$PM_{2.5}$ SIP Evaluation Report: Procter and Gamble Paper Products Company

UTAH $PM_{2.5}$ SIP SERIOUS SIP

Salt Lake City $PM_{2.5}$ Serious Nonattainment Area

Utah Division of Air Quality

Major New Source Review Section

July 1, 2019

DAQ-2018-007201

$PM_{2.5}$ SERIOUS SIP EVALUATION REPORT
PROCTER AND GAMBLE PAPER PRODUCTION COMPANY

1.0 Introduction

The following is an updated version of the original RACT evaluation that was completed on May 1, 2017 as a part of the Technical Support Documentation (TSD) for Section IX, Parts H.11, 12 and 13 of the Utah SIP; to address the Salt Lake City $PM_{2.5}$ and Provo, Utah $PM_{2.5}$ Nonattainment Areas.

1.1 Facility Identification

Name: Procter and Gamble Paper Production Company
Address: 5000 North Iowa String Road, Bear River City, Utah 84301
Owner/Operator: Procter and Gamble Paper Products Company (P&G)
UTM coordinates: 4,605,600 m Northing, 402,500 m Easting, Zone 12

1.2 Facility Process Summary

P&G owns and operates a paper, assembled paper products, and manufacturing processes which are located in Bear River City, Utah. Currently, the plant consists of two separate product lines; a paper process line and assembled paper products lines.

The paper process line consists of the following equipment and operations; paper machine, converting room, boilers and support equipment.

A paper machine is comprised of the following equipment: a drying section with two natural gas fired duct burner systems with a combined heat input of 150 MMBTU/hr, three make-up air units, two cyclonic separators and a venturi scrubber to assist in the removal of the particulates. The paper machine has up to five individual permitted process exhaust stacks, as well as additional room exhaust vents.

The converting room houses equipment used to convert the paper roll stock obtained from the paper machine into individual paper products for distribution. The converting operation contains three converting lines. Fugitive emissions within this operation are routed to three dust control systems. The dust control system consists of one drum filter per converting line, each drum filter vented to separate stacks.

Steam required for the paper making line is supplied by two boilers. Each boiler is rated at 60.24 MMBTU/hr and is operated on natural gas as primary fuel and propane as secondary fuel (used only during natural gas curtailment). Emissions from each boiler are vented through its own single stack.

All space heaters are operated on natural gas. The paper machine room has up to 3 direct fired heaters with a total heat input of approximately 47.25 MMBTU/hr. The distribution warehouse has several space heaters with a combined heat input rating of approximately 8.38 MMBTU/hr.

In order to support cooling needs for the paper making line, there are three (3) existing cooling towers. The existing cooling towers are equipped with drift eliminators to minimize particulate emissions.

The assembled paper product line functions to assemble various raw materials into the finished product. Emissions from an Assembled Paper Product line are Particulate Matter (PM/PM10/PM2.5) and VOCs. Several raw materials are unwound at points along the assembly process. Some raw materials are de-bulked in an offline process and delivered via air to the lines. Various raw and scented materials are also used in the assembly and packaging of Assembled Paper Products. Particulate is captured during the de-bulking of raw materials, the delivery of raw materials, and from the cutting operations on the line. VOCs occur as a result of raw and scented material application as well as from finished product packaging. Emission points for the assembled paper products include: converting line, CVC baghouse, drum filters and drum filter baghouses. In order to support cooling needs for the Assembled Paper Products lines, there are two (2) existing cooling towers.

Future manufacturing operations include a soap manufacturing process, a consumer article cleaning products line, a chemical surfactant product line, additional assembled paper product lines and a bottle blowing line.

The soap manufacturing process line includes three soap products. The first of these three soap product lines is referred to as Soap A. The Soap A manufacturing process involves a mixing and blending operation with a few chemical transformations. Raw materials will be unloaded into the building for placement into the mixing system. Raw materials are pumped from the totes or from on-site storage tanks for blending. As the blending occurs in a closed system, on a batch basis, there are no process vents, therefore results in minimal VOCs emissions from the Soap A manufacturing process. The resultant mixture represents the final product. Variations of the mixture are dependent upon the soap product to be manufactured. Once made, the soap from Soap A product, is piped into a bottle filling line. After filling the containers, the product will proceed to packaging for off-site transport. Alternatively, the soap product may be loaded into truck via a pipeline for packaging at an external facility.

The emission sources for the Soap A manufacturing process include: storing raw materials (in tanks, totes, or drums), bottle filling and truck loading. The materials used in the soap making process have low volatility. Ethanol’s vapor pressure is used in PTE emissions calculations as a conservative estimate of VOC emissions

The second and third soap product lines are herein referred to as Soap B and C. The Soap B and C manufacturing processes involve storage, mixing, and packaging operations that are anticipated to result in VOC and PM emissions. These soap lines involve mixing multiple raw ingredients in line or in tanks to make the desired product. Once mixed, the material is transported to a converting process for placing the soaps into containers. The converting process involves filling and capping multiple types of consumer product packaging. The sources of emissions include the following equipment; raw material storage tanks, mixing tanks, converting, tanker truck loading and finished product packaging.

The primary raw materials include fragrances and surfactant paste. The emission estimates are based on the raw materials with the highest vapor pressure to account for the worst case VOCs emissions and to represent the multiple formulations in the soap manufacturing process. Ethanol is used in the manufacturing of Soap B, and is controlled with an ethanol scrubber.

The consumer article cleaning products manufacturing consist of a substrate that is unrolled (or manipulated) and scented raw materials and cleaners are added to the substrate for use as the final product. The process includes delivery of raw materials and transfer of material to holding and mixing tanks. The raw materials and cleaning mixtures are then applied onto a substrate to produce the cleaning article. Once the cleaning articles are complete, they are sent to be packaged and then onto a warehouse for distribution.

The sources of emissions from consumer article cleaning products manufacturing for each process line include the following equipment; raw material storage tanks, material handling equipment, and converting and finished product packaging.

Particulate matter is produced from receiving, sizing, and handling during the substrate converting process. Controls used for particulate emissions include a baghouse.

The chemical surfactant products line manufacture surfactants at the Box Elder facility. The purpose of the surfactants is primarily to use the products in downstream soap manufacturing. The primary product manufactured is a surfactant paste. Secondary products include amine oxide, sulfuric acid and a byproduct precipitated acid mix (PAM) paste. The amine oxide process produces variable intermediates which are either used in the surfactant paste manufacturing process, or provided to soap manufacturing directly depending on its end use. A number of variations to the surfactant paste product are intended, based on the end use. These variations are achieved through the use of different raw materials in different quantities in the surfactant manufacturing process.

The surfactant process requires P&G to preheat a sulfur converter which is accomplished with the use of a natural gas preheater. This is only intended to occur approximately four (4) times per year. A by-product that results during the changeover period is sulfuric acid (H_2SO_4). As the preheater brings the sulfur converter to the desired temperature, combustion gases and the H_2SO_4 are vented through sulfur dioxide (SO_2) packed bed scrubber.

The proposed surfactant making processes are anticipated to emit the following criteria pollutants; SO_2, VOCs, PM_{10} and $PM_{2.5}$.

Small amounts of NO_X, CO, and SO_2 are emitted through the preheating of the sulfur reactor using a natural gas preheater and/or the oxidation of sulfur involved in making the surfactant paste. All potential emissions during normal operations and startup and shutdown of the sulfate reactor are vented through an SO_2 packed bed scrubber. The VOC emissions are emitted from raw material and product storage tanks, inline mixing tanks, and truck loading. As a result of the variations of products to be produced, the raw materials with the highest volatility were used to estimate product storage and truck loading emissions.

The emission sources in the surfactant processes include the following: raw material (intermediate and product tanks), natural gas preheater, in-line mixing, mixing tanks and product truck loading.

The surfactant process will be controlled with a packed bed scrubber to control SO_2 and PM emissions. The surfactant process has fugitive VOC emissions.

The bottle blowing process; the bottles and containers needed for site-wide packaging purposes are molded. The process begins with plastic beads that are delivered to a silo and then conveyed to the appropriate equipment on-site. These plastic pieces are fed into an extruder where the final container shape is formed. This container then receives a label and is delivered for use within the other business units on-site. Any scrap plastic that is created is recycled back to the bottle and container making processes through regrinding. The sources of emissions include the following equipment or processes: raw material storage silos, recycled material grinding, conveying converting finished product packaging and two (2) cooling towers.

In order to support the future manufacture lines, heating, cooling, ventilation, and steam needs are provided by the following utility equipment: two (2) 50 MMBtu/hr steam boilers, and five (5) cooling towers. The boilers will be fueled by natural gas and equipped with ultra-low NO_X burners with propane available as a secondary fuel for emergencies or curtailment. The cooling towers are for cooling manufacturing equipment associated with the surfactant and soap making processes. The cooling towers will be designed with drift eliminators to minimize particulate emissions. For power outages on the future Manufacturing lines, the following equipment is installed: one (1) 350 KW emergency generator, and one (1) 30 KW emergency generator. The emergency generators will be fueled by diesel and meet U.S. EPA's Tier 3 specifications. One 1,955 gallon diesel storage tank to act as a diesel fuel refueling station.

1.3 Facility 2016 Baseline Emissions

Plant-wide 2016 Projected Emissions (tons/yr)

$PM_{2.5}$	NO_X	SO_2	VOC
150.16	124.86	1.45	162.37

1.4 Facility Criteria Air Pollutant Emissions Sources

Emission Unit	Potential to Emit				
	$PM_{2.5}$	NO_x	SO_2	VOC	NH_3
Paper Machine	101.46	71.55	0.46	85.61	<0.01
Boilers	14.39	34.16	0.57	5.21	<0.01
Converting Line	12.26	0.00	0.00	17.08	0.00
Cooling Towers	1.82	0.00	0.00	0.00	0.00
Chemical Make Process-Scrubber	5.31	1.16	0.36	5.26	0.00
Storage Tanks	0.00	0.00	0.00	14.61	0.00
Fugitive VOC	0.00	0.00	0.00	6.76	0.00
Cleaning Article Manufacturing	5.31	0.00	0.00	0.93	0.00
Assembled Paper Products	9.56	0.00	0.00	22.58	0.00
Truck Loading	0.00	0.00	0.00	0.35	0.00
Other/Negligible	0.85	2.72	0.05	3.16	0.00
Emergency Generators	0.05	2.30	0.00	0.05	0.00
Warehouse Space Heaters	0.13	2.20	0.01	0.73	0.00
Facility Wide PTE	150.11	114.10	1.45	162.18	<0.01

2.0 BACT Selection Methodology

The general procedure for identifying and selecting BACT is through use of a process commonly referred to as the “top-down” BACT analysis. The top-down process consists of five steps which consecutively identify control measures, and gradually eliminate less effective or infeasible options until only the best option remains. This process is performed for each emission unit and each pollutant of concern. The five steps are as follows:

1. Identify All Existing and Potential Emission Control Technologies: UDAQ evaluated various resources to identify the various controls and emission rates. These include, but are not limited to: federal regulations, Utah regulations, regulations of other states, the RBLC, recently issued permits, and emission unit vendors.

2. Eliminate Technically Infeasible Options: Any control options determined to be technically infeasible are eliminated in this step. This includes eliminating those options with physical or technological problems that cannot be overcome, as well as eliminating those options that cannot be installed in the projected attainment timeframe.

3. Evaluate Control Effectiveness of Remaining Control Technologies: The remaining control options are ranked in the third step of the BACT analysis. Combinations of various controls are also included.

4. Evaluate Most Effective Controls and Document Results: The fourth step of the BACT analysis evaluates the economic feasibility of the highest ranked options. This evaluation includes energy, environmental, and economic impacts of the control option.

5. Selection of BACT: The fifth step in the BACT analysis selects the "best" option. This step also includes the necessary justification to support the UDAQ's decision.

Should a particular step reduce the available options to zero (0), no additional analysis is required. Similarly, if the most effective control option is already installed, no further analysis is needed.

2.1 Emission Unit (EU) and Existing Controls

2.1.1 Paper Machine

<u>Description:</u>
The paper machine produces both paper towel and tissue paper products. Pulp, manufactured at separate facilities, is mixed with water and additives as raw material. The raw materials that form into a web are dried with hot air from a combination of process heaters and steam dryers.

The paper process begins with the wet end starting with stock preparation, which consists of mixing pulp, additives, and water. This slurry is then fed to the forming system where the sheet screening, formation of paper, and draining occur. The wet paper undergoes drying where the wet paper web is passed through drying zones. Air and heat distribution are required to uniformly dry the paper sheet. Hot air is transferred across the wet paper web, passing directly through the product in the forming system and dry end. The air is heated by two duct burners referred to as Burner #1 and Burner #2.

Burner #1 is 100 million British thermal units per hour (MMBtu/hr) natural gas fired dryer with a low NOx burner. Burner #2 is rated at 50 MMBtu/hr and uses preheated air from the paper process, which was initially heated by Burner #1. Burner #2 duct burner is equipped with the same style of low NOx burner. Burner #1 heats ambient air for the use in drying the wet paper web. This hot air travels through the paper machine and into the duct heated by Burner #2.

Make-up air is delivered into the paper machine room by make-up air units used for room balance and temperature control. The make-up air units provide additional flow, but only heat the air during times of colder ambient temperatures.

The paper towel or tissue paper finishes in the paper machine as a large roll for further processing. The dry-end of the process is controlled by a Venturi scrubber. The wet end of the process and under dryer are controlled by cyclonic separators that function as mist eliminators and remove particulate.

Depending on the product being created, heat intensity and steam demand are varying process parameters required to adapt to new product specifications in a short period of time to eliminate wasting product. The paper machine emission points, are as follows:

Paper Machine Process Stack

Wet End Cyclonic Separator
Under Dryer Cyclonic Separator
Dry End Venturi Scrubber
Four (4) Paper Machine Room Exhaust Fans

The emissions from process stack include natural gas combustion emissions from Burner #1 and Burner #2 as well as particulate matter and VOC emissions from the drying of the wet paper web. The cyclonic separator and venturi scrubber collect cellulose that becomes entrained during the process in the paper machine as particulate matter. The primary function of the cyclonic separator is to act as a mist eliminator, but the cyclonic separator removes particulate matter. The under dryer stack particulate matter is controlled by a cyclonic separator. The make-up air units exhaust and blow air directly into the paper machine room. The emissions associated with the natural gas combustion during the cooler months from the make-up air units are exhausted through the paper machine room exhaust fans.

The make-up air units are equipped with low NOx burners, each burner has the capacity of 15.75 MMBtu/hr. The make-up air units only run half the year, providing a reduction in annual emissions. The make-up air units exhaust to a large room, making any sort of add-on control technologies impractical. The make-up air units are also specifically designed for the space and are not standard packaged units, pricing without purchasing a new unit is not feasible. The emissions associated with the make-up air units make up less than 10% of the paper machines total NOx emissions not being cost effective to replace or add on controls.

<u>Emissions Summary:</u>
The paper machine has the following stacks that will be addressed; wet exhaust stack, process stack, under dryer stack, dry end stack and the roof exhaust. The following are the potential emissions associated with each point in tpy.

Paper Machine	**$PM_{2.5}$**	**NO_X**	**SO_2**	**VOC**
Wet Exhaust Stack	4.82	0.00	0.00	0.00
Process Stack	78.62	59.13	0.39	1.14
Under Dryer Stack	5.26	0.00	0.00	0.00
Dry End Stack	5.48	0.00	0.00	0.00
Roof Exhaust	7.29	12.42	0.06	72.47

[Pollutant - <u>$PM_{2.5}$</u>]
Raw materials including pulp, additives, and water, are used in the paper machine. The beginning of the process is wet, and the pulp dries and becomes a paper web as it moves through the machine. The wet end is where the raw material is introduced to the paper machine and the dry-end is where the product is formed. The particulate matter emitted from the paper machine is generally larger in size. $PM_{2.5}$ is emitted as a by-product of incomplete combustion of the natural gas from Burner #1, Burner #2, and make up air units. The dry-end of the process is controlled by a Venturi scrubber, the wet end of the process and under dryer stack is controlled by a cyclonic separator. Both Venturi

scrubber and cyclonic separator installed and are control technologies designed to remove larger particulate. P&G has conducted studies on ways to minimize particulate matter emissions during the paper making process. P&G have taken the results of the studies and incorporating appropriate techniques into the operation of the paper machine (Mcintyre 2009).

Available Control Technology
The control technologies for $PM_{2.5}$ emissions for the paper machine include:

- Fabric Filters (baghouse),
- Wet Scrubbers,
- Dry Electrostatic precipitators (ESP), and
- Cyclone Separator

Technological Feasibility:
Baghouse/Fabric Filter
There is no proven fabric filter technology that will control condensable $PM_{2.5}$. On the wet end and process stack, a fabric filter would bind up. The high moisture content of the gas stream would clog/plug the fabric filter. On the dry end, the fabric collection of combustible fibers as filterable $PM_{2.5}$ presents a safety hazard for potential fire. Fires in the baghouse are a potential, because of the heat of the gas stream and the presents of cellulose fibers (US-EPA 2002a; US-EPA 2002b).

Wet Scrubbers
A wet gas scrubber is an air pollution control device that removes $PM_{2.5}$ from stationary point sources waste streams. $PM_{2.5}$ is primarily removed through the impaction, diffusion, interception, and/or absorption of the pollutant onto droplets of liquid. This control technology has been operated successfully on the dry-end portions of paper machines at other P&G plants. P&G currently has installed and operates a wet scrubber at the Box Elder paper machine on the dry end with an estimated 95% control efficiency of filterable $PM_{2.5}$.

Wet gas scrubbing is not effective for the process stack because of the high flow rate (250,000 acfm) and low concentration of emissions (US-EPA 2002c). Current wet scrubber designs can accommodate 100,000 acfm. Adding a wet scrubber to the process stack would create backpressure in the operating room. This would require a complete redesign of the heat distribution through the paper machine as well as industrial hygiene concerns to employees. The redesign would take into consideration new infrastructure, building, and paper machine to meet the design requirements, and huge amounts of power to accommodate the large fans required due to back pressure. A wet scrubber is technically infeasible for the wet and process stacks.

Dry ESPs
A dry ESPs is a particle control device that uses electrical forces to move the particles out of the gas stream onto collector plates. This process is accomplished by the charging of particles in the gas stream using positively or negatively charged electrodes. The particles are then collected as they are attracted to oppositely opposed electrodes. Once the

particles are collected on the plates, they are removed by knocking them loose from the plates, allowing the collected layer of particles to fall into a hopper. Dry ESPs are used to capture coarse particles at high concentrations. Small particles at low concentrations are not effectively collected by an ESP (US-EPA 2002d).

The low concentration, high moisture content and high flowrate of the process stack makes this control device technically infeasible. This technology is technically infeasible for the dry end, like the baghouse, in that fire hazard is present with accumulation of combustible material and the possibility of arcing with the collector plates (US-EPA 2002d). Changing between paper towel product and tissue paper is expected to cause upsets to this control technology making this control device technically infeasible.

Cyclone Separator
A cyclone separator (cyclone) operates on the principle of centrifugal separation. Exhaust enters the inlet and spirals around towards the outlet. As the particles proceed through the cyclone, the heavier material hits the outside wall and drops out. The cleaned gas escapes through an inner tube. Cyclones function to reduce dust loading and collect large particles.

P&G is currently operating this technology on the wet end of the paper machine process and the under dryer stack with an estimated 85% control efficiency. The Venturi scrubber has higher control efficiency than the cyclonic separator and can handle high moisture streams. The primary purpose of the cyclonic separator on the wet end is to capture the excess moisture contained in the exhaust stream. The Venturi scrubber could be used as an add-on control technology to the end of the cyclonic separator, but the exhaust stream of the cyclonic separator has particulate concentrations lower than a wet scrubber can practically control.

The wet end and under dryer stack are currently being controlled by cyclonic separators. The wet scrubber controls has the highest control efficiency controls the dry end stack. The wet scrubber technology will be further evaluated for economic feasibility.

Economic Feasibility:
Baghouse and electrostatic precipitator technology have been eliminated as technically infeasible options for all stacks on the Paper Machine. A wet scrubber is currently operating to control filterable particulate on the dry end of the paper machine.

Combining a wet scrubber to the existing cyclonic separator on the wet end stack would reduce the $PM_{2.5}$ emissions to 0.48 tpy. The cost per ton of $PM_{2.5}$ removed calculated for a wet scrubber is $165,250.

BACT Selection:
The wet end and under dryer stack are currently being controlled by cyclonic separators. The dry end stack is controlled by a Venturi Scrubber. The process stack emissions are predominately products of natural gas combustion. Add-on control is not practically feasible for products of natural gas combustion. Good combustion practices and clean

burning fuels are BACT for the process stack. All existing controls are considered BACT.

Implementation Schedule:
All selected BACT control technologies for the paper machine have been installed and operating. No implementation date is needed.

[Pollutant $\underline{NO_X}$]
NOx is emitted from Burner #1, Burner #2, and the make-up air units. Burner #1 and Burner #2 exhaust primarily through the process stack. NOx is formed during combustion by two major mechanisms: thermal NOx and fuel NOx. Since natural gas is relatively free of fuel-bound nitrogen, the contribution of this second mechanism to the formation of NOx emissions in natural gas-fired equipment is minimal and thermal NOx is the chief source of NOx emissions. Thermal NOx formation is a function of residence time, oxygen level, and flame temperature, and can be minimized by controlling these elements in the design of the combustion equipment.

Available Control Technology
The control technologies for NO_X emissions for the paper machine include:

- Low NOX Burners
- Ultra-Low NOX Burners
- Flue Gas Recirculation
- Selective Catalytic Reduction
- Selective Non-Catalytic Reduction
- Good Combustion Practices

Technological Feasibility:
Low NO_X Burners (LNB)
LNB technology uses advanced burner design to reduce NOx formation through the restriction of oxygen, flame temperature, and/or residence time. There are two general types of LNBs: staged fuel and staged air burners. In a stage fuel LNB, the combustion zone is separated into two regions. The first region is a lean combustion region where a fraction of the fuel is supplied with the total quantity of combustion air. Combustion in this zone takes place at substantially lower temperatures than a standard burner. In the second combustion region, the remaining fuel is injected and combusted with left over oxygen from the first region. This technique reduces the formation of thermal NOx.

LNB technology is specific to the combustion unit itself and is therefore evaluated for Burner #1, Burner #2, and make-up air units. The burner installed on Burner #1 and Burner #2 was designed specifically for in-line duct firing. The low NOx emissions are achieved through a patented simulated pre-mix technology that enables the fuel to be fired in a very lean mixture while ensuring optimum flame stability. Low NOx and carbon monoxide (CO) emissions are achieved across a wide firing rate turn down without the need for fuel-to-air ratio combustion controls. Low NOx Burner technology is technically feasible and is currently utilized on the Paper Machine.

Ultra-Low NO_X Burners (ULNB)
ULNB technology uses internal flue gas recirculation, which involves recirculating the hot oxygen depleted flue gas from the heater into the combustion zone using burner design features and fuel staging to reduce NOx. Research conducted on other paper machines (Mcintyre 2009) determined that the only available technology would involve a complete re-design of the hot air system that would allow using a single register style round low NOx burner. The redesign of the paper machine technology would greatly reduce heat efficiency maintained within the machine. The ULNB is considered technically infeasible due to the redesign and reduced heat efficiency.

Flue Gas Recirculation (FGR)
FGR combined with LNB as a method of ULNB technology is another combustion control used to reduce NOx. FGR involves the recycling of flue gas into the air-fuel mixture at the burner to help cool the burner flame. External FGR, usually used with LNB, requires the use of hot-side fans and ductwork to route a portion of the flue gas in the stack back to the burner windbox.

The burners installed on the existing paper machine simulate pre-mix technology that enables the fuel to be fired in a lean mixture while ensuring optimum flame stability. Induced FGR for Burner #1 is impractical as it is firing directly into process air and the significant amount of cellulose would greatly reduce the reliability of the burner. Burner #2 uses process air heated by Burner #1 for efficiency and is used as combustion air. As thermal efficiencies have already been engineered throughout the second generation paper machine, the use of heated air is already implemented and the use of process air would damage the burner; therefore, FGR is considered technically infeasible.

Selective Catalytic Reduction (SCR)
SCR can be applied as a stand-alone NOx control or with other technologies such as combustion controls. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx into molecular nitrogen and water vapor. The optimum operating temperature is dependent on the type of catalyst and the flue gas composition ranging from 480°F to 800°F (US-EPA 2002e).

The hot exhaust gases from the paper machine combustion unit come into direct contact with process material through-air drying process prior to release to the atmosphere. The combustion exhaust cannot be influenced by a reagent prior to contact with the product at the risk of compromising operations and product specifications. If the SCR captures exhaust emissions after the through-air drying process, there is possibility of residue from the PM emissions from the paper machine process coating the surface of the SCR catalyst, reducing effectiveness and increasing maintenance. The paper machine has a process exhaust temperature of 200°F or less. The exhaust stream does not meet the temperature requirements for the SCR (minimum of 480°F) for proper operations leading to optimal efficiency (US-EPA 2002e).

Due to the physical configuration, risk of compromising product, risk of compromising

SCR effectiveness through fouling of the catalyst, SCR is considered technically infeasible.

Selective Non-Catalytic Reduction (SNCR)
SNCR can be applied as a stand-alone NOx control or with other technologies such as combustion controls. SNCR can achieve NOx reduction efficiencies of up to 75% in short-term demonstrations. Field applications have provided NOx reductions efficiencies of 30% to 50%. Reductions of up to 65% have been reported for some field applications of SNCR in tandem with combustion control equipment such as LNB.

SNCR is based on the chemical reduction of the NOx molecule into molecular nitrogen and water vapor. A nitrogen based reducing agent, such as ammonia or urea, is injected into the post combustion flue gas. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored over other chemical reaction processes for a specific temperature range and in the presence of oxygen, therefore, it is considered a selective chemical process.

Practical application of SNCR is limited by the system design and operating conditions. SNCR becomes difficult at temperatures outside its required temperature range of 1,600°F to 2,100°F (US-EPA 2002f). The paper machine has a process exhaust temperature of 200°F or less. The exhaust stream does not meet the temperature requirements for the SNCR (minimum of 1,600°F) for proper operations leading to optimal efficiency.

Due to the design limitation, exhaust stream temperature differences SNCR is considered technically infeasible.

Good Combustion Practices
The use of good combustion practices include the following components: (1) proper fuel mixing in the combustion zone; (2) high temperatures and low oxygen levels in primary zone; (3) Overall excess oxygen levels high enough to complete combustion while maximizing boiler efficiency, and (4) sufficient residence time to complete combustion. Good combustion practices are accomplished through the in-line duct burners currently used for the paper machine design application as it relates to time, temperature, turbulence, and burner operation. All components of good combustion practices are technically feasible and have been implemented on the paper machine.

Economic Feasibility:
ULNB, FGR, SCR and SNCR technology have been eliminated as technically infeasible options for all stacks on the Paper Machine. LNB and good combustion practices are technically feasible and currently operating to control NOx on the burners on the paper machine.

BACT Selection:
The paper machine burners are currently being controlled by LNB and good combustion practices. No add-on control technologies are considered technically feasible on the stack

of the paper machine due to the exhaust steam characteristic. The paper machine uses LNB technology and good combustion practices to control NOx emissions. All existing controls are considered BACT.

Implementation Schedule:
All selected BACT control technologies for the paper machine have been installed and operating.

[Pollutant $\underline{SO_2}$]
SO_2 emissions from the Paper Machine result from oxidation of fuel sulfur in Burner #1, Burner #2, and make-up air units. Burner #1 and Burner #2 exhaust primarily through the process stack. The process stack has 0.48 tons per year of SO_2 from the paper machine.

Available Control Technology
There are two primary mechanisms to reduce SO_2 emissions from combustion sources which are: (1) reduce the amount of sulfur in the fuel, and (2) remove the sulfur from the exhaust gases with a post-combustion control device such as flue gas desulfurization utilizing wet scrubbers or dry scrubbers.

The Box Elder Plant will be using pipeline-quality natural gas as the primary fuel which has a low sulfur content. The use of a fuel containing low sulfur content is considered a control technology.

Two main types of SO_2 post-combustion control technologies, wet and dry scrubbing, were identified to reduce SO_2 in the exhaust gas.

Technological Feasibility:
The requirement for low-sulfur natural gas is a control technique that has been achieved in practice and is technically feasible. Post-combustion devices such as wet or dry scrubbers are installed on coal-fired plants that burn fuels with much higher sulfur content. Scrubber control technologies require much higher sulfur concentrations in the exhaust gases to be feasible as a control technology. The SO_2 concentrations in the natural gas combustion exhaust gases from the paper machine are too low for scrubbing technologies to work effectively or to be technically feasible. Since these controls are not technically feasible, they have been eliminated from further consideration for the process stack or wet end stack. A wet scrubber has been installed on the dry end stack; however, its primary purpose is for particulate removal. Therefore, it has been eliminated for further consideration as an SO_2 control device.

