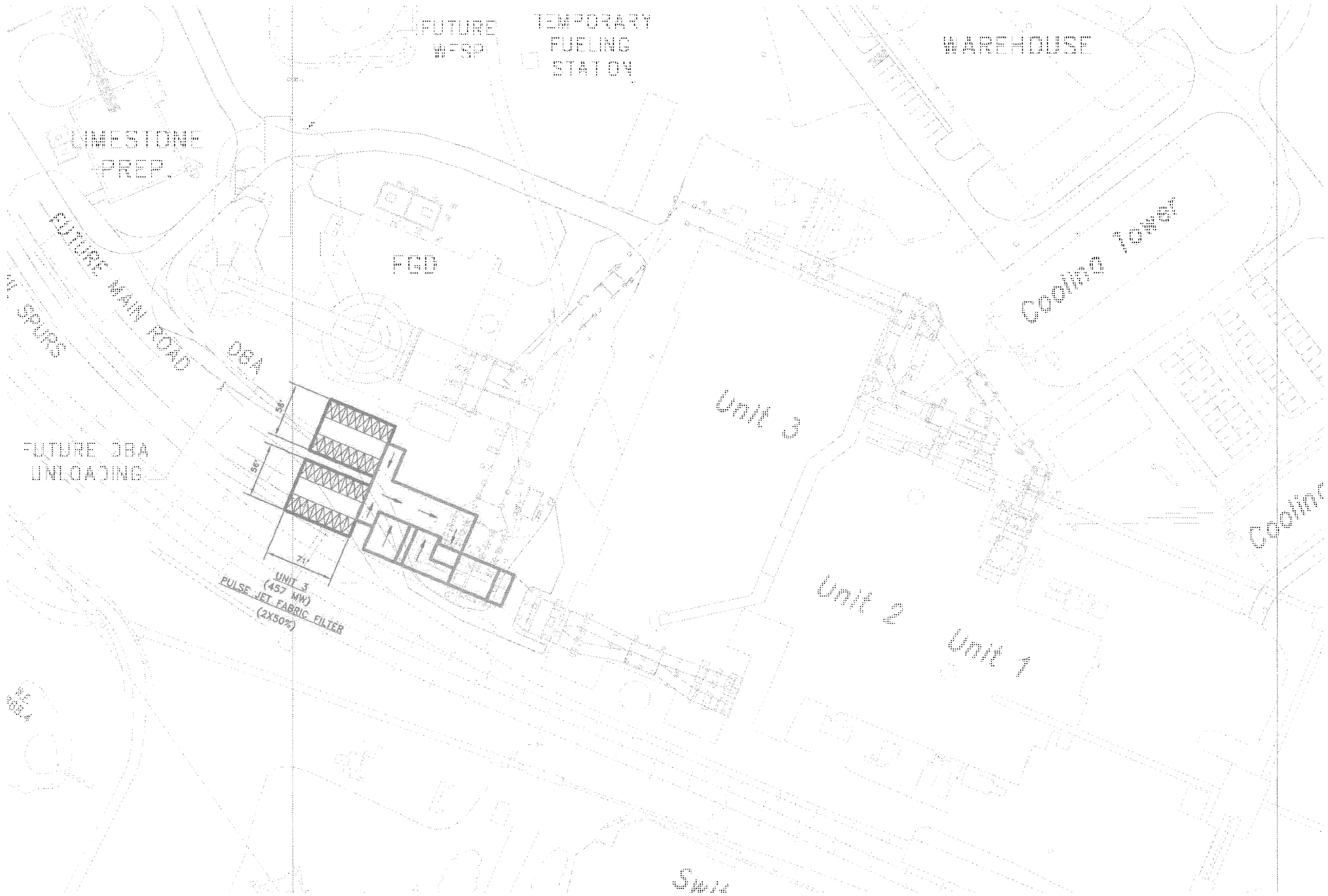
AQC Technology and Equipment

- Pulse Jet Fabric Filter

LEGEND:

NEW EQUIPMENT=

NEW DUCTWORK=



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500' 250' 0 500' 1000'

1"=500'

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ENGINEER | DRAWN MLW | CHECKED | DATE

E.ON.
E W BROWN UNITS 1, 2 & 3

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT / DRAWING NUMBER: 167987-CAQC-M1005 | REV 0

CODE | AREA

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Ghent

Ghent Unit 1

Constructability Challenges

- Real estate constraints
- Elevated New Pulse Jet Fabric Filter
- Crane access is difficult at Unit 1 due to low overhead pipe rack on the roadways around the cooling towers. Some piping bridges on the northeast side of the cooling tower and access roads to Unit 1 will need to be temporarily taken down or permanently relocated. Lattice boom crawler crane booms will need to be final assembled at the working location.
- Access lanes around Unit 1 are also the maintenance lanes for the cooling towers. Cranes and construction equipment will block access on these roads at various periods during project execution. Careful crane placement will be required in order to provide operations access to the cooling tower area.

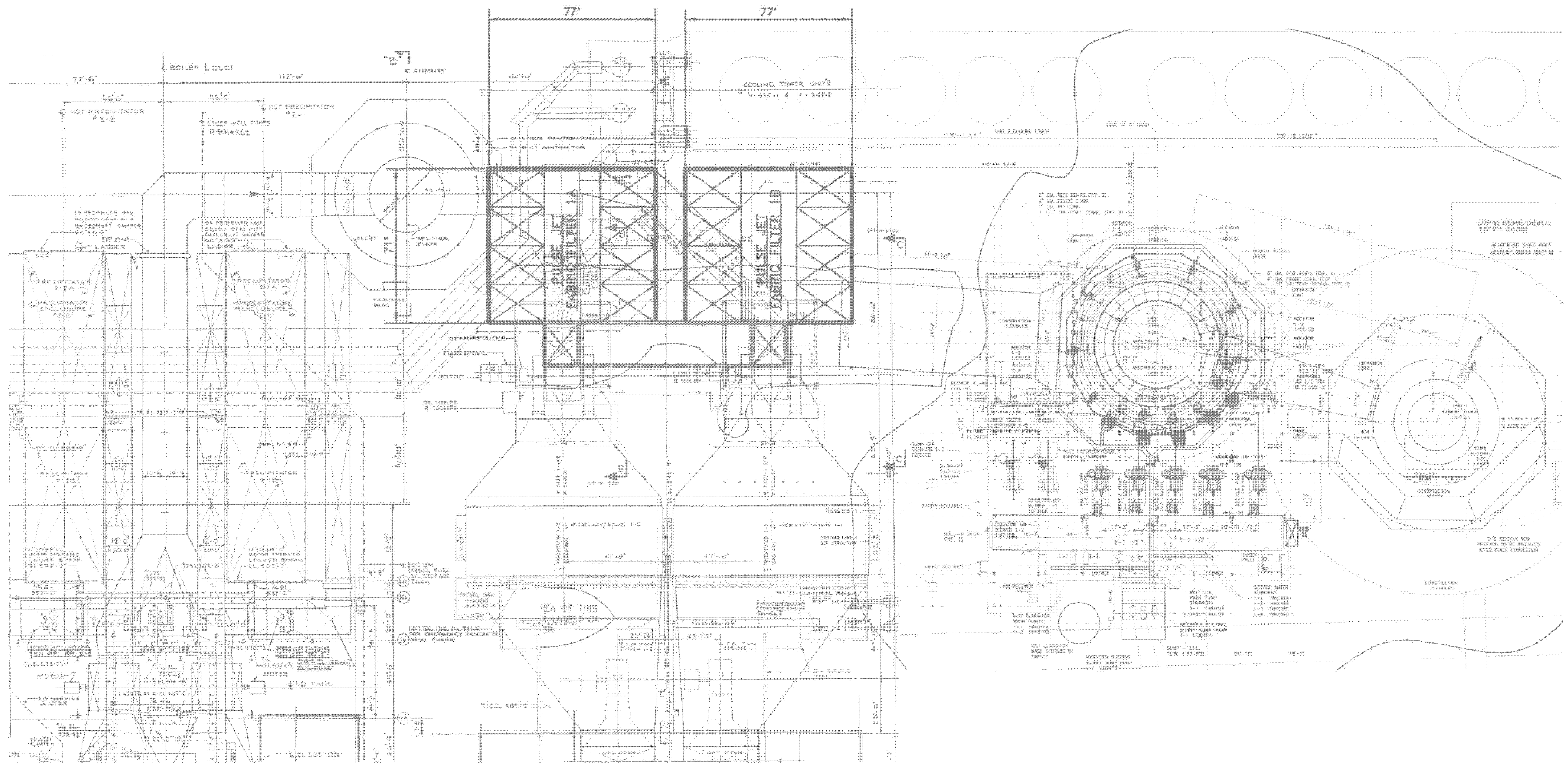
AQC Technology and Equipment

- Pulse Jet Fabric Filter

LEGEND:

NEW EQUIPMENT=

NEW DUCTWORK=



PULSE JET FABRIC FILTERS
(2X50%)

NOT TO BE USED
FOR CONSTRUCTION

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300' 150' 0 300' 600'
1"=300'

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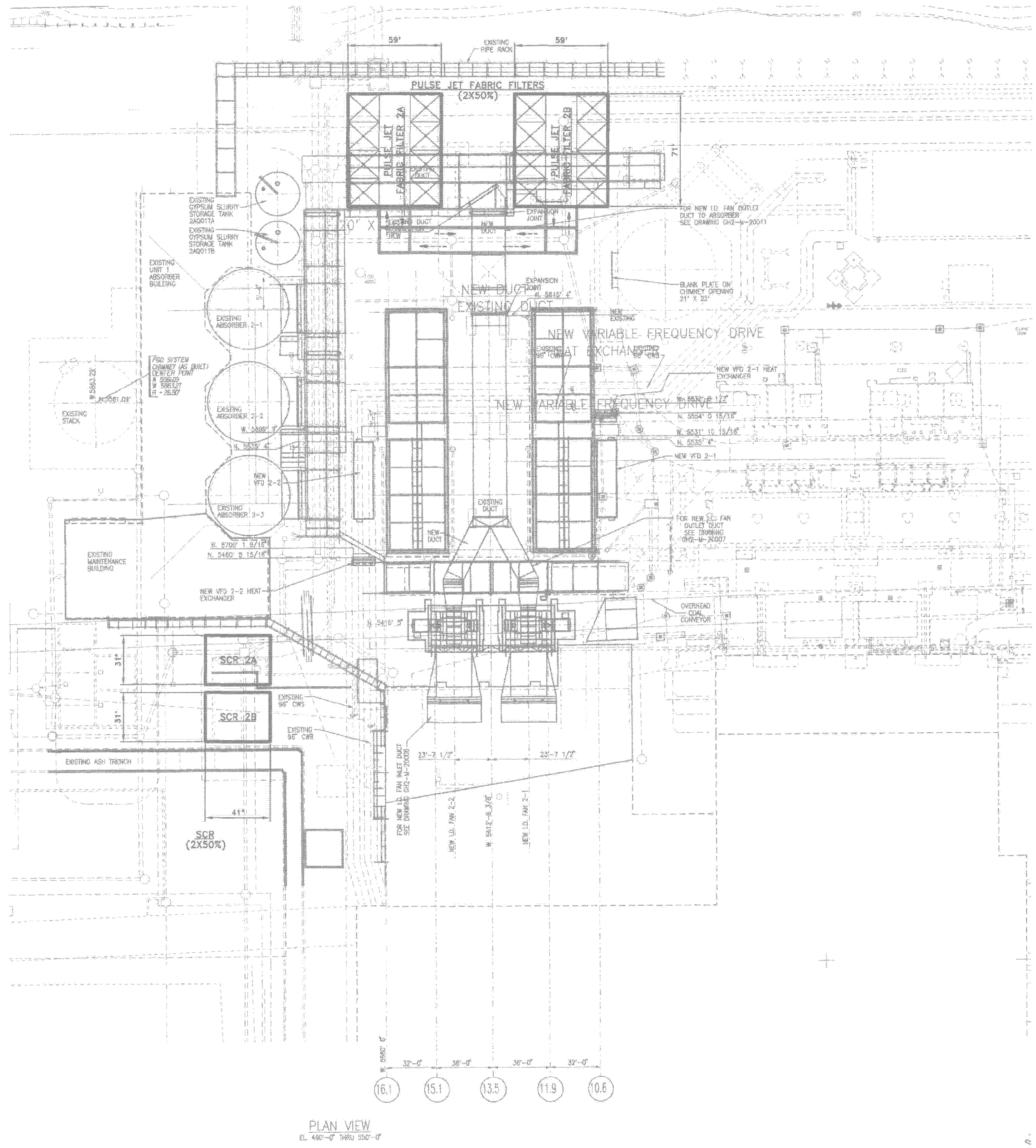
E.ON.
GHENT – UNIT 1

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT DRAWING NUMBER: 167987–CAQC–M1001 | REV: 0

CODE | AREA



PLAN VIEW
EL. 480'-0" THRU 550'-0"

<u>Ghent Unit 2 Pulse Jet Fabric Filter</u>

Constructability Challenges

- Real estate constraints
- Elevated Pulse Jet Fabric Filter
- Crane access is difficult at Unit 2 due to low overhead pipe rack on the roadways around the cooling towers. Some piping bridges on the northeast side of the cooling tower and access roads to Unit 1 will need to be temporarily taken down or relocated. Lattice boom crawler crane booms will need to be final assembled at the working location.
- Access lanes around Unit 2 are also the maintenance lanes for the cooling towers. Cranes and construction equipment will block access on these roads at various periods during project execution. Careful crane placement will be required in order to provide operations access to the cooling tower area.
- Current arrangement for Unit 2 fabric filters require a section of by-pass ductwork to be installed in order to isolate/demolish existing ductwork/duct supports and provide the required footprint for the new equipment. Tie in portions of this work scope must be accomplished during early plant outages.

<u>Ghent Unit 2 SCR</u>

Constructability Challenges

- Erection of Unit 2 SCR will require construction material and equipment to be lifted over areas of high personnel traffic.
- Demolition of overhead walkway.
- Possible use of tower crane for final assembly of SCR
- Demolition & Relocation of pipe rack.

AQC Technology and Equipment

- Selective Catalyst Reduction
- Pulse Jet Fabric Filter

LEGEND:
NEW EQUIPMENT=
NEW DUCTWORK=

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1"=300'

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DRAWN MLW
CHECKED
DATE

E.ON.
GHENT – UNIT 2
FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT / DRAWING NUMBER: 167987-CAQC-M1002
REV: 0
CODE
AREA

Ghent Units 3&4

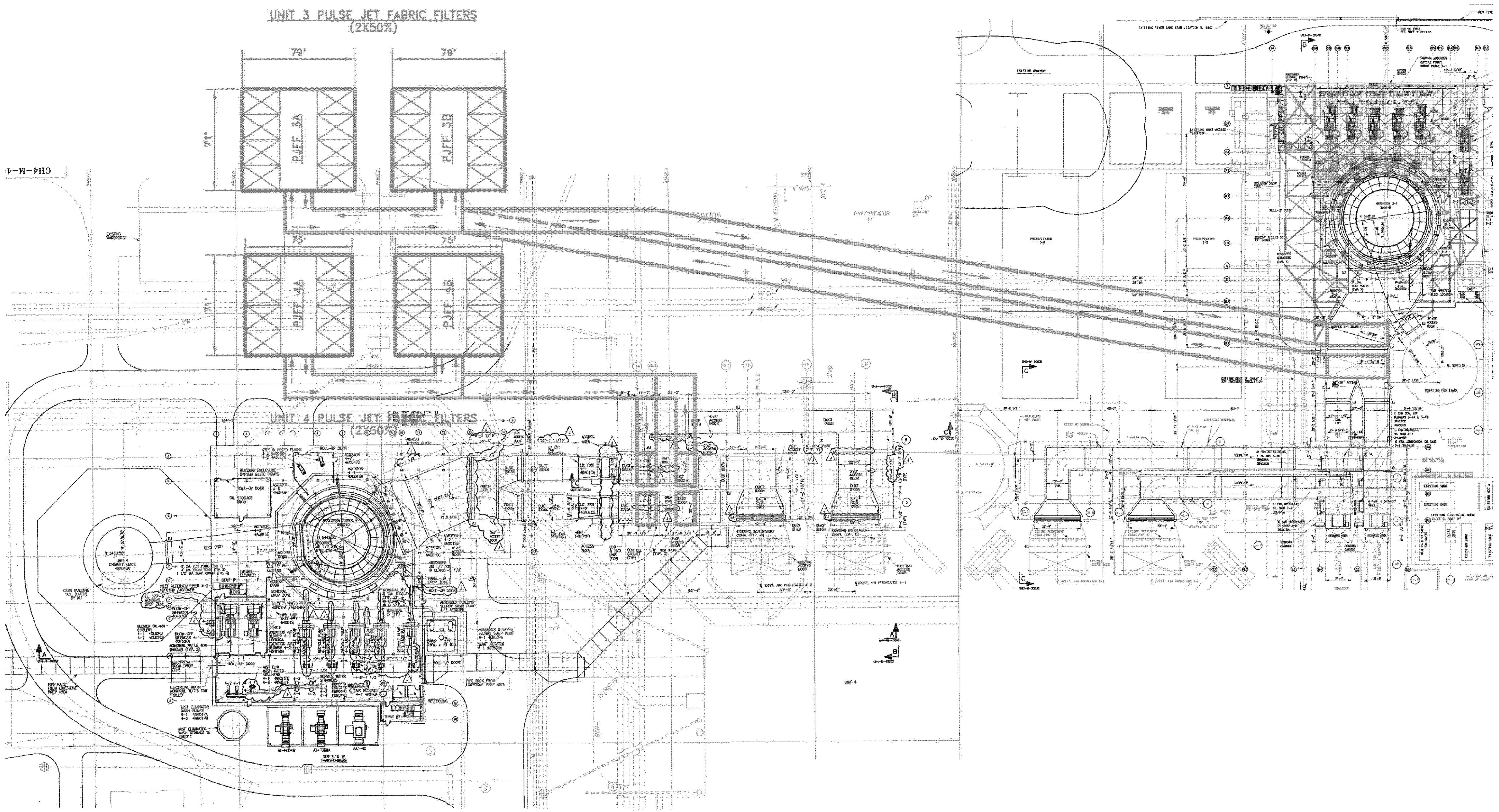
Constructability Challenges

- Current arrangement for Unit 3 fabric filters requires an extensive length of inlet/outlet ductwork to be routed above and across the existing Unit 3 & 4 ESP's. Access around the footprint of the ESP's is restricted, and it will be difficult to stage the construction equipment necessary to erect the ductwork support frame and associated foundations.
- Crane access will be restricted around the tie in for Unit 3 fabric filter inlet/outlet ductwork.
- Existing underground electrical manholes, water wells, storm sewer boxes and piping, and circulating cooling water piping all run in the proposed footprint for Unit 4 fabric filter. The electrical manholes, water wells, and storm sewer piping will need to be relocated in order to install the foundations for the Unit 4 fabric filter structural frame.

AQC Technology and Equipment

- Pulse Jet Fabric Filter

LEGEND:
NEW EQUIPMENT=
NEW DUCTWORK=



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NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
0	16/JUN/10	INITIAL ISSUE	MLW				

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1"=400'

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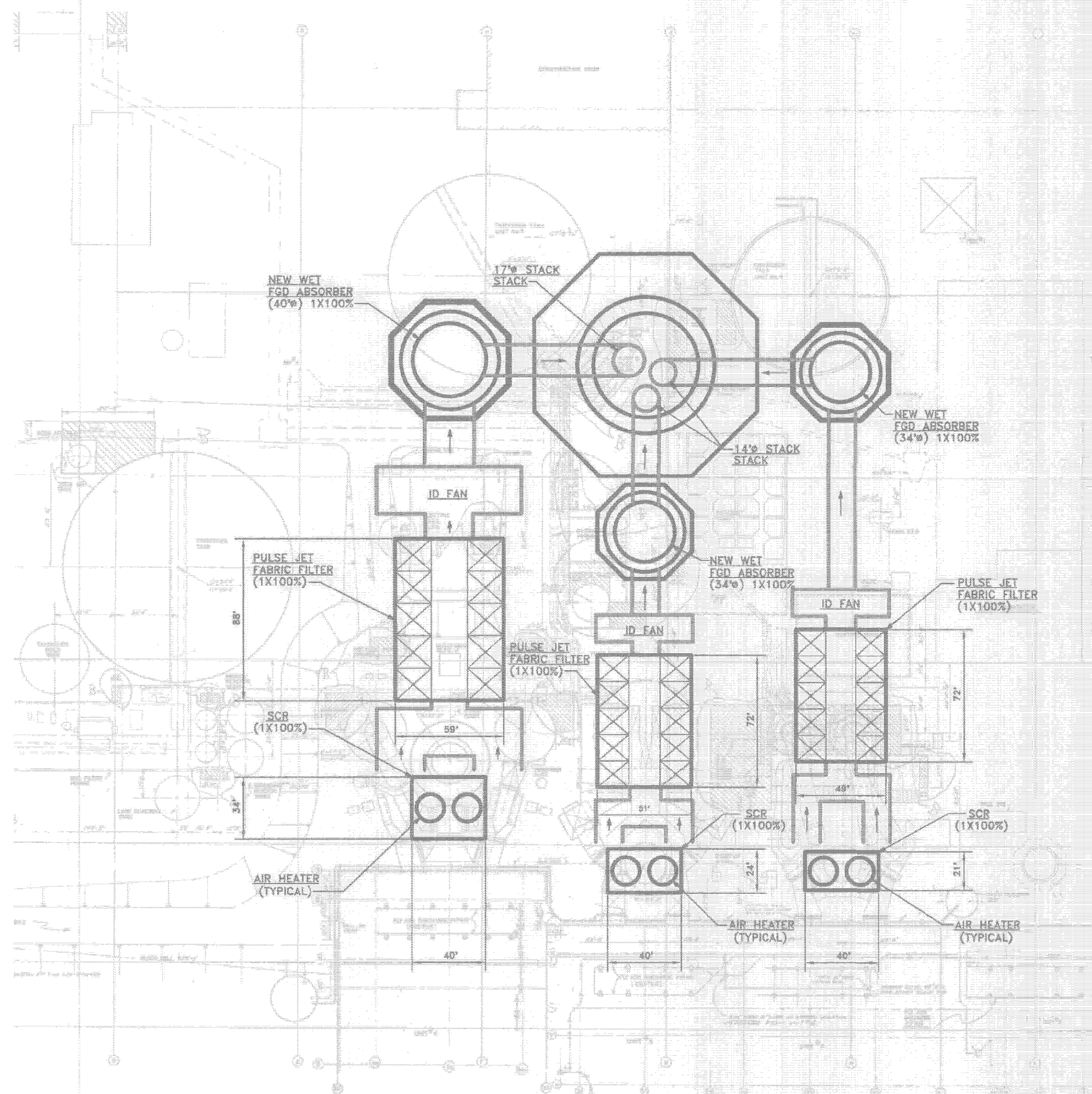
DATE

E.ON.
GHENT – UNITS 3 & 4
FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT / DRAWING NUMBER: 167987–CAQC–M1003
REV: 0
CODE
AREA

Cane Run



Cane Run Units 4, 5 & 6

Constructability Challenges

- Ingress from highways - Multiple power lines need to be raised to accommodate high loads.
- Barge unloading is not economically feasible.
- Existing overhead power lines are routed over ach unit and must be relocated for crane access.
- 4kv building and CT switchyard needs to be relocated.
- Entire unit #5 "back-end" must be dismantled prior to starting any work on unit #4.
- There is a need for multiple mob/demob/outages for tie-ins and access to build new AQCS equipment.
- Underground utility interferences/relocations.
- Above ground utility interferences/relocations.
- Need for areas to build ammonia storage, ASH handling systems, limestone handling, Reagant Prep, Dewatering (Ancillary Systems)
- Extended outages (entire plant) needed to accommodate construction of new AQCS Systems.
- Demolition must be performed in multiple phases followed by extensive earthwork activities to bring existing site up to proper elevation.
- Soils must be tested and stabilized for heavy lift crane operations.
- Space is very limited around units; the most efficient use of modularization will be compromised.

AQC Technology and Equipment

- Selective Catalytic Reduction
- Pulse Jet Fabric Filter
- Wet Flue Gas Desulfurization
- Stack
- Air heater

LEGEND:

NEW EQUIPMENT=

NEW DUCTWORK=

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
0	16/JUN/10	INITIAL ISSUE	MLW				

300' 150' 0 300' 600'

1"=300'

BLACK & VEATCH CORPORATION

ENGINEER | DRAWN MLW | CHECKED | DATE

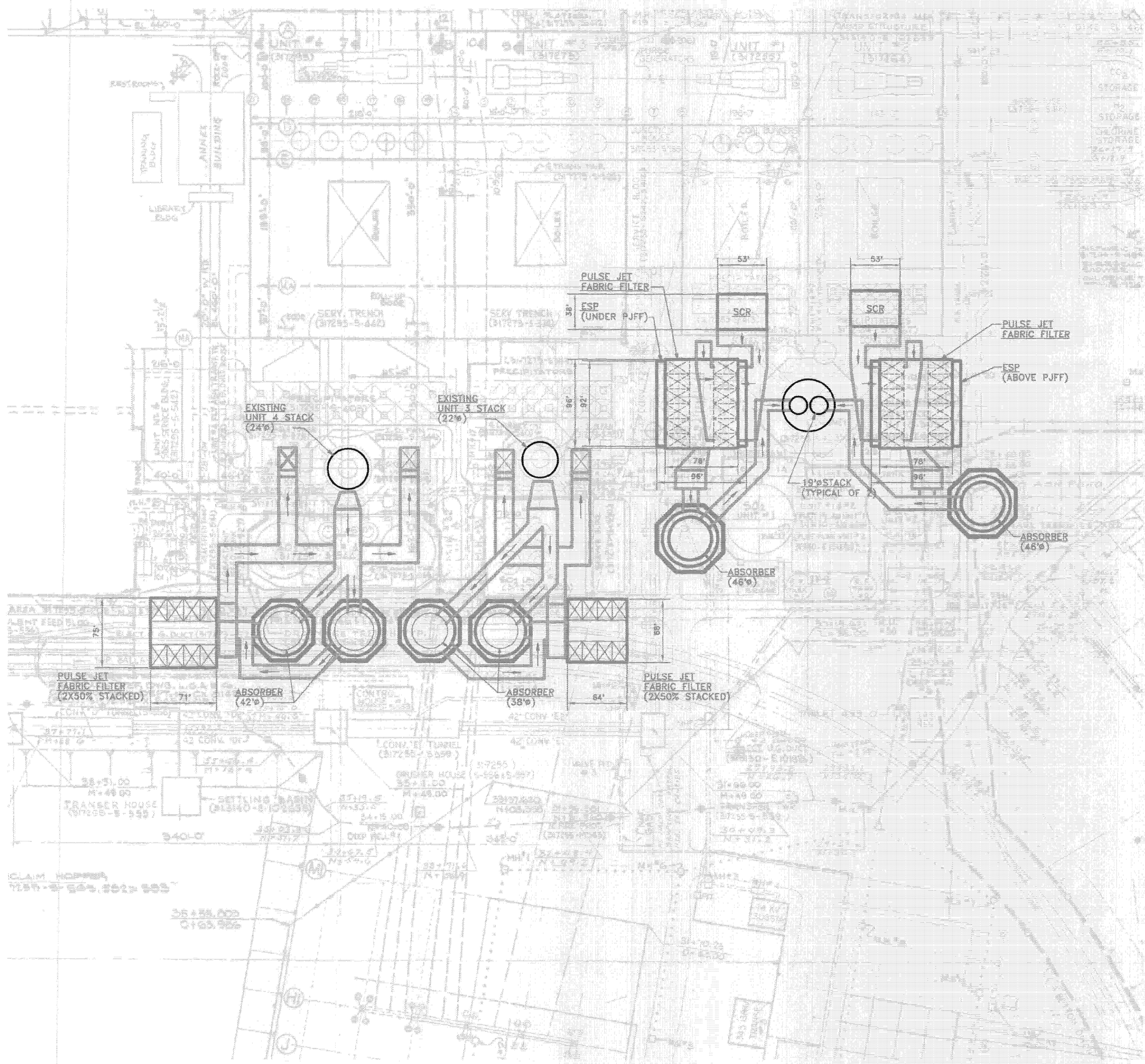
E.ON.
CANE RUN UNITS 4, 5 & 6

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT / DRAWING NUMBER: 167987-CAQC-M1004 | REV 0

CODE | AREA

Mill Creek



<u>Mill Creek Units 1, 2, 3 & 4</u>

Constructability Challenges

- Real estate constraints for all the units.
- Unit 1 & Unit 2 ESP elevated.
- Unit 3 & Unit 4 PJFF (2x50%) stacked one above another.
- Barge unloading is not economically feasible.
- Overhead power lines and @ least 2 transmission towers must be moved.
- Numerous underground utility interferences/relocations
- Numerous above ground utility interferences/relocations
- Very limited access around units due to existing AQCS Systems.
- Multiple mob/demob (very selective) dismantling operations are needed to insure tie-in work is accomplished efficiently.
- Building between units 1 & 3 from unit #1 work will present logistical problems for both plant work and construction. Access/height restrictions will dictate the magnitude of modularization that can be utilized.
- Warehouse and loading dock on unit #2 side must be relocated.
- High complexity of ancillary systems routing to avoid interference with existing AQCS systems.
- Ground stability will need to be verified, modified to accommodate heavy lift cranes.
- Multiple plant outages will be needed for tie-ins because we are utilizing existing scrubbers, etc…through out project.
- Ductwork routing is more extensive due to the lay out of the existing plant and existing AQCS systems in use. Space will be a premium for excavations/foundations/duct steel erection.
- Large existing concrete foundations will need to be removed to accommodate equipment.
- Outage windows are very short and limited.
- Site constraints due to existing rail road tracks.

AQC Technology and Equipment Units 1 & 2

- Selective Catalyst Reduction.
- Electrostatic Precipitator and Pulse Jet Fabric Filter
- Wet Flue Gas Desulfurization

AQC Technology and Equipment Units 3 & 4

- Pulse Jet Fabric Filter
- Wet Flue Gas Desulfurization

LEGEND:

NEW EQUIPMENT=

NEW DUCTWORK=

EXISTING EQUIPMENT=

NOT TO BE USED
FOR CONSTRUCTION

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NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
0	16/JUN/10	INITIAL ISSUE	MLW				

500' 250' 0 500' 1000'
1"=500'

BLACK & VEATCH CORPORATION

ENGINEER | DRAWN MLW | CHECKED | DATE

E.ON.
MILL CREEK UNITS 1, 2, 3 & 4

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT | DRAWING NUMBER: 167987-CAQC-M1008 | REV: 0

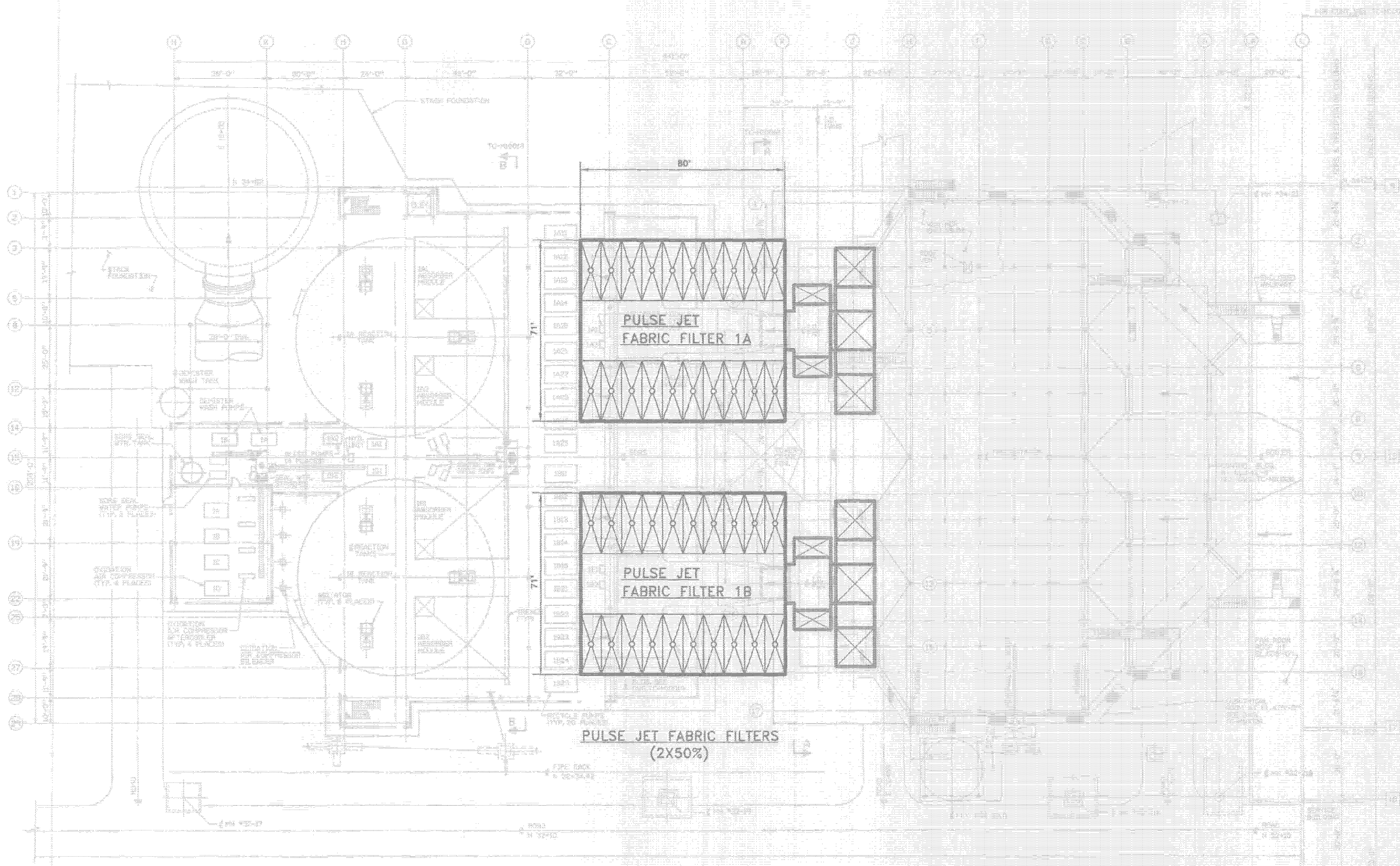
CODE | AREA

Trimble County

<u>Trimble County Unit 1</u>
Constructability Challenges
- Real estate constraints
- Elevated Pulse Jet Fabric Filter
- Extensive underground investigation will be required to identify operating utilities prior to installing new foundations
- An existing abandoned tower crane foundation and multiple runs of electrical duct bank cover a large percentage of the area within the footprint proposed to install foundations for the Unit 1 fabric filter support frame.

AQC Technology and Equipment
- Pulse Jet Fabric Filter

LEGEND:
NEW EQUIPMENT–
NEW DUCTWORK–



NOT TO BE USED FOR CONSTRUCTION

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NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
0	16/JUN/10	INITIAL ISSUE	MLW				

200' 100' 0 200' 400'
1"=200'

BLACK & VEATCH CORPORATION
ENGINEER | DRAWN MLW | CHECKED | DATE

E.ON.
TRIMBLE COUNTY UNIT 1
FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT / DRAWING NUMBER: 167987-CAQC-M1009 REV 0
CODE
AREA

Green River

<u>Green River Units 3 & 4</u>

Constructability Challenges

- Overhead power lines and one tower needs to be relocated.
- Underground utility interferences/relocations
- Above ground utility interferences/relocations

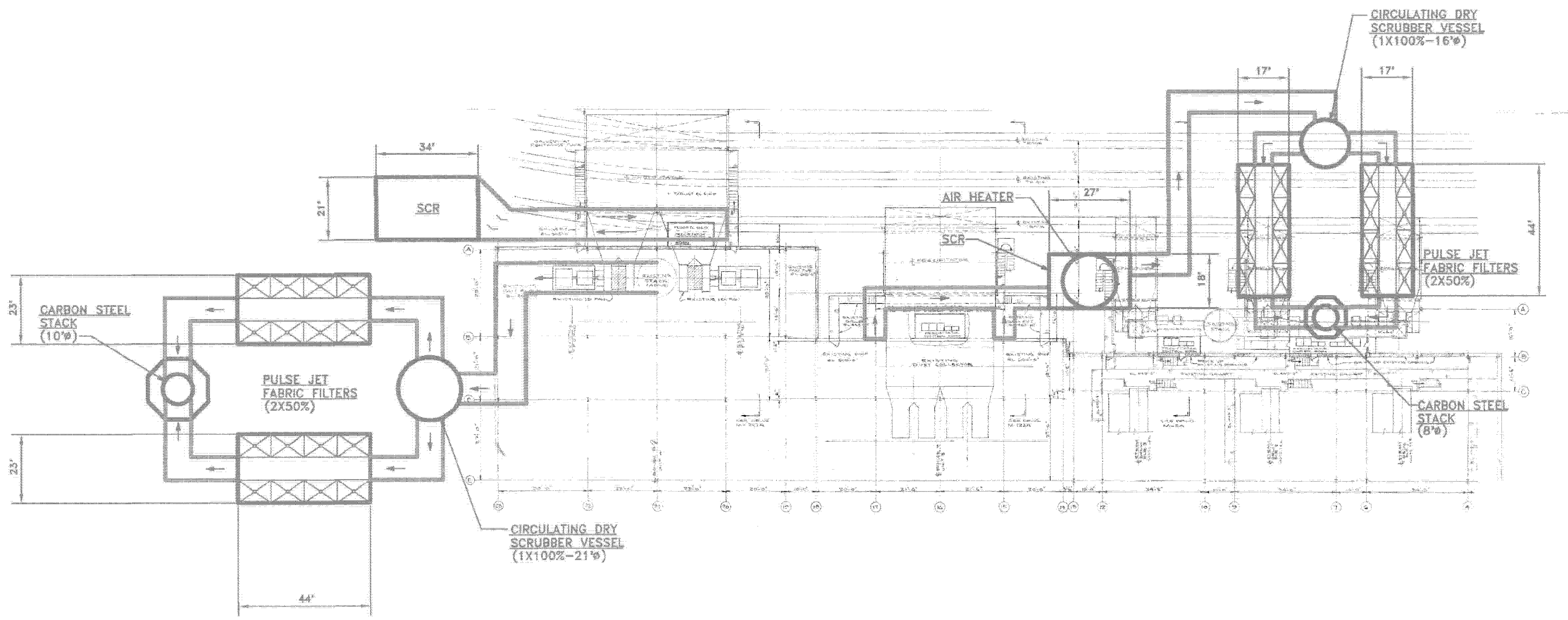
AQC Technology and Equipment

- Selective Catalyst Reduction
- Circulating Dry Scrubber
- Pulse Jet Fabric Filter
- Stack
- Air Heater

LEGEND:

NEW EQUIPMENT=

NEW DUCTWORK=



NOT TO BE USED FOR CONSTRUCTION

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NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
0	15/JUN/10	INITIAL ISSUE	MLW				

200' 100' 0 200' 400'

1"=200'

BLACK & VEATCH CORPORATION

ENGINEER	DRAWN MLW
CHECKED	DATE

E.ON.
GREEN RIVER UNITS 3 & 4

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT	DRAWING NUMBER	REV
	167987-CAQC-M1007	0
CODE		
AREA		

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Appendix H
Air Quality Control Technology Costs

E.W. Brown

Plant Name:	Brown
Unit:	1
MW	110
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$40,000,000	$364	$1,477,000	$6,345,000
PAC Injection	$1,599,000	$15	$614,000	$809,000
Overfire Air	$767,000	$7	$132,000	$225,000
Low NOx Burners	$1,156,000	$11	$0	$141,000
Neural Networks	$500,000	$5	$50,000	$111,000
Total	$44,022,000	$400	$2,273,000	$7,631,000

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BROWN UNIT 1 - PJFF COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$1,969,000			
Mechanical - Balance of Plant (BOP)	$5,641,000			
Electrical - Equipment, Raceway, Switchgears, MCC	$119,000			
Control - DCS Instrumentation	$133,000			
ID Fans	$1,166,000	Engineering Estimates		
Subtotal Purchase Contract	**$9,028,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$1,752,000			
Civil/Structural Construction - Sub-Structures	$666,000			
Mechanical/Chemical Construction	$6,664,000			
Electrical/Control Construction	$2,250,000			
Service Contracts & Construction Indirects	$109,000			
Demolition Costs	$5,000,000	Engineering Estimates		
Subtotal Construction Contracts	**$16,441,000**			
Construction Difficulty Costs	**$11,508,700**	Engineering Estimates		
Total Direct Costs	**$36,977,700**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$1,426,000			
EPC Construction Management (Includes G&A & Fee)	$933,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$141,000			
Sales Taxes	$50,000			
Project Contingency - 18%	$526,000			
Total Indirect Costs	**$3,076,000**			
Total Contracted Costs	$40,000,000			
Cost Effectiveness	*$364 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	44%	
Maintenance labor and materials	$1,200,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$1,200,000**			
Variable Annual Costs				
Byproduct disposal	$6,000	210 lb/hr and	15	$/ton
Bag replacement cost	$91,000	2,740 bags and	100	$/bag
Cage replacement cost	$46,000	2,740 cages and	50	$/cage
ID fan power	$117,000	710 kW and	0.04266	$/kWh
Auxiliary power	$17,000	105 kW and	0.04266	$/kWh
Subtotal Variable Annual Costs	$277,000			
Total Annual Costs	$1,477,000			
Levelized Capital Costs	**$4,868,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$6,345,000			

EW Brown Unit 1
110 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$92,670	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$60,897	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$84,726	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$10,591	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$39,716	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$254,179	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$13,239	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$556,018					
Freight	$14,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$570,000					
Direct installation costs						
Foundation & supports	$57,000	(PEC) X	10.0%			
Handling & erection	$114,000	(PEC) X	20.0%			
Electrical	$57,000	(PEC) X	10.0%			
Piping	$29,000	(PEC) X	5.0%			
Insulation	$11,000	(PEC) X	2.0%			
Painting	$29,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$297,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$942,000					
Indirect Costs						
Engineering	$113,000	(DC) X	12.0%			
Owner's cost	$113,000	(DC) X	12.0%			
Construction management	$94,000	(DC) X	10.0%			
Start-up and spare parts	$14,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$188,000	(DC) X	20.0%			
Total indirect costs (IC)	$622,000					
Allowance for Funds Used During Construction (AFDC)	$35,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$1,599,000**					
Cost Effectiveness	***$15 /kW***					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$28,000	(DC) X	3.0%			
Operating labor	$123,000		1 FTE and	123,325 $/year		Estimated manpower
Total fixed annual costs	$151,000					
Variable annual costs				44 %		capacity factor
Reagent (BPAC)	$445,000		105 lb/hr and	2200 $/ton		
Byproduct disposal cost	$3,000		105 lb/hr and	15 $/ton		
Auxiliary power	$15,000		90 kW and	0.04266 $/kWh		
Total variable annual costs	$463,000					
Total direct annual costs (DAC)	$614,000					
Indirect Annual Costs						
Cost for capital recovery	$195,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$195,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$809,000**					

EW Brown Unit 1
110 MW
High Level Emissions Control Study

Technology: Overfire Air System Operation **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Neuco NOx optimization package	$13,000	B&V cost estimate			
NOx monitoring equipment	$40,000	B&V cost estimate			
Water cannon system	$317,000	B&V cost estimate			
Subtotal capital cost (CC)	$370,000				
Freight	$19,000	(CC) X	5.0%		
Total purchased equipment cost (PEC)	$389,000				
Direct installation costs					
Foundation & supports	$0	(PEC) X	0.0%		
Handling & erection	$78,000	(PEC) X	20.0%		
Electrical	$58,000	(PEC) X	15.0%		
Piping	$8,000	(PEC) X	2.0%		
Insulation	$0	(PEC) X	0.0%		
Painting	$0	(PEC) X	0.0%		
Demolition	$10,000	(PEC) X	2.5%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$154,000				
Site preparation	$0	N/A			
Buildings	$0	N/A			
Total direct costs (DC) = (PEC) + (DIC)	$543,000				
Indirect Costs					
Engineering	$54,000	(DC) X	10.0%		
Owner's cost	$11,000	(DC) X	2.0%		
Construction management	$27,000	(DC) X	5.0%		
Start-up and spare parts	$11,000	(DC) X	2.0%		
Performance test	$50,000	Engineering estimate			
Contingencies	$54,000	(DC) X	10.0%		
Total indirect costs (IC)	$207,000				
Allowance for Funds Used During Construction (AFDC)	$17,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$767,000				
Cost Effectiveness	*$7 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance materials	$10,000	B&V cost estimate			
Maintenance labor	$14,000	B&V cost estimate, 6 man weeks/yr			
Total fixed annual costs	$24,000				
Variable annual costs					
Replacement power due to efficiency hit	$108,000	Engineering estimates, 0.2% efficiency drop, and 0.05 $/kWh			
Total variable annual costs	$108,000				
Total direct annual costs (DAC)	$132,000				
Indirect Annual Costs					
Cost for capital recovery	$93,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$93,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$225,000				

EW Brown Unit 1
110 MW
High Level Emissions Control Study

Technology: Upgraded Low NOx Burners **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
New coal elbow, nozzle with air vane, fuel injector barrel, air zone swirler and coal piping	$602,000				
Subtotal capital cost (CC)	$602,000				
Freight	$30,000	(CC) X	5.0%		
Total purchased equipment cost (PEC)	$632,000				
Direct installation costs					
Foundation & supports	$0	(PEC) X	0.0%		
Handling & erection	$126,000	(PEC) X	20.0%		
Electrical	$63,000	(PEC) X	10.0%		
Piping	$0	(PEC) X	0.0%		
Insulation	$0	(PEC) X	0.0%		
Painting	$0	(PEC) X	0.0%		
Demolition	$16,000	(PEC) X	2.5%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$205,000				
Site preparation	$0	N/A			
Buildings	$0	N/A			
Total direct costs (DC) = (PEC) + (DIC)	$837,000				
Indirect Costs					
Engineering	$84,000	(DC) X	10.0%		
Owner's cost	$17,000	(DC) X	2.0%		
Construction management	$42,000	(DC) X	5.0%		
Start-up and spare parts	$17,000	(DC) X	2.0%		
Performance test	$50,000	Engineering estimate			
Contingencies	$84,000	(DC) X	10.0%		
Total indirect costs (IC)	$294,000				
Allowance for Funds Used During Construction (AFDC)	$25,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$1,156,000				
Cost Effectiveness	*$11 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
N/A	$0	Similar annual costs as current LNB			
Total fixed annual costs	$0				
Variable annual costs					
N/A	$0	Similar annual costs as current LNB			
Total variable annual costs	$0				
Total direct annual costs (DAC)	$0				
Indirect Annual Costs					
Cost for capital recovery	$141,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$141,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$141,000				

Plant Name:	Brown
Unit:	2
MW	180
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$92,000,000	$511	$3,278,000	$14,474,000
Fabric Filter	$51,000,000	$283	$1,959,000	$8,166,000
Lime Injection	$2,739,000	$15	$1,155,000	$1,488,000
PAC Injection	$2,476,000	$14	$1,090,000	$1,391,000
Neural Networks	$500,000	$3	$50,000	$111,000
Total	$148,715,000	$826	$7,532,000	$25,630,000

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BROWN UNIT 2 - SCR COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$4,636,000			
Ductwork and Breeching	$3,580,000			
Mechanical - Balance of Plant (BOP)	$1,173,000			
Electrical - Equipment, Raceway	$1,339,000			
VFDs, Motors and Couplings	$500,000	Engineering Estimates		
Switchgear and MCCs	$468,000			
Control - DCS Instrumentation	$151,000			
Air Heater Modifications	$0	Engineering Estimates		
ID Fans	$1,158,000	Engineering Estimates		
Catalyst	$1,883,000			
Selective Catalytic Reduction System (Including Ammonia System)	$1,643,000			
Subtotal Purchase Contract	**$16,531,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$2,854,000			
Civil/Structural Construction - Sub-Structures	$742,000			
Mechanical/Chemical Construction	$8,971,000			
Electrical/Control Construction	$4,103,000			
Service Contracts & Construction Indirects	$14,331,000			
Demolition Costs	$6,500,000	Engineering Estimates		
Subtotal Construction Contracts	**$37,501,000**			
Construction Difficulty Costs	**$26,250,700**	Engineering Estimates		
Total Direct Costs	**$80,282,700**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$2,696,000			
EPC Construction Management (Includes G&A & Fee)	$1,691,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$444,000			
Sales Taxes	$627,000			
Project Contingency	$6,326,000			
Total Indirect Costs	**$11,784,000**			
Total Contracted Costs	**$92,000,000**			
Capital Cost Effectiveness	***$511***	***/kW***		

ANNUAL COST

		Capacity Factor =	62%	
Fixed Annual Costs				
Operating labor	$123,000	1 FTE and	123,325	$/year
Maintenance labor & materials	$2,408,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$2,581,000**			
Variable Annual Costs				
Reagent	$309,000	215 lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$186,000	940 kW and	0.03646	$/kWh
Catalyst replacement	$202,000	50 m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$697,000**			
Total Annual Costs	**$3,278,000**			
Levelized Capital Costs	**$11,196,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	**$14,474,000**			

BROWN UNIT 2 - PJFF COSTS

CAPITAL COST

Purchase Contracts					
Civil/Structural	$2,646,000				
Mechanical - Balance of Plant (BOP)	$7,580,000				
Electrical - Equipment, Raceway, Switchgears, MCC	$161,000				
Control - DCS Instrumentation	$178,000				
ID Fans	$535,000	Engineering Estimates			
Subtotal Purchase Contract	**$11,100,000**				
Construction Contracts					
Civil/Structural Construction - Super Structures	$2,355,000				
Civil/Structural Construction - Sub-Structures	$895,000				
Mechanical/Chemical Construction	$8,956,000				
Electrical/Control Construction	$3,024,000				
Service Contracts & Construction Indirects	$146,000				
Demolition Costs	$5,000,000	Engineering Estimates			
Subtotal Construction Contracts	**$20,376,000**				
Construction Difficulty Costs	**$14,263,200**	Engineering Estimates			
Total Direct Costs	**$45,739,200**				
Indirect Costs					
Engineering Costs (Includes G&A & Fee)	$2,334,000				
EPC Construction Management (Includes G&A & Fee)	$1,527,000				
Startup Spare Parts (Included)	$0				
Construction Utilites (Power & Water) - Included	$0				
Project Insurance	$231,000				
Sales Taxes	$82,000				
Project Contingency - 18%	$860,000				
Total Indirect Costs	**$5,034,000**				
Total Contracted Costs	$51,000,000				
Cost Effectiveness	*$283 /kW*				

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	62%		
Maintenance labor and materials	$1,530,000	(DC) X 3.0%			
Subtotal Fixed Annual Costs	**$1,530,000**				
Variable Annual Costs					
Byproduct disposal	$5,000	120	lb/hr and	15	$/ton
Bag replacement cost	$129,000	3,880	bags and	100	$/bag
Cage replacement cost	$65,000	3,880	cages and	50	$/cage
ID fan power	$200,000	1,010	kW and	0.03646	$/kWh
Auxiliary power	$30,000	150	kW and	0.03646	$/kWh
Subtotal Variable Annual Costs	$429,000				
Total Annual Costs	$1,959,000				
Levelized Capital Costs	**$6,207,000**	(TCI) X 12.17%	CRF		
Levelized Annual Costs	$8,166,000				

Brown Unit 2
180 MW
High Level Emissions Control Study

Technology: Lime Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$133,800	From Previous Mill Creek BACT Study				
Short-term storage silo	$88,800	From Previous Mill Creek BACT Study				
Air blowers	$121,800	From Previous Mill Creek BACT Study				
Rotary feeders	$19,800	From Previous Mill Creek BACT Study				
Injection system	$80,400	From Previous Mill Creek BACT Study				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$526,800	From Previous Mill Creek BACT Study				
Instrumentation and controls	$25,200	From Previous Mill Creek BACT Study				
Subtotal capital cost (CC)	$996,600					
Freight	$45,000	(CC) X	4.5%			
Total purchased equipment cost (PEC)	$1,042,000					
Direct installation costs						
Foundation & supports	$104,000	(PEC) X	10.0%			
Handling & erection	$208,000	(PEC) X	20.0%			
Electrical	$104,000	(PEC) X	10.0%			
Piping	$52,000	(PEC) X	5.0%			
Insulation	$21,000	(PEC) X	2.0%			
Painting	$52,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$541,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$1,658,000					
Indirect Costs						
Engineering	$199,000	(DC) X	12.0%			
Owner's cost	$199,000	(DC) X	12.0%			
Construction management	$166,000	(DC) X	10.0%			
Start-up and spare parts	$25,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$332,000	(DC) X	20.0%			
Total indirect costs (IC)	$1,021,000					
Allowance for Funds Used During Construction (AFDC)	$60,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$2,739,000					
Cost Effectiveness	*$15 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$50,000	(DC) X	3.0%			
Operating labor	$123,000		1 FTE and	123,325	$/year	Estimated manpower
Total fixed annual costs	$173,000					
Variable annual costs				62	%	capacity factor
Lime	$754,000		2,100 lb/hr and	132.19	$/ton	
Byproduct disposal cost	$208,000		2,400 lb/hr and	15	$/ton	
Auxiliary power	$20,000		100 kW and	0.03646	$/kWh	
Total variable annual costs	$982,000					
Total direct annual costs (DAC)	$1,155,000					
Indirect Annual Costs						
Cost for capital recovery	$333,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$333,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,488,000					

Brown Unit 2
180 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis		
CAPITAL COST				
Direct Costs				
Purchased equipment costs				
Long-term storage silo (with truck unloading sys.)	$151,641	Ratio from Brown Unit 3 BACT Analysis		
Short-term storage silo	$99,650	Ratio from Brown Unit 3 BACT Analysis		
Air blowers	$138,643	Ratio from Brown Unit 3 BACT Analysis		
Rotary feeders	$17,330	Ratio from Brown Unit 3 BACT Analysis		
Injection system	$64,989	Ratio from Brown Unit 3 BACT Analysis		
Ductwork modifications, supports, platforms	$0			
Electrical system upgrades	$415,930	Ratio from Brown Unit 3 BACT Analysis		
Instrumentation and controls	$21,663	Ratio from Brown Unit 3 BACT Analysis		
Subtotal capital cost (CC)	$909,847			
Freight	$23,000	(CC) X	2.5%	
Total purchased equipment cost (PEC)	$933,000			
Direct installation costs				
Foundation & supports	$93,000	(PEC) X	10.0%	
Handling & erection	$187,000	(PEC) X	20.0%	
Electrical	$93,000	(PEC) X	10.0%	
Piping	$47,000	(PEC) X	5.0%	
Insulation	$19,000	(PEC) X	2.0%	
Painting	$47,000	(PEC) X	5.0%	
Demolition	$0	(PEC) X	0.0%	
Relocation	$0	(PEC) X	0.0%	
Total direct installation costs (DIC)	$486,000			
Site preparation	$0	N/A		
Buildings	$75,000	Engineering estimate		
Total direct costs (DC) = (PEC) + (DIC)	$1,494,000			
Indirect Costs				
Engineering	$179,000	(DC) X	12.0%	
Owner's cost	$179,000	(DC) X	12.0%	
Construction management	$149,000	(DC) X	10.0%	
Start-up and spare parts	$22,000	(DC) X	1.5%	
Performance test	$100,000	Engineering estimate		
Contingencies	$299,000	(DC) X	20.0%	
Total indirect costs (IC)	$928,000			
Allowance for Funds Used During Construction (AFDC)	$54,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$2,476,000			
Cost Effectiveness	*$14 /kW*			
ANNUAL COST				
Direct Annual Costs				
Fixed annual costs				
Maintenance labor and materials	$45,000	(DC) X	3.0%	
Operating labor	$123,000		1 FTE and 123,325 $/year	Estimated manpower
Total fixed annual costs	$168,000			
Variable annual costs			62 %	capacity factor
Reagent (BPAC)	$896,000		150 lb/hr and 2200 $/ton	
Byproduct disposal cost	$6,000		150 lb/hr and 15 $/ton	
Auxiliary power	$20,000		100 kW and 0.03646 $/kWh	
Total variable annual costs	$922,000			
Total direct annual costs (DAC)	$1,090,000			
Indirect Annual Costs				
Cost for capital recovery	$301,000	(TCI) X	12.17% CRF	
Total indirect annual costs (IDAC)	$301,000			
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,391,000			

E-ON Fleetwide Study Black & Veatch Cost Estimates 167987

Plant Name:	Brown
Unit:	3
MW	457
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$61,000,000	$133	$3,321,000	$10,745,000
PAC Injection	$5,426,000	$12	$2,330,000	$2,990,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$67,426,000	$148	$5,751,000	$13,957,000

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BROWN UNIT 3 - PJFF COSTS

CAPITAL COST

Purchase Contracts

Civil/Structural	$4,628,000	
Mechanical - Balance of Plant (BOP)	$13,257,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$281,000	
Control - DCS Instrumentation	$312,000	
ID Fans	$1,930,000	Engineering Estimates
Subtotal Purchase Contract	**$20,408,000**	

Construction Contracts

Civil/Structural Construction - Super Structures	$4,118,000	
Civil/Structural Construction - Sub-Structures	$1,565,000	
Mechanical/Chemical Construction	$15,663,000	
Electrical/Control Construction	$5,289,000	
Service Contracts & Construction Indirects	$255,000	
Demolition Costs	$500,000	Engineering Estimates
Subtotal Construction Contracts	**$27,390,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$47,798,000**	

Indirect Costs

Engineering Costs (Includes G&A & Fee)	$5,925,000
EPC Construction Management (Includes G&A & Fee)	$3,877,000
Startup Spare Parts (Included)	$0
Construction Utilites (Power & Water) - Included	$0
Project Insurance	$586,000
Sales Taxes	$209,000
Project Contingency - 18%	$2,183,000
Total Indirect Costs	**$12,780,000**
Total Contracted Costs	$61,000,000
Cost Effectiveness	*$133 /kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	57%	
Maintenance labor and materials	$1,830,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$1,830,000**			
Variable Annual Costs				
Byproduct disposal	$11,000	290 lb/hr and	15	$/ton
Bag replacement cost	$588,000	17,630 bags and	100	$/bag
Cage replacement cost	$294,000	17,630 cages and	50	$/cage
ID fan power	$460,000	2,540 kW and	0.03624	$/kWh
Auxiliary power	$138,000	760 kW and	0.03624	$/kWh
Subtotal Variable Annual Costs	$1,491,000			
Total Annual Costs	$3,321,000			
Levelized Capital Costs	**$7,424,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$10,745,000			

EW Brown Unit 3
457 MW
High Level Emissions Control Study

Technology: PAC Injection — **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$350,000	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$230,000	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$320,000	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$40,000	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$150,000	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$960,000	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$50,000	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$2,100,000					
Freight	$53,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$2,153,000					
Direct installation costs						
Foundation & supports	$215,000	(PEC) X	10.0%			
Handling & erection	$431,000	(PEC) X	20.0%			
Electrical	$215,000	(PEC) X	10.0%			
Piping	$108,000	(PEC) X	5.0%			
Insulation	$43,000	(PEC) X	2.0%			
Painting	$108,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$1,120,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$3,348,000					
Indirect Costs						
Engineering	$402,000	(DC) X	12.0%			
Owner's cost	$402,000	(DC) X	12.0%			
Construction management	$335,000	(DC) X	10.0%			
Start-up and spare parts	$50,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$670,000	(DC) X	20.0%			
Total indirect costs (IC)	$1,959,000					
Allowance for Funds Used During Construction (AFDC)	$119,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$5,426,000					
Cost Effectiveness	*$12 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$100,000	(DC) X	3.0%			
Operating labor	$123,000		1 FTE and	123,325 $/year		Estimated manpower
Total fixed annual costs	$223,000					
Variable annual costs				57 %		capacity factor
Reagent (BPAC)	$2,060,000		375 lb/hr and	2200 $/ton		
Byproduct disposal cost	$14,000		375 lb/hr and	15 $/ton		
Auxiliary power	$33,000		180 kW and	0.03624 $/kWh		
Total variable annual costs	$2,107,000					
Total direct annual costs (DAC)	$2,330,000					
Indirect Annual Costs						
Cost for capital recovery	$660,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$660,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$2,990,000					

Ghent

Plant Name:	Ghent
Unit:	1
MW	541
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$131,000,000	$242	$5,888,000	$21,831,000
PAC Injection	$6,380,000	$12	$4,208,000	$4,984,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$138,380,000	$256	$10,196,000	$27,037,000

GHENT UNIT 1 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$5,121,000	
Mechanical - Balance of Plant (BOP)	$14,669,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$311,000	
Control - DCS Instrumentation	$345,000	
ID Fans	$2,493,000	Engineering Estimates
Subtotal Purchase Contract	**$22,939,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,557,000	
Civil/Structural Construction - Sub-Structures	$1,732,000	
Mechanical/Chemical Construction	$17,332,000	
Electrical/Control Construction	$5,853,000	
Service Contracts & Construction Indirects	$283,000	
Demolition Costs	$6,000,000	Engineering Estimates
Subtotal Construction Contracts	**$35,757,000**	
Construction Difficulty Costs	**$57,211,200**	Engineering Estimates
Total Direct Costs	**$115,907,200**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$7,014,000	
EPC Construction Management (Includes G&A & Fee)	$4,590,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$693,000	
Sales Taxes	$247,000	
Project Contingency - 18%	$2,585,000	
Total Indirect Costs	**$15,129,000**	
Total Contracted Costs	$131,000,000	
Cost Effectiveness	*$242*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	81%	
Maintenance labor and materials	$3,930,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$3,930,000**			
Variable Annual Costs				
Byproduct disposal	$0	0 lb/hr and	15	$/ton
Bag replacement cost	$786,000	23,590 bags and	100	$/bag
Cage replacement cost	$393,000	23,590 cages and	50	$/cage
ID fan power	$600,000	3,400 kW and	0.02487	$/kWh
Auxiliary power	$179,000	1,015 kW and	0.02487	$/kWh
Subtotal Variable Annual Costs	$1,958,000			
Total Annual Costs	$5,888,000			
Levelized Capital Costs	**$15,943,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$21,831,000			

Ghent Unit 1
514 MW
High Level Emissions Control Study

Technology: PAC Injection　　**Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$414,333	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$272,276	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$378,818	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$47,352	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$177,571	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$1,136,455	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$59,190	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,485,996				
Freight	$62,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,548,000				
Direct installation costs					
Foundation & supports	$255,000	(PEC) X	10.0%		
Handling & erection	$510,000	(PEC) X	20.0%		
Electrical	$255,000	(PEC) X	10.0%		
Piping	$127,000	(PEC) X	5.0%		
Insulation	$51,000	(PEC) X	2.0%		
Painting	$127,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,325,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,948,000				
Indirect Costs					
Engineering	$474,000	(DC) X	12.0%		
Owner's cost	$474,000	(DC) X	12.0%		
Construction management	$395,000	(DC) X	10.0%		
Start-up and spare parts	$59,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$790,000	(DC) X	20.0%		
Total indirect costs (IC)	$2,292,000				
Allowance for Funds Used During Construction (AFDC)	$140,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$6,380,000				
Cost Effectiveness	*$12 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$118,000	(DC) X	3.0%		
Operating labor	$121,000		1 FTE and	121,000 $/year	Estimated manpower
Total fixed annual costs	$239,000				
Variable annual costs				81 %	capacity factor
Reagent (BPAC)	$3,903,000		500 lb/hr and	2200 $/ton	
Byproduct disposal cost	$27,000		500 lb/hr and	15 $/ton	
Auxiliary power	$39,000		220 kW and	0.02487 $/kWh	
Total variable annual costs	$3,969,000				
Total direct annual costs (DAC)	$4,208,000				
Indirect Annual Costs					
Cost for capital recovery	$776,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$776,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$4,984,000				

Plant Name:	Ghent
Unit:	2
MW	517
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$227,000,000	$439	$7,078,000	$34,704,000
Fabric Filter	$120,000,000	$232	$5,002,000	$19,606,000
Lime Injection	$5,483,000	$11	$2,775,000	$3,442,000
PAC Injection	$6,109,000	$12	$2,880,000	$3,623,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$359,592,000	$696	$17,835,000	$61,597,000

