American Crystal Sugar Company

PSD Construction Permit Application

for

Drayton Sugar Beet Processing Facility
Drayton, Pembina County, North Dakota

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Executive Summary

American Crystal Sugar Company (ACS) proposes to modify its sugar beet processing plant located two miles north of the city of Drayton, in Pembina County North Dakota. The primary purpose of the modification is to support an approximate 20 percent increase in production that would raise the standard slice rate of the facility to 11,000 tons per day (tpd) from the current standard slice rate of 9,000 tpd.

The proposed modification includes the replacement of Pulp Dryer No. 2 with a larger coal-fired pulp dryer and the addition of a new natural gas-fired package boiler. In addition to the direct emission unit replacements/installations, numerous process-related modifications are proposed to increase operational efficiency and relieve production bottlenecks. The modification would be implemented over a five-year construction schedule with the pulp dryer installation occurring in 2023 and, the package boiler installation occurring in 2025. Other supporting equipment modifications would take place during the period from 2023 through 2028.

The proposed modification is classified as a major modification under the Title V Operating Permits program and the federal New Source Review Prevention of Significant Deterioration (PSD) program. Significant net potential emissions increases will occur for total particulate matter (PM), particulate matter less than 10 micron in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), volatile organic compounds (VOC), and greenhouse gas emissions (GHG).

The Best Available Control Technology (BACT) analyses identified the following requirements:

- Pulp Dryer – Use of low sulfur fuels, good combustion practice, and the installation of two cyclones and wet scrubber operated in series; and,
- Package Boiler – Use of Ultra Low NO_x Burners and good combustion practice.

An air quality dispersion modeling analysis utilizing the current EPA approved dispersion model, AERMOD, was performed as required by PSD rules. Criteria pollutant emissions of PM_{10}, $PM_{2.5}$, NO_x, SO_2 and CO were evaluated for compliance with applicable state of North Dakota and National Ambient Air Quality Standards (NDAAQS and NAAQS). Furthermore, a PSD Class II Increment Consumption analysis was performed for PM_{10}, $PM_{2.5}$, NO_x and SO_2. Results of the modeling analysis, incorporating proposed facility changes and BACT emission limits, demonstrate that the proposed Drayton facility expansion project will comply with all applicable ambient air quality standards and allowable increments. A summary of final proposed air emission permit limits has been provided in Chapter 7.0.

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Chapter 1.0 – Introduction

1.1 General

Pursuant to North Dakota Rules, Chapter 33-15-15, Prevention of Significant Deterioration of Air Quality (PSD), American Crystal Sugar Company (ACS) is applying for a construction permit for modification of their Drayton, North Dakota processing plant.

The ACS Drayton facility is an existing sugar beet processing facility located approximately 2 miles north of the city of Drayton, in Pembina County in northeastern North Dakota. The facility's principal products are granulated beet sugar, beet pulp pellets and beet molasses. Most emission sources related to sugar beet processing operations at the Drayton facility consist of material and sugar handling sources. However, several combustion related emission sources are utilized to support processing operations, such as: one coal-fired boiler, two coal-fired pulp driers and one natural gas-fired lime kiln.

ACS is proposing to modify the Drayton facility to support an approximate 20 percent increase in production. The production increase would raise the standard slice rate of the facility to 11,000 tons per day (tpd) from the current standard slice rate of 9,000 tpd.

The proposed production increase would affect multiple processing areas of the Drayton facility, such as juice purification, evaporation, sugar handling, and pulp management. Major direct emission unit modifications would include the installation of a new coal-fried rotary pulp dryer to replace one of the two existing pulp dryers and the addition of a new natural gas-fired package boiler.

In addition to the direct emission unit modifications, numerous process equipment modifications would also be necessary to support the increase in production. The process equipment modifications do not involve direct pollutant emissions but allow a relaxation of process bottlenecks and increase the potential product throughput at the Drayton facility. In general, affected process equipment would include carbonation systems and filters, juice softening, evaporator pans, and various piping, pumps and tanks.

The scope of work and investment associated with the proposed production increase is great enough such that project engineering and implementation will occur over a period of five years. This Prevention of Significant Deterioration (PSD) construction permit application addresses the staged construction schedule and combined project elements.

The Drayton facility is currently a major source of air emissions under both the federal New Source Review PSD program and under the Title V Operating Permits program. The proposed modification of the facility to increase the sugar beet processing capacity would be classified as a major modification for both PSD and Title V purposes. This application contains the information required for an air emissions construction permit under state and federal PSD rules. North Dakota Department of Environmental Quality (NDDEQ) construction permit application forms have been included. A Title V Operating Permit application will be required within one-year of completion of construction of the project.

1.2 Application Overview

Chapters 1 and 2 provide a brief introduction and project description. Chapter 3 provides a summary of the estimated emissions of criteria and hazardous air pollutants (HAPs) from the proposed modification, as well as a summary of air pollution control regulations that apply to the proposed facility modification. Chapter 4 presents the Best Available Control Technology (BACT) analysis for each PSD-regulated pollutant potentially emitted in significant amounts by the project. Chapter 5 presents the air quality impact analysis for the project. Chapter 6 presents the additional impact analyses for associated growth and potential impacts on visibility, soils and vegetation. Chapter 7 provides a summary of new and modified emission limits being requested with this permit application.

Chapter 2.0 – Project Description

2.1 Facility Location

The ACS Drayton facility is located approximately two miles north of the city of Drayton, in Pembina County North Dakota. A site location map is provided in Appendix B. Site layout diagrams including a general site orientation map, as well as a stack identification/location diagram, are also provided in Appendix B.

2.2 Process Description

The Drayton facility's principal products are granulated beet sugar, beet pulp pellets and low-grade beet molasses. In general terms, facility operations follow a seasonal pattern. Sugar beets are harvested in the fall and transported by truck to intermediate storage facilities as well as stockpiled on site at the Drayton facility. As the processing campaign commences, sugar beets are continually transported from the intermediate storage facilities to the facility for processing. Toward the end of the processing campaign (generally the last four weeks) the intermediate storage facilities are emptied and the sugar beets stockpiled on site at the facility are processed. The processing campaign typically lasts about 263 standard days but can vary depending on annual harvest amounts and beet quality. During off-campaign periods routine factory maintenance and repairs are performed. Beet sugar, molasses, and pellets are shipped out by rail and truck. Major processing areas are raw beet receiving and storage, beet processing to produce juice, sugar production and refining, pulp drying and pellet production.

The primary production process begins with sugar beets entering the facility through a horizontal beet washer to remove the adhered dirt (tare) prior to introduction to the main process. Beet slicers then cut the beets into cossettes. The cossettes are introduced into the bottom of a counter-flow diffuser tower to begin the diffusion process. The sucrose in water resulting from this osmotic process is known as "raw juice." A solution of caustic lime in recycled sugar juice called "milk of lime" is added to the juice to remove impurities as part of a purification process. Carbon dioxide is then added to the juice to re-precipitate the lime and impurities.

The process juice is filtered to remove suspended matter and softened prior to an evaporation step. Once purified and filtered, the raw juice is referred to as "thin juice". The thin juice is subsequently processed through several evaporator stages. The syrup leaving the evaporators is known as "thick juice" and is mixed with dissolved sugar and standard liquor from storage tanks. This mixture is boiled in vacuum pans to increase the dissolved solids content, and then seeded with a sugar/alcohol slurry which initiates the process of crystallization. Once the crystal size and concentration are appropriate, the sugar crystals are separated from the syrup by centrifuges. The remaining syrup is sent to a second set of vacuum pans where the process is repeated. After the process is repeated a third time the remaining syrup, termed "beet molasses", is stored until it is transported to a different facility to be processed or sold directly to customers. The sugar from the second and third boiling is continuously returned to the high melter where it is dissolved with further evaporated thick juice and reintroduced into the above-described process.

Sugar crystals from the centrifuge process are conveyed to the sugar dryer/granulator where heated air removes excess moisture. The dried sugar is then conveyed by an elevator to the sugar cooler where an ambient air-cooled glycol loop heat exchanger is used to cool the sugar prior to transport to bulk storage bins. The sugar is screened for crystal size control prior to distribution.

During a typical sugar beet processing campaign, the plant will operate 24 hours per day for 263 standard days (approximately 6,000 to 6,500 hours per year) from mid-August until the middle of May. The exact length of a given campaign is dependent on many factors and varies from year to year. The size of the harvest influences campaign length the most; however, ambient weather conditions, beet quality and storage capability also play a role.

Many emission sources related to sugar beet processing operations at the Drayton facility consist of material and sugar handling sources. However, there are several combustion related emission sources utilized to support processing operations. In general, current emission sources at the Drayton facility include the following:

- One Babcock & Wilcox coal-fired spreader stoker boiler;
- Two Stearns-Roger coal-fired rotary pulp driers;
- One natural gas-fired vertical shaft lime kiln;
- Lime slaking operations;
- Numerous sugar storage bins and conveying systems;
- Three pulp pellet mills with associated cooler;
- One sugar dryer/granulator system;
- Raw material and pulp handling operations; and,
- Raw material storage stockpiles.

2.3 Proposed Modification

As stated previously, the overall goal of Drayton facility modification is to increase production from a standard slice rate of 9,000 tpd to 11,000 tpd. To accomplish the production increase, multiple processing areas of the Drayton facility, such as juice purification, evaporation, sugar handling, and pulp management would need to be upgraded.

The following sections provide additional details on the proposed new emission units, as well as the impact of the proposed modification on existing emission units and process equipment.

2.3.1 Coal-Fired Boiler

Emission Unit (EU) 1 is a Babcock & Wilcox coal-fired spreader stoker boiler with a nominal heat input capacity of 392 million British thermal units per hour (MMBtu/hr) and a nominal steam load capacity of 300,000 pounds per hour (lbs/hr). The proposed modification would result in no physical modification or change in the method of operation of EU1. The production increase is anticipated to result in a greater annual steam demand and a more consistent short-term peak steam demand. However, the current coal-fired boiler system is capable of accommodating the increased demand as it is currently designed and configured. If the proposed project results in a short-term peak steam demand greater than the current coal-fired boiler can accommodate, it will be supplied by the proposed natural gas-fired package boiler (See Section 2.3.4).

2.3.2 Coal Handling Operations

Coal handling operations consist of two separate operations:

- EU1a – coal handling equipment for the boiler house; and,
- Fug2 – fugitive emissions from coal handling associated with onsite stockpiles.

Coal handling equipment for the boiler house would not be physically modified as part of the proposed modification. Operations of Fug2 would experience no change. The onsite coal stockpile provides approximately a two-week supply of coal to allow continuous operations in the event of an interruption in routine daily coal shipments. The same procedures would continue after the proposed modification.

2.3.3 Coal-Fired Pulp Dryer

The Drayton facility currently utilizes two coal-fired pulp dryers to dry beet pulp (spent cossettes) prior to pelletization: Pulp Dryer No. 1 (EU4) and Pulp Dryer No. 2 (EU3). Pulp Dryer No. 1 is a Stearns-Roger rotary direct-fired, traveling grate pulp dryer, with a nominal process rate of approximately 65 tons per hour (tph) of pressed pulp. Pulp Dryer No. 2 is a Stearns-Roger direct-fired, traveling grate pulp dryer, with a nominal process rate of approximately 33.8 tph pressed pulp.

ACS proposes to decommission Pulp Dryer No. 2 and the associated exhaust stack and replace it with a new, higher-capacity, pulp dryer and exhaust stack. The proposed new pulp dryer (EU36) would be installed in the same factory location as Pulp Dryer No. 2. The new pulp dryer would be a Promill direct-fired triple-pass rotary dryer with a nominal process rate of approximately 65 tph pressed pulp. It would be primarily coal-fired (8.6 tph) with natural gas as a supplemental fuel (40 MMBtu/hour). No physical modifications are proposed to Pulp Dryer No. 1.

The Drayton facility utilizes a common coal hopper feed for the two pulp dryers. The coal hopper is controlled by a baghouse (EU23). No physical modifications are proposed to the current system. Therefore, any change in operation as a result of the proposed modification would be strictly due to an increase in annual utilization.

2.3.4 New Package Boiler

ACS proposes to install a new natural-gas fired package boiler to provide steam to support production operations. The proposed new package boiler would have a nominal capacity rating of 359 MMBtu/hr. The make and model of the package boiler has not been determined at this time.

2.3.5 Lime Kiln Operations

Lime kiln operations at the Drayton facility consist of a natural gas-fired vertical shaft lime kiln (EU28) with a nominal capacity of 500 tons per day (tpd) lime production, a lime slaker (EU30) with a nominal capacity of 20.8 tph lime, and fugitive emissions from lime rock handling (Fug 3). The Drayton facility also utilizes a small flume lime slaker (EU25) that is used to maintain the pH of flume water entering the diffuser. The flume slaker is not part of the juice purification process, but instead facilitates sugar recovery.

The proposed modification would result in no physical modification or change in the method of operation of the lime kiln operations. However, the factory production increase may result in a greater annual lime demand and a more consistent short-term peak demand. The current lime kiln operations are capable of accommodating the increased demand as currently designed and configured.

2.3.6 Sugar Dryer and Granulator

The current sugar dryer/granulator system (EU29) has a nominal capacity of 100 tph. The proposed modification would result in no physical modification or change in the method of operation of the sugar dryer/granulator. However, the factory production increase may result in a greater annual demand and a more consistent short-term peak demand. The current sugar dryer/granulator is capable of accommodating the increased demand as currently designed and configured.

2.3.7 Sugar Handling Equipment

Sugar handling emission sources located downstream from the dryer/granulator include the MAC2 Flow Headhouse (EU14a), Old Hummer Room Pulsaire (EU14b), Hummer Room MAC (EU14c), Sugar Warehouse (EU18), Bulk Loading Pulsaire (EU19a), North Bulk Sugar Loadout (EU19b), South Bulk Sugar Loadout (EU19c), and Main Warehouse Pulsaire (EU20).

The sugar handling emission sources consist of a number of baghouse controlled pickup points on various sugar transport conveyor systems supporting bulk loadout and bagging operations. Several of the sources are considered insignificant and vent internally in the factory. The baghouse controls utilized by emission units EU18 through EU20, which are associated with bulk loadout and warehouse operations, are classified as inherent product recovery devices which recover sugar and return it to the process.

Proposed modifications to the sugar handling operations include upgrades to the conveying and screening equipment to eliminate current bottlenecks and improve railcar loading through conveyor automation. No changes to current control equipment configurations or equipment capacities are proposed. Based on preliminary design data, changes to bulk loadout to improve efficiency would only impact internally vented and insignificant emission units.

2.3.8 Pulp Pellet Processing

As a result of the increased pulp drying capacity, the downstream pelletization and pulp handling equipment would experience higher utilization. The Drayton facility currently utilizes the following pulp handling equipment:

- Three pulp pellet mills and cooler system (EU31, EU33 and EU34) with an overall nominal 30 tph capacity;

- A collection of dry pulp belt conveyors (EU9) with a nominal 16.8 tph capacity;
- Dry pulp reclaim system (EU10) with a nominal 16.8 tph capacity;
- Dry pulp bucket elevator (EU11) with a 16.8 tph capacity;
- Three pulp pellet storage bins (EU15, EU16 and EU17); and,
- One pulp pellet bulk loadout system (EU32).

The proposed modification would result in no physical modification or change in the method of operation of the pulp pellet processing sources. However, the factory production increase may result in a greater annual demand and a more consistent short-term peak demand. The current pulp pellet processing equipment is capable of accommodating the increased demand as currently designed and configured.

2.3.9 Process Modifications

In addition to the previously discussed direct emission units, the proposed modification of the Drayton facility would include several process modifications that would debottleneck internal production equipment to accommodate an increased slice rate. These process modifications would not directly result in the physical modification of any emission units, but instead would result only in the debottlenecking of emission source operations. To address all proposed process modifications from a conservative regulatory applicability approach, all considered process modifications have been summarized below. During the NDDEQ permit review and approval process, ACS will communicate final process changes for incorporation into construction permit documents. Rescinded (or added) process changes will not affect PSD applicability because all emission sources are currently being evaluated at maximum capacity. The proposed process modifications include the following:

- Various heaters, pumps and condensate upgrades
- High melter/STD liquid tank
- Evaporator modifications
- Affination pump upgrade
- Cold water tank modifications
- South 2nd carbonation tank repair
- Diffuser tower and arc screens
- Cossette mixer
- Seal water line
- 50# reducing station
- Low raw vertical vacuum pan (VKT)
- White pan (2) addition
- Two (2) new white centrifugals
- Carbonation clarifier upgrade
- Cooler chiller system/discharge
- Screen house upgrade
- Two (2) new pulp presses
- Two (2) new intermediate centrifugals
- Wet hopper extension
- CO_2 blower addition

- PKF station upgrade
- Standard liquor filters
- Sugar screen modifications
- White pan (1) addition
- USC bulk loadout modifications (Internal modifications inside the bulk loadout building. The building vents to a baghouse, which will not be modified as part of this project.)
- Turbine/generator upgrade
- Molasses tank/loading upgrade
- Pellet bin (Internal modifications inside the bulk loadout building. The building vents to a baghouse, which will not be modified as part of this project.)
- Secondary truck tipper/hopper

These process modifications would enable the Drayton facility to increase sugar production capacity and accommodate a greater slice rate.