Economic Feasibility:
The use of low sulfur fuel (natural gas) is economically feasible and implemented on the paper machine.

BACT Selection:
The use of low sulfur fuel (natural gas) is considered BACT on the paper machine to control SO_2 emissions.

Implementation Schedule:
The paper machine has been designed to operate on natural gas which is a low sulfur fuel. This control technology is currently installed and no implementation date is needed.

[Pollutant VOC]
Raw material for the paper machine include pulp, water, and additives. The additives and pulp for the paper make up approximately 80% of the VOC emissions. The emissions from the additives and pulp are characterized as VOC fugitive emissions. Fugitive emissions are difficult to capture for control thru the use of add-on control technologies. Add-on control techniques for paper machine vents are considered impractical because of the high moisture content, high volume of air, and low VOC concentrations. The remaining 20% of the VOC emissions are generated from combustion of natural gas in Burner #1, Burner #2, and make-up air units.

Available Control Technology
The control technologies for VOC emissions for the paper machine include:
- Regenerative Thermal Oxidizer
- Simple Thermal Oxidizer
- Condenser
- Biofilter
- Low VOC Additives and Good Operating Practices
- Good Combustion Practices and Use of Clean Fuel

Technological Feasibility:
Regenerative Thermal Oxidizer (RTO)
A RTO is equipped with ceramic heat recovery media (stoneware) that has large surface area for heat transfer and can be stable to 2,300°F. Operating temperatures of the RTO system range from 1,500°F to 1,800°F with a retention time of approximately one second to achieve maximum efficiency (US-EPA 2002g). The combustion chamber of the RTO is surrounded by multiple integral heat recovery chambers, each of which sequentially switches back and forth from being a predryer to a heat recovery chamber. Energy is absorbed from the gas exhausted and stored in the heat exchange media to preheat the next cycle of incoming gas.

The process stack exhaust stream from the paper machine is well below 1,500°F. The process stack exhaust stream has high moisture content, high volume of air, and low VOC concentrations making the RTO technically infeasible. Fugitive VOC emission collection from the room would require large volumes of air with low concentrations to be routed to the RTO which makes this technology technically infeasible.

Simple Thermal Oxidizer (TO)

In a simple TO or afterburner, the flue gas is reheated in the presence of sufficient oxygen to oxidize the CO present in the flue gas. A typical TO is a flare and is not equipped with any heat recovery device.

The process stack exhaust stream from the paper machine has high moisture content, high volume of air, and low emission concentrations. Operating the TO on the process stack with the exhaust stream with these characteristics is technically infeasible (US-EPA 2002h). Operating the TO to control the fugitive VOC emission would require large volumes of air with low concentrations to be routed to the TO which makes this technology technically infeasible.

Condenser

A condenser is used to cool an emission stream with organic vapors to change the vapors to a liquid. This liquid is recovered, refined, and reused to prevent release to the atmosphere. This technology is most typically used within the oil and gas industry to recover saleable product and/or dry cleaning. The condenser provides the most effective control for process streams having high emission concentrations and low flow rate. The condenser is less effective in controlling on process streams having low emission concentrations and high flow rates (US-EPA 1995).

The process stack exhaust stream has VOC emissions resulting from the combustion of natural gas. The process stack has low VOC emission concentrations and high flow rates making a condenser technically infeasible. Collecting fugitive VOC emissions would require large volumes of air with low concentration to be routed to the condenser by design this technology is considered technically infeasible.

Biofilter

Biofilters use microbes to consume pollutants from a contaminated stream. Microbes require specific pollutant concentrations, temperatures, humidity, and pH to work properly. The bio reactor system requires steady state temperatures between 60°F and 105°F, with humidity between 40% and 60% and a neutral pH (7) (US-EPA 2003).

The process stack exhaust characteristics do not fit the bio reactor system requirements making the bio reactor technically infeasible. Collecting fugitive VOC emissions would require large volumes of air with low concentration and low humidity to be routed to the bio reactor by design this technology is considered technically infeasible.

Low VOC Additives and Good Operating Practices

P&G is proposing to utilize low-end VOC formulations. P&G has conducted studies for substitute additives to lower VOC emission and maintain product quality (Mcintyre 2009). Studies indicate that the VOC content associated with the proposed additive(s) cannot be lowered any further without compromising product quality. Low VOC additives has not been developed that will effect product quality so low VOC additives are not technically feasible. P&G is conducting research to develop low VOC additives and continually changing operating practices to lower VOC emissions in the paper making operations.

Good Combustion Practices and Use of Clean Fuel
Good combustion practices for VOC emissions combustion byproduct include adequate fuel residence times, proper fuel-air mixing, and temperature control. P&G implement good combustion practices to the operation of the paper machine to lower VOC emissions. Good combustion practices are technically feasible. The use of clean fuel (natural gas) is economically feasible and implemented on the paper machine.

Economic Feasibility:
RTO, TO, condenser, biofilter and low VOC additives control technologies have been eliminated due to the fugitive nature of a majority of VOC emissions and the exhaust stack characteristics of the process stack.

BACT Selection:
Good combustion practices and use of clean burning fuels is the available control technology for combustion VOC emissions. Low VOC additives and good operating practices are the available control technologies for the fugitive VOC emissions.

Implementation Schedule:
The paper machine has been designed to operate on natural gas which is a clean burning fuel to control the combustion VOC emissions. Low VOC additives will be continually researched to determine possible alternatives without impacting quality.

2.1.2 Boilers

Description:
The Box Elder Plant currently has two Paper Machine Boilers which are fire tube boilers. The Paper Making Boilers have a heat input of 60.243 MMBtu/hr (each). Both Paper Machine Boilers are equipped with low NOx burners and flue gas recirculation. The purpose of the Paper Making boilers is to control steam in the Paper Machine. Different paper products require a large difference in steam input, which equates to operating the boilers at a high steam load for one product type and a low steam load for another. A boiler's range in load operability is described by the turn down parameter. The required turn down affects the emissions and exhaust stream and has been considered in this analysis. Additionally, the rate of adjusting the boiler's steam load is significant for product changeover to minimize waste. Adjusting the steam load affects the boiler's exhaust parameters.

The Box Elder Plant currently has two boilers utility boilers to supply steam for Project Maple. The two utility boilers have a heat input of 50 MMBtu/hr (each), and are equipped with ultra-low NOx burners.

Emissions Summary:
The boilers are broken down into two categories; paper making boilers and utility boilers for the Maple Project. The following are the potential emissions for the

associated paper making boilers and the utility boilers, in tpy.

Boilers	$PM_{2.5}$	NO_X	SO_2	VOC
Paper Making Boilers (combined)	7.86	28.91	0.31	2.85
Utility Boilers (combined)	6.53	5.26	0.26	2.36

[Pollutant $PM_{2.5}$]

Natural gas is a gaseous fuel, by definition, gaseous fuel have low filterable PM emissions. Particulate matter from natural gas combustion has been estimated to be less than one micrometer in size and has filterable and condensable fractions. Particulate matters in natural gas combustion are larger molecular weight hydrocarbons that are not fully combusted. Increased particulate matter emissions can result from poor air/fuel mixing or maintenance problems. P&G is evaluating filterable $PM_{2.5}$ only. The condensable fraction is represented with the other precursors (NO_X, SO_2, and VOCs). The Paper Machine Boilers are permitted for an emission rate of 0.9 lbs/hr of $PM_{2.5}$, each. The Utility Boilers are permitted for an emission rate of 0.74 lb/hr of $PM_{2.5}$, each

Available Control Technology

The control technologies for $PM_{2.5}$ emissions for the paper making boilers and utility boilers include:

- Fabric Filters
- Wet Scrubber
- Dry Electrostatic Precipitator
- Cyclone Separator
- Good Combustion Practices and Use of Clean Burning Fuels

Technological Feasibility:

Fabric Filters (Baghouses)

A fabric filter unit (or baghouse) consists of one or more compartments containing rows of fabric bags. Particle laden gases pass along the surface of the bags then through the fabric. Particles are retained on the upstream face of the bags and the cleaned gas stream is vented to the atmosphere. Fabric filters collect particles with sizes ranging from submicron to several hundred microns in diameter. Fabric filters are used for medium and low gas flow streams with high particulate concentrations. As the boilers combust of natural gas, concentration of $PM_{2.5}$ is low and small in size. As such, a fabric filter is considered technically infeasible for a boiler firing natural gas (US-EPA 2002a; US-EPA 2002b).

Wet Scrubber

A wet gas scrubber is an air pollution control device that removes PM and acid gases from waste streams from stationary point sources. PM and acid gases are primarily removed through the impaction, diffusion, interception and/or absorption of the pollutant onto droplets of liquid. Wet scrubbers are not effective in controlling PM2.5 due to the particulate size in lower concentration. The four boiler stacks have low concentration of

PM2.5 and the small size of particulate where a wet scrubber is considered technically infeasible for a boiler firing natural gas (US-EPA 2002c).

Dry Electrostatic Precipitator (ESP)
An ESP is a particle control device that uses electrical forces to move the particles out of the gas stream onto collector plates. This process is accomplished by the charging of particles in the gas stream using positively or negatively charged electrodes. The particles are then collected as they are attracted to oppositely opposed electrodes. Once the particles are collected on the plates, they are removed by knocking them loose from the plates, allowing the collected layer of particles to fall down into a hopper. ESPs are used to capture coarse particles at high concentrations. Small particles at low concentrations are not effectively collected by an ESP (US-EPA 2002d). As this analysis is for the control technology of $PM_{2.5}$ from the combustion of natural gas, the concentration of $PM_{2.5}$ is low and small in size. ESP is considered technically infeasible for a boiler firing natural gas.

Cyclone Separator (cyclone)
A cyclone operates on the principle of centrifugal separation. Exhaust enters the inlet and spirals around towards the outlet. As the particles proceed through the cyclone, the heavier material hits the outside wall and drops out. The cleaned gas escapes through an inner tube. Cyclones function to reduce dust loading and collect large particles. Small particles at low concentrations are not effectively collected by a cyclone(US-EPA 2002i). As this analysis is for the control technology of $PM_{2.5}$ from the combustion of natural gas, the concentration of $PM_{2.5}$ is low and small in size. A cyclone is considered technically infeasible for a boiler firing natural gas.

Good Combustion Practices and Use of Clean Burning Fuels
The use of good combustion practices include the following components: (1) proper fuel mixing in the combustion zone; (2) high temperatures and low oxygen levels in primary zone; (3) Overall excess oxygen levels high enough to complete combustion while maximizing boiler efficiency, and (4) sufficient residence time to complete combustion. Good combustion practices are accomplished through boiler design as it relates to time, temperature, and turbulence, and boiler operation (which control excess oxygen levels) (BetterBricks 2015). Good combustion practices are technically feasible. The use of clean fuel (natural gas) is technically feasible on the boilers.

Economic Feasibility:
Good combustion practices and use of clean burning fuels are economically feasible.

BACT Selection:
Good combustion practices and use of clean burning fuels is the best available control technology for combustion $PM_{2.5}$ emissions.

Implementation Schedule:
The boilers have been designed to operate on natural gas which is a clean burning fuel to control the $PM_{2.5}$ emissions. This control technology is currently installed and no

implementation date is needed.

[Pollutant NO_x]

The NOx that will be formed during combustion in the boilers is from two major mechanisms: thermal NOx and fuel NOx. Since natural gas is relatively free of fuel-bound nitrogen, the contribution of this second mechanism to the formation of NOx emissions in natural gas-fired equipment is minimal, leaving thermal NOx as the main source of NOx emissions. Thermal NOx formation is a function of residence time, oxygen level, and flame temperature, and can be minimized by controlling these elements in the design of the combustion equipment.

The Paper Machine Boilers are permitted for an emission rate of 45 parts per million (ppm) NOx at 3% Oz and 3.3 lbs/hr of NOx, each. The Utility Boilers are permitted for an emission rate of 10 ppm NOx at 3% O2 and 1.80 lb/hr of NOx, each.

Available Control Technology

The control technologies for NO_X emissions for the paper making boilers and utility boilers include:

- Low NO_X Burners
- Ultra-Low NO_X Burners
- Flue Gas Recirculation
- Selective Catalytic Reduction
- Selective Non-Catalytic Reduction
- Good Combustion Practices

Technological Feasibility:

Low NO_X Burners (LNB)

LNB technology uses advanced burner design to reduce NOx formation through the restriction of oxygen, flame temperature, and/or residence time. There are two general types of LNBs: staged fuel and staged air burners. In a stage fuel LNB, the combustion zone is separated into two regions. The first region is a lean combustion region where a fraction of the fuel is supplied with the total quantity of combustion air. Combustion in this zone takes place at substantially lower temperatures than a standard burner. In the second combustion region, the remaining fuel is injected and combusted with left over oxygen from the first region. This technique reduces the formation of thermal NOx (BetterBricks 2015).

LNB technology is specific to the combustion unit itself and is therefore evaluated for the paper machine boilers and utility boilers. Low NOx Burner technology is technically feasible and is currently utilized on the paper machine boilers.

Ultra-Low NOX Burners (ULNB)

ULNB technology uses internal FGR which involves recirculating the hot O_2 depleted flue gas from the heater into the combustion zone using burner design features and fuel staging to reduce NOx. An ULNB uses an internal induced draft to reach the desired emission limitations. Due to this induced draft, an ULNB cannot handle a quick change in load to achieve the desired operational flexibility necessary for the varied products and change overs in the paper making operation. This technology is technically feasible control technology. Currently, the Utility Boilers are proposing to use this technology to control NOx. An ULNB can achieve an emission rate of approximately 9 ppm or 0.011 Ib/MMBtu when used in conjunction with FGR. P&G reviewed potential replacement burner options with an emission rate of 9 ppm NOx or less that would also meet the same process demands as the current Paper Machine Boilers. Due to the different types of products from the paper machines, the Paper Machine Boilers must have ample turndown capabilities to adjust the amount of steam. ULNB is not technically feasible due to the changing steam load needed for the paper making operation.

Flue Gas Recirculation (FGR)
FGR may be used with both LNB and ULNB burners. FGR involves the recycling of post-combustion air into the air-fuel mixture to reduce the available oxygen and help cool the burner flame. External FGR requires the use of ductwork to route a portion of the flue gas in the stack back to the burner windbox. FGR can be either forced draft (where hot side fans are used) or induced draft. This technology is technically feasible for the paper machine boilers. The paper machine boilers use this technology in conjunction with LNBs. The Paper Machine Boilers have LNB and FGR installed on them.

Selective Catalytic Reduction (SCR)
SCR can be applied as a stand-alone NOx control or with other technologies such as combustion controls. The reagent reacts selectively with the flue gas NOx within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NOx into molecular nitrogen and water vapor. The optimum operating temperature is dependent on the type of catalyst and the flue gas composition ranging from 480°F to 800°F (US-EPA 2002e).

The following are specific technical considerations for the application of a SCR technology on the paper making boilers and utility boilers. The need for turndown or modulation of the paper machine boilers load produces inconsistent exhaust stream in turn producing erratic removal efficiencies. SCR systems require the use of ammonia which will result in ammonia emissions from the ammonia slip associated with the catalyst. The exhaust stream will require additional heating to meet the SCR operating temperature requirements (minimum of 480°F). This increase in exhaust temperature would require an additional combustion device, also increasing NOx, SO_2, and $PM_{2.5}$ emissions. Even with the increase in ammonia, $PM_{2.5}$, and SO_2 emissions, P&G has considered this technology to be technically feasible for the utility boilers and further evaluated the economic feasibility of this technology. Due to the necessary turndown requirements of the paper machine boilers, an SCR is considered technically infeasible for these units.

Selective Non-Catalytic Reduction (SNCR)
SNCR can be applied as a stand-alone NOx control or with other technologies such as combustion controls. SNCR can achieve NOx reduction efficiencies of up to 75% in short-term demonstrations. Field applications have provided NOx reductions efficiencies

of 30% to 50%. Reductions of up to 65% have been reported for some field applications of SNCR in tandem with combustion control equipment such as LNB.

SNCR is based on the chemical reduction of the NOx molecule into molecular nitrogen and water vapor. A nitrogen based reducing agent, such as ammonia or urea, is injected into the post combustion flue gas. The reagent can react with a number of flue gas components. However, the NOx reduction reaction is favored over other chemical reaction processes for a specific temperature range and in the presence of oxygen, therefore, it is considered a selective chemical process.

Practical application of SNCR is limited by the system design and operating conditions. SNCR becomes difficult at temperatures outside its required temperature range of 1,600°F to 2,100°F (US-EPA 2002f). The paper machine and utility boilers have an exhaust temperature less than the 1,600°F. The exhaust stream does not meet the temperature requirements for the SNCR (minimum of 1,600°F) for proper operations leading to optimal efficiency.

Due to the design limitation, exhaust stream temperature differences SNCR is considered technically infeasible for all the boilers.

Good Combustion Practices
The use of good combustion practices include the following components: (1) proper fuel mixing in the combustion zone; (2) high temperatures and low oxygen levels in primary zone; (3) Overall excess oxygen levels high enough to complete combustion while maximizing boiler efficiency, and (4) sufficient residence time to complete combustion. Good combustion practices are accomplished through boiler design as it relates to time, temperature, and turbulence, and boiler operation (which control excess oxygen levels) (BetterBricks 2015). Good combustion practices are technically feasible.

Economic Feasibility:
The paper machine boilers have ruled ULNB, SCR and SNCR as being technically infeasible. The paper machine boilers currently has LNB and FGR technology installed on the units and currently operate them using good combustion practices.

The utility boilers have ruled SNCR as being technically infeasible. The utility boilers are being constructed with ULNB and operated using good combustion practices. The cost to add SCR to the utility boilers (which have ULNB and FGR) would be $165,250 per ton of NOx removed. The cost to install SCR on the utility boilers is economically infeasible (US-EPA 2002m).

BACT Selection:
The paper making boilers have been constructed with LNB and FGR technologies. The irregular load demand on the paper making boilers restrict the use of post controls. LNB, FGR and good combustion practices is BACT for the paper making boilers.

The utility boilers are being constructed with ULNB technology. The cost of SCR is economically infeasible. SNCR is technically infeasible due to exhaust stack temperature requirements. ULNB and good combustion practices is BACT for the utility boilers.

Implementation Schedule:
All selected BACT control technologies for the paper making boilers have been installed and operating. All selected BACT control technologies for the utility boilers will be installed when being constructed.

[Pollutant SO_2]
SO_2 emissions associated with the boilers are due to natural gas combustion. Emissions associated with all boilers are less than 1 tpy SO_2.

Available Control Technology
The control technologies for SO_2 emissions for the paper making boilers and utility boilers include:

- Low Sulfur Fuel
- Post-Combustion Control
- Good Combustion Practices

Technological Feasibility:

Low Sulfur Fuel
Low-sulfur natural gas is a control technique that has been achieved in practice and is technically feasible and will be further considered for BACT.

Post-Combustion Control
Post-combustion devices such as wet or dry scrubbers are installed on sources that burn fuels with much higher sulfur contents. The SO_2 concentrations in the natural gas combustion exhaust gases from the boilers are too low for scrubbing technologies to work effectively or to be technically feasible. Scrubber control technologies require much higher sulfur concentrations in the exhaust gases to be feasible as a control technology. Post-combustion SO_2 control devices (wet and dry scrubbing) have not been achieved in practice on natural gas boilers. The post-combustion controls are not technically feasible.

Good Combustion Practices
The use of good combustion practices include the following components: (1) proper fuel mixing in the combustion zone; (2) high temperatures and low oxygen levels in primary zone; (3) Overall excess oxygen levels high enough to complete combustion while maximizing boiler efficiency, and (4) sufficient residence time to complete combustion. Good combustion practices are accomplished through boiler design as it relates to time, temperature, and turbulence, and boiler operation (which control excess oxygen levels) (BetterBricks 2015). Good combustion practices are technically feasible. The use of clean fuel (natural gas) is technically feasible on the boilers.

Economic Feasibility:

The use of low-sulfur natural gas as a control technique for SO_2 emissions from boilers is cost-effective. The SO_2 concentrations in the natural gas combustion exhaust gases from the boilers are too low for scrubbing technologies to be cost effective.

BACT Selection:
The use of low-sulfur natural gas is BACT for controlling SO_2 emissions for the paper making and utility boilers.

Implementation Schedule:
The paper making boilers are operated on low-sulfur natural gas. The utility boilers will be operated on low-sulfur natural gas once constructed.

[Pollutant VOC]
The VOC emissions associated with the boilers are due to natural gas combustion. Emissions associated with all boilers are 4.85 tpy.

Available Control Technology
The control technologies for VOC emissions for the paper making and utility boilers include:
- Thermal Oxidizer/Afterburner
- Regenerative Thermal Oxidizer
- Catalytic Oxidation
- Good Combustion Practices

Technological Feasibility:

Thermal Oxidizer/Afterburner
In a Thermal Oxidizer (TO) or afterburner, the flue gas exiting the boiler is reheated in the presence of sufficient oxygen to oxidize the VOC present in the flue gas. A TO requires additional fuel to heat the gas stream starting (from 280°F to at least 1,600°F) generating additional emissions (US-EPA 2002h). A TO functions like the combustion chamber of the boiler. Adding a TO in conjunction with a combustion chamber has results in small amounts of reduction in VOC with an increase in other combustion pollutants for the required heating of the exhaust stream. Increasing other combustion pollutants makes the TO technically infeasible.

Regenerative Thermal Oxidizer
A Regenerative Thermal Oxidizer (RTO) is equipped with ceramic heat recovery media (stoneware) that has large surface area for heat transfer and can be stable to 2,300°F. Operating temperatures of the RTO system typically range from 1,500°F to 1,800°F (US-EPA 2002g)with a retention time of approximately one second. The combustion chamber of the RTO is surrounded by multiple integral heat recovery chambers, each of which sequentially switches back and forth from being a preheater to a heat recovery chamber. Energy is absorbed from the gas exhausted from the unit and stored in the heat exchange media to preheat the next cycle of incoming gas. RTO require additional fuel to heat the gas stream from 280°F to at least 1,500°F which will generate additional emissions.

Increasing other combustion pollutants makes the RTO technically infeasible.

Catalytic Oxidation
Catalytic oxidation allows complete oxidation to take place at a faster rate and a lower temperature than is possible with thermal oxidation. Oxidation efficiency depends on exhaust flow rate and composition. Residence time required for oxidation to take place at the active sites of the catalyst may not be achieved if exhaust flow rates exceed design specifications. Sulfur and other compounds may foul the catalyst, leading to decreased efficiency. The gas stream, in a catalytic oxidizer, is passed through a flame area and then through a catalyst bed at a velocity in the range of 10 to 30 feet per second. Catalytic oxidizers operate at a narrow temperature range of approximately 600°F to 1100°F (US-EPA 2002j). Catalytic oxidizer require additional fuel to heat the gas stream from 280°F to at least 600°F and generate additional combustion emissions. Increasing other combustion pollutants makes the catalytic oxidation technically infeasible.

Good Combustion Practices
Good combustion practices for VOCs include adequate fuel residence times, proper fuel-air mixing, and temperature control (BetterBricks 2015). Good combustion practices to control VOC emissions is technically feasible.

Economic Feasibility:
Good combustion practices to control VOC emissions is technically feasible.

BACT Selection:
Good combustion practices are BACT to control VOC emissions.

Implementation Schedule:
The Box Elder Plant operates good combustion practices to maintain combustion optimal to their process. This control technology is currently installed and no implementation date is needed.

2.1.3 Solid Material Handling

<u>Description:</u>
Processes that will generate particulate emissions from solid material handling include Papermaking Converting Lines, Cleaning Article Manufacturing, and Assembled Paper Product A. Dry materials in each of these processes are involved in unloading, conveying, converting, and/or packaging.

The converting room has paper rolls that are removed from the paper machine are unwound and converted into the final product using one of the three converting lines. The paper is rerolled onto cores and packaged according to specification. Finished products are sent to the distribution center for storage and/or shipping. Each converting line is equipped with a drum filter. One inlet to the drum filter, stream A, collect material from the floor sweeps/CVC system and the air stream is pretreated with a cyclone unit to dropout large material. The other inlet stream, stream B, collects dust directly from the unit operations. Streams A and B pass through a mesh pre-separator filter to remove large particulate materials prior to passing through the drum filter. The system achieves >99.5% control efficiency of filterable PM10 and does not control condensable particulate.

Two manufacturing lines produce consumer article cleaning products, which were recently permitted in 2016 undergoing a BACT analysis. In this process, substrate is unrolled (or manipulated) and scented raw materials and cleaners are added for use as the final product. Once the cleaning articles are complete, they are sent to be packaged and then onto a warehouse for distribution. Particulate matter is produced from receiving, sizing, and handling during the substrate converting process. This process is currently controlled by a baghouse that controls to 0.01gr/dscf.

Each Assembled Paper Product line functions to assemble various raw materials into the finished product. Several raw materials are unwound at points along the assembly process. Some raw materials are de-bulked in an offline process and delivered via air to the lines. Particulate is captured during the de-bulking of raw materials, the delivery of raw materials, and from the cutting operations on the line. This process is equipped with drum filters and baghouses, which provide control efficiencies of 99%.

Emissions Summary:
Solid Material Handling operations include Converting Room, Cleaning Article Manufacturing, and Assembled Paper Product. The following are the potential emissions for all operations pertaining to the solid material handling, in tpy.

	$PM_{2.5}$	NO_X	SO_2	VOC
Solid Material Handling	26.10	0.00	0.00	40.59

[Pollutant $PM_{2.5}$]
Fugitive particulate matter is emitted during the processing of the paper. This section addresses filterable $PM_{2.5}$ only.

Available Control Technology
The control technologies for $PM_{2.5}$ emissions for the converting lines in the paper making process:

- Fabric Filters,
- Wet Scrubbers,
- Wet Electrostatic precipitators (ESP),
- Cyclone Separator,
- Drum Filter, and
- Water Sprays/Dust Suppression

Technological Feasibility:

Fabric Filters

Fabric Filters (baghouse) remove particulates by collecting particulates on the filter bag as the exhaust stream passes through the baghouse. Baghouses typically cannot withstand high exhaust temperatures (greater than 500 °F). Fabric filer technology is a well-established particulate control technology that has historically been established as BACT. Baghouses have been shown to obtain particulate collection efficiency up to 99.5% for PM_{10}, and up to 99% capture for $PM_{2.5}$. The use of a baghouse is technically feasible.

Wet Scrubbers
Wet gas scrubber (WGS) technology was also evaluated for us as a particulate control technology for the proposed gas stream. A WGS reduces particulate emissions by mixing flue gas with scrubber liquid to remove particulate. The purge stream containing the collected particulate exits the bottom of the WGS to be further treated as wastewater. High efficiency wet scrubbers have been shown to achieve 99% capture for PM_{10}, but only up to 90% capture for $PM_{2.5}$. This type of control technology is technically feasible for use with the proposed gas stream.

Wet Electrostatic precipitators
Wet Electrostatic Precipitator (ESP) technology removes particulates by electrically charging the particles and collecting the charged particles on plates. The collected particulate is washed off the plates and collected in hoppers at the bottom of the ESP. High efficiency ESPs have been shown to achieve control of particulates up to 99.5% for PM_{10}, and up to 95% capture for $PM_{2.5}$. Due to the presence of small consumer fiber filaments when sizing the substrate for the Cleaning Article Manufacturing and absorbency materials for Assembled Paper Product A, this type of control technology is technically infeasible (US-EPA 2002k).

Cyclone Separator
Cyclones use centrifugal force and inertia to remove particles from a gas stream. The inertia of the particles resists the change in direction of the gas and they move outward under the influence of centrifugal force until they strike the walls of the cyclone. At this point, the particles are caught in a thin laminar layer of air next to the cyclone wall and are carried downward by gravity where they are collected in hoppers. Cyclones are capable of removing in excess of 90% of the larger diameter (> 30 pm) PM. However, their efficiency decreases with smaller particles. This technology is feasible for PM but not effective for PM_{10} and $PM_{2.5}$ (US-EPA 2002i).

Drum Filter
Air containing particulate or fibers is drawn into a chamber with a rotating drum wrapped with filter material. The solids are captured on the filter material. As the drum rotates there are vacuum pickup points that remove the solids material captured on the drum. From the pickup points the particulate matter is conveyed to a storage or processing area to be recycled or disposed. Drum filters are typically used in applications based on the type of particulate matter material to be controlled where a baghouse would be infeasible due to plugging (US-EPA 2002l). The drum filters have a 99.5% control efficiency. The drum filter control technology is technically infeasible for the Cleaning Article

manufacturing. Drum filter are technically feasible for Converting Line and Assembled Paper Product A.

Water Sprays/Dust Suppression
Considering the processes work with final product and packaging, adding water or chemicals would degrade the integrity of material for use. Water sprays and dust suppression are considered technically infeasible for any of solid material handling processes.

Economic Feasibility:
Baghouses, WGS, Wet ESP, and Cyclone Separator technologies are all technically feasible and economically feasible. The baghouse technology is currently operating to control PM_{10}/$PM_{2.5}$ missions for the solid material handling process.