GHENT UNIT 2 - SCR COSTS

CAPITAL COST

Purchase Contracts			
Civil/Structural	$8,731,000		
Ductwork and Breeching	$6,743,000		
Mechanical - Balance of Plant (BOP)	$2,208,000		
Electrical - Equipment, Raceway	$2,522,000		
VFDs, Motors and Couplings	$500,000	Engineering Estimates	
Switchgear and MCCs	$882,000		
Control - DCS Instrumentation	$284,000		
Air Heater Modifications	$0	Engineering Estimates	
ID Fans	$2,858,000	Engineering Estimates	
Catalyst	$3,547,000		
Selective Catalytic Reduction System (Including Ammonia System)	$3,094,000		
Subtotal Purchase Contract	**$31,369,000**		
Construction Contracts			
Civil/Structural Construction - Super Structures	$5,375,000		
Civil/Structural Construction - Sub-Structures	$1,397,000		
Mechanical/Chemical Construction	$16,896,000		
Electrical/Control Construction	$7,727,000		
Service Contracts & Construction Indirects	$26,991,000		
Demolition Costs	$9,000,000	Engineering Estimates	
Subtotal Construction Contracts	**$67,386,000**		
Construction Difficulty Costs	**$94,340,400**	Engineering Estimates	
Total Direct Costs	**$193,095,400**		
Indirect Costs			
Engineering Costs (Includes G&A & Fee)	$7,743,000		
EPC Construction Management (Includes G&A & Fee)	$4,858,000		
Startup Spare Parts (Included)	$0		
Construction Utilites (Power & Water) - Included	$0		
Project Insurance	$1,275,000		
Sales Taxes	$1,800,000		
Project Contingency	$18,169,000		
Total Indirect Costs	**$33,845,000**		
Total Contracted Costs	**$227,000,000**		
Capital Cost Effectiveness	***$439***	***/kW***	
ANNUAL COST			
		Capacity Factor =	71%
Fixed Annual Costs			
Operating labor	$121,000	1 FTE and	121,000 $/year
Maintenance labor & materials	$5,793,000	(DC) X 3.0%	
Yearly emissions testing	$25,000	Engineering Estimates	
Catalyst activity testing	$5,000	Engineering Estimates	
Fly ash sampling and analysis	$20,000	Engineering Estimates	
Subtotal Fixed Annual Costs	**$5,964,000**		
Variable Annual Costs			
Reagent	$459,000	285 lb/hr and	517.55 $/ton
Auxiliary and ID fan power	$355,000	2,320 kW and	0.02459 $/kWh
Catalyst replacement	$300,000	65 m3 and	6,500 $/m3
Subtotal Variable Annual Costs	**$1,114,000**		
Total Annual Costs	**$7,078,000**		
Levelized Capital Costs	**$27,626,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	**$34,704,000**		

GHENT UNIT 2 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$4,984,000	
Mechanical - Balance of Plant (BOP)	$14,275,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$302,000	
Control - DCS Instrumentation	$336,000	
ID Fans	$1,319,000	Engineering Estimates
Subtotal Purchase Contract	**$21,216,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,435,000	
Civil/Structural Construction - Sub-Structures	$1,686,000	
Mechanical/Chemical Construction	$16,866,000	
Electrical/Control Construction	$5,695,000	
Service Contracts & Construction Indirects	$275,000	
Demolition Costs	$6,000,000	Engineering Estimates
Subtotal Construction Contracts	**$34,957,000**	
Construction Difficulty Costs	**$48,939,800**	Engineering Estimates
Total Direct Costs	**$105,112,800**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$6,703,000	
EPC Construction Management (Includes G&A & Fee)	$4,386,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$662,000	
Sales Taxes	$236,000	
Project Contingency - 18%	$2,470,000	
Total Indirect Costs	**$14,457,000**	
Total Contracted Costs	$120,000,000	
Cost Effectiveness	*$232*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	71%	
Maintenance labor and materials	$3,600,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$3,600,000**			
Variable Annual Costs				
Byproduct disposal	$5,000	115 lb/hr and	15	$/ton
Bag replacement cost	$592,000	17,770 bags and	100	$/bag
Cage replacement cost	$296,000	17,770 cages and	50	$/cage
ID fan power	$392,000	2,560 kW and	0.02459	$/kWh
Auxiliary power	$117,000	765 kW and	0.02459	$/kWh
Subtotal Variable Annual Costs	$1,402,000			
Total Annual Costs	$5,002,000			
Levelized Capital Costs	**$14,604,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$19,606,000			

Ghent Unit 2
517 MW
High Level Emissions Control Study

Technology: Sorbent Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$279,493	From Previous Mill Creek BACT Study			
Short-term storage silo	$185,493	From Previous Mill Creek BACT Study			
Air blowers	$254,427	From Previous Mill Creek BACT Study			
Rotary feeders	$41,360	From Previous Mill Creek BACT Study			
Injection system	$167,947	From Previous Mill Creek BACT Study			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$1,100,427	From Previous Mill Creek BACT Study			
Instrumentation and controls	$52,640	From Previous Mill Creek BACT Study			
Subtotal capital cost (CC)	$2,081,787				
Freight	$94,000	(CC) X	4.5%		
Total purchased equipment cost (PEC)	$2,176,000				
Direct installation costs					
Foundation & supports	$218,000	(PEC) X	10.0%		
Handling & erection	$435,000	(PEC) X	20.0%		
Electrical	$218,000	(PEC) X	10.0%		
Piping	$109,000	(PEC) X	5.0%		
Insulation	$44,000	(PEC) X	2.0%		
Painting	$109,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,133,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,384,000				
Indirect Costs					
Engineering	$406,000	(DC) X	12.0%		
Owner's cost	$406,000	(DC) X	12.0%		
Construction management	$338,000	(DC) X	10.0%		
Start-up and spare parts	$51,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$677,000	(DC) X	20.0%		
Total indirect costs (IC)	$1,978,000				
Allowance for Funds Used During Construction (AFDC)	$121,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$5,483,000				
Cost Effectiveness	*$11 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$102,000	(DC) X	3.0%		
Operating labor	$121,000		1 FTE and	121,000 $/year	
Total fixed annual costs	$223,000				
Variable annual costs				71 %	capacity factor
Lime	$2,233,000		5,450 lb/hr and	131.78 $/ton	
Byproduct disposal	$291,000		6,230 lb/hr and	15 $/ton	
Auxiliary power	$28,000		180 kW and	0.02459 $/kWh	
Total variable annual costs	$2,552,000				
Total direct annual costs (DAC)	$2,775,000				
Indirect Annual Costs					
Cost for capital recovery	$667,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$667,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$3,442,000				

Ghent Unit 2
517 MW
High Level Emissions Control Study

Technology: PAC Injection   **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$395,952	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$260,197	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$362,013	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$45,252	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$169,694	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$1,086,039	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$56,565	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$2,375,711					
Freight	$59,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$2,435,000					
Direct installation costs						
Foundation & supports	$244,000	(PEC) X	10.0%			
Handling & erection	$487,000	(PEC) X	20.0%			
Electrical	$244,000	(PEC) X	10.0%			
Piping	$122,000	(PEC) X	5.0%			
Insulation	$49,000	(PEC) X	2.0%			
Painting	$122,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$1,268,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$3,778,000					
Indirect Costs						
Engineering	$453,000	(DC) X	12.0%			
Owner's cost	$453,000	(DC) X	12.0%			
Construction management	$378,000	(DC) X	10.0%			
Start-up and spare parts	$57,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$756,000	(DC) X	20.0%			
Total indirect costs (IC)	$2,197,000					
Allowance for Funds Used During Construction (AFDC)	$134,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$6,109,000					
Cost Effectiveness	*$12 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$113,000	(DC) X	3.0%			
Operating labor	$121,000		1 FTE and	121,000 $/year		Estimated manpower
Total fixed annual costs	$234,000					
Variable annual costs				71 %		capacity factor
Reagent (BPAC)	$2,600,000		380 lb/hr and	2200 $/ton		
Byproduct disposal cost	$18,000		380 lb/hr and	15 $/ton		
Auxiliary power	$28,000		180 kW and	0.02459 $/kWh		
Total variable annual costs	$2,646,000					
Total direct annual costs (DAC)	$2,880,000					
Indirect Annual Costs						
Cost for capital recovery	$743,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$743,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$3,623,000					

Plant Name: Ghent
Unit: 3
MW 523
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$138,000,000	$264	$6,122,000	$22,917,000
PAC Injection	$6,173,000	$12	$4,134,000	$4,885,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$145,173,000	$278	$10,356,000	$28,024,000

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GHENT UNIT 3 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$10,036,000	
Mechanical - Balance of Plant (BOP)	$14,374,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$305,000	
Control - DCS Instrumentation	$338,000	
ID Fans	$2,654,000	Engineering Estimates
Subtotal Purchase Contract	**$27,707,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$8,931,000	
Civil/Structural Construction - Sub-Structures	$3,395,000	
Mechanical/Chemical Construction	$16,984,000	
Electrical/Control Construction	$5,735,000	
Service Contracts & Construction Indirects	$277,000	
Demolition Costs	$1,500,000	Engineering Estimates
Subtotal Construction Contracts	**$36,822,000**	
Construction Difficulty Costs	**$58,915,200**	Engineering Estimates
Total Direct Costs	**$123,444,200**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$6,781,000	
EPC Construction Management (Includes G&A & Fee)	$4,437,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$670,000	
Sales Taxes	$239,000	
Project Contingency - 18%	$2,499,000	
Total Indirect Costs	**$14,626,000**	
Total Contracted Costs	$138,000,000	
Cost Effectiveness	*$264*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	78%	
Maintenance labor and materials	$4,140,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$4,140,000**			
Variable Annual Costs				
Byproduct disposal	$4,000	85 lb/hr and	15	$/ton
Bag replacement cost	$799,000	23,960 bags and	100	$/bag
Cage replacement cost	$399,000	23,960 cages and	50	$/cage
ID fan power	$601,000	3,455 kW and	0.02544	$/kWh
Auxiliary power	$179,000	1,030 kW and	0.02544	$/kWh
Subtotal Variable Annual Costs	$1,982,000			
Total Annual Costs	$6,122,000			
Levelized Capital Costs	**$16,795,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$22,917,000			

Ghent Unit 3
523 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$400,547	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$263,217	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$366,214	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$45,777	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$171,663	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$1,098,643	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$57,221	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$2,403,282					
Freight	$60,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$2,463,000					
Direct installation costs						
Foundation & supports	$246,000	(PEC) X	10.0%			
Handling & erection	$493,000	(PEC) X	20.0%			
Electrical	$246,000	(PEC) X	10.0%			
Piping	$123,000	(PEC) X	5.0%			
Insulation	$49,000	(PEC) X	2.0%			
Painting	$123,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$1,280,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$3,818,000					
Indirect Costs						
Engineering	$458,000	(DC) X	12.0%			
Owner's cost	$458,000	(DC) X	12.0%			
Construction management	$382,000	(DC) X	10.0%			
Start-up and spare parts	$57,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$764,000	(DC) X	20.0%			
Total indirect costs (IC)	$2,219,000					
Allowance for Funds Used During Construction (AFDC)	$136,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$6,173,000					
Cost Effectiveness	*$12 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$115,000	(DC) X	3.0%			
Operating labor	$121,000		1 FTE and	121,000 $/year		Estimated manpower
Total fixed annual costs	$236,000					
Variable annual costs				78 %		capacity factor
Reagent (BPAC)	$3,833,000		510 lb/hr and	2200 $/ton		
Byproduct disposal cost	$26,000		510 lb/hr and	15 $/ton		
Auxiliary power	$39,000		225 kW and	0.02544 $/kWh		
Total variable annual costs	$3,898,000					
Total direct annual costs (DAC)	$4,134,000					
Indirect Annual Costs						
Cost for capital recovery	$751,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$751,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$4,885,000					

Plant Name:	Ghent
Unit:	4
MW	526
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$117,000,000	$222	$5,363,000	$19,602,000
PAC Injection	$6,210,000	$12	$3,896,000	$4,652,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$124,210,000	$236	$9,359,000	$24,476,000

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GHENT UNIT 4 - PJFF COSTS

CAPITAL COST

Purchase Contracts					
Civil/Structural	$5,035,000				
Mechanical - Balance of Plant (BOP)	$14,424,000				
Electrical - Equipment, Raceway, Switchgears, MCC	$306,000				
Control - DCS Instrumentation	$339,000				
ID Fans	$2,574,000	Engineering Estimates			
Subtotal Purchase Contract	**$22,678,000**				
Construction Contracts					
Civil/Structural Construction - Super Structures	$4,481,000				
Civil/Structural Construction - Sub-Structures	$1,703,000				
Mechanical/Chemical Construction	$17,042,000				
Electrical/Control Construction	$5,755,000				
Service Contracts & Construction Indirects	$278,000				
Demolition Costs	$1,500,000	Engineering Estimates			
Subtotal Construction Contracts	**$30,759,000**				
Construction Difficulty Costs	**$49,214,400**	Engineering Estimates			
Total Direct Costs	**$102,651,400**				
Indirect Costs					
Engineering Costs (Includes G&A & Fee)	$6,820,000				
EPC Construction Management (Includes G&A & Fee)	$4,463,000				
Startup Spare Parts (Included)	$0				
Construction Utilites (Power & Water) - Included	$0				
Project Insurance	$674,000				
Sales Taxes	$240,000				
Project Contingency - 18%	$2,513,000				
Total Indirect Costs	**$14,710,000**				
Total Contracted Costs	$117,000,000				
Cost Effectiveness	*$222*	*/kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	77%		
Maintenance labor and materials	$3,510,000	(DC) X 3.0%			
Subtotal Fixed Annual Costs	**$3,510,000**				
Variable Annual Costs					
Byproduct disposal	$0	0	lb/hr and	15	$/ton
Bag replacement cost	$758,000	22,730	bags and	100	$/bag
Cage replacement cost	$379,000	22,730	cages and	50	$/cage
ID fan power	$551,000	3,280	kW and	0.0249	$/kWh
Auxiliary power	$165,000	980	kW and	0.0249	$/kWh
Subtotal Variable Annual Costs	$1,853,000				
Total Annual Costs	$5,363,000				
Levelized Capital Costs	**$14,239,000**	(TCI) X 12.17%	CRF		
Levelized Annual Costs	$19,602,000				

Ghent Unit 4
526 MW
High Level Emissions Control Study

Technology: PAC Injection | **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$402,845	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$264,726	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$368,315	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$46,039	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$172,648	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$1,104,945	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$57,549	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,417,068				
Freight	$60,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,477,000				
Direct installation costs					
Foundation & supports	$248,000	(PEC) X	10.0%		
Handling & erection	$495,000	(PEC) X	20.0%		
Electrical	$248,000	(PEC) X	10.0%		
Piping	$124,000	(PEC) X	5.0%		
Insulation	$50,000	(PEC) X	2.0%		
Painting	$124,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,289,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,841,000				
Indirect Costs					
Engineering	$461,000	(DC) X	12.0%		
Owner's cost	$461,000	(DC) X	12.0%		
Construction management	$384,000	(DC) X	10.0%		
Start-up and spare parts	$58,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$768,000	(DC) X	20.0%		
Total indirect costs (IC)	$2,232,000				
Allowance for Funds Used During Construction (AFDC)	$137,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$6,210,000**				
Cost Effectiveness	***$12 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$115,000	(DC) X	3.0%		
Operating labor	$121,000		1 FTE and	121,000 $/year	Estimated manpower
Total fixed annual costs	$236,000				
Variable annual costs				77 %	capacity factor
Reagent (BPAC)	$3,599,000		485 lb/hr and	2200 $/ton	
Byproduct disposal cost	$25,000		485 lb/hr and	15 $/ton	
Auxiliary power	$36,000		215 kW and	0.0249 $/kWh	
Total variable annual costs	$3,660,000				
Total direct annual costs (DAC)	$3,896,000				
Indirect Annual Costs					
Cost for capital recovery	$756,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$756,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$4,652,000**				

Cane Run

Plant Name:	Cane Run
Unit:	4
MW	168
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$63,000,000	$375	$2,219,000	$9,886,000
WFGD	$152,000,000	$905	$8,428,000	$26,926,000
Fabric Filter	$33,000,000	$196	$1,924,000	$5,940,000
Lime Injection	$2,569,000	$15	$983,000	$1,296,000
PAC Injection	$2,326,000	$14	$1,087,000	$1,370,000
Neural Networks	$500,000	$3	$50,000	$111,000
Total	$253,395,000	$1,508	$14,691,000	$45,529,000

CANE RUN UNIT 4 - SCR COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$4,448,000	
Ductwork and Breeching	$3,435,000	
Mechanical - Balance of Plant (BOP)	$1,125,000	
Electrical - Equipment, Raceway	$1,285,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$449,000	
Control - DCS Instrumentation	$145,000	
Air Heater	$2,910,000	Engineering Estimates
ID Fans	$1,717,000	Engineering Estimates
Catalyst	$1,807,000	
Selective Catalytic Reduction System (Including Ammonia System)	$1,576,000	
Subtotal Purchase Contract	**$19,397,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$2,738,000	
Civil/Structural Construction - Sub-Structures	$712,000	
Mechanical/Chemical Construction	$8,607,000	
Electrical/Control Construction	$3,937,000	
Service Contracts & Construction Indirects	$13,750,000	
Demolition Costs	$2,754,000	Engineering Estimates
Subtotal Construction Contracts	**$32,498,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$51,895,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$2,516,000	
EPC Construction Management (Includes G&A & Fee)	$1,579,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$414,000	
Sales Taxes	$585,000	
Project Contingency	$5,904,000	
Total Indirect Costs	**$10,998,000**	
Total Contracted Costs	**$63,000,000**	
Capital Cost Effectiveness	***$375***	***/kW***

ANNUAL COST

Capacity Factor = 60%

Fixed Annual Costs					
Operating labor	$127,000	1	FTE and	126,882	$/year
Maintenance labor & materials	$1,557,000	(DC) X 3.0%			
Yearly emissions testing	$25,000	Engineering Estimates			
Catalyst activity testing	$5,000	Engineering Estimates			
Fly ash sampling and analysis	$20,000	Engineering Estimates			
Subtotal Fixed Annual Costs	**$1,734,000**				
Variable Annual Costs					
Reagent	$202,000	145	lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$146,000	965	kW and	0.0288	$/kWh
Catalyst replacement	$137,000	35	m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$485,000**				
Total Annual Costs	**$2,219,000**				
Levelized Capital Costs	**$7,667,000**	(TCI) X 12.17%	CRF		
Levelized Annual Costs	**$9,886,000**				

CANE RUN UNIT 4 - WFGD COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$1,712,000	
Ductwork and Breeching	$2,638,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$56,758,000	
Electrical - Equipment, Raceway	$6,304,000	
VFDs, Motors and Couplings	$3,705,000	
Switchgear and MCCs	$3,825,000	
Control - DCS Instrumentation	$3,537,000	
ID Fans	$1,189,000	Engineering Estimates
Subtotal Purchase Contract	**$79,668,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$6,373,000	
Civil/Structural Construction - Sub-Structures	$621,000	
Mechanical/Chemical Construction	$14,560,000	
Electrical/Control Construction	$5,969,000	
Service Contracts & Construction Indirects	$11,344,000	
Subtotal Construction Contracts	**$38,867,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$118,535,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$4,849,000	
EPC Construction Management (Includes G&A & Fee)	$6,369,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$653,000	
Sales Taxes	$26,000	
Project Contingency	$21,236,000	
Total Indirect Costs	**$33,133,000**	
Total Contracted Costs	$152,000,000	
Cost Effectiveness	*$905 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	60%	
Operating labor	$2,538,000	20 FTE and	126,882	$/year
Maintenance labor and materials	$3,556,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$6,094,000**			
Variable Annual Costs				
Reagent	$479,000	15,795 lb/hr and	11.54	$/ton
Byproduct disposal	$1,071,000	27,170 lb/hr and	15	$/ton
Auxiliary and ID fan power	$607,000	4,010 kW and	0.03	$/kWh
Water	$177,000	280 gpm and	2	$/1,000 gal
Subtotal Variable Annual Costs	$2,334,000			
Total Annual Costs	$8,428,000			
Levelized Capital Costs	**$18,498,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$26,926,000			

CANE RUN UNIT 4 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$2,539,000	
Mechanical - Balance of Plant (BOP)	$7,272,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$154,000	
Control - DCS Instrumentation	$171,000	
ID Fans	$793,000	Engineering Estimates
Subtotal Purchase Contract	**$10,929,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$2,259,000	
Civil/Structural Construction - Sub-Structures	$859,000	
Mechanical/Chemical Construction	$8,592,000	
Electrical/Control Construction	$2,901,000	
Service Contracts & Construction Indirects	$140,000	
Demolition Costs	$2,754,000	Engineering Estimates
Subtotal Construction Contracts	**$17,505,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$28,434,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$2,178,000	
EPC Construction Management (Includes G&A & Fee)	$1,425,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$215,000	
Sales Taxes	$77,000	
Project Contingency - 18%	$803,000	
Total Indirect Costs	**$4,698,000**	
Total Contracted Costs	$33,000,000	
Cost Effectiveness	*$196 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	60%
Maintenance labor and materials	$990,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$990,000**		
Variable Annual Costs			
Byproduct disposal	$551,000	13,975 lb/hr and	15 $/ton
Bag replacement cost	$134,000	4,030 bags and	100 $/bag
Cage replacement cost	$67,000	4,030 cages and	50 $/cage
ID fan power	$159,000	1,050 kW and	0.03 $/kWh
Auxiliary power	$23,000	155 kW and	0.03 $/kWh
Subtotal Variable Annual Costs	$934,000		
Total Annual Costs	$1,924,000		
Levelized Capital Costs	**$4,016,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$5,940,000		

Cane Run Unit 4
168 MW
High Level Emissions Control Study

Technology: Lime Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$124,880	From Previous Mill Creek BACT Study				
Short-term storage silo	$82,880	From Previous Mill Creek BACT Study				
Air blowers	$113,680	From Previous Mill Creek BACT Study				
Rotary feeders	$18,480	From Previous Mill Creek BACT Study				
Injection system	$75,040	From Previous Mill Creek BACT Study				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$491,680	From Previous Mill Creek BACT Study				
Instrumentation and controls	$23,520	From Previous Mill Creek BACT Study				
Subtotal capital cost (CC)	$930,160					
Freight	$42,000	(CC) X	4.5%			
Total purchased equipment cost (PEC)	$972,000					
Direct installation costs						
Foundation & supports	$97,000	(PEC) X	10.0%			
Handling & erection	$194,000	(PEC) X	20.0%			
Electrical	$97,000	(PEC) X	10.0%			
Piping	$49,000	(PEC) X	5.0%			
Insulation	$19,000	(PEC) X	2.0%			
Painting	$49,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$505,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$1,552,000					
Indirect Costs						
Engineering	$186,000	(DC) X	12.0%			
Owner's cost	$186,000	(DC) X	12.0%			
Construction management	$155,000	(DC) X	10.0%			
Start-up and spare parts	$23,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$310,000	(DC) X	20.0%			
Total indirect costs (IC)	$960,000					
Allowance for Funds Used During Construction (AFDC)	$57,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$2,569,000					
Cost Effectiveness	*$15 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$47,000	(DC) X	3.0%			
Operating labor	$127,000		1 FTE and	126,882 $/year		Estimated manpower
Total fixed annual costs	$174,000					
Variable annual costs				60 %		capacity factor
Lime	$702,000		2,020 lb/hr and	132.19 $/ton		
Byproduct disposal	$91,000		2,310 lb/hr and	15 $/ton		
Auxiliary power	$16,000		105 kW and	0.0288 $/kWh		
Total variable annual costs	$809,000					
Total direct annual costs (DAC)	$983,000					
Indirect Annual Costs						
Cost for capital recovery	$313,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$313,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,296,000					

Cane Run Unit 4
168 MW
High Level Emissions Control Study

Technology: PAC Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$141,532	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$93,007	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$129,400	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$16,175	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$60,656	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$388,201	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$20,219	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$849,190				
Freight	$21,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$870,000				
Direct installation costs					
Foundation & supports	$87,000	(PEC) X	10.0%		
Handling & erection	$174,000	(PEC) X	20.0%		
Electrical	$87,000	(PEC) X	10.0%		
Piping	$44,000	(PEC) X	5.0%		
Insulation	$17,000	(PEC) X	2.0%		
Painting	$44,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$453,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$1,398,000				
Indirect Costs					
Engineering	$168,000	(DC) X	12.0%		
Owner's cost	$168,000	(DC) X	12.0%		
Construction management	$140,000	(DC) X	10.0%		
Start-up and spare parts	$21,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$280,000	(DC) X	20.0%		
Total indirect costs (IC)	$877,000				
Allowance for Funds Used During Construction (AFDC)	$51,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$2,326,000				
Cost Effectiveness	*$14 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$42,000	(DC) X	3.0%		
Operating labor	$127,000		1 FTE and	126,882 $/year	Estimated manpower
Total fixed annual costs	$169,000				
Variable annual costs				60 %	capacity factor
Reagent (BPAC)	$896,000		155 lb/hr and	2200 $/ton	
Byproduct disposal	$6,000		155 lb/hr and	15 $/ton	
Auxiliary power	$16,000		105 kW and	0.0288 $/kWh	
Total variable annual costs	$918,000				
Total direct annual costs (DAC)	$1,087,000				
Indirect Annual Costs					
Cost for capital recovery	$283,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$283,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,370,000				

Plant Name:	Cane Run
Unit:	5
MW	181
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$66,000,000	$365	$2,421,000	$10,453,000
WFGD	$159,000,000	$878	$8,789,000	$28,139,000
Fabric Filter	$35,000,000	$193	$2,061,000	$6,321,000
Lime Injection	$2,752,000	$15	$1,089,000	$1,424,000
PAC Injection	$2,490,000	$14	$1,120,000	$1,423,000
Neural Networks	$500,000	$3	$50,000	$111,000
Total	$265,742,000	$1,468	$15,530,000	$47,871,000

CANE RUN UNIT 5 - SCR COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$4,651,000			
Ductwork and Breeching	$3,592,000			
Mechanical - Balance of Plant (BOP)	$1,176,000			
Electrical - Equipment, Raceway	$1,344,000			
VFDs, Motors and Couplings	$500,000	Engineering Estimates		
Switchgear and MCCs	$470,000			
Control - DCS Instrumentation	$151,000			
Air Heater	$3,135,000	Engineering Estimates		
ID Fans	$1,864,000	Engineering Estimates		
Catalyst	$1,890,000			
Selective Catalytic Reduction System (Including Ammonia System)	$1,648,000			
Subtotal Purchase Contract	**$20,421,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$2,864,000			
Civil/Structural Construction - Sub-Structures	$744,000			
Mechanical/Chemical Construction	$9,001,000			
Electrical/Control Construction	$4,117,000			
Service Contracts & Construction Indirects	$14,379,000			
Demolition Costs	$2,967,000	Engineering Estimates		
Subtotal Construction Contracts	**$34,072,000**			
Construction Difficulty Costs	**$0**	Engineering Estimates		
Total Direct Costs	**$54,493,000**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$2,711,000			
EPC Construction Management (Includes G&A & Fee)	$1,701,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$446,000			
Sales Taxes	$630,000			
Project Contingency	$6,361,000			
Total Indirect Costs	**$11,849,000**			
Total Contracted Costs	**$66,000,000**			
Capital Cost Effectiveness	***$365***	***/kW***		

ANNUAL COST

		Capacity Factor =	62%	
Fixed Annual Costs				
Operating labor	$127,000	1 FTE and	126,882	$/year
Maintenance labor & materials	$1,635,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$1,812,000**			
Variable Annual Costs				
Reagent	$273,000	190 lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$155,000	1,005 kW and	0.02835	$/kWh
Catalyst replacement	$181,000	45 m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$609,000**			
Total Annual Costs	**$2,421,000**			
Levelized Capital Costs	**$8,032,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	**$10,453,000**			

CANE RUN UNIT 5 - WFGD COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$1,791,000	
Ductwork and Breeching	$2,759,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$59,354,000	
Electrical - Equipment, Raceway	$6,592,000	
VFDs, Motors and Couplings	$3,874,000	
Switchgear and MCCs	$4,000,000	
Control - DCS Instrumentation	$3,698,000	
ID Fans	$1,291,000	Engineering Estimates
Subtotal Purchase Contract	**$83,359,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$6,665,000	
Civil/Structural Construction - Sub-Structures	$649,000	
Mechanical/Chemical Construction	$15,226,000	
Electrical/Control Construction	$6,242,000	
Service Contracts & Construction Indirects	$11,862,000	
Subtotal Construction Contracts	**$40,644,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$124,003,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$5,147,000	
EPC Construction Management (Includes G&A & Fee)	$6,760,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$693,000	
Sales Taxes	$27,000	
Project Contingency	$22,541,000	
Total Indirect Costs	**$35,168,000**	
Total Contracted Costs	$159,000,000	
Cost Effectiveness	*$878 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	62%
Operating labor	$2,538,000	20 FTE and	126,882 $/year
Maintenance labor and materials	$3,720,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$6,258,000**		
Variable Annual Costs			
Reagent	$542,000	17,310 lb/hr and	11.54 $/ton
Byproduct disposal	$1,216,000	29,850 lb/hr and	15 $/ton
Auxiliary and ID fan power	$617,000	4,010 kW and	0.03 $/kWh
Water	$156,000	240 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$2,531,000		
Total Annual Costs	$8,789,000		
Levelized Capital Costs	**$19,350,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$28,139,000		

CANE RUN UNIT 5 - PJFF COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$2,655,000			
Mechanical - Balance of Plant (BOP)	$7,605,000			
Electrical - Equipment, Raceway, Switchgears, MCC	$161,000			
Control - DCS Instrumentation	$179,000			
ID Fans	$861,000	Engineering Estimates		
Subtotal Purchase Contract	**$11,461,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$2,362,000			
Civil/Structural Construction - Sub-Structures	$898,000			
Mechanical/Chemical Construction	$8,985,000			
Electrical/Control Construction	$3,034,000			
Service Contracts & Construction Indirects	$146,000			
Demolition Costs	$2,967,000	Engineering Estimates		
Subtotal Construction Contracts	**$18,392,000**			
Construction Difficulty Costs	**$0**	Engineering Estimates		
Total Direct Costs	**$29,853,000**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$2,347,000			
EPC Construction Management (Includes G&A & Fee)	$1,536,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$232,000			
Sales Taxes	$83,000			
Project Contingency - 18%	$865,000			
Total Indirect Costs	**$5,063,000**			
Total Contracted Costs	$35,000,000			
Cost Effectiveness	*$193 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	62%	
Maintenance labor and materials	$1,050,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$1,050,000**			
Variable Annual Costs				
Byproduct disposal	$624,000	15,315 lb/hr and	15	$/ton
Bag replacement cost	$134,000	4,030 bags and	100	$/bag
Cage replacement cost	$67,000	4,030 cages and	50	$/cage
ID fan power	$162,000	1,050 kW and	0.03	$/kWh
Auxiliary power	$24,000	155 kW and	0.03	$/kWh
Subtotal Variable Annual Costs	$1,011,000			
Total Annual Costs	$2,061,000			
Levelized Capital Costs	**$4,260,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$6,321,000			

Cane Run Unit 5
181 MW
High Level Emissions Control Study

Technology: Lime Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$134,543	From Previous Mill Creek BACT Study				
Short-term storage silo	$89,293	From Previous Mill Creek BACT Study				
Air blowers	$122,477	From Previous Mill Creek BACT Study				
Rotary feeders	$19,910	From Previous Mill Creek BACT Study				
Injection system	$80,847	From Previous Mill Creek BACT Study				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$529,727	From Previous Mill Creek BACT Study				
Instrumentation and controls	$25,340	From Previous Mill Creek BACT Study				
Subtotal capital cost (CC)	$1,002,137					
Freight	$45,000	(CC) X	4.5%			
Total purchased equipment cost (PEC)	$1,047,000					
Direct installation costs						
Foundation & supports	$105,000	(PEC) X	10.0%			
Handling & erection	$209,000	(PEC) X	20.0%			
Electrical	$105,000	(PEC) X	10.0%			
Piping	$52,000	(PEC) X	5.0%			
Insulation	$21,000	(PEC) X	2.0%			
Painting	$52,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$544,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$1,666,000					
Indirect Costs						
Engineering	$200,000	(DC) X	12.0%			
Owner's cost	$200,000	(DC) X	12.0%			
Construction management	$167,000	(DC) X	10.0%			
Start-up and spare parts	$25,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$333,000	(DC) X	20.0%			
Total indirect costs (IC)	$1,025,000					
Allowance for Funds Used During Construction (AFDC)	$61,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$2,752,000					
Cost Effectiveness	*$15 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$50,000	(DC) X	3.0%			
Operating labor	$127,000		1 FTE and	126,882 $/year		Estimated manpower
Total fixed annual costs	$177,000					
Variable annual costs				62 %		capacity factor
Lime	$793,000		2,210 lb/hr and	132.19 $/ton		
Byproduct disposal	$103,000		2,530 lb/hr and	15 $/ton		
Auxiliary power	$16,000		105 kW and	0.0288 $/kWh		
Total variable annual costs	$912,000					
Total direct annual costs (DAC)	$1,089,000					
Indirect Annual Costs						
Cost for capital recovery	$335,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$335,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,424,000					

Cane Run Unit 5
181 MW
High Level Emissions Control Study

Technology: **PAC Injection** **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$152,484	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$100,204	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$139,414	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$17,427	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$65,350	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$418,241	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$21,783	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$914,902					
Freight	$23,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$938,000					
Direct installation costs						
Foundation & supports	$94,000	(PEC) X	10.0%			
Handling & erection	$188,000	(PEC) X	20.0%			
Electrical	$94,000	(PEC) X	10.0%			
Piping	$47,000	(PEC) X	5.0%			
Insulation	$19,000	(PEC) X	2.0%			
Painting	$47,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$489,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$1,502,000					
Indirect Costs						
Engineering	$180,000	(DC) X	12.0%			
Owner's cost	$180,000	(DC) X	12.0%			
Construction management	$150,000	(DC) X	10.0%			
Start-up and spare parts	$23,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$300,000	(DC) X	20.0%			
Total indirect costs (IC)	$933,000					
Allowance for Funds Used During Construction (AFDC)	$55,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)		
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$2,490,000**					
Cost Effectiveness	***$14 /kW***					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$45,000	(DC) X	3.0%			
Operating labor	$127,000		1 FTE and	126,882 $/year	Estimated manpower	
Total fixed annual costs	$172,000					
Variable annual costs				62 %	capacity factor	
Reagent (BPAC)	$926,000		155 lb/hr and	2200 $/ton		
Byproduct disposal	$6,000		155 lb/hr and	15 $/ton		
Auxiliary power	$16,000		105 kW and	0.0288 $/kWh		
Total variable annual costs	$948,000					
Total direct annual costs (DAC)	$1,120,000					
Indirect Annual Costs						
Cost for capital recovery	$303,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$303,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$1,423,000**					

Plant Name:	Cane Run
Unit:	6
MW	261
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$86,000,000	$330	$2,793,000	$13,259,000
WFGD	$202,000,000	$774	$10,431,000	$35,014,000
Fabric Filter	$45,000,000	$172	$2,672,000	$8,149,000
Lime Injection	$3,873,000	$15	$1,367,000	$1,838,000
PAC Injection	$3,490,000	$13	$1,336,000	$1,761,000
Neural Networks	$500,000	$2	$50,000	$111,000
Total	$340,863,000	$1,306	$18,649,000	$60,132,000

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CANE RUN UNIT 6 - SCR COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$5,794,000	
Ductwork and Breeching	$4,475,000	
Mechanical - Balance of Plant (BOP)	$1,465,000	
Electrical - Equipment, Raceway	$1,673,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$585,000	
Control - DCS Instrumentation	$189,000	
Air Heater	$4,700,000	Engineering Estimates
ID Fans	$2,349,000	Engineering Estimates
Catalyst	$2,354,000	
Selective Catalytic Reduction System (Including Ammonia System)	$2,053,000	
Subtotal Purchase Contract	**$26,137,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$3,567,000	
Civil/Structural Construction - Sub-Structures	$927,000	
Mechanical/Chemical Construction	$11,211,000	
Electrical/Control Construction	$5,128,000	
Service Contracts & Construction Indirects	$17,911,000	
Demolition Costs	$4,279,000	Engineering Estimates
Subtotal Construction Contracts	**$43,023,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$69,160,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$3,909,000	
EPC Construction Management (Includes G&A & Fee)	$2,453,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$644,000	
Sales Taxes	$909,000	
Project Contingency	$9,172,000	
Total Indirect Costs	**$17,087,000**	
Total Contracted Costs	**$86,000,000**	
Capital Cost Effectiveness	***$330***	***/kW***

ANNUAL COST

Capacity Factor = 54%

Fixed Annual Costs				
Operating labor	$127,000	1 FTE and	126,882	$/year
Maintenance labor & materials	$2,075,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$2,252,000**			
Variable Annual Costs				
Reagent	$207,000	165 lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$194,000	1,360 kW and	0.03018	$/kWh
Catalyst replacement	$140,000	40 m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$541,000**			
Total Annual Costs	**$2,793,000**			
Levelized Capital Costs	**$10,466,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	**$13,259,000**			

CANE RUN UNIT 6 - WFGD COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$2,231,000	
Ductwork and Breeching	$3,437,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$73,931,000	
Electrical - Equipment, Raceway	$8,211,000	
VFDs, Motors and Couplings	$4,826,000	
Switchgear and MCCs	$4,983,000	
Control - DCS Instrumentation	$4,607,000	
ID Fans	$1,626,000	Engineering Estimates
Subtotal Purchase Contract	**$103,852,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$8,302,000	
Civil/Structural Construction - Sub-Structures	$809,000	
Mechanical/Chemical Construction	$18,966,000	
Electrical/Control Construction	$7,775,000	
Service Contracts & Construction Indirects	$14,776,000	
Subtotal Construction Contracts	**$50,628,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$154,480,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$6,898,000	
EPC Construction Management (Includes G&A & Fee)	$9,060,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$929,000	
Sales Taxes	$36,000	
Project Contingency	$30,210,000	
Total Indirect Costs	**$47,133,000**	
Total Contracted Costs	$202,000,000	
Cost Effectiveness	*$774 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	54%	
Operating labor	$2,538,000	20 FTE and	126,882	$/year
Maintenance labor and materials	$4,634,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$7,172,000**			
Variable Annual Costs				
Reagent	$696,000	25,510 lb/hr and	11.54	$/ton
Byproduct disposal	$1,560,000	43,980 lb/hr and	15	$/ton
Auxiliary and ID fan power	$799,000	5,595 kW and	0.03	$/kWh
Water	$204,000	360 gpm and	2	$/1,000 gal
Subtotal Variable Annual Costs	$3,259,000			
Total Annual Costs	$10,431,000			
Levelized Capital Costs	**$24,583,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$35,014,000			

CANE RUN UNIT 6 - PJFF COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$3,307,000			
Mechanical - Balance of Plant (BOP)	$9,473,000			
Electrical - Equipment, Raceway, Switchgears, MCC	$201,000			
Control - DCS Instrumentation	$223,000			
ID Fans	$1,084,000	Engineering Estimates		
Subtotal Purchase Contract	**$14,288,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$2,943,000			
Civil/Structural Construction - Sub-Structures	$1,119,000			
Mechanical/Chemical Construction	$11,192,000			
Electrical/Control Construction	$3,779,000			
Service Contracts & Construction Indirects	$182,000			
Demolition Costs	$4,279,000	Engineering Estimates		
Subtotal Construction Contracts	**$23,494,000**			
Construction Difficulty Costs	**$0**	Engineering Estimates		
Total Direct Costs	**$37,782,000**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$3,384,000			
EPC Construction Management (Includes G&A & Fee)	$2,214,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$334,000			
Sales Taxes	$119,000			
Project Contingency - 18%	$1,247,000			
Total Indirect Costs	**$7,298,000**			
Total Contracted Costs	$45,000,000			
Cost Effectiveness	*$172 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	54%	
Maintenance labor and materials	$1,350,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$1,350,000**			
Variable Annual Costs				
Byproduct disposal	$801,000	22,570 lb/hr and	15	$/ton
Bag replacement cost	$188,000	5,630 bags and	100	$/bag
Cage replacement cost	$94,000	5,630 cages and	50	$/cage
ID fan power	$208,000	1,460 kW and	0.03	$/kWh
Auxiliary power	$31,000	215 kW and	0.03	$/kWh
Subtotal Variable Annual Costs	$1,322,000			
Total Annual Costs	$2,672,000			
Levelized Capital Costs	**$5,477,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$8,149,000			

Cane Run Unit 6
261 MW
High Level Emissions Control Study

Technology: Lime Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$194,010	From Previous Mill Creek BACT Study				
Short-term storage silo	$128,760	From Previous Mill Creek BACT Study				
Air blowers	$176,610	From Previous Mill Creek BACT Study				
Rotary feeders	$28,710	From Previous Mill Creek BACT Study				
Injection system	$116,580	From Previous Mill Creek BACT Study				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$763,860	From Previous Mill Creek BACT Study				
Instrumentation and controls	$36,540	From Previous Mill Creek BACT Study				
Subtotal capital cost (CC)	$1,445,070					
Freight	$65,000	(CC) X	4.5%			
Total purchased equipment cost (PEC)	$1,510,000					
Direct installation costs						
Foundation & supports	$151,000	(PEC) X	10.0%			
Handling & erection	$302,000	(PEC) X	20.0%			
Electrical	$151,000	(PEC) X	10.0%			
Piping	$76,000	(PEC) X	5.0%			
Insulation	$30,000	(PEC) X	2.0%			
Painting	$76,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$786,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$2,371,000					
Indirect Costs						
Engineering	$285,000	(DC) X	12.0%			
Owner's cost	$285,000	(DC) X	12.0%			
Construction management	$237,000	(DC) X	10.0%			
Start-up and spare parts	$36,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$474,000	(DC) X	20.0%			
Total indirect costs (IC)	$1,417,000					
Allowance for Funds Used During Construction (AFDC)	$85,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$3,873,000					
Cost Effectiveness	*$15 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$71,000	(DC) X	3.0%			
Operating labor	$127,000		1 FTE and	126,882 $/year		Estimated manpower
Total fixed annual costs	$198,000					
Variable annual costs				54 %		capacity factor
Lime	$1,019,000		3,260 lb/hr and	132.19 $/ton		
Byproduct disposal	$132,000		3,730 lb/hr and	15 $/ton		
Auxiliary power	$18,000		125 kW and	0.03018 $/kWh		
Total variable annual costs	$1,169,000					
Total direct annual costs (DAC)	$1,367,000					
Indirect Annual Costs						
Cost for capital recovery	$471,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$471,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,838,000					

Cane Run Unit 6
261 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$219,880	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$144,492	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$201,033	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$25,129	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$94,234	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$0					
Electrical system upgrades	$603,098	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$31,411	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$1,319,278					
Freight	$33,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$1,352,000					
Direct installation costs						
Foundation & supports	$135,000	(PEC) X	10.0%			
Handling & erection	$270,000	(PEC) X	20.0%			
Electrical	$135,000	(PEC) X	10.0%			
Piping	$68,000	(PEC) X	5.0%			
Insulation	$27,000	(PEC) X	2.0%			
Painting	$68,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$703,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$2,130,000					
Indirect Costs						
Engineering	$256,000	(DC) X	12.0%			
Owner's cost	$256,000	(DC) X	12.0%			
Construction management	$213,000	(DC) X	10.0%			
Start-up and spare parts	$32,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$426,000	(DC) X	20.0%			
Total indirect costs (IC)	$1,283,000					
Allowance for Funds Used During Construction (AFDC)	$77,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$3,490,000					
Cost Effectiveness	*$13 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$64,000	(DC) X	3.0%			
Operating labor	$127,000		1 FTE and	126,882 $/year		Estimated manpower
Total fixed annual costs	$191,000					
Variable annual costs				54 %		capacity factor
Reagent (BPAC)	$1,119,000		215 lb/hr and	2200 $/ton		
Byproduct disposal	$8,000		215 lb/hr and	15 $/ton		
Auxiliary power	$18,000		125 kW and	0.03018 $/kWh		
Total variable annual costs	$1,145,000					
Total direct annual costs (DAC)	$1,336,000					
Indirect Annual Costs						
Cost for capital recovery	$425,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$425,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,761,000					

Mill Creek

Plant Name: Mill Creek
Unit: 1
MW 330
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$97,000,000	$294	$3,366,000	$15,171,000
WFGD	$297,000,000	$900	$14,341,000	$50,486,000
Fabric Filter	$81,000,000	$245	$3,477,000	$13,335,000
Electrostatic Precipitator	$32,882,000	$100	$3,581,000	$7,583,000
Lime Injection	$4,480,000	$14	$2,024,000	$2,569,000
PAC Injection	$4,412,000	$13	$2,213,000	$2,750,000
Neural Networks	$1,000,000	$3	$100,000	$222,000
Total	$517,774,000	$1,569	$29,102,000	$92,116,000

MILL CREEK UNIT 1 - SCR COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$6,669,000			
Ductwork and Breeching	$5,151,000			
Mechanical - Balance of Plant (BOP)	$1,687,000			
Electrical - Equipment, Raceway	$1,926,000			
VFDs, Motors and Couplings	$500,000	Engineering Estimates		
Switchgear and MCCs	$674,000			
Control - DCS Instrumentation	$217,000			
Air Heater Modifications	$1,704,000	Engineering Estimates		
ID Fans	$3,262,000	Engineering Estimates		
Catalyst	$2,709,000			
Selective Catalytic Reduction System (Including Ammonia System)	$2,363,000			
Subtotal Purchase Contract	**$26,862,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$4,106,000			
Civil/Structural Construction - Sub-Structures	$1,067,000			
Mechanical/Chemical Construction	$12,906,000			
Electrical/Control Construction	$5,902,000			
Service Contracts & Construction Indirects	$20,617,000			
Demolition Costs	$4,104,000	Engineering Estimates		
Subtotal Construction Contracts	**$48,702,000**			
Construction Difficulty Costs	**$0**	Engineering Estimates		
Total Direct Costs	**$75,564,000**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$4,942,000			
EPC Construction Management (Includes G&A & Fee)	$3,101,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$814,000			
Sales Taxes	$1,149,000			
Project Contingency	$11,597,000			
Total Indirect Costs	**$21,603,000**			
Total Contracted Costs	**$97,000,000**			
Capital Cost Effectiveness	***$294***	***/kW***		

ANNUAL COST

			Capacity Factor =	68%
Fixed Annual Costs				
Operating labor	$133,000	1 FTE and	132,901	$/year
Maintenance labor & materials	$2,267,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$2,450,000**			
Variable Annual Costs				
Reagent	$418,000	265 lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$233,000	1,815 kW and	0.02156	$/kWh
Catalyst replacement	$265,000	60 m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$916,000**			
Total Annual Costs	**$3,366,000**			
Levelized Capital Costs	**$11,805,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	**$15,171,000**			

MILL CREEK UNIT 1 - WFGD COSTS

CAPITAL COST

Purchase Contracts			
Civil/Structural	$2,568,000		
Ductwork and Breeching	$3,956,000		
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$85,104,000		
Electrical - Equipment, Raceway	$9,452,000		
VFDs, Motors and Couplings	$5,555,000		
Switchgear and MCCs	$5,736,000		
Control - DCS Instrumentation	$5,303,000		
ID Fans	$2,510,000	Engineering Estimates	
Subtotal Purchase Contract	**$120,184,000**		
Construction Contracts			
Civil/Structural Construction - Super Structures	$9,556,000		
Civil/Structural Construction - Sub-Structures	$931,000		
Mechanical/Chemical Construction	$21,832,000		
Electrical/Control Construction	$8,950,000		
Service Contracts & Construction Indirects	$17,009,000		
Demolition Costs	$12,313,000	Engineering Estimates	
Subtotal Construction Contracts	**$70,591,000**		
Construction Difficulty Costs	**$49,414,000**	Engineering Estimates	
Total Direct Costs	**$240,189,000**		
Indirect Costs			
Engineering Costs (Includes G&A & Fee)	$8,322,000		
EPC Construction Management (Includes G&A & Fee)	$10,930,000		
Startup Spare Parts (Included)	$0		
Construction Utilites (Power & Water) - Included	$0		
Project Insurance	$1,121,000		
Sales Taxes	$44,000		
Project Contingency	$36,445,000		
Total Indirect Costs	**$56,862,000**		
Total Contracted Costs	$297,000,000		
Cost Effectiveness	*$900 /kW*		

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	68%
Operating labor	$2,658,000	20 FTE and	132,901 $/year
Maintenance labor and materials	$7,206,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$9,864,000**		
Variable Annual Costs			
Reagent	$713,000	31,765 lb/hr and	7.54 $/ton
Byproduct disposal	$2,444,000	54,715 lb/hr and	15 $/ton
Auxiliary and ID fan power	$963,000	7,495 kW and	0.02156 $/kWh
Water	$357,000	500 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$4,477,000		
Total Annual Costs	$14,341,000		
Levelized Capital Costs	**$36,145,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$50,486,000		

MILL CREEK UNIT 1 - PJFF COSTS

CAPITAL COST

Purchase Contracts						
Civil/Structural	$4,568,000					
Mechanical - Balance of Plant (BOP)	$13,085,000					
Electrical - Equipment, Raceway, Switchgears, MCC	$277,000					
Control - DCS Instrumentation	$308,000					
ID Fans	$1,757,000	Engineering Estimates				
Subtotal Purchase Contract	**$19,995,000**					
Construction Contracts						
Civil/Structural Construction - Super Structures	$4,065,000					
Civil/Structural Construction - Sub-Structures	$1,545,000					
Mechanical/Chemical Construction	$15,460,000					
Electrical/Control Construction	$5,221,000					
Service Contracts & Construction Indirects	$252,000					
Demolition Costs	$4,104,000	Engineering Estimates				
Subtotal Construction Contracts	**$30,647,000**					
Construction Difficulty Costs	**$21,452,900**	Engineering Estimates				
Total Direct Costs	**$72,094,900**					
Indirect Costs						
Engineering Costs (Includes G&A & Fee)	$4,279,000					
EPC Construction Management (Includes G&A & Fee)	$2,800,000					
Startup Spare Parts (Included)	$0					
Construction Utilites (Power & Water) - Included	$0					
Project Insurance	$423,000					
Sales Taxes	$151,000					
Project Contingency - 18%	$1,577,000					
Total Indirect Costs	**$9,230,000**					
Total Contracted Costs	$81,000,000					
Cost Effectiveness	*$245 /kW*					

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	68%			
Maintenance labor and materials	$2,430,000	(DC) X 3.0%				
Subtotal Fixed Annual Costs	**$2,430,000**					
Variable Annual Costs						
Byproduct disposal	$0	0	lb/hr and	15	$/ton	
Bag replacement cost	$471,000	14,140	bags and	100	$/bag	
Cage replacement cost	$236,000	14,140	cages and	50	$/cage	
ID fan power	$262,000	2,040	kW and	0.02156	$/kWh	
Auxiliary power	$78,000	610	kW and	0.02156	$/kWh	
Subtotal Variable Annual Costs	$1,047,000					
Total Annual Costs	$3,477,000					
Levelized Capital Costs	**$9,858,000**	(TCI) X 12.17%	CRF			
Levelized Annual Costs	$13,335,000					

Mill Creek Unit 1
330 MW
High Level Emissions Control Study

Technology: Electrostatic Precipitator (ESP) **Date:** 6/16/2010

Cost Item	$	Remarks			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
ESP	$7,399,831	From Previous Study			
Ash handling system	$538,703	From Previous Study			
ID fan	$501,831	Apportioned Engineering Estimate			
Flue gas ductwork	$2,000,000	Engineering Estimate			
Subtotal capital cost (CC)	$10,440,365				
Instrumentation and controls	$209,000	(CC) X	2.0%		
Taxes	$731,000	(CC) X	7.0%		
Freight	$522,000	(CC) X	5.0%		
Total purchased equipment cost (PEC)	$11,902,000				
Direct installation costs					
Foundation & supports	$1,785,000	(PEC) X	15.0%		
Handling & erection	$1,190,000	(PEC) X	10.0%		
Electrical	$2,380,000	(PEC) X	20.0%		
Piping	$298,000	(PEC) X	2.5%		
Insulation	$238,000	(PEC) X	2.0%		
Painting	$60,000	(PEC) X	0.5%		
Demolition	$2,052,000	Engineering Estimate			
Relocation	$1,000	(PEC) X	0.01%		
Total direct installation costs (DIC)	$8,004,000				
Site preparation	$200,000	Estimate			
Total direct costs (DC) = (PEC) + (DIC)	$20,106,000				
Indirect Costs					
Engineering	$2,413,000	(DC) X	12.0%		
Owners Cost	$603,000	(DC) X	3.0%		
Construction and field expenses	$2,011,000	(DC) X	10.0%		
Contractor fees	$2,011,000	(DC) X	10.0%		
Start-up	$603,000	(DC) X	3.0%		
Performance test	$40,000	(DC) X	0.2%		
Contingencies	$3,016,000	(DC) X	15.0%		
Total indirect costs (IC)	$10,697,000				
Allowance for Funds Used During Construction (AFDC)	$2,079,000	[(DC)+(IC)] X	4.50%		3 years (project time length)
Total Capital Investment (TCI) = (DC) + (IC)	$32,882,000				
Cost Effectiveness	*$100 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$2,155,000	Engineering Estimates			
Total fixed annual costs	$2,155,000				
Variable annual costs				68 %	capacity factor
Byproduct disposal	$1,255,000		28,100 lb/hr and	15 $/ton	
ID fan power	$103,000		800 kW and	0.02156 $/kWh	
Auxiliary power	$68,000		530 kW and	0.02156 $/kWh	
Total variable annual costs	$1,426,000				
Total direct annual costs (DAC)	$3,581,000				
Indirect Annual Costs					
Cost for capital recovery	$4,002,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$4,002,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$7,583,000				

Mill Creek Unit 1
330 MW
High Level Emissions Control Study

Technology: Lime Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$223,000	From Previous Mill Creek BACT Study				
Short-term storage silo	$148,000	From Previous Mill Creek BACT Study				
Air blowers	$203,000	From Previous Mill Creek BACT Study				
Rotary feeders	$33,000	From Previous Mill Creek BACT Study				
Injection system	$134,000	From Previous Mill Creek BACT Study				
Ductwork modifications, supports, platforms	$26,000	Ratio from Brown Unit 3 BACT Analysis				
Electrical system upgrades	$878,000	From Previous Mill Creek BACT Study				
Instrumentation and controls	$42,000	From Previous Mill Creek BACT Study				
Subtotal capital cost (CC)	$1,687,000					
Freight	$76,000	(CC) X	4.5%			
Total purchased equipment cost (PEC)	$1,763,000					
Direct installation costs						
Foundation & supports	$176,000	(PEC) X	10.0%			
Handling & erection	$353,000	(PEC) X	20.0%			
Electrical	$176,000	(PEC) X	10.0%			
Piping	$88,000	(PEC) X	5.0%			
Insulation	$35,000	(PEC) X	2.0%			
Painting	$88,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$916,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$2,754,000					
Indirect Costs						
Engineering	$330,000	(DC) X	12.0%			
Owner's cost	$330,000	(DC) X	12.0%			
Construction management	$275,000	(DC) X	10.0%			
Start-up and spare parts	$41,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$551,000	(DC) X	20.0%			
Total indirect costs (IC)	$1,627,000					
Allowance for Funds Used During Construction (AFDC)	$99,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)		
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$4,480,000					
Cost Effectiveness	*$14 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$83,000	(DC) X	3.0%			
Operating labor	$133,000		1 FTE and	132,901 $/year	Estimated manpower	
Total fixed annual costs	$216,000					
Variable annual costs				68 %	capacity factor	
Lime	$1,428,000		4,060 lb/hr and	118.13 $/ton		
Byproduct disposal cost	$360,000		4,640 lb/hr and	15 $/ton		
Auxiliary power	$20,000		155 kW and	0.02156 $/kWh		
Total variable annual costs	$1,808,000					
Total direct annual costs (DAC)	$2,024,000					
Indirect Annual Costs						
Cost for capital recovery	$545,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$545,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$2,569,000					

Mill Creek Unit 1
330 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$278,009	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$182,691	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$254,179	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$31,772	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$119,147	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$23,829	Ratio from Brown Unit 3 BACT Analysis				
Electrical system upgrades	$762,538	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$39,716	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$1,691,882					
Freight	$42,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$1,734,000					
Direct installation costs						
Foundation & supports	$173,000	(PEC) X	10.0%			
Handling & erection	$347,000	(PEC) X	20.0%			
Electrical	$173,000	(PEC) X	10.0%			
Piping	$87,000	(PEC) X	5.0%			
Insulation	$35,000	(PEC) X	2.0%			
Painting	$87,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$902,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$2,711,000					
Indirect Costs						
Engineering	$325,000	(DC) X	12.0%			
Owner's cost	$325,000	(DC) X	12.0%			
Construction management	$271,000	(DC) X	10.0%			
Start-up and spare parts	$41,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$542,000	(DC) X	20.0%			
Total indirect costs (IC)	$1,604,000					
Allowance for Funds Used During Construction (AFDC)	$97,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)		
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$4,412,000					
Cost Effectiveness	*$13 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$81,000	(DC) X	3.0%			
Operating labor	$133,000		1 FTE and	132,901 $/year	Estimated manpower	
Total fixed annual costs	$214,000					
Variable annual costs				68 %	capacity factor	
Reagent (BPAC)	$1,966,000		300 lb/hr and	2200 $/ton		
Byproduct disposal cost	$13,000		300 lb/hr and	15 $/ton		
Auxiliary power	$20,000		155 kW and	0.02156 $/kWh		
Total variable annual costs	$1,999,000					
Total direct annual costs (DAC)	$2,213,000					
Indirect Annual Costs						
Cost for capital recovery	$537,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$537,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$2,750,000					

Plant Name: Mill Creek
Unit: 2
MW 330
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$97,000,000	$294	$3,401,000	$15,206,000
WFGD	$297,000,000	$900	$14,604,000	$50,749,000
Fabric Filter	$81,000,000	$245	$3,518,000	$13,376,000
Electrostatic Precipitator	$32,882,000	$100	$3,664,000	$7,666,000
Lime Injection	$4,480,000	$14	$2,117,000	$2,662,000
PAC Injection	$4,412,000	$13	$2,340,000	$2,877,000
Neural Networks	$1,000,000	$3	$100,000	$222,000
Total	$517,774,000	$1,569	$29,744,000	$92,758,000

MILL CREEK UNIT 2 - SCR COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$6,669,000	
Ductwork and Breeching	$5,151,000	
Mechanical - Balance of Plant (BOP)	$1,687,000	
Electrical - Equipment, Raceway	$1,926,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$674,000	
Control - DCS Instrumentation	$217,000	
Air Heater Modifications	$1,704,000	Engineering Estimates
ID Fans	$3,262,000	Engineering Estimates
Catalyst	$2,709,000	
Selective Catalytic Reduction System (Including Ammonia System)	$2,363,000	
Subtotal Purchase Contract	**$26,862,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,106,000	
Civil/Structural Construction - Sub-Structures	$1,067,000	
Mechanical/Chemical Construction	$12,906,000	
Electrical/Control Construction	$5,902,000	
Service Contracts & Construction Indirects	$20,617,000	
Demolition Costs	$4,104,000	Engineering Estimates
Subtotal Construction Contracts	**$48,702,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$75,564,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$4,942,000	
EPC Construction Management (Includes G&A & Fee)	$3,101,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$814,000	
Sales Taxes	$1,149,000	
Project Contingency	$11,597,000	
Total Indirect Costs	**$21,603,000**	
Total Contracted Costs	**$97,000,000**	
Capital Cost Effectiveness	***$294***	***/kW***

ANNUAL COST

Capacity Factor = 70%

Fixed Annual Costs					
Operating labor	$133,000	1	FTE and	132,901	$/year
Maintenance labor & materials	$2,267,000	(DC) X 3.0%			
Yearly emissions testing	$25,000	Engineering Estimates			
Catalyst activity testing	$5,000	Engineering Estimates			
Fly ash sampling and analysis	$20,000	Engineering Estimates			
Subtotal Fixed Annual Costs	**$2,450,000**				
Variable Annual Costs					
Reagent	$431,000	265	lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$247,000	1,860	kW and	0.02169	$/kWh
Catalyst replacement	$273,000	60	m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$951,000**				
Total Annual Costs	**$3,401,000**				
Levelized Capital Costs	**$11,805,000**	(TCI) X 12.17%	CRF		
Levelized Annual Costs	**$15,206,000**				

MILL CREEK UNIT 2 - WFGD COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$2,568,000			
Ductwork and Breeching	$3,956,000			
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$85,104,000			
Electrical - Equipment, Raceway	$9,452,000			
VFDs, Motors and Couplings	$5,555,000			
Switchgear and MCCs	$5,736,000			
Control - DCS Instrumentation	$5,303,000			
ID Fans	$2,510,000	Engineering Estimates		
Subtotal Purchase Contract	**$120,184,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$9,556,000			
Civil/Structural Construction - Sub-Structures	$931,000			
Mechanical/Chemical Construction	$21,832,000			
Electrical/Control Construction	$8,950,000			
Service Contracts & Construction Indirects	$17,009,000			
Demolition Costs	$12,313,000	Engineering Estimates		
Subtotal Construction Contracts	**$70,591,000**			
Construction Difficulty Costs	**$49,414,000**	Engineering Estimates		
Total Direct Costs	**$240,189,000**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$8,322,000			
EPC Construction Management (Includes G&A & Fee)	$10,930,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$1,121,000			
Sales Taxes	$44,000			
Project Contingency	$36,445,000			
Total Indirect Costs	**$56,862,000**			
Total Contracted Costs	$297,000,000			
Cost Effectiveness	*$900 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	70%	
Operating labor	$2,658,000	20 FTE and	132,901	$/year
Maintenance labor and materials	$7,206,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$9,864,000**			
Variable Annual Costs				
Reagent	$754,000	32,620 lb/hr and	7.54	$/ton
Byproduct disposal	$2,584,000	56,195 lb/hr and	15	$/ton
Auxiliary and ID fan power	$1,023,000	7,695 kW and	0.02169	$/kWh
Water	$379,000	515 gpm and	2	$/1,000 gal
Subtotal Variable Annual Costs	$4,740,000			
Total Annual Costs	$14,604,000			
Levelized Capital Costs	**$36,145,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$50,749,000			

MILL CREEK UNIT 2 - PJFF COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$4,568,000			
Mechanical - Balance of Plant (BOP)	$13,085,000			
Electrical - Equipment, Raceway, Switchgears, MCC	$277,000			
Control - DCS Instrumentation	$308,000			
ID Fans	$1,757,000	Engineering Estimates		
Subtotal Purchase Contract	**$19,995,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$4,065,000			
Civil/Structural Construction - Sub-Structures	$1,545,000			
Mechanical/Chemical Construction	$15,460,000			
Electrical/Control Construction	$5,221,000			
Service Contracts & Construction Indirects	$252,000			
Demolition Costs	$4,104,000	Engineering Estimates		
Subtotal Construction Contracts	**$30,647,000**			
Construction Difficulty Costs	**$21,452,900**	Engineering Estimates		
Total Direct Costs	**$72,094,900**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$4,279,000			
EPC Construction Management (Includes G&A & Fee)	$2,800,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$423,000			
Sales Taxes	$151,000			
Project Contingency - 18%	$1,577,000			
Total Indirect Costs	**$9,230,000**			
Total Contracted Costs	$81,000,000			
Cost Effectiveness	*$245 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	70%	
Maintenance labor and materials	$2,430,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$2,430,000**			
Variable Annual Costs				
Byproduct disposal	$0	0 lb/hr and	15	$/ton
Bag replacement cost	$484,000	14,520 bags and	100	$/bag
Cage replacement cost	$242,000	14,520 cages and	50	$/cage
ID fan power	$279,000	2,095 kW and	0.02169	$/kWh
Auxiliary power	$83,000	625 kW and	0.02169	$/kWh
Subtotal Variable Annual Costs	$1,088,000			
Total Annual Costs	$3,518,000			
Levelized Capital Costs	**$9,858,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$13,376,000			