2.3.10 Non-Affected Emission Units

Emission sources that would not be affected by the proposed modification to increase the slice rate at the Drayton facility include the Diesel Fire Suppression Pump (EU21), Flume Lime Slaker (EU25) and spent lime wind erosion (FUG4).

The fire suppression pump is used for emergency purposes only and is not impacted by the processing campaign. The flume lime slaker is used for infection control purposes and will not be impacted by the increase in production. Spent lime wind erosion will not be appreciably changed as a result of the proposed modification. Wind erosion emissions are based on the overall pile area and local meteorological conditions. The proposed modification will not significantly alter the spent lime pile size or shape.

2.3.11 Physical Modification and Debottlenecked Source Cross Reference

Table 2.1 provides a listing of the affected emission sources and indicates which sources would experience a change in the method of operation and which sources would be debottlenecked as part of the proposed modification.

Table 2.1 – Affected Emission Sources

Emission Unit	EU	EP	Status
Main Boiler	EU1	EP1	Debottlenecked
Boiler Coal Handling	EU1a	EP1a	Debottlenecked
~~Pulp Dryer No. 2~~	~~EU3~~	~~EP3~~	Removed
Pulp Dryer No. 1	EU4	EP4	Debottlenecked
Dry Pulp Belt Conveyors	EU9	EP9	Debottlenecked
Dry Pulp Reclaim System	EU10	EP10	Debottlenecked
Dry Pulp Bucket Elevator	EU11	EP9	Debottlenecked

Emission Unit	EU	EP	Status
MAC 2 Flow Headhouse	EU14a	EP14a	Debottlenecked
Old Hummer Room Pulsaire	EU14b	EP14b	Debottlenecked
Hummer Room MAC	EU14c	NA	Debottlenecked
Pulp Storage Bin No. 1	EU15	EP15	Debottlenecked
Pulp Storage Bin No. 2	EU16	EP16	Debottlenecked
Pulp Storage Bin No. 3	EU17	EP17	Debottlenecked
Sugar Warehouse (Hi-Vac)	EU18	EP18	Debottlenecked
Bulk Loading Pulsaire	EU19a	EP19a	Debottlenecked
North Bulk Sugar Loadout	EU19b	EP19b	Debottlenecked
South Bulk Sugar Loadout	EU19c	EP19c	Debottlenecked
Main Sugar Warehouse Pulsaire	EU20	EP20	Debottlenecked
Diesel Fire Suppression Pump	EU21	EP21	No Change
Pulp Dryer Coal Hopper	EU23	EP23	Debottlenecked
Flume Lime Slaker	EU25	EP24	No Change
Vertical Shaft Lime Kiln	EU28	EP27a-c	Debottlenecked
Sugar Dryer/Granulator	EU29	EP28	Debottlenecked
Lime Slaker	EU30	EP29	Debottlenecked
Pulp Pellet Mill No.1	EU31	EP30	Debottlenecked
Pulp Pellet Mill No.2	EU33	EP30	Debottlenecked
Pulp Pellet Mill No.3	EU34	EP30	Debottlenecked
Pulp Pellet Loadout	EU32	EP31	Debottlenecked
NEW PACKAGE BOILER	**EU35**	**EP32**	**NEW SOURCE**
NEW PULP DRYER No. 2	**EU36**	**EP33**	**NEW SOURCE**
Coal Handling Fugitive	Fug2	NA	Debottlenecked
Lime Rock Handling Fugitive	Fug3	NA	Debottlenecked
Spent Lime Wind Erosion	Fug4	NA	No Change

2.4 Past Facility Modifications

No modifications have taken place at the ACS Drayton facility since the issuance of Permit to Construct No. PTC17001 issued on July 31, 2017. This permit action was a major PSD modification and there are no contemporaneous changes within the last five years to be included in the current permit action.

2.5 Project Schedule

The expected schedule of project implementation is shown in Table 2.2.

Table 2.2 – Schedule of Construction

Milestone	Date	Description
Preliminary Engineering	2022	Start of preliminary engineering, preconstruction permitting/approvals and ordering of select long-lead equipment.
Engineering	2023	Detailed engineering and project preparation.
Phase I Construction	2023-2024	Pulp dryer installation, condensate upgrades, evaporator upgrades, diffuser tower, and other ancillary equipment installation.
Phase II Construction	2025-2026	White pans, white centrifugals, pulp presses, filtering upgrades, package boiler installation, and other ancillary equipment installation.
Phase III Construction	2027	Turbine generator upgrade, pellet loading upgrades, sugar loadout upgrades, and other ancillary equipment installation.

Chapter 3.0 – Estimated Emissions and Applicable Regulations

3.1 Emission Factors

Emission factors for criteria air pollutants emitted from the Drayton facility were obtained by reviewing data from several sources. These include the Environmental Protection Agency's (EPA) Compilation of Air Pollutant Emission Factors (AP42), emission test data from emission unit performance tests, and permitted allowable emission rates where applicable. Details concerning specific emission factors and emission units are included in calculation spreadsheets provided in Appendix C.

3.2 Emission Estimates

3.2.1 General Emission Calculations

Future potential emission calculations are based on 8,760 hour per year operation for all emission sources at maximum capacity. The proposed project will have the potential to increase emissions of several PSD-regulated pollutants, including nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}), particulate matter with a nominal aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$), sulfur dioxide (SO_2), volatile organic compounds (VOC) and greenhouse gas (GHG) emissions. The project may also have the potential to increase emissions of several pollutants regulated under North Dakota's Air Toxic Policy.

Past actual emissions were calculated using emission inventory data as submitted to the NDDEQ for the Drayton facility. When available, performance test data were used in conjunction with operational data to calculate actual emission levels. If unit specific performance test data were not available, AP42 emission factors were used in conjunction with actual operational data. For purposes of determining the significant net emission increase related to the proposed project, baseline emissions (past actual) were calculated using a representative two-year average emission rate selected from the last ten years of operational data for the Drayton facility (average of 2017 and 2018 calendar years).

Details concerning future potential and past actual emission calculations are included in calculation spreadsheets provided in Appendix C.

3.2.5 Potential Emission Increase

Calculated maximum potential-to-actual emission increases resulting from the proposed Drayton facility modification are summarized in Table 3.1.

Table 3.1 – Project Maximum Potential Emission Increases

Pollutant	Potential Emissions (tpy)	Past Emissions (tpy)	Emission Increase (tpy)	PSD Significant Emission Rate (tpy)
PM	829	590	239	25
PM_{10}	994	670	323	15
$PM_{2.5}$	699	423	276	10
NO_x	1,462	662	800	40
CO	6,582	2,589	3,994	100
VOC	709	63	646	40
SO_2	2,085	420	1,665	40
Carbon dioxide equivalent (CO_2e)	929,356	341,880	587,476	75,000
Lead (Pb)	0.06	0.04	0.02	0.6
Sulfuric acid mist (H_2SO_4)	5.99	1.07	4.92	7
Fluorides (measured as HF)	1.84	0.52	1.32	3

The emission increases presented in Table 3.1 reflect full-year operation at 8,760 hours per year and maximum capacity. Actual operations of the Drayton facility, due to the agricultural campaign-based production schedule, are typically on the order of 6,500 hours per year. Therefore, calculated potential emission increases are somewhat inflated for regulatory purposes. Both PM_{10} and $PM_{2.5}$ include condensable emission fractions and therefore appear greater than total PM emissions, which reflect filterable emissions only.

3.3 New Source Performance Standards

Federal New Source Performance Standards (NSPS) found in 40 CFR 60 have been adopted by reference within North Dakota Air Pollution Control Rules, Chapter 33-15-12. Due to initial construction dates prior to NSPS promulgation dates, none of the existing emission sources at the Drayton facility are subject to current standards. Furthermore, the definition of modification under 40 CFR 60.2 and 40 CFR 60.14 states that any physical change in or change in the method of operation of an existing facility which increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility is considered a modification. The determination of an increase in the amount of an air pollutant is based on an hourly increase in the potential emission rate (short-term maximum capacity) of an affected source, not an annual increase in utilization. The proposed modification of the Drayton facility will not result in an increase to potential hourly emissions of any existing emission unit for which a NSPS exists.

The proposed new natural gas-fired package boiler will be subject to 40 CFR 60, Subpart Db, Standards of Performance for Industrial-Commercial-Institutional Steam Generating units because it will have a rated heat input in excess of 100 MMBtu/hr.

3.4 Prevention of Significant Deterioration (PSD)

As a facility with greater than 250 MMBtu/hr of combined fossil-fuel boiler capacity, the Drayton facility is included as one of the 28 listed source categories in 40 CFR 52.21(b)(1)(i)(a) that are subject to a 100 tpy potential emission threshold to determine major status. By virtue of its current potential emissions, the facility is currently classified as a major source. Therefore, any facility modification that increases emissions by a significant amount as defined in 40 CFR 52.21 must obtain a PSD permit prior to beginning construction on the project.

PSD regulations require that all new or modified major stationary sources undergo a BACT review and ambient air quality analysis for all criteria and other PSD-regulated pollutants emitted over significant amount thresholds. As summarized previously in Table 3.1, the proposed production increase modification at the Drayton facility would be classified as a major modification for PM, PM_{10}, $PM_{2.5}$, NO_x, SO_2, VOC, and CO_2e.

3.5 Maximum Achievable Control Technology (MACT)

As part of the 1990 Amendments to the Clean Air Act (CAA), Section 112 was established to address emissions of HAPs. Under Section 112, emissions of HAPs are controlled by establishing emission standards and/or control technologies for identified source categories, and by addressing case-by-case analysis of new or reconstructed major sources of HAPs (those sources with greater than 10 tons per year of an individual HAP and greater than 25 tons per year combined HAPs). The emission limitation requirements proposed by subsequent regulations for the listed source categories are called Maximum Achievable Control Technology (MACT) standards and the regulations that contain the MACT standards and their associated compliance and reporting requirements are called the National Emissions Standards for Hazardous Air Pollutants (NESHAPs), which are listed under 40 CFR 63.

The coal-fired boiler at the Drayton facility is classified as an industrial boiler and therefore subject to MACT requirements under 40 CFR 63, Subpart DDDDD, National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters. Under the industrial boiler MACT rule the Drayton facility boiler (EU1) is classified as a unit designed to burn coal/solid fossil fuel and is therefore subject to emission limitations for PM, hydrogen chloride (HCl), mercury (Hg) and CO.

All applicable emission limitations under the boiler MACT rule have been incorporated as part of Permit to Construct No. PTC17001 issued on July 31, 2017.

The proposed new natural gas-fired package boiler (EU35) would be subject to 40 CFR 63, Subpart DDDDD. However, as the boiler is natural gas-fired, it would only be subject to periodic tune up requirements under the rule.

The proposed new pulp dryer at the Drayton facility is not regulated under a specific source category in 40 CFR 63. Therefore, if the total HAP emissions from the new source would exceed 10 tpy for an individual HAP or 25 tpy for the aggregate of all HAPs, a case-by-case MACT analysis would be required. Based on potential HAP emission calculations performed as part of the PTE calculations included in Appendix C, the total potential HAP emissions from the proposed new source would be 1.0 tpy for an individual HAP (Hydrofluoric Acid) and 2.71 tpy for the aggregate of all HAPs. Therefore, no MACT requirements apply.

3.6 Process Weight Rate Limits

The pulp dryers are currently subject to industrial process PM emission limits under North Dakota Air Pollution Control Rules, Chapter 33-15-05. Maximum allowable PM emission rates from the pulp dryers are based on the process weight rate, which includes solid fuel, and the following formulas:

For process weight rates in excess of 30 tons/hr:

$$E = (55.0)(p^{0.11}) - 40$$

Where,

p = the process rate in tons/hour; and,
E = the emission limit in lb/hr.

The proposed new pulp dryer will be subject to the same process weight rate limits.

3.7 North Dakota Air Toxics Policy

The NDDEQ has a published policy regarding the control of HAPs, also known as an "Air Toxics Policy". This policy requires evaluations of new emission sources or modifications to assure that HAP emissions do not endanger public health.

The proposed modification at the Drayton facility will result in an increase in hourly emissions from the proposed new pulp dryer and package boiler. Therefore, it was necessary to evaluate the HAP emissions from the proposed new pulp dryer and package boiler with respect to the current Air Toxics Policy. The Drayton facility modification will not result in an increase in hourly emissions from any other facility emission sources, but instead will only result in an increase in annual utilization; therefore, no other emission units were included in the analysis. As indicated above, the coal-fired boiler at the Drayton facility is subject to federal MACT requirements under 40 CDR 63, Subpart DDDDD.

HAP emissions for the proposed pulp dryer and package boiler were estimated using the maximum short-term fuel combustion rate and published emission factors from AP-42, Chapter 1.1, Bituminous and Subbituminous Coal Combustion, and Chapter 1.4, Natural Gas Combustion. Annual emissions were estimated assuming 8,760 hours of operation per year.

The Tier 2 Procedure was selected based on the published Air Toxics Policy guidance available from the NDDH. This procedure utilizes a conservative screen model assessment of affected point sources to estimate maximum 1-hour emission impacts that are scaled to determine relative impacts for longer time averaging periods (i.e., 8-hour and annual). No terrain functions were assessed in the screen model analysis due to the fact that the terrain around the Drayton facility is primarily flat.

The modeled impacts were utilized in conjunction with published guideline concentrations and unit risk factors for individual HAPs to determine the maximum individual carcinogenic risk (MICR) for known carcinogenic compounds and overall hazard index for non-carcinogenic compounds. Calculation spreadsheets detailing the emissions calculations and risk analysis procedures have been included in Appendix D.

Results of the air toxics review indicate an overall hazard index (HI) of 0.1, which is lower than the target threshold of 1.0. This is based on the summation of all individual hazard quotients for each HAP with an associated 1-hour or 8-hour guideline concentration. The overall MICR was calculated as 8.00E-07, which is less than the target threshold of 1.00E-05. Based on these results it has been determined that the proposed Drayton facility modification will not result in a significant risk due to air toxics emissions.

Chapter 4.0 – Best Available Control Technology

4.1 Overview

4.1.1 Definition of BACT

Federal regulation 40 CFR Part 52.21, Subpart (b)(12) defines a Best Available Control Technology (BACT) analysis as:

> *"an emission limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under the Clean Air Act which would be emitted from any proposed major stationary source or major modification which the Administrator [or permitting authority], on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through the application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment, or innovative fuel combustion techniques for control of such pollutant…"*

In summary, BACT is defined as an emission limitation established based on the maximum degree of pollutant reduction, determined on a case-by-case basis, considering technical, economic, energy, and environmental factors. However, BACT cannot be less stringent than emission limits established by an applicable NSPS.

4.1.2 Top-Down BACT Analysis

To bring consistency to the BACT process, the EPA has developed a draft guidance document (March 15, 1990) on the use of the "top-down" approach to BACT determinations. The first step in a top-down BACT analysis is to determine, for the pollutant in question, the most stringent control technology and emission limit available for a similar source or source category. Technologies required under Lowest Achievable Emission Rate (LAER) determinations must be considered. These technologies represent the top control alternative under the BACT analysis. If it can be shown that this level of control is infeasible on the basis of technical, economic, energy, and environmental impacts for the source in question, then the next most stringent level of control is identified and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any technical, economic, energy or environmental consideration.

For this study, the economic analysis used to determine the capital and annual costs of the control technologies was based on methodologies shown in the *EPA Best Available Control Technology Draft Guidance Document* (October, 1990), EPA *BACT Guidelines*, the Office of Air Quality Planning and Standards (OAQPS) *Air Pollution Control Cost Manual* (Sixth Edition), internal project developer cost factor, and vendor budgetary cost quotes.

A “Top-Down” BACT analysis basically consists of the following steps:

- *Identify All Control Technologies*. All control technologies for similar processes, as well as LAER technologies are included.

- *Eliminate Technically Infeasible Options*. Technologies demonstrated to be infeasible based on physical, chemical, and engineering principles are excluded from further consideration.

- *Rank Technologies By Control Effectiveness*. Technically feasible control technologies are ranked in the order of highest expected emission reduction to lowest expected emission reduction. The ranking also includes expected emission rate, control effectiveness, energy impacts, environmental impacts (including toxic and hazardous air emissions), and economic impacts.

- *Control Technology Evaluation*. The technology ranking is evaluated and case-by-case consideration is given to energy, environmental, and economic impacts. The most effective option not rejected is chosen as BACT and is used to express an enforceable emission limitation for the affected emission unit.