BACT Selection:
BACT will be addressed for each individual process; Converting Room, Cleaning Article Manufacturing, and Assembled Paper Product.

Converting Line
The drum filter system achieves >99.5% control efficiency of filterable PM2.5 and does not control condensable particulate. No add on control technology has better control efficiency. The drum filter system is BACT for the Converting Line.

Cleaning Article Manufacturing
The baghouse achieves 0.01 gr/dscf of filterable PM2.5 and does not control condensable particulate. No add on control technology has better control efficiency. A baghouse is BACT for the Cleaning Article Manufacturing.

Assembled Paper Product A
The drum filter system achieves >99% control efficiency of filterable PM2.S and does not control condensable particulate. No add on control technology yields a better control efficiency. The drum filter system is BACT for the Assembled Paper Product A.

Implementation Schedule:
The solid material handling operations are conducted with the gas stream going through a baghouse and drum filter systems prior to being discharged to the atmosphere. This control technology is currently installed and no implementation date is needed.

[Pollutant VOC]
VOC emissions are emitted during the solid material handling operations at Converting room (Paper Manufacturing Line), Cleaning Article Manufacturing, and Assembled Paper Product (Soap Manufacturing lines). The majority of the 35.72 tons per year of VOC emissions are fugitive emissions. To collect the fugitive VOC emissions requires extensive exhaust collections systems throughout the entire facility (for both manufacturing lines) with large volumes of air with small VOC concentrations.

Converting Room
The converting lines involve preparing the process for shipment including the sealing with adhesives, use additives and/or printing.

Cleaning Article Manufacturing
The consumer article cleaning products manufacturing consist of a substrate that is unrolled (or manipulated) and scented raw materials and cleaners are added to the substrate for use as the final product. The process includes delivery of raw materials and transfer of material to holding and mixing tanks. The raw materials and cleaning mixtures are then applied onto a substrate to produce the cleaning article. Once the cleaning articles are complete, they are sent to be packaged and then onto a warehouse for distribution.

Assembled Paper Products
The assembled paper product line functions to assemble various raw materials into the finished product. Several raw materials are unwound at points along the assembly process. In addition, some raw materials are de-bulked in an offline process and delivered via air to the lines. Various raw and scented materials are also used in the assembly and packaging of Assembled Paper Products. VOCs occur as a result of raw and scented material application as well as from finished product packaging.

Available Control Technology
The control technologies for VOC emissions for the solid material handling operations are as follows:

- Wet Scrubber
- Carbon Filtration System
- Simple Thermal Oxidizer
- Low Vapor Recovery Products

Technological Feasibility:
Wet Scrubber
Absorption through a packed-bed tower wet scrubber is used for raw material and/or product recovery technique in separation and purification of gaseous streams containing high concentrations of water soluble VOCs compounds such as methanol, ethanol, isopropanol, butanol, acetone, and formaldehyde. Wet scrubbers are used to control inorganic gases. Removal efficiencies for gas absorbers vary for each pollutant-solvent system with the type of absorber used. The suitability of gas absorption as a pollution control method is generally dependent on the availability of the solvent, required removal efficiency, pollutant concentration inlet vapor, capacity required for handling waste gases and recovery value of the pollutants or the disposal cost of unrecoverable solvent. Air flow rates for packed bed scrubbers are 500 to 75,000 standard cubic feet per minute (scfm) (US-EPA 2002c). Due to the required flow rate needed for the scrubber this technology is technically infeasible.

Carbon Filtration System
Carbon Filtration System (adsorption) may be used on a low or medium concentrated

gaseous stream to remove VOCs. During adsorption, a gaseous molecule is attracted to the solid material in the filtration system. Carbon adsorption has a linear control rate with the vapor pressure. The vapor pressures of the material in solid material handling operations are low, making the control rate low (US-EPA 1995). The use of vapor recovery systems would require the gas stream entering the vapor recovery system to be consistent makeup which makes this technology infeasible.

Simple Thermal Oxidizer
In a simple Thermal Oxidizer (TO) or afterburner, the displaced headspace gas is reheated in the presence of sufficient oxygen to oxidize the VOC. A TO is a flare not equipped with any heat recovery device. This technology is implemented with storage tanks large throughputs and several tanks co-located. TO control technology requires a combustion source increasing VOC, NO_X, and $PM_{2.5}$ from the facility (US-EPA 2002h). This technology is technically not feasible for a source with minimal concentrations and volume of air flow.

Low Vapor Pressure Material
Solid material handling operations are low vapor pressure materials and/or mixtures. Materials selected are low VOC containing materials that meet specifications for product requirements (Mcintyre 2009). As low vapor pressure materials are in use by the Box Elder Plant this option is considered technically feasible.

Economic Feasibility:
Low vapor pressure material is technically feasible and economically feasible.

BACT Selection:
BACT to control the VOC emissions from he solid material handling operations is the use of low vapor pressure material.

Implementation Schedule:
The use of low vapor pressure material is already in use so no implementation date is needed.

2.1.4 Cooling Tower

Description:
The cooling tower is a multi-cell, mechanical induced draft cooling tower that will be used to reject heat from cooling water to cool plant water. There are nine cooling towers to support the Box Elder Plant processes.

Particulate matter is emitted from wet cooling towers because the water circulating in the tower contains small amounts of dissolved solids that crystallize and form airborne particles as some of the water (drift) leaves the cooling tower through the induced draft fans and evaporates.

Emissions Summary:

The following are the potential emissions for the cooling towers, in tpy.

	$PM_{2.5}$	NO_X	SO_2	VOC
Cooling Towers	1.82	0.00	0.00	0.00

Available Control Technology
The control technologies for $PM_{2.5}$ emissions for the cooling towers are as follows:

- Drift/Mist Eliminator

Technological Feasibility:
Technically feasible technology includes a drift eliminator on the cooling tower. Based on established control efficiencies for these technologies, the drift eliminator is ranked as the control device providing the highest control efficiency. Additionally, the cooling towers are engineered to minimize water evaporation and cool machines as necessary. The DAQ has determined that for and proper engineering control and design has been selected as BACT for proposed gas stream for the control of $PM_{2.5}$ emissions.

Economic Feasibility:
The installation of drift/mist eliminators on the cooling towers is economically feasible. The DAQ is determined that the conversion from a 0.005% drift eliminators to 0.001% drift eliminators is not economically feasible to additionally control the 1.50 tons per year of $PM_{2.5}$.

BACT Selection:
BACT for $PM_{2.5}$ emissions from the proposed gas stream is use of a drift eliminator. The DAQ has reviewed the cooling towers as a common emitting unit with minor emissions. DAQ determined that new cooling towers shall have drift eliminator installed with a drift of 0.001%. Drift eliminator technology, with a drift of 0.005% is currently installed and operating at the Facility.

Implementation Schedule:
This control technology is currently installed and no implementation date is needed.

2.1.5 Chemical Surfactant Manufacturing

Description:
The chemical manufacturing process involves the production of surfactants at the Box Elder facility. Surfactants are made through oxidation of sulfur in a reactor. Emissions associated with the surfactant making process are NO_X, CO, SO_2, H_2SO_4, VOCs, and PM_{10} and $PM_{2.5}$. Exhaust gases containing both combustion and process emissions from the reactor are routed through a duct and controlled by a packed bed scrubber. An ESP which is upstream of the packed bed scrubber is inherent to the process, and also serves to remove particulate matter.

Emissions Summary

The following are the potential emissions for the Chemical surfactant manufacturing, in tpy.

	$PM_{2.5}$	NO_X	SO_2	VOC
Chemical Surfactant Manufacturing	15.31	1.17	0.36	5.26

[Pollutant $PM_{2.5}$]

In the chemical manufacturing/surfactant making process there is only one solid material generated, which is a precipitated acid mix (PAM) from the dry electrostatic preceptor (dry ESP). The PAM is a product developed for soap manufacturing. Since the dry ESP is inherent to the process and removes the PAM upstream of the wet gas scrubber, the amount of particulate in the gas stream entering the scrubber is negligible.

Available Control Technologies:

The control technologies for $PM_{2.5}$ emissions for the chemical manufacturing/surfactant making process are as follows:

- Wet Gas Scrubbers
- Electrostatic Precipitators

Technological Feasibility:

Both a Wet Gas Scrubber and ESP have been employed as part of the process design for chemical recovery purposes and are inherent to the process. These technologies have been applied as part of the recovery process rather than control technology. The amount of particulate resulting from these gas streams is negligible.

Economic Feasibility:

As both ESP and packed bed wet scrubbers are inherent to the process, they are not proposed as $PM_{2.5}$ control technology.

BACT Selection:

As the use of an ESP and wet gas scrubber have been employed as inherent to the process, the use of is the use of natural gas during startup is BACT for $PM_{2.5}$.

Implementation Schedule:

The use of an ESP and a wet gas scrubber for the chemical manufacturing/surfactant making process is already in use so no implementation date is needed.

[Pollutant NO_X]

Preheaters are used to heat the oxidation ovens in order to achieve a desired temperature for the oxidation reaction for the surfactant making process. The preheater burners are fired with natural gas. The preheaters are anticipated to operate a total of 12 hours per year. Emissions from natural gas combustion from the preheater are vented through a packed bed wet scrubber prior to venting into the atmosphere.

Available Control Technologies:

The control technologies for NO_X emissions for the chemical manufacturing process are as follows:

- Natural Gas Combustion
- Low NOX burners
- LoTox

Technological Feasibility:

Natural Gas Combustion
Natural gas is a clean burning fuel that can be produced domestically and is technically feasible.

Low NO_X Burners
A Low NO_X Burners (LNB) provides a stable flame with two zones. There are many variations on the LNB theme of reducing NO_X that can produce more than 80% destruction removal efficiency. As the preheaters are rated less than 5 MMBtu/hr, LNB are not technically feasible (C.B. Oland 2002).

LoTox
LoTox™ technology (oxidation/reduction scrubbing), is a low-temperature oxidation process that employs ozone to oxidize NO_2 to higher oxides of nitrogen such as N_2O_5. NO is also converted to NO_2, which is NO_X. This technology requires to be paired with SCR or SNCR (The Linde Group 2017) for gas streams such as those from the proposed oven, which is expected to emit larger portions of NO than NO_2. The potential to increase total NOx emissions makes this option technically infeasible.

Economic Feasibility:
The only control technology that is technically feasible is the use of natural gas for combustion which is economically feasible.

BACT Selection:
BACT for the preheaters in the chemical making process to control NO_X is the use of natural gas.

Implementation Schedule:
The use of natural gas for the preheaters is already in use so no implementation date is needed.

[Pollutant SO_2]
In the surfactant making process, the primary reaction includes oxidation of sulfur. The resultant emissions from the surfactant making process will be SO_2, H_2SO_4, NO_X, CO, PM_{10}, $PM_{2.5}$ and VOCs. The emissions from the surfactant making process are captured and controlled by a packed bed scrubber.

Available Control Technology
The control technologies for SO_2 emissions for the chemical manufacturing/surfactant

making process are as follows:

- Wet Gas Scrubber
- Double Adsorption

Technological Feasibility:

Wet Gas Scrubber
In a wet scrubber, the gaseous SO_2 is absorbed into an aqueous solution in a contacting section that has a large liquid surface for mass transfer. Contacting sections may include sprays, venturis, tray beds, or packed beds. Once the SO_2 is absorbed into the water, it is neutralized by an alkali (either sodium or calcium based). Sodium based scrubbers use either soda ash, sodium bicarbonate, or sodium hydroxide as a neutralizing agent. In a caustic scrubber, the blow-down (which would contain dissolved salts such as sodium sulfate) would have to be disposed of offsite. Wet gas scrubber is technically feasible and has been employed for chemical recovery inherent to the process.

Double Adsorption
Double adsorption is used to make H_2S0_4. The primary purpose of the chemicals process is to make surfactants and not H_2S0_4, it is not applicable to surfactant making process. The chemical manufacturing/surfactant making process is needed to make surfactant by oxidizing sulfur with H_2SO_4 being generated as a byproduct from the sulfur trioxide (SO_3) scrubber in the proposed chemicals process. The gas stream leaving the SO_3 scrubber is routed through the packed bed scrubber. The double adsorption is technology is used to make H2SO4 not control it, making this technology not feasible to control SO_2 emission.

Economic Feasibility:
The wet gas scrubber is the only option that is technically feasible and is economically feasible.

BACT Selection:
BACT to control the SO_2 emissions from the chemical manufacturing/surfactant making process is the use of wet gas scrubber.

Implementation Schedule:
The use of a wet gas scrubber for the chemical manufacturing/surfactant making process is already in use so no implementation date is needed.

<u>[Pollutant VOC]</u>
The chemical manufacturing process/surfactant making produces VOC emissions from the mixing and oxidation of material and from the combustion of the preheaters. Exhausts from the surfactant making process will be directly ducted and treated by the SO_2 wet gas scrubber.

Available Control Technology

The control technologies for VOC emissions for the chemical manufacturing/surfactant making process are as follows:

- Thermal Oxidation/Afterburner
- Regenerative Thermal Oxidizer
- Recuperative Thermal Oxidizer
- Regenerative Catalytic Oxidation
- Good Combustion Practices

Technological Feasibility:

Thermal Oxidation/Afterburner
In a Thermal Oxidation (TO) or afterburner, the flue gas exiting the scrubber is reheated in the presence of sufficient oxygen to oxidize the CO present in the flue gas. A TO is a flare and is not equipped with any heat recovery device. A TO will require additional fuel to heat the gas stream from 100-150 °F before the scrubber and 80°F after the scrubber to at least 1,600 °F (US-EPA 2002h). This additional fuel will generate additional emissions; therefore, the TO is considered technically infeasible.

Regenerative Thermal Oxidizer
A Regenerative Thermal Oxidizer (RTO) is equipped with ceramic heat recovery media (stoneware) with large surface area for heat transfer and can be stable to 2,300°F. Operating temperatures of the RTO system typically range from 1,500°F to 1,800°F (US-EPA 2002g) with a retention time of approximately one second. The combustion chamber of the RTO is surrounded by multiple integral heat recovery chambers, each of which sequentially switches back and forth from being a preheater to a heat recovery chamber. Energy is absorbed from the gas exhausted from the unit and stored in the heat exchange media to preheat the next cycle of incoming gas. An RTO will require additional fuel to heat the gas stream from 100-150 °F before the scrubber and 80°F after the scrubber to at least 1,500°. This additional fuel will generate additional emissions; therefore, the RTO is considered technically infeasible.

Recuperative Thermal Oxidizer
A Recuperative Thermal Oxidizer (RCTO) is more thermally efficient than simple thermal oxidization but less efficient than an RTO. The thermal efficiency is improved through the use of either a shell-and-tube or a plate-and-frame type heat exchanger in which heat from the treated flue gas is transferred or recirculated to the untreated flue gas. Up to 65 to 70% heat recovery is common. A RCTO is not technically feasible for VOC control for the surfactant process because; the metallic heat exchanger efficiency (65-70 percent) is lower than a RTO system and increasing the need for additional fuel (US-EPA 2002h).

Regenerative Catalytic Oxidation
A regenerative catalytic oxidizer (RCO) employs principles similar to those used in an RTO except that a catalyst is used to enhance the conversion of CO to CO_2 at a lower temperature (600-700°F) than an RTO (US-EPA 2002g). Despite use of a catalyst, it would be necessary to reheat the post- flue gas to a temperature sufficient to operate the

RCO. This reheating would create an increase in NOx relative to the untreated exit gas stream.

The largest potential problem associated with catalytic oxidation involves catalyst fouling and poisoning. Sulfur oxides present in the exit gas stream would poison the catalyst (US-EPA 2002g). Based on the technical difficulties of utilizing the catalyst as well as the fact that catalytic oxidation has not been applied to a surfactant process, catalytic oxidation is considered to be a technically infeasible VOC control option.

Good Combustion Practices
Good combustion practices for VOCs include adequate fuel residence times, proper fuel-air mixing, and temperature control. As it is imperative for process controls, the Box Elder Plant will maintain combustion optimal to their process. This technology is technically feasible.

Economic Feasibility:
A good combustion practice to control the VOCs is the only technically feasible control technology and economically feasible option.

BACT Selection:
BACT to control the VOC emissions from the chemical manufacturing/surfactant making process is the use of good combustion practice.

Implementation Schedule:
The use of good combustion practice for the chemical manufacturing/surfactant making process is already in use so no implementation date is needed.

2.1.6 Storage Tanks

The Box Elder Plant has several storage tanks associated with soap making, cleaning article manufacture, chemical making, gasoline (500 gallons), and a diesel tank (500 gallons). The contents of the tanks range from raw materials, intermediates, final products, and fuel. Storage tanks hold a range of products from organic liquids, ethanol, petroleum products, and mostly inert materials. All chemical tanks are aboveground fixed roof vertical tanks. These tanks are not subject to regulations under NSPS Subpart Kb, Standards of Performance for Volatile Liquid Storage Vessels, since all tanks are either, less than 75 cubic meters, tanks greater than 151 cubic meters storing liquid with a maximum true vapor pressure less than 3.5 kilopascals or tanks greater than 75 to 151 cubic meters storing liquid with a maximum true vapor pressure less than 15.0 kilopascals.

Description:
Emissions from fixed roof storage tanks result from displacement of headspace vapor during filling operations (working losses) and from diurnal temperature and heating variations (breathing losses). VOC emissions from the storage tanks at the Box Elder

Plant are a result from displacement of headspace during filling operations and minimal emissions as a result of temperature variations and solar heating cycles since most of the tanks are indoors.

Emissions:
The following are the potential emissions for the storage tanks, in tpy.

	$PM_{2.5}$	**NO_X**	**SO_2**	**VOC**
Storage Tanks	0.00	0.00	0.00	14.45

Available Control Technology
The control technologies for VOC emissions for the storage tanks are as follows:
- Internal Floating Roof
- Vapor Recovery System
- Wet Scrubber
- Low Vapor Recovery Products
- Carbon Filtration System
- Simple Thermal Oxidizer

Technological Feasibility:

Internal Floating Roof
Internal floating roofs are installed on storage tanks greater than 1,000 barrels (bbls) (42,000 gallons). All storage tanks at the Box Elder Plant are less than 1,000 bbls. Internal floating roofs tanks are considered technically infeasible.

Vapor Recovery System
Vapor recovery through carbon adsorption, vapor balance, or refrigerated condenser provides control of emissions by collecting the vented material for recycle or reuse. Vapor adsorption units are not implemented on facilities with a multiple smaller storage tanks containing different materials with throughputs less than 50,000 barrels. The tanks located onsite are several sets of smaller storage tanks. This option is technically infeasible.

Wet Scrubber
Absorption through a packed-bed tower wet scrubber is used for raw material and/or product recovery technique in separation and purification of gaseous streams containing high concentrations of water soluble VOCs compounds such as methanol, ethanol, isopropanol, butanol, acetone, and formaldehyde. Wet scrubbers are used to control inorganic gases. Removal efficiencies for gas absorbers vary for each pollutant-solvent system with the type of absorber used. The suitability of gas absorption as a pollution control method is generally dependent on the availability of the solvent, required removal efficiency, pollutant concentration inlet vapor, capacity required for handling waste gases and recovery value of the pollutants or the disposal cost of unrecoverable solvent. Air flow rates for packed bed scrubbers are 500 to 75,000 standard cubic feet per minute (scfm). An ethanol scrubber is used for the ethanol tanks on a soap making line.

Absorption through a packed-bed tower wet scrubber is not in use for diesel or gasoline storage tanks of similar size and is technically infeasible(US-EPA 2002c).

Low Vapor Recovery Products
Many of the storage tanks store low vapor pressure materials and/or mixtures utilizing fixed roof tanks. For storage tanks containing materials with higher vapor pressure, the storage tanks are sealed and have an inert gas vapor blanket. The source is limited by the material stored in the tanks to maintain product quality. Alternate material is not technically feasible (Mcintyre 2009).

Carbon Filtration System
Carbon Filtration System (adsorption) may be used on a low or medium concentrated gaseous stream to remove VOCs. During adsorption, a gaseous molecule is attracted to the solid material in the filtration system. Carbon adsorption has a linear control rate with the vapor pressure. The vapor pressures of the material in the storage tanks are low, making the control rate low (US-EPA 1995). Adsorption is technically feasible with a low control rate.

Simple Thermal Oxidizer
In a simple Thermal Oxidizer (TO) or afterburner, the displaced headspace gas is reheated in the presence of sufficient oxygen to oxidize the VOC. A TO is a flare not equipped with any heat recovery device. This technology is implemented with storage tanks large throughputs and several tanks co-located. TO control technology requires a combustion source increasing VOC, NO_X, and $PM_{2.5}$ from the facility. This technology is technically not feasible for a source with minimal throughputs (US-EPA 2002h).

Economic Feasibility:
The following technologies are technically feasible, wet scrubber to control ethanol, and carbon filtration system. The use of wet scrubber to control ethanol is economically feasible. The use of carbon filiation to control VOC is with low vapor pressure material lower the control efficiency increasing the cost per ton removed (US-EPA 2002m), making carbon filiation economically infeasible.

BACT Selection:
BACT to control the VOC emissions (ethanol) from an ethanol tank is the use of a wet scrubber. BACT to control the VOC emissions from material with higher vapor pressure is the use of storage tanks are sealed storage tanks and an inert gas vapor blanket. BACT to control the VOC emissions from all other storage tanks is the use of fixed roof tanks.

Implementation Schedule:
The use of fixed roof tanks, wet scrubber for soap making line and sealed storage tanks with vapor blanket for high vapor pressure material is already in use so no implementation date is needed.

2.1.7 Fugitive VOC

The Box Elder Plant uses several additives, inks, and chemicals that contain VOCs and are potentially emitted as fugitives. Fugitive VOC emissions detailed in this section are emitted from the soap making and bottle blowing operations.

Description:

Soap Making

Raw materials to make soaps are pumped for blending. As the blending occurs in a closed system, minimal VOCs are emitted from the soap making operation.

Bottle Blowing Supplier

Within the bottle blowing supplier business unit, the bottles and containers needed for site-wide packaging purposes are molded. The process begins with plastic beads that are delivered to a silo and then conveyed to the appropriate equipment on-site. These plastic pieces are fed into an extruder where the final container shape is formed. This container then receives a label and is delivered for use within the other business units on-site. Any scrap plastic that is created is recycled back to the bottle and container making processes through regrinding.

Emissions:

The following are the potential emissions for the fugitive VOC, in tpy.

	$PM_{2.5}$	NO_X	SO_2	VOC
Fugitive VOC	0.00	0.00	0.00	6.76

Available Control Technology

The control technologies for VOC emissions for the fugitive VOC are as follows:

- Wet Scrubber
- Carbon Filtration System
- Simple Thermal Oxidizer
- Low Vapor Recovery Products

Technological Feasibility:

Wet Scrubber

Absorption through a packed-bed tower wet scrubber is used for raw material and/or product recovery technique in separation and purification of gaseous streams containing high concentrations of water soluble VOCs compounds such as methanol, ethanol, isopropanol, butanol, acetone, and formaldehyde. Wet scrubbers are used to control inorganic gases. Removal efficiencies for gas absorbers vary for each pollutant-solvent system with the type of absorber used. The suitability of gas absorption as a pollution control method is generally dependent on the availability of the solvent, required removal efficiency, pollutant concentration inlet vapor, capacity required for handling waste gases and recovery value of the pollutants or the disposal cost of unrecoverable solvent. Air flow rates for packed bed scrubbers are 500 to 75,000 standard cubic feet per minute (scfm) (US-EPA 2002c). Due to the required flow rate needed for the scrubber this technology is technically infeasible.

Carbon Filtration System
Carbon Filtration System (adsorption) may be used on a low or medium concentrated gaseous stream to remove VOCs. During adsorption, a gaseous molecule is attracted to the solid material in the filtration system. Carbon adsorption has a linear control rate with the vapor pressure. The vapor pressures of the material in the fugitive VOCs are low, making the control rate low (US-EPA 1995). The use of vapor recovery systems would require the gas stream entering the vapor recovery system to be consistent makeup which makes this technology infeasible.

Simple Thermal Oxidizer
In a simple Thermal Oxidizer (TO) or afterburner, the displaced headspace gas is reheated in the presence of sufficient oxygen to oxidize the VOC. A TO is a flare not equipped with any heat recovery device. This technology is implemented with storage tanks large throughputs and several tanks co-located. TO control technology requires a combustion source increasing VOC, NO_X, and $PM_{2.5}$ from the facility (US-EPA 2002h). This technology is technically not feasible for a source with minimal concentrations and volume of air flow.

Low Vapor Pressure Material
Like the storage tanks the perfumes, adhesives, and paper additives are low vapor pressure materials and/or mixtures. Materials selected are low VOC containing materials that meet specifications for product requirements (Mcintyre 2009). As low vapor pressure materials are in use by the Box Elder Plant this option is considered technically feasible.

Economic Feasibility:
Low vapor pressure material is technically feasible and economically feasible.

BACT Selection:
BACT to control the fugitive VOC emissions is the use of low vapor pressure material.

Implementation Schedule:
The use of low vapor pressure material is already in use so no implementation date is needed.

2.1.8 Truck Loading

Truck loading operations occur at P&G. VOC and HAPs emissions are anticipated to be generated from the loading and unloading of tanker trucks.

Description:
VOC emissions occur when products or intermediates containing organics are loaded or unloaded into tanker trucks. VOC emissions during loading are from vapors evaporated from the new liquid being loaded. Since the Box Elder Plant only loads out products or intermediates very infrequently, the emissions associated with this operation truck loading is not a significant emissions source. The Box Elder site has evaluated controls for BACT.

Emissions:
The following are the potential emissions for the truck loading (<1% of source wide VOC emission), in tpy.

	$PM_{2.5}$	NO_X	SO_2	VOC
Fugitive VOC	0.00	0.00	0.00	0.35

Available Control Technology
The control technologies for VOC emissions for the truck loading operations are as follows:

- Vapor Recovery System
- Vapor Balancing
- Submerged Loading

Technological Feasibility:
Vapor Recovery System
Vapor recovery through carbon adsorption, vapor balance, or refrigerated condenser provides control of emissions by collecting the vented material for recycle or reuse. The tanks located onsite are several sets of smaller storage tanks. This control technology requires a large consistent throughput which makes this technically infeasible (US-EPA 1995).

Vapor Balancing
In vapor balancing, hydrocarbon vapors are collected from the compartment where the liquid is being loaded and returned to the tank from which the liquid is being sent. This balancing works since the volume of displaced vapors is almost identical to the volume of liquid removed from the tank. This technique is most effective when loading tank trucks from fixed roof tanks. This technology is technically feasible.

Submerged Loading
The use of submerged loading as a means of control offers the low cost way to control loading emissions. The two types of submerged loading are the submerged fill pipe method and the bottom loading method. In the submerged fill pipe method, the fill pipe extends almost to the bottom of the cargo tank. This technology is technically feasible.

Economic Feasibility:
The following technologies are technically feasible and submerged loading. The use of vapor balancing would require the source to install additional piping on each storage tanks. The cost to install the piping on the tanks and tankers for the infrequent filling makes this technology economically infeasible. The use of submerged loading to control VOC is economically feasible.

BACT Selection:
BACT to control the truck loading VOC emissions is the use of submerged loading.

Implementation Schedule:
The use of submerged loading is already in use so no implementation date is needed.

2.1.9 Diesel Emergency Generators and Firepumps

P&G has emergency equipment to support operations during power outages or an emergency.

Description:
The P&G has several diesel-fueled non-road engines generators and firepump engines used for emergency purposes. Diesel engines are classified as compression ignition (CI) internal combustion engines (ICE). The primary pollutants in the exhaust gases include NO_X, VOC, SO_2, and $PM_{2.5}$. The engines are for emergency use only (except for readiness testing) and use diesel fuel meeting the requirements of 40 CFR §80.510(b) for nonroad diesel fuel.

Emissions:
The following are the potential emissions for the diesel-fueled non-road engines generators and firepump engines, in tpy.

	$PM_{2.5}$	NO_X	SO_2	VOC
Diesel Non-Road Engines	0.00	2.30	0.00	0.00

Available Control Technology
The control technologies for diesel-fueled non-road engines generators and firepump engines are as follows:

- Limited Hours of Operation
- Good Combustion Practices
- Use of Tier Certified Engine
- Engine Design
- Diesel Particulate Filter
- Ultra-Low Sulfur Fuel
- Oxidation Catalyst
- Selective Catalyst Reduction

Technological Feasibility:
Limited Hours of Operation
One of the apparent opportunities to control the emissions of all pollutants released from the emergency engines powering generators and fire pumps is to limit the hours of operation for the equipment. Due to the designation of this equipment as emergency equipment, only 100 hours of operation for maintenance and testing are permitted per NSPS Subpart IIII. P&G complies with NSPS Subpart IIII requirements and minimizes operation time for emergency generators to maintenance and testing. Limiting hours of operation is technically feasible to control NO_X and $PM_{2.5}$.