Mill Creek Unit 2
330 MW
High Level Emissions Control Study

Technology: Electrostatic Precipitator (ESP) **Date:** 6/16/2010

Cost Item	$	Remarks			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
ESP	$7,399,831	From Previous Study			
Ash handling system	$538,703	From Previous Study			
ID fan	$501,831	Apportioned Engineering Estimate			
Flue gas ductwork	$2,000,000	Engineering Estimate			
Subtotal capital cost (CC)	$10,440,365				
Instrumentation and controls	$209,000	(CC) X	2.0%		
Taxes	$731,000	(CC) X	7.0%		
Freight	$522,000	(CC) X	5.0%		
Total purchased equipment cost (PEC)	$11,902,000				
Direct installation costs					
Foundation & supports	$1,785,000	(PEC) X	15.0%		
Handling & erection	$1,190,000	(PEC) X	10.0%		
Electrical	$2,380,000	(PEC) X	20.0%		
Piping	$298,000	(PEC) X	2.5%		
Insulation	$238,000	(PEC) X	2.0%		
Painting	$60,000	(PEC) X	0.5%		
Demolition	$2,052,000	Engineering Estimate			
Relocation	$1,000	(PEC) X	0.01%		
Total direct installation costs (DIC)	$8,004,000				
Site preparation	$200,000	Estimate			
Total direct costs (DC) = (PEC) + (DIC)	$20,106,000				
Indirect Costs					
Engineering	$2,413,000	(DC) X	12.0%		
Owners Cost	$603,000	(DC) X	3.0%		
Construction and field expenses	$2,011,000	(DC) X	10.0%		
Contractor fees	$2,011,000	(DC) X	10.0%		
Start-up	$603,000	(DC) X	3.0%		
Performance test	$40,000	(DC) X	0.2%		
Contingencies	$3,016,000	(DC) X	15.0%		
Total indirect costs (IC)	$10,697,000				
Allowance for Funds Used During Construction (AFDC)	$2,079,000	[(DC)+(IC)] X	4.50%	3 years (project time length)	
Total Capital Investment (TCI) = (DC) + (IC)	**$32,882,000**				
Cost Effectiveness	***$100 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$2,155,000	Engineering Estimates			
Total fixed annual costs	$2,155,000				
Variable annual costs				70 %	capacity factor
Byproduct disposal	$1,327,000		28,860 lb/hr and	15 $/ton	
ID fan power	$110,000		825 kW and	0.02169 $/kWh	
Auxiliary power	$72,000		545 kW and	0.02169 $/kWh	
Total variable annual costs	$1,509,000				
Total direct annual costs (DAC)	$3,664,000				
Indirect Annual Costs					
Cost for capital recovery	$4,002,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$4,002,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$7,666,000**				

Mill Creek Unit 2
330 MW
High Level Emissions Control Study

Technology: Lime Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$223,000	From Previous Mill Creek BACT Study				
Short-term storage silo	$148,000	From Previous Mill Creek BACT Study				
Air blowers	$203,000	From Previous Mill Creek BACT Study				
Rotary feeders	$33,000	From Previous Mill Creek BACT Study				
Injection system	$134,000	From Previous Mill Creek BACT Study				
Ductwork modifications, supports, platforms	$26,000	Ratio from Brown Unit 3 BACT Analysis				
Electrical system upgrades	$878,000	From Previous Mill Creek BACT Study				
Instrumentation and controls	$42,000	From Previous Mill Creek BACT Study				
Subtotal capital cost (CC)	$1,687,000					
Freight	$76,000	(CC) X	4.5%			
Total purchased equipment cost (PEC)	$1,763,000					
Direct installation costs						
Foundation & supports	$176,000	(PEC) X	10.0%			
Handling & erection	$353,000	(PEC) X	20.0%			
Electrical	$176,000	(PEC) X	10.0%			
Piping	$88,000	(PEC) X	5.0%			
Insulation	$35,000	(PEC) X	2.0%			
Painting	$88,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$916,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$2,754,000					
Indirect Costs						
Engineering	$330,000	(DC) X	12.0%			
Owner's cost	$330,000	(DC) X	12.0%			
Construction management	$275,000	(DC) X	10.0%			
Start-up and spare parts	$41,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$551,000	(DC) X	20.0%			
Total indirect costs (IC)	$1,627,000					
Allowance for Funds Used During Construction (AFDC)	$99,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$4,480,000					
Cost Effectiveness	*$14 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$83,000	(DC) X	3.0%			
Operating labor	$133,000	1	FTE and	132,901	$/year	Estimated manpower
Total fixed annual costs	$216,000					
Variable annual costs				70	%	capacity factor
Lime	$1,510,000	4,170	lb/hr and	118.13	$/ton	
Byproduct disposal cost	$370,000	4,770	lb/hr and	15	$/ton	
Auxiliary power	$21,000	155	kW and	0.02169	$/kWh	
Total variable annual costs	$1,901,000					
Total direct annual costs (DAC)	$2,117,000					
Indirect Annual Costs						
Cost for capital recovery	$545,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$545,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$2,662,000					

Mill Creek Unit 2
330 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$278,009	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$182,691	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$254,179	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$31,772	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$119,147	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$23,829	Ratio from Brown Unit 3 BACT Analysis				
Electrical system upgrades	$762,538	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$39,716	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$1,691,882					
Freight	$42,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$1,734,000					
Direct installation costs						
Foundation & supports	$173,000	(PEC) X	10.0%			
Handling & erection	$347,000	(PEC) X	20.0%			
Electrical	$173,000	(PEC) X	10.0%			
Piping	$87,000	(PEC) X	5.0%			
Insulation	$35,000	(PEC) X	2.0%			
Painting	$87,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$902,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$2,711,000					
Indirect Costs						
Engineering	$325,000	(DC) X	12.0%			
Owner's cost	$325,000	(DC) X	12.0%			
Construction management	$271,000	(DC) X	10.0%			
Start-up and spare parts	$41,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$542,000	(DC) X	20.0%			
Total indirect costs (IC)	$1,604,000					
Allowance for Funds Used During Construction (AFDC)	$97,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$4,412,000					
Cost Effectiveness	*$13 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$81,000	(DC) X	3.0%			
Operating labor	$133,000		1 FTE and	132,901	$/year	Estimated manpower
Total fixed annual costs	$214,000					
Variable annual costs				70	%	capacity factor
Reagent (BPAC)	$2,091,000		310 lb/hr and	2200	$/ton	
Byproduct disposal cost	$14,000		310 lb/hr and	15	$/ton	
Auxiliary power	$21,000		155 kW and	0.02169	$/kWh	
Total variable annual costs	$2,126,000					
Total direct annual costs (DAC)	$2,340,000					
Indirect Annual Costs						
Cost for capital recovery	$537,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$537,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$2,877,000					

E-ON Fleetwide Study   Black & Veatch Cost Estimates   167987

Plant Name: Mill Creek
Unit: 3
MW 423
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
WFGD	$392,000,000	$927	$18,911,000	$66,617,000
Fabric Filter	$114,000,000	$270	$4,923,000	$18,797,000
PAC Injection	$5,592,000	$13	$3,213,000	$3,894,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$512,592,000	$1,212	$27,147,000	$89,530,000

MILL CREEK UNIT 3 - WFGD COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$2,980,000			
Ductwork and Breeching	$4,591,000			
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$98,775,000			
Electrical - Equipment, Raceway	$10,970,000			
VFDs, Motors and Couplings	$6,447,000			
Switchgear and MCCs	$6,657,000			
Control - DCS Instrumentation	$6,155,000			
ID Fans	$2,445,000	Engineering Estimates		
Subtotal Purchase Contract	**$139,020,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$11,091,000			
Civil/Structural Construction - Sub-Structures	$1,080,000			
Mechanical/Chemical Construction	$25,339,000			
Electrical/Control Construction	$10,387,000			
Service Contracts & Construction Indirects	$19,741,000			
Demolition Costs	$15,784,000	Engineering Estimates		
Subtotal Construction Contracts	**$83,422,000**			
Construction Difficulty Costs	**$100,106,000**	Engineering Estimates		
Total Direct Costs	**$322,548,000**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$10,150,000			
EPC Construction Management (Includes G&A & Fee)	$13,332,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$1,367,000			
Sales Taxes	$54,000			
Project Contingency	$44,453,000			
Total Indirect Costs	**$69,356,000**			
Total Contracted Costs	$392,000,000			
Cost Effectiveness	*$927 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	75%	
Operating labor	$2,658,000	20 FTE and	132,901	$/year
Maintenance labor and materials	$9,676,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$12,334,000**			
Variable Annual Costs				
Reagent	$1,027,000	41,470 lb/hr and	7.54	$/ton
Byproduct disposal	$3,520,000	71,435 lb/hr and	15	$/ton
Auxiliary and ID fan power	$1,518,000	9,910 kW and	0.02331	$/kWh
Water	$512,000	650 gpm and	2	$/1,000 gal
Subtotal Variable Annual Costs	$6,577,000			
Total Annual Costs	$18,911,000			
Levelized Capital Costs	**$47,706,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$66,617,000			

MILL CREEK UNIT 3 - PJFF COSTS

CAPITAL COST

Purchase Contracts						
Civil/Structural	$5,302,000					
Mechanical - Balance of Plant (BOP)	$15,187,000					
Electrical - Equipment, Raceway, Switchgears, MCC	$322,000					
Control - DCS Instrumentation	$357,000					
ID Fans	$1,467,000	Engineering Estimates				
Subtotal Purchase Contract	**$22,635,000**					
Construction Contracts						
Civil/Structural Construction - Super Structures	$4,718,000					
Civil/Structural Construction - Sub-Structures	$1,793,000					
Mechanical/Chemical Construction	$17,944,000					
Electrical/Control Construction	$6,059,000					
Service Contracts & Construction Indirects	$292,000					
Demolition Costs	$5,262,000	Engineering Estimates				
Subtotal Construction Contracts	**$36,068,000**					
Construction Difficulty Costs	**$43,282,000**	Engineering Estimates				
Total Direct Costs	**$101,985,000**					
Indirect Costs						
Engineering Costs (Includes G&A & Fee)	$5,485,000					
EPC Construction Management (Includes G&A & Fee)	$3,589,000					
Startup Spare Parts (Included)	$0					
Construction Utilites (Power & Water) - Included	$0					
Project Insurance	$542,000					
Sales Taxes	$193,000					
Project Contingency - 18%	$2,021,000					
Total Indirect Costs	**$11,830,000**					
Total Contracted Costs	$114,000,000					
Cost Effectiveness	*$270 /kW*					

ANNUAL COST

Fixed Annual Costs		Capacity Factor =		75%		
Maintenance labor and materials	$3,420,000	(DC) X 3.0%				
Subtotal Fixed Annual Costs	**$3,420,000**					
Variable Annual Costs						
Byproduct disposal	$5,000	95	lb/hr and	15	$/ton	
Bag replacement cost	$635,000	19,040	bags and	100	$/bag	
Cage replacement cost	$317,000	19,040	cages and	50	$/cage	
ID fan power	$420,000	2,745	kW and	0.02331	$/kWh	
Auxiliary power	$126,000	820	kW and	0.02331	$/kWh	
Subtotal Variable Annual Costs	$1,503,000					
Total Annual Costs	$4,923,000					
Levelized Capital Costs	**$13,874,000**	(TCI) X 12.17%		CRF		
Levelized Annual Costs	$18,797,000					

Mill Creek Unit 3
423 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$356,357	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$234,177	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$325,812	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$40,726	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$152,724	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$30,545	Ratio from Brown Unit 3 BACT Analysis				
Electrical system upgrades	$977,435	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$50,908	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$2,168,685					
Freight	$54,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$2,223,000					
Direct installation costs						
Foundation & supports	$222,000	(PEC) X	10.0%			
Handling & erection	$445,000	(PEC) X	20.0%			
Electrical	$222,000	(PEC) X	10.0%			
Piping	$111,000	(PEC) X	5.0%			
Insulation	$44,000	(PEC) X	2.0%			
Painting	$111,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$1,155,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$3,453,000					
Indirect Costs						
Engineering	$414,000	(DC) X	12.0%			
Owner's cost	$414,000	(DC) X	12.0%			
Construction management	$345,000	(DC) X	10.0%			
Start-up and spare parts	$52,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$691,000	(DC) X	20.0%			
Total indirect costs (IC)	$2,016,000					
Allowance for Funds Used During Construction (AFDC)	$123,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$5,592,000					
Cost Effectiveness	*$13 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$104,000	(DC) X	3.0%			
Operating labor	$133,000		1 FTE and	132,901 $/year	Estimated manpower	
Total fixed annual costs	$237,000					
Variable annual costs				75 %	capacity factor	
Reagent (BPAC)	$2,927,000		405 lb/hr and	2200 $/ton		
Byproduct disposal cost	$20,000		405 lb/hr and	15 $/ton		
Auxiliary power	$29,000		190 kW and	0.02331 $/kWh		
Total variable annual costs	$2,976,000					
Total direct annual costs (DAC)	$3,213,000					
Indirect Annual Costs						
Cost for capital recovery	$681,000	(TCI) X	12.17% CRF			
Total indirect annual costs (IDAC)	$681,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$3,894,000					

Plant Name:	Mill Creek
Unit:	4
MW	525
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
WFGD	$455,000,000	$867	$21,775,000	$77,149,000
Fabric Filter	$133,000,000	$253	$5,804,000	$21,990,000
PAC Injection	$6,890,000	$13	$3,858,000	$4,697,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$595,890,000	$1,135	$31,537,000	$104,058,000

MILL CREEK UNIT 4 - WFGD COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$3,392,000			
Ductwork and Breeching	$5,227,000			
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$112,444,000			
Electrical - Equipment, Raceway	$12,488,000			
VFDs, Motors and Couplings	$7,339,000			
Switchgear and MCCs	$7,578,000			
Control - DCS Instrumentation	$7,007,000			
ID Fans	$5,018,313	Engineering Estimates		
Subtotal Purchase Contract	**$160,493,313**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$12,626,000			
Civil/Structural Construction - Sub-Structures	$1,230,000			
Mechanical/Chemical Construction	$28,846,000			
Electrical/Control Construction	$11,825,000			
Service Contracts & Construction Indirects	$22,473,000			
Demolition Costs	$19,590,000	Engineering Estimates		
Subtotal Construction Contracts	**$96,590,000**			
Construction Difficulty Costs	**$115,908,000**	Engineering Estimates		
Total Direct Costs	**$372,991,313**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$12,065,000			
EPC Construction Management (Includes G&A & Fee)	$15,847,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$1,625,000			
Sales Taxes	$64,000			
Project Contingency	$52,840,000			
Total Indirect Costs	**$82,441,000**			
Total Contracted Costs	$455,000,000			
Cost Effectiveness	*$867 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	75%	
Operating labor	$2,658,000	20 FTE and	132,901	$/year
Maintenance labor and materials	$11,190,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$13,848,000**			
Variable Annual Costs				
Reagent	$1,250,000	50,465 lb/hr and	7.54	$/ton
Byproduct disposal	$4,284,000	86,935 lb/hr and	15	$/ton
Auxiliary and ID fan power	$1,770,000	12,055 kW and	0.02235	$/kWh
Water	$623,000	790 gpm and	2	$/1,000 gal
Subtotal Variable Annual Costs	$7,927,000			
Total Annual Costs	$21,775,000			
Levelized Capital Costs	**$55,374,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$77,149,000			

MILL CREEK UNIT 4 - PJFF COSTS

CAPITAL COST

Purchase Contracts					
Civil/Structural	$6,036,000				
Mechanical - Balance of Plant (BOP)	$17,289,000				
Electrical - Equipment, Raceway, Switchgears, MCC	$366,000				
Control - DCS Instrumentation	$407,000				
ID Fans	$3,010,988	Engineering Estimates			
Subtotal Purchase Contract	**$27,108,988**				
Construction Contracts					
Civil/Structural Construction - Super Structures	$5,371,000				
Civil/Structural Construction - Sub-Structures	$2,042,000				
Mechanical/Chemical Construction	$20,427,000				
Electrical/Control Construction	$6,898,000				
Service Contracts & Construction Indirects	$333,000				
Demolition Costs	$6,530,000	Engineering Estimates			
Subtotal Construction Contracts	**$41,601,000**				
Construction Difficulty Costs	**$49,921,000**	Engineering Estimates			
Total Direct Costs	**$118,630,988**				
Indirect Costs					
Engineering Costs (Includes G&A & Fee)	$6,807,000				
EPC Construction Management (Includes G&A & Fee)	$4,454,000				
Startup Spare Parts (Included)	$0				
Construction Utilites (Power & Water) - Included	$0				
Project Insurance	$673,000				
Sales Taxes	$240,000				
Project Contingency - 18%	$2,508,000				
Total Indirect Costs	**$14,682,000**				
Total Contracted Costs	$133,000,000				
Cost Effectiveness	*$253*	*/kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	75%		
Maintenance labor and materials	$3,990,000	(DC) X 3.0%			
Subtotal Fixed Annual Costs	**$3,990,000**				
Variable Annual Costs					
Byproduct disposal	$1,000	30	lb/hr and	15	$/ton
Bag replacement cost	$768,000	23,050	bags and	100	$/bag
Cage replacement cost	$384,000	23,050	cages and	50	$/cage
ID fan power	$509,000	3,325	kW and	0.02331	$/kWh
Auxiliary power	$152,000	995	kW and	0.02331	$/kWh
Subtotal Variable Annual Costs	$1,814,000				
Total Annual Costs	$5,804,000				
Levelized Capital Costs	**$16,186,000**	(TCI) X 12.17%	CRF		
Levelized Annual Costs	$21,990,000				

Mill Creek Unit 4
##
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$442,287	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$290,646	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$404,376	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$50,547	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$189,551	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$37,910	Ratio from Brown Unit 3 BACT Analysis				
Electrical system upgrades	$1,213,129	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$63,184	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$2,691,630					
Freight	$67,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$2,759,000					
Direct installation costs						
Foundation & supports	$276,000	(PEC) X	10.0%			
Handling & erection	$552,000	(PEC) X	20.0%			
Electrical	$276,000	(PEC) X	10.0%			
Piping	$138,000	(PEC) X	5.0%			
Insulation	$55,000	(PEC) X	2.0%			
Painting	$138,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$1,435,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$4,269,000					
Indirect Costs						
Engineering	$512,000	(DC) X	12.0%			
Owner's cost	$512,000	(DC) X	12.0%			
Construction management	$427,000	(DC) X	10.0%			
Start-up and spare parts	$64,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$854,000	(DC) X	20.0%			
Total indirect costs (IC)	$2,469,000					
Allowance for Funds Used During Construction (AFDC)	$152,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)		
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$6,890,000					
Cost Effectiveness	*$13 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$128,000	(DC) X	3.0%			
Operating labor	$133,000		1 FTE and	132,901 $/year	Estimated manpower	
Total fixed annual costs	$261,000					
Variable annual costs				75 %	capacity factor	
Reagent (BPAC)	$3,541,000		490 lb/hr and	2200 $/ton		
Byproduct disposal cost	$24,000		490 lb/hr and	15 $/ton		
Auxiliary power	$32,000		220 kW and	0.02235 $/kWh		
Total variable annual costs	$3,597,000					
Total direct annual costs (DAC)	$3,858,000					
Indirect Annual Costs						
Cost for capital recovery	$839,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$839,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$4,697,000					

Trimble County

Plant Name: Trimble County
Unit: 1
MW 547
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$128,000,000	$234	$5,782,000	$21,360,000
PAC Injection	$6,451,000	$12	$4,413,000	$5,198,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$135,451,000	$248	$10,295,000	$26,780,000

TRIMBLE COUNTY UNIT 1 - PJFF COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$6,186,000			
Mechanical - Balance of Plant (BOP)	$17,720,000			
Electrical - Equipment, Raceway, Switchgears, MCC	$375,000			
Control - DCS Instrumentation	$417,000			
ID Fans	$2,493,000	Engineering Estimates		
Subtotal Purchase Contract	**$27,191,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$5,505,000			
Civil/Structural Construction - Sub-Structures	$2,092,000			
Mechanical/Chemical Construction	$20,936,000			
Electrical/Control Construction	$7,070,000			
Service Contracts & Construction Indirects	$341,000			
Demolition Costs	$3,050,000	Engineering Estimates		
Subtotal Construction Contracts	**$38,994,000**			
Construction Difficulty Costs	**$46,793,000**	Engineering Estimates		
Total Direct Costs	**$112,978,000**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$7,092,000			
EPC Construction Management (Includes G&A & Fee)	$4,641,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$701,000			
Sales Taxes	$250,000			
Project Contingency - 18%	$2,613,000			
Total Indirect Costs	**$15,297,000**			
Total Contracted Costs	$128,000,000			
Cost Effectiveness	*$234 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	85%	
Maintenance labor and materials	$3,840,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$3,840,000**			
Variable Annual Costs				
Byproduct disposal	$0	0 lb/hr and	15	$/ton
Bag replacement cost	$785,000	23,550 bags and	100	$/bag
Cage replacement cost	$393,000	23,550 cages and	50	$/cage
ID fan power	$588,000	3,395 kW and	0.02325	$/kWh
Auxiliary power	$176,000	1,015 kW and	0.02325	$/kWh
Subtotal Variable Annual Costs	$1,942,000			
Total Annual Costs	$5,782,000			
Levelized Capital Costs	**$15,578,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$21,360,000			

Trimble County Unit 1
547 MW
High Level Emissions Control Study

Technology: PAC Injection | **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$418,928	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$275,295	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$383,020	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$47,877	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$179,540	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$1,149,059	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$59,847	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,513,567				
Freight	$63,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,577,000				
Direct installation costs					
Foundation & supports	$258,000	(PEC) X	10.0%		
Handling & erection	$515,000	(PEC) X	20.0%		
Electrical	$258,000	(PEC) X	10.0%		
Piping	$129,000	(PEC) X	5.0%		
Insulation	$52,000	(PEC) X	2.0%		
Painting	$129,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,341,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,993,000				
Indirect Costs					
Engineering	$479,000	(DC) X	12.0%		
Owner's cost	$479,000	(DC) X	12.0%		
Construction management	$399,000	(DC) X	10.0%		
Start-up and spare parts	$60,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$799,000	(DC) X	20.0%		
Total indirect costs (IC)	$2,316,000				
Allowance for Funds Used During Construction (AFDC)	$142,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$6,451,000**				
Cost Effectiveness	***$12 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$120,000	(DC) X	3.0%		
Operating labor	$132,000		1 FTE and	132,491 $/year	Estimated manpower
Total fixed annual costs	$252,000				
Variable annual costs				85 %	capacity factor
Reagent (BPAC)	$4,095,000		500 lb/hr and	2200 $/ton	
Byproduct disposal cost	$28,000		500 lb/hr and	15 $/ton	
Auxiliary power	$38,000		220 kW and	0.02325 $/kWh	
Total variable annual costs	$4,161,000				
Total direct annual costs (DAC)	$4,413,000				
Indirect Annual Costs					
Cost for capital recovery	$785,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$785,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$5,198,000**				

Green River

Plant Name: Green River
Unit: 3
MW 71
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$29,000,000	$408	$1,040,000	$4,569,000
CDS-FF	$38,000,000	$535	$6,874,000	$11,499,000
PAC Injection	$1,112,000	$16	$323,000	$458,000
Neural Networks	$500,000	$7	$50,000	$111,000
Total	$68,612,000	$966	$8,287,000	$16,637,000

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GREEN RIVER UNIT 3 - SCR COSTS

CAPITAL COST

Purchase Contracts					
Civil/Structural	$2,126,000				
Ductwork and Breeching	$1,642,000				
Mechanical - Balance of Plant (BOP)	$538,000				
Electrical - Equipment, Raceway	$614,000				
VFDs, Motors and Couplings	$500,000	Engineering Estimates			
Switchgear and MCCs	$215,000				
Control - DCS Instrumentation	$69,000				
Air Heater	$1,638,000	Engineering Estimates			
ID Fans	$718,534	Engineering Estimates			
Catalyst	$864,000				
Selective Catalytic Reduction System (Including Ammonia System)	$753,000				
Subtotal Purchase Contract	**$9,677,534**				
Construction Contracts					
Civil/Structural Construction - Super Structures	$1,309,000				
Civil/Structural Construction - Sub-Structures	$340,000				
Mechanical/Chemical Construction	$4,113,000				
Electrical/Control Construction	$1,881,000				
Service Contracts & Construction Indirects	$6,571,000				
Demolition Costs	$395,000	Engineering Estimates			
Subtotal Construction Contracts	**$14,609,000**				
Construction Difficulty Costs	**$0**	Engineering Estimates			
Total Direct Costs	**$24,286,534**				
Indirect Costs					
Engineering Costs (Includes G&A & Fee)	$1,063,000				
EPC Construction Management (Includes G&A & Fee)	$667,000				
Startup Spare Parts (Included)	$0				
Construction Utilites (Power & Water) - Included	$0				
Project Insurance	$175,000				
Sales Taxes	$247,000				
Project Contingency	$2,495,000				
Total Indirect Costs	**$4,647,000**				
Total Contracted Costs	**$29,000,000**				
Capital Cost Effectiveness	***$408***	***/kW***			

ANNUAL COST

			Capacity Factor =	26%	
Fixed Annual Costs					
Operating labor	$122,000	1 FTE and	121,547	$/year	
Maintenance labor & materials	$729,000	(DC) X 3.0%			
Yearly emissions testing	$25,000	Engineering Estimates			
Catalyst activity testing	$5,000	Engineering Estimates			
Fly ash sampling and analysis	$20,000	Engineering Estimates			
Subtotal Fixed Annual Costs	**$901,000**				
Variable Annual Costs					
Reagent	$60,000	100 lb/hr and	530.03	$/ton	
Auxiliary and ID fan power	$37,000	470 kW and	0.03433	$/kWh	
Catalyst replacement	$42,000	25 m3 and	6,500	$/m3	
Subtotal Variable Annual Costs	**$139,000**				
Total Annual Costs	**$1,040,000**				
Levelized Capital Costs	**$3,529,000**	(TCI) X 12.17%	CRF		
Levelized Annual Costs	**$4,569,000**				

GREEN RIVER UNIT 3 - CDS-FF COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$863,000			
Ductwork and Breeching	$554,000			
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$114,000			
Electrical - Equipment, Raceway	$660,000			
Cable Bus	$180,000			
Switchgear and MCCs	$252,000			
Control - DCS Instrumentation	$166,000			
CDS Fabric Filter	$9,704,000			
ID Fans	$663,263	Engineering Estimates		
Subtotal Purchase Contract	**$13,156,263**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$2,627,000			
Civil/Structural Construction - Sub-Structures	$1,780,000			
Mechanical/Chemical Construction	$3,996,000			
Electrical/Control Construction	$1,517,000			
Service Contracts & Construction Indirects	$7,004,000			
Subtotal Construction Contracts	**$16,924,000**			
Construction Difficulty Costs	**$0**	Engineering Estimates		
Total Direct Costs	**$30,080,263**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$2,623,000			
EPC Construction Management (Includes G&A & Fee)	$1,038,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$272,000			
Sales Taxes	$502,000			
Project Contingency	$3,858,000			
Total Indirect Costs	**$8,293,000**			
Total Contracted Costs	$38,000,000			
Cost Effectiveness	*$535 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	26%	
Operating labor	$1,459,000	12 FTE and	121,547	$/year
Maintenance labor and materials	$902,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$2,361,000**			
Variable Annual Costs				
Reagent	$3,431,000	22,790 lb/hr and	132.19	$/ton
Byproduct disposal	$914,000	53,535 lb/hr and	15	$/ton
Auxiliary and ID fan power	$138,000	1,760 kW and	0.03433	$/kWh
Water	$30,000	110 gpm and	2	$/1,000 gal
Subtotal Variable Annual Costs	$4,513,000			
Total Annual Costs	$6,874,000			
Levelized Capital Costs	**$4,625,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$11,499,000			

Green River Unit 3
71 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$60,000	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$39,000	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$55,000	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$7,000	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$26,000	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$0	From Ductwork Cost Calc				
Electrical system upgrades	$164,000	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$9,000	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$360,000					
Freight	$9,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$369,000					
Direct installation costs						
Foundation & supports	$37,000	(PEC) X	10.0%			
Handling & erection	$74,000	(PEC) X	20.0%			
Electrical	$37,000	(PEC) X	10.0%			
Piping	$18,000	(PEC) X	5.0%			
Insulation	$7,000	(PEC) X	2.0%			
Painting	$18,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$191,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$635,000					
Indirect Costs						
Engineering	$76,000	(DC) X	12.0%			
Owner's cost	$76,000	(DC) X	12.0%			
Construction management	$64,000	(DC) X	10.0%			
Start-up and spare parts	$10,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$127,000	(DC) X	20.0%			
Total indirect costs (IC)	$453,000					
Allowance for Funds Used During Construction (AFDC)	$24,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$1,112,000					
Cost Effectiveness	*$16 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$19,000	(DC) X	3.0%			
Operating labor	$122,000		1 FTE and	121,547 $/year		Estimated manpower
Total fixed annual costs	$141,000					
Variable annual costs				26 %		capacity factor
Reagent (BPAC)	$175,000		70 lb/hr and	2200 $/ton		
Byproduct disposal	$1,000		70 lb/hr and	15 $/ton		
Auxiliary power	$6,000		75 kW and	0.03433 $/kWh		
Total variable annual costs	$182,000					
Total direct annual costs (DAC)	$323,000					
Indirect Annual Costs						
Cost for capital recovery	$135,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$135,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$458,000					

Plant Name:	Green River
Unit:	4
MW	109
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$42,000,000	$385	$1,442,000	$6,553,000
CDS-FF	$54,000,000	$495	$10,289,000	$16,861,000
PAC Injection	$1,583,000	$15	$515,000	$708,000
Neural Networks	$500,000	$5	$50,000	$111,000
Total	$98,083,000	$900	$12,296,000	$24,233,000

GREEN RIVER UNIT 4 - SCR COSTS

CAPITAL COST

Purchase Contracts					
Civil/Structural	$3,138,000				
Ductwork and Breeching	$2,423,000				
Mechanical - Balance of Plant (BOP)	$794,000				
Electrical - Equipment, Raceway	$906,000				
VFDs, Motors and Couplings	$500,000	Engineering Estimates			
Switchgear and MCCs	$317,000				
Control - DCS Instrumentation	$102,000				
Air Heater	$1,638,000	Engineering Estimates			
ID Fans	$1,207,000	Engineering Estimates			
Catalyst	$1,275,000				
Selective Catalytic Reduction System (Including Ammonia System)	$1,112,000				
Subtotal Purchase Contract	**$13,412,000**				
Construction Contracts					
Civil/Structural Construction - Super Structures	$1,932,000				
Civil/Structural Construction - Sub-Structures	$502,000				
Mechanical/Chemical Construction	$6,072,000				
Electrical/Control Construction	$2,777,000				
Service Contracts & Construction Indirects	$9,700,000				
Demolition Costs	$606,000	Engineering Estimates			
Subtotal Construction Contracts	**$21,589,000**				
Construction Difficulty Costs	**$0**	Engineering Estimates			
Total Direct Costs	**$35,001,000**				
Indirect Costs					
Engineering Costs (Includes G&A & Fee)	$1,632,000				
EPC Construction Management (Includes G&A & Fee)	$1,024,000				
Startup Spare Parts (Included)	$0				
Construction Utilites (Power & Water) - Included	$0				
Project Insurance	$269,000				
Sales Taxes	$380,000				
Project Contingency	$3,831,000				
Total Indirect Costs	**$7,136,000**				
Total Contracted Costs	**$42,000,000**				
Capital Cost Effectiveness	***$385***	***/kW***			

ANNUAL COST

			Capacity Factor =	32%	
Fixed Annual Costs					
Operating labor	$122,000	1	FTE and	121,547	$/year
Maintenance labor & materials	$1,050,000	(DC) X 3.0%			
Yearly emissions testing	$25,000	Engineering Estimates			
Catalyst activity testing	$5,000	Engineering Estimates			
Fly ash sampling and analysis	$20,000	Engineering Estimates			
Subtotal Fixed Annual Costs	**$1,222,000**				
Variable Annual Costs					
Reagent	$93,000	125	lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$65,000	725	kW and	0.03187	$/kWh
Catalyst replacement	$62,000	30	m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$220,000**				
Total Annual Costs	**$1,442,000**				
Levelized Capital Costs	**$5,111,000**	(TCI) X 12.17%	CRF		
Levelized Annual Costs	**$6,553,000**				

GREEN RIVER UNIT 4 - CDS-FF COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$1,190,000			
Ductwork and Breeching	$764,000			
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$158,000			
Electrical - Equipment, Raceway	$910,000			
Cable Bus	$249,000			
Switchgear and MCCs	$348,000			
Control - DCS Instrumentation	$229,000			
CDS Fabric Filter	$13,384,000			
ID Fans	$1,114,350	Engineering Estimates		
Subtotal Purchase Contract	**$18,346,350**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$3,623,000			
Civil/Structural Construction - Sub-Structures	$2,454,000			
Mechanical/Chemical Construction	$5,511,000			
Electrical/Control Construction	$2,092,000			
Service Contracts & Construction Indirects	$9,660,000			
Subtotal Construction Contracts	**$23,340,000**			
Construction Difficulty Costs	**$0**	Engineering Estimates		
Total Direct Costs	**$41,686,350**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$4,027,000			
EPC Construction Management (Includes G&A & Fee)	$1,593,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$418,000			
Sales Taxes	$770,000			
Project Contingency	$5,923,000			
Total Indirect Costs	**$12,731,000**			
Total Contracted Costs	$54,000,000			
Cost Effectiveness	*$495 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	32%	
Operating labor	$1,459,000	12 FTE and	121,547	$/year
Maintenance labor and materials	$1,251,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$2,710,000**			
Variable Annual Costs				
Reagent	$5,726,000	30,905 lb/hr and	132.19	$/ton
Byproduct disposal	$1,526,000	72,600 lb/hr and	15	$/ton
Auxiliary and ID fan power	$265,000	2,970 kW and	0.03187	$/kWh
Water	$62,000	185 gpm and	2	$/1,000 gal
Subtotal Variable Annual Costs	$7,579,000			
Total Annual Costs	$10,289,000			
Levelized Capital Costs	**$6,572,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$16,861,000			

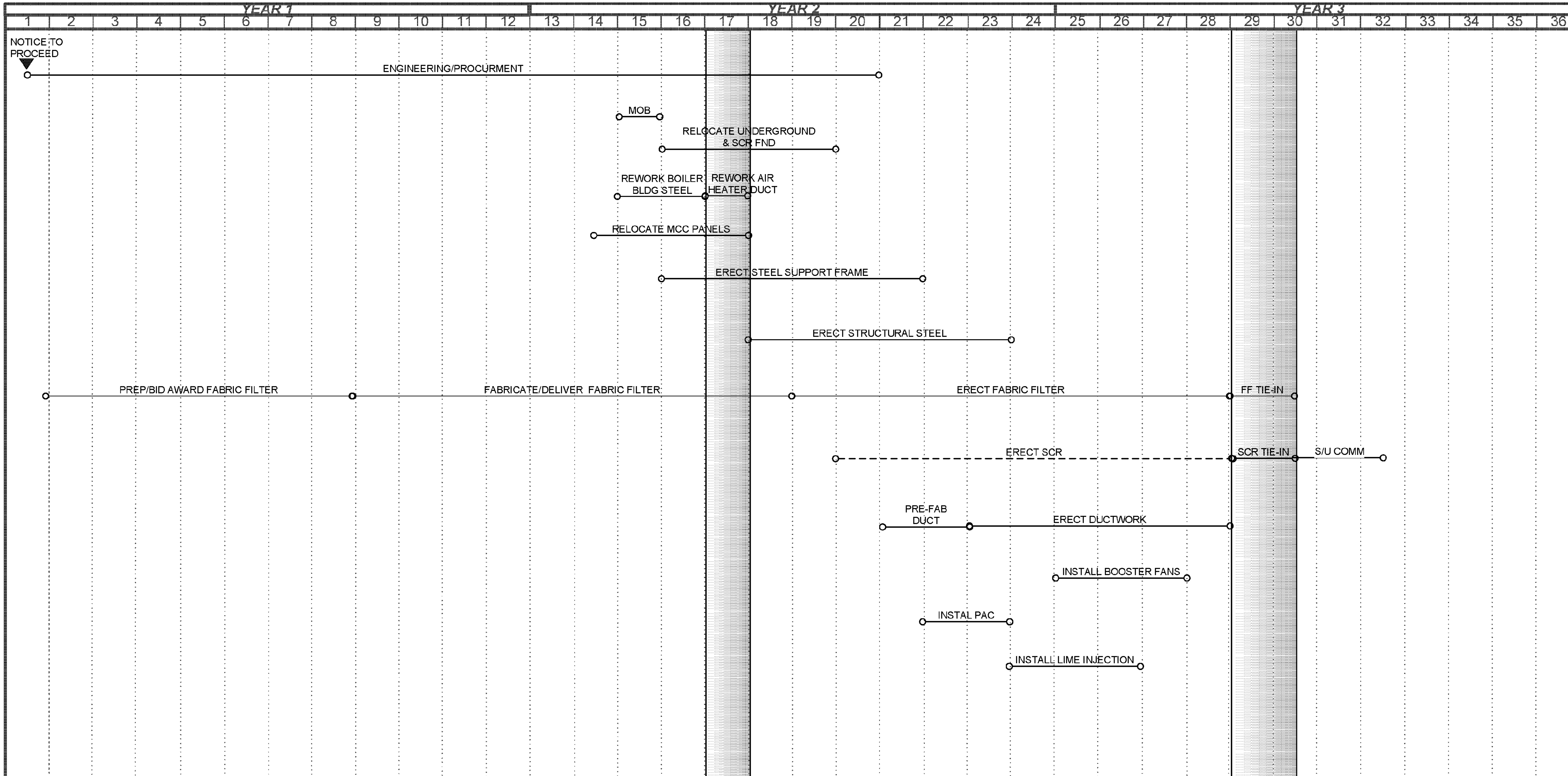
Green River Unit 4
109 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis				
CAPITAL COST						
Direct Costs						
Purchased equipment costs						
Long-term storage silo (with truck unloading sys.)	$92,000	Ratio from Brown Unit 3 BACT Analysis				
Short-term storage silo	$60,000	Ratio from Brown Unit 3 BACT Analysis				
Air blowers	$84,000	Ratio from Brown Unit 3 BACT Analysis				
Rotary feeders	$10,000	Ratio from Brown Unit 3 BACT Analysis				
Injection system	$39,000	Ratio from Brown Unit 3 BACT Analysis				
Ductwork modifications, supports, platforms	$0	From Ductwork Cost Calc				
Electrical system upgrades	$252,000	Ratio from Brown Unit 3 BACT Analysis				
Instrumentation and controls	$13,000	Ratio from Brown Unit 3 BACT Analysis				
Subtotal capital cost (CC)	$550,000					
Freight	$14,000	(CC) X	2.5%			
Total purchased equipment cost (PEC)	$564,000					
Direct installation costs						
Foundation & supports	$56,000	(PEC) X	10.0%			
Handling & erection	$113,000	(PEC) X	20.0%			
Electrical	$56,000	(PEC) X	10.0%			
Piping	$28,000	(PEC) X	5.0%			
Insulation	$11,000	(PEC) X	2.0%			
Painting	$28,000	(PEC) X	5.0%			
Demolition	$0	(PEC) X	0.0%			
Relocation	$0	(PEC) X	0.0%			
Total direct installation costs (DIC)	$292,000					
Site preparation	$0	N/A				
Buildings	$75,000	Engineering estimate				
Total direct costs (DC) = (PEC) + (DIC)	$931,000					
Indirect Costs						
Engineering	$112,000	(DC) X	12.0%			
Owner's cost	$112,000	(DC) X	12.0%			
Construction management	$93,000	(DC) X	10.0%			
Start-up and spare parts	$14,000	(DC) X	1.5%			
Performance test	$100,000	Engineering estimate				
Contingencies	$186,000	(DC) X	20.0%			
Total indirect costs (IC)	$617,000					
Allowance for Funds Used During Construction (AFDC)	$35,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)		
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$1,583,000					
Cost Effectiveness	*$15 /kW*					
ANNUAL COST						
Direct Annual Costs						
Fixed annual costs						
Maintenance labor and materials	$28,000	(DC) X	3.0%			
Operating labor	$122,000		1 FTE and	121,547 $/year	Estimated manpower	
Total fixed annual costs	$150,000					
Variable annual costs				32 %	capacity factor	
Reagent (BPAC)	$355,000		115 lb/hr and	2200 $/ton		
Byproduct disposal	$2,000		115 lb/hr and	15 $/ton		
Auxiliary power	$8,000		90 kW and	0.03187 $/kWh		
Total variable annual costs	$365,000					
Total direct annual costs (DAC)	$515,000					
Indirect Annual Costs						
Cost for capital recovery	$193,000	(TCI) X	12.17%	CRF		
Total indirect annual costs (IDAC)	$193,000					
Total Annual Cost (TAC) = (DAC) + (IDAC)	$708,000					

Appendix I
Level 1 Schedules

E.W. Brown



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Engineer	Drawn
	S. CARUTHERS
Checked	**Date**
T. VANGILDER	JUNE 07, 2010

E.W. BROWN UNIT 1
OPTIONAL SCR & FABRIC FILTER

LEVEL 1 SCHEDULE

Drawing Number - REV 0

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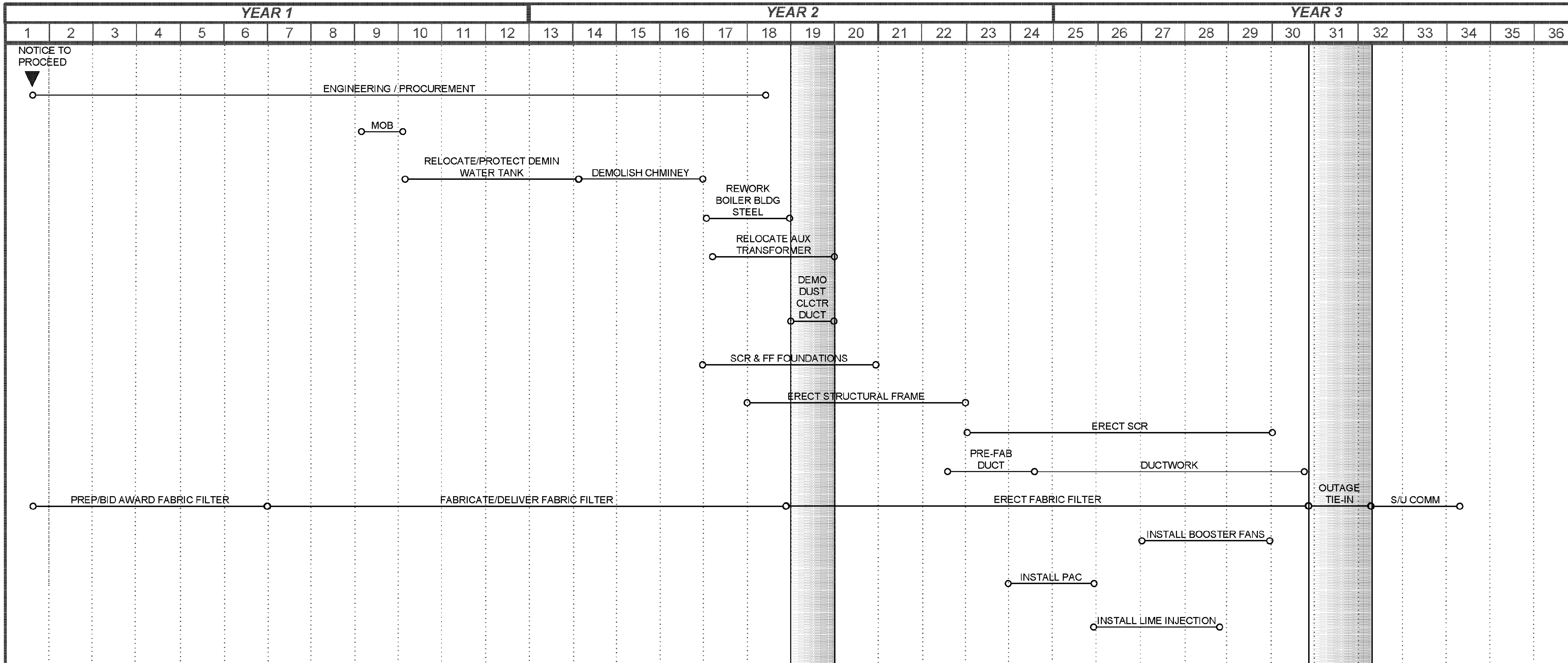

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	S. CARUTHERS
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E.W. BROWN UNIT 2
SCR & FABRIC FILTER

LEVEL 1 SCHEDULE

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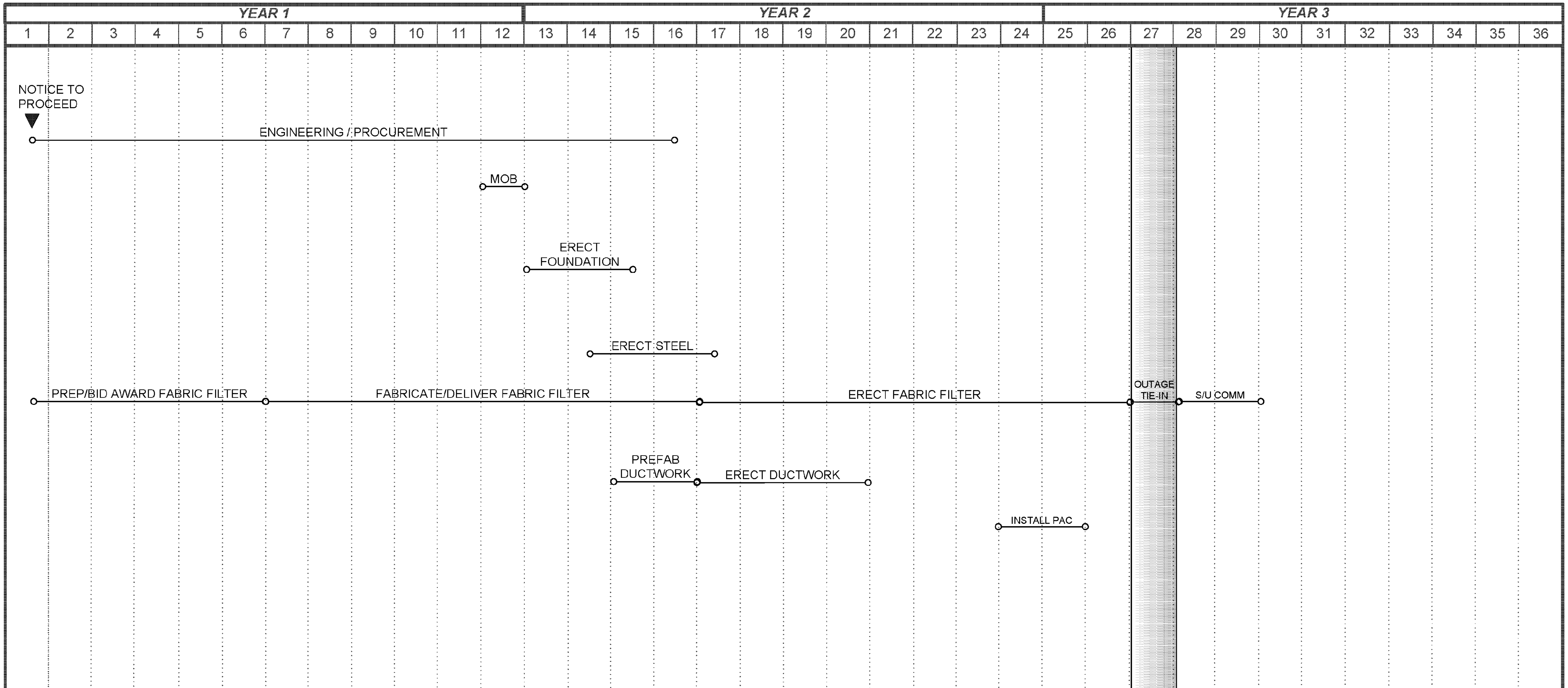

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E.W. BROWN UNIT 3
FABRIC FILTER

LEVEL 1 SCHEDULE

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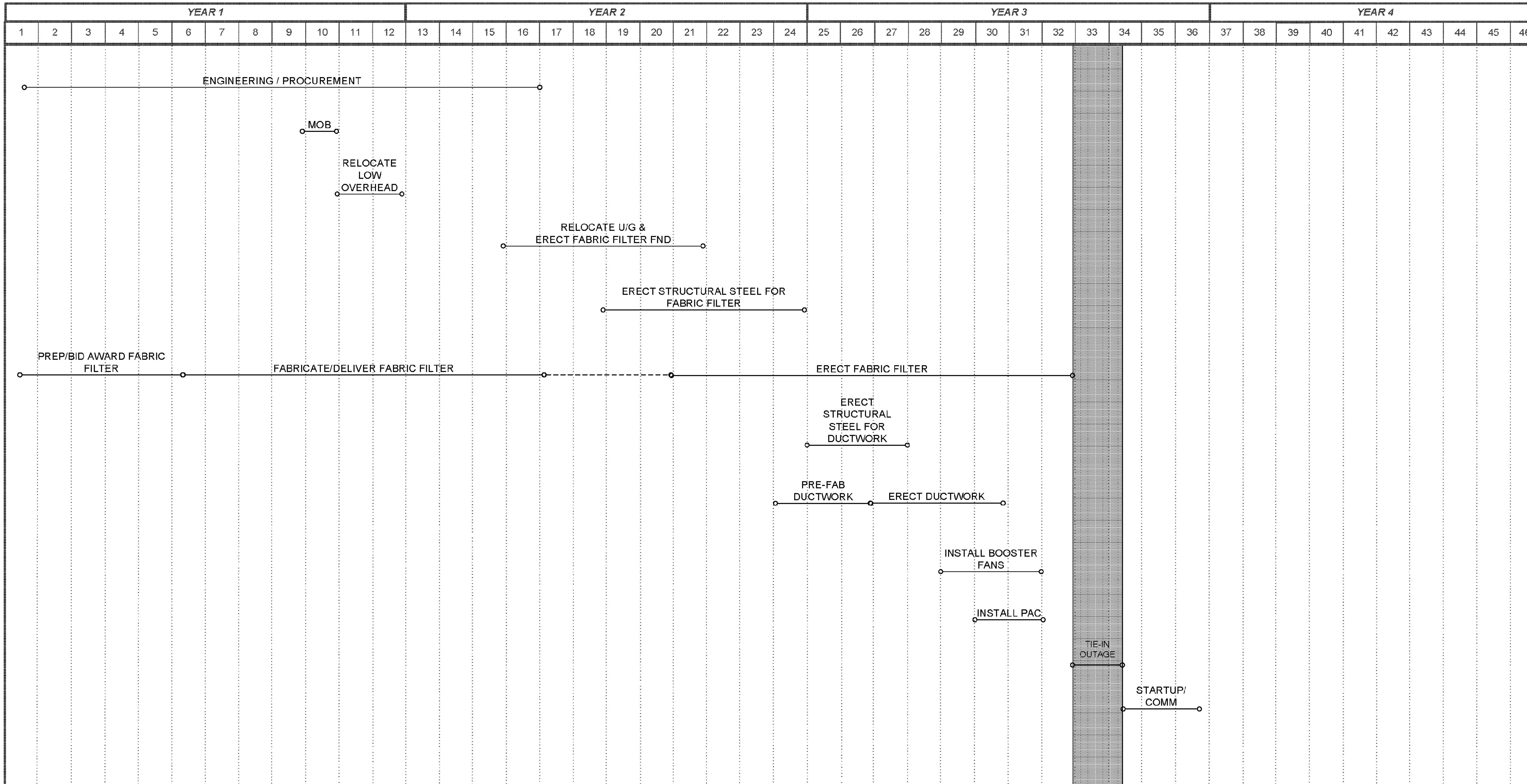
Ghent



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GHENT UNIT 1
FABRIC FILTER

LEVEL 1 SCHEDULE

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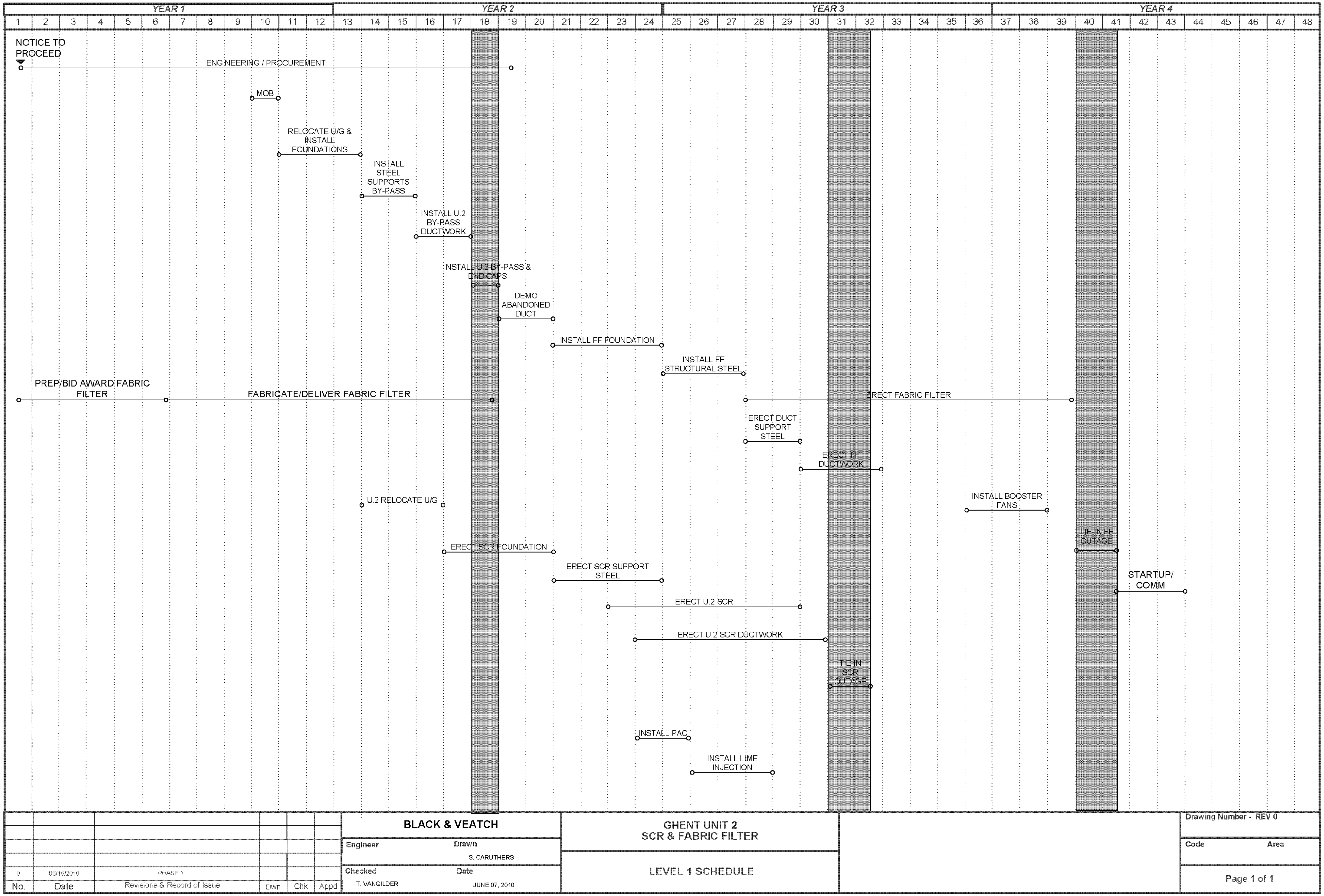
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YEAR 2
YEAR 3
YEAR 4
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NOTICE TO PROCEED
ENGINEERING / PROCUREMENT
MOB
RELOCATE U/G & INSTALL FOUNDATIONS
INSTALL STEEL SUPPORTS BY-PASS
INSTALL U.2 BY-PASS DUCTWORK
INSTALL U.2 BY-PASS & END CAPS
DEMO ABANDONED DUCT
INSTALL FF FOUNDATION
INSTALL FF STRUCTURAL STEEL
PREP/BID AWARD FABRIC FILTER
FABRICATE/DELIVER FABRIC FILTER
ERECT FABRIC FILTER
ERECT DUCT SUPPORT STEEL
ERECT FF DUCTWORK
U.2 RELOCATE U/G
INSTALL BOOSTER FANS
TIE-IN FF OUTAGE
ERECT SCR FOUNDATION
STARTUP/ COMM
ERECT SCR SUPPORT STEEL
ERECT U.2 SCR
ERECT U.2 SCR DUCTWORK
TIE-IN SCR OUTAGE
INSTALL PAC
INSTALL LIME INJECTION
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LEVEL 1 SCHEDULE
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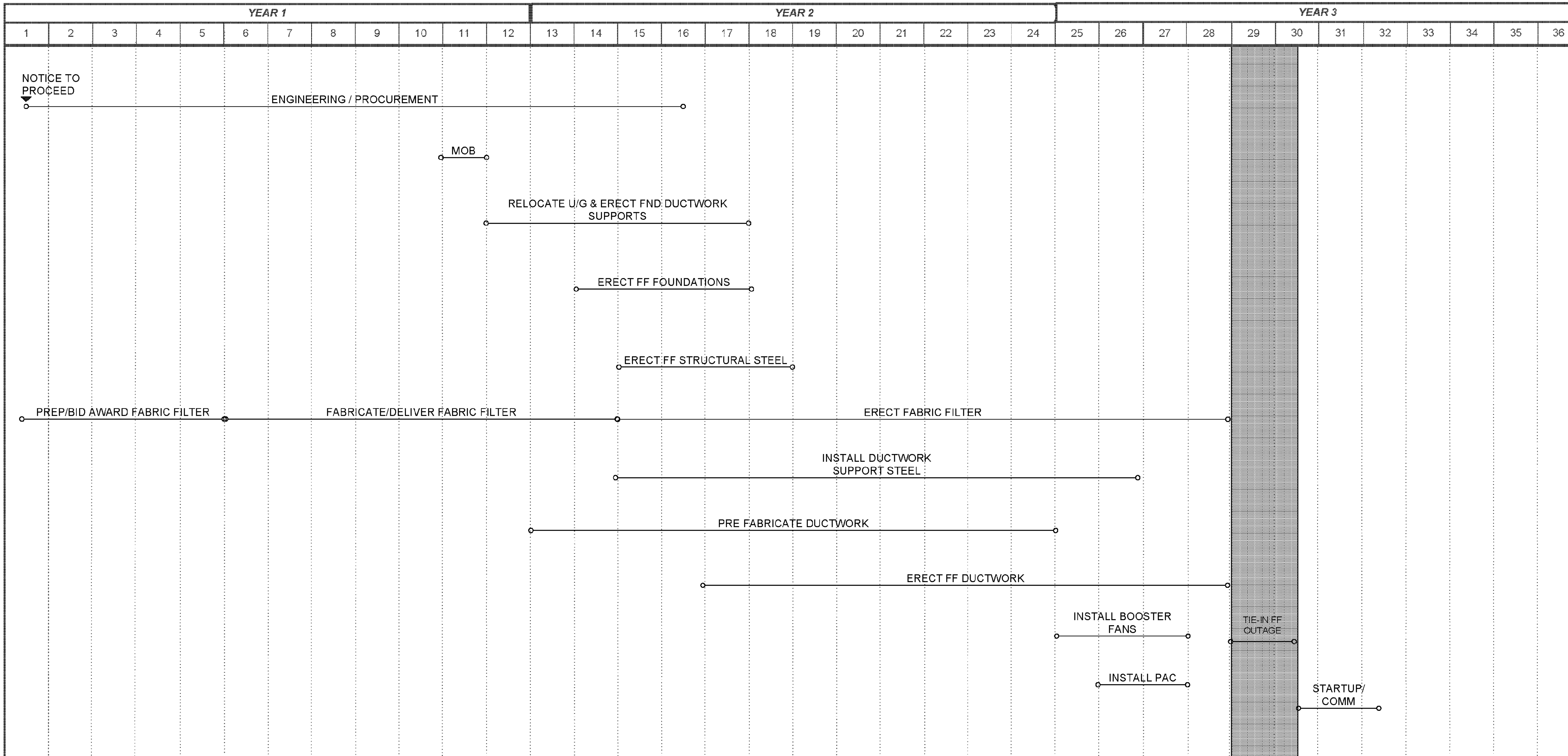
Page 1 of 1



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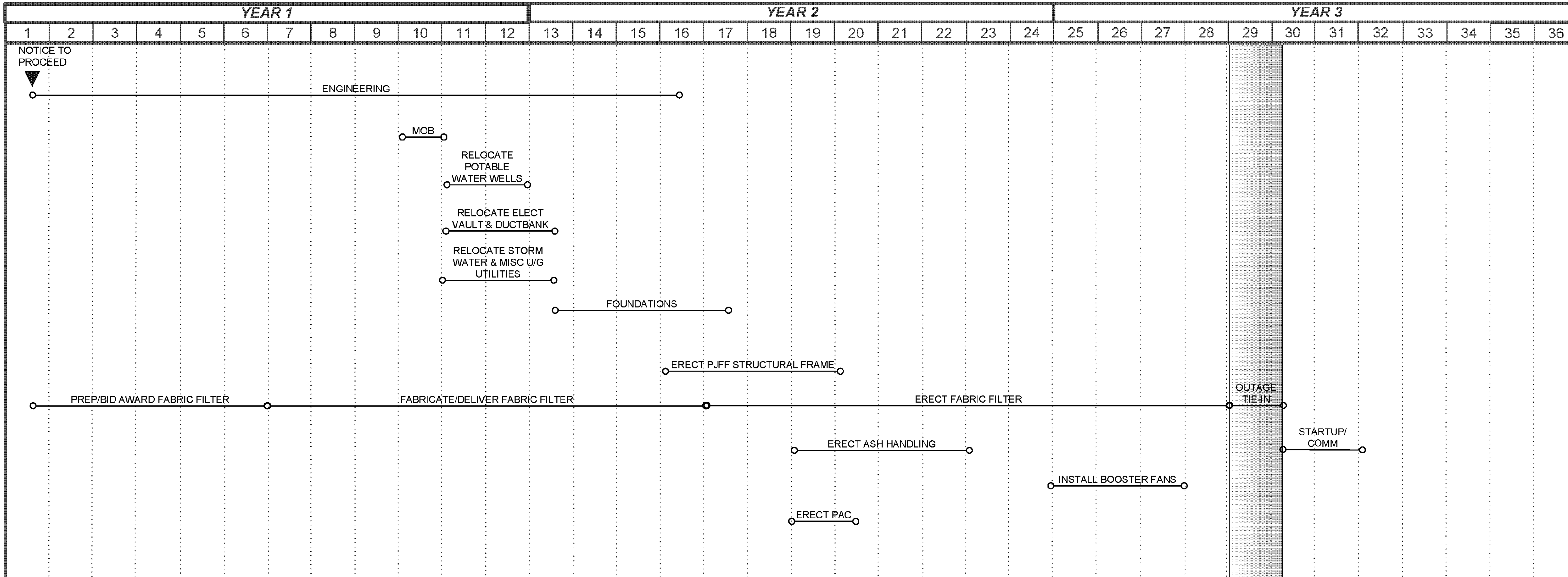