4.1.3 Applicable Pollutants and Affected Sources

Modification of the Drayton facility will result in potential emission increases of PM/PM_{10}/$PM_{2.5}$, NO_x, CO, SO_2, VOC and CO_2e in excess of the PSD significant emission rate increase threshold levels set for these pollutants. A BACT analysis is required for each pollutant subject to regulation for which a modification would result in a significant net emissions increase at the source. More specifically, the BACT requirement applies to each proposed emission unit at which a net emissions increase of the regulated pollutant occurs as a result of a physical change or change in the method of operation in the unit [40 CFR 52.21(j)(3)].

As described previously in Section 2.3 two emission units at the Drayton facility would be constructed as new emission units and thus be subject to BACT as a result of the physical modification associated with the project. These units include:

- Coal-Fired Pulp Dryer
- Natural Gas-Fired Package Boiler

The BACT analysis addresses each of the affected regulated air pollutants with respect to their emission from the two affected sources. The following paragraphs provide a brief description regarding the formation and emission of the regulated air pollutants.

4.1.3.1 PM/PM_{10}/$PM_{2.5}$ Formation

For practicality purposes, total suspended particulate (TSP), PM_{10} and $PM_{2.5}$ emissions are addressed concurrently in the BACT analysis. PM_{10} and $PM_{2.5}$, by definition, are a subset of TSP or total PM emissions and, in general terms, the air pollution control equipment used to mitigate these pollutants are the same. General reference to PM in the BACT analysis discussion refers to TSP, PM_{10} and $PM_{2.5}$, unless specifically noted.

PM emissions from combustion sources such as the new coal-fired pulp dryer and new package boiler are a function of the burner configuration, operation practices, and fuel properties. Uncontrolled PM emissions include ash from non-combustibles in the fuel, as well as unburned carbon resulting from incomplete combustion. PM emissions are classified as filterable and condensable. Filterable PM is the portion of total PM present in the exhaust stream as a solid or liquid that can be measured on an EPA Method 5 filter (40 CFR 60, Appendix A). Condensable PM is the portion of PM that is initially present as a gas in the exhaust stream but condenses to a liquid or solid state at cooler ambient temperatures.

PM emissions from the coal-fired pulp dryer also have a process related component that results from the direct contact of combustion exhaust gases with the product to be dried. Essentially, the airflow through the pulp dryer results in the entrainment of PM from the drying process.

4.1.3.2 NO_x Formation

In general, there are two mechanisms of NO_x formation from combustion related sources. These mechanisms include oxidation of nitrogen bound in the fuel, and thermal production of NO_x from atmospheric nitrogen and oxygen. High combustion temperatures cause the nitrogen (N_2) and oxygen (O_2) molecules in the combustion air to react and form thermal NO_x. Because thermal NO_x is primarily a function of combustion temperature, NO_x emission rates vary with burner and source design. Experimental measurements of thermal NO_x formation have shown that the NO_x concentration is exponentially dependent on temperature and is proportional to the N_2 concentration in the flame, the square root of the O_2 concentration in the flame, and the gas residence time.

4.1.3.3 SO_2 Formation

SO_2 emissions are formed from the oxidation of organic sulfur and soluble alkali in the fuel during combustion processes. The majority of sulfur is oxidized to SO_2, however, a small quantity may be further oxidized to form sulfur trioxide (SO_3). With coal combustion, a large percentage of the sulfur in the fuel will be bound up in the ash produced from the combustion process.

Because of the direct contact nature of the pulp dryer process, where combustion gases come into direct contact with (and filter through) the pulp being dried, there is an inherent level of SO_2 control experienced as a result of the wet pulp adsorbing SO_2 in the exhaust gas stream. This has been observed and demonstrated through performance testing of the pulp dryers and is discussed in more detail in Section 4.2.

4.1.3.4 CO Formation

CO formation occurs primarily through incomplete combustion. The oxidation of CO to carbon dioxide (CO_2) is dependent on temperature, residence time during the combustion process, and the amount of excess O_2 present. Since temperature and residence time are critical factors in the formation of CO, emission units such as pulp dryers, which may have less high-temperature residence time to achieve complete combustion, may have higher CO emission levels than sources such as boilers.

4.1.3.5 VOC Formation

VOC formation generally follows the same principles of CO formation in combustion related emission sources.

4.1.3.6 Greenhouse Gas Formation

Greenhouse gas emissions of concern for the Drayton facility modification include combustion related emissions, such as CO_2, nitrous oxide (N_2O) and methane (CH_4). N_2O and CH_4 are generally produced in small amounts as a combustion byproduct. CO_2 emissions are created in the combustion process as a direct result of the elemental carbon (C) in the fuel combining with free oxygen. For PSD purposes, the combustion related greenhouse gas emissions are scaled based on their global warming potential and combined to form one pollutant, termed carbon dioxide equivalent (CO_2e).

4.1.3.7 Condensable Particulate Matter (CPM) Formation

Condensable particulate matter (CPM) forms from the condensing of gases and/or vapors in a flue gas stream after combustion. This is a result of chemical reactions as well as the physical properties and phenomena of matter phase changes (i.e., solid/liquid/gas). In general, material that is not particulate matter at stack conditions can condense or react upon cooling and dilution by ambient air to form a particulate. This formation generally occurs within a few seconds after discharge from an exhaust stack. However, with typical exhaust gas velocities, the particulate matter is being formed (condensed) up to 100 feet away from the exhaust gas exit.

Aside from questions concerning the accurate quantification of CPM and test method performance, available technological control options for CPM are limited. The fact that CPM formation occurs outside of the exhaust stack exit point, possibly as far as 100 feet away, makes control of CPM very difficult. The difficulty in control can be summarized in the following three questions:

1.) Can CPM formation be prevented? This would entail a form of combustion control that manages complete combustion and controls moisture in the combustion process. Furthermore, accurate real-time quantification of potential CPM formation would need to be developed to manage such combustion control. Currently no standard methods exist for this option.

2.) Can CPM be removed after formation? This is not technically feasible as it would require the capture of emissions formed outside of the exhaust point of the stack. In essence, it is the control of secondary pollution formation in the ambient air.

3.) Can the stack conditions be altered to promote the formation and capture of CPM before release to the ambient air? In general, this would involve either significant dilution of flue gases in the exhaust stack or significant artificial cooling of hot combustion gases. Dilution of exhaust gases is strictly prohibited by most state air quality laws. Artificial cooling of the high-volume exhaust gases from larger combustion sources would be extremely cost prohibitive.

The following paragraphs briefly address current particulate matter control technologies with respect to their technical feasibility for controlling CPM.

Mechanical Collectors: Mechanical collectors generally use the inertia of a moving particle in an exhaust gas stream to achieve particulate collection. A particle-laden exhaust stream is forced to rapidly change direction, either through cyclonic flow in a cylinder or by passing through a series of sieve plates in an impingement device. The mass of the particles in the exhaust stream causes them to move outside of the exhaust stream and impact on a collection surface where they then settle into a hopper or are collected in some other manner. Some mechanical collectors are specifically designed (and generally operated in series) to provide high efficiency particulate matter collection down to a particle size of one micrometer. However, as stated previously, at stack conditions, CPM is in a vapor or gaseous form, and thus has no significant difference in mass as compared to the surrounding exhaust gas. Therefore, inertial type mechanical collectors are not technically feasible for the capture of CPM.

Particulate Scrubbers: Particulate wet scrubbers exist in many forms. All particulate wet scrubber designs utilize particle and/or droplet inertia as the fundamental force to transfer particles from the gas steam to the liquid steam. Within a scrubber, particle laden air is forced to contact liquid droplets, sheets of liquid on packing material, or jets of liquid from a plate. As with the mechanical collectors, but on a smaller scale, the inertia of droplets or particles causes an impact with the collection media. However, vapors or gases with no significant mass with respect to the surrounding exhaust gases will pass around the “target” droplets, steams, or media. The ability of a particulate wet scrubber to remove particles primarily depends on the aerodynamic diameter of a particle, the velocity of a particle, and the velocity of droplets or collection media. Due to the extremely small (molecular) size of gases and vapors, they tend to follow Brownian diffusion, which means they diffuse slowly and primarily due to their interactions with gas molecules in the exhaust gas steam and are not significantly influenced by inertia.

The only advantage provided by a wet particulate scrubber is the potential ability to reduce the exhaust gas stream temperature to a degree which will promote the condensation of a portion of the CPM. After condensation, the particulate matter will then have a larger diameter and mass, which will allow the mechanics of particle collection to function. However, based on the high temperature and flowrate of exhaust gases produced by most combustion sources, the wet particulate scrubbers cannot sufficiently reduce the exhaust gas temperature to result in particle condensation. Therefore, wet particulate scrubbers are not technically feasible for the capture of CPM.

Electrostatic Precipitators: Electrostatic Precipitators (ESP) utilize non-uniform high voltage fields to apply large electrical charges to particulates moving through the field. The charged particles are then attracted to oppositely charged collection plates to promote particulate capture. Gases and vapors are not significantly influenced by the electrical fields and therefore are not captured by ESP devices. As with the other particulate collection devices, the temperature of the exhaust gas steam would need to be reduced to a degree that promotes the condensation of CPM to facilitate capture. As discussed, it is not economically feasible to reduce the exhaust gas temperature, therefore ESP devices are not technologically feasible for the capture of CPM.

Fabric Filtration: Fabric filters are used to collect particulate matter on the surface of filter bags. Most particles are collected by inertial impaction, interception and sieving. As particles are collected, the layer of particles, or filter cake, that develops increases the chances of capture by reducing the size of the fabric filter holes and increasing the chance for interception and sieving. Fabric filters have some limitations in that they cannot be used with corrosive or high moisture exhaust gas streams. Corrosive gases can destroy the integrity of the filters, leading to leaks. High moisture exhaust gases will result in blinding (plugging) of the fabric filters when absorbed by the filter cake.

Despite the limitations, fabric filters offer some advantage for the capture of some specific CPM, especially when used in conjunction with other control devices. For example, sulfur trioxides (SO_3), which may react with moisture in the exhaust gases to form sulfuric acid mist (H_2SO_4), which is a CPM, can be collected on the surface of a fabric filter in the presence of a reagent such as lime. The presence of the lime, due to the implementation of SO_2 controls upstream of the fabric filter, results in a chemical reaction to remove the specific CPM. Fabric filters are therefore considered a technically feasible option for the control of limited and specific CPM emissions when used in conjunction with other control devices.

Absorption: Absorption will only be discussed briefly as such systems are generally cost-prohibitive with respect to the level of CPM control offered. In general, the use of an absorbent such as activated carbon can capture numerous gases and vapors prior to, and without necessity of, condensation. However, due to the large flowrates of most combustion sources, the surface area and size of an absorption tower or bed would have to be prohibitively large to provide for proper residence time and collection efficiency. Therefore, although absorption is theoretically feasible, it is not practical

Given the limitations of PM control equipment with respect to control of CPM, the BACT analysis and subsequent proposed BACT emission limits will focus on filterable PM emissions.

4.1.4 Project Economic Evaluation Criteria

Table 4.1 lists the economic criteria used in the BACT analysis for determination of capital and annual costs of the control technologies.

Table 4.1 –Economic Evaluation Criteria

Economic Parameters	Value
Interest Rate, percent	7[A]
Control Equipment Economic Life, years	15[B]
Base Labor Cost, $/hr	60[C]
Energy Cost, $/kW-hr	0.06[D]

[A] EPA Air Pollution Control Cost Manual, Seventh Edition, November 2017, Chapter 2, Section 2.5.2.
[B] EPA Memorandum, Calculating Amortized Capital Costs, July 24, 1987, Robert D. Bauman, Chief Standards and Implementation Branch.
[C] Loaded labor rate obtained from ACS.
[D] Actual ACS electricity cost.

4.1.5 Organization of BACT Analysis

The BACT analysis focuses specifically on emissions associated with the two new emission sources associated with the project: the coal-fired pulp dryer and the natural gas-fired package boiler. The BACT analysis has been divided into sections that individually address PM, NO_x, SO_2, CO and VOC emissions. GHG emissions are addressed separately in a final section that combines all applicable emission units.

4.2 Coal-Fired Pulp Dryer BACT

The following subsections address each applicable pollutant emitted from the proposed new coal-fired direct contact pulp dryer at the Drayton facility. As previously mentioned, ACS proposes to replace the existing Pulp Dryer No. 2 (EU3), which has a nominal process rate of approximately 33.8 tph of pressed pulp, with a new larger pulp dryer with a nominal process rate of approximately 65 tph of pressed pulp.

4.2.1 BACT for PM

PM emissions from coal-fired combustion result from the combination of the burner firing configuration, operation, and fuel properties. PM emissions from coal-fired sources typically include ash from the combustion of the fuel, potential burning embers, and unburned carbon resulting from incomplete combustion. Because of the direct contact nature of the pulp dryer, the most significant portion of PM emissions results from the dryer process itself (particles of dried pulp).

As discussed in Section 4.1.3.7, condensable particulate matter (CPM) will not be considered further in this BACT analysis.

The final proposed BACT emission limit contains a CPM component for compliance purposes, but the control technology evaluation is based on filterable emissions only. Additionally, all cost evaluations assume that TSP and PM_{10} size fractions are equivalent as this presents the most conservative (worst-case) analysis.

4.2.1.1 Identification of PM Control Technologies

The following sections identify potentially available control technologies for coal-fired combustion processes. Additionally, the feasibility of the control technologies as applied to the operation of the proposed new coal-fired direct contact pulp dryer is addressed.

Control of PM emissions is achieved through the addition of equipment added downstream of the combustion device and pulp dryer drum. Five control technologies have been identified as alternatives for the proposed pulp dryer: fabric filter baghouse, electrostatic precipitator (ESP), wet electrostatic precipitator (WESP), wet scrubber, and mechanical separator (cyclone). These technologies are considered to have the highest control efficiency of all particulate control options.

Fabric Filter Baghouse

Fabric filtration in a baghouse consists of a number of filtering bags that are suspended in a housing. The particulate-laden gas passes through the housing and collects on the fabric of the filter bag.

Accumulated particulate matter on the bag surfaces enhance the filtering efficiency. Periodically, the accumulated material or "cake" is removed from the bags using a physical mechanism such as shaking or pulsing the bags with compressed air. The dust is collected in a hopper and eventually removed.

Because of the very high moisture content of the exhaust gas stream from the pulp dryer, there is great potential for blinding and plugging any fabric filter control device used on the system. Furthermore, because of the direct contact nature of the dryer, there is also potential for burning pulp or coal embers to be transported to the fabric filter, which presents a fire safety issue. Therefore, the application of a fabric filter to control PM emissions from the pulp dryer is not considered technically feasible.

Electrostatic Precipitator

Electrostatic precipitators (ESPs) remove PM from the flue gas stream using the principle of electrostatic attraction. PM in the exhaust stream is charged with a very high direct current (DC) voltage and the charged particles are attracted to oppositely charged collection plates in the ESP. PM collected by the ESP continues to accumulate on the plates until removed by rapping the electrodes. The dust is then collected in a hopper for disposal. ESPs can handle large gas streams and high particulate loading and can operate at high temperatures. However, like baghouse fabric filters, ESPs do not function well with wet exhaust gas streams. Because the exhaust gas from the pulp dryer is saturated with moisture, there is the potential for buildup of particles on the collection plates, which will reduce the effectiveness and require additional maintenance, as well as the potential for electrical shorting. As a result of the saturated exhaust gas steam, ESPs are not considered a technically feasible option for the pulp dryer.

Wet Electrostatic Precipitator

Wet electrostatic precipitators (WESP) operate using the same principles as a standard ESP, but the final cleaning step is different. The collection surfaces are cleaned with water that can be delivered from spray nozzles or by condensing moisture from the flue gas. WESPs effectively reduce particle re-entrainment since the surfaces of the collection plates are constantly cleaned with liquid. WESPs also operate under higher electrical power than standard ESPs and enable higher reduction of very small particles. Operation of a WESP requires the collection and treatment and/or disposal of wastewater containing fly ash from the combustion device.

The operation of a WESP on the pulp dryer is assumed technically feasible. However, it should be noted that there are no known direct-fired pulp dryer operations that currently utilize WESP control, therefore, unknowns concerning particle resistivity could reduce anticipated collection efficiencies. However, humidity lowers the resistivity of most materials, therefore, it is anticipated that adequate collection efficiency could be maintained.

Wet Scrubber

Numerous wet scrubber designs can be used to control PM emissions with varying degrees of efficiency. Final design generally depends on the specific source type and target pollutants. Designs include mechanically-aided scrubbers, orifice scrubbers, packed-bed scrubbers, packed tower scrubbers, spray chamber/spray tower scrubbers and venturi scrubbers.

Because PM is the sole pollutant of concern for the pulp dryer, the most effective wet scrubber design considering exhaust gas flow rate and particulate loading is a mechanically-aided scrubber. Particulate laden gas enters the scrubber and is spun in a vortex-like fashion due to the offset configuration of the gas inlet. The gas then passes upward through a series of spray rings where nozzles spray water downward into the rising gas. The spray nozzles produce rapidly moving water droplets that sweep PM from their path. Some droplets interact with each other and agglomerate into larger droplets that settle to the bottom of the scrubber. Other droplets move upward and enter turning vanes that work to spin and throw the droplets outwards to the scrubber wall where they collect and drop to the bottom of the scrubber.