Good Combustion Practices

Good combustion practices refer to the operation of engines at high combustion efficiency, which reduces the products of incomplete combustion. The emergency generators are designed to achieve maximum combustion efficiency. The manufacturer has provided operation and maintenance manuals that detail the required methods to achieve the highest levels of combustion efficiency making good combustion practices technically feasible.

Use of a Tier Certified Engines

Today engines are required to meet certain emission limits, or tier ratings, based on the size and model year. Emission standards for engines have progressively gotten more stringent over time and are an indicator of good combustion design. The fire pumps meet the lowest emission rating for their size as identified in 40 CFR 60 Subpart IIII making use of a tier certified engines technically feasible.

Diesel Particulate Filters

This technology is placed in the exhaust pathway to prevent the release of particulate and may be coated with a catalyst to further capture hydrocarbon emissions. The technology is technically feasible.

Ultra Low Sulfur Diesel

Ultra low sulfur diesel (ULSD) contains less than 0.0015 % sulfur by weight. The reduced sulfur content reduces the potential for SO_2 emissions. The low sulfur content results in a lower potential for aggregation of sulfur containing compounds and reduces $PM_{2.5}$ emissions. The use of ULSD is technically feasible.

Diesel Oxidation Catalyst

A diesel oxidation catalyst (DOC) utilizes a catalyst such as platinum or palladium to further oxidize the engine's exhaust, which includes hydrocarbons (HC), VOC, to carbon dioxide (CO2) and water. Use of a DOC can result in approximately 90 percent reduction in HC/VOC emissions. In addition to controlling HC/VOC a DOC also has the potential to control PM by 30 percent and CO by 50 percent if low sulfur diesel fuel is used.

The use of a DOC reduces the effective power output of RICE and results in a solid waste stream. A DOC is considered technically feasible.

Selective Catalytic Reduction

Selective Catalytic Reduction (SCR) systems introduce a liquid reducing agent such as ammonia or urea into the flue gas stream before a catalyst. The catalyst reduces the temperature needed to initiate the reaction between the reducing agent and NO_X to form nitrogen and water.

For SCR systems to function effectively, exhaust temperatures must be high enough (200°C to 500°C) to enable catalyst activation (US-EPA 2002e). SCR control efficiencies are relatively low during the first 20 to 30 minutes after engine start up, especially during maintenance and testing. There are also complications controlling the excess ammonia (ammonia slip) from SCR use. SCR is anticipated to have a relatively low combustion efficiency during maintenance and testing, SCR is not considered technically feasible for emergency units.

Economic Feasibility:
The following technologies are technically feasible, limited hours of operation, good combustion practices, use of a Tier Certified engines, diesel particulate filters, ULSD, and DOC. Since the use of the engines is for emergency purposes and operate on a limited time (<100 hrs) for testing and maintenance. The emissions associated with these units are low. The cost to install add-on controls (diesel particulate filters and DOC) to control the low NO_X emitted from the units economically infeasible. The economically feasible control technologies for these units are the limited hours of operation, good combustion practices, use of a Tier Certified engines, and the use of ULSD.

BACT Selection:
BACT to control the diesel-fueled non-road engines generators and firepump engines is limited hours of operation, good combustion practices, use of a Tier Certified engines, and the use of ULSD.

Implementation Schedule:
The source is maintains records of limited hours of operation, and operates the units using good combustion practices, and the engines are Tier Certified engines and the engines operate on ULSD. No implementation date is needed.

3.0 Startup/Shutdown Considerations:

Startup for the Boilers and Paper Machines requires a 30 minute period prior to normal operation for the equipment to reach a steady state operation. Shutdown of the boilers is instantaneous and requires no time period. Shutdown for the paper machines requires a 30 minutes diversion of the hot air to the dryer startup stack.

4.0 Conclusions:

The State of Utah has reviewed P&G operations/equipment and has determined that P&G is meeting BACT. P&G is subject to the following federal requirements; 40 CFR 60 Subpart A- General Provisions, 40 CFR 60 Subpart Dc-Standards of Performance for Small Industrial- Commercial-Institutional Steam Generating Units, 40 CFR 60 Subpart IIII-Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, and 40 CFR 63 Subpart A-General Provisions, and 40 CFR 63 Subpart ZZZZ-NESHAPs for Stationary Reciprocating Internal Combustion Engines.

The following limits shall not be exceeded for P&G operations as per Part H.11.s:
A. 3.3 pounds per hour of NO_X for each Paper Making Boiler.
B. 0.9 pounds per hour of $PM_{2.5}$ filterable and condensable for each Paper Making Boiler.
C. 1.8 pounds per hour of NO_X for each Utility Boiler.
D. 0.74 pounds per hour of $PM_{2.5}$ filterable for each Utility Boiler.
E. 13.50 pounds per hour of NO_X for each Paper Machine Process Stack.

F. 17.95 pounds per hour of $PM_{2.5}$ filterable and condensable for each Paper Machine Process Stack

Compliance with each of the above emission limits shall be determined by stack test as outlined in Section IX Part H.11.e of the $PM_{2.5}$ SIP. Stack testing is required every three years for NO_X and $PM_{2.5}$ for each boiler and paper machine process stack.

Stationary source emissions monitoring provides data from a regulated stationary source to demonstrate compliance with certain regulatory requirements in Federal or State rules and/or in an operating permit, as well as provides information to the facility operator about the performance of the process and air pollution control device.

An indicator of performance is the parameter measured or observed for demonstrating proper operation of the air pollution control measures and compliance with the applicable emissions limitation or standard. Indicators of performance may include direct emissions measurements, surrogate emissions measurements (including opacity), operational parametric measurements that correspond to process or control device (and capture system) efficiencies or emission rates, and recorded findings of inspections of work practice activities, material tracking, or design characteristics. All of these monitoring techniques can be used to ensure a source is operating within its emission limits.

Stack tests are frequently used in short term sampling programs to determine actual source emissions of criteria pollutants and HAPs. A stack test or a CEMS will verify if a source is operating in compliance with a permitted emission rate or limit. If the source has a production or emission rate that is constant, then a stack test provides sufficient verification of the emissions rate. For example, a natural gas combustion source is constant with little or no variation in the emission rate and performing a stack test once every two to three years provides sufficient information to demonstrate compliance with their permitted emission rate(s). Stack testing more frequently is not cost effective and is over burdensome on a source when it only provides information that is constant. Monitoring using portable monitors, between stack tests, can provide information indicating that the source is complying with their permitted emission rates; however, portable monitors are not always reliable and comparison to the data from stack testing using EPA approved methods is problematic. Although the permit may require stack testing less than annually, DAQ compliance inspectors visit major sources annually and if concerns with stack emissions or source operations are observed, the inspector can recommend and the DAQ Director can require a stack test to be conducted.

A Continuous Emissions Monitor (CEM) costs significantly more and places an undue burden on a source if continuous data collection is not needed to verify process performance or fuel consistency. The cost of the equipment for a CEM is over $25,000, and this does not include the cost of the installation or the operation of a CEM. Operation costs include testing that is performed throughout the year by highly trained personnel. Skilled workers are needed to properly operate the system on a daily basis. Also, there is no reliable CEM to monitor particulate matter and so stack testing or visibility testing are typically used for particulate monitoring.

The emissions from the P&G boilers and paper machines are a result of the combustion of natural gas and the emissions are steady. Stack tests of these sources have verified that the emissions are consistent and are well below the permit limit. The DAQ has determined that major sources that require stack testing will be tested at a minimum of once every three years, unless more frequent testing is needed due to a variable fuel source or process, or due to a need for more precise data due to the source emissions being near a regulatory threshold. The performance of a stack test costs from $5,000 to $20,000 per testing session and so test frequency should be set at a rate that provides sufficient data to ensure enforceability of the limit.

5.0 References

BetterBricks
2015 Boilers,BetterBricks-Northwert Energy Efficiency Alliance, Best Practices. https://betterbricks.com/sites/default/files/operations/om_of_boilers_final.pdf.

C.B. Oland
2002 Guide to Low-Emission Boiler and Combustion Equipment Selection. Oak Ridge National Laboratory. https://energy.gov/sites/prod/files/2014/05/f15/guide_low_emission.pdf.

Mcintyre, Michelle
2009 Delivering Sustainable Solutions to Procter & Gamble's Green Bay Facility. Veolia North America.

The Linde Group
2017 LoTOxTM Systems. http://www.linde-gas.com/internet.global.lindegas.global/en/images/LOTOX%20datasheet17_130449.pdf.US-

EPA
1995 Section 3 VOC Controls. https://www3.epa.gov/ttn/ecas/docs/cs3-1ch2.pdf.
2002a Air Pollution Control Technology Fact Sheet, Fabric Filters-Pulse-Jet. https://www3.epa.gov/ttnchie1/mkb/documents/ff-pulse.pdf.
2002b Air Pollution Control Technology Fact Sheet, Fabric Filter-Reverse-Air Cleaned Type. https://www3.epa.gov/ttnchie1/mkb/documents/ff-revar.pdf.
2002c Air Pollution Control Technology Fact Sheet, Spray-Chamber/Spray-Tower Wet Scrubber. https://www3.epa.gov/ttn/catc/dir1/fsprytwr.pdf.
2002d Air Pollution Control Technology Fact Sheet, Dry Electrostatic Precipitator (ESP)-Wire-Plate Type. https://www3.epa.gov/ttnchie1/mkb/documents/fdespwpl.pdf.
2002e Air Pollution Control Technology Fact Sheet, Selective Catalytic Reduction. https://www3.epa.gov/ttncatc1/dir1/fscr.pdf.
2002f Air Pollution Control Technology Fact Sheet, Selective Non - Catalytic Reduction. https://www3.epa.gov/ttncatc1/dir1/fsncr.pdf.
2002g Air Pollution Control Technology Fact Sheet, Regenerative Incinerator. https://www3.epa.gov/ttncatc1/dir1/fregen.pdf.
2002h Air Pollution Control Technology Fact Sheet, Thermal Incinerator. https://www3.epa.gov/ttnchie1/mkb/documents/fthermal.pdf.
2002i Air Pollution Control Technology Fact Sheet, Cyclones. https://www3.epa.gov/ttncatc1/dir1/fcyclon.pdf.
2002j Air Pollution Control Technology Fact Sheet, Catalytic Incinerator. https://www3.epa.gov/ttnchie1/mkb/documents/fcataly.pdf.
2002k Air Pollution Control Technology Fact Sheet, Wet Electrostatic Precipitator (ESP)-Wire-Plate Type. https://www3.epa.gov/ttnchie1/mkb/documents/fwespwpi.pdf.
2002l Air Pollution Control Technology Fact Sheet, Fabric Filter - Mechanical Shaker Cleaned Type. https://www3.epa.gov/ttncatc1/dir1/ff-shaker.pdf.
2002m EPA Air Pollution Control Cost Manual, Sixth Edition. https://www3.epa.gov/ttncatc1/dir1/c_allchs.pdf.
2003 Using Bioreactors to Control Air Pollution.

https://www3.epa.gov/ttncatc1/dir1/fbiorect.pdf.

April 27, 2017

Mr. Marty Gray
Utah Division of Air Quality
195 North 1950 West
Salt Lake City, Utah 84116

RE: The Procter and Gamble Paper Products Company
Box Elder, Utah Facility
BACM/BACT Analysis - Direct $PM_{2.5}$ and $PM_{2.5}$ Precursors

Dear Mr. Gray:

The Procter and Gamble Paper Products Company (P&G) Box Elder facility is submitting this Best Available Control Measures/Technologies (BACM/BACT) analysis for direct particulate matter less than 2.5 microns ($PM_{2.5}$) and $PM_{2.5}$ precursors (including sulfur dioxide (SO_2), nitrogen oxide (NO_X), volatile organic compounds (VOCs), and ammonia (NH_3)) to the Utah Division of Air Quality (UDAQ), as requested in the letter dated January 23, 2017.

P&G understands UDAQ is required to submit a Serious Area Attainment Control Plan as specified in 40 CFR 51, Subpart Z (Federal register (FR) Vol. 81, No. 164, August 24, 2016) due to the $PM_{2.5}$ serious nonattainment re-designation issued by the Environmental Protection Agency (EPA) on December 16, 2016. As P&G's Box Elder facility is considered a major source of $PM_{2.5}$ and $PM_{2.5}$ precursors, it's emission units will be included in the serious nonattainment control plan. This BACM/BACT analysis is in support of UDAQ's development of the Serious $PM_{2.5}$ Nonattainment control plan. As P&G would like to continue to support UDAQ's SIP development effort, please feel free to reach out to Dean Shepherd, Site Environmental Leader at (435) 279-1377 with any questions regarding the BACT/BACM analysis and would appreciate the opportunity to review any draft conditions proposed for inclusion in the state implementation plan (SIP) that pertain to the Box Elder facility.

If you have any additional questions, please feel free to contact me at (435) 279-1200.

Sincerely,

Joseph Tomon

Joseph Tomon
Plant Manager
The Procter and Gamble Paper Products Company

Enclosure

Dean Shepherd, P&G
Brent Edwards, P&G

PM$_{2.5}$ SERIOUS NONATTAINMENT SIP BACM/BACT ANALYSIS

The Procter and Gamble Paper Products Company Box Elder, Utah

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY

MAY 0 1 2017

DIVISION OF AIR QUALITY

Prepared For:
Matthew Strain – Corporate HSE
Dean Shepherd – Box Elder Plant

The Procter and Gamble Paper Products Company
5000 North Iowa String Road
Bear River City, Utah 84301

Prepared By:
Brian Mensinger – Managing Consultant

TRINITY CONSULTANTS
4525 Wasatch Blvd
Suite 200
Salt Lake City, UT 84124
801-272-3000

April 2017

Trinity Consultants

Environmental solutions delivered uncommonly well

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

The Utah Division of Air Quality (UDAQ) is required to submit a Serious Area Attainment Control Plan as specified in 40 CFR 51, Subpart Z (Federal register (FR) Vol. 81, No. 164, August 24, 2016) due to the particulate matter less than 2.5 microns ($PM_{2.5}$) serious nonattainment re-designation issued by the Environmental Protection Agency (EPA) on December 16, 2016.[1] This rule requires UDAQ to identify, adopt, and implement Best Available Control Measures or Technologies (BACM/BACT) for major sources of direct $PM_{2.5}$ and $PM_{2.5}$ precursors (including sulfur dioxide (SO_2), nitrogen oxide (NO_X), volatile organic compounds (VOCs), and ammonia (NH_3)).

The Procter and Gamble Paper Products Company (P&G) operates a paper products manufacturing plant in Box Elder, Utah (Box Elder Plant) which has the potential to emit more than 70 tons or more per year for $PM_{2.5}$ and/or $PM_{2.5}$ precursors. Therefore, the Box Elder Plant is considered a "major source." UDAQ has requested that each major source prepare a BACM/BACT Analysis which includes the following information:

- Detailed analysis of all applicable control measures and techniques (BACM/BACT Analysis);
- Evaluation of Most Stringent Measures (MSM);
- Evaluation of emission limits; and
- Evaluation of emissions monitoring.

The UDAQ must complete the State Implementation Plan (SIP) process by the end of July 2017 so it can be reviewed and approved for public comment by the Air Quality Board (AQB) in September 2017 and finalized in December 2017 for submittal to the Environmental Protection Agency (EPA) by December 31, 2017.[2] As such, the Box Elder Plant is submitting this BACM/BACT analysis in order to meet DAQ's submission deadline of April 30, 2017 as requested in the letter received January, 23, 2017.

---

[1] Federal Register Vol. 81, No. 164, August 24, 2016, pp. 58151

[2] 40 CFR 51.1003 Attainment Plan Submittal Requirements

2.1. DESCRIPTION OF FACILITY

The Procter and Gamble Paper Products Company (P&G) operates a paper products manufacturing plant just west of Corrine, Utah located in Box Elder County located at the following Universal Transverse Mercator (UTM) coordinates. The facility is referred to herein as the Box Elder Plant. The P&G Box Elder Plant manufactures household consumer products.

- Zone 12
- 1984 World Geodetic System
- Easting: 402,500 meters
- Northing: 4,605,600 meters

All correspondence regarding this submission should be addressed to:

Mr. Dean Shepherd
The Procter and Gamble Paper Products Company
5000 North Iowa String Road
Bear River City, Utah 84301
Phone: (435) 279-1337
Email: shepherd.d.8@pg.com

Matthew Strain
The Procter and Gamble Paper Products Company
Beckett Ridge - CETL - CP111
8256 Union Centre Blvd.
West Chester, OH 45069
Phone: (513) 634-4502
Email: strain.mg@pg.com

2.2. PERMITTING BACKGROUND

The Box Elder plant is currently operating as a stationary source under an approval order (AO) from the UDAQ dated October 26, 2016, (DAQE-AN41070009-16) and Title V Operating Permit Number 300053001, last revised June 12, 2013, (expiring March 12, 2018). The paper machine designated as 15B and supporting paper products manufacturing operations, as reflected in the Box Elder plant's current approval order, represent the facility's current operations.

In addition to current operations, the approval order issued on October 26, 2016 permits additional production lines at the Box Elder Plant.[3] The equipment proposed in the October 2016 approval order is referred to as Project Maple. As documented in P&G's notice of intent (NOI) application for Project Maple, P&G desired to focus on other manufacturing operations that could take the place of a second paper machine designated as paper machine 16B. Project Maple was also an extension of the existing 15B and 16B project, with Project Maple emission units replacing 16B emission units.

The processes added at the Box Elder Plant with Project Maple include the following:

[3] Approval Order (No. DAQE-AN141070009-16) was issued on October 26, 2016 for construction of additional production lines at P&G's Box Elder Plant referred to as Project Maple. Construction has commenced on sources with this approval order.

- Soaps Manufacturing A, B, and C;
- Cleaning Article Manufacturing;
- Assembled Paper Product A Manufacturing;
- Chemicals Manufacturing; and
- Supporting Utility Operations.
- Bottle Blowing (On-site supplier)

In support of these operations, P&G will also be installing additional utilities for process steam, comfort heating, cooling water, and back-up emergency power. In addition to P&G's proposed operations, supplier operations including extruding machines and packaging will also be installed.

The Box Elder Plant's Title V permit (No. #300053001) will be updated with the new permitted sources and removal of paper machine 16B as part of the Title V renewal application to be submitted by September 12, 2017.[4]

The emissions are divided among the sources reviewed for BACT as shown in Table 2-1.

[4] Title V Permit #300053001 expires on March 12, 2018 and the renewal application is due by September 12, 2017 in accordance with the "Enforceable Dates and Timelines" documented in the Box Elder Plant's Title V permit.

Table 2-1. Site Wide Emission Summary

Source/Source Type	Current Emission Estimates (% of Total Emissions)				
	$PM_{2.5}$	NO_x	SO_2	VOC	NH_3
Paper Machine	68%	64%	33%	56%	0%
Boilers	10%	31%	40%	3%	0%
Converting Line [1]	8%	0%	0%	7%	0%
Warehouse Space Heaters	0%	2%	1%	0%	0%
Emergency Generators	0%	2%	0%	0%	0%
Cleaning Article Manufacturing [1]	3%	0%	0%	1%	0%
Assembled Paper Products [1]	6%	0%	0%	15%	0%
Process Storage Tanks	0%	0%	0%	9%	0%
Chemical Making Process-Scrubber	4%	1%	26%	3%	0%
Cooling Towers	1%	0%	0%	0%	0%
Truck Loading	0%	0%	0%	0%	0%
Other Fugitive VOC Emissions [1]	0%	0%	0%	4%	0%
Negligible/Other Emissions [2]	0%	0%	0%	1%	0%
Total Emissions (tpy)	**150.16**	**124.86**	**1.45**	**162.37**	**N/A**

1. The $PM_{2.5}$ BACT analysis groups these sources under "solid material handling." The VOC BACT analysis for these sources are grouped under "Fugitive VOC Emissions."
2. Negligible emissions are those less than 1 tpy per unit and include Soap B Packing and Capping, Soap C Converting, Cleaning Article Manufacturing Coating, Bottle Blowing Supplier Molding, Chemicals Making Amine Oxide Mixing, and Soap C Trimming.

3. BEST AVAILABLE CONTROL MEASURES (BACM)

P&G previously submitted a Reasonably Available Control Technology (RACT) evaluation on September 7, 2012. The 2012 RACT analysis and P&G's current SIP requirements as documented in UDAQ's Moderate Non-Attainment SIP have been achieved by the Box Elder Plant.[5] The 2012 RACT analysis serves as a baseline for the BACM/BACT analysis documented herein.[6] Sources addressed with Project Maple were permitted to achieve BACT. A BACM/BACT analysis has been conducted for each source addressed in Approval Order No. DAQE-AN141070009-16 in the following sections. Where appropriate, P&G has addressed startup and shutdown emissions for each source as part of the BACM/BACT analysis. P&G has organized the BACM/BACT analysis by emission unit group and addressed $PM_{2.5}$ and each $PM_{2.5}$ precursor in this analysis in a format that is in accordance with U.S. EPA's top-down BACT procedures.

3.1. BACM/BACT METHODOLOGY

In a memorandum dated December 1, 1987, the United States Environmental Protection Agency (U.S. EPA) stated its preference for a "top-down" BACT analysis.[7] After determining if any New Source Performance Standard (NSPS) is applicable, the first step in this approach is to determine, for the emission unit in question, the most stringent control available for a similar or identical source or source category. If it can be shown that this level of control is technically, environmentally, or economically infeasible for the unit in question, then the next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections. Presented below are the five basic steps of a top-down BACT review as identified by the U.S. EPA.

3.1.1. Step 1 - Identify All Control Technologies

Available control technologies are identified for each emission unit in question. The following methods are used to identify potential technologies:

1. Researching the RACT/BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse (RBLC) database;
2. Surveying regulatory agency emission limit requirements;
3. Drawing from previous engineering experience;
4. Surveying air pollution control equipment vendor emission limit guarantees, and/or
5. Surveying available literature.

---

[5] P&G's Source Specific Emission Limitations are documented in Section H.12 Salt Lake City Nonattainment Area, UDAQ's Moderate SIP, December 3, 2014.

[6] Prior RACT analysis is required to be the baseline consideration for Serious Nonattainment SIP BACM/BACT analysis based on UDAQs Letter dated January 23, 2017.

[7] U.S. EPA, Office of Air and Radiation. Memorandum from J.C. Potter to the Regional Administrators. Washington, D.C. December 1, 1987.

3.1.2. Step 2 - Eliminate Technically Infeasible Options

The second step in the BACT analysis is to eliminate any technically infeasible control technologies. Each control technology for each pollutant is considered, and those that are clearly technically infeasible are eliminated. U.S. EPA states the following with regard to technical feasibility:[8]

> *A demonstration of technical infeasibility should be clearly documented and should show, based on physical, chemical, and engineering principles, that technical difficulties would preclude the successful use of the control option on the emissions unit under review.*

3.1.3. Step 3 - Rank Remaining Control Technologies by Control Effectiveness

Once technically infeasible options are removed from consideration, the remaining options are ranked based on their control effectiveness. If there is only one remaining option or if all of the remaining technologies could achieve equivalent control efficiencies, ranking based on control efficiency is not required.

In a retroactive BACT analysis, this step differs from the equivalent step in the NSR BACT process in that the baseline from which control effectiveness is evaluated is the current emission rate, and not a hypothetical "uncontrolled" level.

3.1.4. Step 4 - Evaluate Most Effective Controls and Document Results

Beginning with the most effective control option in the ranking, detailed economic, energy, and environmental impact evaluations are performed. If a control option is determined to be economically feasible without adverse energy or environmental impacts, it is not necessary to evaluate the remaining options with lower control effectiveness.

The economic evaluation centers on the cost effectiveness of the control option. Costs of installing and operating control technologies are estimated and annualized following the methodologies outlined in the U.S. EPA's *OAQPS Control Cost Manual* (CCM) and other industry resources.[9] Note that the analysis is not whether controls are affordable, but whether the monetary expenditure is effective.

3.1.5. Step 5 - Select BACT

In the final step, one pollutant-specific control option is proposed as BACT for each emission unit under review based on evaluations from the previous step.

The U.S. EPA has consistently interpreted the statutory and regulatory BACT definitions as containing two core requirements that the agency believes must be met by any BACT determination, regardless of whether the "top-down" approach is used. First, the BACT analysis must include consideration of the most stringent available control technologies, i.e., those which provide the "maximum degree of emissions reduction." Second, any

---

[8] U.S. EPA, New Source Review Workshop Manual (Draft): Prevention of Significant Deterioration and Nonattainment Area Permitting, October 1990.

[9] Office of Air Quality Planning and Standards (OAQPS), *EPA Air Pollution Control Cost Manual*, Sixth Edition, EPA 452-02-001 (http://www.epa.gov/ttn/catc/products.html#cccinfo), Daniel C. Mussatti & William M. Vatavuk, January 2002.

decision to require a lesser degree of emissions reduction must be justified by an objective analysis of "energy, environmental, and economic impacts."[10]

The UDAQ NOI Guide also details the requirement to achieve BACT as required in the State of Utah permitting process. The proposed BACT must be based on the most effective engineering techniques and control equipment to minimize emissions of air contaminants into the outside environment from its process.

3.1.6. Most Stringent Measures

The MSM analysis is a separate determination from BACT. The MSM analysis identifies any permanent and enforceable control measure that achieves the most stringent emissions reductions, in direct $PM_{2.5}$ emissions and/or emissions of $PM_{2.5}$ precursors, from among those control measures which are:

- Included in the SIP for any other National Ambient Air Quality Standard (NAAQS); or
- Have been achieved in practice in any state; and
- Can feasibly be implemented in the relevant $PM_{2.5}$ NAAQS nonattainment area.[11]

If the area cannot meet the $PM_{2.5}$ standard by December 31, 2019, through modeled prediction or actual ambient monitoring, the control measure required will rise to the MSMs identified.

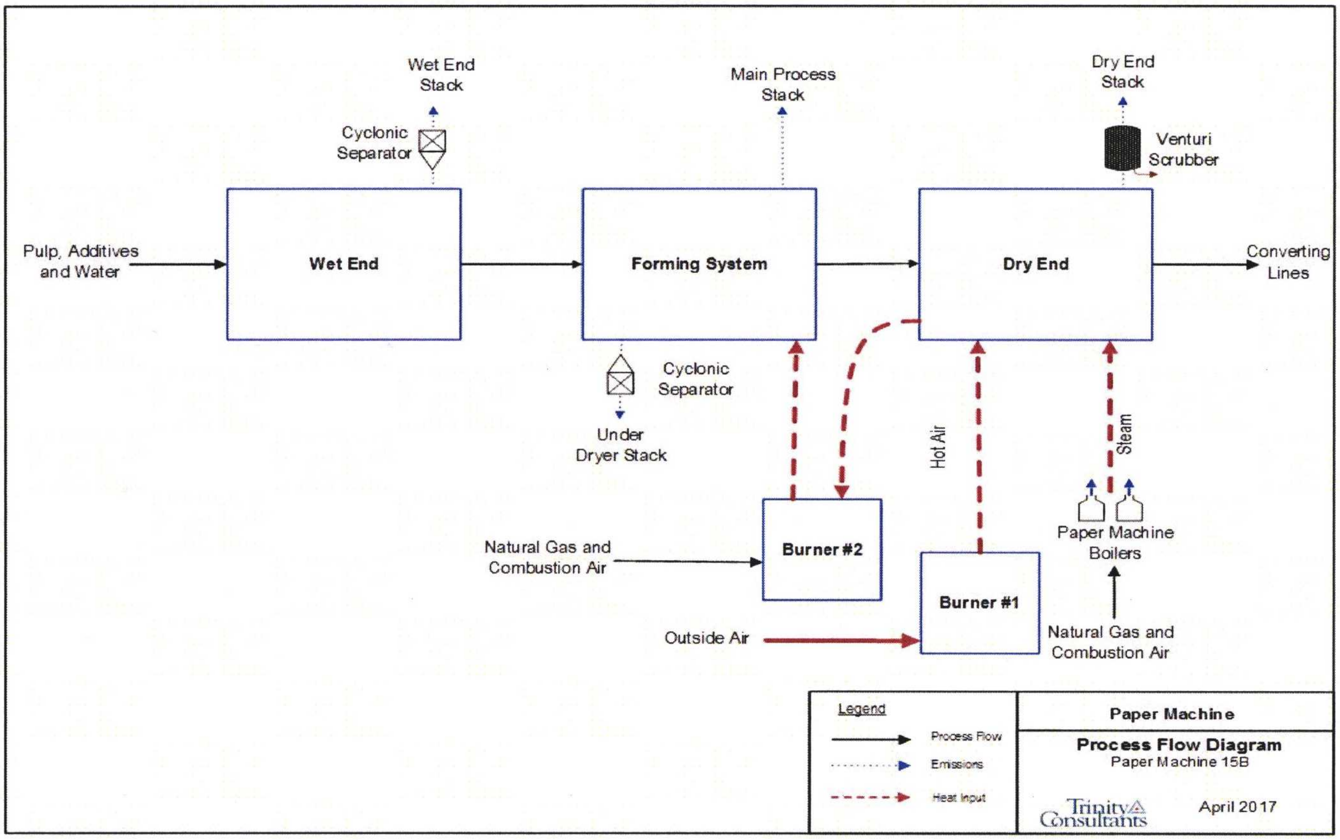
3.2. PAPER MACHINE

The Box Elder Plant has a single paper machine on-site (i.e., paper machine 15B) which produces both paper towel and tissue paper products. The Box Elder Plant uses pulp, which is manufactured at separate facilities, mixed with water and additives as raw material. The additives enhance the paper's softness, strength, and appearance. The raw materials that form into a web are dried with hot air from a combination of process heaters and steam dryers. Figure 3-1 shows a process flow diagram (PFD) for the paper machine process.