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LEVEL 1 SCHEDULE

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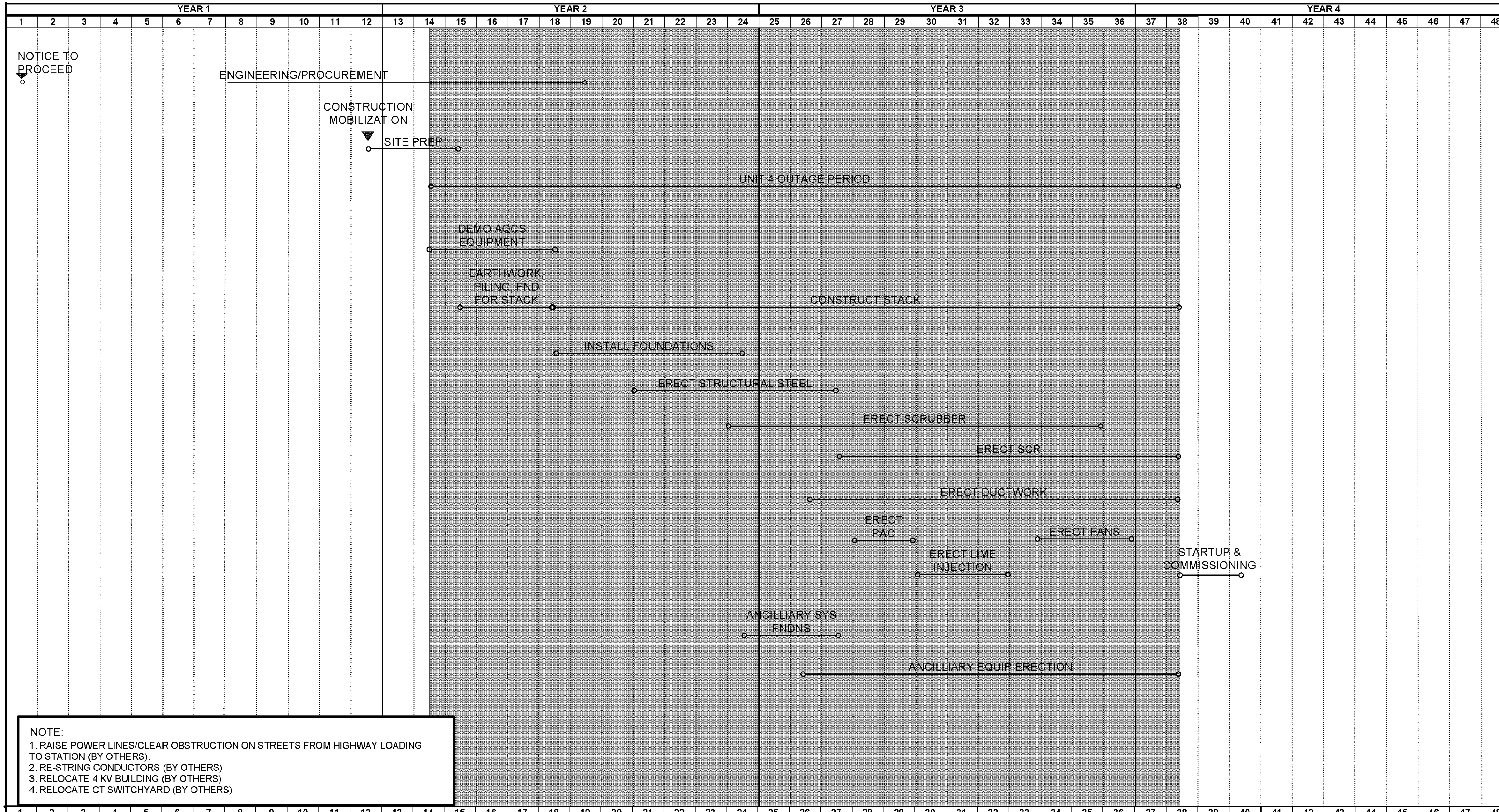
Cane Run



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ENGINEER

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DATE 06/03/2010

CANE RUN UNIT 4
SCR & SCRUBBER

LEVEL 1 SUMMARY SCHEDULE

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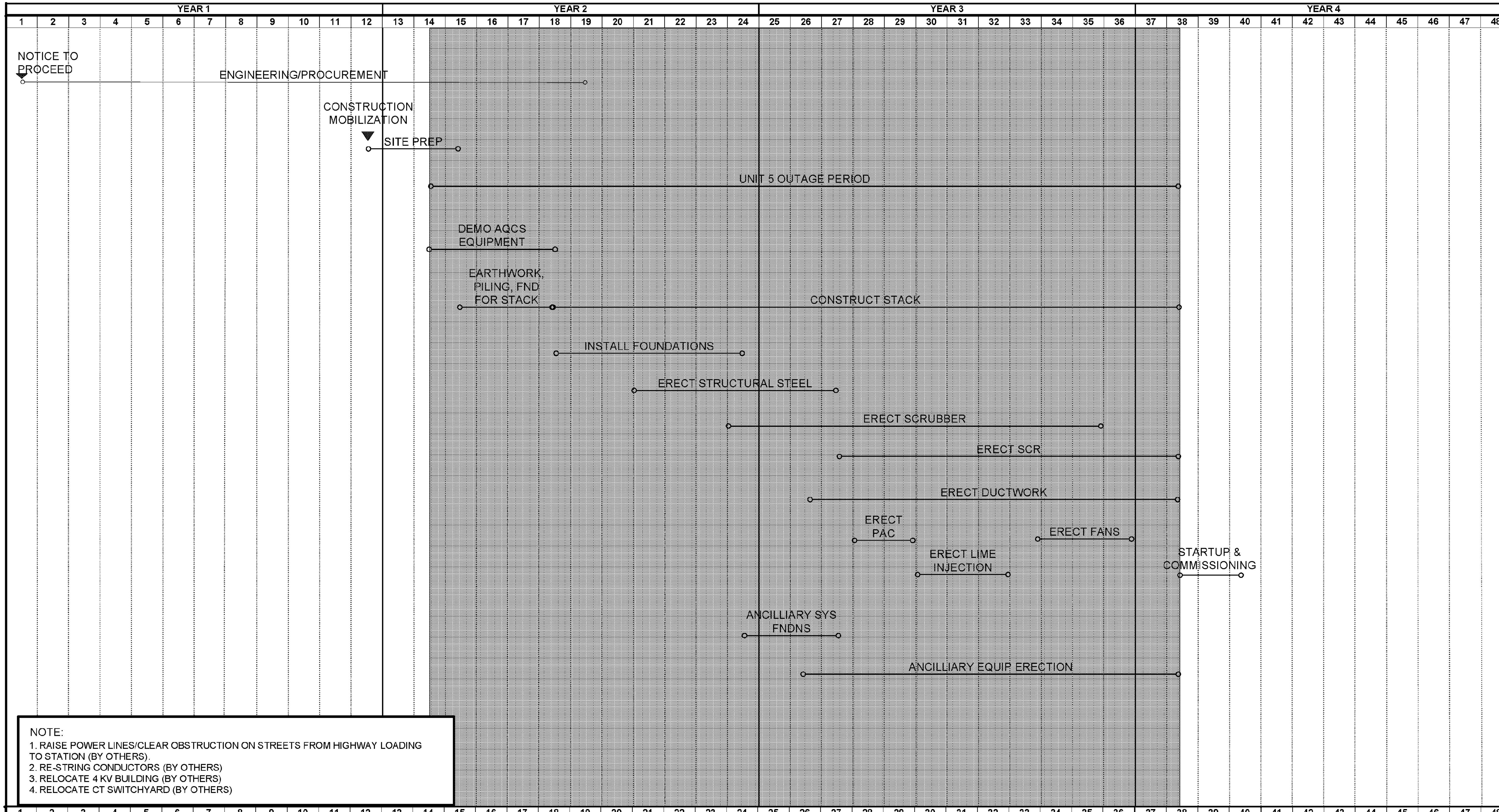

NOTE:
1. RAISE POWER LINES/CLEAR OBSTRUCTION ON STREETS FROM HIGHWAY LOADING TO STATION (BY OTHERS).
2. RE-STRING CONDUCTORS (BY OTHERS)
3. RELOCATE 4 KV BUILDING (BY OTHERS)
4. RELOCATE CT SWITCHYARD (BY OTHERS)

NO.	DATE	REVISIONS & RECORD OF ISSUE	DWN	CHK	APP	FLM
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FILE NAME

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DATE 06/03/2010

CANE RUN UNIT 5
SCR & SCRUBBER

LEVEL 1 SUMMARY SCHEDULE

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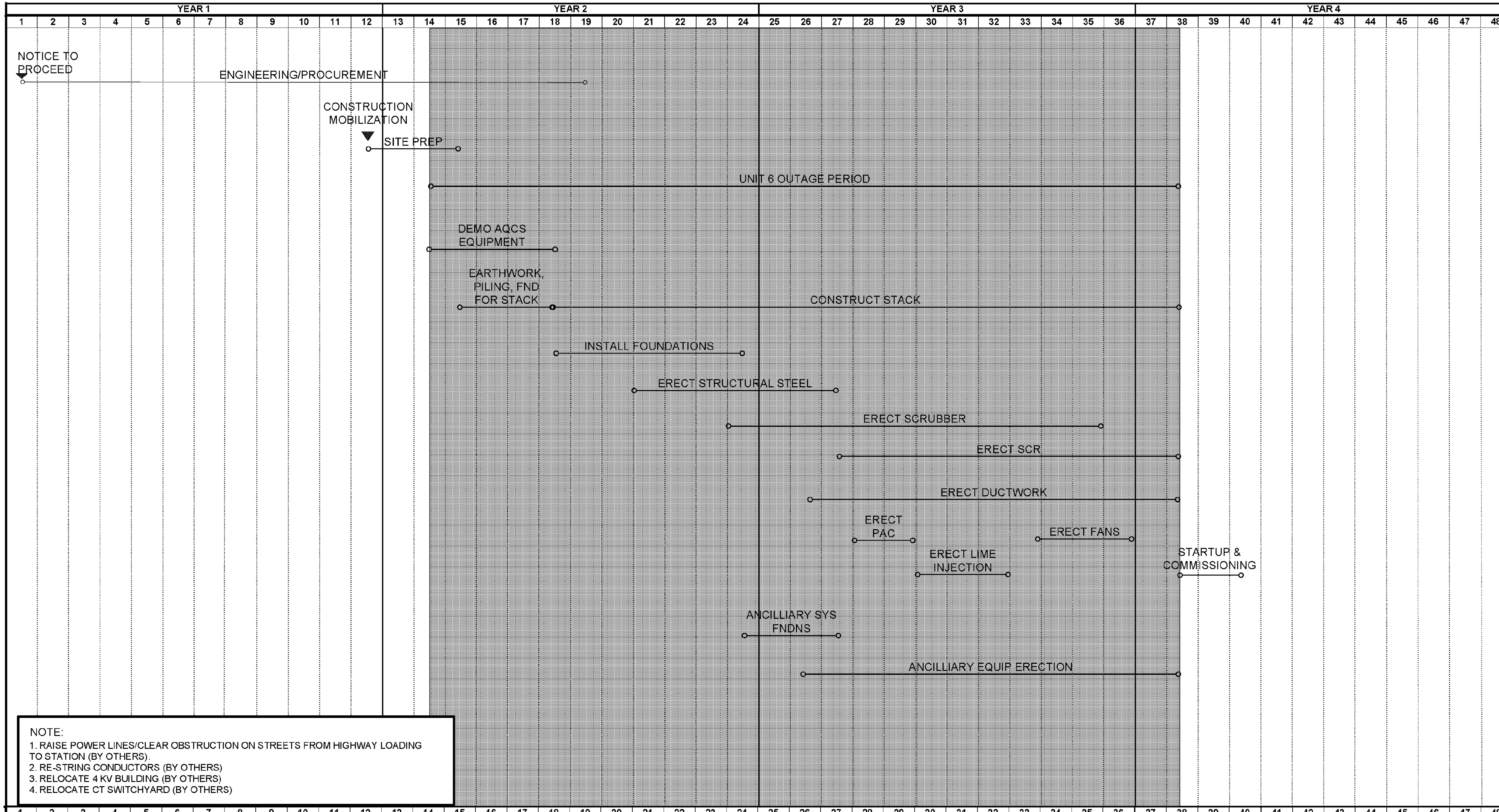

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CANE RUN UNIT 6
SCR & SCRUBBER

LEVEL 1 SUMMARY SCHEDULE

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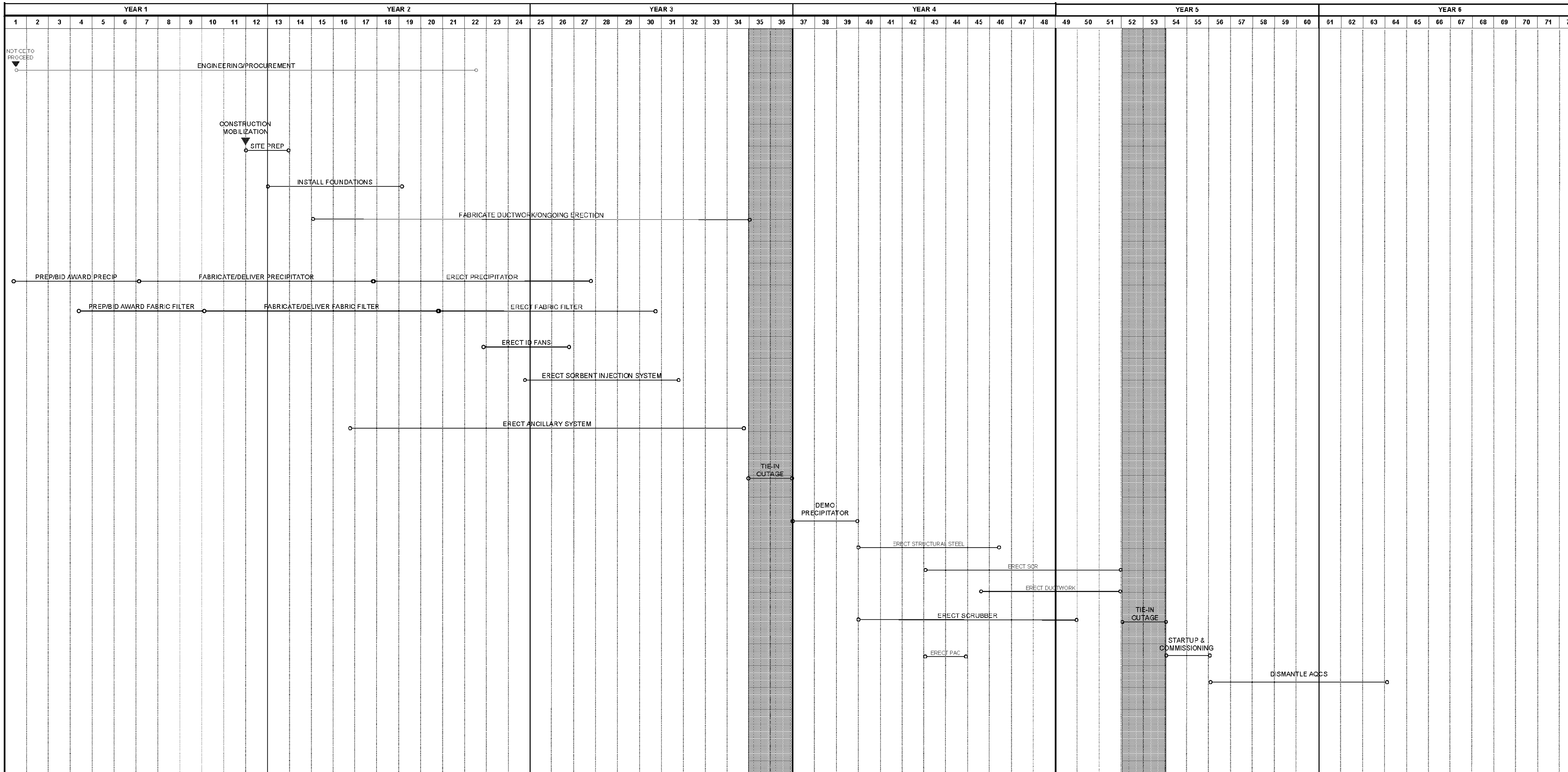
Mill Creek



NOTE:

1. A/G UTILITIES/RELOCATION (BY OTHERS)
2. U/G UTILITIES/RELOCATION (BY OTHERS)
3. MOVE LOADING DOCK (BY OTHERS)
4. MOVE MAINT. BLDG (BY OTHERS)
5. TRANSMISSION TOWERS/RESTORE CONDUCTORS

NO.	DATE	REVISIONS & RECORD OF ISSUE	DWN	CHK	APP	FLM
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DATE 06/03/2010

MILL CREEK UNIT 1
SCRUBBER, ESP, FABRIC FILTER, & SCR

LEVEL 1 SUMMARY SCHEDULE

DRAWING NUMBER

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AREA

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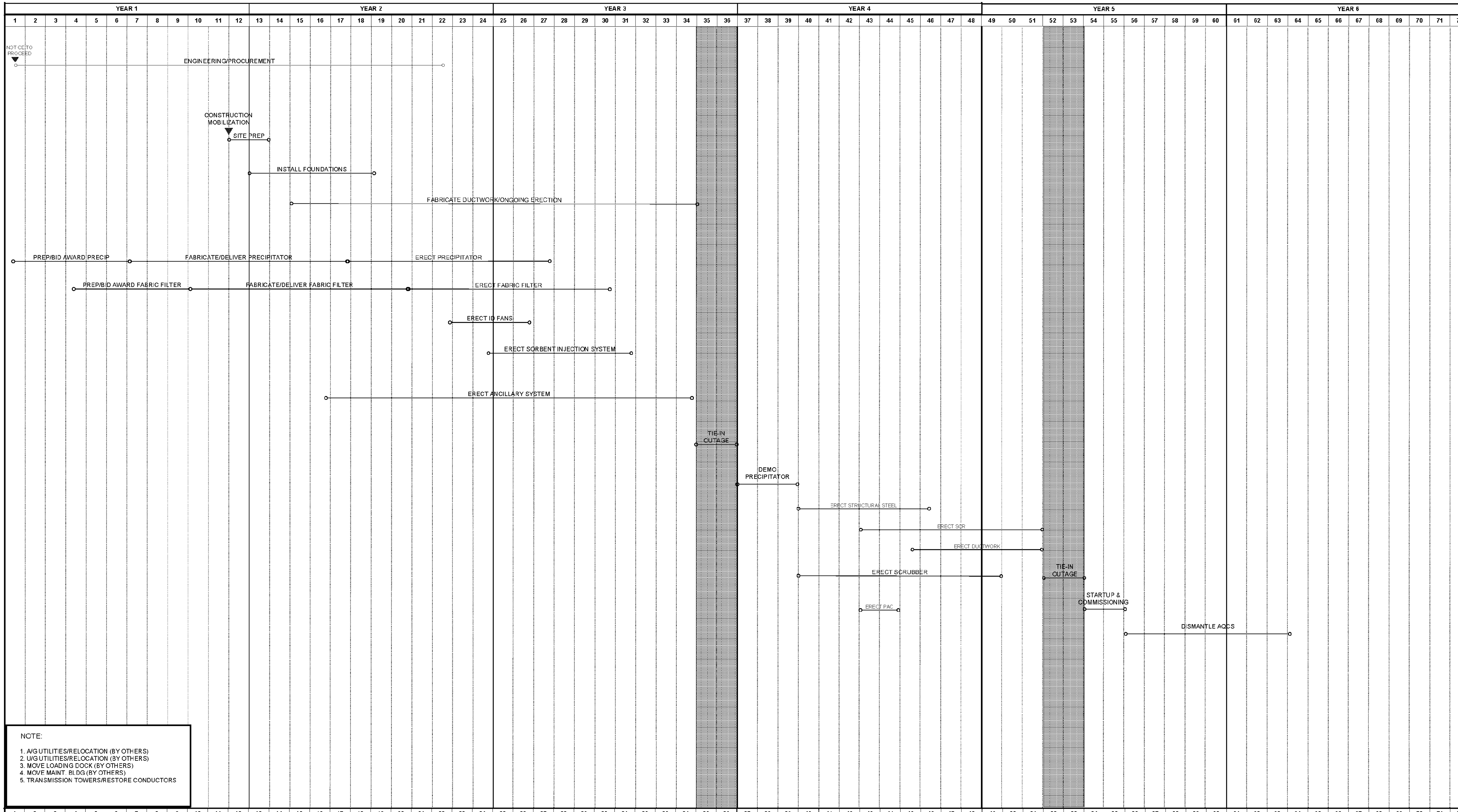

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BLACK & VEATCH CORPORATION

ENGINEER

DRAWN S. CARUTHERS

CHECKED

DATE 06/03/2010

MILL CREEK UNIT 2
SCRUBBER, ESP, FABRIC FILTER, & SCR

LEVEL 1 SUMMARY SCHEDULE

DRAWING NUMBER REV 0

CODE

AREA

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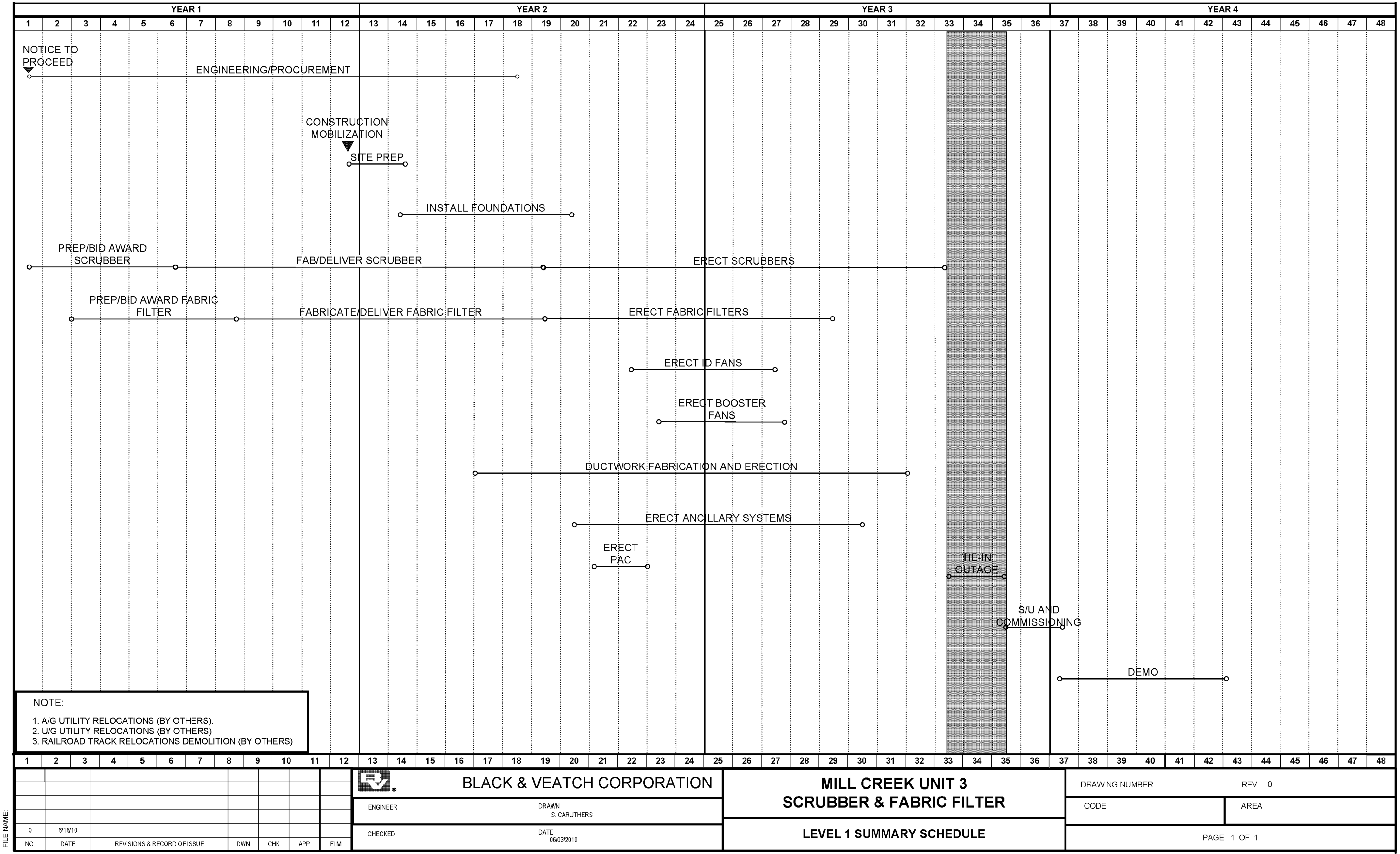
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YEAR 2
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YEAR 4
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NOTICE TO PROCEED
ENGINEERING/PROCUREMENT
CONSTRUCTION MOBILIZATION
SITE PREP
INSTALL FOUNDATIONS
PREP/BID AWARD SCRUBBER
FAB/DELIVER SCRUBBER
ERECT SCRUBBERS
PREP/BID AWARD FABRIC FILTER
FABRICATE/DELIVER FABRIC FILTER
ERECT FABRIC FILTERS
ERECT ID FANS
ERECT BOOSTER FANS
DUCTWORK FABRICATION AND ERECTION
ERECT ANCILLARY SYSTEMS
ERECT PAC
TIE-IN OUTAGE
S/U AND COMMISSIONING
DEMO
NOTE:
1. A/G UTILITY RELOCATIONS (BY OTHERS).
2. U/G UTILITY RELOCATIONS (BY OTHERS)
3. RAILROAD TRACK RELOCATIONS DEMOLITION (BY OTHERS)
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NO. DATE REVISIONS & RECORD OF ISSUE DWN CHK APP FLM
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ENGINEER
DRAWN S. CARUTHERS
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DATE 06/03/2010
MILL CREEK UNIT 3
SCRUBBER & FABRIC FILTER
LEVEL 1 SUMMARY SCHEDULE
DRAWING NUMBER
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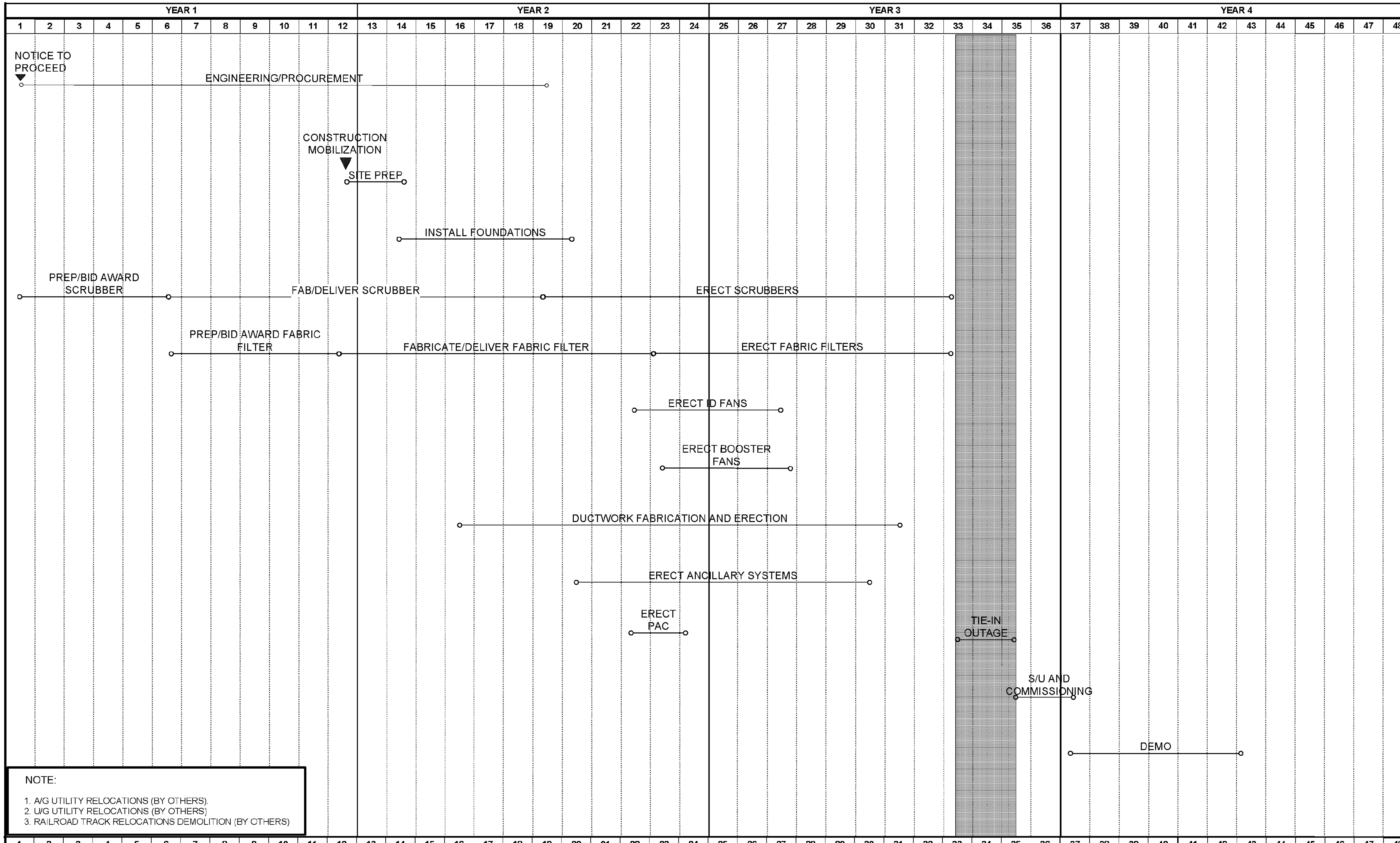

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BLACK & VEATCH CORPORATION

ENGINEER

DRAWN S. CARUTHERS

CHECKED

DATE 06/03/2010

MILL CREEK UNIT 4
SCRUBBER & FABRIC FILTER

LEVEL 1 SUMMARY SCHEDULE

DRAWING NUMBER REV 0

CODE AREA

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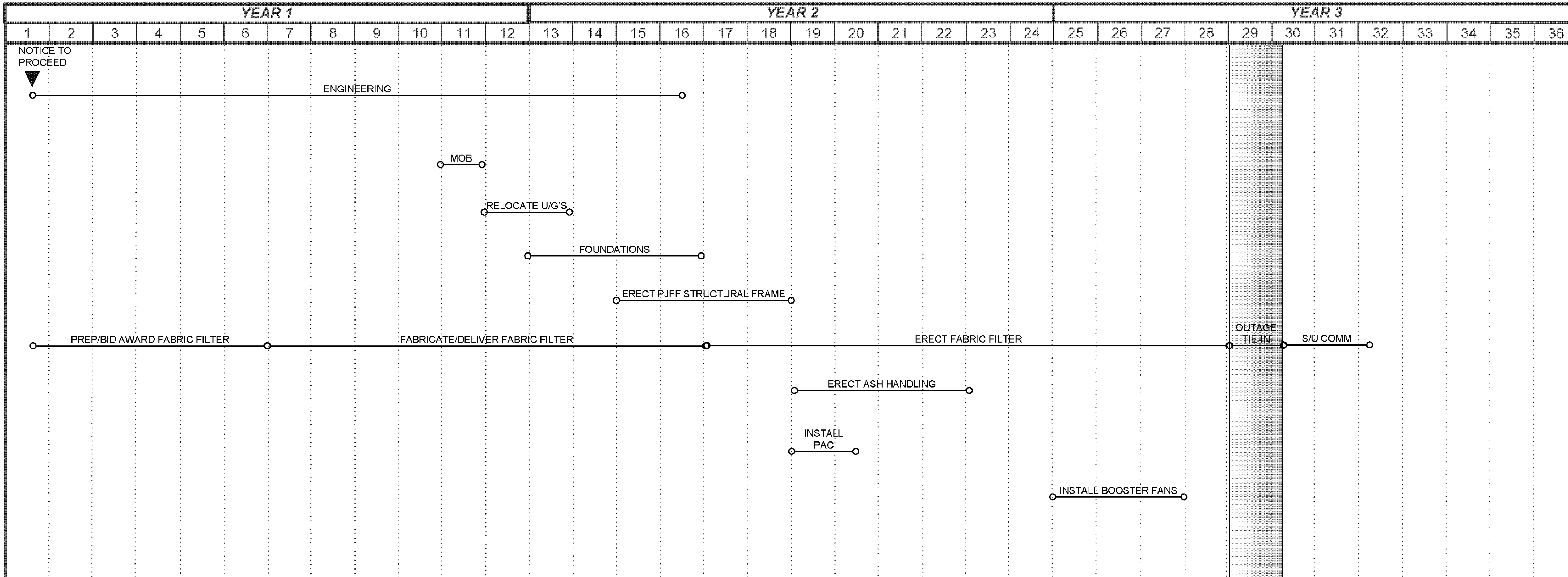
Trimble County



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BLACK & VEATCH

Engineer

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Date: JUNE 07, 2010

TRIMBLE COUNTY UNIT 1
PAC & FABRIC FILTER

LEVEL 1 SCHEDULE

Code

Area

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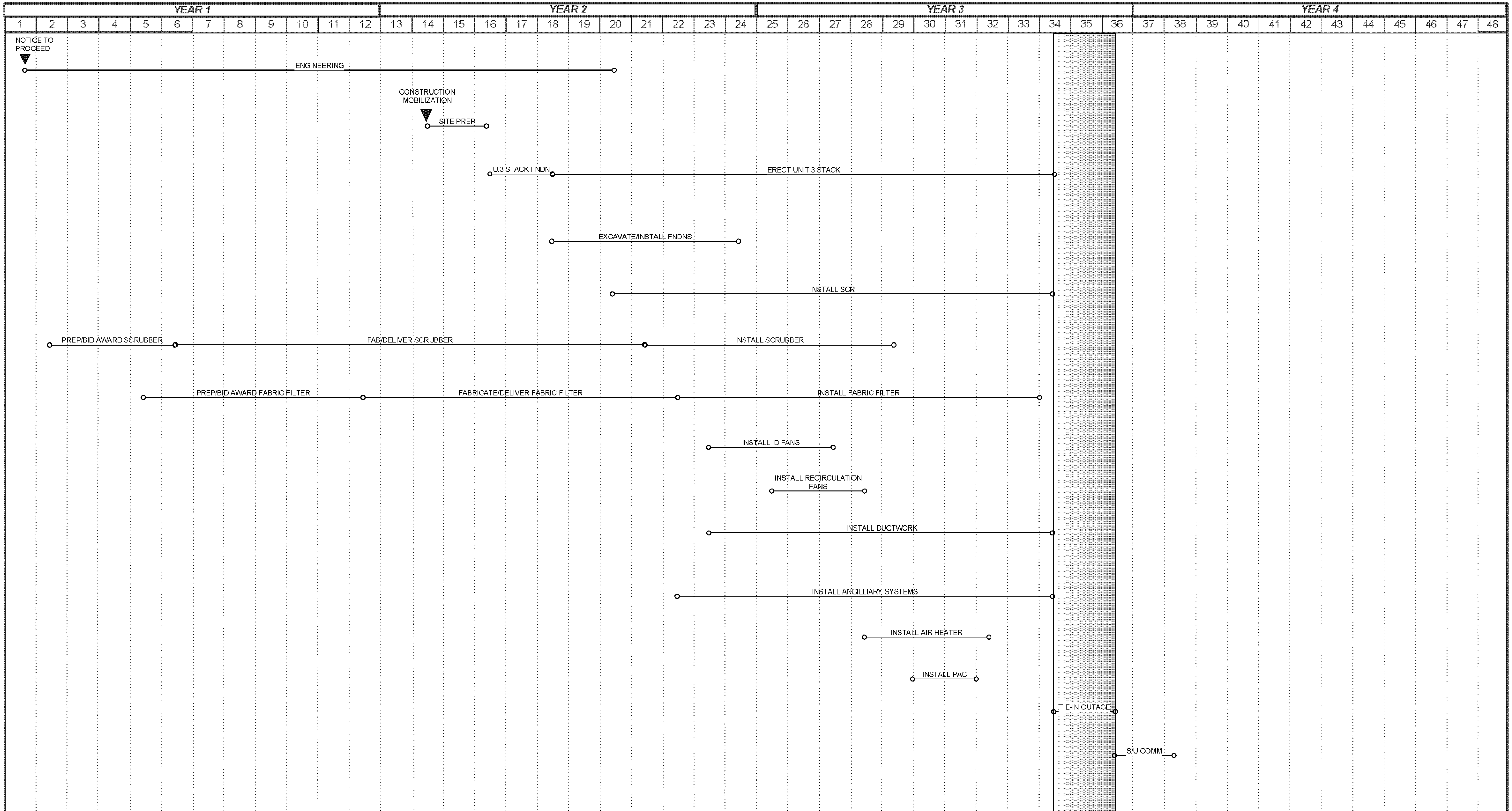
Green River



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GREEN RIVER UNIT 3
SCR, SCRUBBER & FABRIC FILTER

LEVEL 1 SCHEDULE

Drawing Number - REV 0

Code | Area

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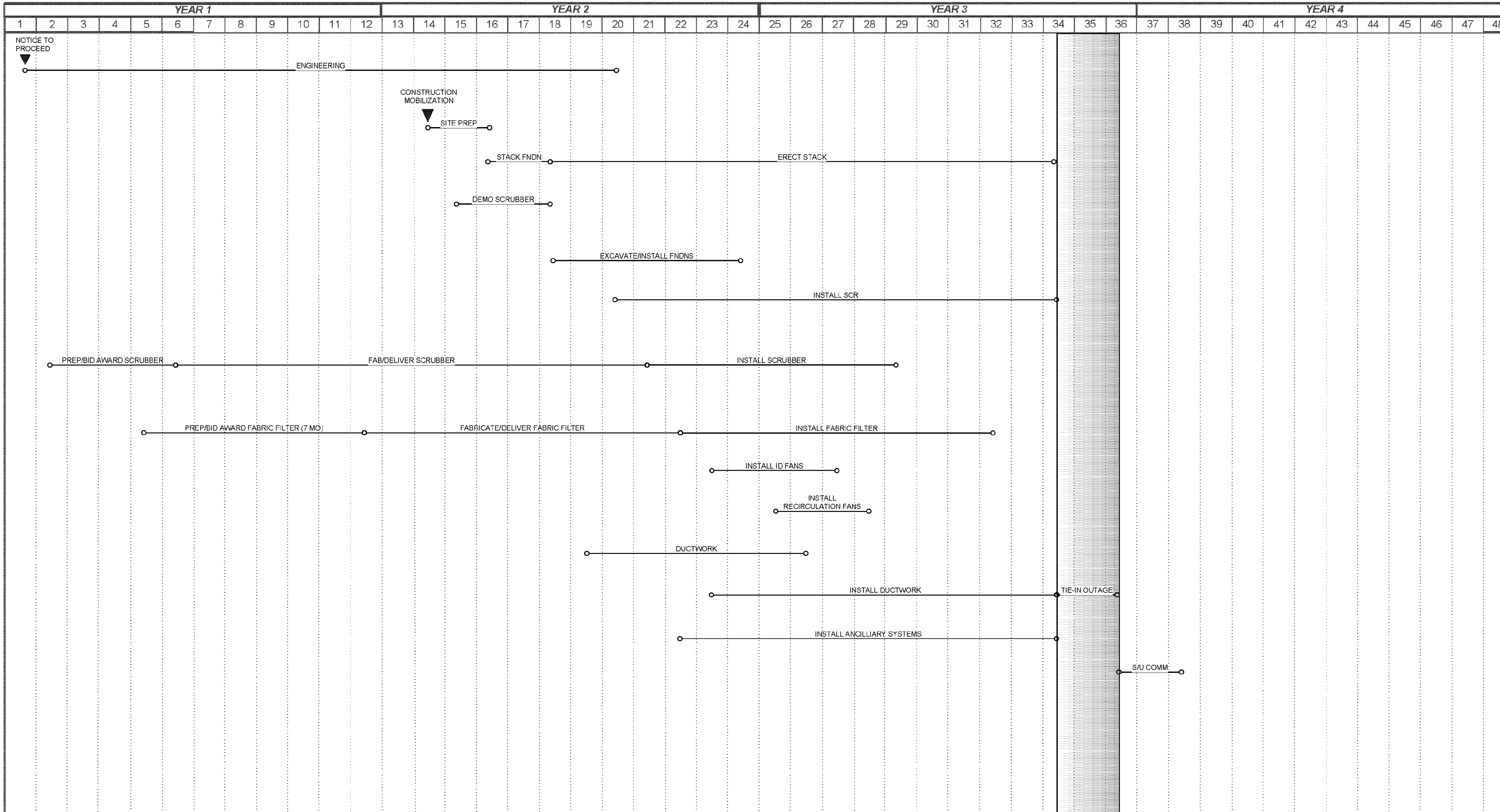

No.	Date	Revisions & Record of Issue	Dwn	Chk	Appd
0	06/18/2010	PHASE 1			

BLACK & VEATCH

Engineer | Drawn: S. CARUTHERS
Checked: T. VANGILDER | Date: JUNE 07, 2010

GREEN RIVER UNIT 4
SCR, SCRUBBER & FABRIC FILTER

LEVEL 1 SCHEDULE

Drawing Number - REV 0
Code | Area

Page 1 of 1

From:	Straight, Scott
To:	Straight, Scott; Thompson, Paul; Voyles, John; Bowling, Ralph; Sturgeon, Allyson; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
CC:	Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Cooper, David; Hance, Chuck; Clements, Joe
Sent:	3/15/2010 11:15:58 AM
Subject:	Project Engineering's ES Bi-Weekly Report - March 15, 2010
Attachments:	PE's Bi-Weekly Update of 3-15-10.docx

Energy Services - Bi-Weekly Update
March 15, 2010
PROJECT ENGINEERING

- **KU SOx**
  - Safety – NTR
  - Auditing – Internal Audit will be starting the Brown FGD audit soon.
  - Schedule/Execution:
    - Ghent Remaining Scope/Schedule
      - Chimney Coatings – Scheduled for May 2010.
      - SCR/FGD Icing Siding – installation in progress.
      - Unit 4 ID Fans – The WEG motor was inspected in the shop and currently runs on magnetic center. The motor is fully expected to be on site for the outage.
      - Chimney Capping - Bids have been received and are being evaluated by PE.
    - Brown
      - FGD, Limestone and BOP construction continues to track to plan. The main focus right now continues to be completing the pre-outage work, planning and preparation for the upcoming BR3 outage in a few weeks.
  - Budget:
    - Brown – NTR.
    - Ghent – NTR
  - Contract Disputes/Resolution:
    - FGD Alliance – NTR
    - Ghent 4 ID Fan Motor – see note above.
  - Issues/Risks:
    - The schedule for material delivery, and then installation, of the structural enhancements to the Brown Unit 3 ductwork, air heaters and precipitators during the outage is going to be tight.

- **TC2**
  - Safety – Bechtel continues to experience higher recordable rates than target. All injuries have been minor in nature.
  - Permitting – EAD reports that the KPDES permit is under review and is expected to be approved with a May 1 effective date.
  - Auditing – Auditing is conducting their annual audit of the EPC Agreement.
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    - Non-Bechtel Scope:
      - PRB Upgrades – The wash down booster pumps are in commissioning.
      - PM Baghouses – TC2's baghouse is not required to be tested for permit compliance as determined by EAD. This item will be removed from the next report.

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  - Air Blow Change Order – Bechtel's revised change order for cancellation of the air blows is under review. Bechtel has held half of the C.O. for the completed chemical cleaning that should reduce fuel oil usage.
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    - $45m has been given back to the RAC on this project.
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    - EPC – Second meeting with Zachry occurred on 3/8-3/9 with very good outcomes. All commercial points are tentatively agreed to with the exception of price for full EPC wrap and moving outage to the spring of 2012.
  - SCR Supplier – NTR
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  - Safety – NTR
  - Auditing - The draft report has been issued on the Summit contract with no material findings.
  - Schedule/Execution:
    - Main Pond
      - Rock placement continues on the East Working Platform and East Starter Dike. Approximately 45% of the rock embankment has been placed to date.
      - Commissioning of the Wet Well pumps has been placed on hold for pump repair and/or replacement due to watertight seal failure.

            - Ash grading continued on the South-East portion of the pond.
        - Aux Pond 900'
            - Bid review meetings with four bidding finalists were held. Second round of bidder follow-up questions have been issued.
            - Project on schedule for presentation at the April Investment Committee meeting.
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        - Decision has been made to relocate the 69kV line in 2010. Real Estate and Right of Way is working to attain the necessary land for this relocation from Metro Government.
    - Budget - NTR
    - Contract Disputes - NTR
    - Issues - NTR

- **TC CCP Project – Holcim**
    - Schedule/Execution:
        - No action at this time.
    - Budget – NTR
    - Contract Disputes/Resolution – NTR
    - Issues/Risk – Status of Holcim contract.

- **TC CCP Project – BAP/GSP**
    - Schedule/Execution:
        - Construction on the project has stopped due to the inclement weather with the exception of the concrete work for the southwest pipe culvert and minor pipe work.
    - Budgeting – NTR
    - Engineering – NTR
    - Permitting – NTR
    - Contract Disputes/Resolution – PE held the first meeting with GAI Consultants to resolve a dispute over engineering costs for the mechanical engineering for the project. GAI's financial counter offer is under review.
    - Issues/Risk – Weather. Currently not anticipating impact on the final completion date.

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    - Schedule/Execution – NTR
    - Budgeting – NTR
    - Engineering – Engineering continues on the single landfill alternative.

  - Permitting – After the meeting with EA on 2/26 a response is being drafted to US Fish & Wildlife regarding the IN bat issue. The outcome will likely result in continuing to perform the stream mitigation and a negotiated offset for fees to cover the bat issue.
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  - Permitting – the final 401/404 Permit internal review will occur on 3/18. The final KYDWM permit review will occur on 3/24. Permit filing is still planned for spring 2010, regardless of final landfill footprint and land acquisition issues.
  - Contract Disputes/Resolution – NTR
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    - Land Acquisition – The drafting of the "last and final" written offers to the remaining three property owners prior to recommending condemnation proceedings is in progress. Meeting held with GAI to review alternative landfill designs to eliminate the need to purchase the remaining three properties. GAI continues to review designs based on feedback in the meeting.

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    - Spoke with E.ON Engineering about SO3 & PM testing in conjunction with the temporary system operation due to them already planning to be at MC in mid-April.
    - Attended Dry Hydrate Users Group. CO2 capture from the convey air appears to be a future trend for mitigating scaling and plugging issues. Nol-Tec and Southern Company are on the leading edge of this promising development.

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  - LFG

        - PE requested to contract specific engineering design work related to gas compression and pipeline work at Valley View and power generation at Tri-K and Ohio County.
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    - Mercury Planning
        - Final Burns & McDonnell report published.
        - Phase II planning and study required.
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        - Releasing Moore Ventures to prepare submittals to get MC, TC, and Ghent certified as a Biomass Conversion Facilities (BCF) under the Biomass Conversion Assistance Program (BCAP). This program has the potential to cut biomass fuel costs in half when purchased from a eligible supplier.
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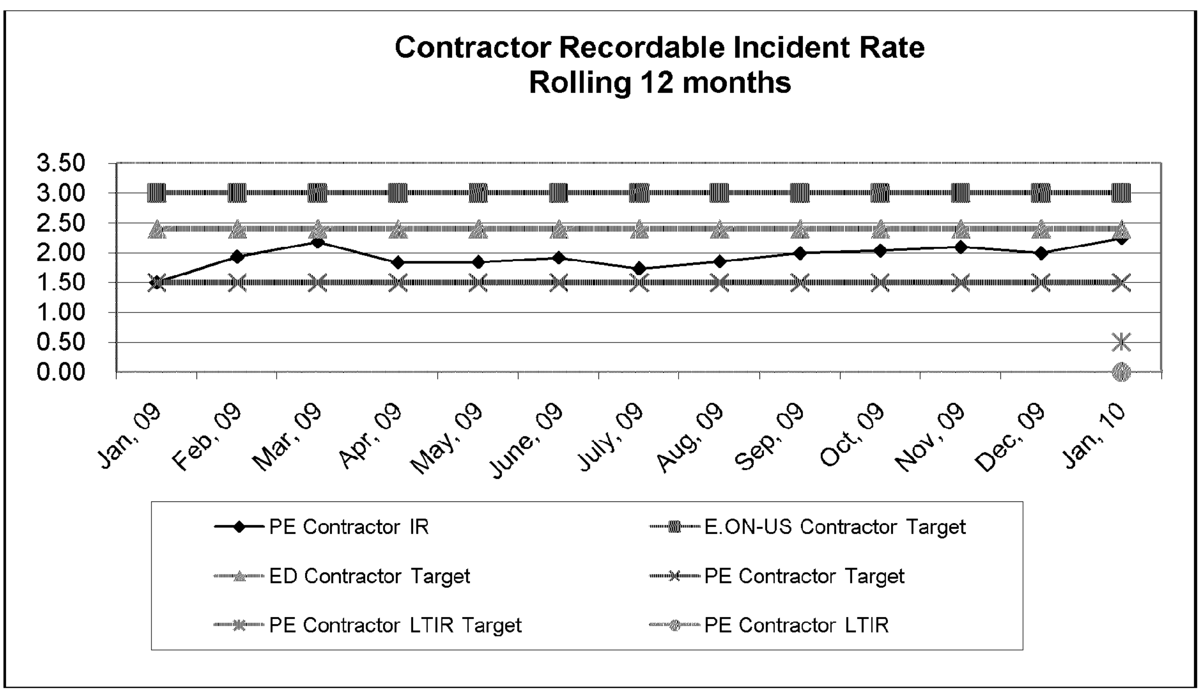
Metrics



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CC:	Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Cooper, David; Hance, Chuck; Clements, Joe
Sent:	3/15/2010 12:18:29 PM
Subject:	RE: Project Engineering's ES Bi-Weekly Report - March 15, 2010
Attachments:	PE's Bi-Weekly Update of 3-15-10.docx

Resending to correct an error in the IC schedule table.

From: Straight, Scott
Sent: Monday, March 15, 2010 11:16 AM
To: Straight, Scott; Thompson, Paul; Voyles, John; Bowling, Ralph; Sturgeon, Allyson; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
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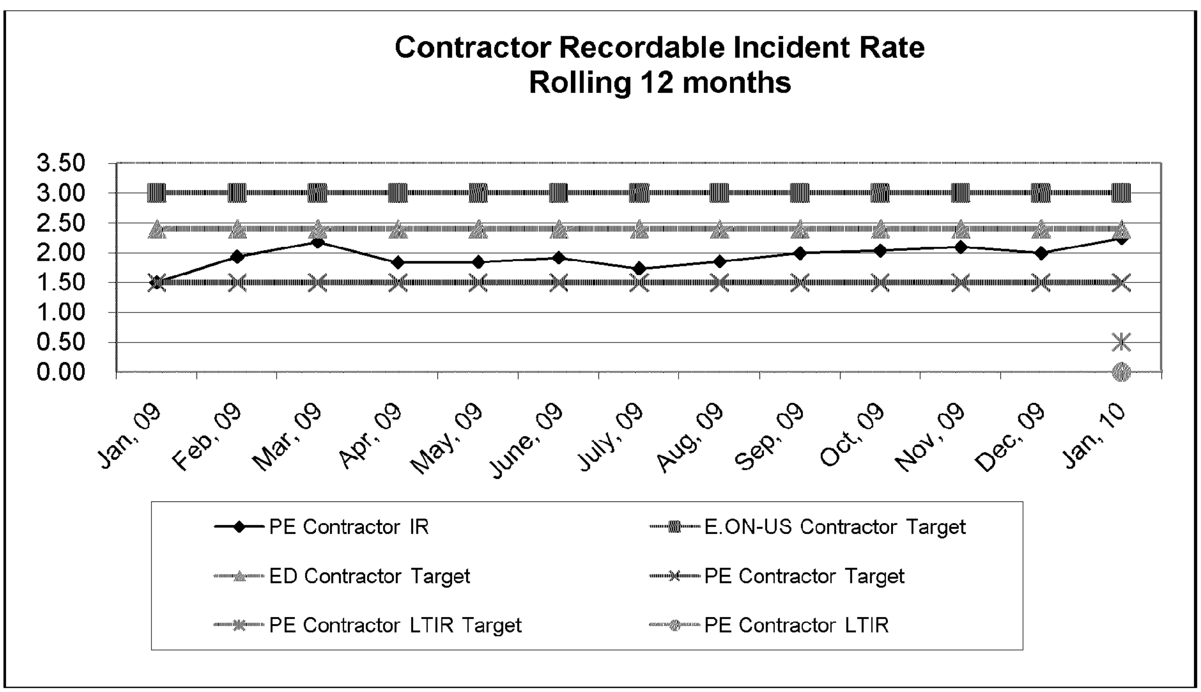

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From:	Lucas, Kyle J.
To:	Saunders, Eileen
CC:	Hillman, Timothy M.; Mahabaleshwarkar, Anand
Sent:	5/17/2010 10:41:17 AM
Subject:	Meeting Minutes from 5/10 meeting
Attachments:	EON AQC Memo 051710.pdf

Eileen,
Attached please find the meeting minutes summary from the kick-off meeting held on 5/10.
Regards,
Kyle

Kyle Lucas | Environmental Permitting Manager
Black & Veatch - Building a World of Difference™
11401 Lamar Avenue
Overland Park, KS 66211
Phone: **(913) 458-9062** | Fax: **(913) 458-9062**
Email: **lucaskj@bv.com**

BLACK & VEATCH

CONFERENCE MEMORANDUM — Page 1

E.ON US — B&V Project 167897
Fleet Wide Coal-Fired Environmental Assessment — B&V File 32.0000
Air Quality Controls — May 17, 2010

A kick-off meeting was held between E.ON and Black & Veatch on May 10, 2010 in E.ON's offices in Louisville, KY.

Recorded By: Kyle Lucas
Meeting: 1 p.m. to 3:30 p.m.

Attending:

E.ON	E.ON	Black & Veatch (B&V)
Ralph Bowling	Scott Straight	Mike King
Eileen Saunders	Philip Imber	Tim Hillman
David Cosby	Haley Turner	Kyle Lucas
Gary Raque	Wayne Whitwatch	Anand Mahabaleshwarkar
Delbert Billiter	Tiffany Koller	
Stephen Nix	Michael Stevens	
Gary Revlett	Jeff Fracky	
Greg Black	Brad Pabian	
Travis Harper	Dan Wilson	
Carla Piening	Barry Carmon	
Chuck Hance	Debbie Vaughn	
Mike Hensley	Stewart Wilson	
LouAnne Karavayev		

This meeting was the kick-off meeting to discuss the scope, methodology, and schedule for the air quality control assessment for all eighteen coal-fired units at six different plants. The scope of the assessment is to provide am air quality control technology solution and high level cost estimate for each coal-fired unit in the E.ON fleet that enables E.ON to meet the estimated limits for future air regulatory requirements.

MEETING DISCUSSION

1. Eileen Saunders opened the meeting and described the purpose of the meeting, team expectations, and initiated staff introductions.

2. Ralph Bowling discussed the current state of environmental affairs affecting E.ON's coal-fired units, which comprise approximately 90% of their power generation. Mr. Bowling reviewed E.ON's objectives by contracting the AQC study and E.ON's immediate requirement to get representative cost information

for use as input into their budgetary planning process. Also highlighted were the following:

- E.ON has reviewed environmental regulations for all media and determined that several proposed air quality regulations have the greatest potential to affect their operation over the next 3-5 years.
- To help define E.ON's path forward in their three-year planning cycle, high-level AQC cost information ($/kW) is required. This information will also help provide direction to the new owners of E.ON.
- Due to the quick nature of the analyses, the project team will have to due the best they can within the confines of time, available information, and rely on staff experience to develop inputs to drive the cost analyses. For each stage, the team must decide that the data are adequate for this exercise, finalize it (drive a stake into it), and move on to the next step. The team cannot afford time to delay transmittal of data.
- The cost information generated from this immediate exercise is a start and not a final stage of this project. Refinements and additional analyses are expected, and can be done after completion of the initial tasks.
- Several units are already included in the Power Plant MD model.
- This project has a high priority. If there are any staffing issues, they should be discussed with management. It is critical that each plant support this process to meet the June 1 deadline.

3. Scott Straight reiterated the importance of the project and reviewed the project expectations.

4. Ms. Saunders reviewed the project's objectives and provided a written summary of the team expectations.

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- B&V should assume that the mercury emissions limit is 0.012 lb/GWh and not 90% control.
- Particulate matter (PM) should be used as a surrogate for all metal hazardous air pollutants (HAPs).

6. Kyle Lucas facilitated a review of the project scope, status of data requests, AQC information data sheets, project design memorandum (design basis) for each unit, the environmental compliance matrix and the AQC technology feasibility option summary. These items were reviewed in concert with the overall project schedule. The project schedule has been summarized separately at the end of this section. Also highlighted were the following:

    - In completing the AQC information data sheets for each unit, E.ON should present information for each unit's operation over the next 5 year period. For example, if a unit is planning a fuel switch, this information should be reflected in the provided data.
    - Based on the information provided by E.ON for each unit, information gathered from the site visits, and other issues including site specific constructability, B&V will issue a unit-by-unit summary of feasible control technology options per pollutant. Due to time constraints, B&V will provide one cost per pollutant per unit based on E.ON's approval of the recommended AQC technologies.
    - The June 1 draft report will consist of only the E.ON approved AQC technologies and their associated costs. A more detailed draft report of these costs will be completed for the June 18th submittal.
    - E.ON noted that the E.W. Brown plant is switching to a higher sulfur fuel.
    - E.ON noted that Trimble County Unit 2 is close to begining operation. Thus, more information will become available regarding its ability to meet its SO_2 emissions limits without using a PRB fuel blend.

7. Anand Mahabaleshwarka briefly reviewed the logistics, site specific coordination, and safety issues for the two B&V teams conducting the site visits during the week of May 10th. It was determined that the B&V site teams would be fully escorted and would not be required to go through the PassPort training. The following were discussed as focus items for the site visit teams:

- Understanding the existing unit's capabilities for supporting new emissions control equipment and any on-going AQC retrofit projects.
- Reviewing potential new AQC equipment locations.
- Reviewing existing auxiliary electric system's capacities and opportunities for expansion.
- Reviewing the general condition of the balance-of-plant and major equipment, for use in estimating the existing equipment upgrade costs.
- Identifing existing combustion byproducts handling and storage facilities and capabilities, and any associated ash and scrubber solid management issues.
- Identifing potential arrangements, interferences, and interfaces for future equipment.

8. Tim Hillman reviewed the project administration for the project.

- The weekly progress report and action item list will be in a spreadsheet list format.
- A weekly conference call would be established for each Monday during the project to review status and address any issues. A conference call-in number would be established and transmitted to E.ON.

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CONFERENCE MEMORANDUM Page 5

E.ON US B&V Project 167897
Fleet Wide Coal-Fired Environmental Assessment B&V File 32.0000
Air Quality Controls May 17, 2010

PROJECT SCHEDULE

Week of May 10th

- B&V to conduct site visits at all six plants
- E.ON to complete AQC information data request issued by B&V on 5/3/10.
- E.ON to complete environmental compliance matrix.

Week of May 17th

- B&V to complete review of each unit and develop an AQC technology feasibility option summary and issue the summary to E.ON for review and approval.
- B&V to complete Project Design Memorandum (design basis) for each unit and issue to E.ON.
- E.ON to review AQC technology options for each unit and approve options, or detail an alternative option for B&V to develop cost information.
- B&V to provide draft table of contents for the upcoming draft report.

Week of May 24th

- B&V to develop capital and operational and maintenance costs for each unit's approved AQC technology.

Week of May 31st

- By June 1, B&V to provide cost information for approved AQC technology.

Week of June 14th

- June 18th, B&V to provide draft summary report for E.ON's review and consolidated comment.

Week of June 28th

- July 1, B&V to provide final report to E.ON.

From:	Straight, Scott
To:	Straight, Scott; Thompson, Paul; Voyles, John; Bowling, Ralph; Sturgeon, Allyson; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
CC:	Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Hance, Chuck; Clements, Joe; Cooper, David (Legal); Jones, Greg
Sent:	5/17/2010 1:12:39 PM
Subject:	Project Engineering's ES Bi-Weekly Report - May 14, 2010
Attachments:	PE's Bi-Weekly Update of 5-14-10.docx

<<...>>

Energy Services - Bi-Weekly Update
May 14, 2010
PROJECT ENGINEERING

- **KU SOx**
  - Safety – NTR
  - Auditing – Internal Auditing continues internal activities for the Brown FGD audit.
  - Schedule/Execution:
    - Ghent Remaining Scope/Schedule
      - Chimney Coatings – Chimney coating continues.
      - SCR/FGD Icing Siding – Installation in progress.
      - Unit 4 ID Fans – On plan for fall 2010 install.
      - Chimney Capping - NTR
      - Elevators- out for bid.
    - Brown
      - FGD, Limestone and BOP construction continues to track to plan. The main focus right now is to successfully complete the BR3 outage that is scheduled to end on May 21, 2010.
  - Budget:
    - Brown – overall cost continues to trend down.
    - Ghent – NTR
    - Contract Disputes/Resolution - NTR
  - Issues/Risks:
    - The work to install the structural enhancements to the Brown Unit 3 ductwork, air heaters and precipitators during the outage is proceeding and is on track to be completed within the available outage window. The commissioning work for the new BR3 I. D. Fans cannot begin until all work in the flue gas path by the project and the station is completed.

- **TC2**
  - Safety – NTR
  - Permitting – NTR
  - Auditing – NTR
  - Schedule/Execution:
    - Bechtel EPC – TC2 achieved first turbine roll and is on schedule for first fire on coal 5/15 followed by load testing around 5/20. **This supports Bechtel's latest forecasted substantial completion date of July 22.**
    - Non-Bechtel Scope:
      - PRB Upgrades – Complete.
  - Budget – Revised EPC authorization and project sanction going to May IC for approval.
  - Contract Disputes/Resolution:
    - Bechtel FM Claims – Meeting held with PWT, JV, RSS, Brightman and Futcher on 5/5 with no resolution being reached. Both parties agreed to let the settlement discussions lay for a month, to continue focusing on commissioning, and to not push for formal dispute resolution.
  - Issues/Risk:

    - Bechtel's schedule performance, Excusable Event claims, start-up of all plant equipment to operational mode, and the expected increase in Labor Claim amounts against budget.

- **Brown 3 SCR**
  - Schedule/Execution – PE and the station have agreed to move the outage to the spring of 2012.
  - Permitting – Working with EA on SO3 BACT responses to KYDAQ.
  - Engineering – RPI is in full engineering/procurement activities.
  - Budget:
    - NTR
  - Contracting:
    - EPC – IC approval obtained pending resolution of Builder's Risk insurance. Meeting scheduled for 5/18 with PWT and Rives to review recommendation for Zachry to retain insurance. Contract signing set for May 19. RPI contract amendments agreed for execution.
  - SCR Supplier – NTR
  - Issues/Risk – NTR

- **Ohio Falls Rehabilitation**
  - Schedule/Execution – Voith Hydro, the original vendor for first two units completed, has submitted tentative schedule for third unit work to begin in June, 2011 with the remaining five following every 7/8 months, with all units complete by the end of 2014.
  - Permitting – NTR
  - Engineering/General:
    - Reviewing Voith updated scope for rehabilitation minus automation.
    - Reviewed plant goals for keeping automation scope in-house.
    - Working with power marketing group on interconnection issues regarding unit testing and commercial dates.
    - Reviewing Historic Preservation and Maintenance Plan developed in 2008.
    - Reviewing inventory of parts on hand for third unit.
  - Budget:
    - Voith Hydro submitted revised pricing as planned. Their submittal is under review. PE continues to assemble pricing for work outside hydro vendor scope
  - Contracting:
    - Work continues on developing a dewatering engineering scope of work for RFQ.
  - Issues/Risk
    - If Voith remains as hydro equipment supplier, they will need to release their turbine runner for the fourth unit sometime in early August in order to meet the tentative schedule.
    - The tentative schedule for completion of all units by late 2014 is highly dependent on year-round dewatering.

- **Cane Run CCP Project**
  - 404/401 and Landfill Permit applications have been submitted and are currently under review. Working to respond to comments on the 404 and Landfill Permit applications. To date permitting process has gone better than expected.

- Development of construction drawings are on hold until the KYDWM has completed their initial review.
- Transmission working towards relocation of the 69kV line.
- <u>Budget</u> – project remains tracking to or below sanction.
- <u>Contract Disputes/Resolution</u> – NTR
- <u>Issues/Risk</u> – NTR

- **Trimble Co. Barge Loading/Holcim**
  - Discussions between the Plant and Holcim have resumed; however, no action has been taken to restart the design of the barge loading system.
  - <u>Budget</u> – project remains tracking to or below sanction.
  - <u>Contract Disputes/Resolution</u> – NTR
  - <u>Issues/Risk</u> – Status and timing of Holcim contract.

- **TC CCP Project – BAP/GSP**
  - Schedule/Execution:
    - Construction on the project has resumed on a limited basis as the weather continues to be a factor. Ohio River flooding has been a recent factor in addition to the heavy rains. Concrete work for the southwest pipe culvert has been completed and minor pipe work continues. Work on the Mechanically Stabilized Earth walls has resumed.
  - Budgeting – NTR
  - Engineering – NTR
  - Permitting – NTR
  - Contract Disputes/Resolution – NTR
  - Issues/Risk – Weather. The contractor has submitted a letter requesting adjustments to the project's Liquidated Damages due to the weather delays. Meeting held on 5/7 with contractor with further meetings anticipated.