Mechanically-aided scrubbers are designed for many applications and are used extensively on a wide variety of industrial applications. Therefore, they are considered a technically feasible option for controlling PM emissions from the pulp dryer.

Mechanical Separator

Mechanical separators (cyclones) operate through inertial separation of particles entrained in an exhaust gas stream. The collection efficiency varies as a function of particle size and cyclone design. Cyclone efficiency generally increases with particle size density, inlet duct velocity, cyclone body length, number of revolutions in the cyclone, ratio of cyclone body diameter to gas exit diameter, dust loading and cyclone wall smoothness.

Cyclones are designed for many applications and are used extensively on a wide variety of industrial applications. Cyclones are considered a technically feasible option for controlling PM emissions from the pulp dryer.

4.2.1.2 PM Control Technology Summary

Table 4.2 summarizes the different PM control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new pulp dryer.

Table 4.2 –PM Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Pulp Dryer
Fabric Filter	Yes	No	No
ESP	Yes	No	No
WESP	Yes	No	Yes
Wet Scrubber	Yes	Yes	Yes
Cyclone	Yes	Yes	Yes

4.2.1.3 Top-Down Ranking

The PM control technologies that are considered technically feasible for implementation on the proposed pulp dryer have been ranked from most to least effective in terms of emission reduction potential. Table 4.3 summarizes the control technology ranking. The particulate control is expressed as a range to reflect the varied particle size distribution of $PM_{2.5}$, PM_{10} and TSP.

Table 4.3 – Top-Down Ranking of PM Control Technologies

Identified Control Technology	Percent PM Reduction
WESP	90-99
Wet Scrubber	70-90
Cyclone	40-80

4.2.1.4 Control Technology Evaluation

The following sections present detailed evaluations of the feasible PM control technologies. Energy, environmental and economic impacts are considered.

Wet ESP

As stated previously, WESPs remove PM from the flue gas stream using the principle of electrostatic attraction. PM in the exhaust stream is charged with a very high direct current (DC) voltage, and the charge particles are attracted to oppositely charged collection plates in the WESP. Collected PM is continually removed as the surfaces of the collection plates are constantly cleaned with liquid.

Under high pollutant loading conditions and where PM consists of relatively large particles (i.e., greater than 2 microns), it is typical to use wet scrubbers or spray chambers to reduce the load on the WESP. The use of wet scrubbers will also be necessary to reduce the exhaust gas temperature of the direct-fired dryer to an acceptable range of 170 to 190°F. Additionally, for very large particles (i.e., greater than 10 microns), mechanical collectors such as cyclones are also used upstream of the WESP. The direct-contact process of the pulp dryer, in conjunction with high airflow, is anticipated to generate a high concentration of large particles as compared to other combustion related sources. Therefore, it will be necessary to employ a cyclone and wet scrubber prior to the WESP to prevent overloading of this control system.

For BACT analysis purposes, a conservative 75 percent capacity factor was incorporated into emission estimates to provide a more accurate analysis with respect to annual control effectiveness costs. As indicated previously, typical processing campaigns do not last for an entire year. Furthermore, pulp processing operations do not last the entire length of the processing campaign. Operating and control costs were performed assuming base (maximum) load operations and the 75 percent annual capacity factor. A summary of the estimated baseline and controlled PM emissions is provided in Table 4.4.

Table 4.4 – Pulp Dryer Baseline PM Emission Rate

Emission Unit Description	Baseline Emissions		Controlled Emissions	
	Baseline Emission Rate (lb/hr)[A]	Annual Emissions (tpy)[B]	BACT Emission Rate (lb/hr)[C]	Annual Emissions (tpy)[B,C]
Pulp Dryer	31.9	104.8	1.60	5.24

[A] Based on a controlled (multiclone/wet scrubber) emission rate of 0.49 lb/ton of wet pulp (NDDEQ process throughput rule). This is equivalent to AP42, Table 9.10.1.2-1 for a wet scrubber-controlled source.
[B] Assumed annual capacity factor of 75 percent.
[C] Based on an assumed control efficiency of 95 percent of baseline emissions.

As indicated in Table 4.4, the target controlled PM emission rate is 1.60 lb/hr. This corresponds to approximately 95 percent control of baseline PM emissions. Incorporating the 75 percent historical annual capacity factor, the overall reduction in PM emissions would be 99.6 tons per year. The reasons for the anticipated low control efficiency of 95 percent for the WESP system include the high flue gas flowrate of the pulp dryer, unknown resistivity of particulate and variable/inconsistent operation of the pulp dryer.

Energy: Direct energy penalties associated with the operation of a WESP system on the pulp dryer are mainly associated with electricity consumption required to operate the WESP. However, additional pumps and water supply will also create energy penalties. The amount of electricity consumed is related to the concentration of PM in the exhaust stream to be controlled.

Environmental: Detrimental environmental effects resulting from the use of a WESP system to control PM emissions from the pulp dryer include the production of wastewater sludge as a result of the collection of particles with water and a small amount of secondary air pollutant emissions as a result of power generation to meet the WESPs power consumption demand.

Economic: Table 4.5 presents the capital costs associated with the installation of a WESP for the pulp dryer to achieve a PM emission level of 1.60 lb/hr. Capital costs were based on standard engineering estimating practices presented in the EPA Air Pollution Control Cost Manual, Sixth Edition, January 2002, as well as additional applicable guidance from the EPA and other resources.

Table 4.5 – WESP Capital Cost Summary

Description of Cost	Cost ($)[A]	Remarks
Equipment Costs[B]	3,470,800	Vendor estimate
Control/Instrumentation[C]	347,100	10% of equipment cost
Sales Tax	208,200	6% of equipment costs

Description of Cost	Cost ($)[A]	Remarks
Freight[C]	173,500	5% of equipment costs
Total Equipment Costs (TEC)	4,199,600	
Total Installation Costs (TIC)/Balance of Plant Costs	2,897,700	Based on percentage of TEC: 4% Foundation and Supports, 50% Erection, 8% Electrical, 1% Piping, 4% Painting, 2% Insulation
Site Preparation[D]	600,000	Estimated based on similar project conditions
Total Direct Investment (TDI)	**7,697,300**	**TEC + TIC + Site Preparation = TDI**
Contingency	126,000	3% of TEC
Engineering	839,900	20% of TEC
Construction and Field Expense	839,900	20% of TEC
Contractor Fees	420,000	10% of TEC
Start-Up Assistance	42,000	1% of TEC
Performance Test	42,000	1% of TEC
Model Study	84,000	2% of TEC
Total Indirect Investment (TII)[C]	**2,393,800**	
Total Capital Investment (TCI)	**10,091,100**	**TDI + TII = TCI**

[A] Values rounded to nearest $100.
[B] Capital costs scaled from 2015 vendor estimate for similar equipment.
[C] Direct and indirect cost percentages estimated from EPA's Air Pollution Control Cost Manual, Sixth Edition, January 2002 for ESPs (Section 6, Chapter 3).
[D] Estimated by HDR.

Table 4.6 presents the annual operating costs associated with the WESP. Annual operating costs include operation labor, maintenance and electricity costs.

Table 4.6 – WESP Annual Cost Summary

Description of Cost	Cost ($)[A]	Remarks
ESP Operator	49,300	1 hour per shift at $60
ESP Supervisor	7,400	15% of operator costs
ESP Coordinator	16,300	33% of operator costs
ESP Maintenance Labor	12,300	¼ hour per shift at $60
ESP Maintenance Material	42,000	1% of TEC
Solids Disposal	2,700	$20/ton @ 2 miles and 0.50/ton-mile
Electricity Costs[C]	92,200	$0.06 x 234 kW-hr x 8760 hr x 75% capacity
Direct Annual Costs (DAC)[B]	**222,200**	
Overhead	76,400	60% of O&M Labor and Materials
Administrative Charges	201,800	2% of TCI

Description of Cost	Cost ($)[A]	Remarks
Property Tax	100,900	1% of TCI
Insurance	100,900	1% of TCI
WESP Capital Recovery[D]	1,107,900	(TCI) x (CRF of 0.10979)
Indirect Annual Costs (IAC)	**1,587,900**	
Total Annualized Costs (TAC)	**1,810,100**	**DAC + IAC = TAC**

[A] Values rounded to nearest $100. All direct and annual costs adjusted to 75% capacity factor.
[B] Direct and indirect cost percentages estimated from EPA's Air Pollution Control Cost Manual, Sixth Edition, January 2002, for ESPs (Section 6, Chapter 3).
[C] Based on actual average energy cost of $0.06/kW.
[D] Capital Recovery Factor (CRF) based on 15-year life and an interest rate of 7%, EPA Air Pollution Control Cost Manual, January 2002, Table A2 in Section 1, Chapter 2).

Total annualized costs for the WESP system are calculated as the sum of the operating costs, plus a capital recovery factor multiplied by the total installed costs. A historical 75 percent capacity factor is also included. The total annualized costs to maintain a 1.60 lb/hr PM emission level for the pulp dryer is estimated to be $1,810,100. Based on the emissions information presented in Table 4.4, the annual reduction in PM emissions would be 99.6 tons per year. The resulting cost effectiveness for installing and operating the WESP is estimated at $18,200/ton of PM removed.

4.2.1.5 Proposed PM BACT Selection

Table 4.7 summarizes the results of the Top-Down BACT analysis for PM emissions. The emission rate baseline for calculating control effectiveness costs assumes the use a cyclone and wet scrubber to remove very large particles and lower the exhaust gas temperature of the pulp dryer, which allows the WESP to be technically feasible. Furthermore, as discussed previously, a historical annual capacity factor of 75 percent has been included in the emission calculations to accurately reflect actual project utilization of the proposed new pulp dryer and associated control equipment.

Table 4.7 – Summary of Top-Down BACT for PM Emissions from the Pulp Dryer

Control Alternative	Emission Level (lb/hr, tpy)	Emission Reduction (tpy)	Annualized Costs ($/yr)	Cost Effectiveness ($/ton)	Adverse Impact (Yes/No)
WESP	1.60, 5.24	99.6	1,810,100	18,200	No
Multiclone/Scrubber	31.9, 104.8	-	-	-	-

The fundamental obstacle to adding a WESP to the pulp dryer to control PM emissions is the overall economics in comparison to the amount of emission reduction. PM reduction costs for the pulp dryer are estimated to be $18,200 per ton of PM removed. This overall annual cost to meet a PM emission limit of 1.60 lb/hr (0.045 lb/ton wet pulp) is judged to be excessive.

Additionally, the EPA Air Pollution Control Technology Fact Sheet for WESPs, EPA-452/F-03-029, indicates that annualized costs for controlling PM emissions should be in the range of $12 to $46/scfm. Calculated annualized costs for the pulp dryer are estimated to be approximately $18/scfm. The fact sheet indicates O&M costs in the range of $6 to $10/scfm. Calculated O&M costs for pulp dryer are estimated to be approximately $1.3/scfm. Both values are below or equivalent to the lowest range specified in the EPA fact sheet for WESP costs, therefore the cost estimates are deemed conservatively low.

Considering the prohibitive cost of adding a WESP to the pulp dryer, the proposed BACT for PM is the use of the baseline cyclone and wet scrubber controls. Table 4.8 lists the PM emission limitation proposed as BACT under typical operating ranges for the pulp dryer.

Table 4.8 – Proposed PM BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Pulp Dryer	PM: 31.9 lb/hr (0.49 lb/ton of pressed pulp) 3-hour average filterable only. PM_{10}: 59.0 lb/hr (0.91 lb/ton of pressed pulp) 3-hour average filterable and condensable. $PM_{2.5}$: 36.7 lb/hr (0.56 lb/ton of pressed pulp) 3-hour average filterable and condensable.	Cyclone and Wet Scrubber

The BACT analysis for PM focused only on controlling filterable particulate matter based on the discussion presented in Section 4.1.3.7 concerning the feasibility of controlling condensable particulate emissions from combustion sources. However, as indicated in Table 4.8 the proposed final particulate matter limit incorporates both condensable and filterable fractions. The combined condensable/ filterable limit will provide the most flexibility with regard to compliance demonstrations, in which various test method interferences have indicated the potential for a high degree of variability in results.

4.2.1.6 RBLC Database Review

Information concerning recently permitted industrial process dryers was obtained from the EPA's RBLC. Due to the lack of available data presented in the RBLC for process dryers similar to the proposed pulp dryer, only one representative emission source was found. This source is the pulp dryer installed at the ACS Hillsboro facility in 1997.

The Drayton pulp dryer is anticipated to be approximately 60 percent of the capacity of the Hillsboro facility pulp dryer. Operational practices are anticipated to be nearly identical. The Hillsboro pulp dryer was permitted with a PM BACT emission limit of 52.0 lb/hr utilizing a cyclone followed by a wet srubber. The proposed BACT limit for the Drayton pulp dryer is 31.9 lb/hr, also utilizing a cyclone followed by a wet scrubber, which corresponds to approximately 60 percent of the Hillsboro dryer emissions.

4.2.2 BACT for SO_2

Control of SO_2 emissions from fuel-combustion sources (such as the proposed direct-fired dryer) can be accomplished through two approaches: removal of elemental sulfur from the fuel prior to combustion, and flue gas desulfurization (FGD), which consists of removal of SO_2 from flue gas after combustion (post-combustion control).

Many oil refineries operate catalyst-based desulfurization units to remove organic sulfur from liquid crude oil. However, in solid fuels, such as coal, a significant fraction of the sulfur is in the form of pyrite (FeS_2) or other mineral sulfates. It is possible to remove some mineral sulfates through physical processes such as washing and/or chemical processing. However, desulfurization of solid fuels is generally viewed as inefficient and expensive. Furthermore, it is unlikely that sufficient desulfurization of solid fuels can be accomplished to meet anticipated emission requirements. Therefore, removal of sulfur from the coal prior to combustion will not be considered a viable option for this BACT analysis.

4.2.2.1 Identification of SO_2 Control Technologies

The following sections identify potentially available control technologies for coal-fired combustion processes. Additionally, the feasibility of the control technologies as applied to the operation of the proposed new coal-fired direct contact pulp dryer is addressed.

FGD technologies can be divided into two main categories, regenerative and throwaway processes. Regenerative processes recover sulfur in a usable form that can be sold as a reusable sulfur product. Throwaway processes remove sulfur from flue gas and scrubber byproducts are subsequently discarded.

Regenerative process, by nature, contain a regeneration step in the FGD process that results in higher costs than throwaway processes due to equipment and operation expenses. However, in instances where disposal options are limited and markets for recovered sulfur products are readily available, regenerative processes may be used

Throwaway processes such as limestone scrubbing have become widely accepted by the coal-fired power industry. Because the throwaway process can achieve the same removal efficiencies as regenerative processes and cost less, this BACT analysis for SO_2 will focus on throwaway processes and further discussion of regenerative processes will not be considered.

Throwaway processes can be divided into two categories, wet and dry. Wet or dry refers to the state of the waste by-products. Both wet and dry technologies have advantages and disadvantages with respect to initial capital and operational expenses.

Wet FGD

Wet scrubbing (wet FGD) systems used for SO_2 reduction typically consist of the following operations: scrubbing or absorption, lime handling and slurry preparation, sludge processing, and flue gas handling.

Wet FGD technology is a well-established process for removing SO_2 from flue gas. In wet scrubbers, the flue gas enters a spray tower or absorber where it is sprayed with a water slurry, which is approximately 10 percent lime or limestone. Sodium alkali solutions can also be used in FGD systems, however these processes are considerably more expensive than lime. The preferred sorbents are limestone ($CaCO_3$) and lime (CaO), respectively, due to the availability and relatively low cost of limestone. Calcium in the slurry reacts with the SO_2 in the flue gas to form calcium sulfite ($CaSO_3 \bullet ½H_2O$) or calcium sulfate ($CaSO_4 \bullet 2H_2O$, or gypsum). Additional oxygen may be added to increase the amount of calcium sulfate created, as this byproduct is easier to dewater than calcium sulfite ($CaSO_3 \bullet ½H_2O$). The overall chemical reactions assuming a limestone reagent can be simply expressed as:

$$SO_2 + CaCO_3\ (s) + ½H_2O \rightarrow CaSO_3 \bullet ½H_2O\ (s) + CO_2$$

$$SO_2 + CaCO_3\ (s) + 2H_2O + ½O_2 \rightarrow CaSO_4 \bullet 2H_2O\ (s) + CO_2$$

Spent slurry from the reaction tank is pumped to a thickener where solids settle before being sent for final dewatering to approximately 50 to 85 percent solids. Water removed during this process is sent to a process water holding tank, which can be reused in the process or sent to a wastewater treatment system. The waste sludge must also be disposed of properly. Finally, scrubbed flue gases are exhausted through a stack. Reheating of the flue gas prior to the stack is sometimes needed for proper drafting and rise of exhaust gases out the stack, as well as minimizing condensation of SO_2 to SO_3 and subsequently sulfuric acid (H_2SO_4). As an alternative, the stack can be constructed of acid resistant material.