[10] Ibid.

[11] 40 CFR 51.1000 – Definitions - Provisions for Implementation of $PM_{2.5}$ National Ambient Air Quality Standards

Figure 3-1. Paper Machine Process Flow Diagram



The paper process begins with the wet end starting with stock preparation, which consists of mixing pulp, additives, and water. This slurry is then fed to the forming system where the sheet screening, formation of paper, and draining occur. Finally, the wet paper undergoes drying where the wet paper web is passed through drying zones. Air and heat distribution are critical in order to uniformly dry the paper sheet and ensure a quality product. Hot air is transferred across the wet paper web, therefore passing directly through the product in the forming system and dry end. The air is heated by two duct burners referred to as Burner #1 and Burner #2.

Burner #1 is a 100 million British thermal units per hour (MMBtu/hr) natural gas fired dryer with a low NO_X burner. Burner #2 is rated at 50 MMBtu/hr and uses preheated air from the paper process, which was initially heated by Burner #1. Burner #2 duct burner is equipped with the same style of low NO_X burner. Burner #1 heats ambient air for the use in drying the wet paper web. This hot air travels through the paper machine and into the duct heated by Burner #2.

Additional make-up air is delivered into the paper machine room by make-up air units used for room balance and temperature control. The make-up air units provide additional flow at all times, but only heat the air for approximately half the year during times of colder ambient temperatures.

The paper towel or tissue paper finishes in the paper machine as a large roll for further processing. The dry-end of the process is controlled by a Venturi scrubber and the wet end of the process and under dryer are controlled by cyclonic separators that function as mist eliminators and remove particulate.

The products (paper towel and tissue paper) manufactured on the 15B paper machine have a wide range of characteristics. Therefore, depending on the product being created, heat intensity and steam demand are varying process parameters required to adapt to new product specifications in a short period of time to eliminate wasting product. Typical paper machines do not produce multiple products with varying properties, instead many facilities will have multiple paper machines each dedicated to a specific product. The paper machine has several emission points, including the following:

- Paper Machine Process Stack
- Wet End Cyclonic Separator
- Under Dryer Cyclonic Separator
- Dry End Venturi Scrubber
- Paper Machine Room Exhaust Fans (4)

The emissions associated with the process stack include natural gas combustion emissions from Burner #1 and Burner #2 as well as particulate matter and VOC emissions associated with the drying of the wet paper web with its associated additives. Some of the combustion emissions and VOC fugitives may be emitted from the other stacks, but a vast majority of the emissions are routed to the process stack due to the flow of drying air. The cyclonic separator and Venturi scrubber collect cellulose that becomes entrained during the process in the paper machine as particulate matter. The primary function of the cyclonic separator is to act as a mist eliminator, but the cyclonic separator also functions to remove particulate matter (very limited on the wet end of the paper machine). The under dryer stack particulate matter is controlled by a cyclonic separator. Finally, the make-up air units exhaust and blow air directly into the paper machine room (approximately the size of a football field). The emissions associated with the natural gas combustion during the cooler months from the make-up air units are exhausted through the paper machine room exhaust fans.

The make-up air units are fairly small units with low NO_X burners, each with a capacity of 15.75 MMBtu/hr. Additionally, the units only run half the year, providing a reduction in annual emissions. Furthermore, the units exhaust to a large room, making any sort of add-on control technologies impractical. These units are also specifically designed for the space and are not a packaged units, making it very difficult to obtain any sort of pricing without purchasing a new unit. Lastly, the emissions associated with this unit make up less than 10% of the paper machines total NO_X emissions. Therefore, considering all of these factors, P&G has not evaluated these units further.

Initial and subsequent source tests have been conducted on the paper machine process stack as required by P&G's AO and Title V air operating permit.[12] The process stack exhaust has a moisture content of approximately 14-15%, at 190°F to 195°F. Flowrates from the process stack range from 210,000 actual cubic feet per minute (acfm) to 250,000 acfm (equivalent to 120,000 dry standard cubic feet per minute (dscfm) – 151,000 dscfm).

Upon startup of the paper machine, Burner #1 and Burner #2 heat duct air to a specified temperature. As the air is heated, it is routed through a separate stack such that it is not coming in contact with the sheet in the paper machine. Startup operations typically occur for less than one hour. As the startup process only consists of natural gas combustion at lower temperatures, it is anticipated to result in lower overall emissions as compared to normal operations. Therefore, because startup operations emissions are less than short-term and annual emission limits, the facility PTE is determined assuming continuous normal operation of the paper machine.

[12] Title V Operating Permit #300053001 Condition II.B.2.a.1, II.B.2.b.1, and II.B.2.c.1. AO DAQE-AN141070009-16 Condition II.B.3.a.1.

Startup operations are included in this BACT analysis but not evaluated separately as the emissions are minor in comparison to normal operations.[13]

For add-on control technologies, exhaust points are evaluated individually for BACT in the sections below. For control technologies specific to the combustion burner, each combustion source is considered separately.

3.2.1. NO_X

NO_X is emitted from Burner #1, Burner #2, and make-up air units. Burner #1 and Burner #2 exhaust primarily through the process stack. NO_X is formed during combustion by two major mechanisms: thermal NO_X and fuel NO_X. Since natural gas is relatively free of fuel-bound nitrogen, the contribution of this second mechanism to the formation of NO_X emissions in natural gas-fired equipment is minimal and thermal NO_X is the chief source of NO_X emissions. Thermal NO_X formation is a function of residence time, oxygen level, and flame temperature, and can be minimized by controlling these elements in the design of the combustion equipment.

Paper Machine NO_X Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Kraft Paper Machines (30.241), Non-Kraft Paper Machines (30.420) and Other Non-Kraft Operations (30.490);[14]
- EPA's Air Pollution Technology Fact Sheets;
- EPA's Clean Air Technology Center (CATC) Technical Bulletin for Nitrogen Oxides;
- EPA's Air Pollution Control Cost Manual for NO_X Controls; and
- Permits available online.

Due to the uniqueness of the P&G paper machine design, it was difficult to compare sources as listed in the RBLC because the Box Elder plant does not represent a typical paper plant. Although a thorough search was conducted for similar technologies, P&G's paper machine design is unique when compared to other paper machines because it produces multiple products with varied characteristics. Consequently, P&G compared paper machines with similar design characteristics and/or located in nonattainment areas. The paper machines that most closely represent the paper machine at the Box Elder Plant are detailed in Table 3-1.

[13] A full description of startup and shut down operations may be found in the April 30, 2014, letter submitted by P&G Box Elder facility to UDAQ as a result of comments from EPA during the Moderate Nonattainment SIP review process.

[14] Database accessed February 27, 2017.

Table 3-1. Comparable Paper Machines

Locations	NO_X Emissions Limit	Burner Description	Additional Information
P&G Green Bay Plant Green Bay, Wisconsin	0.115 pounds per million British thermal units (lb/MMBtu)	Low NO_X Burner #1	Burner #2 is a standard duct burner.
P&G Oxnard Plant Oxnard, California	0.08 lb/MMBtu	Cogen Hot Air provides the majority of heat input during normal operation. Use of Low NOx Burners provide control when Cogen Hot Air is not available.	Hot air from a natural gas-fired Turbine provides the primary source of heat during normal operation The GE LM 6000 is controlled with steam injection, followed by SCR.
P&G Box Elder Plant Bear River, Utah (Subject Source)	0.09 lb/MMBtu	Low NO_X Burners	Use of pre-mix inline burners.

P&G has performed extensive research to install a duct burner design which equally distributes heat across a large volume of air. The current burner technology installed is a second generation design which employs low NO_X technology. Two additional considerations in the burner design include the ability for turn down and reliability of the inline duct burner system. As described in the low NO_X burner evaluation, the installed technology at the Box Elder facility enables turn down design along with a programmable logic controller for precise controls of the burner.

As the Oxnard plant paper machines closely represent the paper machine in Box Elder, it has been included in this evaluation for NO_X technology. Additionally, the P&G Oxnard Plant is located in Oxnard, California in Ventura County which is an ozone non-attainment area. Although the Oxnard units are second generation paper machines, they contrast to the Box Elder unit because under standard conditions they use Cogens in place of burners to dry the paper.

Paper Machine NO_X Step 2 - Eliminate Technically Infeasible Option

To demonstrate a complete analysis, P&G has evaluated the following technologies including consideration of both replacement burners and add-on controls.

Pollutant	Control Technologies
NO_X	Low NO_X Burners (LNB)
	Ultra-Low NO_X Burners (ULNB)
	Flue Gas Recirculation (FGR)
	Selective Non-Catalytic Reduction (SNCR)
	Selective Catalytic Reduction (SCR)
	Good Combustion Practices

Low NO_X Burner

LNB technology uses advanced burner design to reduce NO_X formation through the restriction of oxygen, flame temperature, and/or residence time. There are two general types of LNBs: staged fuel and staged air burners. In a stage fuel LNB, the combustion zone is separated into two regions. The first region is a lean combustion region where a fraction of the fuel is supplied with the total quantity of combustion air. Combustion in this zone takes place at substantially lower temperatures than a standard burner. In the second combustion region, the remaining fuel is injected and combusted with left over oxygen from the first region. This technique reduces the formation of thermal NO_X.

This technology is specific to the combustion unit itself and is therefore evaluated for Burner #1, Burner #2, and make-up air units. The burner installed on Burner #1 and Burner #2 are designed specifically for in-line duct firing. The low NO_X emissions are achieved through a patented simulated pre-mix technology that enables the fuel to be fired in a very lean mixture while ensuring optimum flame stability. Low NO_X and carbon monoxide (CO) emissions are achieved across a wide firing rate turn down without the need for fuel-to-air ratio combustion controls. Low NO_X Burner technology is currently utilized on the Paper Machine.

Ultra Low NO_X Burner

ULNB technology uses internal FGR, which involves recirculating the hot oxygen (O_2)-depleted flue gas from the heater into the combustion zone using burner design features and fuel staging to reduce NO_X. A search was completed for other paper machines which do not have listed proven technology. Based on inquiry with the burner manufacturer, the only available technology would include a complete re-design of the hot air system that would allow using a single register style round low NO_X burner.[15] This redesign of the paper machine technology would greatly reduce heat efficiency maintained within the machine, thereby requiring additional fuel to heat the drying air. As a result, a substantial redesign would be required and there would be significant losses in heat efficiency for the existing paper machine, the ULNB is considered technically infeasible.

Flue Gas Recirculation

FGR combined with LNB as a method of ULNB technology is another combustion control used to reduce NO_X. FGR involves the recycling of flue gas into the air-fuel mixture at the burner to help cool the burner flame.

---

[15] Mar – 2017 email correspondence from Coen Hamworthy Combustion

External FGR, usually used with LNB, requires the use of hot-side fans and ductwork to route a portion of the flue gas in the stack back to the burner windbox.

The burners installed on the 15B paper machine simulate pre-mix technology that enables the fuel to be fired in a very lean mixture while ensuring optimum flame stability. Induced FGR for Burner #1 is impractical as it is firing directly into process air and the significant amount of cellulose would greatly reduce the reliability of the burner. Burner #2uses process air heated by Burner #1 for efficiency and is used as combustion air. As thermal efficiencies have already been engineered throughout the second generation paper machine, the use of heated air is already implemented and the use of process air would damage the burner; therefore, FGR is considered technically infeasible.

Selective Catalytic Reduction

SCR has been applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. It has been applied to large (>250 MMBtu/hr) utility and industrial boilers, process heaters, and combined cycle gas turbines. There has been limited application of SCR to other combustion devices and processes such as simple cycle gas turbines, stationary reciprocating internal combustion engines, nitric acid plants, and steel mill annealing furnaces. SCR can be applied as a stand-alone NO_X control or with other technologies such as combustion controls. The reagent reacts selectively with the flue gas NO_X within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NO_X into molecular nitrogen (N_2) and water vapor (H_2O).[16] The optimum operating temperature is dependent on the type of catalyst and the flue gas composition. Generally, the optimum temperature ranges from 480°F to 800°F.[17]

The hot exhaust gases from the paper machine combustion unit come into direct contact with process material via the through-air drying process prior to release to the atmosphere. The combustion exhaust cannot be influenced by a reagent prior to contact with the product at the risk of compromising operations and product specifications. If the SCR captures exhaust emissions after the through-air drying process, there is concern that even minor residue from the PM emissions from the paper machine process would coat the surface of the SCR catalyst, greatly reducing effectiveness. Additionally, the paper machine has a process exhaust temperature of 200°F or less, as indicated during historical stack tests. Adding an SCR system will result in ammonia emissions from the ammonia slip associated with the catalyst. The exhaust stream will require additional temperature from the exhaust stream to meet the SCR operating temperature requirements (minimum of 480°F). This increase in exhaust temperature would require an additional combustion device, increasing NO_X, SO_2, and $PM_{2.5}$ emissions.

Due to the physical configuration, risk of compromising product, risk of compromising SCR effectiveness through fouling of the catalyst, and increase in ammonia, $PM_{2.5}$, and SO_2 emissions, SCR is considered technically infeasible.

Selective Non-Catalytic Reduction

SNCR is currently being used for NO_X emission control on industrial boilers, electric utility steam generators, thermal incinerators, and municipal solid waste energy recovery facilities. Its use on Utility Boilers has generally been limited to units with output of less than 3,100 MMBtu. SNCR can be applied as a stand-alone NO_X control or

---

[16] Ibid.

[17] OAQPS, *EPA Air Pollution Control Cost Manual*, Sixth Edition, EPA/424/B-02-001 (http://www.epa.gov/ttn/catc/dir1/c_allchs.pdf); January 2002

with other technologies such as combustion controls. SNCR can achieve NO_X reduction efficiencies of up to 75% in short-term demonstrations. In typical field applications, however, it provides 30% to 50% NO_X reduction. Reductions of up to 65% have been reported for some field applications of SNCR in tandem with combustion control equipment such as LNB.[18]

SNCR is based on the chemical reduction of the NO_X molecule into molecular nitrogen (N_2) and water vapor (H_2O). A nitrogen based reducing agent (reagent), such as ammonia or urea, is injected into the post combustion flue gas. The reagent can react with a number of flue gas components. However, the NO_X reduction reaction is favored over other chemical reaction processes for a specific temperature range and in the presence of oxygen, therefore, it is considered a selective chemical process.[19]

The hardware associated with an SNCR installation is relatively simple. Though simple in concept, it is challenging in practice to design an SNCR system that is reliable, economical, simple to control, and meets other technical, environmental, and regulatory criteria. Practical application of SNCR is limited by the system design and operating conditions.[20] SNCR becomes difficult at temperatures outside its required temperature range of 1,600°F to 2,100°F.

As previously discussed under the SCR considerations, due to the physical configuration, risk of compromising product, and increase in ammonia, $PM_{2.5}$, and SO_2 emissions, SNCR is considered technically infeasible.

Good Combustion Practices

The use of good combustion practices usually include the following components: (1) proper fuel mixing in the combustion zone; (2) high temperatures and low oxygen levels in primary zone; (3) Overall excess oxygen levels high enough to complete combustion while maximizing boiler efficiency, and (4) sufficient residence time to complete combustion. Good combustion practices are accomplished through the in-line duct burners currently used for the paper machine design application as it relates to time, temperature, turbulence, and burner operation (which control excess oxygen levels).

Paper Machine NO_x Step 3 - Rank Remaining Control Technologies by Control Effectiveness

State-by-state reviews as well as the EPA's RACT/BACT/LAER Clearinghouse databases were searched to identify facilities that were using post-combustion control devices, such as SNCR and SCR, for removal of NO_X for units similar to the paper machine burners. No facilities were identified as using these technologies, thus eliminating them from further review. As UNLB and FGR would require significant redesign of the paper machine's heat transfer and distribution system and overall design, these technologies have also been eliminated from further review.

The remaining control technologies identified as technically feasible and further considered for BACT include:

- LNB; and
- Good combustion practices.

---

[18] Ibid.

[19] OAQPS, *EPA Air Pollution Control Cost Manual*, Sixth Edition, EPA/424/B-02-001 (http://www.epa.gov/ttn/catc/dir1/c_allchs.pdf); January 2002

[20] Ibid.

Paper Machine NO_x Step 4 - Evaluate Most Effective Controls and Document Results

With the use of a low NO_x burner and good combustion practices, no adverse economic, energy, or collateral environmental impacts are identified that preclude the use of these control options as they are currently in place.

Paper Machine NO_x Step 5 - Select BACT

Burner #1 and Burner #2

Burner #1 has a low NO_X inline duct burner with pre-mix technology. Burner #2 has the same inline duct burner using heated gases circulated through the paper machine. These units achieve a NOx emission rate of 0.09 lb/MMBtu. Based on discussions with the burner manufacturer, they indicate that these are the best emission rates available for the specific design parameters of the paper machine. P&G will continue to optimize combustion of natural gas to ensure quality product and low emissions as BACT.

Paper Machine NO_x Most Stringent Measures

P&G has determined that the second generation Paper Machine, which had been installed in Oxnard California with a 0.08 lb/MMBtu NO_X limit is the lowest emitting unit in P&G's fleet. The 0.08 lb/MMBtu limit was called BACT, but actually represents the LAER for the unit due to non-attainment status in 1992. Since the Oxnard Paper Machines technology is significantly different, being equipped with Cogens as its primary heat source, P&G had identified the MSM as equivalent to BACT as no other facility has been found to achieve a lower NO_X emission rate as proven technology similar to the Box Elder Plant.

3.2.2. $PM_{2.5}$

Raw materials including pulp, additives, and water, are used in the paper machine. The beginning of the process is very wet, and the pulp dries and becomes a paper web as it moves through the machine. The wet end is where the raw material is introduced to the paper machine and the dry-end is where the product is formed. The particulate matter emitted from the paper machine is generally larger in size. $PM_{2.5}$ is emitted as a by-product of incomplete combustion of the natural gas from Burner #1, Burner #2, and make up air units which has been evaluated in the context of the precursors NO_X, SO_2, and VOCs. The dry-end of the process is controlled by a Venturi scrubber, the wet end of the process is controlled by a cyclonic separator, and the under dryer stack is also controlled by a cyclonic separator. Both Venturi scrubber and cyclonic separator control technologies are designed to remove larger particulate. P&G has conducted studies on ways to minimize particulate matter emissions during the paper making process. Appropriate techniques are incorporated into the operation of the paper machine.

Paper Machine $PM_{2.5}$ Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Kraft Paper Machines and Other Non-Kraft Operations;[21]
- EPA's Air Pollution Technology Fact Sheets; and
- Permits available online.

[21] Database accessed February 27, 2017.

Paper Machine $PM_{2.5}$ Step 2 - Eliminate Technically Infeasible Options

To demonstrate a complete analysis, P&G has evaluated the follow technologies for $PM_{2.5}$.

Pollutant	Control Technologies
$PM_{2.5}$	Fabric Filter (Baghouse)
	Wet Scrubber
	Dry Electrostatic Precipitator (ESP)
	Cyclone

Baghouse/Fabric Filter

A fabric filter unit (or baghouse) consists of one or more compartments containing rows of fabric bags. Particle-laden gases pass along the surface of the bags then through the fabric. Particles are retained on the upstream face of the bags and the cleaned gas stream is vented to the atmosphere. Fabric filters collect particles with sizes ranging from submicron to several hundred microns in diameter. Fabric filters are used for medium and low gas flow streams with high particulate concentrations. Emissions associated with the paper machine include both fugitives from paper processing and incomplete combustion byproducts of natural gas.

There is no proven fabric filter technology that will control condensable $PM_{2.5}$. On the wet end and process stack a fabric filter would bind up the filters due to the high moisture content of the gas stream. On the dry end, the fabric collection of combustible fibers as filterable $PM_{2.5}$ presents a safety hazard for potential fire. Small fires in the baghouse are a potential because of the heat. Taking the combustibility of the cellulose fibers into consideration, the potential for a large scale fire in a baghouse drastically increases.

Considering the low concentration, the potential fire hazard associated with the fibrous emission content, and the high moisture content of the wet end and under dryer stacks, this equipment is considered technically infeasible for all exhaust points.

Wet Scrubber

A wet gas scrubber is an air pollution control device that removes $PM_{2.5}$ from stationary point sources waste streams. $PM_{2.5}$ is primarily removed through the impaction, diffusion, interception, and/or absorption of the pollutant onto droplets of liquid. Wet scrubbers have some advantages over ESPs and baghouses in that they are particularly useful in removing PM with the following characteristics:

- Sticky and/or hygroscopic materials;
- Combustible, corrosive or explosive materials;
- Particles that are difficult to remove in dry form;
- PM in the presence of soluble gases; and
- PM in gas stream with high moisture content.

This control technology has been operated successfully on the dry-end portions of paper machines at other P&G plants and the Box Elder paper machine uses this technology on the dry end with an estimated 95% control efficiency.[22]

Installation of a wet scrubber is not a practical method of control on the wet end due to the low and/or non-existent $PM_{2.5}$ emissions. However, it cannot be ruled out as technically infeasible; therefore, P&G has performed an economic feasibility analysis.

This control technology is not the appropriate choice for the process stack because of the high flow rate (250,000 acfm) and low concentration of emissions. Current wet scrubber designs can accommodate 100,000 acfm.[23] Additionally, adding a wet scrubber to the process stack would create backpressure in the operating room. This would require a complete redesign of the heat distribution through the paper machine as well as industrial hygiene concerns to employees. This would also require new infrastructure, building, and paper machine to meet the design requirements, and huge amounts of power to accommodate the large fans required due to back pressure concerns. As a result, a wet scrubber is technically infeasible for the wet and process stacks.

Cyclonic Separator

A cyclone separator (cyclone) operates on the principle of centrifugal separation. The exhaust enters the inlet and spirals around towards the outlet. As the particles proceed through the cyclone, the heavier material hits the outside wall and drops out where it is collected. The cleaned gas escapes through an inner tube. Cyclones are generally used to reduce dust loading and collect large particles.

P&G is currently operating this technology on the wet end of the paper machine process and the under dryer stack with an estimated 85% control efficiency. The Venturi scrubber has a higher control efficiency than the cyclonic separator and can handle high moisture streams. However, the primary purpose of the cyclonic separator is to capture the excess moisture contained in the exhaust stream to prevent excess moisture in the paper machine room which may affect product and personnel hygiene. The Venturi scrubber could be used as an add on control technology to the end of the cyclonic separator, but the exhaust stream of the cyclonic separator has particulate concentrations lower than a wet scrubber can practically control.

A cyclonic separator would not be effective in the capture and removal of $PM_{2.5}$ for the process stack. As previously described, emissions associated with the process stack are due to fugitives from paper processing and incomplete combustion byproducts of natural gas, with a large percentage being fine particulate and condensable. In general, cyclones are only able to capture between zero and 10% for a conventional single cyclone.[24] A cyclone is considered technically infeasible for the process stack. Additionally, the same back pressure concerns noted for a Baghouse/Fabric Filter section would apply if adding any add-on control technology to the process stack. The dry end is currently using add-on control technology with a greater efficiency than the cyclone. The wet end and under dry stacks are equipped with cyclone technology.

Dry Electrostatic Precipitator

A dry electrostatic precipitator (ESP) is a particle control device that uses electrical forces to move the particles out of the gas stream onto collector plates. This process is accomplished by the charging of particles in the gas

---

[22] DAQE-AN141070009-16 Condition II.A.2.

[23] Air Pollution Control Cost Manual, EPA-452/B-02-001, Section 6, Chapter 2.

[24] Air Pollution Control Technology Fact Sheet Cyclones, EPA-452/F-03-005.

stream using positively or negatively charged electrodes. The particles are then collected as they are attracted to oppositely opposed electrodes. Once the particles are collected on the plates, they are removed by knocking them loose from the plates, allowing the collected layer of particles to fall down into a hopper. Dry ESPs are used to capture coarse particles at high concentrations. Small particles at low concentrations are not effectively collected by an ESP.

As previously discussed in the fabric filter section, considering the low concentration, high moisture content and high flowrate of the process stack, this equipment is considered technically infeasible.[25] This technology is considered technically infeasible for the wet end and under dryer stack as dry ESPs are not recommended for removing moist particles.[26] This technology is technically infeasible for the dry end, similar to the baghouse, in that fire hazard is present with accumulation of combustible material and not very conductive.[27] Additionally, and relevant to all exhaust points, these units rely on consistent and conductive exhaust.[28] Changing between paper towel product and tissue paper is expected to cause upsets to this control technology.

Good Combustion Practices and Use of Clean Burning Fuels

Good combustion practices were previously addressed in the context of NO_X controls above. The Box Elder Plant is already using natural gas, which has lower $PM_{2.5}$ emissions than other commercially available combustion fuels.

Paper Machine $PM_{2.5}$ Step 3 - Rank Remaining Control Technologies by Control Effectiveness

As discussed in Step 2, the wet end and under dryer stack are controlled by cyclonic separators. The wet scrubber which controls the dry end is a more efficient control technology. This wet scrubber technology would be impractical for the wet end and under dryer stack; however, as detailed in Step 2, it is further evaluated for economic feasibility.

Paper Machine $PM_{2.5}$ Step 4 - Evaluate Most Effective Controls and Document Results

Baghouse and electrostatic precipitator technology have been eliminated as technically infeasible options. A wet scrubber is currently in use to control filterable particulate on the dry end of the paper machine. A cyclonic separator is in use on the wet end and under dryer vents. Ranking of the following is for the wet end and dry end because they are technically feasible control technologies, but remain not practical. Ranking is as follows:

- Wet scrubber + Cyclonic separator – 90% control efficiency
- Cyclonic Separator Alone – 85% Efficiency

An economic analysis was performed for a combination wet scrubber + cyclonic separator for potential installation on the wet end stack to reduce emissions to 0.48 tpy. The cost per ton of $PM_{2.5}$ removed calculated for a wet scrubber is $165,250. The full cost analysis and basis for calculations is included in 6.Appendix A.

[25] Air Pollution Control Technology Fact Sheet Dry ESP, EPA-452/F-03-027.

[26] Ibid.

[27] Ibid.

[28] Ibid.

Paper Machine $PM_{2.5}$ Step 5 - Select BACT

The following technologies currently installed have been selected as BACT.

Wet End and Under Dryer Stack - Cyclonic Separator

The wet end and under dry stack use a cyclonic separator for PM control. The wet end stack achieves an emission rate of 1.10 pounds per hour (lb/hr) (4.82 tpy). The under dry stack achieves an emission rate of 1.20 lb/hr (5.26 tpy).

Process Stack

The process stack uses good combustion practices and clean burning fuels as BACT. The process stack achieves an emission rate of 17.95 lbs/hr.

Dry End

The dry end uses a Venturi scrubber as BACT with an emission limit of 1.25 lbs/hr (5.48 tpy).

Paper Machine $PM_{2.5}$ Most Stringent Measures

The MSM would be identical to BACT as no other facility has been found to use a paper machine with the same high level of versatility as is required at the Box Elder Plant.

3.2.3. VOC

Raw material for the paper machine include pulp, water, and additives. The additives and pulp for the paper cause VOC fugitive emissions; approximately 80% of the emissions associated with the paper machine can be attributed to the additives and pulp. Fugitive emissions are difficult to capture for control via add-on control technologies. In general, add-on control techniques for paper machine vents are considered impractical because of the high moisture content, high volume of air, and low concentrations. Additional VOC emissions are generated from combustion of natural gas in Burner #1, Burner #2, and make-up air units. For consideration of controls, it is assumed combustion emissions will be emitted from the process stack. Note that there is a concern regarding system back pressure created by addition of any VOC control technologies to the process stack, similar to the determination made for $PM_{2.5}$ and NO_X emission controls.

Paper Machine VOC Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Kraft Paper Machines and Other Non-Kraft Operations;[29]
- EPA's Air Pollution Technology Fact Sheets; and
- Permits available online.

Paper Machine VOC Step 2 - Eliminate Technically Infeasible Options

To demonstrate a complete analysis, P&G has evaluated the follow technologies for VOC.

[29] Database accessed February 27, 2017.

Pollutant	Control Technologies
VOC	Regenerative Thermal Oxidizer (RTO) Simple Thermal Oxidizer (TO) Condenser Biofilter Low VOC Additives and Good Operating Practices Good Combustion Practices and Use of Clean Burning Fuel

Regenerative Thermal Oxidizer

A RTO is equipped with ceramic heat recovery media (stoneware) that has large surface area for heat transfer and can be stable to 2,300°F. Operating temperatures of the RTO system typically range from 1,500°F to 1,800°F with a retention time of approximately one second. The combustion chamber of the RTO is surrounded by multiple integral heat recovery chambers, each of which sequentially switches back and forth from being a predryer to a heat recovery chamber. In this fashion, energy is absorbed from the gas exhausted from the unit and stored in the heat exchange media to preheat the next cycle of incoming gas.