- **TC CCP Project – Landfill**
  - Schedule/Execution – NTR
  - Budgeting – NTR
  - Engineering – Engineering continues on the single landfill alternative.
  - Permitting – Negotiations continue with USFWS on the resolution of the Indiana Bat issue.
  - Contract Disputes/Resolution – NTR
  - Issues/Risk – NTR

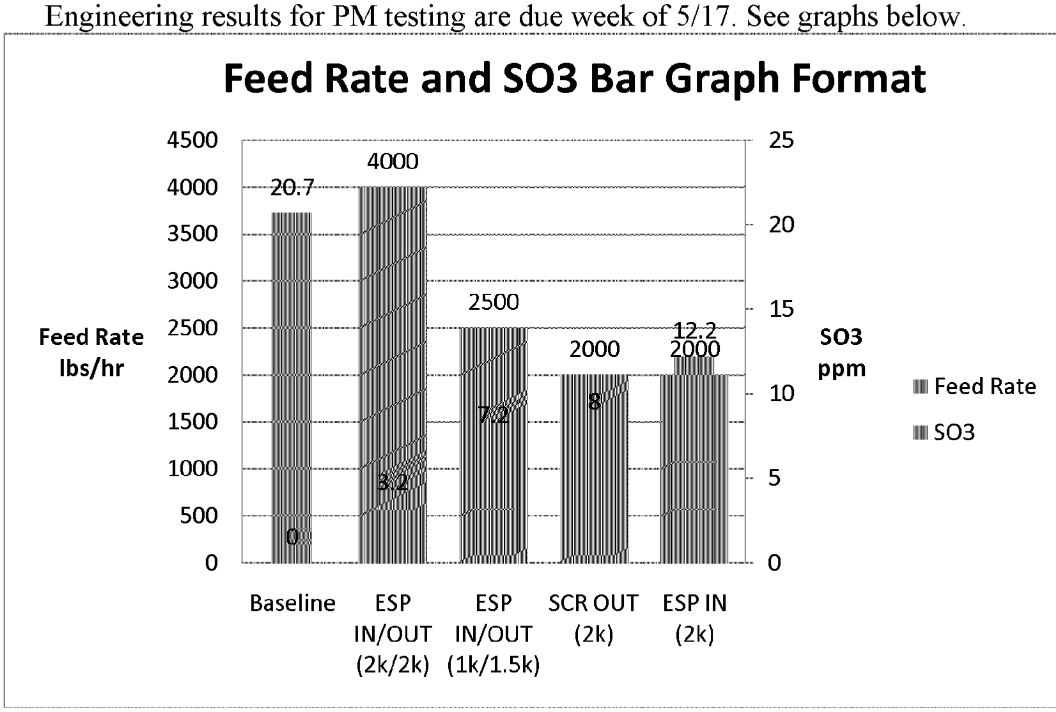
- **Ghent CCP Projects - Landfill**
  - Schedule/Execution – NTR
  - Budget – NTR
  - Engineering – Detailed Engineering of gypsum fines and Conceptual Engineering on CCP transport for landfill continues with Black & Veatch. Conceptual Design for the CCP transport at Ghent is complete. Procurement activities for the gypsum fines project are in progress.
  - Permitting – The DWM Permit Application was filed on 5/6. This completes the filings of ALL the permits for the project.
  - Contract Disputes/Resolution – NTR
  - Issues/Risk:

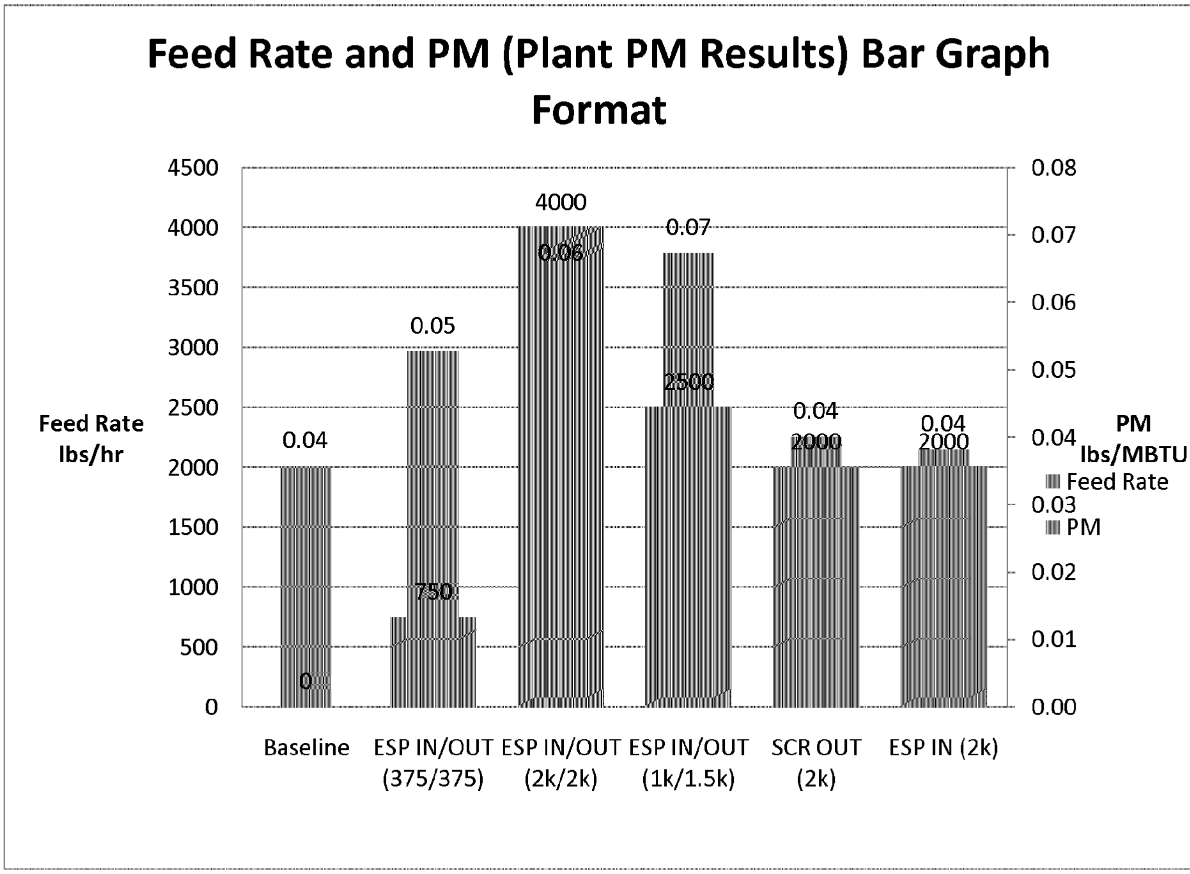
    - Land Acquisition – the review of potential modifications to the landfill's footprint has been completed. Additional land purchases, while preferred, are not necessarily needed. Review of CCP production is currently on-going to finalize path forward on land purchases.

- **General CCP Projects**
  Project Engineering will be developing a high level order of magnitude cost estimate to bring the entire EON US fleet of CCP ponds into compliance with the EPA's Draft CCP Ruling of 5/5 for Subpart C, D and D Prime. The review is expected to be in draft form the first week in June.

- **E.W. Brown Aux Pond 900'**
  - Contract has been awarded to Charah for Phase II.
  - Budget – project remains tracking to or below sanction.
  - Contract Disputes/Resolution – NTR
  - Issues/Risk – NTR

- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3)**
  - Safety - NTR
  - Schedule/Execution:
    - MC3's schedule is now tied to the BART requirement for the end of 2011, with tie-in still required during spring 2011 outage.
    - Preliminary Engineering reports on Wet (URS) and Dry (Nol-Tec) are under review. Dry Injection total installed cost is 2/3 of Wet Injection system, with O&M estimates being comparable.
    - MC 4 tests complete. Baseline was 21 ppm. Max injection at ESP Inlet/ESP Outlet resulted in 3 ppm SAM at the stack. Other configuration of injection ranged from 7-12 ppm. Filterable PM (based on CEMS) **increased** with ESP Outlet injection (most effective SAM reduction injection point), with a total PM increase of >7 tons. E.ON Engineering results for PM testing are due week of 5/17. See graphs below.





  - MC 3 test ports scheduled for installation by Hall the week of May 24. Testing is planned for the week of June 7.

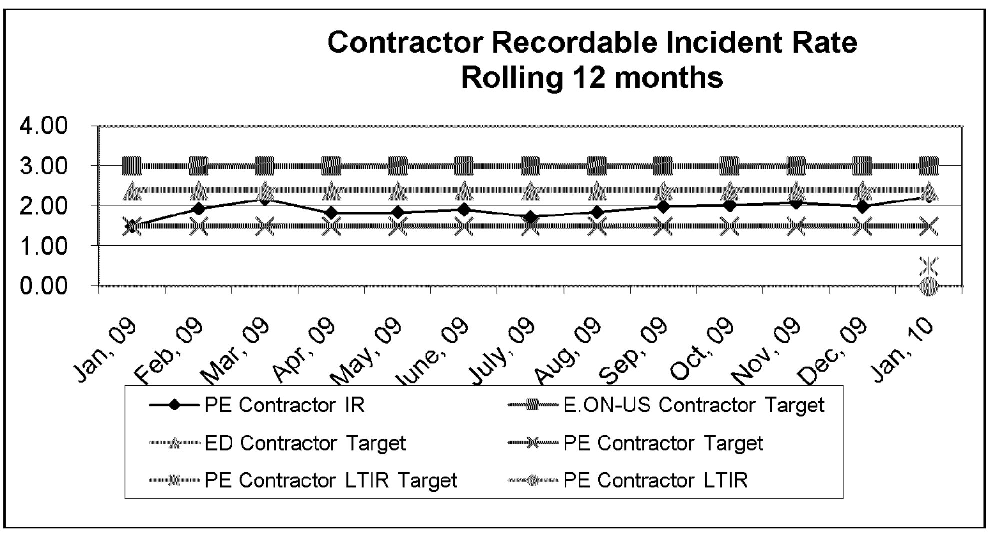
- **SO3 Mitigation (Ghent)**
  - Ghent 2 testing currently scheduled for the week of May 24 may be postponed to mid/late June due to conflicts at the site. Ghent 2 long term temporary injection system being procured by the plant.
  - Requested BACT analysis proposals from Black and Veatch and Trinity. Black and Veatch is a "one stop shop" for this work. Trinity does not have the engineering in house to perform cost estimates and other engineering work related to the BACT analysis. Black and Veatch needs to prove they have the available manpower to do the BACT analysis and SAM position papers.
  - Contacted several testing suppliers regarding a CEMS and Testing position paper. E.ON Engineering is interested. Still checking the market place for others (RMB-Consulting, Grace Engineering, Catalyst Air Management, and AQS.

- **NBU1 and Other Generation Development**
  - LFG
    - First Landfill Gas Sample Results due May 14.
    - LFG Technologies is under contract to perform study work.

- NBU CR – HDR is under contract to perform study work. They plan to visit CR on May 25th.
- Environmental Regulatory Planning –
  - Black and Veatch under contract to perform the study.
  - Kick off meeting held Monday May 10.
  - B&V visited the sites week of May 10.
- Biomass –
  - Released Moore Ventures (MV) to prepare submittals to get MC, TC, and Ghent certified as a Biomass Conversion Facilities (BCF) under the Biomass Conversion Assistance Program (BCAP). MV visited the Ghent & Trimble Landfill projects to assess the timber.
  - Bids received for further MC Project Implementation Planning study work – Black and Veatch, Burns and McDonnell, HDR and KEMA. Although Black and Veatch is not the lowest cost, they preferred scope including the ability to run our Vista modeling with biomass fuel inputs. Will release a contract the week of May 17.
- FutureGen – NTR

- General
  - Impoundment Integrity Program
    - The working session with station representatives was completed 4/21.
  - Environmental Scenario Planning – B&V awarded engineering support work to support the development of the 2011 MTP with draft due early June.
  - Alstom Master Agreement- Negotiations continue.

Metrics



Upcoming PWT Needs:

This calendar is in the process of being modified. Next report will include the revised calendar.

Staffing - NTR

From:	Lucas, Kyle J.
To:	Saunders, Eileen
CC:	Hillman, Timothy M.; Mahabaleshwarkar, Anand
Sent:	5/18/2010 10:54:24 AM
Subject:	Final Meeting Minutes from 5/10 meeting
Attachments:	EON AQC Meeting Memo 051810.pdf

Eileen,
Attached please find the final meeting minutes summary memo from the kick-off meeting held on 5/10.
Regards,
Kyle

Kyle Lucas | Environmental Permitting Manager
Black & Veatch - Building a World of Difference™
11401 Lamar Avenue
Overland Park, KS 66211
Phone: **(913) 458-9062** | Fax: **(913) 458-9062**
Email: **lucaskj@bv.com**

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CONFERENCE MEMORANDUM Page 1

E.ON US	B&V Project 167897
Fleet Wide Coal-Fired Environmental Assessment	B&V File 32.0000
Air Quality Controls	May 18, 2010

A kick-off meeting was held between E.ON and Black & Veatch on May 10, 2010 in E.ON's offices in Louisville, KY.

Recorded By: Kyle Lucas
Meeting: 1 p.m. to 3:30 p.m.

Attending:

E.ON	E.ON	Black & Veatch (B&V)
Ralph Bowling	Scott Straight	Mike King
Eileen Saunders	Philip Imber	Tim Hillman
David Cosby	Haley Turner	Kyle Lucas
Gary Raque	Wayne Whitworth	Anand Mahabaleshwarkar
Delbert Billiter	Tiffany Koller	
Stephen Nix	Michael Stevens	
Gary Revlett	Jeff Fraley	
Greg Black	Brad Pabian	
Travis Harper	Dan Wilson	
Carla Piening	Barry Carman	
Chuck Hance	Debbie Vaughn	
Mike Hensley	Stewart Wilson	
LouAnne Karavayev		

This meeting was the kick-off meeting to discuss the scope, methodology, and schedule for the air quality control assessment for all eighteen coal-fired units at six different plants. The scope of the assessment is to provide am air quality control technology solution and high level cost estimate for each coal-fired unit in the E.ON fleet that enables E.ON to meet the estimated limits for future air regulatory requirements.

MEETING DISCUSSION

1. Eileen Saunders opened the meeting and described the purpose of the meeting, team expectations, and initiated staff introductions.

2. Ralph Bowling discussed the current state of environmental affairs affecting E.ON's coal-fired units, which comprise approximately 90% of their power generation. Mr. Bowling reviewed E.ON's objectives by contracting the AQC study and E.ON's immediate requirement to get representative cost information

for use as input into their budgetary planning process. Also highlighted were the following:

- E.ON has reviewed environmental regulations for all media and determined that several proposed air quality regulations have the greatest potential to affect their operation over the next 3-5 years.
- To help define E.ON's path forward in their financial planning cycle, high-level AQC cost information ($/kW) is required. This information will also help provide direction to the new owners of E.ON.
- Due to the quick nature of the analyses, the project team will have to due the best they can within the confines of time, available information, and rely on staff experience to develop inputs to drive the cost analyses. For each stage, the team must decide that the data are adequate for this exercise, finalize it (drive a stake into it), and move on to the next step. The team cannot afford time to delay transmittal of data.
- The cost information generated from this immediate exercise is a start and not a final stage of this project. Refinements and additional analyses are expected, and can be done after completion of the initial tasks.
- Several units are already included in the Power Plant MD model.
- This project has a high priority. If there are any staffing issues, they should be discussed with management. It is critical that each plant support this process to meet the June 1 deadline.

3. Scott Straight reiterated the importance of the project and reviewed the project expectations.

4. Ms. Saunders reviewed the project's objectives and provided a written summary of the team expectations.

5. Gary Revlett summarized the process by which E.ON developed the proposed environmental regulations and focused the effort to a specific set of future air regulatory drivers and regulations which are expected to most affect their coal-fired fleet operations. Based on the "Estimated Requirements Under Future New Environmental Regulations" handout, it was determined that Tasks No. 4.7 to 4.12 would be the specific air environmental drivers that would be set as targets for each unit. E.ON will summarize these air emissions limits in the environmental compliance matrix to be used for this project. Also highlighted were the following:

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CONFERENCE MEMORANDUM Page 3

E.ON US B&V Project 167897
Fleet Wide Coal-Fired Environmental Assessment B&V File 32.0000
Air Quality Controls May 18, 2010

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CONFERENCE MEMORANDUM Page 5

E.ON US B&V Project 167897
Fleet Wide Coal-Fired Environmental Assessment B&V File 32.0000
Air Quality Controls May 18, 2010

PROJECT SCHEDULE

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From:	Straight, Scott
To:	Clements, Joe
Sent:	3/8/2010 12:11:12 PM
Subject:	FW: Project Engineering's ES Bi-Weekly Report - March 1, 2010
Attachments:	PE's Bi-Weekly Update of 3-1-10.docx

From: Straight, Scott
Sent: Monday, March 01, 2010 10:11 AM
To: Thompson, Paul; Voyles, John; Bowling, Ralph; Sturgeon, Allyson; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
Cc: Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Cooper, David; Hance, Chuck
Subject: Project Engineering's ES Bi-Weekly Report - March 1, 2010

Energy Services - Bi-Weekly Update
March 1, 2010
PROJECT ENGINEERING

- **KU SOx**
  - Safety – NTR
  - Auditing – NTR
  - Schedule/Execution:
    - Ghent Remaining Scope/Schedule
      - Chimney Coatings – Scheduled for May 2010.
      - SCR/FGD Icing Siding – installation in progress.
      - Unit 4 ID Fans – Negotiations continue with FW and WEG on the ID Fan motor rebuild settlement. A meeting with senior management was held in Greenville the week of 2/15. WEG agreed to provide a full, new motor warranty on the rebuilt motor that is being set on magnetic center in Evansville, IN. The motor is fully expected to be on-site for the outage.
      - Chimney Capping - Bids are due back 3/5 with work to begin the week of 4/19.
    - Brown
      - FGD, Limestone and BOP construction continues to track to plan. The main focus right now is completing the pre-outage work, planning and preparation for the upcoming BR3 outage in a few weeks.
  - Budget:
    - Brown – The budget with Fluor this period is at $487.6m with eight (8) pending change orders totaling $2.8m. The current month Fluor forecast decreased by $14.9m for a total projected savings to budget of $73.6m. PE plans to use some of this reduction to take care of the TC2 budget shortfall projected from the Labor Claim noted below.
    - Ghent – NTR
  - Contract Disputes/Resolution:
    - FGD Alliance – NTR
    - Ghent 4 ID Fan Motor – see Unit 4 ID Fans above.
  - Issues/Risks:
    - NTR

- **TC2**
  - Safety – Bechtel continues to experience higher recordable rates than target. All injuries have been minor in nature.
  - Permitting – NTR
  - Auditing – Auditing is conducting their annual audit of the EPC Agreement.
  - Schedule/Execution:
    - Bechtel EPC –Bechtel continues to focus on startup activities required to begin steam blows that are currently scheduled for 3/3. **Bechtel is now indicating the Substantial Completion date is June 22.**
    - Non-Bechtel Scope:
      - PRB Upgrades – The wash down booster pumps are in commissioning, which has been slowed by subfreezing temperatures.
      - PM Baghouses – TC2's baghouse testing scheduled with TC2 commissioning.

- Budget:
  - Bechtel's labor claim for the second half of 2009 was received, and as expected given the higher amounts of labor and schedule extensions, is higher than the accrued amount for the same period. On a net basis, the claim is about $4.5m higher than budget. PE is reviewing all project cost-to-date and will be reconciling the projected final cost for all over/under spends against the budget and sanction in concert with the power credit review that Rusty is doing with Finance. The significant underruns on the FGD Program can fund this overrun to keep PE overall spend well within budget for 2010.
- Contract Disputes/Resolution:
  - Bechtel FM Claims – Bechtel submitted a fifth Force Majeure claim for weather related impacts to the BCP truck delivery during the recent snow storm in the Northeast. Bechtel (Brightman and Hobbs) reviewed the methodology of claim calculations with PE on 2/23.
  - Air Blow Change Order – Still waiting on Bechtel's revised change order on the cancellation of Air Blows.
- Issues/Risk:
  - Bechtel's schedule performance, Excusable Event claims, start-up of all plant equipment to operational mode, and the expected increase in Labor Claim amounts against budget.

- **Brown 3 SCR**
  - Schedule/Execution – PE is working with Brown management and Generation Planning to evaluate moving the BR3 outage from the fall of 2012 to the spring of 2012. This will give Brown the entire summer to operate the SCR instead of having the SCR commissioning just a month ahead of the Dec 31, 2012 CD date. **A decision is likely within the next two weeks to move the outage to the spring of 2012 given Gen Planning review indicates very little impacts to overall 2010 plan.**
  - Permitting – PE attended a meeting with the KYDAQ and EA on 2/19. KDAQ is on board with KU but wants to ensure proper supporting documentation to mitigate possible litigation concerns. KDAQ requested, and KU accepted, a site tour on 3/16.
  - Engineering – RPI has begun engineering and procurement activities. Flow model witnessing is planned for April, 2010 along with a visit to CERAM to see their catalyst manufacturing facility.
  - Budget:
    - $45m has been given back to the RAC on this project.
    - A Tax Exemption Certificate is being prepared in conjunction with EA to provide to RPI and eventually Zachry.
  - Contracting:
    - EPC – Initial round of negotiations held with Zachry on 2/15-2/16. Next meeting scheduled for 3/8-3/9. Zachry is planning another engineering site visit to confirm demolition, relocation, and interferences scope. Conformance of Technical Specifications and Agreement Exhibits on-going.
  - SCR Supplier – Contract is fully executed. RPI is in full engineering and procurement.
  - Issues/Risk – NTR

- **Brown CCP Project – Ash Ponds**
  - <u>E.W. Brown Starter Dike</u>

- Safety – NTR
- Auditing - Nearing completion of work for an audit of the Summit contract with a focus on award process, change order management and invoicing/payments.
- Schedule/Execution:
  - Starter Dike – all work tracking to plan.
  - Rock placement production quantities have increased.
- Budget – NTR
- Contract Disputes/Resolution - Fuel oil baseline adjustment review with Summit continues.
- Issues/Risk – NTR

- <u>E.W. Brown Aux Pond 900'</u>
  - Schedule/Execution:
    - The original 7 bidders have been short listed to 4 with follow up questions and review meetings being scheduled.
  - Budget – NTR.
  - Contract Disputes/Resolution – NTR
  - Issues/Risk – NTR

- **Cane Run CCP Project - Landfill**
  - Schedule/Execution:
    - **404/401 and Landfill Permit applications have been submitted and are currently under review. Public Notice for the 404 Permit was issued by the USACE on 2/12 with a closing date of 3/13.**
    - Development of construction drawings is on hold until the EPA's presents its CCP ruling and the KYDWM has completed their initial review.
    - A meeting was held with Transmission to review the status of their design. A final route for the 345kV lines has been agreed to and the design of the 69kV line has been completed. PE is evaluating the option to relocate the line this year.
  - Budget - NTR
  - Contract Disputes - NTR
  - Issues - NTR

- **TC CCP Project – Holcim**
  - Schedule/Execution:
    - Discussions between the Plant and Holcim have resumed however no action has been taken to restart the design of the barge loading system.
  - Budget – NTR
  - Contract Disputes/Resolution – NTR
  - Issues/Risk – Status of Holcim contract.

- **TC CCP Project – BAP/GSP**
  - Schedule/Execution:
    - Construction on the project has stopped due to the inclement weather with the exception of the concrete work for the southwest pipe culvert.
  - Budgeting – NTR
  - Engineering – NTR
  - Permitting – NTR

  - Contract Disputes/Resolution – PE held the first meeting with GAI Consultants to resolve a dispute over engineering costs for the mechanical engineering for the project. GAI's financial counter offer is under review.
  - Issues/Risk – Weather. Currently not anticipating impact on the final completion date.

- **TC CCP Project – Landfill**
  - Schedule/Execution – NTR
  - Budgeting – NTR
  - Engineering – Engineering continues on the single landfill alternative.
  - Permitting – Follow-up meetings with US Fish & Wildlife to negotiate the mitigation of a juvenile female Indiana Bat have not progressed as well as the earlier meeting in mid-January, 2010. Meeting held with EA on 2/26 with a plan forward with USF&W. The outcome will likely result in continuing to perform the stream mitigation and a negotiated offset for fees to cover the bat issue.
  - Contract Disputes/Resolution – NTR
  - Issues/Risk – NTR

- **Ghent CCP Projects - Landfill**
  - Schedule/Execution – NTR
  - Budget – NTR
  - Engineering – Detailed Engineering of gypsum fines and Conceptual Engineering on CCP transport for landfill continues with Black & Veatch.
  - Permitting – 401/404 Permit revisions are being made by GAI Consultants after review by EON US. The Division of Waste Management (DWM) Permit is being reviewed by EON US. Permit filing is still planned for spring 2010, regardless of final landfill footprint and land acquisition issues.
  - Contract Disputes/Resolution – NTR
  - Issues/Risk:
    - Land Acquisition – Meeting held with D. O'Brien and J. Voyles to review status of land purchase. PE is working with Real Estate and Legal to draft "last and final" written offers to the remaining three property owners prior to recommending condemnation proceedings. PE is also reviewing potential modifications to the landfill design to possibly eliminate the need for the remaining few properties.

- **General CCP Projects (Impoundment Management Program Development)**
    - PE is leading the development of the Impoundment Integrity Program, including the scheduling of meetings with management for conceptual approval of the impoundment document.

- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3)**
  - Safety - NTR
  - Schedule/Execution:
    - MC3's schedule is now tied to the BART requirement for the end of 2011. Tie-in work during spring 2011 outage is still required.
    - Preliminary Engineering on Wet (URS) and Dry (Nol-Tec) are on-going with results expected in a few weeks. Decision to bid wet and/or dry will be made as a result of these studies.

        - Considering dry sorbent injection testing on MC 3 & 4. Both units have a spring outage in which we can install nozzles. Set a site walk down for the nozzle installations with A&D, UGS, and Hall for 3/3. Meetings with Nol-Tec, ADA, BCSI and UCC are in progress to discuss temporary injection equipment and crews.
    - Budget – may require timing shifts in the 2011 MTP to account for shift in scheduled need.
    - Contract Disputes/Resolution – NTR
    - Issues/Risk - NTR

- **NBU1 and Other Generation Development**
    - LFG
        - PE requested to contract specific engineering design work related to gas compression and pipeline work at Valley View and power generation at Tri-K and Ohio County.
        - The PO for sampling and lab analysis of the Republic Landfills will be released to MCC after resolution of insurance issues.
    - NBU 1 – NTR
    - Mercury Planning
        - Submitted unsupported SCR & Hg Capture costs to Generation Planning.
        - A new Final Draft of the B&McD study is expected to be published the week of 3/1.
        - Phase II planning and study required.
    - Biomass –
        - Started Mill Creek Design Development RFP.
    - FutureGen – NTR

- General
    - Supporting the environmental "scenario planning" team by providing very speculative cost and timing for SCRs on all other units, FGD upgrades to CR, Hg control (with added PM control), and other miscellaneous cost (i.e., O&M cost) to Generation Planning. These values and timing are NOT supported by any engineering or project development. These values were created on a relative basis in less than a week.

<u>Metrics</u>

MBE/WBE Spend

Project Engr. direct spend for 2009	
2009 Spend	$12,816,000
MBE target	5%
	$640,800
WBE target	2%
	$256,320
Total M/WBE	$897,120

Bechtel - TC 2 Spend - 2009	
	$13,000,000
MBE target	3%
	$390,000
WBE target	2%
	$260,000
Total M/WBE	$650,000

Fluor - FGD Spend - 2009	
	$48,000,000
MBE target	5%
	$2,400,000
WBE target	2%
	$960,000
Total M/WBE	$3,360,000

Total Project Engineering 2009	
	$73,816,000
MBE target	5%
	$3,430,800
WBE target	2%
	$1,476,320
Total M/WBE	$4,907,120

Project Engr. direct spend for 2010	
2010 Spend	$44,744,000
MBE target	5%
	$2,237,200
WBE target	2%
	$894,880
Total M/WBE	$3,132,080

Bechtel - TC 2 Spend - 2010	
	$3,500,000
MBE target	3%
	$105,000
WBE target	2%
	$70,000
Total M/WBE	$175,000

Fluor - FGD Spend - 2010	
	$11,000,000
MBE target	5%
	$550,000
WBE target	2%
	$220,000
Total M/WBE	$770,000

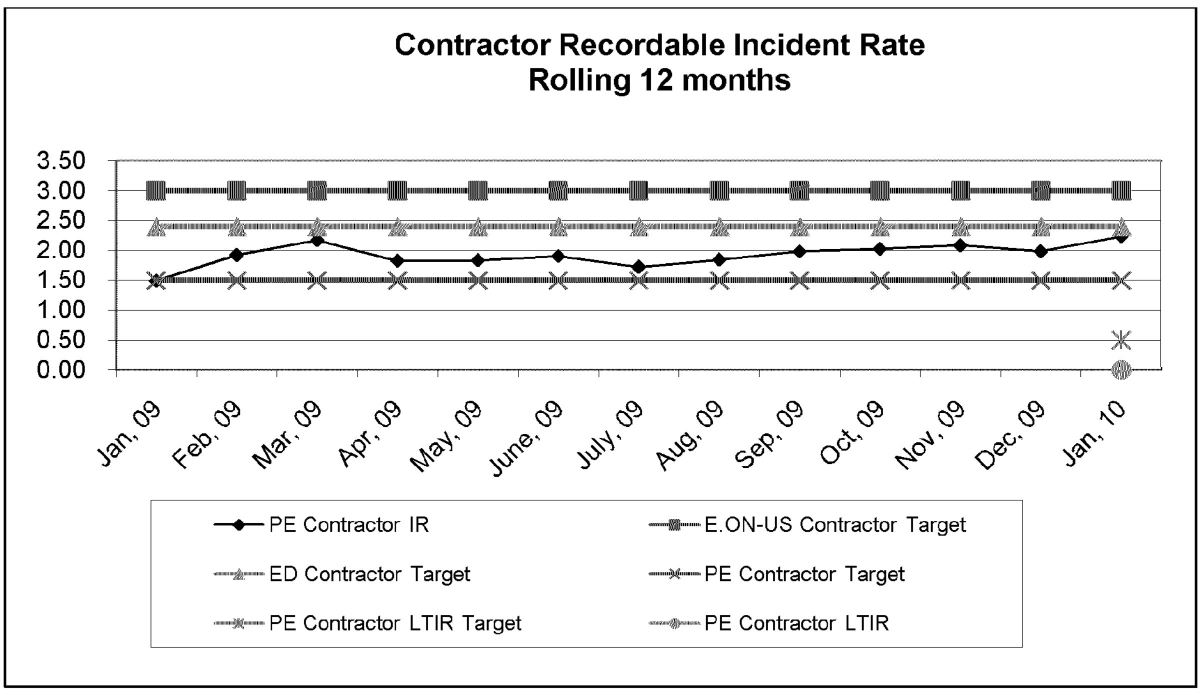
Total Project Engineering 2010	
	$59,244,000
MBE target	5%
	$2,892,200
WBE target	2%
	$1,184,880
Total M/WBE	$4,077,080

Project Engr. direct spend for 2011	
2011 Spend	$69,150,000
MBE target	5%
	$3,457,500
WBE target	2%
	$1,383,000
Total M/WBE	$4,840,500

Bechtel - TC 2 Spend - 2011
N/A

Fluor - FGD Spend - 2011
N/A

Total Project Engineering 2011	
	$69,150,000
MBE target	5%
	$3,457,500
WBE target	2%
	$1,383,000
Total M/WBE	$4,840,500



Upcoming PWT Needs:

Project Engineering
Investment Committee Schedule

INVESTMENT COMMITTEE SCHEDULE

Project Manager	Description	Amount $000s	DE	FE	MAR10	APR10	MAY10	JUN10	JUL10	AUG10	SEP10	OCT10	NOV10	DEC10
JH	CR CCP - Landfill Phase I Project (Not to IC until Feb 20	18,898												
JH	BR CCP - Aux Pond 900' Contract	13,473												
RCW	TC CCP - BAP/GSP Contract	17,352												
RCW	TC CCP - Landfill/BAP Update													
RCW	TC CCP - Landfill													
PI	BioMass Coal Firing	10,300,000												
PI	MC3, MC4, BR3 SO3 Mitigation	19,200,000												
JC	EW Brown SCR EPC Contract	40,000,000												
PI	Land Fill Gas Engineering- (Need to verify with Schetzel)													
RCW	TC CCP - Ghent Landfill													

Full Presentation at PWT Brie
Date of IC Meeting

Staffing:

ME position to replace Bill Maki is still active. Interviews are being scheduled.

From: Straight, Scott
To: Cooper, David (Legal)
Sent: 3/19/2010 7:58:12 AM
Subject: FW: Project Engineering's ES Bi-Weekly Report - March 15, 2010
Attachments: PE's Bi-Weekly Update of 3-15-10.docx

From: Straight, Scott
Sent: Monday, March 15, 2010 12:18 PM
To: Straight, Scott; Thompson, Paul; Voyles, John; Bowling, Ralph; Sturgeon, Allyson; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
Cc: Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Cooper, David; Hance, Chuck; Clements, Joe
Subject: RE: Project Engineering's ES Bi-Weekly Report - March 15, 2010

Resending to correct an error in the IC schedule table.

From: Straight, Scott
Sent: Monday, March 15, 2010 11:16 AM
To: Straight, Scott; Thompson, Paul; Voyles, John; Bowling, Ralph; Sturgeon, Allyson; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
Cc: Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Cooper, David; Hance, Chuck; Clements, Joe
Subject: Project Engineering's ES Bi-Weekly Report - March 15, 2010

<< File: PE's Bi-Weekly Update of 3-15-10.docx >>

Energy Services - Bi-Weekly Update
March 15, 2010
PROJECT ENGINEERING

- **KU SOx**
  - Safety – NTR
  - Auditing – Internal Audit will be starting the Brown FGD audit soon.
  - Schedule/Execution:
    - Ghent Remaining Scope/Schedule
      - Chimney Coatings – Scheduled for May 2010.
      - SCR/FGD Icing Siding – installation in progress.
      - Unit 4 ID Fans – The WEG motor was inspected in the shop and currently runs on magnetic center. The motor is fully expected to be on site for the outage.
      - Chimney Capping - Bids have been received and are being evaluated by PE.
    - Brown
      - FGD, Limestone and BOP construction continues to track to plan. The main focus right now continues to be completing the pre-outage work, planning and preparation for the upcoming BR3 outage in a few weeks.
  - Budget:
    - Brown – NTR.
    - Ghent – NTR
  - Contract Disputes/Resolution:
    - FGD Alliance – NTR
    - Ghent 4 ID Fan Motor – see note above.
  - Issues/Risks:
    - The schedule for material delivery, and then installation, of the structural enhancements to the Brown Unit 3 ductwork, air heaters and precipitators during the outage is going to be tight.

- **TC2**
  - Safety – Bechtel continues to experience higher recordable rates than target. All injuries have been minor in nature.
  - Permitting – EAD reports that the KPDES permit is under review and is expected to be approved with a May 1 effective date.
  - Auditing – Auditing is conducting their annual audit of the EPC Agreement.
  - Schedule/Execution:
    - Bechtel EPC –Bechtel commenced steam blows 3/10 and completed several low pressure blows on the first blow path. There was a major malfunction during the 500 psig blow that caused severe damage to the temporary piping. There were no personnel injuries. All steam blow and related activities are suspended while Bechtel assesses the damage and conducts a root cause analysis. The recovery period is expected to be around 1 week from 3/15. **Bechtel had indicated the completion date would be July 5 just <u>prior</u> to the steam blow incident.**
    - Non-Bechtel Scope:
      - PRB Upgrades – The wash down booster pumps are in commissioning.
      - PM Baghouses – TC2's baghouse is not required to be tested for permit compliance as determined by EAD. This item will be removed from the next report.

- Budget:
    - Bechtel's labor claim for the second half of 2009 was received, and as expected given the higher amounts of labor and schedule extensions, is higher than the accrued amount for the same period by approximately $4.5m higher. PE is reviewing all project cost-to-date and will be reconciling the projected final cost for all over/under spends against the budget and sanction in concert with the power credit review that Rusty is doing with Finance. The significant underruns on the FGD Program can fund this overrun to keep PE overall spend well within department budget for 2010.
- Contract Disputes/Resolution:
    - Bechtel FM Claims – NTR
    - Air Blow Change Order – Bechtel's revised change order for cancellation of the air blows is under review. Bechtel has held half of the C.O. for the completed chemical cleaning that should reduce fuel oil usage.
- Issues/Risk:
    - Bechtel's schedule performance, Excusable Event claims, start-up of all plant equipment to operational mode, and the expected increase in Labor Claim amounts against budget.

- **Brown 3 SCR**
    - Schedule/Execution – PE and the station have agreed to move the outage to the spring of 2012. This decision will not be final until negotiations with Zachry are near final. Gen Planning's analysis shows no material impact to 2012 budget.
    - Permitting – PE will participate in the KYDAQ station tour on 3/16.
    - Engineering – RPI has begun engineering and procurement activities. Flow model witnessing is planned for April, 2010 along with a visit to CERAM to see their catalyst manufacturing facility in Austria.
    - Budget:
        - $45m has been given back to the RAC on this project.
        - A Tax Exemption Certificate is being prepared in conjunction with EA to provide to RPI and eventually Zachry.
    - Contracting:
        - EPC – Second meeting with Zachry occurred on 3/8-3/9 with very good outcomes. All commercial points are tentatively agreed to with the exception of price for full EPC wrap and moving outage to the spring of 2012.
    - SCR Supplier – NTR
    - Issues/Risk – NTR

- **Brown CCP Project – Ash Ponds**
    - Safety – NTR
    - Auditing - The draft report has been issued on the Summit contract with no material findings.
    - Schedule/Execution:
        - Main Pond
            - Rock placement continues on the East Working Platform and East Starter Dike. Approximately 45% of the rock embankment has been placed to date.
            - Commissioning of the Wet Well pumps has been placed on hold for pump repair and/or replacement due to watertight seal failure.

            - Ash grading continued on the South-East portion of the pond.
        - Aux Pond 900'
            - Bid review meetings with four bidding finalists were held. Second round of bidder follow-up questions have been issued.
            - Project on schedule for presentation at the April Investment Committee meeting.
    - Budget – NTR.
    - Contract Disputes/Resolution – Fuel oil baseline adjustment review with Summit continues.
    - Issues/Risk – NTR

- **Cane Run CCP Project - Landfill**
    - Schedule/Execution:
        - 404/401 and KYDWM Permit applications have been submitted. We received notice that the KYDWM completed the administrative review on 2/11 with no issues and is currently in Technical review.
        - Development of construction drawings is on hold until the EPA presents its CCP ruling and the KYDWM has completed their initial review.
        - Decision has been made to relocate the 69kV line in 2010. Real Estate and Right of Way is working to attain the necessary land for this relocation from Metro Government.
    - Budget - NTR
    - Contract Disputes - NTR
    - Issues - NTR

- **TC CCP Project – Holcim**
    - Schedule/Execution:
        - No action at this time.
    - Budget – NTR
    - Contract Disputes/Resolution – NTR
    - Issues/Risk – Status of Holcim contract.

- **TC CCP Project – BAP/GSP**
    - Schedule/Execution:
        - Construction on the project has stopped due to the inclement weather with the exception of the concrete work for the southwest pipe culvert and minor pipe work.
    - Budgeting – NTR
    - Engineering – NTR
    - Permitting – NTR
    - Contract Disputes/Resolution – PE held the first meeting with GAI Consultants to resolve a dispute over engineering costs for the mechanical engineering for the project. GAI's financial counter offer is under review.
    - Issues/Risk – Weather. Currently not anticipating impact on the final completion date.

- **TC CCP Project – Landfill**
    - Schedule/Execution – NTR
    - Budgeting – NTR
    - Engineering – Engineering continues on the single landfill alternative.

- Permitting – After the meeting with EA on 2/26 a response is being drafted to US Fish & Wildlife regarding the IN bat issue. The outcome will likely result in continuing to perform the stream mitigation and a negotiated offset for fees to cover the bat issue.
- Contract Disputes/Resolution – NTR
- Issues/Risk – NTR

- **Ghent CCP Projects - Landfill**
  - Schedule/Execution – NTR
  - Budget – NTR
  - Engineering – Detailed Engineering of gypsum fines and Conceptual Engineering on CCP transport for landfill continues with Black & Veatch. Layouts are being developed for the location of major equipment at each FGD. We have begun issuing RFQ packages for equipment and material. Three alternative plans for CCP Transport are being developed by Black & Veatch.
  - Permitting – the final 401/404 Permit internal review will occur on 3/18. The final KYDWM permit review will occur on 3/24. Permit filing is still planned for spring 2010, regardless of final landfill footprint and land acquisition issues.
  - Contract Disputes/Resolution – NTR
  - Issues/Risk:
    - Land Acquisition – The drafting of the "last and final" written offers to the remaining three property owners prior to recommending condemnation proceedings is in progress. Meeting held with GAI to review alternative landfill designs to eliminate the need to purchase the remaining three properties. GAI continues to review designs based on feedback in the meeting.

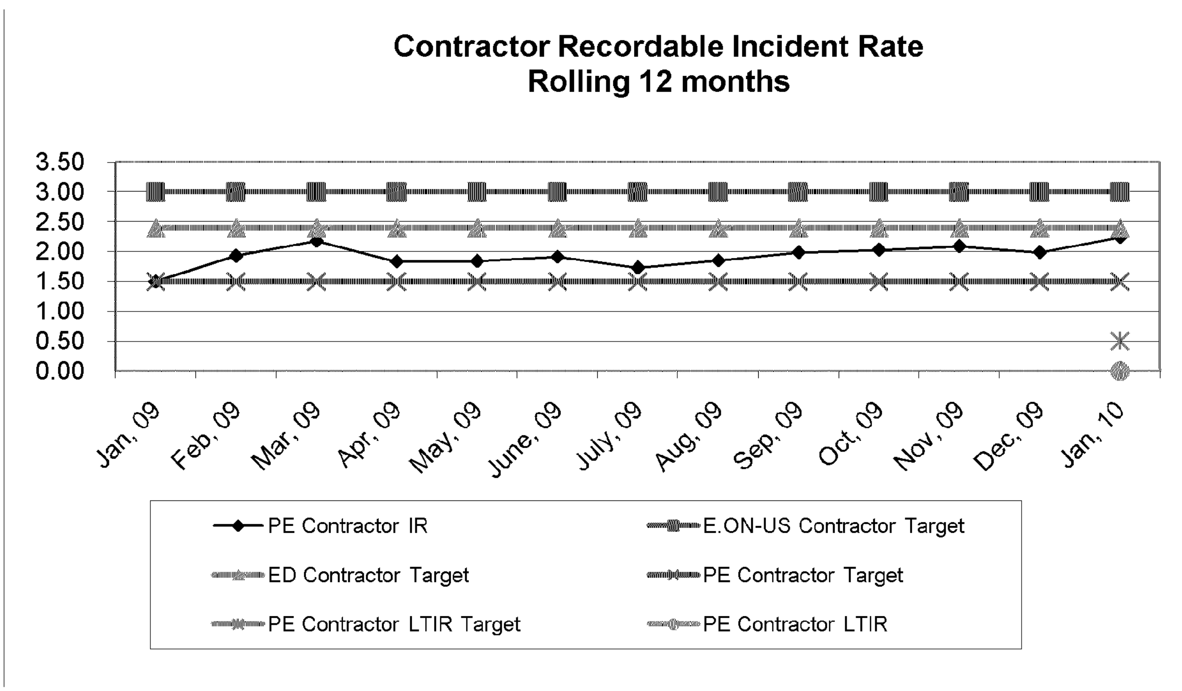
- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3)**
  - Safety - NTR
  - Schedule/Execution:
    - MC3's schedule is now tied to the BART requirement for the end of 2011. Tie-in work during spring 2011 outage is still required.
    - Preliminary Engineering reports on Wet (URS) and Dry (Nol-Tec) are under review. Dry Injection total installed cost is estimated at 2/3 of a Wet Injection system. The reports need final clarifications and editing.
    - Hall, A&D, and UGS bid on installing test ports for MC 3 & 4 dry injection testing. Hall was awarded scope – work has started at site. MC Project Coordinators are assisting with the installation work.
    - Clyde Bergmann, UCC and BCSI visited MC to assess installing temporary systems for testing purposes.
    - Spoke with E.ON Engineering about SO3 & PM testing in conjunction with the temporary system operation due to them already planning to be at MC in mid-April.
    - Attended Dry Hydrate Users Group. CO2 capture from the convey air appears to be a future trend for mitigating scaling and plugging issues. Nol-Tec and Southern Company are on the leading edge of this promising development.

- **NBU1 and Other Generation Development**
  - LFG

    - PE requested to contract specific engineering design work related to gas compression and pipeline work at Valley View and power generation at Tri-K and Ohio County.
    - The PO for sampling and lab analysis of the Republic Landfills will be released to MCC after resolution of insurance issues, which is expected by 3/19.
  - NBU 1 – Provided capacities for NGCC configurations to Generation Planning.
  - Mercury Planning
    - Final Burns & McDonnell report published.
    - Phase II planning and study required.
  - Biomass –
    - Releasing Moore Ventures to prepare submittals to get MC, TC, and Ghent certified as a Biomass Conversion Facilities (BCF) under the Biomass Conversion Assistance Program (BCAP). This program has the potential to cut biomass fuel costs in half when purchased from a eligible supplier.
    - Started Mill Creek Design Development RFP.
  - FutureGen – NTR

- General
  - Participating in the environmental "scenario planning" team by providing very speculative cost and timing for SCRs on all other units, FGD upgrades to CR, Hg control (with added PM control), and other miscellaneous cost (i.e., O&M cost) to Generation Planning. These values and timing are NOT supported by any engineering or project development. These values were created on a relative basis in less than a week.
  - Alstom Master Agreement- met with Alstom team over two days in mid-February and have traded GSA drafts since then. Down to a few issues that should be resolved over the next two weeks. Ownership of drawings and LOL are the two major points to be resolved.

Metrics



Upcoming PWT Needs:

Project Engineering
Investment Committee Schedule

Project Manager	Description	Amount $000s	DJF	MAR10	APR10	MAY10	JUN10	JUL10	AUG10	SEP10	OCT10	NOV10	DEC10
JH	CR CCP - Landfill Phase I Project (Not to IC until Feb 20	18,898											
JH	BR CCP - Aux Pond 900' Contract	13,473											
RCW	TC CCP - BAP/GSP Contract	17,352											
RCW	TC CCP - Landfill/BAP Update												
RCW	TC CCP - Landfill												
PI	BioMass Coal Firing	10,300,000											
PI	MC3, MC4, BR3 SO3 Mitigation	19,200,000											
JC	EW Brown SCR EPC Contract	40,000,000											
PI	Land Fill Gas Engineering- (Need to verify with Schetzel)												
RCW	TC CCP - Ghent Landfill												

Full Presentation at PWT Briefing
Date of IC Meeting

Staffing:

ME position to replace Bill Maki is still active with interviews being held last week.

From: Saunders, Eileen
To: 'Lucas, Kyle J.'
CC: O'Neal, Brian D.; Hillman, Timothy M.; King, Michael L. (Mike); Mahabaleshwarkar, Anand; Revlett, Gary; Black, Greg
Sent: 4/30/2010 3:36:41 PM
Subject: RE: EON AQC Project - Monday Conference Call
Attachments: Generation 2011 MTP Environmental Considerations (els copy).pptx; Generation Future Environmental Requirements.xlsx

Kyle,

This time works for me. I will extend an invitation to a few others from our Environmental Affairs (Gary Revlett) and Environmental Compliance (Greg Black) department. Enclosed, please find the matrix and informational document you refer to in your email. We can discuss any questions you may have regarding the documents as well.

Thank you,

Eileen

From: Lucas, Kyle J. [mailto:LucasKJ@bv.com]
Sent: Friday, April 30, 2010 3:13 PM
To: Saunders, Eileen
Cc: O'Neal, Brian D.; Hillman, Timothy M.; King, Michael L. (Mike); Mahabaleshwarkar, Anand
Subject: EON AQC Project - Monday Conference Call

Eileen,
Based on our conversation this morning, I have set up a conference call with a few members of the team for you to discuss the scope, data request, upcoming kick-off meeting, and site visits.

Pending issuance of the contract, the call for Monday 5/3 can be held at 1 pm eastern (noon central). This was the time that the several of the group were available for a quick call on Monday. If this works for you B&V will initiate the call. If please let Brian O'Neal or Tim Hillman know and they'll coordinate another time during the week.

Also, it is critical that we receive EON's unit specific future regulation and emission compliance matrix. Also, we need an indication from you as to which plants you feel have critical AQC and constructability issues against this matrix so that we can appropriately schedule our staff for the site visits. It would also be helpful, based on your understanding of each plant's location, the most efficient order of plants to send the two teams for the visits.

Regards,
Kyle

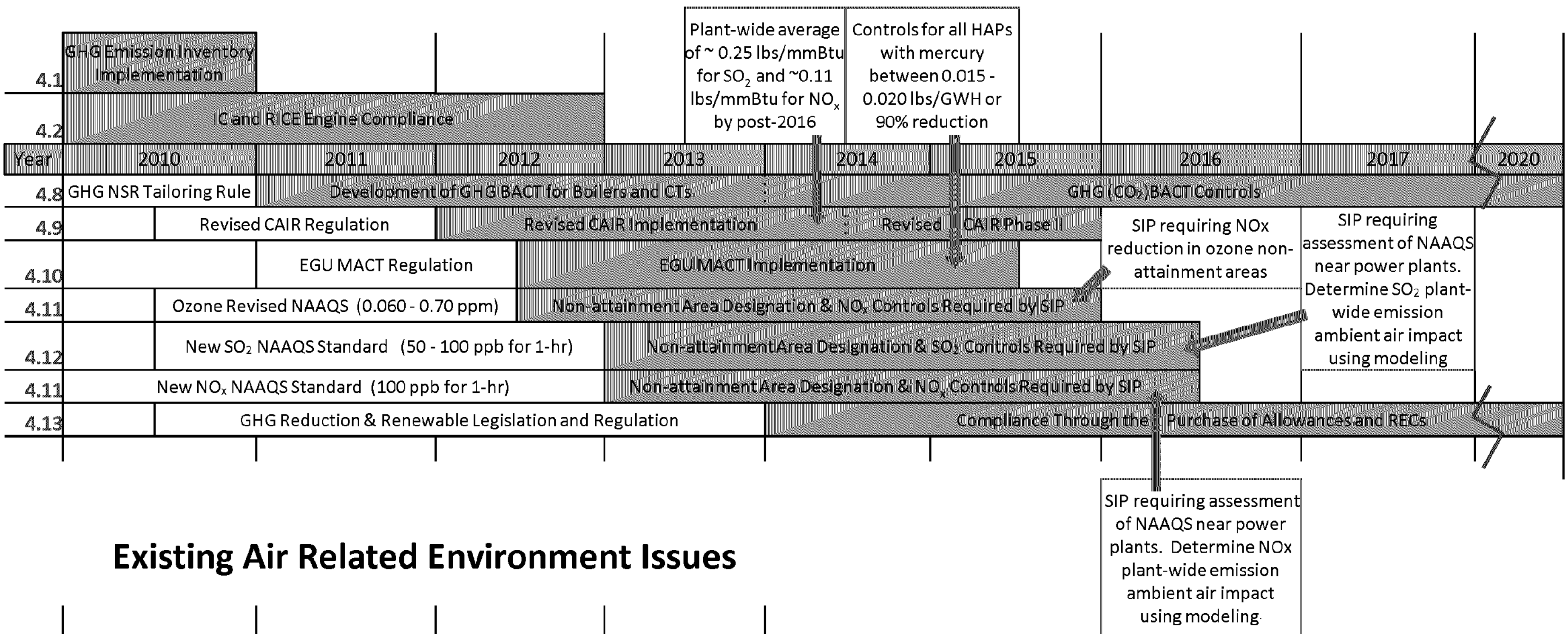
Kyle Lucas | Environmental Permitting Manager
Black & Veatch - Building a World of Difference™
11401 Lamar Avenue
Overland Park, KS 66211
Phone: **(913) 458-9062** | Fax: **(913) 458-9062**
Email: **lucaskj@bv.com**

e·on U.S.

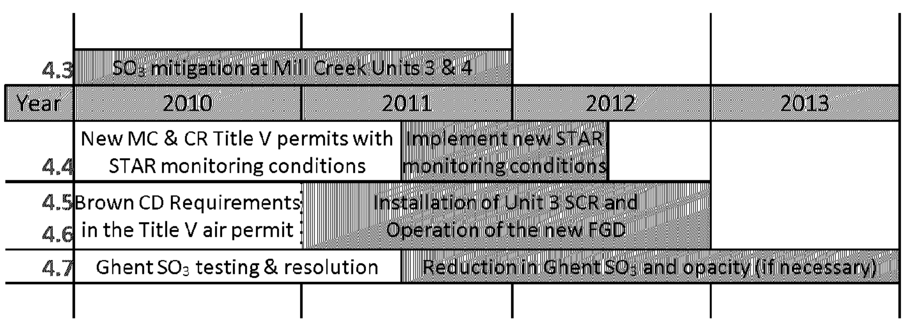
Major Assumptions (Air)

Generation
2011-2013 MTP

Air Related Environmental Regulatory Program Implementation



Existing Air Related Environment Issues



Note:
If the environmental action is above the "Year" row, then regulatory requirements are finalized.

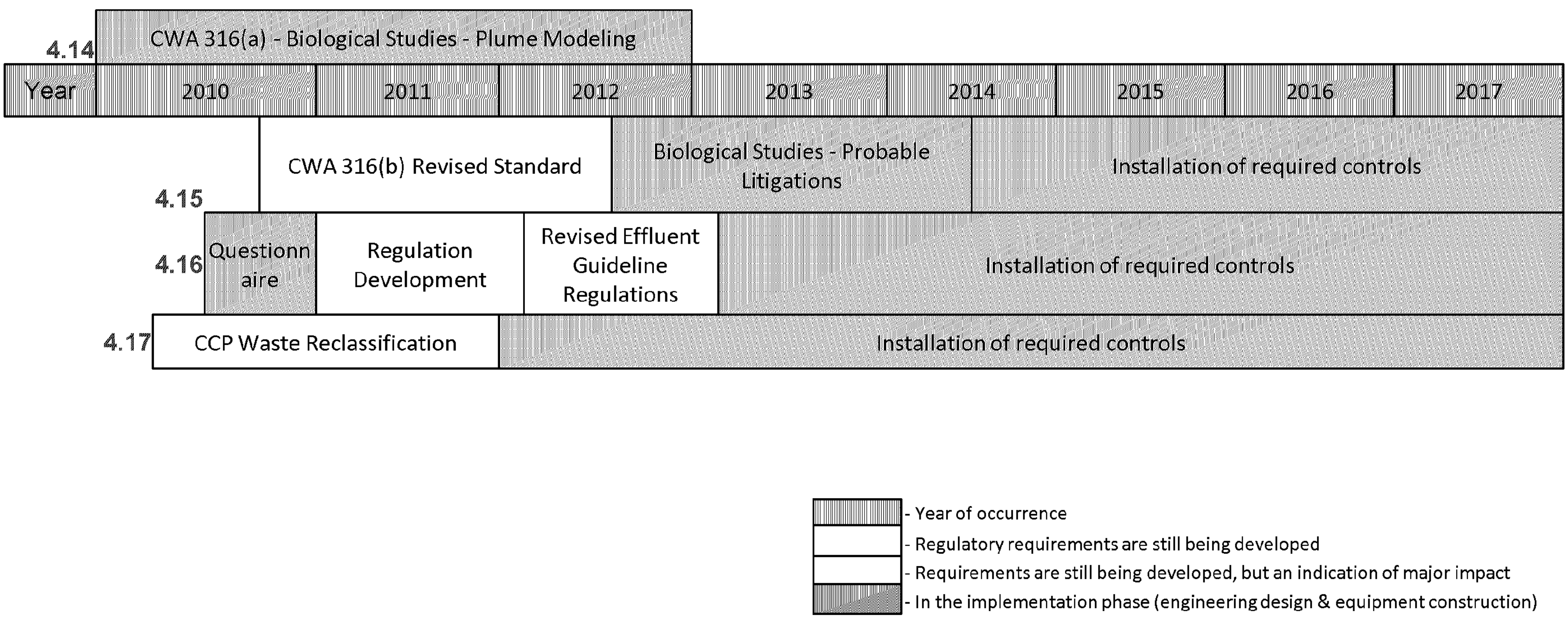
- Year of occurrence
- Regulatory requirements are still being developed
- Requirements are still being developed, but an indication of major impact
- In the implementation phase (engineering design & equipment construction)

April, 2010; Revision 1

e·on U.S. Major Assumptions (Land & Water)

Generation
2011-2013 MTP

Land & Water Related Environmental Regulatory Program Implementation



	A	B	C	D	E	F	G
1							
2	**Estimated Requirements Under Future New Environmental Regulations**						
3							
4	**Task**	**Program**	**Regulated Pollutants**			**Unit/Plant**	**Forcasted Date**
5	**No.**	**Name**	**Pollutant**	**Limit**	**Units**	**Averaging**	**for Compliance**
6	4.1	GHG Inventory	No additional limits			N/A	Spring - 2010
7	4.2	ing Engine NSPS and	PM	lorsepower. Certified to meet Tier		Unit	ting MACT & at insta
8			NO_x				
9			VOC				
10			CO				
11	4.3	Mill Creek BART	MC3 - SAM	64.3	lbs/hour	Unit	During - 2011
12			MC4 - SAM	76.5	lbs/hour		
13	4.4	fferson Co. STAR Re				Plant	Spring - 2012
14			fuels (As) 20 - 50 ppm or $\sim 1x10^{-5}$ lbs/mmBtu emis				
15	&	rown Consent Decre	PM	0.03	lbs/mmBtu	Unit 3	er, 2010 NO_x & SA
16			SO_2	97%	Removal		
17			NO_x	0.07 /0.08	lbs/mmBtu		
18			SAM	110 -220	lbs/mmBtu		
19	4.7	Ghent NOVs	SAM	3.5 - 10	ppm	Unit	During - 2012
20	4.8	GHG NSR	GHG	Energy Efficiency Projects		Unit/Plant	January, 2011
21	4.9	Revised CAIR	SO_2	0.2 - 0.3	lbs/mmBtu	Plant	Beginning in 2014
22			NO_x	0.1 - 0.15	lbs/mmBtu		
23	4.10	New EGU MACT	Hg	90%	Removal	Plant	with 1-yr extension
24				0.010 - 0.015	lbs/GWH		
25			Acids (HCl)	0.002 - 0.010	lbs/mmBtu	Unit	
26			Metals (PM)	0.03 - 0.05	lbs/mmBtu		
27			Metals (As)	$(0.5 - 1.0) \times 10^{-5}$	lbs/mmBtu		
28			Organics (CO)	0.1 - 0.3	lbs/mmBtu		
29	4.11	n Co. Ozone Non-att	NO_x	5 - 10 % reductior	NOx emissions	County-wide	Spring - 2016
30	4.11	v 1-hour NAAQS for	NO_x	TBD	lbs/hours	Plant	During - 2015
31	4.12	v 1-hour NAAQS for	SO_2	TBD	lbs/hours	Plant	Spring - 2016
32	4.13	Reduction & Renew	GHG	TBD	tons/year	Fleet	Beginning in 2014
33	4.14	CWA 316(a)	Thermal impacts	TBD	N/A	Plant	During - 2014
34	4.15	CWA 316(b)	Withdraw impacts	TBD	N/A	Plant	Beginning in 2010

	A	B	C	D	E	F	G
35	4.16	ew Effluent Standa	etals, Chlorides, e	TBD	TBD	Plant	During - 2015
36	4.17	CCP Classification	Haz. Metals	Handle dry in landfill		Plant	Beginning in 2012
37							
38		- New requirements have been finalized					

	A	B	C	D	E	F
1						
2	**Estimated Limits Under Future New Air Requirements**					
3						
4	**Program**	**Regulated Pollutants**			**Unit/Plant**	**Forcasted Date**
5	**Name**	**Pollutant**	**Limit**	**Units**	**Averaging**	**for Compliance**
6	Mill Creek BART	MC3 - SAM	64.3	lbs/hour	Unit	During - 2011
7		MC4 - SAM	76.5	lbs/hour		
8	rown Consent Decre	PM	0.03	lbs/mmBtu	Unit 3	r, 2010 NO_x & SA
9		SO_2	97%	Removal		
10		NO_x	0.07 /0.08	lbs/mmBtu		
11		SAM	110 -220	lbs/mmBtu		
12	Ghent NOVs	SAM	3.5 - 10	ppm	Unit	During - 2012
13	Revised CAIR	SO_2	0.2 - 0.3	lbs/mmBtu	Plant	Beginning in 2014
14		NO_x	0.1 - 0.15	lbs/mmBtu		
15	New EGU MACT	Hg	90% or	Removal	Plant	with 1-yr extension
16			0.010 - 0.015	lbs/GWH		
17		Acids (HCl)	0.002 - 0.010	lbs/mmBtu	Unit	
18		Metals (PM) or	0.03 - 0.05	lbs/mmBtu		
19		Metals (As)	$(0.5 - 1.0) \times 10^{-5}$	lbs/mmBtu		
20		Organics (CO)	0.1 - 0.3	lbs/mmBtu		
21	n Co. Ozone Non-att	NO_x	5 - 10 % reduction	NOx emissions	County-wide	Spring - 2016
22	w 1-hour NAAQS for N	NO_x	TBD	lbs/hours	Plant	During - 2015
23	w 1-hour NAAQS for S	SO_2	TBD	lbs/hours	Plant	Spring - 2016
24	$PM_{2.5}$ NAAQS	$_{.5}$ or Condensable	TBD	lbs/hours	Plant	During 2016
25						
26		- New requirements have been finalized				

From: Straight, Scott
To: Jones, Greg
Sent: 3/29/2010 8:56:17 AM
Subject: FW: Project Engineering's ES Bi-Weekly Report - March 15, 2010
Attachments: PE's Bi-Weekly Update of 3-15-10.docx

From: Straight, Scott
Sent: Monday, March 15, 2010 12:18 PM
To: Straight, Scott; Thompson, Paul; Voyles, John; Bowling, Ralph; Sturgeon, Allyson; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
Cc: Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Cooper, David; Hance, Chuck; Clements, Joe
Subject: RE: Project Engineering's ES Bi-Weekly Report - March 15, 2010

Resending to correct an error in the IC schedule table.

From: Straight, Scott
Sent: Monday, March 15, 2010 11:16 AM
To: Straight, Scott; Thompson, Paul; Voyles, John; Bowling, Ralph; Sturgeon, Allyson; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
Cc: Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Cooper, David; Hance, Chuck; Clements, Joe
Subject: Project Engineering's ES Bi-Weekly Report - March 15, 2010

<< File: PE's Bi-Weekly Update of 3-15-10.docx >>

Energy Services - Bi-Weekly Update
March 15, 2010
PROJECT ENGINEERING

- **KU SOx**
  - Safety – NTR
  - Auditing – Internal Audit will be starting the Brown FGD audit soon.
  - Schedule/Execution:
    - Ghent Remaining Scope/Schedule
      - Chimney Coatings – Scheduled for May 2010.
      - SCR/FGD Icing Siding – installation in progress.
      - Unit 4 ID Fans – The WEG motor was inspected in the shop and currently runs on magnetic center. The motor is fully expected to be on site for the outage.
      - Chimney Capping - Bids have been received and are being evaluated by PE.
    - Brown
      - FGD, Limestone and BOP construction continues to track to plan. The main focus right now continues to be completing the pre-outage work, planning and preparation for the upcoming BR3 outage in a few weeks.
  - Budget:
    - Brown – NTR.
    - Ghent – NTR
  - Contract Disputes/Resolution:
    - FGD Alliance – NTR
    - Ghent 4 ID Fan Motor – see note above.
  - Issues/Risks:
    - The schedule for material delivery, and then installation, of the structural enhancements to the Brown Unit 3 ductwork, air heaters and precipitators during the outage is going to be tight.