Most wet FGD systems have two stages, one for fly ash removal and one for SO_2 removal. The flue gas normally passes first through a fly ash removal device, either an electrostatic precipitator (ESP) or a bag filter, and then into the SO_2 absorber. There are many different types of absorbers that can be used in wet FGD systems, including: spray towers, venturis, plate towers, and mobile packed beds. However, many of these systems can result in scale buildup, plugging or erosion, which can affect the dependability and efficiency of the absorber. Therefore, simple scrubbers such as spray towers are commonly used. The chief drawback of the spray tower design is that it requires a higher liquid-to-gas ratio for equivalent removal of SO_2 to other absorber designs.

Wet FGD systems have been in operation in the United States for several decades and are used widely throughout the coal-fired electric utility industry. Additionally, simple spray towers and venturi scrubbers have been used on direct contact process dryer applications. Therefore, wet FGD systems are considered technically feasible for implementation on the proposed pulp dryer.

<u>Dry FGD</u>

In contrast to wet scrubbing systems, dry FGD (spray dryer) systems use much smaller amounts of liquid. With a spray dryer system, the flue gases enter an absorbing tower (dryer) where the hot gases are contacted with a finely atomized slurry, which is usually a calcium-based sorbent such as calcium hydroxide ($Ca(OH)_2$) or calcium oxide (CaO, lime). Acid gases and SO_2 are absorbed by the slurry mixture and react to form solid salts. The heat of the flue gas evaporates the water droplets in the sprayed slurry, and a non-saturated flue gas exits the absorber tower. The absorption process is also somewhat temperature dependent. Cooler flue gases allow the acid gases to more effectively react with the sorbents. The overall chemical reactions can be simply expressed as:

$$CaO + H_2O \rightarrow Ca(OH)_2$$

$$Ca(OH)_2 + SO_2 \rightarrow CaSO_3 \bullet ½H_2O\ (s) + ½H_2O$$

$$Ca(OH)_2 + 2HCl \rightarrow CaCl_2\ (s) + 2H_2O$$

As can be seen above, one mole of calcium hydroxide will neutralize one mole of SO_2, whereas one mole of calcium hydroxide will neutralize two moles of hydrochloric acid (HCl). A similar reaction occurs with the neutralization of hydrofluoric acid (HF). These reactions demonstrate that when using a spray dryer the HCl and HF are removed more readily than SO_2. Reagent requirements should consider that the HCl and HF are removed first, followed by the reagent quantity required to remove the SO_2[1].

The exhaust stream exiting the absorber contains fly ash, calcium salts, and un-reacted lime, which must be sent to a particulate control device such as a fabric filter (baghouse). The particulate control device not only is necessary to control particulate matter, but also aids in acid-gas removal. Acid gases are removed when the flue gas comes in contact with the lime-containing particles on the surface of the baghouse. Modern dry FGD systems include a loop to recycle a portion of the baghouse-collected material for re-use in the FGD module because this material contains a relatively high amount of unreacted lime.

Dry FGD systems are currently used for many coal-fired utility boilers and some industrial boilers. However, a primary difference in coal-fired boiler application vs. coal-fired pulp dryer application is the temperature and moisture content of the exhaust gas. Pulp dryer exhaust gas temperatures are typically less than 250°F, which is lower than the exhaust gas temperature of a typical coal-fired boiler. Pulp dryer exhaust gases are also in the range of 35 to 40 percent moisture as compared to 10 percent or less in a typical coal-fired boiler. The low exhaust gas temperature and high moisture presents a problem with respect to dry FGD operation as there is not enough heat to effectively evaporate the injected slurry mixture. Furthermore, limiting the slurry injection rate to accommodate the reduced evaporation potential would result in reduced effectiveness of the SO_2 control. Additionally, as the exhaust gas passes through the dry FGD system, the temperature is further reduced, which promotes the condensation of acid gases. The acid gases are corrosive to the components of the exhaust gas system, which reduces the life of the system and increases maintenance costs. Finally, the application of a baghouse as part of the dry FGD system is not technically feasible as the high moisture content of the exhaust gases from the dryer process can lead to blinding (plugging) of the fabric filter.

Because of the technical issues affecting the proper operation of a dry FGD system and the fact that there are no known installations of dry FGD systems on coal-fired pulp dryers in the United States, dry

[1] Karl B. Schnelle, Jr. and Charles A. Brown, Air Pollution Control Technology Handbook, CRC Press, 2002.

FGD is not considered technically feasible for implementation on the proposed new pulp dryer at the Drayton facility and will not be addressed further in this BACT.

Dry Sorbent Injection (DSI)/Fabric Filter

Dry Sorbent Injection (DSI) SO_2 scrubber systems consist of a dry powder SO_2 control reagent that is injected into a flue gas steam ahead of a particulate collection device, which is most often a fabric filter. The dry powdered injection does not require a slurry mix system or additional cooling of the flue gas for drying of the slurry; however, the SO_2 reaction and resulting control efficiency is not as great as with the slurry systems (wet or dry FGD).

Several dry DSI systems have been installed on municipal solid waste and hospital medical waste-fired incinerator systems in the United States in the past several years. There are currently no known operating coal-fired pulp dryer facilities in the United States that employ DSI systems.

With respect to technical feasibility, the DSI and fabric filter system has some of the same issues as discussed with the dry FGD system. Because of the high moisture content of the exhaust gases, the fabric filter associated with the system would be subject to blinding and therefore not feasible for use. Injection of reagent prior to the current multiclone control device would also not be feasible as the reagent would combine with the pulp that is being dried, thus reducing the effectiveness of control as well as contaminating the dried pulp which is sold as a livestock food supplement. Therefore, dry injection fabric filter systems are not considered technically feasible for implementation on the proposed new pulp dryer at the Drayton facility and will not be addressed further in this BACT analysis.

Inherent Process Controls

Any proposed add on flue gas control for the proposed pulp dryer must be evaluated with respect to the inherent SO_2 control experienced by normal dryer operations. The maximum SO_2 emission rate from the pulp dryer based on typical coal sulfur content (0.5 percent) and heat content (9,400 Btu/lb) would be expected to be approximately 150.8 lbs/hr, or 17.5 lbs/ton of coal combusted. Historic stack test data for similar pulp dryer operation performed for engineering test purposes shows average SO_2 emission rates ranging from 4.0 to 6.2 lb/ton of coal combusted. This indicates that through both retention of the sulfur in the coal ash and SO_2 adsorbed by the pulp during the drying process, approximately 65 percent of the SO_2, on average, is removed by the inherent scrubbing properties of the dryer process. Because the inherent SO_2 removal rate may vary somewhat depending on coal sulfur content and pulp quality, it is conservatively assumed that a consistent 60 percent removal rate can be maintained. Inherent process controls are considered a feasible alternative for BACT analysis purposes. Additionally, the resulting effectiveness of any additional add-on SO_2 control will be greatly reduced as a result of the low concentration of SO_2 in the exhaust gas stream.

4.2.2.2 SO_2 Control Technology Summary

Table 4.9 summarizes the different SO_2 control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new pulp dryer.

Table 4.9 – SO_2 Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Pulp Dryer
Wet FGD	Yes	No	Yes
Dry FGD	Yes	No	No
DSI	Yes	No	No
Inherent Controls	Yes	Yes	Yes

4.2.2.3 Top-Down Ranking

The SO_2 control technologies that are considered technically feasible for implementation on the proposed pulp dryer have been ranked from most to least effective in terms of emission reduction potential. Table 4.10 summarizes the control technology ranking. The percent SO_2 reduction for wet FGD is listed as a range because it is dependent on the SO_2 concentration of the inlet exhaust gas stream. Higher concentration exhaust gas streams would experience higher levels of control.

Table 4.10 – Top-Down Ranking of SO_2 Control Technologies

Identified Control Technology	Percent SO_2 Reduction
Wet FGD	50-98
Inherent Controls	60

4.2.2.4 Control Technology Evaluation

The following sections present detailed evaluations of the feasible SO_2 control technologies. Energy, environmental and economic impacts are considered.

Wet FGD

There are numerous operating parameters that can affect the SO_2 removal rate of the wet FGD system such as: liquid-to-gas ratio, pH, gas velocity, residence time, gas distribution, scrubber design and turndown. Additionally, fuel properties such as heating value, moisture content, sulfur content, ash content, and chlorine content play a significant role. Another design consideration with wet FGD systems is that the saturated flue gas exiting the absorber still contains some SO_2. This can lead to the formation of corrosive acid gases that are damaging to downstream equipment. To minimize corrosion of the downstream equipment, the gases can be reheated to temperatures above the dew point, or construction materials and design conditions can be selected to withstand the corrosive conditions. Both of these alternatives increase the capital and operating cost of an FGD system. Reheaters can also experience operational problems ranging from acid attack on reheater components to vibration, which causes structural deterioration.

Another potential problem with wet FGD systems using limestone as a reagent is that calcium sulfite in the sludge produced by the system settles and filters poorly. This problem can be remedied using a forced oxidation system in a designated section of the absorber or in a separate oxidation tank. This process creates calcium sulfate (gypsum), which is easily filtered and sometimes marketed as a material for production of drywall. The forced oxidation process also helps to prevent scale buildup by removing calcium sulfites through conversion to calcium sulfate, thus preventing calcium sulfites from oxidizing and precipitating out in the scrubber internal areas. Scaling and oxidation can also be reduced with chemical inhibitors such as magnesium and dibasic acid. The necessary reduction of scaling in wet FGD equipment increases the operational cost for these systems.

Wet FGD processes also produce a sludge waste, which must be disposed of properly. In these processes, the scrubbing liquid can be recycled or regenerated, but no useful product is obtained from the sludge. Additionally, wastewater treatment is required for the process wastewater produced by wet FGD systems.

For the purposes of this BACT analysis, a conservative 75 percent capacity factor was incorporated into emission estimates to provide a more accurate analysis with respect to annual control effectiveness costs. As indicated previously, typical processing campaigns do not last for an entire year. Furthermore, pulp processing operations do not last the entire length of the processing campaign. Operating and control costs were performed assuming base (maximum) load operations and the 75 percent annual capacity factor. A summary of the estimated baseline and controlled SO_2 emissions is provided in Table 4.11.

Table 4.11 – Pulp Dryer Baseline SO_2 Emission Rate

Emission Unit Description	Baseline Emissions		Controlled Emissions	
	Baseline Emission Rate (lb/hr)[A]	Annual Emissions (tpy)[B]	BACT Emission Rate (lb/hr)[C]	Annual Emissions (tpy)[B,C]
Pulp Dryer	60.3	198.1	24.1	79.3

[A] Based on a current inherently controlled emission rate of 0.93 lb/ton pressed pulp (8.6 tph firing rate, 5 percent S).
[B] Assumed annual capacity factor of 75 percent.
[C] Based on an assumed control efficiency of 60 percent of baseline emissions.

As indicated in Table 4.11, the target controlled SO_2 emission rate is 24.1 lb/hr. This corresponds to approximately 60 percent control of baseline uncontrolled SO_2 emissions. Incorporating the 75 percent historical annual capacity factor, the overall reduction in SO_2 emissions would be 118.9 tons per year. The reasons for the anticipated low control efficiency of 60 percent for the wet FGD system include the low inlet concentration of SO_2 into the wet FGD as a result of inherent process control, as well as the fact that the low temperature and high moisture of the dryer exhaust gas stream will reduce the evaporation and chemical reaction within the wet FGD system.

Energy: Use of wet FGD to control SO_2 emissions from the pulp dryer will result in significant energy penalties to facility operations in the form of the electricity demand required for operation of the ancillary equipment, as well as additional backpressure on the exhaust system that results in a slight reduction in output.

Environmental: The primary detrimental environmental effect of the Wet FGD system is the creation of waste byproducts from the spent slurry. Dewatering of the spent slurry results in the production of a wastewater stream as well as a waste sludge that must be disposed in a landfill.

Economic: Because of the anticipated low SO_2 removal amount of 118.9 tons per year, a complete detailed cost analysis for a wet scrubber was not performed. Instead, information from the EPA Air Pollution Control Technology Fact Sheet for spray-chamber/spray-tower wet scrubbers was used to determine an order of magnitude cost. Based on information presented in the fact sheet the high exhaust gas flowrate of the pulp dryer combined with the low pollutant concentration would likely result in higher-than-typical operating costs. Using the average costs presented in the fact sheet, anticipated annualized costs would be on the order of $25 per scfm. This value is assumed to be conservatively low considering it is expressed in 2002 dollars. Combined with the flow rate of the pulp dryer (100,000 scfm), the calculated annualized costs would be $2,500,000 per year, which would result in cost effectiveness of $21,000 per ton of SO_2 removed.

4.2.2.5 Proposed SO_2 BACT Selection

Table 4.12 summarizes the results of the Top-Down BACT analysis for SO_2 emissions. Note that the emission rate baseline for calculating costs is the use of inherent process controls and the combustion of low sulfur western coals. Furthermore, as discussed previously, a historical annual capacity factor of 75 percent has been included in the emission calculations to accurately reflect actual project utilization of the proposed new pulp dryer and associated control equipment.

Table 4.12 – Summary of Top-Down BACT for SO_2 Emissions from the Pulp Dryer

Control Alternative	Emission Level (lb/hr, tpy)	Emission Reduction (tpy)	Annualized Costs ($/yr)	Cost Effectiveness ($/ton)	Adverse Impact (Yes/No)
Wet-FGD	24.1, 79.3	118.9	2,500,000	21,000	No
Inherent Controls	60.3, 198.1	-	-	-	-

The fundamental obstacle to the use of a wet-FGD system to control SO_2 emissions from the pulp dryer is the overall economics in comparison to the amount of emission reduction. The overall annualized cost to meet a SO_2 emission limit of 24.1 lb/hr (0.37 lb/ton wet pulp) is judged to be excessive. In light of the prohibitive cost of add-on SO_2 controls, BACT for the pulp dryer is proposed as the use of low sulfur western coals in conjunction with the emission limit presented in Table 4.13 below.

Table 4.13 – Proposed SO_2 BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Pulp Dryer	60.3 lb/hr (0.93 lb/ton of pressed pulp) 3-hour average	Low Sulfur Coal, Good Combustion Practice

4.2.2.6 RBLC Database Review

Information concerning recently permitted industrial process dryers was obtained from the EPA's RBLC. Due to the lack of available data presented in the RBLC for process dryers similar to the proposed pulp dryer, only one representative emission source was found. This source is the pulp dryer installed at the ACS Hillsboro facility in 1997.

The Drayton pulp dryer is anticipated to have a heat input capacity of about 90 percent of the capacity of the Hillsboro facility pulp dryer. Operational practices are anticipated to be nearly identical. The Hillsboro pulp dryer was permitted with a SO_2 BACT emission limit of 63.3 lb/hr utilizing good combustion practices. The proposed BACT limit for the Drayton pulp dryer is 60.3 lb/hr, also utilizing inherent process controls and low sulfur coal.

4.2.3 BACT for NO_x

The primary form of NO_x emissions control for the pulp dryer would be through the application of combustion controls or flue gas treatment (post-combustion) technologies. Combustion-based NO_x formation control processes reduce the quantity of NO_x formed during the combustion process. Post-combustion technologies reduce the NO_x emissions in the flue gas stream after the NO_x has been formed in the combustion process. These methods may be used alone or in combination to achieve the various degrees of NO_x emissions required.

4.2.3.1 Identification of NO_x Control Technologies

The following sections identify potentially available NO_x control technologies for coal-fired direct contact process dryers. Additionally, the feasibility of the control technologies as applied to the operation of the proposed new coal-fired direct contact pulp dryer is addressed.

Selective Catalytic Reduction

Selective Catalytic Reduction (SCR) systems are an add-on flue gas treatment (post-combustion control technology) to control NO_x emissions. The SCR process involves the injection of a nitrogen-based reducing agent (reagent) such as ammonia (NH_3) or urea to reduce the NO_x in the flue gas to N_2 and H_2O. The reagent is injected into the flue gas prior to passage through a catalyst bed, which accelerates the

NO_x reduction reaction rate. SCR systems generate a small level of NH_3 emissions, known as NH_3 slip. As the catalyst degrades, NH_3 slip will increase, ultimately driving catalyst replacement.

Many types of catalysts, ranging from active metals to highly porous ceramics, are available for different applications. The type of catalyst chosen depends on several operational parameters, such as reaction temperature range, flue gas flow rate, fuel source, catalyst activity and selectivity, operating life, and cost. Catalyst materials include platinum (Pt), vanadium (V), titanium (Ti), tungsten (W), titanium oxide (TiO_2), zirconium oxide (ZrO_2), vanadium pentoxide (V_2O_5), silicon oxide (SiO_2), and zeolites (crystalline alumina silicates). The optimum exhaust gas temperature for conventional metal oxide catalysts ranges from about 480°F to 750°F.