The process stack exhaust stream associated with the paper machine is well below 1,500°F. Additionally, the process stack has high moisture content, high volume of air, and low VOC concentrations. Fugitive emission collection from the room would be difficult as it's such a large area, roughly the size of a football field. Therefore, this technology is considered technically infeasible.

Simple Thermal Oxidizer

In a simple TO or afterburner, the flue gas is reheated in the presence of sufficient oxygen to oxidize the CO present in the flue gas. A typical TO is a flare and is not equipped with any heat recovery device. As previously discussed in the RTO section, with the relatively high moisture content, high volume of air, low emission concentrations, and difficulty in capturing fugitive emissions for control, this technology is considered technically infeasible.

Condenser

A condenser is used to cool an emission stream with organic vapors to change the vapors to a liquid. This liquid may be recovered, refined, and reused to prevent release to the atmosphere. This technology is most typically used within the oil and gas industry to recover saleable product and/or dry cleaning. The condenser provides the most effective control for process streams having high emission concentrations and low flow rate. The condenser is less effective in controlling on process streams having low emission concentrations and high flow rates.

Exhaust streams associated with natural gas combustion have low emission concentrations and high flow rates. Additionally, collecting fugitive VOC emissions would require additional air flow to capture the emissions, creating high flow rates. Therefore, this technology is considered technically infeasible.

Biofilter

Biofilters use microbes to consume pollutants from a contaminated stream. Microbes need the right pollutant concentration, temperature, humidity, and pH to work properly. Typically, the temperature of the bio reactor system should be between 60°F and 105°F, with humidity between 40% and 60% and a neutral pH (7). Collecting fugitive VOC emissions would require additional air flow to capture the emissions and would also require the addition of a humidifier. The amount of additional air flow is considered impractical for a room of this size. This technology is considered technically infeasible.

Low VOC Additives and Good Operating Practices

With regard to additives, P&G is proposing to utilize low-end VOC formulations. P&G has conducted extensive studies for substitute additives. These studies indicate that the VOC content associated with the proposed additive(s) cannot be lowered any further without compromising product quality. Furthermore, P&G is not aware of such technologies being used at similar mills. P&G maintains that it is using raw materials which are used at similar mills and is committed to research suitable additives with lower VOC contents which will not adversely impact their process or product.

Good Combustion Practices and Use of Clean Burning Fuels

Good combustion practices for VOCs include adequate fuel residence times, proper fuel-air mixing, and temperature control. As it is imperative for process controls, the Box Elder Plant will maintain good combustion practices to optimize their process.

Paper Machine VOC Step 3 - Rank Remaining Control Technologies by Control Effectiveness

All add-on control technologies have been eliminated due to the fugitive nature of a majority of VOC emissions and the exhaust stack characteristics of the process stack.

Paper Machine VOC Step 4 - Evaluate Most Effective Controls and Document Results

Good combustion practices and use of clean burning fuels is the available control technology for combustion VOC emissions. Low VOC additives and good operating practices are the available control technologies for the fugitive VOC emissions.

Paper Machine VOC 5 - Select BACT

Good combustion practices and use of clean burning fuel is selected as BACT for combustion sources.

Low VOC additives and good operating practices are selected as BACT for emissions due to the additives and pulp.

Paper Machine VOC Most Stringent Measures

The MSM is identical to BACT as no other facility has been found to use a paper machine with the same high level of versatility as is required at the Box Elder Plant.

3.2.4. SO_2

SO_2 emissions from the Paper Machine result from oxidation of fuel sulfur in Burner #1, Burner #2, and make-up air units.

Paper Machine SO_2 Step 1 - Identify All Available Control Technologies

There are two primary mechanisms to reduce SO_2 emissions from combustion sources which are: (1) reduce the amount of sulfur in the fuel, and (2) remove the sulfur from the exhaust gases with a post-combustion control device such as flue gas desulfurization utilizing wet scrubbers or dry scrubbers.

The Box Elder Plant will be using pipeline-quality natural gas as the primary fuel which has a low sulfur content. The use of a fuel containing low sulfur content is considered a control technology.

Two main types of SO_2 post-combustion control technologies, wet and dry scrubbing, were identified to reduce SO_2 in the exhaust gas.

Paper Machine SO_2 Step 2 - Eliminate Technically Infeasible Control Options

The requirement for low-sulfur natural gas is a control technique that has been achieved in practice and is technically feasible and cost-effective and will be further considered for BACT. Post-combustion devices such as wet or dry scrubbers are typically installed on coal-fired power plants that burn fuels with much higher sulfur content. The SO_2 concentrations in the natural gas combustion exhaust gases from the paper machine are too low for scrubbing technologies to work effectively or to be technically feasible. These control technologies require much higher sulfur concentrations in the exhaust gases to be feasible as a control technology. Thus, post-combustion SO_2 control devices, such as wet and dry scrubbing have not been used in practice on the process stack or wet end stack of a paper machine. Since these controls are not technically feasible, they have been eliminated from further consideration for the process stack or wet end stack. A wet scrubber has been installed on the dry end stack; however, its primary purpose is for particulate removal. Therefore, it has been eliminated for further consideration as an SO_2 control device.

Paper Machine SO_2 Steps 3-5

The use of pipeline-quality natural gas is the only feasible SO_2 control technology for the paper machine to control SO_2. There is no adverse energy, environmental or cost impact associated with the use of these control technologies. Thus, no further analysis is required under EPA's top-down BACT approach. SO_2 emissions associated with the paper machine are due to natural gas combustion. Emissions associated with this process are less than 1 tpy. Therefore, good combustion practices and the use of pipeline-quality natural gas as the primary fuel is considered BACT.

Paper Machine SO_2 Most Stringent Measures

The most stringent measures are identical to BACT at the Box Elder Plant.

3.2.1. Ammonia (NH_3)

P&G found ammonia emission factors for uncontrolled boilers on EPA's WebFIRE database.[30] The emission factors cited within this document are from the 1994 version of EPA's AP-42 Chapter 1.4. In 1998, this chapter was updated and ammonia emissions were removed from the list of emission factors associated with external combustion sources fueled by natural gas. As such, P&G assumes there are minimal ammonia emissions associated with the paper machine and has not considered these emissions further for BACT.

[30] Database accessed April 12, 2017.

3.3. BOILERS

The Box Elder Plant currently has two existing boilers (referred to as the Paper Machine Boilers) which are fire tube boilers. The Paper Making boilers have a heat input of 60.243 MMBtu/hr, each and are equipped with low NO_X burners and flue gas recirculation. The purpose of the Paper Making boilers is to control steam in the Paper Machine. Different paper products require a large difference in steam input, which equates to operating the boilers at a high steam load for one product type and a low steam load for another. A boiler's range in load operability is described by the turn down parameter.[31] The required turn down affects the emissions and exhaust stream and has been considered in the BACT analysis. Additionally, the rate of adjusting the boiler's steam load is significant for product changeover to minimize waste. Adjusting the steam load affects the boiler's exhaust parameters.

Two additional boilers have been permitted for installation (referred to as Utility Boilers) to supply steam for Project Maple but have not been installed to date. These Utility Boilers have a heat input of 50 MMBtu/hr, each, and are equipped with ultra-low NO_X burners.

Startup and shutdown of the boilers is used to bring the boiler up to the desired temperature for steam load. The Box Elder plant does not anticipate higher emissions during startup and shutdown, and minimizes time spent under these operational conditions.

3.3.1. NO_X

The NO_X that will be formed during combustion is from two major mechanisms: thermal NO_X and fuel NO_X. Since natural gas is relatively free of fuel-bound nitrogen, the contribution of this second mechanism to the formation of NO_X emissions in natural gas-fired equipment is minimal, leaving thermal NO_X as the main source of NO_X emissions. Thermal NO_X formation is a function of residence time, oxygen level, and flame temperature, and can be minimized by controlling these elements in the design of the combustion equipment.

The Paper Machine Boilers are permitted for an emission rate of 45 parts per million (ppm) NO_X at 3% O_2 and 3.3 pounds per hour (lbs/hr), each. The Utility Boilers are permitted for an emission rate of 10 ppm NO_X at 3% O_2 and 1.80 lb/hr, each.

Boilers NO_X Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Natural Gas External Combustion Units (process type 13.31);[32]
- EPA's Air Pollution Technology Fact Sheets;
- EPA's CATC Alternative Control Techniques Document – NO_X Emissions from Utility Boilers;
- NESHAP DDDDD – Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters;
- NESHAP JJJJJJ – Industrial, Commercial, and Institutional Boilers at Area Sources;
- South Coast Air Quality Management District (SCAQMD) LAER/BACT Determinations;
- San Joaquin Valley Air Pollution Control District (SJVAPCD) BACT Clearinghouse;
- Bay Area Air Quality Management District (BAAQMD) BACT/TBACT Workbook; and

[31] Turn down is typically expressed as a number or ratio. For example, a boiler that can operate down to 25% of full load could be said to have a turn down value of 4 or a turn down ratio of 4:1. This boiler is able achieves a turn down ratio of 7:1, but is designed for a turn down ratio of 10:1.

[32] Database accessed February 27, 2017.

- Permits available online.

Boilers NO_X Step 2 - Eliminate Technically Infeasible Options

To demonstrate a complete analysis, P&G has evaluated the following technologies, including both replacement burners and add-on controls.

Pollutant	Control Technologies
NO_X	Low NO_X Burners
	Ultra-Low NO_X Burners
	Flue Gas Recirculation
	Selective Non-Catalytic Reduction
	Selective Catalytic Reduction
	Good Combustion Practices

Low NO_X Burner

LNB technology uses advanced burner design to reduce NO_X formation through the restriction of oxygen, flame temperature, and/or residence time. There are two general types of LNBs: staged fuel and staged air burners. In a stage fuel LNB, the combustion zone is separated into two regions. The first region is a lean combustion region where a fraction of the fuel is supplied with the total quantity of combustion air. Combustion in this zone takes place at substantially lower temperatures than a standard burner. In the second combustion region, the remaining fuel is injected and combusted with left over oxygen from the first region. A staged air burner begins with full fuel but only partial combustion air, and then adds the remaining combustion air in the second combustion region. These techniques reduce the formation of thermal NO_X. This technology is listed in the RBLC search as a technically feasible control technology. BAAQMD lists typical technology for NO_X using a combination of SCR, LNB, and FGR. SCAQMD used LNB as the BACT determined control methodology for the University of California Irvine Medical Center boiler rated at 48.6 MMBtu/hr in 1999. Although this source is documented in the RBLC it is not a boilers required to adjust steam load for a process. Currently, the Paper Machine Boilers use this technology in conjunction with FGR.

Ultra Low NO_X Burner

ULNB technology uses internal FGR which involves recirculating the hot O_2 depleted flue gas from the heater into the combustion zone using burner design features and fuel staging to reduce NO_X. An ULNB most commonly uses an internal induced draft to reach the desired emission limitations. Due to this induced draft, an ULNB cannot handle a quick change in load to achieve the desired operational flexibility necessary for the varied products and change overs in the paper making operation. This technology is listed in the RBLC search as a technically feasible control technology. BAAQMD lists typical technology for BACT for NO_X using a combination of ULNB and FGR. SCAQMD used LNB plus FGR as the BACT determined control methodology for the Los Angeles County Internal Services Department boiler rated at 39 MMBtu/hr in 2004. Currently, the Utility Boilers are proposing to use this technology to control NO_X. An ULNB can achieve an emission rate of approximately 9 ppm or 0.011 lb/MMBtu when used in conjunction with FGR. P&G reviewed potential replacement burner options with an emission rate of 9 ppm NO_X or less that would also meet the same process demands as the current Paper Machine Boilers. Due to the different types of products from the paper machines, the Paper Machine Boilers must have ample turndown capabilities to adjust the amount of steam. Due to the turn down requirements, P&G was unable to find a burner that would meet this requirement at a lower emission rate.

Flue Gas Recirculation

FGR is frequently used with both LNB and ULNB burners. FGR involves the recycling of post-combustion air into the air-fuel mixture to reduce the available oxygen and help cool the burner flame. External FGR requires the use of ductwork to route a portion of the flue gas in the stack back to the burner windbox. FGR can be either forced draft (where hot side fans are used) or induced draft. This technology is listed in the RBLC search as technically feasible and is paired with LNB for the BACT determined control technology. As previously discussed, both SCAQMD and BAAQMD have combined this technology with others to determine BACT. Currently, the Paper Machine Boilers use this technology in conjunction with LNBs.

Selective Catalytic Reduction

SCR has been applied to stationary source, fossil fuel-fired, combustion units for emission control since the early 1970s. It has been applied to large (>250 MMBtu/hr) utility and industrial boilers, process heaters, and combined cycle gas turbines. There has been limited application of SCR to other combustion devices and processes such as simple cycle gas turbines, stationary reciprocating internal combustion engines, nitric acid plants, and steel mill annealing furnaces. SCR can be applied as a stand-alone NO_X control or with other technologies such as combustion controls. The reagent reacts selectively with the flue gas NO_X within a specific temperature range and in the presence of the catalyst and oxygen to reduce the NO_X into molecular nitrogen (N_2) and water vapor (H_2O).[33] The optimum operating temperature is dependent on the type of catalyst and the flue gas composition. Generally, the optimum temperature ranges from 480°F to 800°F.[34] In practice, SCR systems operate at efficiencies in the range of 70% to 90%.[35] However, this can be affected by changes in the boiler.

SCR is listed in the RBLC search as technically feasible. In some cases, this control technology is listed in combination with LNB and FGR. As previously mentioned, BAAQMD defines BACT as the combination of SCR, LNB, and FGR.

There are a few other technical considerations with regards to use of an SCR on the boilers. The need for turndown or modulation of the Paper Machine Boilers load will make it difficult to maintain the suggested removal efficiencies in practice due to the inconsistent exhaust stream. In consideration of both the Paper Machine Boilers and Utility Boilers, adding an SCR system will result in ammonia emissions from the ammonia slip associated with the SCR catalyst. The exhaust stream will require additional temperature from the exhaust stream to meet the SCR operating temperature requirements (minimum of 480°F). This increase in exhaust temperature would require an additional combustion device, also increasing NO_X, SO_2, and $PM_{2.5}$ emissions. Even with the increase in ammonia, $PM_{2.5}$, and SO_2 emissions, P&G has considered this technology to be technically feasible for the Utility Boilers and further evaluated the economic feasibility of this technology as detailed in Step 4. Due to the necessary turndown requirements of the Paper Machine Boilers, an SCR is considered technically infeasible for these units.

---

33 Ibid.

34 OAQPS, *EPA Air Pollution Control Cost Manual*, Sixth Edition, EPA/424/B-02-001 (http://www.epa.gov/ttn/catc/dir1/c_allchs.pdf); January 2002

35 OAQPS, *EPA Air Pollution Control Cost Manual*, Sixth Edition, EPA/424/B-02-001 (http://www.epa.gov/ttn/catc/dir1/c_allchs.pdf); January 2002

Good Combustion Practices

The use of good combustion practices usually include the following components: (1) proper fuel mixing in the combustion zone; (2) high temperatures and low oxygen levels in primary zone; (3) Overall excess oxygen levels high enough to complete combustion while maximizing boiler efficiency, and (4) sufficient residence time to complete combustion. Good combustion practices are accomplished through boiler design as it relates to time, temperature, and turbulence, and boiler operation (which control excess oxygen levels).

Boilers NO_X Step 3 - Rank Remaining Control Technologies by Control Effectiveness

Based on an RBLC search the following technologies are currently being used for boilers between 25 MMBtu/hr and 100 MMBtu/hr. These are ranked based on which technology can achieve the lowest emission rate. Note, an ULNB has not been proven with an SCR based on RBLC review.

1. LNB + FGR (Paper Machine Boiler Current Technology) = 45 ppm or 0.054 lb/MMBtu[36]

Boilers NO_X Step 4 - Evaluate Most Effective Controls and Document Results

Paper Machine Boilers

These boilers are currently using a LNB and FGR to achieve an emission rate of 45 ppm at 3% oxygen (O_2). All other control technologies are considered technically infeasible for these units. The RBLC searches and other databases indicate that LNB + FGR have achieved lower emission rates than guaranteed for these Paper Machine Boilers. Although based on P&G's review of available technology for these boilers that require rapid and large turndown capabilities for changes in steam load, no technology is available with lower exhaust concentrations.

Utility Boilers

The Utility Boilers are included with the Project Maple approval order modification and have not been installed yet. They are currently permitted for an emission rate of 10 ppm. To achieve the emission rate of 9 ppm, the possibility of a SCR installation has been reviewed. An SCR in combination with an ULNB has not been proven as detailed within the RBLC search. However, assuming the SCR is installed with a 70% control efficiency, it would cost $165,250/ton of NO_X removed.[37] Calculations are shown in Appendix A and are based on generally provided capital costs from EPA's Air Pollution CCM. The cost per ton of NO_X removed is beyond acceptable cost control effectiveness levels; therefore, this control technology is considered economically infeasible for the unit.

---

[36] Current technology on the Paper Machine Boilers. Note other facilities have shown lower emission rates for this technology. P&G would require a new burner to achieve the desired emission rate.

[37] An efficiency of 70% was assumed, given that SCR can generally operate between 70% and 90% control efficiency. P&G has not obtained a vendor guarantee for this level of control for a unit with such a low concentration exhaust stream and would require consultation with a vendor prior to installation of this equipment.

Boilers NO_x Step 5 - Select BACT

Paper Machine Boilers

P&G has selected the currently installed control technology as BACT for the Paper Machine Boilers. The boilers have an emission rate of 45 ppm (0.054 lb/MMBtu) using a LNB and between 12 and 20% FGR.

Table 3-2. BACT Summary for Paper Machine Boilers

Control Technologies	Controlled Emission Rate (lb/MMBtu)	Technically Feasible?	Economic Feasibility ($/ton removal)	BACT
LNB + SCR	0.011	No	--	
ULNB	0.012	No	--	
LNB + FGR (Current Technology)	0.054	Yes	--[a]	Yes
Good Combustion Practice	N/A	Yes		Yes

a. This is the current technology used on the system, economic feasibility is not required. Note other facilities have shown lower emission rates for this technology. P&G would require a new burner to achieve the desired emission rate.

Utility Boilers

P&G has selected the currently installed control technology as BACT for the Utility Boilers. The boilers have an emission rate of 10 ppm (0.012 lb/MMBtu) using an ULNB. Table 3-3 summarizes the BACT review.

Table 3-3. BACT Summary for Utility Boilers

Control Technologies	Controlled Emission Rate (lb/MMBtu)	Technically Feasible?	Economic Feasibility ($/ton removal)	BACT
ULNB + SCR	0.008	Yes	165,250	
LNB + FGR	0.011	Yes	--[a]	
ULNB + FGR	0.011	Yes	--[a]	
ULNB (Current Technology)	0.012	Yes	--[b]	Yes
Good Combustion Practice	N/A	Yes		Yes

a. LNB + FGR and ULNB + FGR were not considered for economic feasibility because the ULNB alone can achieve the desired emission rate. Based on review this is the least expensive option to upgrade the current boiler to the designed emission rate.
b. This is the current technology used on the system, economic feasibility is not required. Note other facilities have shown lower emission rates for this technology. P&G would require a new burner to achieve the desired emission rate.

Boilers NO_X Most Stringent Measures

MSM for all boilers is identical to BACT for the boilers.

3.3.2. $PM_{2.5}$

According to EPA's AP-42, Section 1.4, because natural gas is a gaseous fuel, filterable PM emissions are typically low. Particulate matter from natural gas combustion has been estimated to be less than one micrometer in size and has filterable and condensable fractions. Particulate matter in natural gas combustion is usually larger molecular weight hydrocarbons that are not fully combusted. Increased particulate matter emissions can result from poor air/fuel mixing or maintenance problems. For this analysis P&G is evaluating filterable $PM_{2.5}$ only. The condensable fraction is represented with the other precursors (NO_X, SO_2, VOCs, and NH_3). The Paper Machine Boilers are permitted for an emission rate of 0.9 lbs/hr, each. The Utility Boilers are permitted for an emission rate of 0.74 lb/hr, each.

Boiler $PM_{2.5}$ Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Natural Gas External Combustion Units (process type 13.31);[38]
- EPA's Air Pollution Technology Fact Sheets;
- EPA's CATC Alternative Control Techniques Document – NOX Emissions from Utility Boilers;

[38] Database accessed February 27, 2017.

- NESHAP DDDDD – Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters;
- NESHAP JJJJJJ – Industrial, Commercial, and Institutional Boilers at Area Sources;
- SCAQMD LAER/BACT Determinations;
- SJVAPCD BACT Clearinghouse;
- BAAQMD BACT/TBACT Workbook; and
- Permits available online.

To demonstrate a complete analysis, P&G has evaluated the follow technologies for $PM_{2.5}$.

Polluant	Control Technologies
$PM_{2.5}$	Fabric Filter (Dust Collector)
	Wet Scrubber
	Dry Electrostatic Precipitator (ESP)
	Cyclone

Boiler $PM_{2.5}$ Step 2 - Eliminate Technically Infeasible Options

Wet Scrubber

A wet gas scrubber is an air pollution control device that removes PM and acid gases from waste streams from stationary point sources. PM and acid gases are primarily removed through the impaction, diffusion, interception and/or absorption of the pollutant onto droplets of liquid. Wet scrubbers have an advantage over ESPs and baghouses in that they are particularly useful in removing PM with the following characteristics:

- Sticky and/or hygroscopic materials;
- Combustible, corrosive or explosive materials;
- Particles that are difficult to remove in dry form;
- PM in the presence of soluble gases; and
- PM in gas stream with high moisture content.

However, considering the low concentration of $PM_{2.5}$ and the small size of particulate, a wet scrubber is considered technically infeasible for a boiler firing natural gas.

Electrostatic Precipitator

An ESP is a particle control device that uses electrical forces to move the particles out of the gas stream onto collector plates. This process is accomplished by the charging of particles in the gas stream using positively or negatively charged electrodes. The particles are then collected as they are attracted to oppositely opposed electrodes. Once the particles are collected on the plates, they are removed by knocking them loose from the plates, allowing the collected layer of particles to fall down into a hopper. ESPs are used to capture coarse particles at high concentrations. Small particles at low concentrations are not effectively collected by an ESP. As the technology is for the combustion of natural gas, the concentration of $PM_{2.5}$ is low and small in size. As such, an ESP is considered technically infeasible for a boiler firing natural gas.

Fabric Filter

A fabric filter unit (or baghouse) consists of one or more compartments containing rows of fabric bags. Particle-laden gases pass along the surface of the bags then through the fabric. Particles are retained on the upstream face of the bags and the cleaned gas stream is vented to the atmosphere. Fabric filters collect particles with sizes ranging from submicron to several hundred microns in diameter. Fabric filters are used for medium and low gas flow streams with high particulate concentrations. As the boilers combust of natural gas, concentration of $PM_{2.5}$ is low and small in size. As such, a fabric filter is considered technically infeasible for a boiler firing natural gas.

Good Combustion Practices and Use of Clean Burning Fuels

Good combustion practices were previously addressed in the NO_X control device evaluation for boilers above.

Boiler $PM_{2.5}$ Steps 3-5 - Select BACT

Steps 3 and 4 are not necessary because all control technologies that are not currently implemented at the Box Elder facility have been determined technically infeasible in Step 2.

Paper Machine Boilers

The Paper Machine Boilers have a mass emission rate of 0.45 lbs/hr, each. No control technology is technically feasible, therefore this emission rate and the use of good combustion practices and natural gas is considered BACT.

Utility Boilers

The Utility Boilers have a mass emission rate of 0.37 lbs/hr, each. No control technology is technically feasible; therefore, this emission rate and the use of good combustion practices and natural gas is considered BACT.

Boiler $PM_{2.5}$ Most Stringent Measures

The most stringent measures are identical to BACT as no control technology is technically feasible for these units.

3.3.3. VOC

Boiler VOC Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Natural Gas External Combustion Units (process type 13.31);[39]
- EPA's Air Pollution Technology Fact Sheets;
- EPA's CATC Alternative Control Techniques Document – NO_X Emissions from Utility Boilers;
- NESHAP DDDDD – Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters;
- NESHAP JJJJJJ – Industrial, Commercial, and Institutional Boilers at Area Sources;
- SCAQMD LAER/BACT Determinations;
- SJVAPCD BACT Clearinghouse;
- BAAQMD BACT/TBACT Workbook; and
- Permits available online.

---

[39] Database accessed February 27, 2017.

To demonstrate a complete analysis, P&G has evaluated the following technologies for VOCs.

Pollutant	Control Technologies
VOCs	Thermal Oxidizer/Afterburner
	Regenerative Thermal Oxidizer (RTO)
	Catalytic Oxidation
	Good Combustion Practices

Boiler VOC Step 2 - Eliminate Technically Infeasible Options

Simple Thermal Oxidizer or Afterburner

In a simple TO or afterburner, the flue gas exiting the boiler is reheated in the presence of sufficient oxygen to oxidize the VOC present in the flue gas. A typical TO is a flare and is not equipped with any heat recovery device. A TO will require additional fuel to heat the gas stream starting from 280°F to at least 1,600°F and which will generate additional emissions. Additionally, a TO is no different from the combustion chamber of the boiler. Therefore, there would be little expected reduction in VOC with an increase in other combustion pollutants for the required heating of the exhaust stream. Therefore, the TO is considered technically infeasible.

Regenerative Thermal Oxidizer

A RTO is equipped with ceramic heat recovery media (stoneware) that has large surface area for heat transfer and can be stable to 2,300°F. Operating temperatures of the RTO system typically range from 1,500°F to 1,800°F with a retention time of approximately one second. The combustion chamber of the RTO is surrounded by multiple integral heat recovery chambers, each of which sequentially switches back and forth from being a preheater to a heat recovery chamber. In this fashion, energy is absorbed from the gas exhausted from the unit and stored in the heat exchange media to preheat the next cycle of incoming gas. An RTO will require additional fuel to heat the gas stream from 280°F to at least 1,500°F which will generate additional emissions; therefore, the RTO is considered technically infeasible.

Catalytic Oxidation

Catalytic oxidation allows complete oxidation to take place at a faster rate and a lower temperature than is possible with thermal oxidation. Oxidation efficiency depends on exhaust flow rate and composition. Residence time required for oxidation to take place at the active sites of the catalyst may not be achieved if exhaust flow rates exceed design specifications. Also, sulfur and other compounds may foul the catalyst, leading to decreased efficiency. In a typical catalytic oxidizer, the gas stream is passed through a flame area and then through a catalyst bed at a velocity in the range of 10 to 30 feet per second (fps). Catalytic oxidizers typically operate at a narrow temperature range of approximately 600°F to 1100°F. A catalytic oxidizer will require additional fuel to heat the gas stream from 280°F to at least 600°F and which will generate additional emissions; therefore, the catalytic oxidation is considered technically infeasible. This is listed in RBLC for a single source with higher emission rates than others using good operating practices.

Good Combustion Practices and Use of Clean Burning Fuels

Good combustion practices for VOCs include adequate fuel residence times, proper fuel-air mixing, and temperature control. As it is imperative for process controls, the Box Elder Plant will maintain combustion optimal to their process. Most results in RBLC determined that this was sufficient controls for VOC. Additionally, BAAQMD and SCAQMD did not provide BACT determinations for VOC.

Boiler VOC Step 3-5 - Select BACT

Steps 3 and 4 are not necessary since all control technologies not implemented at the Box Elder facility have been determined technically infeasible in Step 2 and/or currently implemented technologies yield lower emission rates. BACT for the boilers is good combustion practices and the use of clean burning fuel.

Boiler VOC Most Stringent Measures

The most stringent measures are identical to BACT as no control technology which would yield lower emission rates than currently achieved is technically feasible for these units.

3.3.4. SO_2

SO_2 emissions associated with the boilers are due to natural gas combustion. Emissions associated with all boilers are less than 1 tpy. Therefore, P&G is proposing good combustion practices and use of natural gas as BACT.

Boilers SO_2 Step 1 - Identify All Available Control Technologies

There are two primary mechanisms to reduce SO_2 emissions from combustion sources which are: (1) reduce the amount of sulfur in the fuel, and (2) remove the sulfur from the exhaust gases with post-combustion control device such as flue gas desulfurization utilizing wet scrubbers or dry scrubbers.

The Box Elder Plant will be using pipeline-quality natural gas as the primary fuel which has a low sulfur content. The use of a fuel containing low sulfur content is considered a control technology.

Two main types of SO_2 post-combustion control technologies, wet and dry scrubbing, were identified to reduce SO_2 in the exhaust gas.