- **TC2**
  - Safety – Bechtel continues to experience higher recordable rates than target. All injuries have been minor in nature.
  - Permitting – EAD reports that the KPDES permit is under review and is expected to be approved with a May 1 effective date.
  - Auditing – Auditing is conducting their annual audit of the EPC Agreement.
  - Schedule/Execution:
    - Bechtel EPC –Bechtel commenced steam blows 3/10 and completed several low pressure blows on the first blow path. There was a major malfunction during the 500 psig blow that caused severe damage to the temporary piping. There were no personnel injuries. All steam blow and related activities are suspended while Bechtel assesses the damage and conducts a root cause analysis. The recovery period is expected to be around 1 week from 3/15. **Bechtel had indicated the completion date would be July 5 just <u>prior</u> to the steam blow incident.**
    - Non-Bechtel Scope:
      - PRB Upgrades – The wash down booster pumps are in commissioning.
      - PM Baghouses – TC2's baghouse is not required to be tested for permit compliance as determined by EAD. This item will be removed from the next report.

- Budget:
    - Bechtel's labor claim for the second half of 2009 was received, and as expected given the higher amounts of labor and schedule extensions, is higher than the accrued amount for the same period by approximately $4.5m higher. PE is reviewing all project cost-to-date and will be reconciling the projected final cost for all over/under spends against the budget and sanction in concert with the power credit review that Rusty is doing with Finance. The significant underruns on the FGD Program can fund this overrun to keep PE overall spend well within department budget for 2010.
- Contract Disputes/Resolution:
    - Bechtel FM Claims – NTR
    - Air Blow Change Order – Bechtel's revised change order for cancellation of the air blows is under review. Bechtel has held half of the C.O. for the completed chemical cleaning that should reduce fuel oil usage.
- Issues/Risk:
    - Bechtel's schedule performance, Excusable Event claims, start-up of all plant equipment to operational mode, and the expected increase in Labor Claim amounts against budget.

- **Brown 3 SCR**
    - Schedule/Execution – PE and the station have agreed to move the outage to the spring of 2012. This decision will not be final until negotiations with Zachry are near final. Gen Planning's analysis shows no material impact to 2012 budget.
    - Permitting – PE will participate in the KYDAQ station tour on 3/16.
    - Engineering – RPI has begun engineering and procurement activities. Flow model witnessing is planned for April, 2010 along with a visit to CERAM to see their catalyst manufacturing facility in Austria.
    - Budget:
        - $45m has been given back to the RAC on this project.
        - A Tax Exemption Certificate is being prepared in conjunction with EA to provide to RPI and eventually Zachry.
    - Contracting:
        - EPC – Second meeting with Zachry occurred on 3/8-3/9 with very good outcomes. All commercial points are tentatively agreed to with the exception of price for full EPC wrap and moving outage to the spring of 2012.
    - SCR Supplier – NTR
    - Issues/Risk – NTR

- **Brown CCP Project – Ash Ponds**
    - Safety – NTR
    - Auditing - The draft report has been issued on the Summit contract with no material findings.
    - Schedule/Execution:
        - Main Pond
            - Rock placement continues on the East Working Platform and East Starter Dike. Approximately 45% of the rock embankment has been placed to date.
            - Commissioning of the Wet Well pumps has been placed on hold for pump repair and/or replacement due to watertight seal failure.

            - Ash grading continued on the South-East portion of the pond.
        - Aux Pond 900'
            - Bid review meetings with four bidding finalists were held. Second round of bidder follow-up questions have been issued.
            - Project on schedule for presentation at the April Investment Committee meeting.
    - Budget – NTR.
    - Contract Disputes/Resolution – Fuel oil baseline adjustment review with Summit continues.
    - Issues/Risk – NTR

- **Cane Run CCP Project - Landfill**
    - Schedule/Execution:
        - 404/401 and KYDWM Permit applications have been submitted. We received notice that the KYDWM completed the administrative review on 2/11 with no issues and is currently in Technical review.
        - Development of construction drawings is on hold until the EPA presents its CCP ruling and the KYDWM has completed their initial review.
        - Decision has been made to relocate the 69kV line in 2010. Real Estate and Right of Way is working to attain the necessary land for this relocation from Metro Government.
    - Budget - NTR
    - Contract Disputes - NTR
    - Issues - NTR

- **TC CCP Project – Holcim**
    - Schedule/Execution:
        - No action at this time.
    - Budget – NTR
    - Contract Disputes/Resolution – NTR
    - Issues/Risk – Status of Holcim contract.

- **TC CCP Project – BAP/GSP**
    - Schedule/Execution:
        - Construction on the project has stopped due to the inclement weather with the exception of the concrete work for the southwest pipe culvert and minor pipe work.
    - Budgeting – NTR
    - Engineering – NTR
    - Permitting – NTR
    - Contract Disputes/Resolution – PE held the first meeting with GAI Consultants to resolve a dispute over engineering costs for the mechanical engineering for the project. GAI's financial counter offer is under review.
    - Issues/Risk – Weather. Currently not anticipating impact on the final completion date.

- **TC CCP Project – Landfill**
    - Schedule/Execution – NTR
    - Budgeting – NTR
    - Engineering – Engineering continues on the single landfill alternative.

- Permitting – After the meeting with EA on 2/26 a response is being drafted to US Fish & Wildlife regarding the IN bat issue. The outcome will likely result in continuing to perform the stream mitigation and a negotiated offset for fees to cover the bat issue.
- Contract Disputes/Resolution – NTR
- Issues/Risk – NTR

- **Ghent CCP Projects - Landfill**
  - Schedule/Execution – NTR
  - Budget – NTR
  - Engineering – Detailed Engineering of gypsum fines and Conceptual Engineering on CCP transport for landfill continues with Black & Veatch. Layouts are being developed for the location of major equipment at each FGD. We have begun issuing RFQ packages for equipment and material. Three alternative plans for CCP Transport are being developed by Black & Veatch.
  - Permitting – the final 401/404 Permit internal review will occur on 3/18. The final KYDWM permit review will occur on 3/24. Permit filing is still planned for spring 2010, regardless of final landfill footprint and land acquisition issues.
  - Contract Disputes/Resolution – NTR
  - Issues/Risk:
    - Land Acquisition – The drafting of the “last and final” written offers to the remaining three property owners prior to recommending condemnation proceedings is in progress. Meeting held with GAI to review alternative landfill designs to eliminate the need to purchase the remaining three properties. GAI continues to review designs based on feedback in the meeting.

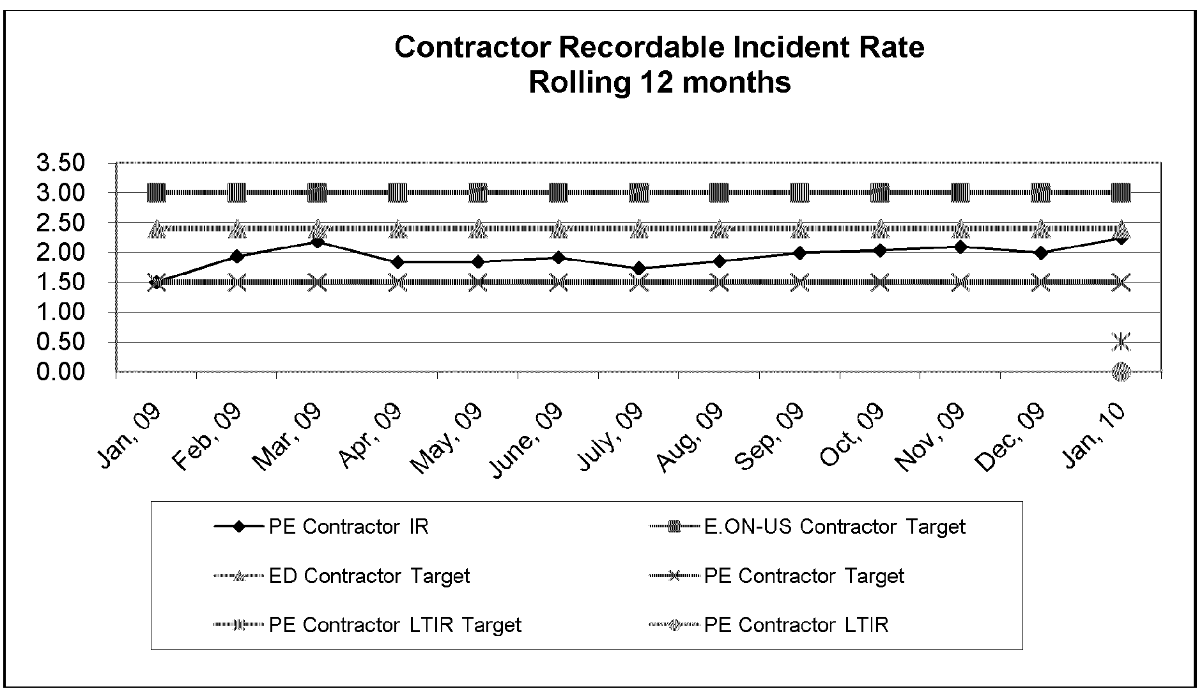
- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3)**
  - Safety - NTR
  - Schedule/Execution:
    - MC3’s schedule is now tied to the BART requirement for the end of 2011. Tie-in work during spring 2011 outage is still required.
    - Preliminary Engineering reports on Wet (URS) and Dry (Nol-Tec) are under review. Dry Injection total installed cost is estimated at 2/3 of a Wet Injection system. The reports need final clarifications and editing.
    - Hall, A&D, and UGS bid on installing test ports for MC 3 & 4 dry injection testing. Hall was awarded scope – work has started at site. MC Project Coordinators are assisting with the installation work.
    - Clyde Bergmann, UCC and BCSI visited MC to assess installing temporary systems for testing purposes.
    - Spoke with E.ON Engineering about SO3 & PM testing in conjunction with the temporary system operation due to them already planning to be at MC in mid-April.
    - Attended Dry Hydrate Users Group. CO2 capture from the convey air appears to be a future trend for mitigating scaling and plugging issues. Nol-Tec and Southern Company are on the leading edge of this promising development.

- **NBU1 and Other Generation Development**
  - LFG

        - PE requested to contract specific engineering design work related to gas compression and pipeline work at Valley View and power generation at Tri-K and Ohio County.
        - The PO for sampling and lab analysis of the Republic Landfills will be released to MCC after resolution of insurance issues, which is expected by 3/19.
    - NBU 1 – Provided capacities for NGCC configurations to Generation Planning.
    - Mercury Planning
        - Final Burns & McDonnell report published.
        - Phase II planning and study required.
    - Biomass –
        - Releasing Moore Ventures to prepare submittals to get MC, TC, and Ghent certified as a Biomass Conversion Facilities (BCF) under the Biomass Conversion Assistance Program (BCAP). This program has the potential to cut biomass fuel costs in half when purchased from a eligible supplier.
        - Started Mill Creek Design Development RFP.
    - FutureGen – NTR

- General
    - Participating in the environmental "scenario planning" team by providing very speculative cost and timing for SCRs on all other units, FGD upgrades to CR, Hg control (with added PM control), and other miscellaneous cost (i.e., O&M cost) to Generation Planning. These values and timing are NOT supported by any engineering or project development. These values were created on a relative basis in less than a week.
    - Alstom Master Agreement- met with Alstom team over two days in mid-February and have traded GSA drafts since then. Down to a few issues that should be resolved over the next two weeks. Ownership of drawings and LOL are the two major points to be resolved.

Metrics



Upcoming PWT Needs:

Project Engineering
Investment Committee Schedule

Project Manager	Description	Amount $000s	D	J	MAR10	APR10	MAY10	JUN10	JUL10	AUG10	SEP10	OCT10	NOV10	DEC10
JH	CR CCP - Landfill Phase I Project (Not to IC until Feb 20	18,898												
JH	BR CCP - Aux Pond 900' Contract	13,473												
RCW	TC CCP - BAP/GSP Contract	17,352												
RCW	TC CCP - Landfill/BAP Update													
RCW	TC CCP - Landfill													
PI	BioMass Coal Firing	10,300,000												
PI	MC3, MC4, BR3 SO3 Mitigation	19,200,000												
JC	EW Brown SCR EPC Contract	40,000,000												
PI	Land Fill Gas Engineering- (Need to verify with Schetzel)													
RCW	TC CCP - Ghent Landfill													

Full Presentation at PWT Briefing
Date of IC Meeting

Staffing:

ME position to replace Bill Maki is still active with interviews being held last week.

From:	Straight, Scott
To:	Straight, Scott; Thompson, Paul; Voyles, John; Bowling, Ralph; Sturgeon, Allyson; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
CC:	Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Hance, Chuck; Clements, Joe; Cooper, David (Legal); Jones, Greg
Sent:	5/3/2010 2:31:15 PM
Subject:	RE: Project Engineering's ES Bi-Weekly Report - May 3, 2010
Attachments:	PE's Bi-Weekly Update of 5-3-10.docx

Energy Services - Bi-Weekly Update
May 3, 2010
PROJECT ENGINEERING

- **KU SOx**
  - Safety – NTR
  - Auditing – Internal Auditing continues internal activities for the Brown FGD audit.
  - Schedule/Execution:
    - Ghent Remaining Scope/Schedule
      - Chimney Coatings – Initial chimney coating has begun.
      - SCR/FGD Icing Siding – Installation in progress. Unit 4 ID Fans – NTR
    - Chimney Capping - Chimney work has been awarded.
    - Elevators- out for bid.
    - Brown
      - FGD, Limestone and BOP construction continues to track to plan. The main focus right now is to successfully complete the BR3 outage that is scheduled to end on May 21, 2010.
  - Budget:
    - Brown – the Project continues to trend down.
    - Ghent – NTR
  - Contract Disputes/Resolution:
    - FGD Alliance – Fluor has sent a letter stating that the original target scope for Brown 3 was completed through the gas path as of April 17, 2010 and that due to work continuing on the added non-target scope (ESP and Ductwork Structural Reinforcements) they are unable to proceed with the Target Scope. Currently, no impacts are forecast to the May 10, 2010 clearing of gas path.
    - Ghent 4 ID Fan Motor – NTR.
  - Issues/Risks:
    - The work to install the structural enhancements to the Brown Unit 3 ductwork, air heaters and precipitators during the outage is proceeding and is on track to be completed within the available outage window. The commissioning work for the new BR3 I. D. Fans cannot begin until all work in the flue gas path by the project and the plant is completed.

- **TC2**
  - Safety – NTR
  - Permitting – NTR
  - Auditing – Auditing completed their annual audit of the EPC Agreement with no findings.
  - Schedule/Execution:
    - Bechtel EPC – Bechtel completed the steam blow restoration outage and is on schedule for load testing beginning May 20. This supports. **Bechtel's latest forecasted substantial completion date of July 22.**
    - Non-Bechtel Scope:
      - PRB Upgrades – Complete.
  - Budget:
  - NTR
  - Contract Disputes/Resolution:
    - Bechtel FM Claims – Meeting at Senior Officer level scheduled for May 5th.

- Issues/Risk:
  - Bechtel's schedule performance, Excusable Event claims, start-up of all plant equipment to operational mode, and the expected increase in Labor Claim amounts against budget.

- **Brown 3 SCR**
  - Schedule/Execution – PE and the station have agreed to move the outage to the spring of 2012. This decision will not be final until negotiations with Zachry are near final. Gen Planning's recent analysis indicates moving the spring outage forward two months. Discussions on-going with Gen Planning on evaluating impacts to move the outage back to the March 31st start date first communicated in their January 20th advisement.
  - Permitting –Working with EA on SO3 BACT responses to KYDAQ.Engineering – RPI is in full engineering/procurement activities. Flow modeling witnessed in Germany along with a visit to the CERAM catalyst manufacturing facility.
  - Budget:
    - NTR
  - Contracting:
    - EPC – IC approval expected the week of May 3rd with signing of the contract the following week. RPI contract recommended amendments sent to RPI for review to sync technology contract up with EPC.
  - SCR Supplier – NTR
  - Issues/Risk – NTR

- **Ohio Falls Rehabilitation**
  - Schedule/Execution – Voith Hydro, the original vendor for first two units completed, has submitted tentative schedule for third unit work to begin in June, 2011 with the remaining five following every 7/8 months, with all units complete by the end of 2014.
  - Permitting – NTR
  - Engineering/General:
    - Reviewing Voith updated scope for rehabilitation minus automation.
    - Reviewed plant goals for keeping automation scope in-house.
    - Working with power marketing group on interconnection issues regarding unit testing and commercial dates.
    - Reviewing Historic Preservation and Maintenance Plan developed in 2008.
    - Reviewing inventory of parts on hand for third unit.
  - Budget:
    - Voith Hydro submitted revised pricing as planned. Their submittal is under review. PE continues to assemble pricing for work outside hydro vendor scope
  - Contracting:
    - Work continues on developing a dewatering engineering scope of work for RFQ.
  - Issues/Risk
    - If Voith remains as hydro equipment supplier, they will need to release their turbine runner for the fourth unit sometime in early August in order to meet the tentative schedule.
    - The tentative schedule for completion of all units by late 2014 is highly dependent on year-round dewatering.

- **Brown CCP Project – Ash Ponds**

- Safety – NTR
- Auditing - NTR.
- Schedule/Execution:
    - Main Pond
        - Approximately 70% of the pond covered with straw mats for dust control.
        - In-Situ work continues with excavation and karst feature identification on the South-West sides of the embankment footprint.
    - Aux Pond 900'
        - Page turn with leading bidder held. Final contract documents under development.
- Budget – NTR.
- Contract Disputes/Resolution – Fuel oil baseline adjustment review with Summit continues.
- Issues/Risk
    - Dust control measures taken by Summit may be inadequate if extreme weather conditions are experienced.
    - Timeline for moving forward on the award of the Aux. Pond 900' contract to support the handling of gypsum expected to be produced by the FGD project in late May.
-

- **Cane Run CCP Project - Landfill**
    - Schedule/Execution:
        - 404/401 and KYDWM Permit applications are currently under review.
        - Assisted with the Courier Journal interview for an article on the CR Landfill.
        - **The public comment period on the 404 permit application ended on March 13. USACE received numerous comments as a result of a letter writing campaign by local and regional anti-coal groups. Initial feedback from the USACE is that the majority of the comments are related to CCP and our outside of their purview.**
        - **KYDWM permit is under technical review. In discussions with DWM it appears at least one Notice of Deficiency has been identified during the review but has not been issued.**
        - Completed review of the MSD Floodplain permit application with no technical comments.
        - Development of construction drawings is on hold until the EPA's presents its CCP ruling and the KYDWM has completed their initial review.
        - Real Estate and Right of Way is working to attain the necessary land for the 69kV relocation from Metro Government.
    - Budget - NTR
    - Contract Disputes - NTR
    - Issues - NTR

- **TC CCP Project – Holcim**
    - Schedule/Execution:
        - No action at this time.
    - Budget – NTR
    - Contract Disputes/Resolution – NTR
    - Issues/Risk – Status of Holcim contract.

- **TC CCP Project – BAP/GSP**
  - Schedule/Execution:
    - Construction on the project has stopped due to the inclement weather with the exception of the concrete work for the southwest pipe culvert and minor pipe work.
  - Budgeting – NTR
  - Engineering – NTR
  - Permitting – NTR
  - Contract Disputes/Resolution – GAI's financial counter offer review has been completed. A settlement offer has been forwarded to GAI. A follow-up meeting is scheduled for Tuesday, 30Mar10.
  - Issues/Risk – Weather. Currently not anticipating impact on the final completion date.

- **TC CCP Project – Landfill**
  - Schedule/Execution – NTR
  - Budgeting – NTR
  - Engineering – Engineering continues on the single landfill alternative.
  - Permitting – After the meeting Negotiations continue with USFWS on the resolution of the Indiana Bat issue. Contract Disputes/Resolution – NTR
  - Issues/Risk – NTR

- **Ghent CCP Projects - Landfill**
  - Schedule/Execution – NTR
  - Budget – NTR
  - Engineering – Detailed Engineering of gypsum fines and Conceptual Engineering on CCP transport for landfill continues with Black & Veatch. Conceptual Design for the CCP transport at Ghent is complete. Procurement activities for the gypsum fines project are in progress. Three CCP Transport layouts were presented to EON US and KU management personnel on March 23.
  - Permitting – The final draft 401/404 Permit review was completed on March 18. The final draft Division of Waste Management (DWM) Permit review occurred on March 24. Permit filing is still planned for spring 2010, regardless of final landfill footprint and land acquisition issues.
  - Contract Disputes/Resolution – NTR
  - Issues/Risk:
    - Land Acquisition – NTR.

- **General CCP Projects (Landfill Operations)**
  - Project Engineering facilitated a meeting with Ghent and Trimble County operations personnel with Environmental Affairs to discuss the regulatory requirements for operating a new Special Waste Landfill. This meeting was held on March 19.

- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3)**
  - Safety - NTR
  - Schedule/Execution:
    - MC3's schedule is now tied to the BART requirement for the end of 2011. Tie-in work during spring 2011 outage is still required.

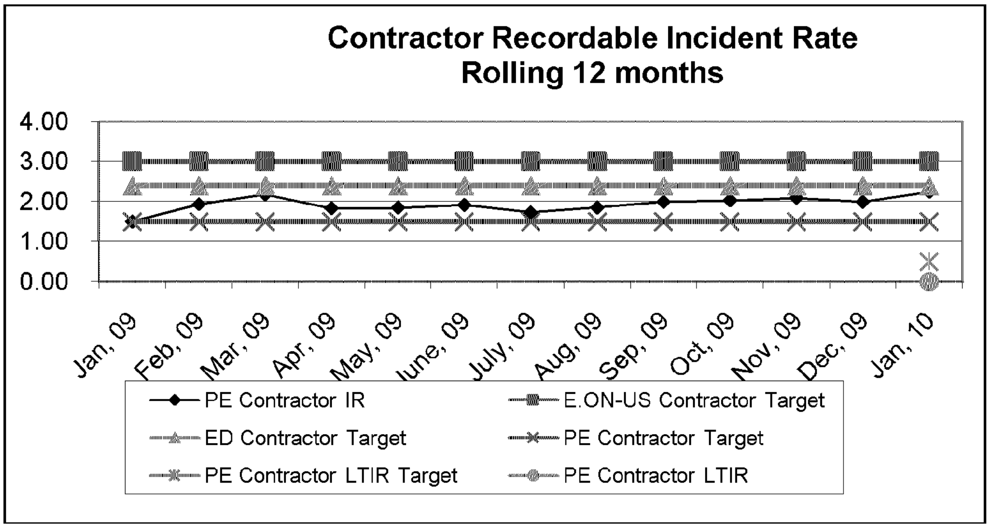
  - Preliminary Engineering reports on Wet (URS) and Dry (Nol-Tec) are under review. Dry Injection total installed cost is estimated at 2/3 of a Wet Injection system. The O&M estimates are comparable between both systems. .
  - Test ports at MC 4 are installed; insulation and lagging work needs to be completed. Hall will install MC 3 test ports during the May outage.
  - RFP for temporary system released to Nol-Tec, Clyde Bergmann, ADA/Breen and BCSI – proposals due March 30.

- **SO3 Mitigation (Ghent)**
  - Working with EA and Ghent management on response to EPA demand letter to reduce Sulfuric Acid Mist at Ghent 1, 3, & 4 to 2.8 ppm and Ghent 2 to 2 ppm.

- **NBU1 and Other Generation Development**
  - LFG
    - PO released to MCC for testing. First sample collection is week of March 29.
    - Update proposal from LFG Technologies is due March 29. Plan is to release them to perform design and estimating work to meet the MTP budgeting process.
  - NBU 1 – NTR
  - Mercury Planning - NTR
  - Biomass –
    - Released Moore Ventures (MV) to prepare submittals to get MC, TC, and Ghent certified as a Biomass Conversion Facilities (BCF) under the Biomass Conversion Assistance Program (BCAP). MV will also assess the timber at the Ghent & Trimble Landfill projects.
    - Working Mill Creek Design Development RFP.
  - FutureGen – NTR
  - CCS – Received request to provide E.ON US R&D budget to E.ON in Germany. Working with J. Moffett to provide information.

- General
  - Impoundment Integrity Program
    - . The working session with station representatives was completed April 21, 2010 to gather feedback regarding the draft policy and associated documents. Revisions are currently being made to the policy.
  - Environmental Scenario Planning – B&V awarded engineering support work to support the development of the 2011 MTP.
  - Alstom Master Agreement- Negotiations continue.

Metrics



<u>Upcoming PWT Needs:</u>

This calendar is in the process of being modified. Next report will include the revised calendar.

Project Engineering
Investment Committee Schedule

INVESTMENT COMMITTEE SCHEDULE

Project Manager	Description	Amount $000s	[illegible]	MAR10	APR10	MAY10	JUN10	JUL10	AUG10	SEP10	OCT10	NOV10	DEC10
JH	CR CCP - Landfill Phase I Project (Not to IC until Feb 20	18,898											
JH	BR CCP - Aux Pond 900' Contract	13,473											
RCW	TC CCP - BAP/GSP Contract	17,352											
RCW	TC CCP - Landfill/BAP Update												
RCW	TC CCP - Landfill												
PI	BioMass Coal Firing	10,300,000											
PI	MC3, MC4, BR3 SO3 Mitigation	19,200,000											
JC	EW Brown SCR EPC Contract	40,000,000											
PI	Land Fill Gas Engineering- (Need to verify with Schetzel)												
RCW	TC CCP - Ghent Landfill												

Full Presentation at PWT Briefing
Date of IC Meeting

<u>Staffing:</u>

May 3rd to be the first day for Vincent Forcellini to report to work as the replacement for Bill Maki.

From: Voyles, John
To: Bellar, Lonnie; Conroy, Robert
Sent: 3/22/2011 5:21:12 PM
Subject: EPA Regs Timeline
Attachments: EPA Regs Schedule 20110312.docx

Here's the current draft of the timeline I had at the meeting.

JV

<<...>>

Please note that my e-mail address has changed from john.voyles@eon-us.com to john.voyles@lge-ku.com. Please take this opportunity to update my address in your address book and delete the old e-mail address immediately. The old e-mail address will soon expire, and I will no longer be able to receive e-mails at that address.

March 14, 2011

Key 2011 Dates for EPA Regulations Actions

Date	Item	Input/Review
Jan 14, 2011	Complete review of EPA's two alternate CATR allowance allocation methods	Env, Gen Planning
Jan 28, 2011	RFP responses for CR replacement capacity due	ES
Jan 31, 2011	Finalize content and timing of ECR filing	ES, RR
Mar 11, 2011	Review ECR filing draft	ES, RR
Mar 14-18, 2011	EPA releases EGU MACT and 316(b) draft of proposed rules	Env, ES
Mar 18, 2011	Evaluation of capacity RFP responses complete	Gen Plan
Mar 31, 2011	Complete initial engineering assessments for fleet ESPs and MC FGD options	PE
Apr 8, 2011	ECR project engineering studies and 3rd party cost estimates for all plants submitted for review to ES and RR	PE
Apr 15, 2011	ECR project least cost analysis for ES review	Gen Plan
Apr 18, 2011	Finalize CATR control plan based on potential NOx/ SO_2 allocations	PE, Gen Plan, Env
April 18, 2011	RR submits draft testimony questions for Gen. Plan, PE and Env review.	RR
Apr 22, 2011	Final ECR PVRR and Bill Impact analyses	RR
May 1, 2011	File NOI for ECR filing for MC FGDs, BR Landfill, GH SAM Mitigation; (bag houses and GH2 SCR TBD)	PE, Gen Plan, RR
May 15, 2011	Final draft ECR application and testimony	ES, RR
May 31, 2011	Inv Committee/internal approvals before public mtgs for NGCC construction project	ES

Input/Review: Env = Environmental; ES= Energy Services; RR = Rates and Regulatory; PE+ Project Engineering

March 14, 2011

Jun 1, 2011	ECR and CCN filing for MC FGDs, BR landfill, GH SAM mitigation and EGU MACT response	ES, RR
Jun 1, 2011	Public ROW meetings – gas pipeline (conclude by Jul 18)	ES, RR
Jun 3, 2011	Decision on selection of final RFP offer(s)	ES
Jun 27, 2011	Final CATR issued for evaluation and impact confirmation	Env, ES
July 1, 2010	Air permit application for NGCC project	ES, Env
July 15, 2011	Draft CCN filing for CR Replacement	ES
Jul 26, 2011	EPA releases proposed GHG regs	Env, ES
Jul 29, 2011	Finalize agreements with RFP finalist(s)	ES
Sep 1, 2011	File CCN for CR replacement	ES, RR
Oct-Dec, 2011	Prepare Transmission CCN for CR replacement	Trans, RR
Nov 19, 2011	Potential ECR filing for MACT/HAPS controls (if not included in June 1 filing), SCRs (if any result from revised CATR allowance allocation)	PE, Gen Plan, RR
Nov 28, 2011	ECR Order due from KPSC	RR
Nov 30, 2011	Receive final MACT/HAPS rule	Env, ES
Dec 30, 2011	Review MACT/HAPS control plan based on final rule	PE

Input/Review: Env = Environmental; ES= Energy Services; RR = Rates and Regulatory; PE+ Project Engineering

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/19/2011 2:53:46 PM
To:	Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Schram, Chuck <Chuck.Schram@lge-ku.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Kendrick Riggs <kendrick.riggs@skofirm.com>; Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; Charnas, Shannon <Shannon.Charnas@lge-ku.com>; Revlett, Gary <Gary.Revlett@lge-ku.com>; Voyles, John <John.Voyles@lge-ku.com>; Straight, Scott <Scott.Straight@lge-ku.com>; Saunders, Eileen <Eileen.Saunders@lge-ku.com>; Wilson, Stuart <Stuart.Wilson@lge-ku.com>; Winkler, Michael <Michael.Winkler@lge-ku.com>; Ehrler, Bob <Bob.Ehrler@lge-ku.com>
Subject:	Copy: General Comments/Discussion on First Draft of ECR Applications and Testimony
Location:	LGEC12 North 2 (Cap 15)
Start:	Tue 4/26/2011 9:00:00 AM
End:	Tue 4/26/2011 10:00:00 AM
Show Time As:	Tentative
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Sturgeon, Allyson; Schroeder, Andrea; Schram, Chuck; Conroy, Robert; Kendrick Riggs; Bellar, Lonnie; Charnas, Shannon; Revlett, Gary; Voyles, John; Straight, Scott; Saunders, Eileen; Wilson, Stuart; Winkler, Michael; Ehrler, Bob

I realize that not everyone is available, but if you can make it, please try to do so. Thanks.

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/20/2011 7:47:03 AM
To:	Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; 'Riggs, Kendrick R.' <kendrick.riggs@skofirm.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; Schram, Chuck <Chuck.Schram@lge-ku.com>; Wilson, Stuart <Stuart.Wilson@lge-ku.com>
Subject:	Copy: ECR Testimony Review-Chuck Schram-Stuart Wilson
Location:	LGEC12 North 1 (Cap 15)
Start:	Mon 5/9/2011 3:00:00 PM
End:	Mon 5/9/2011 4:30:00 PM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Sturgeon, Allyson; 'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; Schram, Chuck; Wilson, Stuart

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/20/2011 7:49:20 AM
To:	Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; 'Riggs, Kendrick R.' <kendrick.riggs@skofirm.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; LGEC12 West 1201 (Cap 20) <LGEC12West1201Cap20@lge-ku.com>
Subject:	Copy: ECR Testimony Review-Robert Conroy
Location:	LGEC 1201
Start:	Mon 5/9/2011 1:30:00 PM
End:	Mon 5/9/2011 3:00:00 PM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Sturgeon, Allyson; 'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; LGEC12 West 1201 (Cap 20)

From:	Walters, Kim
To:	'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; LGEC12 West 1201 (Cap 20)
Sent:	4/20/2011 7:49:19 AM
Subject:	ECR Testimony Review-Robert Conroy

When: Monday, May 09, 2011 1:30 PM-3:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: LGEC 1201

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*

From:	Walters, Kim
To:	'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; Voyles, John; LGEC12 West 1201 (Cap 20); Straight, Scott; Saunders, Eileen
Sent:	4/20/2011 7:51:59 AM
Subject:	ECR Testimony Review-Voyles

When: Tuesday, May 10, 2011 1:30 PM-3:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: LGEC 1201

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/20/2011 7:52:01 AM
To:	Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; LGEC12 West 1201 (Cap 20) <LGEC12West1201Cap20@lge-ku.com>; 'Riggs, Kendrick R.' <kendrick.riggs@skofirm.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Saunders, Eileen <Eileen.Saunders@lge-ku.com>; Voyles, John <John.Voyles@lge-ku.com>; Straight, Scott <Scott.Straight@lge-ku.com>
Subject:	Copy: ECR Testimony Review-Voyles
Location:	LGEC 1201
Start:	Tue 5/10/2011 1:30:00 PM
End:	Tue 5/10/2011 3:00:00 PM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Bellar, Lonnie; Schroeder, Andrea; LGEC12 West 1201 (Cap 20); 'Riggs, Kendrick R.'; Conroy, Robert; Saunders, Eileen; Voyles, John; Straight, Scott

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/20/2011 7:55:52 AM
To:	Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; 'Riggs, Kendrick R.' <kendrick.riggs@skofirm.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; Charnas, Shannon <Shannon.Charnas@lge-ku.com>; LGEC12 West 1201 (Cap 20) <LGEC12West1201Cap20@lge-ku.com>
Subject:	Copy: ECR Testimony Review-Charnas
Location:	LGEC 1201
Start:	Wed 5/11/2011 10:00:00 AM
End:	Wed 5/11/2011 11:00:00 AM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Sturgeon, Allyson; 'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; Charnas, Shannon; LGEC12 West 1201 (Cap 20)
Optional Attendees:	'Crosby, W. Duncan'

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/20/2011 7:57:54 AM
To:	Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; 'Riggs, Kendrick R.' <kendrick.riggs@skofirm.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; LGEC12 West 1201 (Cap 20) <LGEC12West1201Cap20@lge-ku.com>
Subject:	Copy: ECR Testimony Review-Bellar
Location:	LGEC 1201/Conference Bridge
Start:	Thu 5/12/2011 3:00:00 PM
End:	Thu 5/12/2011 4:30:00 PM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Sturgeon, Allyson; 'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; LGEC12 West 1201 (Cap 20)
Optional Attendees:	'Crosby, W. Duncan'

Conferee code:	3825	Moderator Code:	3497
		Conference Phone Numbers:	2526, LG&E Internal 7-627-2526, KU On-net 7+seven 627-2526, Louisville area local call 502-627-2526, North America Long Distance 866-877-4571, North America Toll Free 0 800 666 0569, Argentina FK Region 0 800-444-8188, Argentina AG Region

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/20/2011 8:03:43 AM
To:	Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; 'Riggs, Kendrick R.' <kendrick.riggs@skofirm.com>; Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Revlett, Gary <Gary.Revlett@lge-ku.com>; LGEC12 West 1201 (Cap 20) <LGEC12West1201Cap20@lge-ku.com>
Subject:	Copy: ECR Testimony Review-Revlett
Location:	LGEC1201
Start:	Fri 5/13/2011 2:00:00 PM
End:	Fri 5/13/2011 3:30:00 PM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Bellar, Lonnie; Conroy, Robert; 'Riggs, Kendrick R.'; Schroeder, Andrea; Revlett, Gary; LGEC12 West 1201 (Cap 20)

From: Conroy, Robert
To: Voyles, John
CC: Schram, Chuck; Bellar, Lonnie
Sent: 4/20/2011 7:15:56 PM
Subject: Re: ECR update mtg

I can update on 1) testimony, 2) bill impact, and 3) KPSC letter request. We are waiting on three items from Scott on contracting dates, cancellation $s, and actual breaking ground dates for Kendrick to finish legal memo on CPCN risk. I met with Chris W earlier this week to give her all the info needed for communication plan.

Robert

Sent from my iPhone

On Apr 20, 2011, at 6:44 PM, "Voyles, John" <John.Voyles@lge-ku.com> wrote:

> I have not thought about this update mtg or materials to speak from.
>
> Chuck - Will you have updates on the analytics?
>
> Robert - progress or go forward plan for rate calcs?
>
> Is there missing data I need to pursue?
>
> Will double check with you guys in the a.m.
>
> We've asked chip & c. Whelan to try to join us for communication planning.
>
>
> Thanks
>
> JV

From: Voyles, John
To: Conroy, Robert
CC: Schram, Chuck; Bellar, Lonnie
Sent: 4/20/2011 7:19:07 PM
Subject: Re: ECR update mtg

Thanks Robert.

----- Original Message -----
From: Conroy, Robert
Sent: Wednesday, April 20, 2011 07:15 PM
To: Voyles, John
Cc: Schram, Chuck; Bellar, Lonnie
Subject: Re: ECR update mtg

I can update on 1) testimony, 2) bill impact, and 3) KPSC letter request. We are waiting on three items from Scott on contracting dates, cancellation $s, and actual breaking ground dates for Kendrick to finish legal memo on CPCN risk. I met with Chris W earlier this week to give her all the info needed for communication plan.

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>
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>
>
> Thanks
>
> JV

From: Schram, Chuck
To: Voyles, John; Conroy, Robert
CC: Bellar, Lonnie; Wilson, Stuart
Sent: 4/21/2011 9:44:05 AM
Subject: RE: ECR update mtg

All,

Updates on analytics to be discussed:
Bag houses: All work done except remaining discussions on issues around installation on TC1 (or not).
FGDs: Complete for filing purposes, but still working on break-even analyses.
Brown landfill: Rev requirements not ready. Will be complete next week.

Chuck

-----Original Message-----
From: Voyles, John
Sent: Wednesday, April 20, 2011 7:19 PM
To: Conroy, Robert
Cc: Schram, Chuck; Bellar, Lonnie
Subject: Re: ECR update mtg

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Sent: Wednesday, April 20, 2011 07:15 PM
To: Voyles, John
Cc: Schram, Chuck; Bellar, Lonnie
Subject: Re: ECR update mtg

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>
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>
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>
> We've asked chip & c. Whelan to try to join us for communication planning.
>
>
> Thanks
>
> JV

From:	Schroeder, Andrea </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=E026206>
Sent:	4/21/2011 12:54:19 PM
To:	Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; Straight, Scott <Scott.Straight@lge-ku.com>; Saunders, Eileen <Eileen.Saunders@lge-ku.com>; Voyles, John <John.Voyles@lge-ku.com>; Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; Kendrick Riggs <kendrick.riggs@skofirm.com>; Crosby, W. Duncan <duncan.crosby@skofirm.com>
Subject:	Copy: Discuss supporting documents for Voyles ECR Testimony
Location:	LGEC12 North 1 (Cap 15)
Start:	Tue 5/3/2011 8:30:00 AM
End:	Tue 5/3/2011 10:00:00 AM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Schroeder, Andrea; Conroy, Robert; Bellar, Lonnie; Straight, Scott; Saunders, Eileen; Voyles, John; Sturgeon, Allyson; Kendrick Riggs ; Crosby, W. Duncan

The purpose of the meeting is to finalize the documents to be provided as support to John Voyles's testimony in the 2011 ECR Plan filings.

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	5/9/2011 3:06:07 PM
To:	Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; Voyles, John <John.Voyles@lge-ku.com>; Schram, Chuck <Chuck.Schram@lge-ku.com>; Charnas, Shannon <Shannon.Charnas@lge-ku.com>; Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Revlett, Gary <Gary.Revlett@lge-ku.com>; Straight, Scott <Scott.Straight@lge-ku.com>; Wilson, Stuart <Stuart.Wilson@lge-ku.com>; Saunders, Eileen <Eileen.Saunders@lge-ku.com>; Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Riggs, Kendrick R. <kendrick.riggs@skofirm.com>; Crosby, W. Duncan <duncan.crosby@skofirm.com>; LGEC12 West 1202 (Cap 35) <EONUSC12WEST1202@lge-ku.com>
Subject:	Copy: Final ECR Application and Testimony Review (Updated with new location)
Location:	LGEC 1202
Start:	Wed 5/18/2011 1:00:00 PM
End:	Wed 5/18/2011 3:00:00 PM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Sturgeon, Allyson; Voyles, John; Schram, Chuck; Charnas, Shannon; Bellar, Lonnie; Conroy, Robert; Revlett, Gary; Straight, Scott; Wilson, Stuart; Saunders, Eileen; Schroeder, Andrea; Riggs, Kendrick R.; Crosby, W. Duncan; LGEC12 West 1202 (Cap 35)

From:	Straight, Scott
To:	Thompson, Paul; Voyles, John; Bowling, Ralph; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Jackson, Fred; Sebourn, Michael
CC:	Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Hance, Chuck; Clements, Joe; Jones, Greg; Keeling, Chip; Hendricks, Claudia; Ray, Barry; O'brien, Dorothy (Dot); Bellar, Lonnie; Blake, Kent; Sturgeon, Allyson; Conroy, Robert; Huguenard, Jim
Sent:	5/27/2011 2:36:42 PM
Subject:	Project Engineering's ES Bi-Weekly Report - May27, 2011
Attachments:	PE's Bi-Weekly Update of 5-27-11.docx

Energy Services - Bi-Weekly Update
PROJECT ENGINEERING
May 27, 2011

- **KU SOx**
  - Safety – Nothing To Report (NTR)
  - Schedule/Execution:
    - Ghent
      - Elevators – Elevators are in service and the project has been completed.
      - Ghent Limestone Barge Modifications: Barge modifications are completed and hopper modifications begin the week of June 6, 2011.
    - Brown FGD
      - Performance Testing - The testing company's draft report has been received and returned with comments.
      - SW Pumps - The station pulled a BR3 service water pump for inspection and found corrosion issues to the Goulds pumps similar to those at Ghent. The station is continuing to work with Legal and Ghent to pursue the service water pump issues with the vendor as a warranty issue.
      - Coal Pile Modification – Foundation and embankment placement is complete, except for the clay liner in the pond expansion. Clay placement is on hold for favorable weather conditions.
      - Elevators – NTR
- **TC2**
  - Safety – NTR
  - Schedule/Execution:
    - Bechtel EPC – Bechtel/Doosan conducted a technical review meeting May 12 with the station and PE. Our primary technical concern now is that the data has revealed that the furnace outlet NOx level is significantly greater than Doosan's design point and the SCR may be under sized for this condition. PE issued a letter May 23 that continues our position that Bechtel has not achieved CS Completion. PE also issued Amendment 4 to the Agreement that extends the MCN to May 27 in an effort to allow a broader fuel range, within the Agreement, to be burned in the interim. There is a meeting scheduled for May 27 to go over the results of the recently completed air flow testing by Bechtel/Doosan and how they may affect the combustion system tuning.
  - Contract Disputes/Resolution:
    - Bechtel
      - LD's – NTR
      - Bechtel Labor Claim – NTR
  - Combustion System Completion - The date of Material Change Notice has been revised from May 20 to May 27th to allow both parties more evaluation time of Test Burn results. A technical meeting with PE, the station, Bechtel, and Doosan is scheduled for May 27.
  - Issues/Risk:
    - Design of the DBEL burners for our coal specification.

        - Completion of punchlist.

- **Brown 3 SCR**
    - Safety – NTR
    - Engineering – Proceeding as planned.
    - Schedule/Execution – Proceeding to plan.
    - Issues/Risk – NTR.

- **Ohio Falls Rehabilitation**
    - Schedule/Execution:
        - Continuing to coordinate with underwater repairs contractor regarding an alternate plan for work on gate slots; diving began but river level rose again and is fluctuating at the head-works.
        - Began preparations to clamshell out debris in stop log slots discovered by divers; river fluctuations affecting the work.
        - Voith has been informed that the original date of June 6 for Unit 5 dewatering has been moved to June 27.
        - Head gate modifications are complete and have been shipped to the coating vendor.
        - Tail gate modifications continue at a Louisville area river facility after the gates were relocated from an upriver site.
        - Proposals are being analyzed for the River Services work.
        - Both the station auxiliary electrical upgrade and dewatering electrical work have been awarded.
        - Temporary 480V construction power work to be done by Overhead Dept next week.
        - Parking and lay-down area expansion began but is in a rain delay; work should be complete June 6.
        - Asbestos abatement contractor continued electrical demolition in the old fan/electrical room.
        - Pre-bid for concrete façade repairs set for May 25.
        - Continued assistance to plant on possible new office building at parking plaza.
        - Worked with Rates and Regulatory Dept on documentation in an attempt to convince FERC that the plant road is not a dike nor component of the flood levee system
    - Issues/Risk
        - Outstanding issue regarding Change of Law related international duty – potential $65k Change Order.
        - Standby costs may lead to Change Order based on not dewatering the Unit by June 6 due to high flood waters.

- **Mill Creek Limestone Project**
    - Safety - NTR
    - Schedule/Execution
        - Detailed Engineering - Meetings with the top three bidders were held on May 17. A final review of the updated proposals will take place on May 31.

        - A kickoff meeting with the limestone conveyor contractor, Dearborn Midwest was held at the site on May 20 with participation from plant representatives, HDR and Project Engineering.

- **Cane Run CCP Project**
    - Permitting
        - All permitting proceeding well.
        - Continue to work with KYDWM on Landfill Permit application.
        - Meeting with the KYDWM to discuss the MSE wall option.
    - Engineering
        - The review of constructing the smaller landfill versus modifying the existing landfill, trucking balance of CCR to Mill Creek, and MSE Wall has been completed and a recommendation from the Plant and PE to continue to obtain the permit for the new landfill, apply for a permit modification of the existing landfill and raise the existing landfill to avoid constructing the new landfill was made to Bowling and Voyles. Meeting to be arranged by Bowling with PWT for final review of recommendation.

- **Trimble Co. Barge Loading/Holcim**
    - Permitting
        - The 404 permit has been issued by the USACE and received the 401 Stream Crossing permit in December 2010.
    - Engineering
        - Working to issue BOP engineering contract. Looking to award this work to B&V as part of the CCR Transport design.
        - Looking at potential scope changes as a result of lessons learned at Ghent on the Transport project.
    - Execution
        - This project is behind schedule. A coordination meeting was held with station management to discuss path forward and communication plans.

- **TC CCP Project – BAP/GSP**
    - Safety – NTR
    - Schedule/Execution:
        - Work continues on the electrical duct banks to GSP Electrical Building. The foundation is being prepared for the building after the duct banks are poured.
        - The duct bank from the Ash Pond Electrical Building to the Ash Pond Raft has been completed.
        - With the other dikes being raised to their final height, work is now being concentrated on raising the South Dike due to the high water level inside of the BAP. All ten (10) piping systems have been switched-over from the existing system to the new system. The existing Southwest Pipe Culvert was demolished and fill has been completed to elevation 510 feet. With the completion to this elevation, the minimum freeboard distance from water elevation to dike has been reestablished. The work continues to track to the schedule established in early March.
    - Contract Disputes/Resolution
        - Riverside claims due to weather and engineering delays are being addressed.

- Issues/Risk
    - Weather remains the biggest risk to timing of completion and cost.

- **TC CCP Project – Landfill**
  - Engineering
    - Detailed Engineering in progress with GAI.
    - Meeting held with Black & Veatch concerning the Final Conceptual Design of the CCR Treatment and Transportation Systems.
  - Permitting:
    - The 401 and 404 Permit applications submitted in December 2010. Additional requested field studies are being completed.
    - The review of the DWM Permit has been completed. The permit application was delivered on June 6.
    - GAI has completed the documents for the KTC Permit Application for the bridge crossing at State Road 1838. The permit application was delivered to the KTC in March. In follow-up conversations with KTC, the permit has been lost and preparations are being made to re-file the permit.

- **Ghent CCP Projects - Landfill**
  - Safety – NTR
  - Engineering:
    - Detailed Engineering of gypsum fines nearing completion with B&V.
      - Tank foundations are under construction.
  - Execution
    - Working on the new 1-1 tanks. Hydro of tank has been completed
    - The award for the civil/mechanical to Hall Contracting was approved on May 26th by the IC.
    - The security fence around the perimeter of the land recently purchased is currently under construction.
    - Received the initial bids on the Gypsum Dewater belt package.
    - Reviewing the EPC scope of work with the Plant.
  - Permitting:
    - All permit applications have been submitted. Moving forward as expected.
    - Working on response to NOD #2.
  - Issues/Risk:
    - Land Acquisition – all essential properties under contract with a few closings remaining.

- **E.W. Brown Ash Pond Project**
  - Safety – NTR
  - Engineering – Detailed Engineering by MACTEC continues.
  - Schedule/Execution:
    - All work in the field is currently related to the Aux. Pond Scope of Work.
    - Gypsum placement on hold until density level in gypsum underflow tank reaches 45-50% after coming off the outage.
    - MACTEC and drilling subcontractor on-site to begin dye-testing. Charah performed excavation to locate previously treated karst features to be used as dye injection sites. Mactec continues spring inventory and sampling.
  - Issues/Risk:

    - Bathymetric Survey conducted on the Aux. Pond and preliminary results indicate construction schedule is attainable, but production rates are in excess of production rate forecast.
    - <u>Due to unforeseen hydrogeologic requirements, the landfill permit application submission to KYDWM will be deferred from May to late July/early Aug.</u>

- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3, Ghent)**
  - Safety – NTR
  - Schedule/Execution:
    - Received EPA/DOJ proposal on Ghent NOV. Terms discussed at EPA offices on May 26. EPA requested we counter propose in their format (quite similar to ours). There is a gap between the existing proposals – us at 5 ppm, their proposal 2-3 ppm.
    - Mills contract for Ghent with Nol-Tec for signature.
    - Ghent 1 Aux Boiler Demo work kicked off with A&D Constructors.
    - Contract awaiting B&W signature to perform Exit Gas Temperature Study at Ghent.
    - Contract prepared for Alstom signature to perform Exit Gas Temperature Study at Ghent. SSA needs to be approved for this SOW.
    - EWB SAM Mitigation BAFO due received. URS is no bidding their wet system. Evaluating bids.
    - EW Brown SAM and FGD Performance Testing utilizing high sulfur coal draft reports received, however they need significant updating.

- **Cane Run CCGT**
  - Budget – NTR
  - Gas Pipe Line Routing
    - ROW survey to ongoing.
  - Owner's Engineer
    - Released EPRI document review work as part of the specification preparation.
    - Site water routing drawings submitted.
    - Prepared a new Vendor Prequalification schedule – Prequalification work to commence in September.
  - Environmental Assessment and Permitting
    - Draft Air Permit received from Trinity for review
    - EA work with Mac-Tec ongoing.
  - LS Power Purchase
    - Released Due Diligence Scope of Work for bid – expect proposals week of May 30.
- **Other Generation Development**
  - Biomass – NTR
  - CCS 100 MW Project
    - Report update and pro forma update received.
  - FutureGen – NTR from PE.
  - Paddys & Canal Demolition – NTR

- **General**
  - Environmental Scenario Planning:

- Numerous reviews made on ECR testimonies.
- BPEI flow modeling of MC4 SCR planned in Germany, now pushed from May to June.
- Continue to work with Legal and EA on Ghent SAM compliance. Prepared technical and economic assessment for meeting 5ppm SAM at each Ghent Unit. Draft term sheet/proposal in circulation for submittal to DOJ/EPA week of April 7.
- Continue to work with Legal on asbestos litigation regarding construction of TC1.

Metrics:

NTR

Upcoming PWT Approval Needs:

Project Manager	Description	Contract, Project, SSA	Amount $000s	Month of I/C Meeting	MAY11	JUN11	JUL11	AUG11	SEP11	OCT11	NOV11	DEC11	Jan12	Feb12	Mar12	Apr12
Heun	CR CCR - Landfill Phase I - Construction	C	15,000	Aug												
Heun	GH CCR - Landfill Phase I - Construction	C		Dec												
Heun	GH CCR - Fines Mechanical - Construction	C	6,000	May												
Heun	GH CCR - Gypsum Dewatering Belts	C		Jun												
Heun	GH CCR - Dry Fly Ash System	C		Jun												
Heun	GH CCR - Bottom Ash Scraper Conveyor	C		Jun												
Heun	GH CCR - Pipe Conveyor	C		Jun												
Heun	GH CCR - Transport EPC Contract	C		Aug												
Heun	CCR Storage Compliance	P														
Imber	BR 3 SAM Mitigation	C	8,000	Jun												
Imber	MC 3 and MC4 SAM Mitigation - **On Hold**	P														
Lively	CCGT 2016 - Cane Run 7	P	589,200	Sep												
Saunders	Environmental Air Studies	P	3,250	May												
Saunders	Environmental Air Compliance - BR 1 Fabric Filter	P	105,123	Sep												
Saunders	Environmental Air Compliance - BR 2 Fabric Filter	P	113,602	Sep												
Saunders	Environmental Air Compliance - BR 3 Fabric Filter	P	117,196	Sep												
Saunders	Environmental Air Compliance - MC 1 & 2 Combined FGD	P	358,635	Sep												
Saunders	Environmental Air Compliance - MC 1 Fabric Filter	P	145,751	Sep												
Saunders	Environmental Air Compliance - MC 2 Fabric Filter	P	142,656	Sep												
Saunders	Environmental Air Compliance - MC 3 Fabric Filter	P	140,191	Sep												
Saunders	Environmental Air Compliance - MC4 FGD	P	218,431	Sep												
Saunders	Environmental Air Compliance - MC4 SCR Upgrade	P	5,606	Sep												
Saunders	Environmental Air Compliance - MC4 Fabric Filter	P	151,643	Sep												
Saunders	Environmental Air Compliance - GH1 Fabric Filter	P	147,685	Sep												
Saunders	Environmental Air Compliance - GH2 Fabric Filter	P	156,808	Sep												
Saunders	Environmental Air Compliance - GH3 Fabric Filter	P	182,210	Sep												
Saunders	Environmental Air Compliance - GH4 Fabric Filter	P	168,587	Sep												
Waterman	TC CCR - Landfill Phase I - Construction	C														
Waterman	TC CCR - Transport and Treatment - Engineering	C		Jul												
Waterman	TC CCR - Transport and Treatment - Equipment/Construction	C		Aug												
Waterman	TC CCR - BAP/GSP Sanction	P		Jun												
Williams	BR CCR - Landfill Phase I - Construction	C		Mar												
Williams	BR CCR - Ash Handling Dry Conversion	C		Aug												

- **Staffing**
  - Headcount planning is complete now that the projects are known for the 2011 ECR filing. Currently working on the WFP document.
  - Interviews to replace the loss of Jason Finn are in progress.
  - Approval to post for Business Planning Coordinator to be requested the week of June 6th.

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	2/22/2011 8:59:21 AM
To:	'Riggs, Kendrick R.' <kendrick.riggs@skofirm.com>; Charnas, Shannon <Shannon.Charnas@lge-ku.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>
Subject:	Copy: ECR Testimony Discussion
Location:	Conference Call
Start:	Tue 2/22/2011 9:30:00 AM
End:	Tue 2/22/2011 10:00:00 AM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	'Riggs, Kendrick R.'; Charnas, Shannon; Conroy, Robert; Sturgeon, Allyson

When: Tuesday, February 22, 2011 9:30 AM-10:00 AM (GMT-05:00) Eastern Time (US & Canada).
Where: Conference Call

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*

Conferee code: 5729 Moderator Code: 4862
Conference Phone Numbers: 2526, LG&E Internal
7-627-2526, KU On-net 7+seven
627-2526, Louisville area local call
502-627-2526, North America Long Distance
866-877-4571, North America Toll Free

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/19/2011 2:54:32 PM
To:	Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Schram, Chuck <Chuck.Schram@lge-ku.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; 'Kendrick Riggs' <kendrick.riggs@skofirm.com>; Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; Charnas, Shannon <Shannon.Charnas@lge-ku.com>; Revlett, Gary <Gary.Revlett@lge-ku.com>; Voyles, John <John.Voyles@lge-ku.com>; Straight, Scott <Scott.Straight@lge-ku.com>; Saunders, Eileen <Eileen.Saunders@lge-ku.com>; Wilson, Stuart <Stuart.Wilson@lge-ku.com>; Winkler, Michael <Michael.Winkler@lge-ku.com>; Ehrler, Bob <Bob.Ehrler@lge-ku.com>; Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>
Subject:	Copy: General Comments/Discussion on First Draft of ECR Applications and Testimony
Location:	LGEC12 North 2 (Cap 15)
Start:	Tue 4/26/2011 9:00:00 AM
End:	Tue 4/26/2011 10:00:00 AM
Show Time As:	Tentative
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Schroeder, Andrea; Schram, Chuck; Conroy, Robert; 'Kendrick Riggs'; Bellar, Lonnie; Charnas, Shannon; Revlett, Gary; Voyles, John; Straight, Scott; Saunders, Eileen; Wilson, Stuart; Winkler, Michael; Ehrler, Bob; Sturgeon, Allyson

When: Tuesday, April 26, 2011 9:00 AM-10:00 AM (GMT-05:00) Eastern Time (US & Canada).
Where: LGEC12 North 2 (Cap 15)

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*

I realize that not everyone is available, but if you can make it, please try to do so. Thanks.

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/20/2011 9:31:19 AM
To:	Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; 'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; Charnas, Shannon; LGEC12 West 1201 (Cap 20)
Subject:	Copy: ECR Testimony Review-Charnas
Location:	LGEC 1201
Start:	Wed 5/11/2011 10:00:00 AM
End:	Wed 5/11/2011 11:00:00 AM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Sturgeon, Allyson; 'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; Charnas, Shannon; LGEC12 West 1201 (Cap 20)
Optional Attendees:	'Crosby, W. Duncan'

From:	Conroy, Robert
To:	Charnas, Shannon; Raible, Eric
CC:	Schroeder, Andrea
Sent:	5/5/2011 9:11:54 AM
Subject:	ECR Plan filing.
Attachments:	Work Plan 05042011 - 2011 Plan.docx

Here is the summary document that I mentioned.

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Director, Rates
LG&E and KU Services Company
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(502) 741-4322 (mobile)
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2011 Amended ECR Plan / CCN Filing

Kentucky Utilities Company (KU) and Louisville Gas & Electric Company (LG&E) plan to file an application to amend their respective ECR plans by April 1, 2011. Simultaneously KU will file an application (one ECR/CCN application) for Certificates of Public Convenience and Necessity (CCN) for the construction of Air Compliance projects at Brown and Ghent and modification of the Brown Ash Pond to a Landfill. LG&E will also simultaneously file an application (one ECR/CCN application) for CCNs for the construction of Air Compliance projects at Mill Creek and Trimble County.

ECR Projects included in 2011 Amended Plan

KU

Project 34 - Brown Station – Air Compliance

- Required to comply with existing opacity limits and PSD rules, proposed HAPS regulations, and compliance with consent decree requiring Brown 3 SCR
    - Baghouse with PAC Injection – combined Units 1 and 2, Unit 3
        - O&M for baghouse systems and activated carbon
    - SAM Mitigation – Units 1 and 2
        - O&M for Sorbent Injection
- Project cost forecast is $173.59M
- Baghouse systems will require a CCN

Project 35 – Ghent Station – Air Compliance

- Required to comply with proposed CATR and HAPS regulations, opacity limits, compliance with consent decree expected in early fall
    - Baghouse with PAC Injection – all four units
        - O&M for baghouse systems and activated carbon
    - SCR Turn-Down – Units 1, 3, 4
        - No associated O&M
    - SAM Mitigation – Units 1, 3, 4
        - All Sorbent Injection O&M to be included in the 2011 Plan
- Project cost forecast is $711.53M
- Baghouse systems will require a CCN

Amended Project 29 – Brown Station Landfill

As part of the approved 2009 ECR Plan, Project 29 included Phase II of the Main Pond and Aux Pond Expansion. With the 2011 ECR Plan filing, the recommendation is to amend Project 29 to include dry storage instead of the approved wet storage.

- Required to comply with proposed Coal Combustion Residuals regulations
- Multi-phase project will maximize future vertical expansion opportunities and reduce final landfill height by using original Ash Pond footprint
- Phase I anticipated in-service by January 2014

- Phase I project cost forecast is $57.12M; total project cost forecast is $154.94M, and will have associated O&M
- Landfill does not require a CCN

LG&E

Project 26 – Mill Creek Station – Air Compliance

- Required to comply with NAAQS, Jefferson County Non-Attainment, proposed CATR and HAPS regulations
    - New FGD – combined Units 1 and 2, Unit 4
        - O&M with base rate baseline
    - Upgrade and tie-in existing Unit 4 FGD to Unit 3
        - O&M with base rate baseline
    - Baghouse with PAC Injection – all four units
        - O&M for baghouse systems and activated carbon
    - SCR Turn-Down – Unit 3 and 4
        - No associated O&M
    - SCR Upgrade – Unit 4
        - No associated O&M
    - SAM Mitigation – all four units
        - All Sorbent Injection O&M to be included in the 2011 Plan
- Project cost forecast is $1281.27M
- FGDs and baghouse systems require a CCN

Project 27 – Trimble County Unit 1 – Air Compliance

- Required to comply with proposed CATR and HAPS regulations
    - Baghouse with PAC Injection
        - O&M for baghouse system and activated carbon
- Project cost forecast is $123.75M
- Baghouses require CCN

Work Plan

Identify Eligible ECR Projects	On-going
Begin drafting application and testimony	January 31, 2011
Exhibits supporting application and testimony due to Rates	April 8, 2011
Least cost analysis / Cost justification	April 15, 2011
1st Draft of Application and Testimony to be circulated	April 18, 2011
Finalize Revenue Requirements/Bill Impact Analysis of eligible projects	April 22, 2011

2nd Draft of Application and Testimony to be circulated	April 28, 2011
File a "Notice of Intent" with KPSC (30-days prior to filing)	May 2, 2011
3rd Draft of Application and Testimony to be circulated	May 6, 2011
Submit KU and LG&E newspaper notice of proposed tariff changes and estimated bill impact (21 days prior to filing)	May 11, 2011
Final Draft of Application and Testimony to be circulated	May 13, 2011
Final Reviews	May 18, 2011
File KU CCN/ECR Application and LG&E CCN/ ECR Application with the KPSC	June 1, 2011

Witness Listing and Subject Matter

Witness: Lonnie E. Bellar

- Support/Contact: Andrea Schroeder
- Subject Matter: CCN and ECR
  - Overview of the applications
  - Introduction of Company witnesses & testimony
  - Reasons for requesting CCN
  - Reasons for ECR projects
  - Requested Rate of Return (10.63% in accordance with Rate Case assumption)
  - Project financing

Witness: John Voyles

- Support/Contact: Eileen Saunders
- Subject Matter: CCN and ECR
  - Engineering studies supporting the cost and construction for the environmental projects
  - Overview of the projects contained in the ECR Plan
  - Detailed discussion of each project contained in the ECR Plan
    - Any O&M savings associated with projects
    - Any incremental O&M cost to be recovered
    - Any retirements resulting from new projects
    - Why the projects are needed

Witness: Gary Revlett

- Support/Contact: Mike Winkler, Jason Wilkerson

- Subject Matter: CCN and ECR

    - Ghent NOV Consent Decree status (SAM Mitigation)
    - Discussion of environmental regulation requiring additional compliance measures including the Clean Air Act Amendments (CAAA)
    - Specific Environmental laws and/or regulations that require each of the Projects included in the ECR filing
    - Status of environmental permits/requirements for each project, as necessary

Witness: Chuck Schram

- Support/Contact: Stuart Wilson

- Subject Matter: CCN and ECR
    - Least cost analyses for environmental compliance
    - Project cost justification
    - Cost support as needed for each project contained in the ECR Plan
        - Accuracy/confidence of cost estimates

Witness: Shannon Charnas

- Support/Contact: Eric Raible

- Subject Matter: ECR Only
    - Explanation of the Company's reporting and accounting of the O&M expenses associated with the projects contained in the plan
    - Discussion of the level of expenditures already included in existing rates

Witness: Robert M. Conroy

- Support/Contact: Andrea Schroeder

- Subject Matter: ECR Only
    - Discussion of Customer bill impact
        - Increase due to ECR projects
    - Presentation of forms for ECR filings

Overall Risks/Issues associated with the Filing

- ECR Legislation under KRS 278.183

- Significant cost overruns for project construction of prior approved projects

- Ghent NOV Consent Decree (SAM Mitigation)

- Lack of final regulations adds uncertainty to the need for and scope of the projects
- Commission could grant a CCN and deny ECR recovery until a future compliance plan or rate case
- Previous compliance plan results
- New Commission and PSC staff turnover

From:	Walters, Kim </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=E010358>
Sent:	5/18/2011 7:58:07 AM
To:	Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; Voyles, John <John.Voyles@lge-ku.com>; Schram, Chuck <Chuck.Schram@lge-ku.com>; Charnas, Shannon <Shannon.Charnas@lge-ku.com>; Bellar, Lonnie <Lonnie.Bellar@lge-ku.com>; Conroy, Robert <Robert.Conroy@lge-ku.com>; Revlett, Gary <Gary.Revlett@lge-ku.com>; Straight, Scott <Scott.Straight@lge-ku.com>; Wilson, Stuart <Stuart.Wilson@lge-ku.com>; Saunders, Eileen <Eileen.Saunders@lge-ku.com>; Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; 'Riggs, Kendrick R.' <kendrick.riggs@skofirm.com>; 'Crosby, W. Duncan' <duncan.crosby@skofirm.com>; LGEC12 West 1202 (Cap 35) <EONUSC12WEST1202@lge-ku.com>
Subject:	Copy: Final ECR Application and Testimony Review (Updated with new location)
Location:	LGEC 1202
Start:	Wed 5/18/2011 1:00:00 PM
End:	Wed 5/18/2011 3:00:00 PM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Sturgeon, Allyson; Voyles, John; Schram, Chuck; Charnas, Shannon; Bellar, Lonnie; Conroy, Robert; Revlett, Gary; Straight, Scott; Wilson, Stuart; Saunders, Eileen; Schroeder, Andrea; 'Riggs, Kendrick R.'; 'Crosby, W. Duncan'; LGEC12 West 1202 (Cap 35)

From:	Straight, Scott
To:	Straight, Scott; Thompson, Paul; Voyles, John; Bowling, Ralph; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
CC:	Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Hance, Chuck; Clements, Joe; Cooper, David (Legal); Jones, Greg; Keeling, Chip; Hendricks, Claudia; Ray, Barry; O'brien, Dorothy (Dot); Bellar, Lonnie; Blake, Kent; Sturgeon, Allyson; Conroy, Robert; Cornett, Greg
Sent:	1/13/2011 1:24:31 PM
Subject:	Project Engineering's ES Bi-Weekly Report - January 14, 2011
Attachments:	PE's Bi-Weekly Update of 1-14-11.docx

Scott Straight, P.E.
Director, Project Engineering
LG&E and KU Energy, LLC
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scott.straight@lge-ku.com

Energy Services - Bi-Weekly Update
PROJECT ENGINEERING
January 14, 2011

- **KU SOx**
  - Safety – NTR
  - Schedule/Execution:
    - Ghent Elevators – in progress.
    - Ghent Misc. - Fluor demobilized in December. Two Fluor engineers returned to the site to oversee ID Fan Testing which is taking place the week of January 10, 2011.
    - Brown Unit 2 - ID fan and damper control implementation was completed during the last week of the outage as planned and scheduled.
    - Brown Gypsum - De-watering continues
    - Brown Coal Pile Modification – in progress.