SCR systems can utilize aqueous NH_3, anhydrous NH_3, or a urea solution to produce NH_3 on demand. Aqueous NH_3 is generally transported and stored in concentrations ranging from 19 to 30 percent and therefore requires more storage capacity than anhydrous NH_3. Anhydrous NH_3 is nearly 100 percent pure in concentration and is a gas at normal atmospheric temperature and pressure. Anhydrous NH_3 must be stored and transported under pressure and, when stored in quantities greater than 10,000 pounds, is subject to the Risk Management Planning (RMP) requirements of 40 CFR Part 68. Urea solutions (urea and water at approximately 32 percent concentration) are used to form NH_3 on demand for injection into the flue gas. Generally, a specifically designed duct and decomposition chamber with a small supplemental burner is used to provide an appropriate temperature window and residence time to decompose urea to NH_3 and isocyanic acid (HNCO).

Because of the relatively low exhaust gas temperature of the pulp dryer, which is typically less than 200°F, proper operation of a SCR system could not be maintained without substantial energy input to reheat the exhaust stream. Furthermore, because of the high degree of particulate matter, moisture, and inorganic trace constituents in the exhaust gas (as a result of the direct contact nature of the dryer), fouling and short catalyst life would be experienced. Finally, because there are no known applications of SCR systems on coal-fired, direct-contact process dryers in the United States, SCR technologies are not considered technically feasible for implementation on the pulp dryer and will not be discussed further in this BACT analysis

<u>Selective Non-Catalytic Reduction</u>

Selective non-catalytic reduction (SNCR) is another method of post-combustion control. Similar to SCR, the SNCR process involves the injection of a nitrogen-based reducing agent (reagent) such as NH_3 or urea to reduce the NO_x in the flue gas to N_2 and H_2O. However, the SNCR process works without the use of a catalyst. Instead, the SNCR process occurs within a combustion unit, which acts as the reaction chamber. The heat from the combustion process provides the energy for the NO_x reduction reaction. Flue gas temperatures in the range of 1,500 to 1,900°F, along with adequate reaction time within this temperature range, are required for this technology. SNCR is currently being used for NO_x emission control on coal fired industrial boilers and can achieve NO_x reduction efficiencies of up to 75 percent. However, in typical applications, SNCR provides 30 to 50 percent NO_x reduction.

Because of the direct contact nature of the pulp dryer, the burner configuration is such that it is attached directly to the dryer drum and combustion gases pass through the pulp to be dried. There is not sufficient room to install reagent injection nozzles in an optimum temperature zone to ensure adequate operation of a SNCR system. Furthermore, inconsistent firing of the pulp dryer due to changing pulp quality, moisture content and availability would further reduce the ability to balance a SNCR injection system properly. Finally, the injection of ammonia directly into the combustion chamber prior to the pulp would result in saturating the pulp with excess unreacted ammonia. This would potentially contaminate the pulp, which is currently sold as a livestock feed supplement. There are no known applications of SNCR systems on coal-fired direct contact process dryers in the United States, therefore, SNCR technologies are not considered technically feasible for implementation on the pulp dryer and will not be discussed further in this BACT analysis.

Combustion Controls

Combustion controls such as flue gas recirculation (FGR), reducing air preheat temperature (RAP), oxygen trim (OT), low excess air (LEA), staged combustion air (SCA), and low NO_x burners (LNB) can be used to reduce NO_x emissions depending on the type of burner, characteristics of fuel and method of firing. In practice, combustion controls have not provided the same degree of NO_x control as provided by add-on post combustion control technologies. The current operation practice of similar coal-fired direct contact pulp dryers is to route a small percentage of exhaust gas from multiclone PM control devices back into the dryer furnace. This practice essentially constitutes exhaust gas recirculation and helps to reduce NO_x emissions.

Implementation of further combustion controls is not feasible for the pulp dryer because the balancing of air flow and dryer throat temperature to maintain adequate pulp drying may interfere with additional combustion air flow changes.

4.2.3.2 NO_x Control Technology Summary

Table 4.14 summarizes the different NO_x control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new pulp dryer.

Table 4.14 – NO_x Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Pulp Dryer
SCR	Yes	No	No
SNCR	Yes	No	No
Combustion Controls	Yes	Yes	Yes

4.2.2.3 Control Technology Evaluation

As a result of the type of combustion process and associated source-specific exhaust parameters, the only NO_x control technology feasible for implementation on the pulp dryer is the continued use of good combustion practice and limited exhaust gas recirculation.

Energy: There are no significant energy penalties associated with the use combustion controls. Furthermore, there are no additional energy impacts associated with exhaust system modifications or ancillary equipment installations for the control technology.

Environmental: There are no detrimental environmental effects resulting from the use of combustion controls. The technology functions through strict control of air/fuel mixtures and combustion parameters and does not utilize chemical additives or contribute to the generation of potentially hazardous compounds not associated with the combustion process.

Economic: A detailed economic analysis addressing the use of combustion controls was not performed for this BACT analysis. Combustion controls are considered the baseline cost and emission scenario.

4.2.3.4 Proposed NO_x BACT Selection

Use of combustion controls is supported as a viable BACT alternative in light of the above analysis. Furthermore, use of combustion controls will prevent any potential collateral impacts as associated with other NO_x control technologies. Table 4.15 lists the NO_x emission limitation proposed as BACT under typical operating ranges for the pulp dryer.

Table 4.15 – Proposed NO_x BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Pulp Dryer	46.8 lb/hr (0.66 lb/ton of pressed pulp) 3-hour average	Good Combustion Practice

4.2.3.5 RBLC Database Review

Information concerning recently permitted industrial process dryers was obtained from the EPA's RBLC. Due to the lack of available data presented in the RBLC for process dryers similar to the proposed pulp dryer, only one representative emission source was found. This source is the pulp dryer installed at the ACS Hillsboro facility in 1997.

The Drayton pulp dryer is anticipated to have a heat input capacity of about 90 percent of the capacity of the Hillsboro facility pulp dryer. Operational practices are anticipated to be nearly identical. The Hillsboro pulp dryer was permitted with a NO_x BACT emission limit of 100.0 lb/hr utilizing good combustion practices. The proposed BACT limit for the Drayton pulp dryer is lower (46.8 lb/hr), also utilizing good combustion practice.

4.2.4 BACT for CO

The objective of this analysis is to determine BACT for CO emissions from the proposed pulp dryer. The rate of CO emissions from combustion sources is dependent upon the combustion efficiency of the source. High combustion temperatures, adequate excess air, and good air/fuel mixing during combustion can minimize CO emissions. Control of CO emissions can be achieved by application of combustion controls or by treatment of the flue gas after combustion. Often, measures used to minimize or control emissions of NO_x can result in incomplete combustion and increased CO emissions. Therefore, an acceptable compromise is necessary to achieve the lowest NO_x emission rate possible while keeping CO emissions as low as practical.

4.2.4.1 Identification of CO Control Technologies

The following technologies have been identified for potential control of CO emissions: catalytic oxidation, thermal oxidation, and combustion controls. Catalytic oxidation and thermal oxidation are post-combustion controls designed for the exhaust gas stream.

Catalytic Oxidation

There are a variety of manufacturers who offer oxidation catalysts to control CO emissions. The catalysts are a flue gas treatment technology, typically with a honeycomb type of arrangement to allow the maximum surface area exposure to a given gas flow. CO catalysts are generally precious metal based. The use of an oxidation catalyst with sulfur-containing fuels can promote oxidation of SO_2 to SO_3, which can readily form H_2SO_4 in the presence of moisture, causing severe corrosion in the ductwork and downstream control equipment. Oxidation catalysts also require a minimum temperature (>500 °F) for proper operation.

Because of the relatively low exhaust gas temperature of the pulp dryer, which is typically less than 200°F, proper operation of an oxidation catalyst system could not be maintained. Furthermore, because of the high degree of particulate matter, moisture, and inorganic trace constituents in the exhaust gas (as a result of the direct contact nature of the dryer), fouling and short catalyst life would be experienced. Finally, because there are no known applications of oxidation catalyst systems on coal-fired direct contact process dryers in the United States, oxidation catalyst technologies are not considered technically feasible for implementation on the pulp dryer and will not be discussed further in this BACT analysis.

Thermal Oxidation

High temperature oxidation is another method for controlling emissions of CO in the flue gas. This type of system would be added at the exit of a particulate control device and has been reported to achieve up to 95% reduction of CO in the exhaust gas on other types of industrial facilities with much higher CO emissions and lower flow rates than the pulp dryer. Because a coal-fired dryer is essentially a thermal oxidation device, adding this type of control would be redundant. The application of thermal oxidation would require additional fuel usage and would result in secondary emissions from that combustion process. Given the low exhaust gas temperatures following the particulate control device, as well as the high flowrate and high moisture content of the exhaust gas, the size and fuel consumption rate of a thermal oxidizer necessary to achieve complete oxidation of CO emissions would not be practical. Therefore, use of a thermal oxidation system for the pulp dryer is not considered technically feasible.

Combustion Controls

CO emissions primarily result from incomplete combustion. The oxidation of CO to CO_2 is dependent upon temperature and residence time of the combustion process. The use of good combustion practice such as high combustion temperatures, adequate combustion air, and proper air/fuel mixing can minimize CO emissions. Proper design and operation of a coal-fired dryer effectively acts like a thermal oxidizer for control of CO emissions. Therefore, good combustion practice is considered a feasible control technology for CO emissions.

4.2.4.2 CO Control Technology Summary

Table 4.16 summarizes the different CO control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new pulp dryer.

Table 4.16 – CO Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Pulp Dryer
Catalytic Oxidation	Yes	No	No
Thermal Oxidation	Yes	No	No
Combustion Controls	Yes	Yes	Yes

4.2.4.3 Control Technology Evaluation

As a result of the type of combustion process and associated source-specific exhaust gas parameters including low temperature, high moisture and high flowrate, the only CO control technology feasible for implementation on the pulp dryer is the continued use of good combustion practice.

Energy: There are no significant energy penalties associated with the use combustion controls. Furthermore, there are no additional energy impacts associated with exhaust system modifications or ancillary equipment installations for the control technology.

Environmental: There are no detrimental environmental effects resulting from the use of combustion controls. The technology functions through strict control of air/fuel mixtures and combustion parameters and does not utilize chemical additives or contribute to the generation of potentially hazardous compounds not associated with the combustion process.

Economic: A detailed economic analysis addressing the use of combustion controls was not performed for this BACT analysis. Combustion controls are considered the baseline cost and emission scenario.

4.2.4.4 Proposed CO BACT Selection

Use of combustion controls is supported as a viable BACT alternative in light of the above analysis. Furthermore, use of combustion controls will prevent any potential collateral impacts as associated with other CO control technologies. Table 4.17 lists the CO emission limitation proposed as BACT under typical operating ranges for the pulp dryer.

Table 4.17 – Proposed CO BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Pulp Dryer	458 lb/hr (7.0 lb/ton of pressed pulp) 3-hour average	Good combustion practice

4.2.4.5 RBLC Database Review

Information concerning recently permitted industrial process dryers was obtained from the EPA's RBLC. Due to the lack of available data presented in the RBLC for process dryers similar to the method of operation of the pulp dryer, only one representative emission source was found. This source is the pulp dryer installed at the ACS Hillsboro facility in 1997.

The Drayton pulp dryer is anticipated to have a heat input capacity of about 90 percent of the capacity of the Hillsboro facility pulp dryer. Operational practices are anticipated to be nearly identical. The Hillsboro pulp dryer was permitted with a CO BACT emission limit of 700.0 lb/hr utilizing good combustion practices. The proposed BACT limit for the Drayton pulp dryer is 458.0 lb/hr, also utilizing good combustion practice. The slightly lower BACT limit for the Drayton pulp dryer reflects recent performance testing at similar units and differences in anticipated pulp throughput.

4.2.5 BACT for VOC

The objective of this analysis is to determine BACT for VOC emissions from the proposed pulp dryer. VOC formation generally follows the same principles of CO formation in combustion related emission sources. High combustion temperatures, adequate excess air, and good air/fuel mixing during combustion can minimize VOC emissions. Control of VOC emissions can be achieved by application of combustion controls or by treatment of the flue gas after combustion.

4.2.5.1 Identification of VOC Control Technologies

As with CO emissions, the same following technologies have been identified for potential control of VOC emissions: catalytic oxidation, thermal oxidation, and combustion controls. Catalytic oxidation and thermal oxidation are post-combustion controls designed for the exhaust gas stream.

4.2.5.2 VOC Control Technology Summary

Table 4.18 summarizes the different VOC control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new pulp dryer. The same discussion as presented in the previous section for CO emissions control and feasibility applies to VOC emissions.

Table 4.18 – VOC Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Pulp Dryer
Catalytic Oxidation	Yes	No	No
Thermal Oxidation	Yes	No	No
Combustion Controls	Yes	Yes	Yes

4.2.5.3 Control Technology Evaluation

As a result of the type of combustion process and associated source-specific exhaust gas parameters including low temperature, high moisture and high flowrate, the only VOC control technology feasible for implementation on the pulp dryer is the use of good combustion practice.

Energy: There are no significant energy penalties associated with the use combustion controls. Furthermore, there are no additional energy impacts associated with exhaust system modifications or ancillary equipment installations for the control technology.

Environmental: There are no detrimental environmental effects resulting from the use of combustion controls. The technology functions through strict control of air/fuel mixtures and combustion parameters and does not utilize chemical additives or contribute to the generation of potentially hazardous compounds not associated with the combustion process.

Economic: A detailed economic analysis addressing the use of combustion controls was not performed for this BACT analysis. Combustion controls are considered the baseline cost and emission scenario.

4.2.5.4 Proposed VOC BACT Selection

Use of combustion controls is supported as a viable BACT alternative in light of the above analysis. Furthermore, use of combustion controls will prevent any potential collateral impacts as associated with other VOC control technologies. Table 4.19 lists the VOC emission limitation proposed as BACT under typical operating ranges for the pulp dryer.

Table 4.19 – Proposed VOC BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Pulp Dryer	78.2 lb/hr (1.20 lb/ton of pressed pulp) 3-hour average	Good combustion practice

4.2.2.6 RBLC Database Review

Information concerning recently permitted industrial process dryers was obtained from the EPA's RBLC. Due to the lack of available data presented in the RBLC for process dryers similar to the proposed pulp dryer, only one representative emission source was found. This source is the pulp dryer installed at the ACS Hillsboro facility in 1997.

The Drayton pulp dryer is anticipated to have a heat input capacity of about 90 percent of the capacity of the Hillsboro facility pulp dryer. Operational practices are anticipated to be nearly identical. The Hillsboro pulp dryer was permitted with a VOC BACT emission limit of 92.1 lb/hr utilizing good combustion practices. The proposed BACT limit for the Drayton pulp dryer is 78.2 lb/hr, also utilizing good combustion practices. The lower BACT limit for the Drayton pulp dryer reflects minor differences in anticipated pulp throughput.

4.3 Natural Gas-Fired Package Boiler BACT

The following subsections address each applicable pollutant emitted from the proposed new natural gas-fired package boiler at the Drayton facility. As previously mentioned, ACS proposes to add a new package boiler to deliver up to 300,000 lbs/hr of steam. The natural gas firing capacity of the proposed boiler will be 359 MMBtu/hr.

4.3.1 BACT for PM

PM emissions from the combustion of natural gas result from the combination of the burner firing configuration, operation, and fuel properties. As discussed in Section 4.1.3.7, condensable particulate matter (CPM) will not be considered further in this BACT analysis.

The final proposed BACT emission limit contains a CPM component for compliance purposes, but the control technology evaluation is based on filterable emissions only. Additionally, all cost evaluations assume that TSP and PM_{10} size fractions are equivalent as this presents the most conservative (worst-case) analysis.

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 1 micrometer in size and has filterable and condensable fractions. Particulate matter in natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted. Increased PM emissions may result from poor air/fuel mixing or maintenance problems.

4.3.1.1 Identification of PM Control Technologies

Each of the add-on control technologies for PM discussed in Section 4.2.1.1 (fabric filter baghouses, ESPs, WESPs, wet scrubbers and mechanical separators) were evaluated for use on the proposed package boiler. An additional technology considered for natural gas-fired boilers is the use of pipeline quality natural gas and good combustion practices as a means for minimizing PM emissions. This is the technology chosen to meet BACT for PM for the majority of the RBLC entries for natural gas boilers.

4.3.1.2 PM Control Technology Summary

Table 4.20 summarizes the different PM control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new packaged boiler. Both fabric filters and cyclones are not effective for collecting and removing small particles such as those expected from the natural gas-fired package boiler. An ESP would not effectively remove PM from a natural-gas boiler due to the low inlet PM loading.

Table 4.20 – PM Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Package Boiler
Fabric Filter	Yes	No	No
ESP	Yes	No	No
WESP	Yes	No	Yes
Wet Scrubber	Yes	No	Yes
Cyclone	Yes	No	No
Pipeline quality natural gas & good combustion practices	Yes	Yes	Yes

4.3.1.3 Top-Down Ranking

The PM control technologies that are considered technically feasible for implementation on the proposed pulp dryer have been ranked from most to least effective in terms of emission reduction potential. Table 4.21 summarizes the control technology ranking. The relatively low control efficiencies for the WESP and wet scrubber are assumed based on the unknown resistivity and small size of the particulate, and low particulate inlet loading.