Boilers SO_2 Step 2 - Eliminate Technically Infeasible Control Options

The requirement for low-sulfur natural gas is a control technique that has been achieved in practice and is technically feasible and cost-effective and will be further considered for BACT. Post-combustion devices such as wet or dry scrubbers are typically installed on coal-fired power plants that burn fuels with much higher sulfur contents. The SO_2 concentrations in the natural gas combustion exhaust gases from the boilers are too low for scrubbing technologies to work effectively or to be technically feasible and cost effective. These control technologies require much higher sulfur concentrations in the exhaust gases to be feasible as a control technology. Thus, post-combustion SO_2 control devices, such as wet and dry scrubbing have not been achieved in practice on natural gas boilers. Since these controls are not technically feasible, they have been eliminated from further consideration for the boilers.

Boilers SO_2 Steps 3-5

The use of pipeline-quality natural gas is the only feasible SO_2 control technology for the boilers to control SO_2. There is no adverse energy, environmental or cost impact associated with the use of these control technologies. Thus, no further analysis is required under EPA's top-down BACT approach. SO_2 emissions associated with the boilers are due to natural gas combustion. Emissions associated with this process are less than 1 tpy. Therefore, P&G is proposing good combustion practices and use pipeline-quality natural gas as the primary fuel is considered BACT.

Boiler SO_2 Most Stringent Measures

MSM is equivalent to BACT because no add-on SO_2 control technologies are available for these units.

3.3.5. Ammonia (NH_3)

P&G found ammonia emission factors for uncontrolled boilers on EPA's WebFIRE database.[40] The emission factors cited within this document are from the 1994 version of EPA's AP-42 Chapter 1.4. In 1998, this chapter was updated and ammonia emissions were removed from the list of emission factors associated with external combustion sources fueled by natural gas. As such, P&G assumes there are minimal ammonia emissions associated with the boilers and has not considered them further for BACT.

3.4. SOLID MATERIAL HANDLING

Processes that will generate particulate emissions from solid material handling include converting lines, Cleaning Article Manufacturing, and Assembled Paper Product A. Dry materials in each of these processes are involved in unloading, conveying, converting, and/or packaging. Further descriptions of each source are provided below.

In the converting room, paper rolls removed from the paper machine are unwound and converted into the final product using one of the three converting lines. The paper is rerolled onto cores, printed, and packaged according to specification. Finished products are sent to the distribution center for storage and/or shipping. Each converting line is equipped with a drum filter.[41] The converting air handing system dust generated during the production process. One inlet to the drum filter, stream A, collect material from the floor sweeps/CVC system and the air stream is pretreated with a cyclone unit to dropout large material. The other inlet stream, stream B, collects dust directly from the unit operations. Streams A and B pass through a mesh pre-separator filter to remove large particulate materials prior to passing through the drum filter. The system achieves >99.5% control efficiency of filterable PM_{10} and does not control condensable particulate.

Two manufacturing lines produce consumer article cleaning products, which were recently permitted in 2016 as BACT. In this process, substrate is unrolled (or manipulated) and scented raw materials and cleaners are added to the substrate for use as the final product. Once the cleaning articles are complete, they are sent to be packaged and then onto a warehouse for distribution. Particulate matter is produced from receiving, sizing, and handling during the substrate converting process. This process is currently controlled by a baghouse that controls to 0.01 gr/dscf.[42]

Each Assembled Paper Product line functions to assemble various raw materials into the finished product. Several raw materials are unwound at points along the assembly process. In addition, some raw materials are de-bulked in an offline process and delivered via air to the lines. Particulate is captured during the de-bulking of

---

[40] Database accessed April 12, 2017.

[41] Permit Unit II.A.4 of DAQE-AN141070009-16.

[42] Permit Unit II.A.6 of DAQE-AN141070009-16.

raw materials, the delivery of raw materials, and from the cutting operations on the line. This process is equipped with drum filters and baghouses, which provide control efficiencies of 99% or more for particulate emissions, depending on the configuration and filter types associated with each individual drum filter and baghouse.[43]

3.4.1. $PM_{2.5}$

Fugitive particulate matter is emitted during the processing of the paper. This section addresses filterable $PM_{2.5}$ only.

Solid Material Handling $PM_{2.5}$ Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Other Fugitive Dust Sources (process type 99.190);[44] and
- EPA's Air Pollution Technology Fact Sheets.

Solid Material Handling $PM_{2.5}$ Step 2 - Eliminate Technically Infeasible Options

Baghouse

Baghouses remove particulates by collecting particulates on the filter bag as the exhaust stream passes through the baghouse. Baghouses typically cannot withstand high exhaust temperatures (greater than 500 °F). Fabric filer technology is a well-established particulate control technology that has historically been established as BACT. Baghouses have been shown to obtain a particulate collection efficiency up to 99.5% for PM_{10}, and up to 99% capture for $PM_{2.5}$.

Wet Electrostatic Precipitator

As part of this analysis, the possibility of using a Wet Electrostatic Precipitator (ESP) was also reviewed. Wet ESP technology removes particulates by electrically charging the particles and collecting the charged particles on plates. The collected particulate is washed off the plates and collected in hoppers at the bottom of the ESP. High efficiency ESPs have been shown to achieve control of particulates up to 99.5% for PM_{10}, and up to 95% capture for $PM_{2.5}$.

The Box Elder Plant anticipates systematic failure of an ESP due to the presence of small consumer fiber filaments when sizing the substrate for the Cleaning Article Manufacturing and absorbency materials for Assembled Paper Product A. Specifically, the very fine filaments in the process gas stream would likely adhere to the plates on the ESP. Based on this technical infeasibility, the Box Elder Plant is not considering this control technology for this application. Additionally, selected fabric filter technology provides better control efficiency than the ESP.

Wet Scrubber

Wet gas scrubber (WGS) technology was also evaluated for us as a particulate control technology for the proposed gas stream. A WGS reduces particulate emissions by mixing flue gas with scrubber liquid to remove particulate. The purge stream containing the collected particulate exits the bottom of the WGS to be further

---

[43] Permit Units II.A.7, II.A.8, and II.A.9 of DAQE-AN141070009-16.

[44] Accessed March 3, 2017.

treated as wastewater. High efficiency wet scrubbers have been shown to achieve 99% capture for PM_{10}, but only up to 90% capture for $PM_{2.5}$. This type of control may be feasible for use with the proposed gas stream. However, selected fabric filter technology provides better control efficiency than the wet scrubber for $PM_{2.5}$.

Cyclone

Cyclones use centrifugal force and inertia to remove particles from a gas stream. The inertia of the particles resists the change in direction of the gas and they move outward under the influence of centrifugal force until they strike the walls of the cyclone. At this point, the particles are caught in a thin laminar layer of air next to the cyclone wall and are carried downward by gravity where they are collected in hoppers. Cyclones are capable of removing in excess of 90% of the larger diameter (> 30 μm) PM. However, their efficiency decreases with smaller particles.

Drum Filter

Air containing particulate or fibers is drawn into a chamber with a rotating drum wrapped with filter material. The solids are captured on the filter material. As the drum rotates there are vacuum pickup points that remove the solids material captured on the drum. From the pickup points the particulate matter is conveyed to a storage or processing area to be recycled or disposed. Drum filters are typically used in applications based on the type of particulate matter material to be controlled where a baghouse would be infeasible due to plugging. The drum filters have a 99.5% control efficiency.

Water Sprays/Dust Suppression

Considering the processes work with final product and packaging, adding water or chemicals would degrade the integrity of material for use. Water sprays and dust suppression are considered technically infeasible for any of these processes.

Solid Material Handling $PM_{2.5}$ Step 3 - Rank Remaining Control Technologies by Control Effectiveness

Technically feasible technologies are baghouse wet scrubber, cyclone, and drum filter technologies. Based on established control efficiencies for these technologies, the baghouse is ranked as the control device providing the highest control efficiency (i.e., rank 1). A drum filter has been selected on the Assembled Paper Products A and the converting room and existing paper converting lines because the nature of the particulate matter material collected would render a baghouse technically infeasible. A baghouse has been selected for cleaning article manufacturing.

Solid Material Handling $PM_{2.5}$ Step 4 - Evaluate Most Effective Controls and Document Results

Since the highest ranked control has been accepted as BACT for this gas stream, no detailed economic, energy, and environmental impact evaluations were conducted.

Solid Material Handling $PM_{2.5}$ Step 5 - Select BACT

Converting

The drum filter system achieves >99.5% control efficiency of filterable $PM_{2.5}$ and does not control condensable particulate. No add on control technology has better control efficiency.

Cleaning Article Manufacturing

The baghouse achieves 0.01 gr/dscf of filterable $PM_{2.5}$ and does not control condensable particulate. No add on control technology has better control efficiency.

Assembled Paper Product A

The drum filter system achieves >99% control efficiency of filterable $PM_{2.5}$ and does not control condensable particulate. No add on control technology yields a better control efficiency.

Solid Material Handling $PM_{2.5}$ Most Stringent Measures

Since the control technology with the highest control efficiency was selected, MSM is equivalent to BACT.

3.5. COOLING TOWERS

The cooling tower is a multi-cell, mechanical induced draft cooling tower that will be used to reject heat from cooling water to cool plant water. There are nine cooling towers to support the Box Elder Plant processes.

3.5.1. $PM_{2.5}$

Particulate matter is emitted from wet cooling towers because the water circulating in the tower contains small amounts of dissolved solids (e.g., calcium, magnesium, etc.) that crystallize and form airborne particles as some of the water (i.e., drift) leaves the cooling tower through the induced draft fans and evaporates. However, advances in drift eliminator technology have greatly reduced the potential for cooling tower drift. This analysis addresses filterable $PM_{2.5}$ only.

Cooling Towers $PM_{2.5}$ Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Cooling Towers (process type 99.009);[45]
- EPA's Air Pollution Technology Fact Sheets; and
- Permits available online.

Cooling Towers $PM_{2.5}$ Step 2 - Eliminate Technically Infeasible Options

Drift/Mist Eliminator

Drift/mist eliminators reduce the amount of particulate matter entrained on the water droplets that are released into the atmosphere from the exit stream of the cooling tower thereby reducing the drift of the cooling tower. A drift of 0.005%, as specified by the vendor, is being identified as BACT.

Cooling Towers $PM_{2.5}$ Step 3-5 - Select BACT

Technically feasible technology includes a drift eliminator on the cooling tower. Based on established control efficiencies for these technologies, the drift eliminator is ranked as the control device providing the highest control efficiency (i.e., rank 1). Since the highest ranked control has been accepted as BACT for this emission source, no detailed economic, energy, and environmental impact evaluations were conducted. The selected

[45] Database accessed March 3, 2017.

BACT for $PM_{2.5}$ emissions from the proposed gas stream is use of a drift eliminator. Additionally, the cooling towers are engineered to minimize water evaporation and cool machines as necessary. The implementation of the drift eliminator technology, with a drift of 0.005%, and proper engineering control and design has been selected as BACT for proposed gas stream for the control of $PM_{2.5}$ emissions.

Cooling Towers $PM_{2.5}$ Most Stringent Measures

MSM is identical to BACT in this instance.

3.6. CHEMICAL MAKING PROCESS

As part of the Project Maple, P&G proposes to install a chemical manufacturing process to produce surfactants at the Box Elder facility. Surfactants are made through oxidation of sulfur in a reactor. Emissions associated with the surfactant making process are NO_X, CO, SO_2, H_2SO_4, VOCs, and PM_{10} and $PM_{2.5}$. Exhaust gases containing both combustion and process emissions from the reactor will be routed through a duct to be controlled by a packed bed scrubber. An ESP which is upstream of the packed bed scrubber is inherent to the process, and also serves to remove particulate matter.

3.6.1. NO_X

Preheaters are used to heat the oxidation ovens in order to achieve a desired temperature for the oxidation reaction for the surfactant making process. The preheater burners will be fired with natural gas. As the process is optimized by continuous operation, the preheaters are anticipated to operate a total of 12 hours per year. Emissions from natural gas combustion from the preheater will be vented through a packed bed wet scrubber prior to venting into the atmosphere. Related natural gas combustion emissions are anticipated to be minimal. As demonstrated below, this system is selected as a BACT.

Chemical Making NO_X Step 1 - Identify All Control Technologies

The RBLC database was searched to identify comparable sources that have implemented BACT for similar soap and detergents making operations on July 31, 2015. The following paragraphs represent draft determinations and RBLC permits issued without a date range, and thus covered all data in the RBLC, going back 10 years: [46]

A search was conducted by querying all sources within the RBLC database in which the "Process Type Code" contained the number "69.016" (Soap and Detergent Manufacturing), which covers operations from the proposed Project Maple. Similar operations were found at the following facilities; however, they did not trigger PSD:

- E.I. DuPont Morses Mill Plant (NJ-0070)
- Agrifos Sulfuric Acid Plant (TX-0519)

The top-down BACT analysis for NO_X emissions for the surfactant making process is presented below. This BACT determination is consistent with the NO_X BACT determinations contained in the RBLC.

The technologies identified as possible NO_X reduction technologies for Surfactant Making Process are shown in the table below.

---

[46] U.S. EPA, Technology Transfer Network, Clean Air Technology Center. RACT/BACT/LAER Clearinghouse Advanced Search. http://cfpub.epa.gov/rblc/index.cfm?Action=search.AdvancedSearch (November 11, 2014).

Polluant	Control Technologies
NO_X	Natural Gas Combustion
	Low NO_X Burner
	LoTox

Chemical Making NO_X Step 2 - Eliminate Technically Infeasible Options.

Use of Natural Gas

Natural gas is an inherently cleaner burning fuel that is ubiquitous in the US and can be produced domestically.

Low NO_X Burners

A LNB provides a stable flame that with two zones. There are many variations on the LNB theme of reducing NO_X that can produce more than 80% Destruction Removal Efficiency (DRE).[47] As the surfactant process is less than 5 MMBtu/hr it is exempt as a source category exemption, therefore, LNBs are not considered further.

Oxidation/Reduction Scrubbing

LoTOx™ technology, is a low-temperature oxidation process that employs ozone to oxidize NO_2 to higher oxides of nitrogen such as N_2O_5. However, NO is also converted to NO_2, which is NO_X. As such, this technology would need to be paired with SCR or SNCR for gas streams such as those from the proposed oven, which is expected to emit larger portions of NO than NO_2. The potential to increase total NO_X emissions makes this option technically infeasible.

Chemical Making NO_X Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The Box Elder Plant proposes to use the two available control technologies available for the surfactant process which are the use of natural gas and installation of LNBs which are technically feasible control technologies. However, because the burner is less than 5 MMBtu/hr, it meets UDAQ's source category exemption in UAC R307-401-9.

Chemical Making NO_X Step 4 - Evaluate Most Effective Controls and Document Results

Since the highest ranked controls have been accepted as BACT for this gas stream, no detailed economic, energy, and environmental impact evaluations were conducted.

Chemical Making NO_X Step 5 - Select BACT

The burners for the surfactant making process are less than 5 MMBtu/hr.

Chemical Making NO_X Most Stringent Measures

MSM is identical to BACT in this instance.

---

[47] OAQPS, *Technical Bulletin, Nitrogen Oxides (NOx) Why and How are They Controlled*, EPA/456/F-99-006R (http://www.epa.gov/ttn/catc/dir1/fnoxdoc.pdf); November 1999

3.6.2. SO_2

In the surfactant making process, the primary reaction includes oxidation of sulfur. As previously mentioned, the resultant emissions from the surfactant making process will be SO_2, H_2SO_4, NO_x, CO, PM_{10} and $PM_{2.5}$ and VOCs that are generated. The emissions from the surfactant making process will be captured and controlled by a packed bed scrubber. As demonstrated below, this system is selected as a BACT. The available technologies include the following:

Chemical Making SO_2 Step 1 - Identify All Control Technologies

The RBLC database was searched to identify comparable sources that have implemented BACT for similar soap and detergents making operations on July 31, 2015. Similar operations were found in the RBLC search using "69.016" (Soap and Detergent Manufacturing), as previously listed in the NOx analysis.

The top-down BACT analysis for SO_2 emissions for the surfactant making process is presented below. This BACT determination is consistent with the SO_2 BACT determinations contained in the RBLC.

The technologies identified as possible SO_2 reduction technologies for Surfactant Making Process are shown in the table below.

Polluant	Control Technologies
SO_2	Wet Gas Scrubber
	Double Adsorption
	Low Sulfur Fuel

Chemical Making SO_2 Step 2 - Eliminate Technically Infeasible Options

Wet Gas Scrubber

In a wet scrubber, the gaseous SO_2 is absorbed into an aqueous solution in a contacting section that has a large liquid surface for mass transfer. Contacting sections may include sprays, venturis, tray beds, or packed beds. Once the SO_2 has been absorbed into the water, it is neutralized by an alkali, generally either sodium or calcium based. Typical sodium based scrubbers use either soda ash, sodium bicarbonate, or sodium hydroxide as a neutralizing agent. In a caustic scrubber, the blow-down (which would contain dissolved salts such as sodium sulfate) would have to be disposed of offsite. Caustic scrubbing is a technically feasible option.

Double Adsorption

Double adsorption was identified in the RBLC for the production of H_2SO_4. However, since the primary purpose of the chemicals process is to make surfactants and not H_2SO_4, it is not applicable to Project Maple. In the RBLC, the related processes refer to H_2SO_4 production as the primary process; whereas, for Project Maple, the H_2SO_4 is generated as a byproduct from the sulfur trioxide (SO_3) scrubber in the proposed chemicals process. The gas stream leaving the SO_3 scrubber is routed through the packed bed scrubber. Therefore, double absorption is eliminated from further consideration.

Use of Low Sulfur Fuel

Natural gas is an inherently cleaner burning fuel that is ubiquitous in the US and can be produced domestically. Compressed natural gas (CNG) consists mainly of methane (CH_4) and is drawn from gas wells or in conjunction with crude oil production. Liquefied natural gas (LNG) is compressed natural gas that is cooled to -260°F degrees. The preponderance of sulfur, emitted as sulfur dioxide, comes from the sulfur content of the fuel. Switching to a low-sulfur fuel would reduce the SO_2 in the exhaust gases. The available natural gas in Utah is 0.0005% sulfur.

Chemical Making SO_2 Step 3 - Rank Remaining Control Technologies by Control Effectiveness

Based on the information provided, combustion of low sulfur fuel with the installation of a wet scrubber represents BACT for SO_2 emissions from the surfactant making process. Both technologies were selected for evaluation.

Chemical Making SO_2 Step 4 - Evaluate Most Effective Controls and Document Results

Since the highest ranked controls have been accepted as BACT for this gas stream, no detailed economic, energy, and environmental impact evaluations were conducted.

Chemical Making SO_2 Step 5 - Select BACT

The selected BACT for SO_2 emissions from the proposed gas stream is use of low sulfur fuels and a wet gas scrubber. The RBLC database indicates that low sulfur fuels are widely accepted as BACT for similar facilities. Since the facilities either used low sulfur fuels or double adsorption, with the combination of low sulfur fuels and a wet scrubber. Thus, the BACT determination for Project Maple exceeds previously identified BACT determinations for the soap and detergents making industry.

Chemical Making SO_2 Most Stringent Measures

Since the control technology with the highest control efficiency was selected, MSM is equal to BACT.

3.6.3. $PM_{2.5}$

In the surfactant making process there is only one solid material generated, which is a precipitated acid mix (PAM) from the ESP. The PAM is a product developed for soap manufacturing. Since the ESP is inherent to the process and removes the PAM upstream of the packed bed scrubber, the amount of particulate in the gas stream entering the scrubber is negligible. For completeness of the analysis, a BACT analysis for PM has been included.

Chemical Making $PM_{2.5}$ Step 1 - Identify All Control Technologies

Similar operations were found in the RBLC search using "69.016" (Soap and Detergent Manufacturing), as the search criteria did not list PM, PM_{10} or $PM_{2.5}$ controls. The minimal amount of particulate that remains will be captured by the packed bed scrubber.

Chemical Making $PM_{2.5}$ Step 2 - Eliminate Technically Infeasible Options

The minimal amount of particulate that remains will be captured by the packed bed scrubber. No other technologies were listed in the RBLC.

Chemical Making $PM_{2.5}$ Step 3-5 Select BACT

The selected BACT for PM_{10} and $PM_{2.5}$ emissions from the proposed gas stream is use of packed bed wet scrubber and natural gas. Since the gas stream is moist, the wet scrubbing technology is the most effective control device. Thus, the implementation of the wet scrubbing technology and use of natural gas has been selected as BACT for proposed gas stream for the control of PM_{10} and $PM_{2.5}$ emissions.

Chemical Making $PM_{2.5}$ MSM

Since the control technology with the highest control efficiency was selected, MSM is equal to BACT.

3.6.4. VOC

The RBLC database was searched to identify comparable sources that have implemented BACT for similar soap and detergents making operations on July 31, 2015. Similar operations were found in the RBLC search using "69.016" (Soap and Detergent Manufacturing), as previously listed in the NO_X analysis.

A search of the RBLC database, as well as review of BACT approved by other State Departments where surfactant manufacturing facilities. Results of this search are presented in the table below. The VOC and CO emissions from the process will be minimal. Exhausts from the surfactant making process will be directly ducted and treated by the SO_2 packed bed scrubber.

Chemical Making VOC Step 1 - Identify All Control Technologies

Technologies below have been evaluated based on similar processes as nothing was listed in the RBLC.

Pollutant	Control Technologies
VOCs	Thermal Oxidation
	Catalytic Oxidation
	Good Combustion Practices

Chemical Making VOC Step 2 - Eliminate Technically Infeasible Options

Thermal Oxidation

An evaluation of the thermal oxidizers considered include the following devices:

Simple Thermal Oxidizer or Afterburner

In a simple TO or afterburner, the flue gas exiting the scrubber is reheated in the presence of sufficient oxygen to oxidize the CO present in the flue gas. A typical TO is a flare and is not equipped with any heat recovery device. A TO will require additional fuel to heat the gas stream starting from 100-150 °F before the scrubber and 80°F after the scrubber to at least 1,600 °F. This additional fuel will generate additional emissions; therefore, the TO is considered technically infeasible.

Regenerative Thermal Oxidizer

A RTO is equipped with ceramic heat recovery media (stoneware) that has large surface area for heat transfer and can be stable to 2,300°F. Operating temperatures of the RTO system typically range from 1,500°F to 1,800°F with a retention time of approximately one second. The combustion chamber of the RTO is surrounded by multiple integral heat recovery chambers, each of which sequentially switches back and forth from being a preheater to a heat recovery chamber. In this fashion, energy is absorbed from the gas exhausted from the unit and stored in the heat exchange media to preheat the next cycle of incoming gas. An RTO will require additional fuel to heat the gas stream from 100-150 °F before the scrubber and 80°F after the scrubber to at least 1,500°. This additional fuel will generate additional emissions; therefore, the RTO is considered technically infeasible.

Recuperative Thermal Oxidizer

A recuperative thermal oxidizer (RCTO) is more thermally efficient than simple thermal oxidization but less efficient than an RTO. The thermal efficiency is improved through the use of either a shell-and-tube or a plate-and-frame type heat exchanger in which heat from the treated flue gas is transferred or recirculated to the untreated flue gas. Up to 65 to 70% heat recovery is common. However, a RCTO is not feasible for VOC control for the surfactant process due to the following reasons:

- The metallic heat exchanger efficiency (65-70 percent) is much lower than that of an RTO system, thus substantially increasing the need for additional fuel.
- Since the heat exchanger would be of metallic construction, it will be subject to corrosion due to the presence of H_2SO_4, and other corrosive gases, reducing the system effectiveness and limiting the lifespan of the equipment.
- The higher oxidizer operating temperature would expose the metallic heat exchanger surfaces to temperatures at which many metals can fail, thus requiring expensive alloys.
- The potential exists for auto-ignition, which could cause hot spots and metal failure.

Thus, given the additional fuel costs and energy requirements relative to an RTO, a RCTO is considered a less desirable option to the RTO and is not considered further.

Catalytic Oxidation

A regenerative catalytic oxidizer (RCO) employs principles similar to those used in an RTO except that a catalyst is used to enhance the conversion of CO to CO_2 at a lower temperature (600-700°F) than an RTO. Despite use of a catalyst, it would be necessary to reheat the post- flue gas to a temperature sufficient to operate the RCO. This reheating would create an increase in NO_X relative to the untreated exit gas stream.

The largest potential problem associated with catalytic oxidation involves catalyst fouling and poisoning. Sulfur oxides present in the exit gas stream would poison the catalyst. Based on the technical difficulties of utilizing the catalyst as well as the fact that catalytic oxidation has not been applied to a surfactant process, catalytic oxidation is considered to be a technically infeasible VOC control option.

Good Combustion

Good combustion practices for CO and VOCs include adequate fuel residence times, proper fuel-air mixing, and temperature control. As it is imperative for process controls, the Box Elder Plant will maintain combustion optimal to their process.

In step two of the BACT analysis, each control technology which was considered to be clearly infeasible based on physical, chemical, and engineering principles was eliminated. The control technologies and their technical feasibilities are summarized below.

Chemical Making VOC Steps 3-5 Select BACT

Good combustion practices were selected as BACT. As the control techniques evaluated are infeasible or technologies based on the proposed process, no further analysis is being conducted for evaluation. As the process is using natural gas as a fuel for preheat and under normal conditions continuous regeneration is maintained for the oxidation process, the CO and VOC emissions will be minimal. Thus, Project Maple's BACT determination exceeds previously identified BACT determinations for the soap and detergents making industry.

Chemical Making VOC Most Stringent Measures

MSM is identical to BACT for VOC emissions from chemical making.

3.7. STORAGE TANKS

The Box Elder Plant has several storage tanks associated with soap making, cleaning article manufacture, chemical making, gasoline (500 gallons), and a diesel tank (500 gallons). The contents of the tanks range from raw materials, intermediates, final products, and fuel. Storage tanks hold a range of products from organic liquids, ethanol, petroleum products, and mostly inert materials. All chemical tanks can be categorized as aboveground fixed roof vertical tanks. These tanks are not subject to regulations under NSPS Subpart Kb, *Standards of Performance for Volatile Liquid Storage Vessels*, since all tanks meet one of the three qualifications:

1. Have a capacity less than 75 cubic meters (m^3);
2. Have a capacity greater than or equal to 151 m^3 and storing a liquid with a maximum true vapor pressure of less than 3.5 kilopascals (kPa); or
3. Have a capacity between 75 m^3 and 151 m^3 and storing a liquid with a maximum true vapor pressure of less than 15.0 kPa.

3.7.1. VOC

Emissions from fixed roof storage tanks result from displacement of headspace vapor during filling operations (working losses) and from diurnal temperature and heating variations (breathing losses). VOC emissions from the storage tanks at the Box Elder Plant will more likely result from displacement of headspace during filling operations and to a lesser degree due to temperature variations and solar heating cycles since most of the tanks are indoors.

Storage Tanks VOC Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Volatile Organic Liquid Storage (process type 42.009);[48]
- EPA's Air Pollution Technology Fact Sheets;
- NSPS Kb – Standards of Performance for Volatile Liquid Storage Vessels;
- NESHAP G – Synthetic Organic Chemical Manufacturing Industry for Process Vents, Storage Vessels, Transfer Operations, and Wastewater;
- NESHAP WW – Storage Vessels (Tanks) – Control Level 2;
- SCAQMD LAER/BACT Determinations;
- SJVAPCD BACT Clearinghouse;
- BAAQMD BACT/TBACT Workbook; and
- Permits available online.

The technologies identified as possible VOC reduction technologies for Storage Tanks are shown in the table below.

[48] Database accessed March 3, 2017.

Pollutant	Control Technologies
VOC	Internal Floating Roof
	Vapor Recovery System
	Wet Scrubber
	Low Vapor Pressure Products
	Carbon Filtration System
	Simple Thermal Oxidizer

Storage Tanks VOC Step 2 - Eliminate Technically Infeasible Options

Internal Floating Roof

For this project, fixed roof tanks are being proposed. There are no internal or external floating roof tanks being proposed. Due to the size of the tanks proposed an internal or external floating roofs are technically infeasible. Internal floating roof identified within RBLC is for tanks with a much larger capacity than the tanks located at the Box Elder Plant. Internal floating roofs are typically installed on tanks greater than 1,000 barrels (bbls) (42,000 gallons). Thus, internal floating roofs and any combination thereof is considered technically infeasible.

Vapor Recovery System

Vapor recovery through carbon adsorption, vapor balance, or refrigerated condenser provides control of emissions by collecting the vented material for recycle or reuse. A vapor adsorption unit was not identified through a literature and permit search at a site that has a throughput of 50,000 barrels or less. The tanks located onsite are several sets of smaller storage tanks. Thus, this option has been eliminated from further consideration.