- **TC2**
  - Safety – NTR
  - Schedule/Execution:
    - Bechtel EPC – Performance Guarantee Tests (on restricted coals) were completed 12/23/10. Bechtel's preliminary results indicate all guaranteed values for thermal performance and air emissions were met for Final Completion except for ammonia consumption, which met the Substantial Completion guarantee value. The preliminary results also indicate the Net Electrical Output Guarantee was surpassed by about 10 MW and Bechtel will qualify for the maximum performance bonus of $6M if major changes to the combustion system are not performed during the amendment period. PE officially rejected Bechtel's petition for Substantial Completion because the work is not complete with respect to the burners and the ammonia forwarding system. An Amendment to the EPC Agreement is being negotiated with Bechtel that allows care, custody, and control of the unit to transfer to Owners while suspending delay LD's to Bechtel while Bechtel completes the burner and ammonia forwarding system work. The Amendment reserves our rights to LD's, warranty, performance, risk of loss, among other key business points, during this Interim Operation period.
  - Contract Disputes/Resolution:
    - Bechtel completed a wire transfer of LD payments totaling just over $25.6M on 1/12/11. This represents the undisputed amount of our $38.1M demand letter for LD's accumulated through 11/20/10.
    - Finalization of the Amendment is targeted for week of Jan 10.
  - Issues/Risk:
    - Design of the DBEL burners for our coal specification
    - Completion of the ammonia forwarding system.
    - Long-term life of the coal mill gearbox bearings.

- **Brown 3 SCR**
  - Safety – NTR
  - Permitting – NTR
  - Engineering – proceeding as planned to support the spring 2012 in-service.
  - Schedule/Execution – SCR ductwork deliveries nearly complete.

- Issues/Risk – NTR

- **Ohio Falls Rehabilitation**
  - Safety – Received and reviewing Voith Hydro Health and Safety Plan
  - Engineering
    - Voith Hydro proceeding with equipment orders and pre-mobilization issues for a restart of rehabilitation on Unit 5 in June, 2011.
    - RFQ for underwater repairs to Unit 5 gate slots to be out by Monday, 1/17.
    - B&V continues engineering on gate modifications; RFQ expected to be out in early February.
    - Continued review and edit of Aquarius Marine's submittal of underwater inspection report for entire plant as required by FERC.
    - PE reviewing potential change in SOW for possible 240/480 VAC station auxiliary system upgrade.
    - PE completed work with Voith (VHMS) generator group on application for grid interconnection; information forwarded.
    - PE continues assembling SOW documents for Historic Maintenance Plan repairs to concrete building façade.
  - Issues/Risks
    - NTR

- **Mill Creek Limestone Project**
  - Safety - NTR
  - Schedule/Execution
    - East and Westbrook nearing completion of the building erection. Final work will take place the week of 1/10/11 with a punch list walk-down scheduled for 1/18/11.
    - Detailed Engineering - The award recommendation has been signed and notifications to the successful and non-successful bidders are in progress.

- **Cane Run CCP Project**
  - Permitting
    - 404 and Landfill Permit applications remain under review by the agencies. To date permitting process has gone well. The 401 permit was received on 8/4/10. The Flood Plain permit was received 11/22/10.
  - Engineering
    - The review of constructing the smaller landfill versus modifying the existing landfill and trucking balance of CCR to Mill Creek is nearing completion. Preliminary results indicate no financial benefit to NOT building the landfill; however, while cons exist for long-term trucking to Mill Creek (i.e. Safety, emissions off of trucks, bad weather handling, etc.) there are pros as well with regards to local issues. Initial review held with Bowling and a final review held with Bowling and Voyles. Currently looking at a third alternative, MSE wall around existing landfill to determine if it's a viable option. Review meeting planned for 2/14/11.
    - Finalization of construction drawings are on hold until the KYDWM permit review is completed and any necessary changes can be incorporated.
    - Working on finalizing design, currently 60% complete, of the smaller landfill to support the proposed 2016 CCGT. A revised estimate for the smaller landfill has been completed by STANTEC and is under review with PE. The revised estimate is lower than the 2011 MTP amount that was a prorate from the original landfill scope.

- **Trimble Co. Barge Loading/Holcim**
  - Finalized order with UCC to purchase pneumatic Fly Ash handling system.
  - The permit has been published on the USACE's website.
  - Received 401 Stream Crossing permit on 20-Dec-10.
  - Working to issue BOP engineering contract.

- **TC CCP Project – BAP/GSP**
  - Safety – NTR
  - Schedule/Execution:
    - GSP's liner system installation completed. Placement of ballasting water for the liner was completed on 1/10/11. Preparations are now being made to set the GSP Raft.
    - All fill and mechanically stabilized earth wall work on the BAP is completed except for a small section of the South Dike. Work continues on erection of the new Pipe Rack, electrical duct banks to GSP Electrical Building and to Ash Pond Raft.
    - Actions being taken to prevent deer from entering the GSP. Fencing was completed at the GSP on 1/7/11.
  - Contract Disputes/Resolution
    - Minor issues to resolve with Riverside.
    - IC approved $4.2m increase in Riverside contract authorization.
  - Issues/Risk
    - Weather remains the biggest risk; however, the weather over the last 4 months has been exceptional for this project.

- **TC CCP Project – Landfill**
  - Engineering
    - Detailed Engineering in progress with GAI.
    - Drill crews continue the geotechnical exploration.
  - Permitting:
    - The 401 Permit Application was submitted to the Kentucky Division of Water on 12/10/10.
    - The 404 Permit Application was submitted to the US Army Corps of Engineers on 12/21/10.
    - The final review with MACTEC and Environmental Affairs occurred 12/9/10 along with meetings with Legal and Right of Way on potential acquisition of small land parcels for right of ways and stream mitigation.

- **Ghent CCP Projects - Landfill**
  - Safety – NTR
  - Engineering:
    - Detailed Engineering of gypsum fines continues with B&V.
      - Issued tank foundation contract to E&W.
    - Detailed Engineering of the CCR Transport System awarded to B&V. The first conceptual scope meeting is scheduled for 1/17/11 to finalize the conceptual scope of the transport and handling systems.
    - Drawings and Specifications for the Detailed Engineering for the Landfill have been submitted for review within EON-US.
  - Permitting:
    - **All permit applications have been submitted.**
  - Miscellaneous

- Issues/Risk:
    - Land Acquisition – A meeting was held in LG&E Building on 12/17/10 with the remaining land owner's counsel (Mr. Crawford) and the Deatons. A final offer will be submitted to Deatons counsel the by mid-January that positions them to accept the offer or we move to condemnation

- **E.W. Brown Ash Pond Project**
    - Safety – NTR
    - Issues/Risk:
    - Continue to work with Summit on contract settlement payout/resolution.
    - Engineering – Detailed Engineering in progress by MACTEC.
    - Schedule/Execution:
        - All work in the field is currently related to the Aux. Pond Scope of Work.
        - Placement of Gypsum on hold for favorable weather conditions. Gypsum will be stockpiled instead of sluicing to Aux Pond.
        - Continue to provide BR Landfill design information to MACTEC.
        - BR Landfill design Kick-Off was held on 1/11/11.

- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3, Ghent)**
    - Safety – NTR
    - Schedule/Execution – all projects essentially on hold until resolution of Ghent with EPA and Air Compliance planning with B&V study nears finalization in 1Q of 2011.
    - Next EPA discussion with respect to Ghent is the week of January 17th.
    - Planning further testing at Brown in conjunction with FGD Performance Testing utilizing high sulfur coal in March.

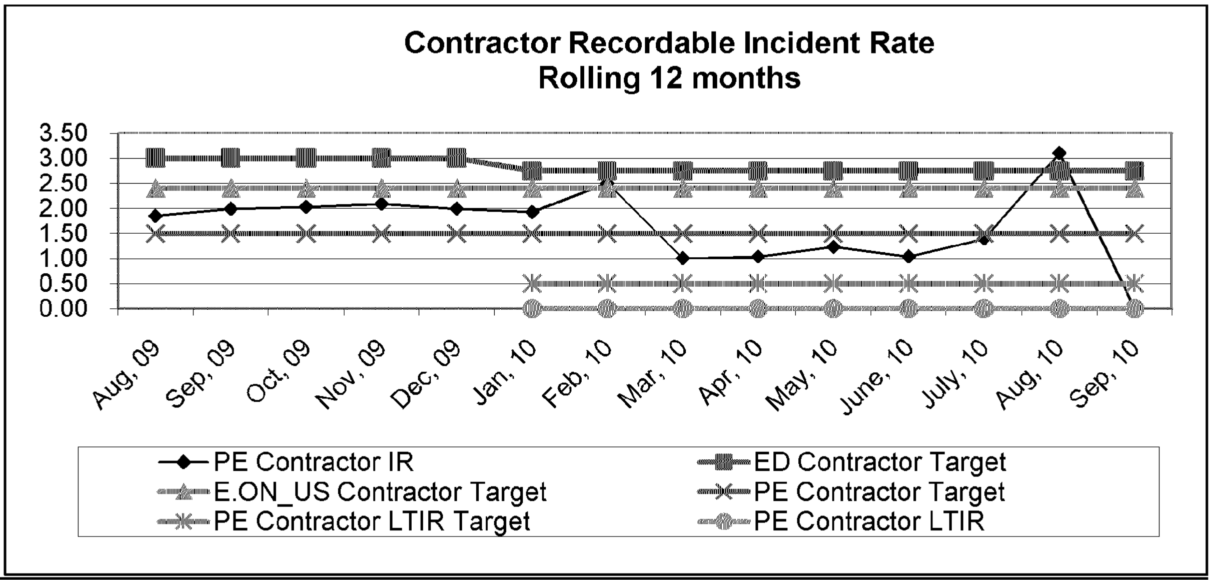
- **Cane Run CCGT**
    - Gas Pipe Line Routing – EMS has submitted and LGE has commented on a gas pipeline Routing Report. Planning second phase of design and engineering considering EMS for continued effort on this project.
    - Owner's Engineer – HDR awarded $200k to begin OE efforts. Preparing IC paper for February to increase AIP to $5.5m to cover continued development efforts including full release of OE. Held NGCC primer to further educate Operations, EA, PE, Generation Planning on the CR7 design basis. Booked NGCC technology plant due diligence trips for the week of 1/24/11.
    - Sound Survey –. Survey complete and distributed. Note concerning results from survey.
    - Set-back Survey of Neighbors at Cane Run – OE has submitted new layout meeting the 2000' foot residential setback requirements.
    - Start Up Emissions – Preparing all heat balances and emissions based on 640 net MW 1% summer design condition which equates to 690 net MW winter condition. Planned kickoff meeting with Trinity on week of 1/31/11.

- **Other Generation Development**
    - LFG - NTR.
    - Biomass – BCAP rules promulgated. Working to complete forms for submittal.
    - CCS 100 MW Project –
    - EPRI questionnaire released to 13 technology suppliers; response date January 31st.
    - KGS ongoing. 1 set of geology data under contract. Negotiating licensing agreement for 2nd set of data.
    - KBR under contract. Site visit planned for week of January 17th.

- FutureGen –Surface Team completed evaluations on schedule.

- **General**
  - Environmental Scenario Planning:
    - All stations (MC, Ghent and Brown) are under review.
    - Various meetings being held with Gen Planning, Rates & Regulatory to continue honing the plan and various compliance scenarios.
    - SCRs not in plan for Hg co-benefit. This will lead towards several (if not all but Ghent 2) SCRs not being needed, pending final allowance allocation by EPA.
  - 2011 MTP ECR/CCN Filings – working closely with Rates on PSC submittals and presentations/updates. **A filing date has been preliminarily set with Rates for April 1 2011.**
  - Continue to work with Legal and EA on Ghent SAM compliance.
  - Continue to work with Legal on asbestos litigation regarding construction of TC1.

Metrics



PE finished 2010 with an IR of 1.49, just under the goal of 1.50.

Upcoming PWT Needs:

Project Engineering
Investment Committee Schedule

INVESTMENT COMMITTEE SCHEDULE

Project Manager	Description	Contract, Project SSA	Amount $000s	Month of I/C Meeting	SEP10	OCT10	NOV10	DEC10	JAN11	FEB11	MAR11	APR11	MAY11	JUN11	JUL11	Aug11
Heun	CR CCP - Landfill Phase I - Construction	C	15,000	Aug												
Heun	GH CCP - Landfill Phase I - Construction	C														
Heun	GH CCP - Gypsum Fines and Transport - Engineering	C	4,000	Oct												
Heun	GH CCP - Gypsum Fines and Transport - Equipment Construction	C														
Heun	GH CCP - Biannual Update	C														
Imbe	BR 3 SAM Mitigation	C	8,000	Dec												
Imbe	GH 1 -4 SAM Mitigation	P	32,000	Dec												
Imbe	MC 3 and MC4 SAM Mitigation - On Hold	P														
Imbe	Biomass Coal Firing															
Imbe	Land Fill Gas Engineering															
Lively	CCGT 2016 - Cane Run	P	589,200	Apr												
Saunders	MC Limestone Mill EPC Contract	C	12,000	Dec												
Saunders	BR 2 SCR Technology	P														
Saunders	BR 2 SCR EPC	P														
Saunders	GH 2 SCR Technology	P														
Saunders	GH 2 SCR EPC	P														
Waterman	TC CCP - Landfill Phase I - Construction	C														
Waterman	TC CCP - Gypsum Fines and Transport - Engineering	C														
Waterman	TC CCP - Gypsum Fines and Transport - Equipment Construction	C														
Williams	BR CCP - Landfill	P	66,000	Oct												
Williams	BR CCP - Landfill Phase I - Construction	C		Jun												
Williams	BR CCP - Ash Handling Dry Conversion	C		Jun												

Staffing

- Significant staffing increases in PE expected to manage the current slate of projects in PE's 2011 MTP and to account for retirements. Headcount planning is in process now that the MTP has been approved by LG&E and KU Energy. The revised PE headcount plan is expected to be in final draft in January 2011.
- The new position to manage project approval documentation and schedules is expected to be posted within two weeks. The position description is under final review with HR.

From:	Thomson, Robert
To:	Conroy, Robert
CC:	Schram, Chuck; Foxworthy, Carol
Sent:	1/17/2011 11:06:25 AM
Subject:	Rate impact of EPA proposals
Attachments:	KU Rev Req template - environmental retrofits.xlsx; LG&E Rev Req template - environmental retrofits.xlsx; Potential rate impacts of EPA proposals; Rate impact of EPA proposals 01_14_11.xlsx

Robert,

Back in November we took a first shot at estimating EPA rate impacts at a company and customer-category level (see attached email). We used a revenue-share basis for cost allocation as recommended by Rates & Reg.

Last week John Voyles asked for an update of this approach using more detailed capital cost estimates for the necessary retrofits, and recognizing an accelerated schedule of implementation (everything completed by the end of 2016). The provisional results are shown in the attached file; I have also attached our revenue requirements calculation for each utility (how we convert the capital expenditure profile for each utility to an annual carrying charge).

One thing that has not been updated is the revenue share of each customer category, for each utility (residential, commercial, industrial) in 2016. I have left the 2019 shares unchanged. I would expect that these shares do not change greatly from year to year; however I am still not clear on what the actual 2019 revenue totals (from Rates) represent - presumably some projection of base rate revenues (only)? The relative impact on the different customer classes is of course critically dependent on this projection (cells C162:C164 (LG&E) and C179:C181 (KU) of the Rate Impact tab).

I'd appreciate if the Rates group could take a look at our approach and confirm that you are comfortable with the new results. If you need more details on the composition of the capex totals for each company I can forward those also.

Thanks,

Bob

	A	B	C	D	E	F	G
1		**Revenue Requirements Template: Inputs**					
2							
3		Start year	**2011**				
4		Asset life	**25**				
5		Include deferred tax impact	**Yes**				
6		Tax life	**15**				
7							
8		Capital structure					
9		Debt	**50%**				
10		Equity	50%				
11							
12		Interest rate (pre-tax)	**5.0%**				
13		Equity return (post-tax)	**10.5%**				
14		Tax rate	**40%**				
15							
16		WACC					
17		Pre-tax	11.3%				
18		Post-tax	6.8%				
19							
20		Property tax	**0.25%**				
21		Insurance	**1.00%**				
22							
23							Choose scenario
24		Total LG&E CapEx	Scenario 1	Scenario 2	Scenario 3	Scenario 4	**4**
25			Air (exc SCR)	Air (inc SCR)	Air (inc SCR) + C	Air (exc SCR) + CCP	
26		2010	$1.9	$1.9	$1.9	$1.9	$1.9
27		2011	$18.7	$44.0	$45.1	$19.8	$19.8
28		2012	$33.3	$168.0	$182.2	$47.5	$47.5
29		2013	$78.3	$262.3	$263.2	$79.1	$79.1
30		2014	$276.5	$368.6	$395.4	$303.3	$303.3
31		2015	$379.4	$379.4	$534.1	$534.1	$534.1
32		2016	$81.7	$81.7	$230.0	$230.0	$230.0
33							
34			$869.7	$1,305.9	$1,651.8	$1,215.6	

	A	B
1	**Variable O&M**	
2		
3	2011	$0.00
4	2012	$0.00
5	2013	$0.00
6	2014	$0.00
7	2015	$0.00
8	2016	$0.00
9	2017	$0.00
10	2018	$0.00
11	2019	$0.00
12	2020	$0.00
13	2021	$0.00
14	2022	$0.00
15	2023	$0.00
16	2024	$0.00
17	2025	$0.00
18	2026	$0.00
19	2027	$0.00
20	2028	$0.00
21	2029	$0.00
22	2030	$0.00
23	2031	$0.00
24	2032	$0.00
25	2033	$0.00
26	2034	$0.00
27	2035	$0.00
28	2036	$0.00
29	2037	$0.00
30	2038	$0.00
31	2039	$0.00
32	2040	$0.00
33	2041	$0.00
34	2042	$0.00
35	2043	$0.00
36	2044	$0.00
37	2045	$0.00
38	2046	$0.00
39	2047	$0.00
40	2048	$0.00
41	2049	$0.00
42	2050	$0.00
43	2051	$0.00
44	2052	$0.00
45	2053	$0.00
46	2054	$0.00
47	2055	$0.00
48	2056	$0.00
49	2057	$0.00
50	2058	$0.00
51	2059	$0.00

	A	B
52	2060	$0.00
53	2061	$0.00
54	2062	$0.00
55	2063	$0.00
56	2064	$0.00
57	2065	$0.00
58	2066	$0.00
59	2067	$0.00
60	2068	$0.00

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Capital-related Revenue Requirements**																
2																	
3			CapEx		Retirements		GBV	Ann Depr	Cum Depr	NBV		Revenue Requirements					
4					(cumulative)							Depr	Interest	Dividend	Tax & Ins	Total	
5	2011	0	20		0		20			20		0	0	0		0	
6	2012	1	48		0		67	1	1	67		1	0	2	1	4	
7	2013	2	79		0		146	3	3	143		3	2	6	1	11	
8	2014	3	303		0		450	6	9	440		6	4	12	4	26	
9	2015	4	534		0		984	18	27	956		18	11	38	9	76	
10	2016	5	230		0		1,214	39	67	1,147		39	24	83	13	159	
11	2017	6	0		0		1,214	49	115	1,099		49	28	99	14	190	
12	2018	7	0		0		1,214	49	164	1,050		49	27	93	13	181	
13	2019	8	0		0		1,214	49	212	1,001		49	25	87	13	173	
14	2020	9	0		0		1,214	49	261	953		49	23	81	12	165	
15	2021	10	0		0		1,214	49	309	904		49	22	76	12	157	
16	2022	11	0		0		1,214	49	358	856		49	20	70	11	150	
17	2023	12	0		0		1,214	49	407	807		49	19	65	10	143	
18	2024	13	0		0		1,214	49	455	759		49	17	60	10	136	
19	2025	14	0		0		1,214	49	504	710		49	16	55	9	129	
20	2026	15	0		0		1,214	49	552	662		49	14	50	9	122	
21	2027	16	0		0		1,214	49	601	613		49	13	45	8	114	
22	2028	17	0		0		1,214	49	649	564		49	11	40	7	107	
23	2029	18	0		0		1,214	49	698	516		49	10	35	7	100	
24	2030	19	0		0		1,214	49	746	467		49	9	30	6	94	
25	2031	20	0		0		1,214	49	795	419		49	7	26	6	87	
26	2032	21	0		0		1,214	49	843	370		49	6	22	5	82	
27	2033	22	0		0		1,214	49	892	322		49	6	19	4	78	
28	2034	23	0		0		1,214	49	941	273		49	5	17	4	74	
29	2035	24	0		0		1,214	49	989	225		49	4	14	3	70	
30	2036	25	0		20		1,214	49	1,038	176		49	3	12	3	66	
31	2037	26	0		67		1,194	48	1,066	128		48	3	9	2	62	
32	2038	27	0		146		1,146	46	1,064	82		46	2	7	1	56	
33	2039	28	0		450		1,067	43	1,028	40		43	1	4	1	49	
34	2040	29	0		984		764	31	755	9		31	1	2	0	34	
35	2041	30	0		1,214		230	9	230	0		9	0	0	0	10	
36	2042	31	0		1,214		0	0	0	0		0	0	0	0	0	
37	2043	32	0		1,214		0	0	0	0		0	0	0	0	0	
38	2044	33	0		1,214		0	0	0	0		0	0	0	0	0	
39	2045	34	0		1,214		0	0	0	0		0	0	0	0	0	
40	2046	35	0		1,214		0	0	0	0		0	0	0	0	0	
41	2047	36	0		1,214		0	0	0	0		0	0	0	0	0	
42	2048	37	0		1,214		0	0	0	0		0	0	0	0	0	
43	2049	38	0		1,214		0	0	0	0		0	0	0	0	0	
44	2050	39	0		1,214		0	0	0	0		0	0	0	0	0	
45	2051	40	0		1,214		0	0	0	0		0	0	0	0	0	
46	2052	41	0		1,214		0	0	0	0		0	0	0	0	0	
47	2053	42	0		1,214		0	0	0	0		0	0	0	0	0	

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1																
2																
3	Tax Depr	Def Tax		Book Deprecation												
4				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
5																
6	1	0		1	1	1	1	1	1	1	1	1	1	1	1	1
7	4	1		0	2	2	2	2	2	2	2	2	2	2	2	2
8	10	2		0	0	3	3	3	3	3	3	3	3	3	3	3
9	28	4		0	0	0	12	12	12	12	12	12	12	12	12	12
10	67	11		0	0	0	0	21	21	21	21	21	21	21	21	21
11	99	20		0	0	0	0	0	9	9	9	9	9	9	9	9
12	100	21		0	0	0	0	0	0	0	0	0	0	0	0	0
13	91	17		0	0	0	0	0	0	0	0	0	0	0	0	0
14	82	13		0	0	0	0	0	0	0	0	0	0	0	0	0
15	76	11		0	0	0	0	0	0	0	0	0	0	0	0	0
16	72	10		0	0	0	0	0	0	0	0	0	0	0	0	0
17	72	9		0	0	0	0	0	0	0	0	0	0	0	0	0
18	72	9		0	0	0	0	0	0	0	0	0	0	0	0	0
19	72	9		0	0	0	0	0	0	0	0	0	0	0	0	0
20	72	9		0	0	0	0	0	0	0	0	0	0	0	0	0
21	71	9		0	0	0	0	0	0	0	0	0	0	0	0	0
22	69	8		0	0	0	0	0	0	0	0	0	0	0	0	0
23	65	7		0	0	0	0	0	0	0	0	0	0	0	0	0
24	54	2		0	0	0	0	0	0	0	0	0	0	0	0	0
25	29	-8		0	0	0	0	0	0	0	0	0	0	0	0	0
26	7	-17		0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	-18		0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	-17		0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	-12		0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	-4		0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0

	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
1																
2																
3																
4	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5																
6	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
7	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0
8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0	0
9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	0
10	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
11	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM
1																
2																
3																
4	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
5																
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC
1																
2																
3														Tax Depreciation		
4	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068		2012	2013	2014
5																
6	0	0	0	0	0	0	0	0	0	0	0	0		1	2	2
7	0	0	0	0	0	0	0	0	0	0	0	0		0	2	5
8	0	0	0	0	0	0	0	0	0	0	0	0		0	0	4
9	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0

	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR
1															
2															
3															
4	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
5															
6	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0
7	4	4	3	3	3	3	3	3	3	3	3	3	3	1	0
8	8	7	6	5	5	5	5	5	5	5	5	5	5	5	2
9	15	29	26	23	21	19	18	18	18	18	18	18	18	18	18
10	0	27	51	46	41	37	33	32	32	32	32	32	32	32	32
11	0	0	11	22	20	18	16	14	14	14	14	14	14	14	14
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG
1															
2															
3															
4	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
5															
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	32	16	0	0	0	0	0	0	0	0	0	0	0	0	0
11	14	14	7	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV
1															
2															
3															
4	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
5															
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP
1																				
2																				
3											Tax Depreciation Year									
4	2060	2061	2062	2063	2064	2065	2066	2067	2068		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
5																				
6	0	0	0	0	0	0	0	0	0		1	2	3	4	5	6	7	8	9	10
7	0	0	0	0	0	0	0	0	0		0	1	2	3	4	5	6	7	8	9
8	0	0	0	0	0	0	0	0	0		0	0	1	2	3	4	5	6	7	8
9	0	0	0	0	0	0	0	0	0		0	0	0	1	2	3	4	5	6	7
10	0	0	0	0	0	0	0	0	0		0	0	0	0	1	2	3	4	5	6
11	0	0	0	0	0	0	0	0	0		0	0	0	0	0	1	2	3	4	5
12	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1	2	3	4
13	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	2	3
14	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	2
15	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1
16	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0

	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP
1																										
2																										
3																										
4	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
5																										
6	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
7	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
9	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
10	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
11	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
12	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
13	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
14	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
15	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
16	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
17	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
18	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
19	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
20	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
21	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
22	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
23	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
24	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
25	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
26	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
27	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
28	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
29	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK
1																					
2																					
3																					
4	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
5																					
6	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
7	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
8	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
9	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
10	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
11	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
12	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
13	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
14	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
15	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
16	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
17	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
18	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
19	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
20	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
22	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
23	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
24	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
25	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
26	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
27	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
28	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
29	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
30	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
31	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
32	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
33	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
34	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
35	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
36	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
37	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
38	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
39	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
40	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
41	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
42	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
43	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
44	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
45	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
46	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
47	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
48	2054	43	0		1,214		0	0	0	0		0	0	0	0	0	
49	2055	44	0		1,214		0	0	0	0		0	0	0	0	0	
50	2056	45	0		1,214		0	0	0	0		0	0	0	0	0	
51	2057	46	0		1,214		0	0	0	0		0	0	0	0	0	
52	2058	47	0		1,214		0	0	0	0		0	0	0	0	0	
53	2059	48	0		1,214		0	0	0	0		0	0	0	0	0	
54	2060	49	0		1,214		0	0	0	0		0	0	0	0	0	
55	2061	50	0		1,214		0	0	0	0		0	0	0	0	0	
56	2062	51	0		1,214		0	0	0	0		0	0	0	0	0	
57	2063	52	0		1,214		0	0	0	0		0	0	0	0	0	
58	2064	53	0		1,214		0	0	0	0		0	0	0	0	0	
59	2065	54	0		1,214		0	0	0	0		0	0	0	0	0	
60	2066	55	0		1,214		0	0	0	0		0	0	0	0	0	
61	2067	56	0		1,214		0	0	0	0		0	0	0	0	0	
62	2068	57	0		1,214		0	0	0	0		0	0	0	0	0	
63																	
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	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
48	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
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53	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
63				1	3	6	18	39	49	49	49	49	49	49	49	49
64																
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	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	49	49	49	49	49	49	49	49	49	49	49	49	48	46	43	31
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	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64																
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78																
79																
80																

	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC
48	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0		1	4	10
64																
65																
66																
67																
68																
69																
70														**TAX (MACRS) DEPRECIATION RAT**		
71																
72														HALF YEAR CONVENTION		
73														5	Year Property	
74														7	Year Property	
75														10	Year Property	
76														15	Year Property	
77														20	Year Property	
78														30	Year Property	
79																
80														15		

	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	28	67	99	100	91	82	76	72	72	72	72	72	71	69	65
64															
65															
66															
67															
68															
69															
70	**ES**														
71															
72		1	2	3	4	5	6	7	8	9	10	11	12	13	14
73		20.0%	32.0%	19.2%	11.5%	11.5%	5.8%								
74		14.3%	24.5%	17.5%	12.5%	8.9%	8.9%	8.9%	4.5%						
75		10.0%	18.0%	14.4%	11.5%	9.2%	7.4%	6.6%	6.6%	6.6%	6.6%	3.3%			
76		5.0%	9.5%	8.6%	7.7%	6.9%	6.2%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%
77		3.8%	7.2%	6.7%	6.2%	5.7%	5.3%	4.9%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
78		1.7%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
79		1	2	3	4	5	6	7	8	9	10	11	12	13	14
80		5.0%	9.5%	8.6%	7.7%	6.9%	6.2%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%

	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	54	29	7	0	0	0	0	0	0	0	0	0	0	0	0
64															
65															
66															
67															
68															
69															
70															
71															
72	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
73															
74															
75															
76	5.9%	3.0%													
77	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	2.2%								
78	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
79	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
80	5.9%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64															
65															
66															
67															
68															
69															
70															
71															
72	30	31													
73															
74															
75															
76															
77															
78	2.6%	2.6%													
79	30	31													
80	0.0%	0.0%													

	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP
48	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0											
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	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK
48	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
49	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
50	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13
51	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12
52	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11
53	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10
54	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9
55	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Proforma Financial Projection**																
2																	
3	**Income statement**			***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***	***2023***	***2024***
4																	
5		Revenue			4	11	26	76	159	190	181	173	165	157	150	143	136
6																	
7		Expenses															
8			Fixed O&M		1	1	4	9	13	14	13	13	12	12	11	10	10
9			Variable O&M		-	-	-	-	-	-	-	-	-	-	-	-	-
10			Depreciation		1	3	6	18	39	49	49	49	49	49	49	49	49
11					1	4	10	27	52	63	62	61	61	60	60	59	58
12																	
13		Operating profit (EBIT)			2	7	16	49	107	127	119	112	104	97	91	84	77
14																	
15		Interest expense			0	2	4	11	24	28	27	25	23	22	20	19	17
16																	
17		EBT			2	6	12	38	83	99	93	87	81	76	70	65	60
18																	
19		Tax			1	2	5	15	33	40	37	35	32	30	28	26	24
20																	
21		Net Income (NIAC)			1	3	7	23	50	59	56	52	49	45	42	39	36
22																	
23		Deferred taxes			0	1	2	4	11	20	21	17	13	11	10	9	9
24																	
25																	
26	**Balance sheet**			***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***	***2023***	***2024***
27																	
28		Assets		20	67	143	440	956	1,147	1,099	1,050	1,001	953	904	856	807	759
29																	
30		Liabilities															
31			LT Debt	10	33	71	219	475	565	530	496	463	432	402	373	344	315
32			Cum Deferred Taxes	-	0	1	2	7	18	38	59	75	89	100	109	119	128
33			Equity	10	33	71	219	475	565	530	496	463	432	402	373	344	315
34				20	67	143	440	956	1,147	1,099	1,050	1,001	953	904	856	807	759
35																	
36																	
37	**Free Cash Flow to Equity**			***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***	***2023***	***2024***
38																	
39		EBT		-	2	6	12	38	83	99	93	87	81	76	70	65	60
40		Depreciation		-	1	3	6	18	39	49	49	49	49	49	49	49	49
41		Cash Taxes		-	(1)	(2)	(3)	(11)	(22)	(19)	(16)	(18)	(19)	(19)	(19)	(17)	(15)
42		Capital Expenditure		(20)	(48)	(79)	(303)	(534)	(230)	-	-	-	-	-	-	-	-
43		Residual Value		-	-	-	-	-	-	-	-	-	-	-	-	-	-
44		Debt Finance		10	24	40	152	267	115	-	-	-	-	-	-	-	-
45		Debt Repayment (loan principal)			(0)	(2)	(4)	(11)	(25)	(34)	(35)	(33)	(31)	(30)	(29)	(29)	(29)
46				(10)	(22)	(34)	(140)	(233)	(40)	94	90	85	80	75	71	68	65
47																	
48			NPV at 10.5% DR:	0.000													
49			IRR:	10.5%													

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1																		
2																		
3	***2025***	***2026***	***2027***	***2028***	***2029***	***2030***	***2031***	***2032***	***2033***	***2034***	***2035***	***2036***	***2037***	***2038***	***2039***	***2040***	***2041***	***2042***
4																		
5	129	122	114	107	100	94	87	82	78	74	70	66	62	56	49	34	10	0
6																		
7																		
8	9	9	8	7	7	6	6	5	4	4	3	3	2	1	1	0	0	0
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	49	49	49	49	49	49	49	49	49	49	49	49	48	46	43	31	9	-
11	58	57	57	56	55	55	54	53	53	52	52	51	50	47	43	31	9	0
12																		
13	71	64	58	51	45	39	33	29	25	22	18	15	12	9	6	3	1	0
14																		
15	16	14	13	11	10	9	7	6	6	5	4	3	3	2	1	1	0	0
16																		
17	55	50	45	40	35	30	26	22	19	17	14	12	9	7	4	2	0	0
18																		
19	22	20	18	16	14	12	10	9	8	7	6	5	4	3	2	1	0	0
20																		
21	33	30	27	24	21	18	15	13	12	10	9	7	6	4	3	1	0	0
22																		
23	9	9	9	8	7	2	(8)	(17)	(19)	(19)	(19)	(19)	(19)	(18)	(17)	(12)	(4)	-
24																		
25																		
26	***2025***	***2026***	***2027***	***2028***	***2029***	***2030***	***2031***	***2032***	***2033***	***2034***	***2035***	***2036***	***2037***	***2038***	***2039***	***2040***	***2041***	***2042***
27																		
28	710	662	613	564	516	467	419	370	322	273	225	176	128	82	40	9	0	-
29																		
30																		
31	287	258	229	200	173	147	127	111	97	82	67	53	38	25	12	3	0	(0)
32	137	146	155	164	170	172	165	148	129	109	90	70	51	33	16	4	-	0
33	287	258	229	200	173	147	127	111	97	82	67	53	38	25	12	3	0	(0)
34	710	662	613	564	516	467	419	370	322	273	225	176	128	82	40	9	0	-
35																		
36																		
37	***2025***	***2026***	***2027***	***2028***	***2029***	***2030***	***2031***	***2032***	***2033***	***2034***	***2035***	***2036***	***2037***	***2038***	***2039***	***2040***	***2041***	***2042***
38																		
39	55	50	45	40	35	30	26	22	19	17	14	12	9	7	4	2	0	0
40	49	49	49	49	49	49	49	49	49	49	49	49	48	46	43	31	9	-
41	(13)	(11)	(9)	(8)	(7)	(10)	(18)	(26)	(27)	(26)	(25)	(24)	(23)	(21)	(19)	(13)	(4)	(0)
42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	(29)	(29)	(29)	(28)	(28)	(25)	(20)	(16)	(15)	(15)	(15)	(15)	(14)	(14)	(13)	(9)	(3)	(0)
46	62	59	56	52	49	44	36	29	26	25	23	22	20	18	15	10	3	(0)
47																		
48																		
49																		

	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
1																			
2																			
3	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061
4																			
5	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
6																			
7																			
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12																			
13	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
14																			
15	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
16																			
17	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
18																			
19	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
20																			
21	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
22																			
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24																			
25																			
26	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061
27																			
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29																			
30																			
31	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35																			
36																			
37	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061
38																			
39	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
47																			
48																			
49																			

	BC	BD	BE	BF	BG	BH	BI
1							
2							
3	***2062***	***2063***	***2064***	***2065***	***2066***	***2067***	***2068***
4							
5	(0)	(0)	(0)	(0)	(0)	(0)	(0)
6							
7							
8	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-
12							
13	(0)	(0)	(0)	(0)	(0)	(0)	(0)
14							
15	(0)	(0)	(0)	(0)	(0)	(0)	(0)
16							
17	(0)	(0)	(0)	(0)	(0)	(0)	(0)
18							
19	(0)	(0)	(0)	(0)	(0)	(0)	(0)
20							
21	(0)	(0)	(0)	(0)	(0)	(0)	(0)
22							
23	-	-	-	-	-	-	-
24							
25							
26	***2062***	***2063***	***2064***	***2065***	***2066***	***2067***	***2068***
27							
28	-	-	-	-	-	-	-
29							
30							
31	(0)	(0)	(0)	(0)	(0)	(0)	(0)
32	0	0	0	0	0	0	0
33	(0)	(0)	(0)	(0)	(0)	(0)	(0)
34	-	-	-	-	-	-	-
35							
36							
37	***2062***	***2063***	***2064***	***2065***	***2066***	***2067***	***2068***
38							
39	(0)	(0)	(0)	(0)	(0)	(0)	(0)
40	-	-	-	-	-	-	-
41	0	0	0	0	0	0	0
42	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-
44	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-
46	(0)	(0)	(0)	(0)	(0)	(0)	(0)
47							
48							
49							

	A	B	C	D	E	F	G
1		**Revenue Requirements Template: Inputs**					
2							
3		Start year	**2011**				
4		Asset life	**25**				
5		Include deferred tax impact	**Yes**				
6		Tax life	**15**				
7							
8		Capital structure					
9		Debt	**50%**				
10		Equity	50%				
11							
12		Interest rate (pre-tax)	**5.0%**				
13		Equity return (post-tax)	**10.5%**				
14		Tax rate	**40%**				
15							
16		WACC					
17		Pre-tax	11.3%				
18		Post-tax	6.8%				
19							
20		Property tax	**0.25%**				
21		Insurance	**1.00%**				
22							
23							Choose scenario
24		Total LG&E CapEx	Scenario 1	Scenario 2	Scenario 3	Scenario 4	**4**
25			Air (exc SCR)	Air (inc SCR)	Air (inc SCR) + (	Air (exc SCR) + CCP	
26		2010	$1.8	$1.8	$1.8	$1.8	$1.8
27		2011	$52.6	$52.6	$52.8	$52.8	$52.8
28		2012	$231.3	$234.6	$237.9	$234.6	$234.6
29		2013	$492.7	$527.8	$528.5	$493.5	$493.5
30		2014	$575.1	$649.7	$666.8	$592.2	$592.2
31		2015	$346.8	$447.7	$533.7	$432.7	$432.7
32		2016	$74.1	$123.6	$213.5	$163.9	$163.9
33							
34			$1,774.5	$2,037.8	$2,234.9	$1,971.6	

	A	B
1	**Variable O&M**	
2		
3	2011	$0.00
4	2012	$0.00
5	2013	$0.00
6	2014	$0.00
7	2015	$0.00
8	2016	$0.00
9	2017	$0.00
10	2018	$0.00
11	2019	$0.00
12	2020	$0.00
13	2021	$0.00
14	2022	$0.00
15	2023	$0.00
16	2024	$0.00
17	2025	$0.00
18	2026	$0.00
19	2027	$0.00
20	2028	$0.00
21	2029	$0.00
22	2030	$0.00
23	2031	$0.00
24	2032	$0.00
25	2033	$0.00
26	2034	$0.00
27	2035	$0.00
28	2036	$0.00
29	2037	$0.00
30	2038	$0.00
31	2039	$0.00
32	2040	$0.00
33	2041	$0.00
34	2042	$0.00
35	2043	$0.00
36	2044	$0.00
37	2045	$0.00
38	2046	$0.00
39	2047	$0.00
40	2048	$0.00
41	2049	$0.00
42	2050	$0.00
43	2051	$0.00
44	2052	$0.00
45	2053	$0.00
46	2054	$0.00
47	2055	$0.00
48	2056	$0.00
49	2057	$0.00
50	2058	$0.00
51	2059	$0.00

	A	B
52	2060	$0.00
53	2061	$0.00
54	2062	$0.00
55	2063	$0.00
56	2064	$0.00
57	2065	$0.00
58	2066	$0.00
59	2067	$0.00
60	2068	$0.00

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Capital-related Revenue Requirements**																
2																	
3			**CapEx**		Retirements		**GBV**	**Ann Depr**	**Cum Depr**	**NBV**		**Revenue Requirements**					
4					(cumulative)							Depr	Interest	Dividend	Tax & Ins	Total	
5	2011	0	53		0		53			53		0	0	0		0	
6	2012	1	235		0		287	2	2	285		2	1	5	2	10	
7	2013	2	493		0		781	11	14	767		11	7	25	7	50	
8	2014	3	592		0		1,373	31	45	1,328		31	19	67	13	130	
9	2015	4	433		0		1,806	55	100	1,706		55	33	115	19	222	
10	2016	5	164		0		1,970	72	172	1,798		72	42	147	22	283	
11	2017	6	0		0		1,970	79	251	1,719		79	44	152	22	297	
12	2018	7	0		0		1,970	79	330	1,640		79	41	143	21	283	
13	2019	8	0		0		1,970	79	408	1,561		79	38	133	20	270	
14	2020	9	0		0		1,970	79	487	1,483		79	36	124	19	258	
15	2021	10	0		0		1,970	79	566	1,404		79	33	116	18	246	
16	2022	11	0		0		1,970	79	645	1,325		79	31	108	17	234	
17	2023	12	0		0		1,970	79	724	1,246		79	28	99	16	223	
18	2024	13	0		0		1,970	79	802	1,167		79	26	91	15	211	
19	2025	14	0		0		1,970	79	881	1,089		79	24	83	14	200	
20	2026	15	0		0		1,970	79	960	1,010		79	21	75	13	188	
21	2027	16	0		0		1,970	79	1,039	931		79	19	67	12	176	
22	2028	17	0		0		1,970	79	1,117	852		79	17	58	11	165	
23	2029	18	0		0		1,970	79	1,196	773		79	14	51	10	154	
24	2030	19	0		0		1,970	79	1,275	695		79	12	43	9	144	
25	2031	20	0		0		1,970	79	1,354	616		79	11	37	8	135	
26	2032	21	0		0		1,970	79	1,433	537		79	9	33	7	128	
27	2033	22	0		0		1,970	79	1,511	458		79	8	28	6	121	
28	2034	23	0		0		1,970	79	1,590	380		79	7	24	5	115	
29	2035	24	0		0		1,970	79	1,669	301		79	6	20	4	109	
30	2036	25	0		53		1,970	79	1,748	222		79	5	16	3	102	
31	2037	26	0		287		1,917	77	1,772	145		77	3	12	2	94	
32	2038	27	0		781		1,682	67	1,604	78		67	2	8	1	78	
33	2039	28	0		1,373		1,189	48	1,158	30		48	1	4	1	53	
34	2040	29	0		1,806		597	24	590	7		24	0	2	0	26	
35	2041	30	0		1,970		164	7	164	0		7	0	0	0	7	
36	2042	31	0		1,970		0	0	0	0		0	0	0	0	0	
37	2043	32	0		1,970		0	0	0	0		0	0	0	0	0	
38	2044	33	0		1,970		0	0	0	0		0	0	0	0	0	
39	2045	34	0		1,970		0	0	0	0		0	0	0	0	0	
40	2046	35	0		1,970		0	0	0	0		0	0	0	0	0	
41	2047	36	0		1,970		0	0	0	0		0	0	0	0	0	
42	2048	37	0		1,970		0	0	0	0		0	0	0	0	0	
43	2049	38	0		1,970		0	0	0	0		0	0	0	0	0	
44	2050	39	0		1,970		0	0	0	0		0	0	0	0	0	
45	2051	40	0		1,970		0	0	0	0		0	0	0	0	0	
46	2052	41	0		1,970		0	0	0	0		0	0	0	0	0	
47	2053	42	0		1,970		0	0	0	0		0	0	0	0	0	

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1																
2																
3	**Tax Depr**	**Def Tax**		**Book Deprecation**												
4				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
5																
6	3	0		2	2	2	2	2	2	2	2	2	2	2	2	2
7	17	2		0	9	9	9	9	9	9	9	9	9	9	9	9
8	51	8		0	0	20	20	20	20	20	20	20	20	20	20	20
9	101	18		0	0	0	24	24	24	24	24	24	24	24	24	24
10	142	28		0	0	0	0	17	17	17	17	17	17	17	17	17
11	157	31		0	0	0	0	0	7	7	7	7	7	7	7	7
12	150	29		0	0	0	0	0	0	0	0	0	0	0	0	0
13	136	23		0	0	0	0	0	0	0	0	0	0	0	0	0
14	126	19		0	0	0	0	0	0	0	0	0	0	0	0	0
15	119	16		0	0	0	0	0	0	0	0	0	0	0	0	0
16	117	15		0	0	0	0	0	0	0	0	0	0	0	0	0
17	116	15		0	0	0	0	0	0	0	0	0	0	0	0	0
18	116	15		0	0	0	0	0	0	0	0	0	0	0	0	0
19	116	15		0	0	0	0	0	0	0	0	0	0	0	0	0
20	116	15		0	0	0	0	0	0	0	0	0	0	0	0	0
21	115	14		0	0	0	0	0	0	0	0	0	0	0	0	0
22	106	11		0	0	0	0	0	0	0	0	0	0	0	0	0
23	85	2		0	0	0	0	0	0	0	0	0	0	0	0	0
24	53	-10		0	0	0	0	0	0	0	0	0	0	0	0	0
25	22	-23		0	0	0	0	0	0	0	0	0	0	0	0	0
26	5	-30		0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	-32		0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	-32		0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	-32		0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	-32		0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	-31		0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	-27		0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	-10		0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	-3		0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0

	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
1																
2																
3																
4	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5																
6	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0
7	9	9	9	9	9	9	9	9	9	9	9	9	9	0	0	0
8	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	0
9	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	0
10	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
11	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM
1																
2																
3																
4	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
5																
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC
1																
2																
3														**Tax Depreciation**		
4	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068		2012	2013	2014
5																
6	0	0	0	0	0	0	0	0	0	0	0	0		3	5	5
7	0	0	0	0	0	0	0	0	0	0	0	0		0	12	22
8	0	0	0	0	0	0	0	0	0	0	0	0		0	0	25
9	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0

	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR
1															
2															
3															
4	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
5															
6	4	4	3	3	3	3	3	3	3	3	3	3	2	0	0
7	20	18	16	15	14	14	14	14	14	14	14	14	14	7	0
8	47	42	38	34	31	29	29	29	29	29	29	29	29	29	15
9	30	56	51	46	41	37	35	35	35	35	35	35	35	35	35
10	0	22	41	37	33	30	27	26	26	26	26	26	26	26	26
11	0	0	8	16	14	13	11	10	10	10	10	10	10	10	10
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG
1															
2															
3															
4	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
5															
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	26	13	0	0	0	0	0	0	0	0	0	0	0	0	0
11	10	10	5	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV
1															
2															
3															
4	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
5															
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP
1																				
2																				
3											**Tax Depreciation Year**									
4	2060	2061	2062	2063	2064	2065	2066	2067	2068		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
5																				
6	0	0	0	0	0	0	0	0	0		1	2	3	4	5	6	7	8	9	10
7	0	0	0	0	0	0	0	0	0		0	1	2	3	4	5	6	7	8	9
8	0	0	0	0	0	0	0	0	0		0	0	1	2	3	4	5	6	7	8
9	0	0	0	0	0	0	0	0	0		0	0	0	1	2	3	4	5	6	7
10	0	0	0	0	0	0	0	0	0		0	0	0	0	1	2	3	4	5	6
11	0	0	0	0	0	0	0	0	0		0	0	0	0	0	1	2	3	4	5
12	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1	2	3	4
13	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	2	3
14	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	2
15	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1
16	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0

	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP
1																										
2																										
3																										
4	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
5																										
6	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
7	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
9	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
10	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
11	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
12	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
13	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
14	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
15	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
16	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
17	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
18	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
19	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
20	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
21	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
22	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
23	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
24	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
25	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
26	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
27	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
28	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
29	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK
1																					
2																					
3																					
4	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
5																					
6	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
7	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
8	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
9	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
10	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
11	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
12	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
13	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
14	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
15	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
16	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
17	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
18	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
19	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
20	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
22	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
23	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
24	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
25	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
26	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
27	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
28	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
29	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
30	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
31	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
32	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
33	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
34	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
35	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
36	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
37	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
38	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
39	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
40	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
41	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
42	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
43	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
44	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
45	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
46	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
47	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
48	2054	43	0		1,970		0	0	0	0		0	0	0	0	0	
49	2055	44	0		1,970		0	0	0	0		0	0	0	0	0	
50	2056	45	0		1,970		0	0	0	0		0	0	0	0	0	
51	2057	46	0		1,970		0	0	0	0		0	0	0	0	0	
52	2058	47	0		1,970		0	0	0	0		0	0	0	0	0	
53	2059	48	0		1,970		0	0	0	0		0	0	0	0	0	
54	2060	49	0		1,970		0	0	0	0		0	0	0	0	0	
55	2061	50	0		1,970		0	0	0	0		0	0	0	0	0	
56	2062	51	0		1,970		0	0	0	0		0	0	0	0	0	
57	2063	52	0		1,970		0	0	0	0		0	0	0	0	0	
58	2064	53	0		1,970		0	0	0	0		0	0	0	0	0	
59	2065	54	0		1,970		0	0	0	0		0	0	0	0	0	
60	2066	55	0		1,970		0	0	0	0		0	0	0	0	0	
61	2067	56	0		1,970		0	0	0	0		0	0	0	0	0	
62	2068	57	0		1,970		0	0	0	0		0	0	0	0	0	
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	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
48	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
63				2	11	31	55	72	79	79	79	79	79	79	79	79
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	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	79	79	79	79	79	79	79	79	79	79	79	79	77	67	48	24
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	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC
48	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0		3	17	51
64																
65																
66																
67																
68																
69																
70														**TAX (MACRS) DEPRECIATION RAT**		
71																
72														HALF YEAR CONVENTION		
73														5	Year Property	
74														7	Year Property	
75														10	Year Property	
76														15	Year Property	
77														20	Year Property	
78														30	Year Property	
79																
80														15		

	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	101	142	157	150	136	126	119	117	116	116	116	116	115	106	85
64															
65															
66															
67															
68															
69															
70	**ES**														
71															
72		1	2	3	4	5	6	7	8	9	10	11	12	13	14
73		20.0%	32.0%	19.2%	11.5%	11.5%	5.8%								
74		14.3%	24.5%	17.5%	12.5%	8.9%	8.9%	8.9%	4.5%						
75		10.0%	18.0%	14.4%	11.5%	9.2%	7.4%	6.6%	6.6%	6.6%	6.6%	3.3%			
76		5.0%	9.5%	8.6%	7.7%	6.9%	6.2%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%
77		3.8%	7.2%	6.7%	6.2%	5.7%	5.3%	4.9%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
78		1.7%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
79		1	2	3	4	5	6	7	8	9	10	11	12	13	14
80		5.0%	9.5%	8.6%	7.7%	6.9%	6.2%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%

	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	53	22	5	0	0	0	0	0	0	0	0	0	0	0	0
64															
65															
66															
67															
68															
69															
70															
71															
72	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
73															
74															
75															
76	5.9%	3.0%													
77	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	2.2%								
78	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
79	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
80	5.9%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64															
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67															
68															
69															
70															
71															
72	30	31													
73															
74															
75															
76															
77															
78	2.6%	2.6%													
79	30	31													
80	0.0%	0.0%													

	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP
48	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0											
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	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK
48	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
49	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
50	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13
51	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12
52	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11
53	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10
54	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9
55	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
63																					
64																					
65																					
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67																					
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80																					

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Proforma Financial Projection**																
2																	
3	**Income statement**			***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***	***2023***	***2024***
4																	
5		Revenue			10	50	130	222	283	297	283	270	258	246	234	223	211
6																	
7		Expenses															
8			Fixed O&M		2	7	13	19	22	22	21	20	19	18	17	16	15
9			Variable O&M		-	-	-	-	-	-	-	-	-	-	-	-	-
10			Depreciation		2	11	31	55	72	79	79	79	79	79	79	79	79
11					4	18	44	74	94	101	100	99	98	97	96	95	94
12																	
13		Operating profit (EBIT)			6	32	86	148	189	196	183	171	160	149	138	128	117
14																	
15		Interest expense			1	7	19	33	42	44	41	38	36	33	31	28	26
16																	
17		EBT			5	25	67	115	147	152	143	133	124	116	108	99	91
18																	
19		Tax			2	10	27	46	59	61	57	53	50	46	43	40	36
20																	
21		Net Income (NIAC)			3	15	40	69	88	91	86	80	75	70	65	60	55
22																	
23		Deferred taxes			0	2	8	18	28	31	29	23	19	16	15	15	15
24																	
25																	
26	**Balance sheet**			***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***	***2023***	***2024***
27																	
28		Assets		53	285	767	1,328	1,706	1,798	1,719	1,640	1,561	1,483	1,404	1,325	1,246	1,167
29																	
30		Liabilities															
31			LT Debt	26	143	382	659	839	871	815	762	711	662	615	568	521	474
32			Cum Deferred Taxes	-	0	2	10	29	57	88	117	139	158	174	190	205	220
33			Equity	26	143	382	659	839	871	815	762	711	662	615	568	521	474
34				53	285	767	1,328	1,706	1,798	1,719	1,640	1,561	1,483	1,404	1,325	1,246	1,167
35																	
36																	
37	**Free Cash Flow to Equity**			***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***	***2023***	***2024***
38																	
39		EBT		-	5	25	67	115	147	152	143	133	124	116	108	99	91
40		Depreciation		-	2	11	31	55	72	79	79	79	79	79	79	79	79
41		Cash Taxes		-	(2)	(8)	(19)	(28)	(31)	(29)	(29)	(30)	(31)	(30)	(28)	(25)	(21)
42		Capital Expenditure		(53)	(235)	(493)	(592)	(433)	(164)	-	-	-	-	-	-	-	-
43		Residual Value		-	-	-	-	-	-	-	-	-	-	-	-	-	-
44		Debt Finance		26	117	247	296	216	82	-	-	-	-	-	-	-	-
45		Debt Repayment (loan principal)			(1)	(7)	(20)	(37)	(50)	(55)	(54)	(51)	(49)	(48)	(47)	(47)	(47)
46				(26)	(113)	(225)	(236)	(111)	56	147	139	131	123	117	112	107	102
47																	
48			NPV at 10.5% DR:	0.000													
49			IRR:	10.5%													

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1																		
2																		
3	***2025***	***2026***	***2027***	***2028***	***2029***	***2030***	***2031***	***2032***	***2033***	***2034***	***2035***	***2036***	***2037***	***2038***	***2039***	***2040***	***2041***	***2042***
4																		
5	200	188	176	165	154	144	135	128	121	115	109	102	94	78	53	26	7	0
6																		
7																		
8	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1	0	0	0
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	79	79	79	79	79	79	79	79	79	79	79	79	77	67	48	24	7	-
11	93	92	91	90	89	88	87	86	85	84	83	82	79	69	48	24	7	0
12																		
13	107	96	86	75	65	56	48	42	36	31	26	20	15	10	5	2	0	0
14																		
15	24	21	19	17	14	12	11	9	8	7	6	5	3	2	1	0	0	0
16																		
17	83	75	67	58	51	43	37	33	28	24	20	16	12	8	4	2	0	0
18																		
19	33	30	27	23	20	17	15	13	11	10	8	6	5	3	2	1	0	0
20																		
21	50	45	40	35	30	26	22	20	17	14	12	9	7	5	2	1	0	0
22																		
23	15	15	14	11	2	(10)	(23)	(30)	(32)	(32)	(32)	(32)	(31)	(27)	(19)	(10)	(3)	-
24																		
25																		
26	***2025***	***2026***	***2027***	***2028***	***2029***	***2030***	***2031***	***2032***	***2033***	***2034***	***2035***	***2036***	***2037***	***2038***	***2039***	***2040***	***2041***	***2042***
27																		
28	1,089	1,010	931	852	773	695	616	537	458	380	301	222	145	78	30	7	0	-
29																		
30																		
31	427	380	334	289	248	214	186	161	137	114	90	67	44	23	9	2	0	(0)
32	235	250	264	275	277	267	244	215	183	152	120	89	58	31	12	3	0	0
33	427	380	334	289	248	214	186	161	137	114	90	67	44	23	9	2	0	(0)
34	1,089	1,010	931	852	773	695	616	537	458	380	301	222	145	78	30	7	0	-
35																		
36																		
37	***2025***	***2026***	***2027***	***2028***	***2029***	***2030***	***2031***	***2032***	***2033***	***2034***	***2035***	***2036***	***2037***	***2038***	***2039***	***2040***	***2041***	***2042***
38																		
39	83	75	67	58	51	43	37	33	28	24	20	16	12	8	4	2	0	0
40	79	79	79	79	79	79	79	79	79	79	79	79	77	67	48	24	7	-
41	(18)	(15)	(12)	(12)	(18)	(28)	(38)	(43)	(43)	(41)	(39)	(38)	(35)	(30)	(21)	(10)	(3)	(0)
42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	(47)	(47)	(47)	(45)	(41)	(34)	(28)	(25)	(24)	(24)	(24)	(24)	(23)	(20)	(14)	(7)	(2)	(0)
46	97	92	87	80	71	60	51	44	41	38	36	33	30	25	17	8	2	(0)
47																		
48																		
49																		

	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
1																			
2																			
3	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061
4																			
5	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
6																			
7																			
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12																			
13	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
14																			
15	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
16																			
17	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
18																			
19	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
20																			
21	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
22																			
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24																			
25																			
26	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061
27																			
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29																			
30																			
31	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35																			
36																			
37	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061
38																			
39	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
47																			
48																			
49																			

	BC	BD	BE	BF	BG	BH	BI
1							
2							
3	2062	2063	2064	2065	2066	2067	2068
4							
5	(0)	(0)	(0)	(0)	(0)	(0)	(0)
6							
7							
8	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-
12							
13	(0)	(0)	(0)	(0)	(0)	(0)	(0)
14							
15	(0)	(0)	(0)	(0)	(0)	(0)	(0)
16							
17	(0)	(0)	(0)	(0)	(0)	(0)	(0)
18							
19	(0)	(0)	(0)	(0)	(0)	(0)	(0)
20							
21	(0)	(0)	(0)	(0)	(0)	(0)	(0)
22							
23	-	-	-	-	-	-	-
24							
25							
26	2062	2063	2064	2065	2066	2067	2068
27							
28	-	-	-	-	-	-	-
29							
30							
31	(0)	(0)	(0)	(0)	(0)	(0)	(0)
32	0	0	0	0	0	0	0
33	(0)	(0)	(0)	(0)	(0)	(0)	(0)
34	-	-	-	-	-	-	-
35							
36							
37	2062	2063	2064	2065	2066	2067	2068
38							
39	(0)	(0)	(0)	(0)	(0)	(0)	(0)
40	-	-	-	-	-	-	-
41	0	0	0	0	0	0	0
42	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-
44	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-
46	(0)	(0)	(0)	(0)	(0)	(0)	(0)
47							
48							
49							

From:	Thomson, Robert
To:	Conroy, Robert; Foxworthy, Carol
CC:	Schram, Chuck
Sent:	11/3/2010 9:41:27 AM
Subject:	Potential rate impacts of EPA proposals
Attachments:	EPA Emissions - Draft 15 2010_1_10.pptx; Rate impact of EPA proposals 10_22_10.xlsx

Robert & Carol,

Chuck asked me to forward this 'EPA rate impact' file to you, where we have taken one further step from the previous 'combined company' view by allocating the $542 million incremental revenue requirement (in 2019) between the two utilities.

In the tab "Company allocation" you'll see that we looked at two sets of cost estimates upon which to base the company allocation. At the top of the sheet we took the cost estimates from Slide 11 of a PowerPoint presentation on the potential EPA impact (also attached below), allocating Brown, Ghent and Green River costs to KU and Cane Run, Mill Creek and Trimble 1 costs to LG&E (i.e. assuming that Cane Run is upgraded rather than replaced). This yielded a 38% KU / 62% LG&E split. In the lower half of the sheet we took revised (B&V estimate) costs for Brown, Ghent, Mill Creek and Trimble and assumed that Cane Run would be replaced by a CCCT (allocated 100% to LG&E). This allocation produced a similar result - 34% KU / 66% LG&E. For purposes of illustration we applied the latter ⅓ / ⅔ split to the $542 million (incremental) revenue requirement in 2019 - $185 million to KU and $357 million to LG&E - and then proceeded to allocated between customer classes (residential, industrial, commercial) as before, on a revenue share basis (using the revenue projections for 2019 provided by Carol) (see pages 3 & 4 of tab "Rate Impact"). I assume these 2019 revenue projections (by class) represent base rate revenue (only), since the total projected 2019 revenue is lower than 2009 actual (all-inclusive) revenue.

As before, after allocating the $542 million by company and then by class, we divide the class increments by projected (2019) class sales to derive the $/kWh 'impact', which is then compared to all-in average $/kWh revenue in July 2010.

Clearly there are other methodologies that we could apply to justify other allocations; however this simple approach highlights potential (escalating) challenges ahead in squaring joint planning and dispatch with individual asset ownership.

Bob

E.ON U.S.