Table 4.21 – Top-Down Ranking of PM Control Technologies

Identified Control Technology	Percent PM Reduction
WESP	90
Wet Scrubber	70
Pipeline quality natural gas & good combustion practices	Baseline

4.3.1.4 Control Technology Evaluation

Generally, PM emissions from the combustion of natural gas are relatively low. A summary of the estimated baseline and controlled PM emissions is provided in Table 4.22.

Table 4.22 – Natural Gas Package Boiler Baseline PM Emission Rate

Emission Unit Description	Baseline Emissions		Controlled Emissions	
	Baseline Emission Rate (lb/hr)[A]	Annual Emissions (tpy)[B]	BACT Emission Rate (lb/hr)[C]	Annual Emissions (tpy)[B,C]
Natural Gas Boiler / WESP	2.68	8.80	0.27	0.89
Natural Gas Boiler / Wet Scrubber	2.68	8.80	0.80	2.63
Natural Gas Boiler / Pipeline quality natural gas & good combustion practices	2.68	8.80	-	-

[A] Based on the emission factor from the USEPA's *Compilation of Air Pollutant Emissions Factors* (AP-42), Chapter 1 – External Combustion Sources, Section 1.4 – Natural Gas Combustion, Table 1.4-2 (July 1998).

[B] Assumed annual capacity factor of 75 percent.

[C] Based on an assumed control efficiency of 90 percent of baseline emissions for the WESP and 70 percent for the wet scrubber.

The overall reduction in PM emissions would be 7.9 tons per year (90 percent) for the WESP and 6.2 tons per year (70 percent) for the wet scrubber. It is assumed that the very small amount of PM control that could be collected from the packaged boiler would preclude the application of any control technology on an economic feasibility basis.

4.3.1.5 Proposed PM BACT Selection

In light of the previous discussion, the use of pipeline quality natural gas and good combustion practices is proposed as BACT for the natural gas-fired package boiler. Table 4.23 lists the PM emission limitation proposed as BACT under typical operating ranges.

Table 4.23 – Proposed PM BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Natural Gas Boiler	PM: 0.0075 lb/MMBtu 3-hour average filterable only. PM_{10}: 0.0075 lb/MMBtu 3-hour average filterable only. $PM_{2.5}$: 0.0075 lb/MMBtu 3-hour average filterable only.	Pipeline quality natural gas & good combustion practices

4.3.1.6 RBLC Database Review

Information concerning recently permitted natural gas-fired boilers was obtained from the EPA's RBLC. The majority of the RBLC entries for natural gas boilers determined that BACT for PM from these boilers range from 0.005 to 0.008 lb/MMBtu. A few entries have lower limits (ranging from 0.002 to 0.003). To maintain some compliance margin, ACS proposes that BACT for PM emissions from the new package boiler is the use of natural gas and good combustion practices to achieve an emission rate of 0.0075 lb/MMBtu.

4.3.2 BACT for SO_2

SO_2 emissions from the combustion of natural gas result from the combination of the burner firing configuration, operation, and fuel properties. Because the boiler will fire only pipeline quality natural gas, which is very low in sulfur content (no more than 0.002 grains of sulfur per standard cubic feet), SO_2 emissions are anticipated to be very low.

4.3.2.1 Identification of SO_2 Control Technologies

The add-on control technologies for SO_2 discussed in Section 4.2.2.1 (Wet FGD, dry FGD and dry sorbent injection) were evaluated for use on the proposed package boiler. An additional technology considered for natural gas-fired boilers is the use of pipeline quality natural gas and good combustion practices as a means for minimizing SO_2 emissions. This is the technology chosen to meet BACT for SO_2 for the majority of the RBLC entries for natural gas boilers.

4.3.2.2 SO_2 Control Technology Summary

Table 4.24 summarizes the different SO_2 control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new packaged boiler. Both wet and dry FGD systems are add-on control systems that could be used downstream of the package boiler, however, due to the low SO_2 inlet loading, these technologies are not expected to be economically feasible. The use of DSI technology would involve injecting a solid reagent into the exhaust gas from the boiler. Because of the low inlet SO_2 concentration, this technology would not result in significant SO_2

removal without a disproportionately high sorbent injection rate, which would increase PM emissions from the boiler.

Table 4.24 – SO_2 Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Package Boiler
Wet FGD	Yes	No	Yes
Dry FGD	Yes	No	Yes
DSI	Yes	No	No
Natural Gas Boiler / Pipeline quality natural gas & good combustion practices	Yes	Yes	Yes

4.3.2.3 Top-Down Ranking

The SO_2 control technologies that are considered technically feasible for implementation on the proposed new packaged boiler have been ranked from most to least effective in terms of emission reduction potential. Table 4.25 summarizes the control technology ranking. The percent SO_2 reduction for wet FGD and dry FGD is listed as a range because it is dependent on the SO_2 concentration of the inlet exhaust gas stream. The ranges presented in Table 4.25 are based on coal-fired boiler applications, which would have much higher SO_2 concentrations in the inlet gas. Lower concentration exhaust gas streams would experience lower levels of control.

Table 4.25 – Top-Down Ranking of SO_2 Control Technologies

Identified Control Technology	Percent SO_2 Reduction
Wet FGD	90-98[A]
Dry FGD	70-98[A]
Natural Gas Boiler / Pipeline quality natural gas & good combustion practices	Baseline

[A] Percent reduction based on coal-fired boiler applications.

4.3.2.4 Control Technology Evaluation

The following sections present detailed evaluations of the feasible SO_2 control technologies. Energy, environmental and economic impacts are considered. Generally, SO_2 emissions from the combustion of natural gas are relatively low. This BACT analysis conservatively assumes that 90 percent SO_2 control can be achieved with a wet FGD system and 70 percent SO_2 control can be achieved with a dry FGD system. This is very conservative considering the low SO_2 concentration produced by the natural gas boiler.

A summary of the estimated baseline and controlled SO_2 emissions is provided in Table 4.26.

Table 4.26 – Natural Gas-Fired Package Boiler Baseline SO_2 Emission Rate

Emission Unit Description	Baseline Emissions		Controlled Emissions	
	Baseline Emission Rate (lb/hr)[A]	Annual Emissions (tpy)[B]	BACT Emission Rate (lb/hr)[C]	Annual Emissions (tpy)[B]
Natural Gas Boiler / Wet FGD	0.21	0.69	0.02	0.07
Natural Gas Boiler / Dry FGD	0.21	0.69	0.06	0.21
Natural Gas Boiler / Pipeline quality natural gas & good combustion practices	0.21	0.69	-	-

[A] Based on the emission factor from the USEPA's *Compilation of Air Pollutant Emissions Factors (*AP-42), Chapter 1 – External Combustion Sources, Section 1.4 – Natural Gas Combustion, Table 1.4-2 (July 1998).

[B] Assumed annual capacity factor of 75 percent.

[C] Based on an assumed control efficiency of 90 percent of baseline emissions for a wet FGD and 70 percent of baseline emissions for a dry FGD.

The overall reduction in SO_2 emissions would be 0.62 tons per year (90 percent) for the wet FGD and 0.48 tons per year (70 percent) for the dry FGD. It is assumed that the very small amount of SO_2 control that could be collected from the packaged boiler would preclude the application of any control technology on an economic feasibility basis.

Energy: Use of wet FGD or dry FGD technology to control SO_2 emissions from the natural gas-fired package boiler will result in significant energy penalties to facility operations in the form of the electricity demand required for operation of the ancillary equipment, as well as additional backpressure on the exhaust system that results in a slight reduction in output.

Environmental: The primary detrimental environmental effect of the wet and dry FGD systems is the creation of waste byproducts. For a wet FGD system, dewatering of the spent slurry results in the production of a wastewater stream as well as a waste sludge that must be disposed in a landfill. A dry FGD system produces a dry byproduct that would need to be disposed in a landfill.

Economic: Because of the anticipated low SO_2 removal amount of 0.62 tons per year to 0.48 tons per year, a complete detailed cost analysis for a wet or dry FGD system was not performed. Instead, information from the EPA Air Pollution Control Technology Fact Sheet for FGD technologies, EPA-452/F-03-034, was used to estimate an order of magnitude cost. Using the lower end of the range of costs presented in the fact sheet, anticipated annualized costs would be on the order of $60 per MMBtu/hr for wet FGD and $10,000 per MMBtu/hr for dry FGD. This value is assumed to be conservatively low considering it is expressed in 2001 dollars. Combined with the fuel burn rate of the proposed package boiler (359 MMBtu/hr), the calculated annualized cost of a wet FGD system would be $21,500 per year, which would result in cost effectiveness of $34,700 per ton of SO_2 removed. The calculated annualized cost of a dry FGD system would be significantly higher and thus would result in an even higher cost effectiveness per ton of SO_2 removed.

4.3.2.5 Proposed SO_2 BACT Selection

Table 4.27 summarizes the results of the Top-Down BACT analysis for SO_2 emissions. Note that the emission rate baseline for calculating costs is the of pipeline quality natural gas and good combustion practices.

Table 4.27 – Summary of Top-Down BACT for SO_2 Emissions from the Natural Gas Package Boiler

Control Alternative	Emission Level (lb/hr, tpy)	Emission Reduction (tpy)	Annualized Costs ($/yr)	Cost Effectiveness ($/ton)	Adverse Impact (Yes/No)
Wet FGD	0.02, 0.07	0.62	21,500	34,700	Yes
Dry FGD	0.06, 0.21	0.48	3,590,000	7,479,200	Yes
Pipeline quality natural gas & good combustion practices	0.21, 0.69	-	-	-	-

The fundamental obstacle to the use of a wet or dry FGD system to control SO_2 emissions from the natural gas-fired boiler is the overall economics in comparison to the amount of emission reduction. The overall annualized cost for these technologies is judged to be excessive.

Considering the prohibitive cost of adding a wet or dry FGD system to the new natural gas-fired package boiler, the proposed BACT for SO_2 for the natural gas-fired boiler is the use of pipeline quality natural gas and good combustion practices. Table 4.28 lists the SO_2 emission limitation proposed as BACT under typical operating ranges for the boiler. No add-on control equipment is proposed for SO_2 control.

Table 4.28 – Proposed SO_2 BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Natural Gas-Fired Package Boiler	0.0006 lb/MMBtu 3-hour average	Pipeline quality natural gas & good combustion practices

4.3.2.6 RBLC Database Review

Information concerning recently permitted natural gas-fired boilers was obtained from the EPA's RBLC. The majority of the RBLC entries for natural gas-fired boilers determined that BACT for SO_2 from these boilers range from 0.005 to 0.008 lb/MMBtu. A few entries have lower limits (ranging from 0.002 to 0.003). To maintain some compliance margin, ACS proposes that BACT for SO_2 emissions from the new package boiler is the use of natural gas and good combustion practices to achieve an emission rate of 0.0006 lb/MMBtu.

4.3.3 BACT for NO_x

The primary form of NO_x emissions control for the natural gas-fired package boiler would be through the application of combustion controls or flue gas treatment (post-combustion) technologies. Combustion-based NO_x formation control processes reduce the quantity of NO_x formed during the combustion process. Post-combustion technologies reduce the NO_x emissions in the flue gas stream after the NO_x has been formed because of the combustion process. These methods may be used alone or in combination to achieve the various degrees of NO_x emissions required.

4.3.3.1 Identification of NO_x Control Technologies

The add-on control technologies for NO_x discussed in Section 4.2.3.1 (SCR and SNCR) are also evaluated here for use on the proposed natural gas-fired package boiler. In addition to the combustion controls previously discussed in Section 4.2.3.1 (FGR, RAP, OT, LEA, SCA and LNB), ultra-low NO_x burners (UNLB) will also be evaluated for the boiler.

Both SNCR and SCR are technically feasible post-combustion options to control NO_x emissions from the boiler. Combustion controls such as ultra-low NO_x burners (ULNB) and LNB (baseline emissions) are also technically feasible.

4.3.3.2 NO_x Control Technology Summary

Table 4.29 summarizes the different NO_x control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new boiler.

Table 4.29 – NO_x Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Package Boiler
SCR	Yes	Yes	Yes
SNCR	Yes	No	Yes
ULNB	Yes	Yes	Yes
LNB (Baseline)	Yes	Yes	Yes

4.3.3.3 Top-Down Ranking

The NO_x control technologies that are considered technically feasible for implementation on the proposed boiler have been ranked from most to least effective in terms of emission reduction potential. Table 4.30 summarizes the control technology ranking.

Table 4.30 – Top-Down Ranking of NO_x Control Technologies

Identified Control Technology	Percent NO_x Reduction
LNB+SCR	90
LNB+SNCR	79
ULNB	79
LNB (Baseline)	-

4.3.3.4 Control Technology Evaluation

The following sections present detailed evaluations of the feasible NO_x control technologies. Energy, environmental and economic impacts are considered.

SCR

Energy: Direct energy penalties associated with the operation of a SCR system are mainly associated with electricity consumption required to operate the SCR system. The amount of electricity consumed is related to the concentration of NO_x in the exhaust stream to be controlled.

Environmental: Detrimental environmental effects resulting from the use of a SCR system include the requirement to store either aqueous ammonia or urea on site and a small amount of secondary air pollutant emissions because of power generation to meet the SCR power consumption demand. SCR technology also emits a small amount of ammonia (2 to 10 ppm), known as ammonia slip, due to the reagent used. Ammonia slip can cause formation of ammonium sulfates, which can plug or corrode downstream components.

Economic: Table 4.31 presents the costs associated with the installation of a SCR to achieve a NO_x removal efficiency of 90%. Annualized costs were estimated using generic EPA costing information obtained from EPA's Air Pollution Control Technology Fact Sheet (EPA-452/F-03-032). The annualized cost of an SCR on a natural gas-fired boiler is estimated to be $700/MMBtu/hr. This is conservatively low as it is in 1999 dollars. Both the overall cost effectiveness for an SCR, as well as the incremental cost to remove an additional 11.9 tpy of NO_x over what can be removed with an SNCR, are presented in Table 4.31.

SNCR

Energy: Direct energy penalties associated with the operation of a SNCR system are mainly associated with electricity consumption required to operate the SNCR system. The amount of electricity consumed is related to the concentration of NO_x in the exhaust stream to be controlled.

Environmental: Detrimental environmental effects resulting from the use of a SNCR system include the requirement to store either aqueous ammonia or urea on site and a small amount of secondary air pollutant emissions because of power generation to meet the SNCR power consumption demand.

Economic: Table 4.31 presents the costs associated with the installation of a SNCR to achieve a NO_x removal efficiency of 79%. Annualized costs were estimated using generic EPA costing information obtained from EPA's Air Pollution Control Technology Fact Sheet (EPA-452/F-03-031). The annualized cost of an SNCR on a natural gas-fired boiler is estimated to be $300-1,000/MMBtu. The costs in Table 4.31 are based on the lower end of this range ($300/MMBtu/hr). This is conservatively low as it is in 1999 dollars. The overall cost effectiveness for an SNCR is presented in Table 4.31, however, the same NO_x removal can be achieved with ULNB alone, so the incremental cost is not listed.

Combustion Controls

Energy: There are no significant energy penalties associated with the use combustion controls. Furthermore, there are no additional energy impacts associated with exhaust system modifications or ancillary equipment installations for the control technology.

Environmental: There are no detrimental environmental effects resulting from the use of combustion controls. The technology functions through strict control of air/fuel mixtures and combustion parameters and does not utilize chemical additives or contribute to the generation of potentially hazardous compounds not associated with the combustion process.

Economic: A detailed economic analysis addressing the use of combustion controls was not performed for this BACT analysis. Combustion controls (LNB or ULNB) are considered the baseline cost and emission scenario. Both LNB and ULNB are expected to have similar costs.

Because of the environmental, energy and economic impacts of SCR and SNCR technology, combustion controls (LNB and ULNB) are the only NO_x control technology feasible for implementation on the proposed natural gas-fired package boiler.

Table 4.31 – Summary of Top-Down BACT for NO_x Emissions from the Natural Gas Package Boiler

Control Alternative	Emission Level (tpy)[A]	Emission Reduction (tpy)	Annualized Costs ($/yr)	Cost Effectiveness ($/ton)
LNB+SCR	11.8	103.9	251,500	2,400 (overall) 21,100 (incremental)
LNB+SNCR	23.7	92.0	107,800	1,200 (overall) (incremental - NA)
ULNB	23.7	92.0	-	-
LNB (Baseline)	115.7	-	-	-

[A] Assumed annual capacity factor of 75 percent.

4.3.3.5 Proposed NO_x BACT Selection

Use of combustion controls is supported as a viable BACT alternative considering the above analysis. Furthermore, use of combustion controls will prevent any potential collateral impacts as associated with other NO_x control technologies. ULNB is proposed as BACT for the natural gas-fired package boiler as both LNB and ULNB are expected to have similar costs, but the use of ULNB can achieve a lower NO_x emission rate. The addition of an SNCR system is not expected to reduce NOx emissions any further than what can be achieved with ULNB alone.