Wet Scrubber

Absorption through a packed-bed tower wet scrubber is used for raw material and/or product recovery technique in separation and purification of gaseous streams containing high concentrations of VOCs, especially water soluble compounds such as methanol, ethanol, isopropanol, butanol, acetone, and formaldehyde. However, as an emission control technique, it is much more commonly employed for controlling inorganic gases than for VOC. Removal efficiencies for gas absorbers vary for each pollutant-solvent system with the type of absorber used. The suitability of gas absorption as a pollution control method is generally dependent on the following factors: 1) availability of the solvent; 2) required removal efficiency; 3) pollutant concentration inlet vapor; 4) capacity required for handling waste gases; and 5) recovery value of the pollutants or the disposal cost of unrecoverable solvent. Air flow rates for packed bed scrubbers are 500 to 75,000 standard cubic feet per minute (scfm). An ethanol scrubber is used for the ethanol tanks on Soap B; which involves ethanol storage and usage. This technology is not in use for any diesel or gasoline tanks of similar size and is therefore removed from consideration from these tanks.

Low Vapor Pressure Products

Many of the storage tanks will store low vapor pressure materials and/or mixtures utilizing fixed roof tanks. For materials that may contain higher vapor pressure materials they are sealed and have an inert gas vapor blanket. No economically viable options exist to control emissions from these small storage tanks.

Carbon Filtration System

Adsorption may be used on a low or medium concentrated gaseous stream to remove VOCs. During adsorption, a gaseous molecule will be attracted to the solid material in the filtration system. This control technology is shown in the RBLC being used for a corrosion inhibitor tank of unknown size. Carbon adsorption has a linear control rate with the vapor pressure. Since the vapor pressure for these chemicals are very low, this system is not considered further.

Simple Thermal Oxidizer

In a simple TO or afterburner, the flue gas is reheated in the presence of sufficient oxygen to oxidize the VOC present in the flue gas. A typical TO is a flare and is not equipped with any heat recovery device. This technology was identified for sources through RBLC and SCAQMD with large throughputs and several tanks co-located. Additionally, this control technology would require a combustion source increasing VOC, NO_X, and $PM_{2.5}$ from the facility. This technology is not considered further since it is not a proven control technology for sources of this size.

Storage Tanks VOC Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The following technologies that have not been eliminated in step 2 include: wet scrubber, pressure/vacuum valve settings, and low vapor pressure products.

Storage Tanks VOC Step 4 - Evaluate Most Effective Controls and Document Results

P&G is implementing the control available for VOC fugitive emissions, this includes an ethanol scrubber for the ethanol tank associated with Soap B and low vapor pressure products as available/applicable. Therefore, no detailed economic energy, and environmental evaluation were conducted.

Storage Tanks VOC Step 5 - Select BACT

Gasoline and Diesel (500 gallon) Tanks

Based on the size of the gasoline and diesel tanks their emissions are negligible. No additional control measures are identified as BACT.

Ethanol Tank in Soap B

An ethanol scrubber and low vapor pressure products have been evaluated to ensure the lowest available vapor pressure chemical is used for the designed purpose. These control measures are identified as BACT.

Other Chemical Tanks

All other chemical tanks have been evaluated to ensure the lowest available vapor pressure chemical is used for the designed purpose. These control measures are identified as BACT.

Storage Tanks VOC Most Stringent Measures

MSM is identical to BACT in this instance.

3.8. FUGITIVE VOC

The Box Elder Plant uses several additives, inks, and chemicals that contain VOCs and are potentially emitted as fugitives. Fugitive VOC emissions detailed in this section are emitted from the, Soap Making, Cleaning Article manufacturing, Assembled Paper Products, Bottle Blowing Supplier process, and converting lines packaging. Fugitives associated with chemical/process tanks is discussed in a separate Section 3.9.

Soap Making

Raw materials to make soaps are pumped from the totes or from on-site storage tanks for blending. As the blending occurs in a closed system, on a batch basis, there are no process vents, which results in minimal VOCs emitted from the manufacturing process.

Cleaning Article

Consumer article cleaning products. In this process, substrate is unrolled (or manipulated) and scented raw materials and cleaners are added to the substrate for use as the final product.

Assembled Paper Products

Various raw and scented materials are also used in the assembly and packaging of Assembled Paper Products.

Bottle Blowing Supplier

Minor VOC emissions will occur during the molding/extrusion process.

Converting Lines

The converting lines involve preparing the process for shipment including the sealing with adhesives, use additives and/or printing.

3.8.1. VOC

VOCs occur from all processes as a result of raw and scented material application as well as from finished product packaging. VOC emissions can be reduced via two approaches: alternative chemical properties, and add-on control technologies for removal.

Fugitive VOC Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's Alternative Control Technology Paper "Control Techniques for Volatile Organic Compound Emissions from Stationary Sources" published in December of 1992; and
- TCEQ BACT Guidelines and the BAAQMD BACT/TBACT Workbook.

Fugitive VOC Step 2 - Eliminate Technically Infeasible Options

The technologies identified as possible VOC reduction technologies for Storage Tanks are shown in the table below.

Pollutant	Control Technologies
VOC	Wet Scrubber
	Carbon Filtration System
	Simple Thermal Oxidizer
	Low VOC Additives

Wet Scrubber

Absorption through a packed-bed tower wet scrubber is used for raw material and/or product recovery technique in separation and purification of gaseous streams containing high concentrations of VOCs, especially water soluble compounds such as methanol, ethanol, isopropanol, butanol, acetone, and formaldehyde. However, as an emission control technique, it is much more commonly employed for controlling inorganic gases than for VOC. Removal efficiencies for gas absorbers vary for each pollutant-solvent system with the type of absorber used. The suitability of gas absorption as a pollution control method is generally dependent on the following factors: 1) availability of the solvent; 2) required removal efficiency; 3) pollutant concentration inlet vapor; 4) capacity required for handling waste gases; and 5) recovery value of the pollutants or the disposal cost of unrecoverable solvent. Air flow rates for packed bed scrubbers are 500 to 75,000 scfm. As the solubility for these materials is minimal except for ethanol which is controlled by an ethanol scrubber in Soap Making C, it is therefore removed from consideration.

Carbon Filtration System

Adsorption may be used on a low or medium concentrated gaseous stream to remove VOCs. During adsorption, a gaseous molecule will be attracted to the solid material in the filtration system. This control technology is shown in the RBLC being used for a corrosion inhibitor tank of unknown size. Carbon adsorption has a linear control rate with the vapor pressure. Since the vapor pressure for these chemicals are very low and individual application rates are minor VOCs this system is not considered further.

Simple Thermal Oxidizer

In a simple TO or afterburner, the flue gas is reheated in the presence of sufficient oxygen to oxidize the VOC present in the flue gas. A typical TO is a flare and is not equipped with any heat recovery device. This technology was identified for sources through RBLC and SCAQMD with large throughputs. Additionally, this control technology would require a combustion source increasing VOC, NOx, and $PM_{2.5}$ from the facility. This technology is not considered further since it is not a proven control technology for sources of this size.

Low Vapor Pressure Materials

Similar to process tanks the perfumes, adhesives, and paper additives are low vapor pressure materials and/or mixtures. Materials selected are low VOC containing materials that meet specifications for product requirements. As Low vapor pressure materials are in use by the Box Elder Plant this option is considered technically feasible.

Fugitive VOC Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The following technologies that have been eliminated in step 2 include wet scrubber, carbon filtration systems, and simple thermal oxidizer. As P&G uses low vapor pressure products where available and that meet product specifications, this option is considered further.

Fugitive VOC Step 4 - Evaluate Most Effective Controls and Document Results

Economic feasibility is unnecessary as P&G has selected the highest level of control available for VOC fugitive emissions.

Fugitive VOC Step 5 - Select BACT

All applications have been evaluated to ensure the lowest available vapor pressure chemical is used for the designed purpose. This control measure is considered BACT.

Fugitive VOC Most Stringent Measures

MSM is identical to BACT in this instance.

3.9. TRUCK LOADING

As there will be truck loading proposed with the process equipment to be installed with Project Maple VOC and HAPs emissions are anticipated to be generated from the loading of tanker trucks. Consideration of BACT for truck loading has been considered.

3.9.1. VOC

VOC emissions occur when products or intermediates containing organics are loaded into tanker trucks. VOC emissions during loading are from vapors evaporated from the new liquid being loaded. Since the Box Elder Plant only loads out products or intermediates very infrequently, truck loading is not a significant emissions source. The Box Elder site has evaluated controls for BACT.

Truck Loading VOC Step 1 - Identify All Control Technologies

P&G has reviewed the following sources to ensure all available control technologies have been identified:

- EPA's RBLC Database for Volatile Organic Liquid Storage (process type 42.009);[49]
- EPA's Air Pollution Technology Fact Sheets;
- NSPS Kb – Standards of Performance for Volatile Liquid Storage Vessels;
- NESHAP G – Synthetic Organic Chemical Manufacturing Industry for Process Vents, Storage Vessels, Transfer Operations, and Wastewater;
- NESHAP WW – Storage Vessels (Tanks) – Control Level 2;
- SCAQMD LAER/BACT Determinations;
- SJVAPCD BACT Clearinghouse;
- BAAQMD BACT/TBACT Workbook; and
- Permits available online.

Truck Loading VOC Step 2 - Eliminate Technically Infeasible Options

Vapor Recovery System

Vapor recovery through carbon adsorption, vapor balance, or refrigerated condenser provides control of emissions by collecting the vented material for recycle or reuse. A vapor adsorption unit was not identified through a literature and permit search at a site that has a throughput of 50,000 barrels or less. The tanks located

[49] Database accessed March 3, 2017.

onsite are several sets of smaller storage tanks. Thus, this option has been eliminated from further consideration.

Vapor Balancing

In vapor balancing, hydrocarbon vapors are collected from the compartment where the liquid is being loaded and returned to the tank from which the liquid is being sent. This balancing works since the volume of displaced vapors is almost identical to the volume of liquid removed from the tank. This technique is most effective when loading tank trucks from fixed roof tanks. A vapor balance system has not been identified through literature review for the type of materials to be transported from the site. Thus, this option has been eliminated from further consideration.

Submerged Loading

The use of submerged loading as a means of control offers the low cost way to control loading emissions. The two types of submerged loading are the submerged fill pipe method and the bottom loading method. In the submerged fill pipe method, the fill pipe extends almost to the bottom of the cargo tank.

Truck Loading VOC Step 3 - Rank Remaining Control Technologies by Control Effectiveness

In the bottom loading method, a permanent fill pipe is attached to the cargo tank bottom. During most of submerged loading by both methods, the fill pipe opening is below the liquid surface level. Liquid turbulence is controlled significantly during submerged loading, resulting in much lower vapor generation than encountered during splash loading.

Truck Loading VOC Step 4 - Evaluate Most Effective Controls and Document Results

The remaining VOC and HAPs control option is to load trucks through the use of submerged or bottom loading. Several similar sources throughout the country as well as Utah utilize this method of reducing emissions during the loading of trucks.[50] UDAQ has promulgated regulations for the oil and gas industry for submerged loading; therefore, the Box Elder Plant proposes to meet the baseline BACT requirements.[51]

Truck Loading VOC Step 5 - Select BACT

BACT for the loading of tanker trucks at the Box Elder Plant is the utilization of submerged or bottom fill loading at the facility.

Truck Loading VOC Most Stringent Measures

MSM is identical to BACT in this instance.

3.10. DIESEL EMERGENCY GENERATORS AND FIREPUMPS

The Box Elder Plant has seven diesel-fueled non-road engines as permitted in its Approval Order, the Box Elder Plant's permitted expansion referred to as Project Maple, which include the following:

- One 350 kilowatt (kW) emergency generator,
- One 30 kW emergency generator,

---

[50] Ibid.

[51] UAC R307-504

- One 1,214 horsepower (hp) emergency generator,
- Two 375 hp fire pumps, and
- Two 399 hp fire pumps.

Diesel engines are classified as compression ignition (CI) internal combustion engines (ICE). The primary pollutants in the exhaust gases include NO_X, VOC, SO_2, and $PM_{2.5}$. The engines will be for emergency use only (except for readiness testing) and will use diesel fuel meeting the requirements of 40 CFR §80.510(b) for non-road diesel fuel (i.e., a maximum sulfur content of 15 ppm and either a minimum cetane index of 40 or a maximum aromatic content of 35 percent by volume).

EPA's RBLC was queried to identify controls for other similar-sized emergency generators. The RBLC shows that most emergency generators have BACT emission limits or permitted emission limits under other regulatory programs at or above the recently promulgated NSPS Subpart IIII emissions standards.

3.10.1. NO_X, $PM_{2.5}$, SO_X, and VOC

Diesel Non-Road Engines Step 1 - Identify All Control Technologies

The following sources were reviewed to identify available control technologies:

- EPA's RBLC Database for Diesel Generators (process type 17.110 Large Internal Combustion Engines [>500 Hp] – Fuel Oil);[52]
- EPA's Air Pollution Technology Fact Sheets; and
- South Coast Air Quality Management District Example Permits.

Available control technologies for emergency generators includes the following:

Polluant	Control Technologies
NO_X, $PM_{2.5}$,	Limited Hours of Operation
SO_2, and VOCs	Good Combustion Practices
	Use of a Tier Certified Engine
	Engine Design
	Diesel Particulate Filter
	Ultra Low Sulfur Fuel
	Diesel Oxidation Catalyst
	Selective Catalyst Reduction

[52] Database accessed March 3, 2017.

Diesel Non-Road Engines Step 2 - Eliminate Technically Infeasible Options

Limited Hours of Operation

One of the apparent opportunities to control the emissions of all pollutants released from the emergency engines powering generators and fire pumps is to limit the hours of operation for the equipment. Due to the designation of this equipment as emergency equipment, only 100 hours of operation for maintenance and testing are permitted per NSPS Subpart IIII.[53] P&G complies with NSPS Subpart IIII requirements and minimizes operation time for emergency generators to maintenance and testing.[54]

Good Combustion Practices

Good combustion practices refer to the operation of engines at high combustion efficiency, which reduces the products of incomplete combustion. The proposed emergency generator is designed to achieve maximum combustion efficiency. The manufacturer has provided operation and maintenance manuals that detail the required methods to achieve the highest levels of combustion efficiency. P&G operates and maintains this engine in accordance with the manufacture provided instructions and best industry practices.[55]

Use of a Tier Certified Engines

EPA noted that non-road engines were a significant source of emissions and began adopting emission standards for these emission units in 1994. Today engines are required to meet certain emission limits, or tier ratings, based on the size and model year. Emission standards for these engines have progressively gotten more stringent over time and are an indicator of good combustion design. The Box Elder Plant has installed non-road engines with a Tier rating available at the time of purchase. Since all of the engines were purchased after 2001 the existing non-road engines are either Tier 2 or 3.[56,57] The fire pumps meet the lowest emission rating for their size as identified in Table 4 of 40 CFR 60 Subpart IIII.

Diesel Particulate Filters

This simple technology is placed in the exhaust pathway to prevent the release of particulate and may be coated with a catalyst to further capture hydrocarbon emissions.

According to EPA's Response to Public Comments on Notice of Reconsideration of NESHAP for RICE and NSPS for Stationary ICE, "Diesel particulate filters are also proven, commercially available technology for retrofit applications to stationary engines...and are capable of reducing diesel PM by 90 percent or more."[58] Additionally

---

[53] 40 CFR 60.4211(f)(2).

[54] AN141070009-16 Condition II.B.1.d.

[55] Title V Operating Permit #300053001 Conditions II.B.5, II.B.6, and II.B.7.

[56] EPA Nonroad Compression-Ignition Engines: Exhaust Emission Standards, March 2016.

[57] 40 CFR 89.122, 40 CFR 1039.101, 40 CFR 1039.102, 40 CFR 1039 Subpart F, 40 CFR 86 Subpart I, and 40 CFR 1065

[58] Response to Public Comments on Notice of Reconsideration of National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines and New Source Performance Standards for Stationary Internal Combustion Engines, EPA Docket EPA-HQ-OAR-2008-0708, June 16, 2014

the CA ARB was able to determine that this technology was technically feasible for emergency and prime engines through obtaining several vendor quotes. [59]

However EPA remained concerned with the installation of a catalyzed particulate filter, citing technical issues including the fact that many older engines are not electronically controlled, PM emissions are often too high for efficient operation and, in some cases, engine exhaust temperatures are not high enough for filter substrate regeneration.[60]

While a catalytic diesel particulate filter is not considered to be technically feasible, consideration of a simple particulate filter is evaluated.

Ultra Low Sulfur Diesel

Ultra low sulfur diesel (ULSD) contains less than 0.0015 % sulfur by weight. The reduced sulfur content reduces the potential for SO_x emissions. Additionally the low sulfur content results in a lower potential for aggregation of sulfur containing compounds and thus reduces $PM_{2.5}$ emissions. P&G uses ULSD fuel meeting the requirements of 40 CFR §80.510(b) for non-road diesel fuel (i.e., a maximum sulfur content of 15 ppm and either a minimum cetane index of 40 or a maximum aromatic content of 35 percent by volume[61],[62]

Diesel Oxidation Catalyst

A diesel oxidation catalyst (DOC) utilizes a catalyst such as platinum or palladium to further oxidize the engine's exhaust, which includes hydrocarbons (HC), e.g., VOC, to carbon dioxide (CO_2) and water. Use of a DOC can result in approximately 90 percent reduction in HC/VOC emissions.[63] In addition to controlling HC/VOC a DOC also has the potential to control PM by 30 percent (based on the concentration of soluble organics) and CO by 50 percent if low sulfur diesel fuel is used.[64]

The use of a DOC reduces the effective power output of RICE and results in a solid waste stream. However, for the purposes of identifying technical feasibility, no formal consideration of these adverse energy and environmental impacts is presented. A DOC is considered technically feasible and is further considered for BACT.

---

[59] Response to Public Comments on Notice of Reconsideration of National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines and New Source Performance Standards for Stationary Internal Combustion Engines, EPA Docket EPA-HQ-OAR-2008-0708, June 16, 2014

[60] Response to Public Comments on Notice of Reconsideration of National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines and New Source Performance Standards for Stationary Internal Combustion Engines, EPA Docket EPA-HQ-OAR-2008-0708, June 16, 2014

[61] Title V Operating Permit #300053001 Conditions II.B.5.d

[62] Collectively, diesel standards reduce harmful emissions from both onroad and nonroad diesel sources by more than 90%. https://www.epa.gov/diesel-fuel-standards/diesel-fuel-standards-rulemakings

[63] U.S. EPA, *Alternative Control Techniques Document: Stationary Diesel Engines*, March 5, 2010, p. 41. (https://www.epa.gov/sites/production/files/2014-02/documents/3_2010_diesel_eng_alternativecontrol.pdf)

[64] Response to Public Comments on Notice of Reconsideration of National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines and New Source Performance Standards for Stationary Internal Combustion Engines, EPA Docket EPA-HQ-OAR-2008-0708, June 16, 2014

Selective Catalytic Reduction

SCR systems introduce a liquid reducing agent such as ammonia or urea into the flue gas stream before a catalyst. The catalyst reduces the temperature needed to initiate the reaction between the reducing agent and NO_X to form nitrogen and water.

For SCR systems to function effectively, exhaust temperatures must be high enough (200°C to 500°C) to enable catalyst activation. For this reason, SCR control efficiencies are expected to be relatively low during the first 20 to 30 minutes after engine start up, especially during maintenance and testing. There are also complications controlling the excess ammonia (ammonia slip) from SCR use. Since SCR is anticipated to have a relatively low combustion efficiency during maintenance and testing, SCR is not considered technically feasible for emergency units.

Diesel Non-Road Engines Step 3 - Rank Remaining Control Technologies by Control Effectiveness

Effective control technologies for diesel engines include the limited hours of operation, good combustion practices, use of tier certified engines, diesel particulate filters, ultra-low sulfur diesel, and diesel oxidation catalysts. All control technologies considered effective are currently implemented on the engines permitted at the Box Elder Plant with the exception of diesel particulate filters and diesel oxidation catalysts. Both technologies result in significant emission reductions and are further evaluated to determine the economic feasibility of implementation.

Diesel Non-Road Engines Step 4 - Evaluate Most Effective Controls and Document Results

When reviewing the implementation and costs associated with installing diesel oxidation catalyst controls for an emergency-use or intermittent-use engines P&G found that "[b]ecause these engines are typically used only a few number of hours per year...[s]uch engines rarely if ever use the [diesel oxidation catalyst] type of emission controls."[65] Additionally, in its 2010 MACT/GACT evaluation for engines, EPA concluded for emergency engines: "Because these engines are typically used only a few number of hours per year [(27 hours per year per NFPA codes)], the costs of emission control are not warranted when compared to the emission reductions that would be achieved."[66] Based on EPA's assessment and the fact that the RBLC contains no records of diesel oxidation catalyst installation on emergency-use or nonroad engines, installation of a diesel oxidation catalyst is eliminated from consideration as BACT.

EPA gathered cost estimates for installing a diesel particulate filter when reviewing NESAHP ZZZZ and NSPS JJJJ and IIII, and determined the costs to be excessive.[67] EPA determined that the cost per ton of PM reduced from engines between 300 and 600 HP was close to $260,000 and more than $700,000 for engines above 750 HP when installed at the time of manufacturing.[68] EPA concluded that the installation of a diesel particulate filter

---

[65] U.S. EPA, Memorandum: *Response to Public Comments on Proposed National Emission Standards for Hazardous Air Pollutants for Existing Stationary Reciprocating Internal Combustion Engines Located at Area Sources of Hazardous Air Pollutant Emissions or Have a Site Rating Less Than or Equal to 500 Brake HP Located at Major Sources of Hazardous Air Pollutant Emissions*, August 10, 2010, p. 172-173. (EPA-HQ-OAR-2008-0708)

[66] Ibid.

[67] Response to Public Comments on Notice of Reconsideration of National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines and New Source Performance Standards for Stationary Internal Combustion Engines, EPA Docket EPA-HQ-OAR-2008-0708, June 16, 2014

[68] Memorandum from Tanya Parise, Alpha-Gamma Technologies to Jaime Pagán, EPA. Cost per Ton for NSPS for Stationary CI ICE. EPA-HQ-OAR-2005-0029-0276. May 12, 2006.

was only required for the operation non-emergency engines as documented in NESHAP Subpart ZZZZ, therefore this technology is not further considered.[69]

Diesel Non-Road Engines Step 5 - Select BACT

The emergency generators and fire pumps are well designed, efficient, and reliable, operated using good combustion practices. The engines meet the Tier rating in 40 CFR 89 based on available inventory at the time of purchase. Additionally, the emergency generators and fire pumps will be operated and maintained in accordance with good combustion practices and combust only ultra-low sulfur diesel.[70] The hours of operation are restricted to 100 hours for maintenance and testing per year in accordance with 40 CFR 60, Subpart IIII. As a result, the emergency generators and fire pumps meet BACT.

Diesel Non-Road Engines Most Stringent Measures

The most stringent measure for the emergency generators and fire pumps would be equivalent to BACT with the exception of the 1,214 hp emergency generator. This generator would be replaced with a newer model which complied with Tier 4 intermittent standards upon purchase.

3.11. INSIGNIFICANT UNITS

Negligible emissions are those less than one tpy per unit which includes the Soap B Packing and Capping, Soap C Converting, Packaging, and Intermediate Mixing, Chemicals Finished Product D Mixing, and Ink Usage. These sources emit VOCs and PM and are fugitive in nature. An analysis for these units would be similar or identical to the analysis provided in the VOC Fugitives and PM Material Handling Sections. Since emissions from these sources are minor and fugitive, P&G has not considered control technologies beyond best operating practices for these units.

Additionally, the Box Elder Plant has several space heaters located in the warehouse. The combined capacity of the space heaters in the warehouse is 8.38 MMBtu/hr. These units are very small and exhaust to a large open space. Add-on control technology would be impractical and not cost effective relative to the anticipated reduction in emissions (expected to be negligible). As such, these units have not been evaluated further for BACT.

---

[69] 40 CFR 63.6625(g)

[70] Title V Operating Permit #300053001 Conditions II.B.5 and AN141070009-16 Condition II.B.1.d.

4.1. EMISSION SUMMARY

No emission estimates have been updated during this BACM review. The BACM review did not require any new emission units or controls be installed from the previous facility design. As such, facility wide potential emissions for the Box Elder Plant are provided in Table 4-1.

Table 4-1. Site Wide Emission Summary

Source/Source Type	Current Emission Estimates (tpy)				
	$PM_{2.5}$	NO_x	SO_2	VOC	NH_3[71]
Total Emissions	**150.16**	**124.86**	**1.45**	**162.37**	--

[71] An emission limit for NH3 has not been established in the Box Elder Approval Order (No. DAQE-AN141070009-16) or Title V No. (#300053001).

Table 5-1 provides a summary of monitoring conditions for the site that affect $PM_{2.5}$ or its precursors.

Table 5-1. Monitoring Conditions

Monitoring Condition	Frequency	Source(s) Covered	Permit Condition
Method 9 Visible Emissions Observations	As Necessary	Cooling Towers	AN141070009-16 Condition II.B.1.a
Method 9 Visible Emissions Observations	As Necessary or if Visible Emissions are observed	Facility Wide Sources (Except Cooling Towers and Natural Gas Combustion Units)	AN141070009-16 Condition II.B.1.a and #300053001 Condition II.B.1.e.1
Method 22 Visible Emissions Observations	Monthly 1 Minute Observations; Reduce to Semi-Annual Observations if 6 consecutive month Method 22 tests demonstrate compliance; Further reduce to Annual Observations if 2 consecutive Semi-Annual Method 22 tests demonstrate compliance; Refer to permit for details on procedure in case visible emissions are observed	Facility Wide Sources (Except Cooling Towers and Natural Gas Combustion Units)	#300053001 Condition II.B.1.e.1
Emergency Engine Hourly Usage – Date of Operation, Operating Hours and Reason for Use	As Used	Emergency Generators and Firepumps	AN141070009-16 Condition II.B.1.d #300053001 Condition II.B.5.c.1 #300053001 Condition II.B.6.a.1
Fuel Usage	As Used	Combustion Sources	#300053001 Condition II.B.1.f.2
Natural Gas Fuel Delivery every Calendar Month	As Delivered	Natural Gas Combustion Sources	#300053001 Condition II.B.3.d.1
Diesel Fuel Delivery	As Delivered	Emergency Generators and Firepumps	#300053001 Condition II.B.5.d.1
VOC or HAP Emitting Material Usage	As Used	Facility Wide	AN141070009-16 Condition II.B.1.c #300053001

Monitoring Condition	Frequency	Source(s) Covered	Permit Condition
			Condition II.B.1.c.1
Pressure Drop	Once Per Operating Day	Paper Making Converting Room Drum Filter	#300053001 Condition II.B.4.a.1
Pressure Drop	Once Per Operating Day	Paper Machine Venturi Scrubber	AN141070009-16 Condition II.B.2.d #300053001 Condition II.B.2.d.1
Pressure Drop	Once Per Operating Day	Chemical Manufacturing SO_2 Scrubber	AN141070009-16 Condition II.B.4.b.1
Pressure Drop	Once Per Operating Day	Cleaning Article Manufacturing Baghouse	AN141070009-16 Condition II.B.5.b.1
Pressure Drop	Once Per Operating Day	Paper Products CVC Baghouse	AN141070009-16 Condition II.B.6.b.1
Pressure Drop	Once Per Operating Day	Assembled Paper Products Drum Filter/Baghouse	AN141070009-16 Condition II.B.6.b.1
NO_X Stack Test	Once Every 3 Years	Paper Machine Process Stack	AN141070009-16 Condition II.B.3.a.1 #300053001 Condition II.B.2.b.1
NO_X Stack Test	Once Every 3 Years	Paper Making Boilers	AN141070009-16 Condition II.B.3.a.1 #300053001 Condition II.B.3.b.1
NO_X Stack Test	Once Every 3 Years	Utility Boilers	AN141070009-16 Condition II.B.3.a.1 #300053001 Condition II.B.3.b.1
Purchase of Certified Engines (for same model year and maximum power)	Upon Purchase	Emergency Generators and Firepumps	#300053001 Condition II.B.5.a.1 #300053001 Condition II.B.6.c.1
Installation and Maintenance Records	As Maintained	Emergency Generators and Firepumps	#300053001 Condition II.B.5.a.1 #300053001 Condition II.B.5.b.1
365 day Rolling Monthly Throughput	As delivered	Gasoline Tank	#300053001 Condition II.B.8.a.2
Conditions listed in Table 3 of 40 CFR Part 63 Subpart CCCCCC	As required	Gasoline Tank	#300053001 Condition II.B.8.a.1

P&G feels that these monitoring conditions will sufficiently ensure the site operates in compliance with all permits and potential SIP conditions.

6. PROPOSED SIP CONDITIONS

Emissions to the atmosphere at all times from the indicated emission points shall not exceed the following rates:

Source: Paper Machines Process Stacks (Each)

Pollutant	lb/hr
$PM_{2.5}$	17.95
NO_X	13.50

Source: Paper Making Boilers (Each)

Pollutant	lb/hr
$PM_{2.5}$	0.9
NO_X	3.3

Source: Utility Boilers (Each)

Pollutant	lb/hr
$PM_{2.5}$	0.74
NO_X	1.80

Compliance with the above emission limits shall be determined by stack test.

Subsequent to initial compliance testing, stack testing is required at a minimum of every three years.

APPENDIX A. COST ANALYSIS