Proposed EPA Regulations Will Increase the Cost of Coal-fired Electricity

October 1, 2010

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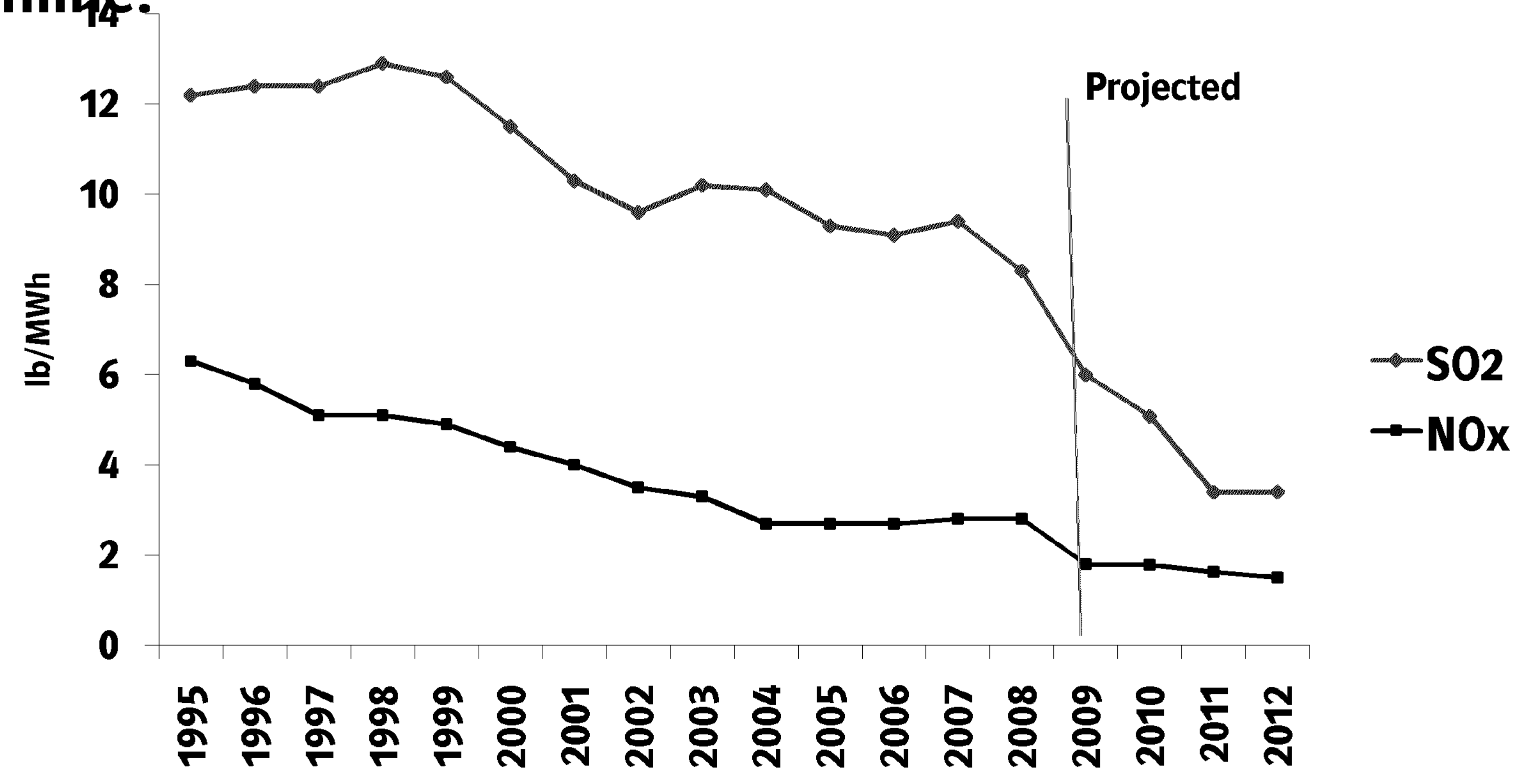
Environmental compliance is a high priority for E.ON U.S.

- In the 1970's, we pioneered flue gas desulfurization (FGD) or "scrubber" technology used to control SO_2.
- LG&E and KU and their customers have spent $2.6 billion on emission controls since the 1970's.
- Our new Trimble County 2 generating unit will be among the cleanest coal-fired power plants in the U.S., as evidenced by the receipt of the advance coal technology tax incentive for efficiency and environmental controls. Control Technology installed on TC2 includes the following:
  - Selective Catalytic Reduction (SCR)
  - Dry Electrostatic Precipitator (ESP)
  - Powdered Activated Carbon Injection
  - Fabric Filter Baghouse
  - Wet Flue Gas Desulfurization (WFGD)
  - Wet Electrostatic Precipitator (WESP)

e·on U.S.

Since 1995, LG&E/KU coal SO_2 emission rates have been reduced by 50%; NO_x emission rates by 70%. Further reductions are expected as TC2 and Brown FGD are online.



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Unprecedented number of proposed regulations

EPA is proposing an unprecedented number of regulations that will have a major impact on coal-fired utilities and their customers. The significant risks are as follows –

- Absence of a comprehensive and coordinated federal strategy compels implementation on a piecemeal basis.
- Reversal of prior regulatory determinations will generate large economic impacts.
- Inconsistent deadlines will cause unnecessary compliance costs.
- Short deadlines are compromising state and utility efforts to prepare proper implementation plans.
- Practical implication: We will be proposing construction projects without benefit of final regulations in order to meet federal deadlines for compliance because of long lead time in fabrication and construction.

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New air regulations

- National Ambient Air Quality Standards (NAAQS) – lowers the SO_2, NO_x, ozone, and Particulate Matter (PM) standards which will make Louisville a "nonattainment" area subject to federal sanctions.
- Clean Air Transport Rule (CATR) – aimed at reducing air quality problems (SO_2, NO_x, ozone and PM) in the eastern U.S.
- Maximum Achievable Control Technology (MACT) for Hazardous Air Pollutants (HAP) – new federal focus on plant by plant controls (as opposed to a system basis) will dramatically increase the cost of reducing mercury and HAP other emissions.
- Carbon Dioxide (CO_2) Best Available Control Technology (BACT) – EPA will require implementation of BACT despite the consensus that no commercial scale control technology is currently available.

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New coal combustion products and water regulations

- Coal Combustion Residuals (CCR) – (Ash ponds and landfills) – Despite past EPA determinations that CCPs do not pose any significant human health or environmental risks, EPA is considering designation of CCPs as a "hazardous waste" subject to extensive requirements or modifying current "non-hazardous" rules with more stringent requirements. Both approaches will increase costs.

- Water quality – EPA is revising cooling water withdrawal and water discharge guidelines and standards.

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The new EPA regulations will significantly impact Kentucky's electric customers

- The new regulations are focused on coal-fired power plants.
- 95% of Kentucky's electricity is provided by coal.
- LG&E/KU will comply with any new EPA regulations in the most cost effective manner possible, but the cost increase will be significant.

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Short compliance timelines likely once final rules are issued

- **National Ambient Air Quality Standards (NAAQS) for NO_2 and SO_2 – Issued: February - June 2010; Compliance: 2016, 2017 respectively**
- **Clean Air Transport Rule (CATR) – Projected Final Rule: June 2011; Compliance: January 2012 & January 2014**
- **Maximum Achievable Control Technology (MACT) for Hazardous Air Pollutants (HAP) – Projected Final Rule: November 2011; Compliance: January 2015**
- **Carbon Dioxide (CO_2) Best Available Control Technology (BACT) – Issued: May 2010; Compliance: January 2011**
- **Coal Combustion Residuals (CCR) – Alternatives Proposed: May 2010; Projected Final Rule: uncertain; Compliance: within 5 years of final rule**
- **Water quality – Water withdrawal Projected Issue date: December 2010; Water Discharge Projected Issue date: 2012; Compliance: Uncertain**

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LG&E/KU's coal fleet already has a high level of control technologies, but some additions or enhancements will be required

				SO2			NOx		
	Commercial Dates	Net Summer Capacity (MW)	Cooling Towers	FGD Install	Emission Rate (lb/MMBtu)	Emission Control Efficiency	SCR Install	Emission Rate (lb/MMBtu)	Emission Control Efficiency
Brown	1957 - 1971	684	Yes	2010 (3 units)	0.12	98%	2012 (1 Unit)	0.38	90%
Ghent	1974 – 1984	1,918	Yes	2000 – 2009 (4 units)	0.17	94 – 98%	2003 – 2004 (3 Units)	0.12	80 - 90%
Green River	1954 – 1959	163	No	None	2.99	None	None	0.40	None
Tyrone	1953	71	No	None	1.33	None	None	0.50	None
Cane Run	1962 – 1969	563	No	1976 – 1978 (3 units)	0.59	90 %	None	0.34	None
Mill Creek	1972 – 1982	1,472	Yes	1978 – 1982 (4 Units)	0.49	90 – 92%	2003 (2 Units)	0.16	85 - 87%
Trimble County 1	1990	383	Yes	1990	0.12	98 %	2002	0.06	80 - 85%
Trimble County 2	2010	549	Yes	2010	0.10	98 %	2010	0.04	90%

- All units have precipitators
- Mill Creek 1 does not have a cooling tower.
- Trimble 1 and 2 capacities reflects 75% ownership

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Technology options for addressing air emissions are known – except for CO_2

Technology	Targeted Pollutant	Regulation Addressed	Removal Rate	LG&E/KU Estimated Cost ($/kW)	LG&E/KU Estimated Cost ($/quantity captured)
Flue Gas Desulfurization (FGD)	SO_2	CATR, NAAQS	98%	450 – 900	5,000 – 11,000 /ton
Selective Catalytic Reduction (SCR)	NO_x	CATR, NAAQS	90%	300 – 500	4,000 – 8,000 /ton
FGD + SCR (Hg Co-Benefit)	Hg	MACT for HAP	60-70%	Co-benefit	Co-benefit
Fabric Filter & PAC* Injection (with FGD and SCR)	Hg	MACT for HAP	25-35%	200 – 500	150,000 – 450,000 /lb
Sorbent Injection	SO_3, Hg	MACT for HAP	TBD	15 – 30	TBD
Replace Coal Plant with Gas Plant					
Combined Cycle Combustion Turbine	All	All	NA	950 – 1,250	NA

*Powdered Activated Carbon

U.S.

Despite low emission levels at most stations, sizable investments will be required to meet new air regulations

Station	Capacity (Net MW)	Options to Address Regulations	Cost ($M)
Brown	684	SCR, Fabric Filter Baghouse, PAC Injection, Lime Injection	350 – 450
Ghent	1,918	SCR, Fabric Filter Baghouse, PAC Injection	950 – 1,150
Green River	163	SCR, Fabric Filter Baghouse, PAC Injection	150 – 250
Cane Run	563	FGD, SCR, Fabric Filter Baghouse, PAC Injection, Lime Injection	850 – 950
Mill Creek	1,472	FGD, SCR, Fabric Filter Baghouse, Electrostatic Precipitator (ESP), PAC Injection, Lime Injection, Ammonia	1,250 – 1,900
Trimble County	932	Fabric Filter Baghouse, PAC Injection	150 – 200
Replace Coal Plant with Gas Plant			
Potential CCCT Replacement	640	600 MW 2x1 Combined Cycle Combustion Turbine	600 – 800

Note: does not include any investment to control for CO_2

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Proposed EPA CCR regulations would require dry storage and closing of existing ash ponds

- Retrofit or close 21 ponds, including 10 ash ponds and 11 process/runoff ponds across the fleet (8 stations)
- Build landfills for future storage (Brown, Cane Run, Ghent, Mill Creek, Trimble County)
- Construct new process water ponds for each operating site
- Closing ponds and moving to dry storage will cost an estimated $700 million over the next ten years under the proposed CCR rules for non-hazardous waste. Additional closure costs will be incurred upon plant retirements.

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Increased water withdrawal and discharge requirements

Potential federal EPA water regulations would impose more stringent requirements on water withdrawal and discharges

- **Potential addition of cooling towers or discharge water treatment systems**
  - **Stations without cooling towers: Cane Run, Green River, Mill Creek 1, Tyrone**
- **New treatment technologies are being developed for water discharges but are not widely deployed in utility operations**
  - **Physical-chemical treatment and/or biological treatment systems may be required**
  - **Cost of $40 - $300 million for each site pending final regulations, specific standards, and treatment volumes**

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Estimate at least $4 billion in capital costs needed over next ten years

Regulation	Capital ($M)	Annual Operating Expense ($M)
Air	**3,300 – 5,000**	**150 – 300**
CCP	**700**	*To be determined*
Water	*To be determined*	

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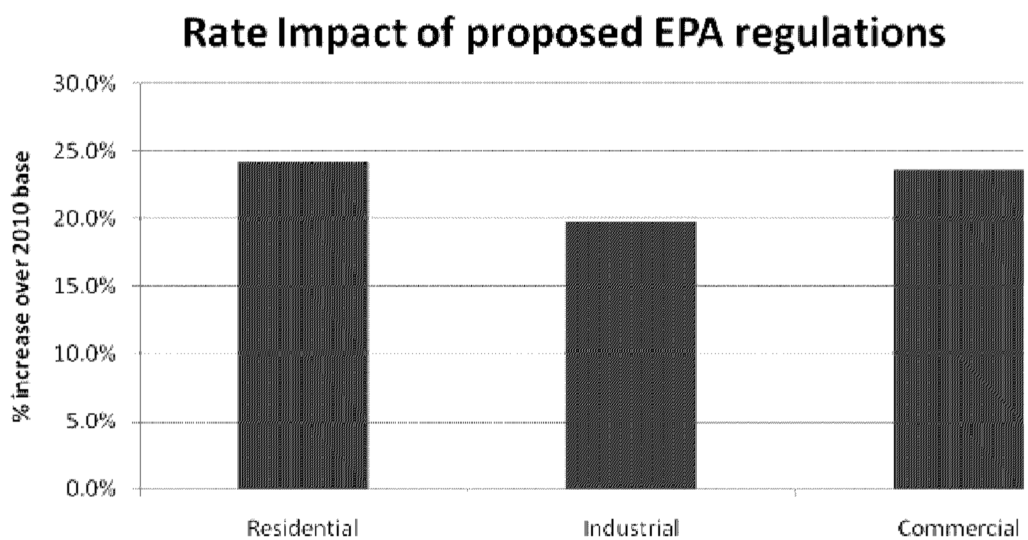
Cumulative impact of proposed EPA regulations will significantly increase electricity rates

- **Due to these regulations, by 2019 rates could increase by over 20% and almost $550 million annually.**



Note: This calculation does not include potential compliance costs for water regulations, Renewal Portfolio Standards (RPS) or carbon dioxide (CO2) reductions.

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Challenges and risks related to proposed regulations

- **Short time horizon – some air regulations would require compliance as early as 2012 with the most costly regulations beginning in 2014 and 2015. This allows insufficient time to design facilities, obtain necessary federal and state regulatory approvals, contract with vendors and install equipment.**

- **Potential impacts on system reliability and transmission system – one consequence of the proposed regulations will be the retirement of significant amounts of coal-fired generation across the region.**

- **Rapid cost escalation – industry rush to achieve compliance will drive up labor and material costs (repeat of 2008) and make it difficult to obtain labor and equipment at any price.**

- **CO_2 policy could change – uncertainty associated with future CO_2 legislation could result in less than optimal long-term investment decisions.**

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What should the KPSC expect?

- Requests for approval of environmental compliance projects perhaps before the federal regulations are finalized
- Compressed construction timelines due to compliance timing
- Additional compliance costs to meet implementation dates of federal rules
- More frequent requests for rate increases due to substantial upward cost pressures caused by compliance with the federal regulations

E.ON U.S.

What is the Company doing?

- Evaluating multiple compliance alternatives
- Participating in industry efforts to advocate more reasonable regulations and timelines
- Communicating our concerns directly with EPA on proposed regulations
- Educating elected officials, regulators and customers on the effect of the federal regulations will have on their electric bill

	A	B	C
1		SO2	NOx
2	1995	12.2	6.3
3	1996	12.4	5.8
4	1997	12.4	5.1
5	1998	12.9	5.1
6	1999	12.6	4.9
7	2000	11.5	4.4
8	2001	10.3	4
9	2002	9.6	3.5
10	2003	10.2	3.3
11	2004	10.1	2.7
12	2005	9.3	2.7
13	2006	9.1	2.7
14	2007	9.4	2.8
15	2008	8.3	2.8
16	2009	6	1.8
17	2010	5.1	1.8
18	2011	3.4	1.6
19	2012	3.4	1.5

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Sales, Revenue and Average Unit Rates (per Utility Financial Reports)**											
2												
3			**2008**				**2009**				**July 2010**	
4												
5	**LG&E**		**kWh**	**$**	**$/kWh**		**kWh**	**$**	**$/kWh**		**kWh**	**$**
6	Residential Sales		4,206,410,526	301,021,844	0.072		4,095,806,460	310,340,508	0.076		593,573,594	44,858,233
7	Small Commercial and Industrial Sales		1,392,051,319	111,125,344	0.080		1,344,247,037	110,666,000	0.082		154,077,990	12,849,498
8	Large Commercial Sales		2,331,119,751	137,250,087	0.059		2,272,699,738	141,774,569	0.062		232,055,516	14,896,275
9	Large Industrial Sales		2,850,830,033	138,314,832	0.049		2,412,418,682	124,099,537	0.051		252,296,232	13,405,650
10	Public Street and Highway Lighting		61,974,931	6,896,924	0.111		59,012,932	6,806,105	0.115		3,705,924	534,560
11	Other Sales to Public Authorities		1,240,681,990	68,992,558	0.056		1,220,972,154	71,502,523	0.059		126,045,463	7,458,653
12	Total - Ultimate Consumers		12,083,068,550	763,601,589	0.063		11,405,157,003	765,189,241	0.067		1,361,754,719	94,002,869
13												
14												
15	**KU (including ODP)**		**kWh**	**$**	**$/kWh**		**kWh**	**$**	**$/kWh**		**kWh**	**$**
16	Residential Sales		6,802,830,237	462,085,548	0.068		6,594,160,339	480,270,452	0.073		679,264,592	51,758,876
17	Commercial Sales		4,713,879,375	316,402,846	0.067		4,518,585,415	320,837,831	0.071		445,622,461	32,224,752
18	Industrial Sales		5,125,141,555	268,939,540	0.052		4,867,629,386	267,669,673	0.055		506,098,071	28,765,346
19	Mine Power		870,237,299	50,316,630	0.058		784,985,635	48,322,690	0.062		49,166,234	3,444,565
20	Public Street and Highway Lighting		57,575,377	10,014,050	0.174		53,938,858	10,185,756	0.189		4,245,108	942,854
21	Other Sales to Public Authorities		1,572,082,501	93,273,848	0.059		1,524,112,658	95,587,730	0.063		150,438,149	9,267,928
22	Municipal Pumping		76,854,641	4,760,365	0.062		69,094,357	4,532,294	0.066		5,711,572	379,950
23	Refunds							(469,231)				
24	Total - Ultimate Consumers		19,218,600,985	1,205,792,827	0.063		18,412,506,648	1,226,937,195	0.067		1,840,546,187	126,784,273
25												
26												
27	**Combined Company**		**kWh**	**$**	**$/kWh**		**kWh**	**$**	**$/kWh**		**kWh**	**$**
28	Residential		11,009,240,763	763,107,392	0.069		10,689,966,799	790,610,959	0.074		1,272,838,186	96,617,110
29	Industrial		8,846,208,887	457,571,002	0.052		8,065,033,703	440,091,901	0.055		807,560,537	45,615,561
30	Commercial / Other		11,446,219,885	748,716,021	0.065		11,062,663,149	761,892,807	0.069		1,121,902,183	78,554,472
31	Total - Ultimate Consumers		31,301,669,535	1,969,394,416	0.063		29,817,663,651	1,992,126,436	0.067		3,202,300,906	220,787,142
32												
33												
34	KU											
35	Residential										679,264,592	51,758,876
36	Industrial										555,264,305	32,209,911
37	Commercial / Other										606,017,290	42,815,485
38												
39	LGE											
40	Residential										593,573,594	44,858,233
41	Industrial										252,296,232	13,405,650
42	Commercial / Other										515,884,893	35,738,986

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5	**$/kWh**
6	0.076
7	0.083
8	0.064
9	0.053
10	0.144
11	0.059
12	0.069
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15	**$/kWh**
16	0.076
17	0.072
18	0.057
19	0.070
20	0.222
21	0.062
22	0.067
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24	0.069
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27	**$/kWh**
28	0.076
29	0.056
30	0.070
31	0.069
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35	0.076
36	0.058
37	0.071
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40	0.076
41	0.053
42	0.069

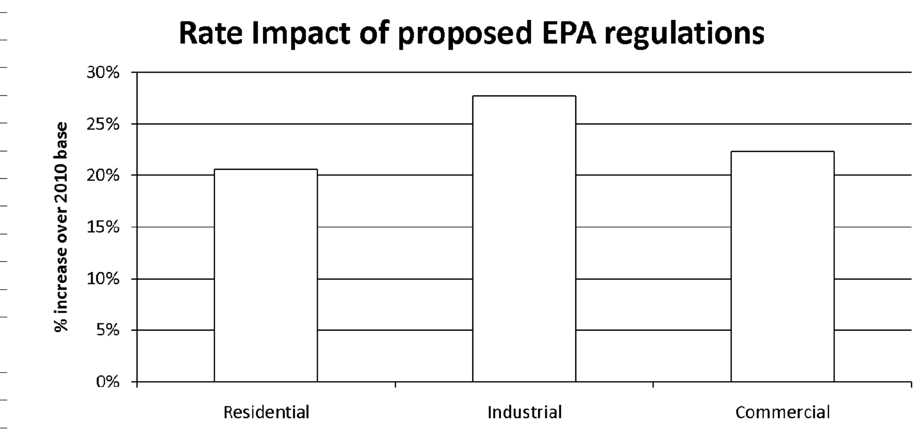
	A	B	C	D	E	F	G
1	**2011 MTP Sales Forecast**						
2							
3	**2019 Forecasted Billed Sales by Revenue Class (GWh)**						
4							
5		Residential	Industrial	Commercial	l - Ultimate Consumers	Municipals	Total sales
6	KU	6,841	6,473	7,056	20,370	2,176	22,546
7	LG&E	4,435	2,868	5,978	13,281		13,281
8	Total KY	11,276	9,341	13,034	33,651	2,176	35,827
9							
10	ODP	419	224	332	975		975
11	Total	11,695	9,565	13,366	34,626	2,176	36,802
12							
13	Commercial includes Public Authority, Street Lighting, and Municipal Pumping						
14	Industrial includes Mine Power						
15	Source: 20100621_LF Results_0304D03.docx						

Rate impact of environmental compliance costs

1. Cost allocation on Sales Share Basis (Combined Company, Total Retail Sales)

Incremental revenue requirement in 2019 $542 million

	July 2010 Sales, Revenue and Average Rates				Forecasted sales in 2019		Cost allocation ($M)	Rate adder ($/kV
	Sales (GWh)		**Revenue**	**Rates ($/kWh)**	**GWh**	**Share**		
Residential	1,273	40%	$96,617,110	0.076	11,695	34%	$183	0.016
Industrial	808	25%	$45,615,561	0.056	9,565	28%	$150	0.016
Commercial	1,122	35%	$78,554,472	0.070	13,366	39%	$209	0.016
	3,202		220,787,142	0.069	34,626	100%	$542	



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7	Rate increase over 2010 base	
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10	21%	
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12	22%	
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33													
34	**2. Cost allocation on Revenue Share Basis (Combined Company, Total Retail Sales)**												
35													
36	Incremental revenue requirement in 2019			$542 million									
37													
38	*Cost allocation*		2019 Revenue		% of total revenue		Allocated Portion of Revenue Requirement						
39	Residential		$485	million	40%		$214	million					
40	Industrial		$242	million	20%		$107	million					
41	Commercial/Other		$501	million	41%		$221	million					
42			$1,228				$542						
43													
44	*Rate impact*			2019 Sales (GWh)	Rate impact per kWh		"All-in" $/kwh, July 2010			Percent Change			
45	Residential			11,695	$0.018		$0.076			24%			
46	Industrial			9,565	$0.011		$0.056			20%			
47	Commercial/Other			13,366	$0.017		$0.070			24%			
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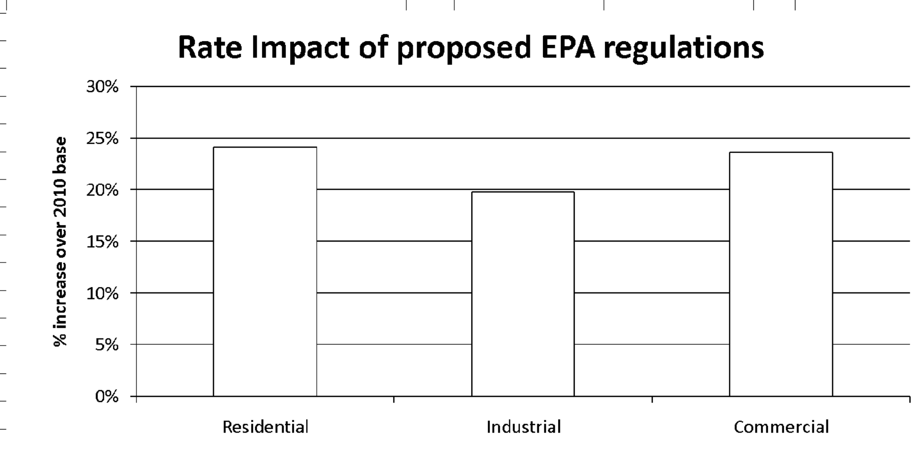

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145	**Rate Impact by Company**												
146													
147	**Cost allocation on revenue share basis, retail sales only**												
148													
149	**(i) LG&E**												
150													
151	Incremental revenue requirement in 2019			$357	million								
152													
153	*Cost allocation*		2019 Revenue		% of total revenue		Allocated Portion of Revenue Requirement						
154	Residential		$235	million	40%		$143	million					
155	Industrial		$94	million	16%		$57	million					
156	Commercial/Other		$260	million	44%		$158	million					
157			$588				$357						
158													
159	*Rate impact*			2019 Sales (GWh)	Rate impact per kWh		"All-in" $/kwh, July 2010			Percent Change			
160	Residential			4,435	$0.032		$0.076			43%			
161	Industrial			2,868	$0.020		$0.053			37%			
162	Commercial/Other			5,978	$0.026		$0.069			38%			
163				13,281									
164													
165													
166	**(ii) KU**												
167													
168	Incremental revenue requirement in 2019			$185	million								
169													
170	*Cost allocation*		2019 Revenue		% of total revenue		Allocated Portion of Revenue Requirement						
171	Residential		$250	million	39%		$72	million					
172	Industrial		$148	million	23%		$43	million					
173	Commercial/Other		$242	million	38%		$70	million					
174			$640				$185						
175													
176	*Rate impact*			2019 Sales (GWh)	Rate impact per kWh		"All-in" $/kwh, July 2010			Percent Change			
177	Residential			7,260	$0.010		$0.076			13%			
178	Industrial			6,697	$0.006		$0.058			11%			
179	Commercial/Other			7,388	$0.009		$0.071			13%			
180				21,345									
181													
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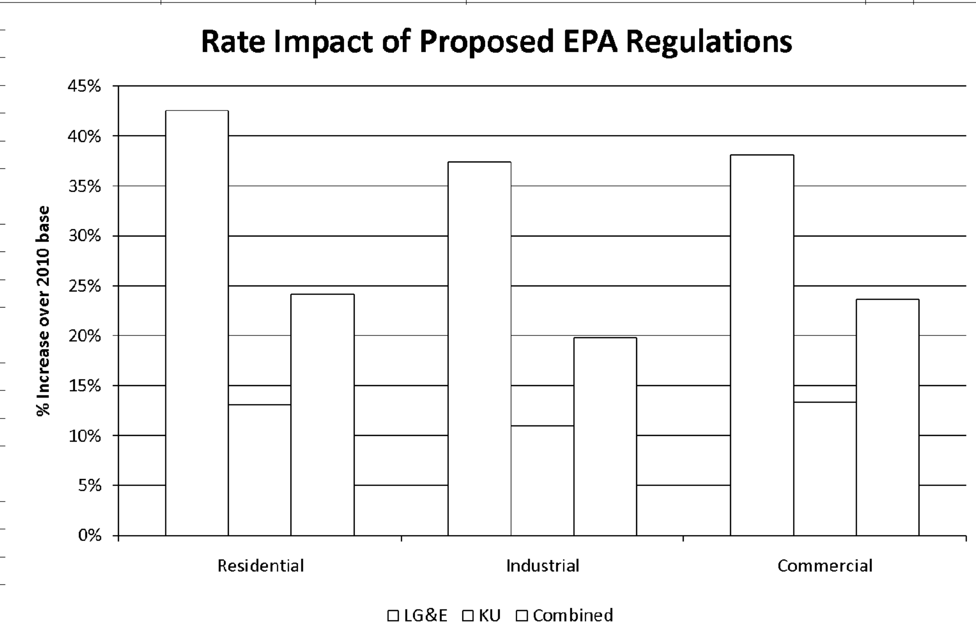
Rate Impacts Summary

	LG&E	KU	Combined
Residential	43%	13%	24%
Industrial	37%	11%	20%
Commercial	38%	13%	24%



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Total Company ECR Revenue Requirements, 2019 (FW Model BV.xls; ECRRevenues)								Questions					
2		Total		Jurisdictional					What is the source of 2019 revenues in Rate Impact tab? Represents					
3	LGE	$541	million	$481	million				Why is total 2019 EPA-related revenue requirement $760 million (vs					
4	KU	$329	million	$286	million				Why are '"jurisdictional" costs used to calculate impacts based on re					
5									Check - allocation shares, cells d31:d33 (correction)					
6	Capital Expenditure for New EPA Regulations, total (CapEx Rollforward BV.xls; Capex B&V, rows 6-20)													
7	LGE	$2,815	million	66%										
8	KU	$1,456	million	34%										
9														
10	Total Capital Expenditures for ECR Recovery, per LTP (FW Model BV.xls; ECRRevenues)													
11	LGE	$2,995	million											
12	KU	$1,901	million											
13														
14	Percent of total ECR expenditures related to new regulations:													
15	LGE	94.0%												
16	KU	76.6%												
17														
18	ECR Revenue Requirement related to new EPA regulations:													
19		Total		Jurisdictional										
20	LGE	$508.57	million	$452.17		67%								
21	KU	$252.02	million	$219.16		33%								
22														
23	Rate Impact of ECR revenue requirement, based on percent of revenue estimates													
24	LGE	July 2010 Revenues			Forecast 2019	Rate Impact								
25	Residential	$ 44,858,233	47.7%	$215.78	4,435.00	0.0486528								
26	Industrial	$ 13,405,650	14.3%	$64.48	2,868.00	0.0224837								
27	Commercial/Other	$ 35,738,986	38.0%	$171.91	5,978.00	0.0287571								
28		$ 94,002,869												
29														
30	KU	July 2010 Revenues			Forecast 2019	Rate Impact								
31	Residential	$ 51,758,876	40.8%	$89.47	6,841.00	0.0130783								
32	Industrial	$ 32,209,911	25.4%	$55.68	6,473.00	0.0086014								
33	Commercial/Other	$ 42,815,485	33.8%	$74.01	7,056.00	0.0104889								
34		$ 126,784,273												
35														
36														

	O	P	Q	R	S	T	U	V
1								
2	base rate revenue only?							
3	$542 million shown in Rate Impact tab)							
4	venue shares, and "total" costs used to calculate impacts based on demand shares							
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37														
38	Rate Impact of ECR revenue requirement, based on demand allocation													
39	LGE total ECR revenue requirement for new regulation:				$508.57	million								
40	Demands, per 2008 rate case cost of service study													
41		Peak		Intermediate		Base								
42	Residential	1,314,970	49.8%	692,749	39.0%	197,877	21.6%							
43	Industrial	417,687	15.8%	680,875	38.3%	413,717	45.2%							
44	Commercial/Other	908,226	34.4%	403,280	22.7%	302,899	33.1%							
45														
46	Demand Allocator	0.5078		0.1532		0.3389								
47														
48	ECR costs by demand	$258.25		$77.91		$172.35								
49														
50	ECR costs to classes							Total						
51	Residential	$128.59		$30.38		$37.29		$196.26						
52	Industrial	$40.85		$29.85		$77.97		$148.67						
53	Commercial/Other	$88.82		$17.68		$57.09		$163.59						
54								$508.52						
55														
56														
57	Estimated Peak Dema	08 COS load factor	2019 sales	2019 NCP, MW	Rate Impact									
58	Residential		4,435		$0.044	per kWh								
59	Industrial	69.8%	2,868	469	$2.64	per kw-month								
60	Commercial/Other	54.3%	5,978	1,256	$1.09	per kw-month								
61														
62														
63	Rate Impact of ECR revenue requirement, based on demand allocation													
64	KU total ECR revenue requirement for new regulation:				$252.02	million								
65	Demands, per 2008 rate case cost of service study													
66		Peak		Intermediate		Base								
67	Residential	1,565,459	36.0%	1,896,227	44.5%	258,530	17.7%							
68	Industrial	901,997	20.8%	776,586	18.2%	475,925	32.6%							
69	Commercial/Other	1,463,426	33.7%	1,250,642	29.3%	583,314	40.0%							
70	Wholesale	413,276	9.5%	340,623	8.0%	140,494	9.6%							
71														
72	Demand Allocator	0.5078		0.1532		0.3389								
73														
74	ECR costs by demand	$127.97		$38.61		$85.41								
75														
76	ECR costs to classes							Total						
77	Residential	$46.12		$17.17		$15.14		$78.43						
78	Industrial	$26.57		$7.03		$27.87		$61.48						
79	Commercial/Other	$43.11		$11.32		$34.16		$88.60						
80	Wholesale	$12.17		$3.08		$8.23		$23.49						

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81								$251.99						
82														
83	Estimated Peak Dema	08 COS load factor	2019 sales	2019 NCP, MW	Rate Impact									
84	Residential		6,841		$0.011	per kWh								
85	Industrial	0.42979	6,473	1,719.27	$0.30	per kw-month								
86	Commercial/Other	0.62918	7,056	1,280.21	$0.58	per kw-month								
87	Wholesale	0.55226	2,176	449.79	$0.44	per kw-month								

	A	B	C	D	E	F	G	H	I
1	Capital Expenditures for EPA Compliance								
2									
3	Station		MW		Capital expenditure required ($ million)				
4					Min	Max	Expected		$/kW
5	Brown	KU	684	SCR, Fabric Filter Baghouse, PAC Injection, Lime Injection	350	450	400		585
6	Ghent	KU	1,918	SCR, Fabric Filter Baghouse, PAC Injection	950	1,150	1,050		547
7	Green River	KU	163	SCR, Fabric Filter Baghouse, PAC Injection	150	250	200		1,227
8	Cane Run	LG&E	563	FGD, SCR, Fabric Filter Baghouse, PAC Injection, Lime Injec	850	950	900		1,599
9	Mill Creek	LG&E	1,472	FGD, SCR, Fabric Filter Baghouse, Electrostatic Precipitato	1,250	1,900	1,575		1,070
10	Trimble 1	LG&E	932	Fabric Filter Baghouse, PAC Injection	150	200	175		188
11			5,732		3,700	4,900	4,300		750
12									
13	KU assets		2,765		1,450	1,850	1,650	38%	
14	LG&E assets		2,967		2,250	3,050	2,650	62%	
15									
16	CCCT replacement		640	600 MW 2x1 Combined Cycle Combustion Turbine	600	800	700		1,094
17					4,300	5,700	5,000		
18									
19									
20									
21	Alternative CapEx Allocation								
22				Expected CapEx ($ million)					
23	Brown	KU		389					
24	Ghent	KU		909					
25	Mill Creek	LG&E		1645					
26	Trimble	LG&E		166					
27									
28	CCCT replacement	LG&E		700					
29									
30	**KU share**			1298	**34%**				
31	**LG&E share**			2511	**66%**				
32				3809	100%				

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1	**Projection of Muni revenues (from LTP model - 2011-20)**														
2															
3	2011-2020 LTP (Final)		2011	2012	2013	2014	2015	2016	2017	2018	2019				
4	Non-Fuel Base Rates		61.6	62.2	62.8	63.4	64.0	64.6	65.2	65.8	66.5				
5	Fuel (Base + FAC)		51.3	53.5	54.6	58.8	59.8	66.3	67.5	72.3	78.0				
6	Base Rate Increases		2.1	8.9	15.6	18.9	23.1	29.6	37.9	44.4	47.2				
7															
8	FERC Revenues ($MMs-excl Misc Charges)		115.0	124.6	132.9	141.1	146.8	160.5	170.6	182.6	191.7			**32.6**	Increase from
9											0.0		CO2		
10															
11	2011-2020 LTP (Preliminary Draft used in EPA regulations presentation)	2011	2011	2012	2013	2014	2015	2016	2017	2018	2019				
12	Non-Fuel Base Rates	46.2	47.3	49.5	50.4	50.9	51.8	52.2	52.5	52.9	53.3				
13	Fuel (Base + FAC)	47.7	49.4	55.3	58.2	58.0	55.9	60.3	62.4	66.1	70.7				
14	Base Rate Increases	4.3	10.5	15.8	21.3	28.2	37.4	47.6	58.5	68.9	75.7				
15															
16	FERC Revenues ($MMs-excl Misc Charges)		107.2	120.6	129.9	137.1	145.0	160.1	173.3	187.8	199.8			**40.7**	
17											0.0		CO2		
18															
19	2010-2019 LTP	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019				
20	Non-Fuel Base Rates	46.2	47.3	49.5	50.4	50.9	51.8	52.2	52.5	52.9	53.3				
21	Fuel (Base + FAC)	47.7	49.4	55.3	58.4	58.9	57.3	59.6	61.7	64.7	68.2				
22	Base Rate Increases	5.1	13.2	19.6	24.6	30.2	37.3	44.2	49.4	52.3	54.0				
23															
24	FERC Revenues ($MMs-excl Misc Charges)	99.0	110.0	124.3	133.4	140.0	146.4	156.0	163.6	169.8	175.5				
25											(16.5)		CO2		
26															
27															
28	Projected 2019 Muni sales (GWh)	2,176													
29	EPA-related increase ($/kWh) in 2019	$0.0150													
30															
31		2008	2009	2010	Jul-10										
32	Revenue from sales to Munis ($ million)	91.9	91.2	62.2	12.6										
33	Muni sales (GWh)	1,971	1,848	1,177	199										
34	Unit revenue from sales to Munis ($/kWh)	$0.0466	$0.0493	$0.0529	$0.0633										
35															
36	EPA-related impact in 2019 as % of 2010 unit revenue			28%											
37															
38															
39	KU MUNICIPALS - 2010 RATES														
40	AVERAGE COST PER MWH FOR POWER USED DURING THE MONTH LISTED - BILL DUE DATE TWO MONTHS LATER														
41															
42		Jan	Feb	Mar	Apr	May	Jun	Jul	YTD						
43															
44	Barbourville	$50.72	$49.84	$51.27	$49.66	$54.56	$57.25	$59.93	$53.32						

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8	prior plan (i.e. new EPA regulations)		
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45	Bardstown	$51.04	$49.62	$48.69	$49.54	$53.11	$55.30	$58.60	$52.27						
46	Bardwell	$52.35	$50.39	$49.73	$52.65	$58.43	$58.96	$61.83	$54.91						
47	Benham	$57.26	$54.45	$60.03	$58.96	$57.57	$59.68	$63.20	$58.74						
48	Berea	$52.22	$51.43	$52.74	$48.46	$53.33	$56.42	$59.17	$53.40						
49	Corbin	$51.07	$49.75	$50.50	$51.16	$55.84	$58.37	$60.80	$53.93						
50	Falmouth	$51.83	$52.09	$51.85	$52.38	$61.19	$63.03	$65.48	$56.84						
51	Frankfort	$50.38	$49.81	$49.35	$49.48	$53.95	$56.05	$59.06	$52.58						
52	Madisonville	$50.30	$48.39	$47.28	$50.33	$53.84	$55.82	$58.90	$52.12						
53	Nicholasville	$50.42	$49.17	$49.16	$47.90	$52.04	$54.88	$58.94	$51.79						
54	Paris	$39.04	$36.78	$36.32	$30.93	$35.76	$45.98	$45.99	$38.69						
55	Providence	$50.94	$49.62	$49.90	$51.47	$58.47	$58.27	$60.87	$54.22						
56															
57	Average All Muni's	$50.63	$49.28	$49.73	$49.41	$54.01	$56.67	$59.40	$52.73						
58	Average All Muni's except Paris	$51.68	$50.41	$50.95	$51.09	$55.67	$57.64	$60.62	$54.01						
59	Avg All Muni's except Benham & Paris	$51.13	$50.01	$50.05	$50.31	$55.47	$57.44	$60.36	$53.54						

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Sales, Revenue and Average Unit Rates (per Utility Financial Reports)**											
2												
3			**2008**				**2009**				**July 2010**	
4												
5	**LG&E**		**kWh**	**$**	**$/kWh**		**kWh**	**$**	**$/kWh**		**kWh**	**$**
6	Residential Sales		4,206,410,526	301,021,844	0.072		4,095,806,460	310,340,508	0.076		593,573,594	44,858,233
7	Small Commercial and Industrial Sales		1,392,051,319	111,125,344	0.080		1,344,247,037	110,666,000	0.082		154,077,990	12,849,498
8	Large Commercial Sales		2,331,119,751	137,250,087	0.059		2,272,699,738	141,774,569	0.062		232,055,516	14,896,275
9	Large Industrial Sales		2,850,830,033	138,314,832	0.049		2,412,418,682	124,099,537	0.051		252,296,232	13,405,650
10	Public Street and Highway Lighting		61,974,931	6,896,924	0.111		59,012,932	6,806,105	0.115		3,705,924	534,560
11	Other Sales to Public Authorities		1,240,681,990	68,992,558	0.056		1,220,972,154	71,502,523	0.059		126,045,463	7,458,653
12	Total - Ultimate Consumers		12,083,068,550	763,601,589	0.063		11,405,157,003	765,189,241	0.067		1,361,754,719	94,002,869
13												
14												
15	**KU (including ODP)**		**kWh**	**$**	**$/kWh**		**kWh**	**$**	**$/kWh**		**kWh**	**$**
16	Residential Sales		6,802,830,237	462,085,548	0.068		6,594,160,339	480,270,452	0.073		679,264,592	51,758,876
17	Commercial Sales		4,713,879,375	316,402,846	0.067		4,518,585,415	320,837,831	0.071		445,622,461	32,224,752
18	Industrial Sales		5,125,141,555	268,939,540	0.052		4,867,629,386	267,669,673	0.055		506,098,071	28,765,346
19	Mine Power		870,237,299	50,316,630	0.058		784,985,635	48,322,690	0.062		49,166,234	3,444,565
20	Public Street and Highway Lighting		57,575,377	10,014,050	0.174		53,938,858	10,185,756	0.189		4,245,108	942,854
21	Other Sales to Public Authorities		1,572,082,501	93,273,848	0.059		1,524,112,658	95,587,730	0.063		150,438,149	9,267,928
22	Municipal Pumping		76,854,641	4,760,365	0.062		69,094,357	4,532,294	0.066		5,711,572	379,950
23	Refunds							(469,231)				
24	Total - Ultimate Consumers		19,218,600,985	1,205,792,827	0.063		18,412,506,648	1,226,937,195	0.067		1,840,546,187	126,784,273
25												
26												
27	**Combined Company**		**kWh**	**$**	**$/kWh**		**kWh**	**$**	**$/kWh**		**kWh**	**$**
28	Residential		11,009,240,763	763,107,392	0.069		10,689,966,799	790,610,959	0.074		1,272,838,186	96,617,110
29	Industrial		8,846,208,887	457,571,002	0.052		8,065,033,703	440,091,901	0.055		807,560,537	45,615,561
30	Commercial / Other		11,446,219,885	748,716,021	0.065		11,062,663,149	761,892,807	0.069		1,121,902,183	78,554,472
31	Total - Ultimate Consumers		31,301,669,535	1,969,394,416	0.063		29,817,663,651	1,992,126,436	0.067		3,202,300,906	220,787,142
32												
33												
34	KU											
35	Residential										679,264,592	51,758,876
36	Industrial										555,264,305	32,209,911
37	Commercial / Other										606,017,290	42,815,485
38												
39	LGE											
40	Residential										593,573,594	44,858,233
41	Industrial										252,296,232	13,405,650
42	Commercial / Other										515,884,893	35,738,986

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5	**$/kWh**
6	0.076
7	0.083
8	0.064
9	0.053
10	0.144
11	0.059
12	0.069
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14	
15	**$/kWh**
16	0.076
17	0.072
18	0.057
19	0.070
20	0.222
21	0.062
22	0.067
23	
24	0.069
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27	**$/kWh**
28	0.076
29	0.056
30	0.070
31	0.069
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35	0.076
36	0.058
37	0.071
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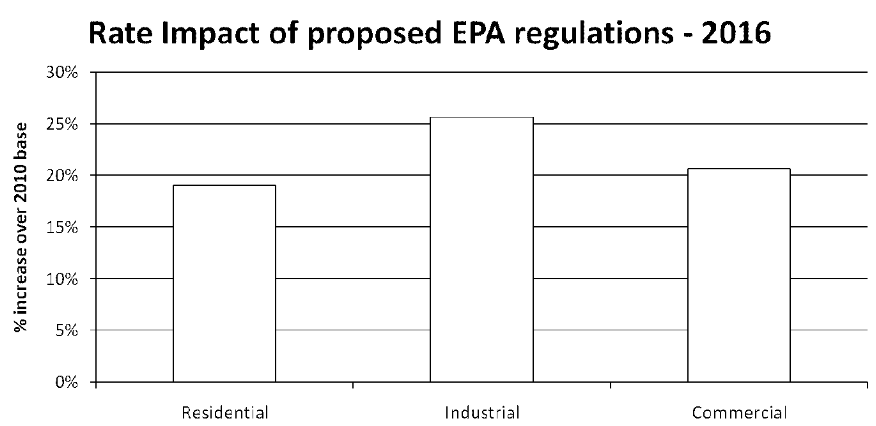
40	0.076
41	0.053
42	0.069

	A	B	C	D	E	F	G
1	**2011 MTP Sales Forecast**						
2							
3	**2016 Forecasted Billed Sales by Revenue Class (GWh)**						
4							
5		Residential	Industrial	Commercial	l - Ultimate Consumers	Municipals	Total sales
6	KU	6,560	6,607	6,768	19,935	2,116	22,051
7	LG&E	4,277	2,821	5,692	12,790		12,790
8	Total KY	10,837	9,428	12,460	32,725	2,116	34,841
9							
10	ODP	414	217	321	952		952
11	Total	11,251	9,645	12,781	33,677	2,116	35,793
12							
13	Commercial includes Public Authority, Street Lighting, and Municipal Pumping						
14	Industrial includes Mine Power						
15	Source: 20100621_LF Results_0304D03.docx						

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Rate impact of environmental compliance costs**												
2													
3	***Choose scenario***		**4**										
4													
5	**2016 Revenue Requirements ($ million)**						Scenarios						
6		1	2	3	4		1	Air compliance (exc SCR)					
7	LG&E	$265	$306	$338	$297		2	Air compliance (inc SCR)					
8	KU	$134	$197	$252	$190		3	Air compliance (inc SCR) + CCP compliance					
9	Combined Co	$399	$503	$590	$487		4	Air compliance (exc SCR) + CCP compliance					
10													
11	**1. Cost allocation on Sales Share Basis (Combined Company, Total Retail Sales)**												
12													
13	Incremental revenue requirement in 2016			$487	million								
14													
15		July 2010 Sales, Revenue and Average Rates					Forecasted sales in 2016			Cost allocation ($M)		Rate adder ($/kV	
16													
17		**Sales (GWh)**		**Revenue**	**Rates ($/kWh)**		**GWh**	**Share**					
18	Residential	1,273	40%	$96,617,110	0.076		11,251	33%		$163		0.014	
19	Industrial	808	25%	$45,615,561	0.056		9,645	29%		$139		0.014	
20	Commercial	1,122	35%	$78,554,472	0.070		12,781	38%		$185		0.014	
21		3,202		220,787,142	0.069		33,677	100%		$487			
22													
23													
24													



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15	Rate increase over 2010 base	
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18	19%	
19	26%	
20	21%	
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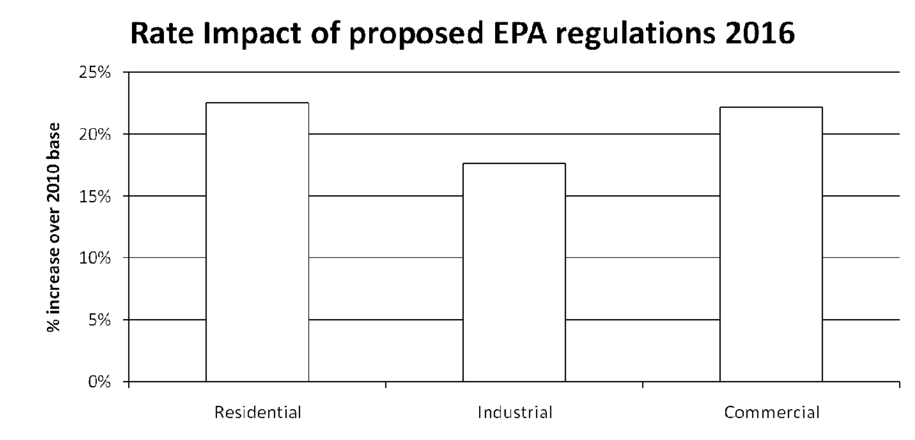
41													
42	**2. Cost allocation on Revenue Share Basis (Combined Company, Total Retail Sales)**												
43													
44	Incremental revenue requirement in 2016			$487	million								
45													
46	*Cost allocation*		2019 Revenue		% of total revenue		Allocated Portion of Revenue Requirement						
47	Residential		$485	million	40%		$192	million					
48	Industrial		$242	million	20%		$96	million					
49	Commercial/Other		$501	million	41%		$199	million					
50			$1,228				$487						
51													
52	*Rate impact*			2016 Sales (GWh)	Rate impact per kWh		"All-in" $/kwh, July 2010			Percent Change			
53	Residential			11,251	$0.017		$0.076			23%			
54	Industrial			9,645	$0.010		$0.056			18%			
55	Commercial/Other			12,781	$0.016		$0.070			22%			
56													
57													



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153	**Rate Impact by Company**												
154													
155	**Cost allocation on revenue share basis, retail sales only**												
156													
157	**(i) LG&E**												
158													
159	Incremental revenue requirement in 2016			$297	million								
160													
161	*Cost allocation*		2019 Revenue		% of total revenue		Allocated Portion of Revenue Requirement						
162	Residential		$235	million	40%		$119	million					
163	Industrial		$94	million	16%		$47	million					
164	Commercial/Other		$260	million	44%		$131	million					
165			$588				$297						
166													
167	*Rate impact*			2016 Sales (GWh)	Rate impact per kWh		"All-in" $/kwh, July 2010			Percent Change			
168	Residential			4,277	$0.028		$0.076			37%			
169	Industrial			2,821	$0.017		$0.053			32%			
170	Commercial/Other			5,692	$0.023		$0.069			33%			
171				12,790									
172													
173													
174	**(ii) KU**												
175													
176	Incremental revenue requirement in 2016			$190	million								
177													
178	*Cost allocation*		2019 Revenue		% of total revenue		Allocated Portion of Revenue Requirement						
179	Residential		$250	million	39%		$74	million					
180	Industrial		$148	million	23%		$44	million					
181	Commercial/Other		$242	million	38%		$72	million					
182			$640				$190						
183													
184	*Rate impact*			2016 Sales (GWh)	Rate impact per kWh		"All-in" $/kwh, July 2010			Percent Change			
185	Residential			6,974	$0.011		$0.076			14%			
186	Industrial			6,824	$0.006		$0.058			11%			
187	Commercial/Other			7,089	$0.010		$0.071			14%			
188				20,887									
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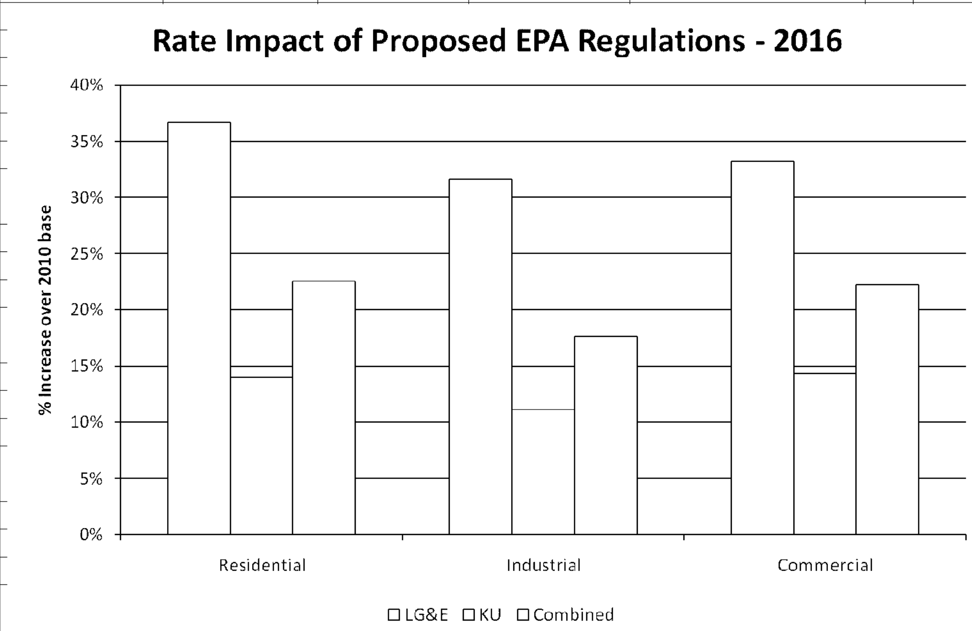
	A	B	C	D
191	**Rate Impacts Summary**			
192		LG&E	KU	Combined
193	Residential	37%	14%	23%
194	Industrial	32%	11%	18%
195	Commercial	33%	14%	22%



From:	Conroy, Robert
To:	Foxworthy, Carol; Thomson, Robert
CC:	Schram, Chuck; Schroeder, Andrea
Sent:	1/17/2011 6:40:57 PM
Subject:	FW: Rate impact of EPA proposals
Attachments:	KU Rev Req template - environmental retrofits.xlsx; LG&E Rev Req template - environmental retrofits.xlsx; Potential rate impacts of EPA proposals; Rate impact of EPA proposals 01_14_11.xlsx

Carol,

Please review since you worked with Bob the first go around.

Bob,

What is this being used for? How different are the capital cost estimate from what is in the MTP and what Andrea is using to develop ECR bill impacts for the 2011 Plan Filing? We have developed ECR revenue requirement for the plan filing.

Robert M. Conroy
Director, Rates
LG&E and KU Services Company
(502) 627-3324 (phone)
(502) 627-3213 (fax)
(502) 741-4322 (mobile)
robert.conroy@lge-ku.com

From: Thomson, Robert
Sent: Monday, January 17, 2011 11:06 AM
To: Conroy, Robert
Cc: Schram, Chuck; Foxworthy, Carol
Subject: Rate impact of EPA proposals

Robert,

Back in November we took a first shot at estimating EPA rate impacts at a company and customer-category level (see attached email). We used a revenue-share basis for cost allocation as recommended by Rates & Reg.

Last week John Voyles asked for an update of this approach using more detailed capital cost estimates for the necessary retrofits, and recognizing an accelerated schedule of implementation (everything completed by the end of 2016). The provisional results are shown in the attached file; I have also attached our revenue requirements calculation for each utility (how we convert the capital expenditure profile for each utility to an annual carrying charge).

One thing that has not been updated is the revenue share of each customer category, for each utility (residential, commercial, industrial) in 2016. I have left the 2019 shares unchanged. I would expect that these shares do not change greatly from year to year; however I am still not clear on what the actual 2019 revenue totals (from Rates) represent - presumably some projection of base rate revenues (only)? The relative impact on the different customer classes is of course critically dependent on this projection (cells C162:C164 (LG&E) and C179:C181 (KU) of the Rate Impact tab).

I'd appreciate if the Rates group could take a look at our approach and confirm that you are comfortable with the new results. If you need more details on the composition of the capex totals for each company I can forward those also.

Thanks,

Bob

	A	B	C	D	E	F	G
1		**Revenue Requirements Template: Inputs**					
2							
3		Start year	**2011**				
4		Asset life	**25**				
5		Include deferred tax impact	**Yes**				
6		Tax life	**15**				
7							
8		Capital structure					
9		Debt	**50%**				
10		Equity	50%				
11							
12		Interest rate (pre-tax)	**5.0%**				
13		Equity return (post-tax)	**10.5%**				
14		Tax rate	**40%**				
15							
16		WACC					
17		Pre-tax	11.3%				
18		Post-tax	6.8%				
19							
20		Property tax	**0.25%**				
21		Insurance	**1.00%**				
22							
23							Choose scenario
24		Total LG&E CapEx	Scenario 1	Scenario 2	Scenario 3	Scenario 4	**4**
25			Air (exc SCR)	Air (inc SCR)	Air (inc SCR) + C	Air (exc SCR) + CCP	
26		2010	$1.9	$1.9	$1.9	$1.9	$1.9
27		2011	$18.7	$44.0	$45.1	$19.8	$19.8
28		2012	$33.3	$168.0	$182.2	$47.5	$47.5
29		2013	$78.3	$262.3	$263.2	$79.1	$79.1
30		2014	$276.5	$368.6	$395.4	$303.3	$303.3
31		2015	$379.4	$379.4	$534.1	$534.1	$534.1
32		2016	$81.7	$81.7	$230.0	$230.0	$230.0
33							
34			$869.7	$1,305.9	$1,651.8	$1,215.6	

	A	B
1	Variable O&M	
2		
3	2011	$0.00
4	2012	$0.00
5	2013	$0.00
6	2014	$0.00
7	2015	$0.00
8	2016	$0.00
9	2017	$0.00
10	2018	$0.00
11	2019	$0.00
12	2020	$0.00
13	2021	$0.00
14	2022	$0.00
15	2023	$0.00
16	2024	$0.00
17	2025	$0.00
18	2026	$0.00
19	2027	$0.00
20	2028	$0.00
21	2029	$0.00
22	2030	$0.00
23	2031	$0.00
24	2032	$0.00
25	2033	$0.00
26	2034	$0.00
27	2035	$0.00
28	2036	$0.00
29	2037	$0.00
30	2038	$0.00
31	2039	$0.00
32	2040	$0.00
33	2041	$0.00
34	2042	$0.00
35	2043	$0.00
36	2044	$0.00
37	2045	$0.00
38	2046	$0.00
39	2047	$0.00
40	2048	$0.00
41	2049	$0.00
42	2050	$0.00
43	2051	$0.00
44	2052	$0.00
45	2053	$0.00
46	2054	$0.00
47	2055	$0.00
48	2056	$0.00
49	2057	$0.00
50	2058	$0.00
51	2059	$0.00

	A	B
52	2060	$0.00
53	2061	$0.00
54	2062	$0.00
55	2063	$0.00
56	2064	$0.00
57	2065	$0.00
58	2066	$0.00
59	2067	$0.00
60	2068	$0.00

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Capital-related Revenue Requirements**																
2																	
3			CapEx		Retirements		GBV	Ann Depr	Cum Depr	NBV		**Revenue Requirements**					
4					(cumulative)							Depr	Interest	Dividend	Tax & Ins	Total	
5	2011	0	20		0		20			20		0	0	0		0	
6	2012	1	48		0		67	1	1	67		1	0	2	1	4	
7	2013	2	79		0		146	3	3	143		3	2	6	1	11	
8	2014	3	303		0		450	6	9	440		6	4	12	4	26	
9	2015	4	534		0		984	18	27	956		18	11	38	9	76	
10	2016	5	230		0		1,214	39	67	1,147		39	24	83	13	159	
11	2017	6	0		0		1,214	49	115	1,099		49	28	99	14	190	
12	2018	7	0		0		1,214	49	164	1,050		49	27	93	13	181	
13	2019	8	0		0		1,214	49	212	1,001		49	25	87	13	173	
14	2020	9	0		0		1,214	49	261	953		49	23	81	12	165	
15	2021	10	0		0		1,214	49	309	904		49	22	76	12	157	
16	2022	11	0		0		1,214	49	358	856		49	20	70	11	150	
17	2023	12	0		0		1,214	49	407	807		49	19	65	10	143	
18	2024	13	0		0		1,214	49	455	759		49	17	60	10	136	
19	2025	14	0		0		1,214	49	504	710		49	16	55	9	129	
20	2026	15	0		0		1,214	49	552	662		49	14	50	9	122	
21	2027	16	0		0		1,214	49	601	613		49	13	45	8	114	
22	2028	17	0		0		1,214	49	649	564		49	11	40	7	107	
23	2029	18	0		0		1,214	49	698	516		49	10	35	7	100	
24	2030	19	0		0		1,214	49	746	467		49	9	30	6	94	
25	2031	20	0		0		1,214	49	795	419		49	7	26	6	87	
26	2032	21	0		0		1,214	49	843	370		49	6	22	5	82	
27	2033	22	0		0		1,214	49	892	322		49	6	19	4	78	
28	2034	23	0		0		1,214	49	941	273		49	5	17	4	74	
29	2035	24	0		0		1,214	49	989	225		49	4	14	3	70	
30	2036	25	0		20		1,214	49	1,038	176		49	3	12	3	66	
31	2037	26	0		67		1,194	48	1,066	128		48	3	9	2	62	
32	2038	27	0		146		1,146	46	1,064	82		46	2	7	1	56	
33	2039	28	0		450		1,067	43	1,028	40		43	1	4	1	49	
34	2040	29	0		984		764	31	755	9		31	1	2	0	34	
35	2041	30	0		1,214		230	9	230	0		9	0	0	0	10	
36	2042	31	0		1,214		0	0	0	0		0	0	0	0	0	
37	2043	32	0		1,214		0	0	0	0		0	0	0	0	0	
38	2044	33	0		1,214		0	0	0	0		0	0	0	0	0	
39	2045	34	0		1,214		0	0	0	0		0	0	0	0	0	
40	2046	35	0		1,214		0	0	0	0		0	0	0	0	0	
41	2047	36	0		1,214		0	0	0	0		0	0	0	0	0	
42	2048	37	0		1,214		0	0	0	0		0	0	0	0	0	
43	2049	38	0		1,214		0	0	0	0		0	0	0	0	0	
44	2050	39	0		1,214		0	0	0	0		0	0	0	0	0	
45	2051	40	0		1,214		0	0	0	0		0	0	0	0	0	
46	2052	41	0		1,214		0	0	0	0		0	0	0	0	0	
47	2053	42	0		1,214		0	0	0	0		0	0	0	0	0	

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1																
2																
3	Tax Depr	Def Tax		Book Deprecation												
4				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
5																
6	1	0		1	1	1	1	1	1	1	1	1	1	1	1	1
7	4	1		0	2	2	2	2	2	2	2	2	2	2	2	2
8	10	2		0	0	3	3	3	3	3	3	3	3	3	3	3
9	28	4		0	0	0	12	12	12	12	12	12	12	12	12	12
10	67	11		0	0	0	0	21	21	21	21	21	21	21	21	21
11	99	20		0	0	0	0	0	9	9	9	9	9	9	9	9
12	100	21		0	0	0	0	0	0	0	0	0	0	0	0	0
13	91	17		0	0	0	0	0	0	0	0	0	0	0	0	0
14	82	13		0	0	0	0	0	0	0	0	0	0	0	0	0
15	76	11		0	0	0	0	0	0	0	0	0	0	0	0	0
16	72	10		0	0	0	0	0	0	0	0	0	0	0	0	0
17	72	9		0	0	0	0	0	0	0	0	0	0	0	0	0
18	72	9		0	0	0	0	0	0	0	0	0	0	0	0	0
19	72	9		0	0	0	0	0	0	0	0	0	0	0	0	0
20	72	9		0	0	0	0	0	0	0	0	0	0	0	0	0
21	71	9		0	0	0	0	0	0	0	0	0	0	0	0	0
22	69	8		0	0	0	0	0	0	0	0	0	0	0	0	0
23	65	7		0	0	0	0	0	0	0	0	0	0	0	0	0
24	54	2		0	0	0	0	0	0	0	0	0	0	0	0	0
25	29	-8		0	0	0	0	0	0	0	0	0	0	0	0	0
26	7	-17		0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	-19		0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	-18		0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	-17		0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	-12		0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	-4		0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0

	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
1																
2																
3																
4	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5																
6	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
7	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0
8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0	0
9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	0
10	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
11	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM
1																
2																
3																
4	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
5																
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC
1																
2																
3														Tax Depreciation		
4	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068		2012	2013	2014
5																
6	0	0	0	0	0	0	0	0	0	0	0	0		1	2	2
7	0	0	0	0	0	0	0	0	0	0	0	0		0	2	5
8	0	0	0	0	0	0	0	0	0	0	0	0		0	0	4
9	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0