Table 4.32 lists the NO_x emission limitation proposed as BACT for the natural gas-fired package boiler.

Table 4.32 – Proposed NO_x BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Natural Gas-Fired Package Boiler	0.020 lb/MMBtu (7.2 lb/hr) 3-hour average	Good Combustion Practice, ULNB

The fundamental obstacle to using SCR or SNCR to control NO_x emissions is the overall economics in comparison to the amount of emission reduction. Based on this, SCR and SNCR are considered not to be economically feasible control options for NO_x emissions from the boiler.

4.3.3.6 RBLC Database Review

Information concerning recently permitted natural gas-fired boilers was obtained from the EPA's RBLC. The majority of the RBLC entries for boilers determined that BACT for NO_x was LNB with an emission limit of 0.035 lb/MMBtu. The more stringent entries correspond to either SCR- or UNLB-equipped control. There are many other boilers in the RBLC around the size of the Drayton package boiler that are achieving 0.011 to 0.02 with ULNB and other combustion controls.

To maintain some compliance margin, ACS proposes that BACT for NO_x emissions from the new package boiler is the use of ULNB and good combustion practices to achieve an emission rate of 0.020 lb/MMBtu.

4.3.4 BACT for CO

The rate of CO emissions from combustion sources is dependent upon the combustion efficiency of the source. High combustion temperatures, adequate excess air, and good air/fuel mixing during combustion can minimize CO emissions. Control of CO emissions can be achieved by application of combustion controls or by treatment of the flue gas after combustion. Often, measures used to minimize or control emissions of NO_x can result in incomplete combustion and increased CO emissions. Therefore, an acceptable compromise is necessary to achieve the lowest NO_x emission rate possible while keeping CO emissions as low as practical.

4.3.4.1 Identification of CO Control Technologies

The following technologies have been identified for potential control of CO emissions: catalytic oxidation, thermal oxidation, and good combustion practices. Catalytic oxidation and thermal oxidation are post-combustion controls designed for the exhaust gas stream.

Catalytic Oxidation

There are a variety of manufacturers who offer oxidation catalysts to control CO emissions. The catalysts are a flue gas treatment technology, typically with a honeycomb type of arrangement to allow the maximum surface area exposure to a given gas flow. CO catalysts are generally precious metal based. The use of an oxidation catalyst with sulfur-containing fuels can promote oxidation of SO_2 to SO_3, which can readily form H_2SO_4 in the presence of moisture, causing severe corrosion in the ductwork and downstream control equipment. Oxidation catalysts also require a minimum temperature (>500 °F) for proper operation.

Oxidation catalyst technologies are considered technically feasible for implementation on the new natural gas-fired package boiler.

Thermal Oxidation

High temperature oxidation is another method for controlling emissions of CO in the flue gas. This type of system has been reported to achieve up to 95% reduction of CO in the exhaust gas. Because a boiler is essentially a thermal oxidation device, adding this type of control would be redundant. The application of thermal oxidation would require additional fuel usage and would result in secondary emissions from that combustion process. Therefore, use of a thermal oxidation system for the new natural gas-fired boiler is not considered technically feasible.

Good Combustion Practices

CO emissions primarily result from incomplete combustion. The oxidation of CO to CO_2 is dependent upon temperature and residence time of the combustion process. The use of good combustion practice such as high combustion temperatures, adequate combustion air, and proper air/fuel mixing can minimize CO emissions. Proper design and operation of a natural gas-fired boiler effectively acts like a thermal oxidizer to reduce CO emissions. Therefore, good combustion practice is considered a feasible control technology for CO emissions.

4.3.4.2 CO Control Technology Summary

Table 4.33 summarizes the different CO control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new boiler.

Table 4.33 – CO Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Package Boiler
Catalytic Oxidation	Yes	Yes	Yes
Thermal Oxidation	Yes	No	No
Good Combustion Practices	Yes	Yes	Yes

4.3.4.3 Top-Down Ranking

The CO control technologies that are considered technically feasible for implementation on the proposed boiler have been ranked from most to least effective in terms of emission reduction potential. Table 4.34 summarizes the control technology ranking.

Table 4.34 – Top-Down Ranking of CO Control Technologies

Identified Control Technology	Percent CO Reduction
Catalytic Oxidation	95
Good Combustion Practices (Baseline)	-

4.3.4.4 Control Technology Evaluation

The following sections present detailed evaluations of the feasible CO control technologies. Energy, environmental and economic impacts are considered.

Catalytic Oxidation

Energy: Direct energy penalties associated with the operation of a catalytic oxidation system are mainly associated with electricity consumption required to operate the system. The amount of electricity consumed is related to the flowrate of the exhaust stream to be controlled.

Environmental: Detrimental environmental effects resulting from the use of a catalytic oxidation system include the additional natural gas usage of the system and the secondary air pollutant emissions from that combustion process. The catalyst would also need to be replaced on a regular basis and the spent catalyst may be disposed in a landfill.

Economic: The add-on CO control option of catalytic oxidation is technically feasible and one of the RBLC entries for boilers determined that BACT for CO was catalytic oxidation. A cost analysis was performed as follows.

The Fifth Edition Chemical Engineer's Handbook (Perry and Chilton) presents a methodology, called the six-tenths factor, for scaling capital costing information from previous studies, the form of which is:

$C_n = r^{0.6} * C$, where

- C_n is the new plant cost
- r is the ratio of the new to previous capacity
- C is the previous plant cost

Agrium KNO (Agrium) recently prepared a BACT analysis to evaluate the cost effectiveness of oxidation catalyst to control CO emissions from a large natural gas fired boiler in the State of Alaska: (https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwif9uuazKj5AhVChIkEHdqZBE4QFnoECAsQAQ&url=https%3A%2F%2Fdec.alaska.gov%2Fmedia%2F21907%2Fcat-ox-cost-analyses-8-9-19.xlsx&usg=AOvVaw0PJOEE6eeg0qiH_Dcmcika.)

The catalytic oxidizer for that boiler, with a heat input of 243 MMBtu/hr, had an annualized cost (C) of $1,747,300 in 2019 dollars. The value of r was calculated as the ratio of heat inputs of the proposed boiler (i.e., 359.28 MMBtu/hr) and the Agrium boiler (243 MMBtu/hr). Note the economic evaluation does not account for the cost of periodic replacement of the catalyst, or any additional fans needed to overcome the pressure drop added by the catalytic oxidation system. This cost analysis also underestimates the cost of a catalytic oxidizer as the costs are in 1999 dollars.

The fundamental obstacle to using catalytic oxidation to control CO emissions from the proposed natural gas-fired package boiler is the overall economics. Table 4.35 presents the costs associated with the installation of a catalytic oxidation system to achieve a CO removal efficiency of 95%.

Good Combustion Practices

Energy: There are no significant energy penalties associated with the use of good combustion practices. Furthermore, there are no additional energy impacts associated with exhaust system modifications or ancillary equipment installations for the control technology.

Environmental: There are no detrimental environmental effects resulting from the use of good combustion practices. The technology functions through strict control of air/fuel mixtures and combustion parameters and does not utilize chemical additives or contribute to the generation of potentially hazardous compounds not associated with the combustion process.

Economic: A detailed economic analysis addressing the use of good combustion practices was not performed for this BACT analysis. Good combustion practices are considered the baseline cost and emission scenario.

Table 4.35 – Summary of Top-Down BACT for CO Emissions from the Boilers

Control Alternative	Emission Level (tpy)[A]	Emission Reduction (tpy)	Annualized Costs ($/yr)	Cost Effectiveness ($/ton)
Catalytic Oxidation	2.2	41.4	2,209,400	53,400
Good Combustion Practices (Baseline)	43.6	-	-	-

[A] Assumed annual capacity factor of 75 percent.

4.3.4.5 Proposed CO BACT Selection

Use of good combustion practices is supported as a viable BACT alternative in light of the above analysis. Furthermore, use of good combustion practices will prevent any potential collateral impacts as associated with other CO control technologies. Table 4.36 lists the CO emission limitation proposed as BACT under typical operating ranges for the new natural gas-fired boiler.

Table 4.36 – Proposed CO BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Natural Gas-Fired Package Boiler	0.037 lb/MMBtu (13.3 lb/hr) 3-hour average	Good combustion practice

4.3.4.6 RBLC Database Review

Information concerning recently permitted natural gas-fired boilers was obtained from the EPA's RBLC. The majority of the RBLC entries for boilers determined that BACT for CO was good combustion practices with an emission limit of 0.015 to 0.465 lb/MMBtu. The add-on CO control option of catalytic oxidation discussed previously is technically feasible, and three of the RBLC entries for boilers determined that BACT for CO was catalytic oxidation. The proposed BACT emission limit for these boilers was 0.0013, 0.008 and 0.035 lb/MMBtu. The rest of the numerous RBLC entries for similar size boilers determined BACT for CO as good combustion practices.

Based on information provided by the boiler supplier, and to maintain some compliance margin, ACS proposes that BACT for CO emissions from the new package boiler is the use of good combustion practices to achieve an emission rate of 0.037 lb/MMBtu.

4.3.5 BACT for VOC

The objective of this analysis is to determine BACT for VOC emissions from the proposed pulp dryer. VOC formation generally follows the same principles of CO formation in combustion related emission sources. High combustion temperatures, adequate excess air, and good air/fuel mixing during combustion can minimize VOC emissions. Control of VOC emissions can be achieved by application of combustion controls or by treatment of the flue gas after combustion.

4.3.5.1 Identification of VOC Control Technologies

The same technologies discussed for control of CO emissions have been identified for potential control of VOC emissions: catalytic oxidation, thermal oxidation, and combustion controls. Catalytic oxidation and thermal oxidation are post-combustion controls designed for the exhaust gas stream.

4.3.5.2 VOC Control Technology Summary

Table 4.37 summarizes the different VOC control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new natural gas-fired boiler. The same discussion as presented in the previous section for CO emissions control and feasibility applies to VOC emissions.

Table 4.37 summarizes the different VOC control technologies and indicates which technologies have been chosen as technically feasible options for the proposed new boiler.

Table 4.37 – VOC Control Technology Summary

Identified Control Technology	Available and Demonstrated Effective	In Service On Similar Units	Technically Feasible for Package Boiler
Catalytic Oxidation	Yes	Yes	Yes
Thermal Oxidation	Yes	No	No
Good Combustion Practices	Yes	Yes	Yes

4.3.5.3 Top-Down Ranking

The VOC control technologies that are considered technically feasible for implementation on the proposed boiler have been ranked from most to least effective in terms of emission reduction potential. Table 4.38 summarizes the control technology ranking.

Table 4.38 – Top-Down Ranking of NO_x Control Technologies

Identified Control Technology	Percent NO_x Reduction
Catalytic Oxidation	95
Good Combustion Practices (Baseline)	-

4.3.5.4 Control Technology Evaluation

The evaluations of the feasible CO control technologies in Section 4.3.4.4 also apply to the technologies as applied for VOC control. Good combustion practices and catalytic oxidation have the same energy, environmental and economic impacts discussed previously when used for VOC control. However, the economic impact of catalytic oxidation is even greater when applied for VOC control as VOC emissions are an order of magnitude lower.

Table 4.39 – Summary of Top-Down BACT for VOC Emissions from the Boilers

Control Alternative	Emission Level (tpy)[A]	Emission Reduction (tpy)	Annualized Costs ($/yr)	Cost Effectiveness ($/ton)
Catalytic Oxidation	0.32	6.1	2,209,400	362,200
Good Combustion Practices (Baseline)	6.4	-	-	-

[A] Assumed annual capacity factor of 75 percent.

4.3.5.5 Proposed VOC BACT Selection

Use of good combustion practices is supported as a viable BACT alternative in light of the above analysis. Furthermore, use of good combustion practices will prevent any potential collateral impacts as associated with other CO control technologies. Table 4.40 lists the VOC emission limitation proposed as BACT under typical operating ranges for the new natural gas-fired boiler.

Table 4.40 – Proposed VOC BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Natural Gas-Fired Package Boiler	0.0054 lb/MMBtu (1.9 lb/hr) 3-hour average	Good combustion practice

4.3.5.6 RBLC Database Review

Information concerning recently permitted natural gas-fired boilers was obtained from the EPA's RBLC. The majority of the RBLC entries for boilers determined that BACT for VOC was good combustion practices with an emission limit of 0.0013 to 0.077 lb/MMBtu. The add-on VOC control option of catalytic oxidation discussed previously is technically feasible, and two of the RBLC entries for boilers determined that BACT for CO was catalytic oxidation. The proposed BACT emission limits for the boilers using catalytic oxidation were 0.0015 and 0.0020 lb/MMBtu. The rest of the numerous RBLC entries for similar size boilers determined BACT for VOC as good combustion practices.

Based on information provided by the boiler supplier, and to maintain some compliance margin, ACS proposes that BACT for VOC emissions from the new package boiler is the use of good combustion practices to achieve an emission rate of 0.0054 lb/MMBtu.

4.7 BACT for GHG

GHG emissions are analyzed separately from the rest of the pollutants, given the special status of these emissions per EPA's Tailoring Rule for PSD purposes and subsequent court decisions, as well as the global nature of these emissions and potential impacts. The Supreme Court decision of June 23, 2014 rescinded EPA's imposition of PSD permitting requirements on the basis of GHG emissions alone. Subsequent to that decision, GHG emissions can only be reviewed under PSD rules if some other PSD-regulated pollutant first triggers PSD review for a project. As summarized in Table 3.2, the proposed project will result in a significant emissions increase for a number of pollutants, including GHG.

EPA guidance on GHG BACT analyses ("PSD and Title V Permitting Guidance for Greenhouse Gases", EPA-457/B-11-001, March 2011) states that options that improve the overall efficiency of a source must be evaluated. Considering this, the CO_2 control options that are potentially applicable for the proposed new pulp dryer and natural gas-fired package boiler:

a. Efficient Design (will also reduce N_2O and CH_4);
b. Carbon Capture and Storage (CCS); and
c. Low Carbon Fuels.

The available control options that are potentially applicable for the control of N_2O and CH_4 emissions from the proposed pulp dryer and natural gas-fired package boiler include the following:

a. Selective Catalytic Reduction for N_2O
b. Oxidation Catalyst for CH_4
c. Thermal Oxidation for CH_4

The feasibility of each of these GHG control options will be discussed separately in the following sections for the proposed new pulp dryer and natural gas-fired package boiler.

4.7.1 Identification of GHG Control Technologies

Based on the potential GHG control options identified above, the following sections evaluate the feasibility of the control options as applied to the operation of the proposed new coal-fired direct contact pulp dryer and natural gas-fired package boiler.

4.7.1.1 Efficient Design

Efficient dryer design reduces GHG emissions by reducing the amount of fuel burned per ton of pulp dried. This efficiency is achieved by optimizing combustion control to maximize utilization of the fuel heat content (i.e., good combustion practice), along with the use of energy efficient equipment to optimize use of the produced energy (i.e., the pulp dryer's direct-fired design). As discussed in earlier BACT sections, good combustion practice will be implemented and the pulp dryer will be direct-fired. Therefore, efficient dryer design is considered technically feasible for the pulp dryer.

The natural gas-fired package boiler will utilize ULNB and combustion controls to minimize criteria pollutant emissions. Additionally, the boiler will be required to undergo periodic tuning as a result of applicable MACT requirements. As discussed in earlier BACT sections, good combustion practice will be implemented. Therefore, efficient burner design is considered technically feasible for the natural gas-fired package boiler.

4.7.1.2 Carbon Capture and Storage

EPA has specified that CCS is a CO_2 control strategy that is "available" for facilities emitting CO_2 in large amounts. CCS consists of three basic steps:

1. Capture – The CO_2 is separated from the other constituents in the exhaust gas.
2. Compression – The captured CO_2 is compressed to a liquid or near-liquid state and transported via pipeline to a designated storage area.
3. Storage – The CO_2 is introduced deep underground into reservoirs where the pressures will keep it in a liquid form and keep it sequestered for millennia. Depleted oil and gas reservoirs are typically used for this type of storage. Other options include deep saline formations, un-mineable coal seams, and offshore storage.

CCS requires significant infrastructure and energy to capture, compress, transport, and store CO_2. Although a number of post-combustion CO_2 capture technologies are available, none are currently demonstrated in practice for pulp dryers or any similar sources.

EPA's March 2011 Guidance states the following regarding the feasibility of CCS:

> "For the purposes of a BACT analysis for GHGs, EPA classifies CCS as an add-on pollution control technology that is "available" for facilities emitting CO_2 in large amounts, including fossil fuel-fired power plants, and for industrial facilities with high-purity CO_2 streams (e.g., hydrogen

production, ammonia production, natural gas processing, ethanol production, ethylene oxide production, cement production, and iron and steel manufacturing)."

The Drayton facility is not a fossil-fuel fired power plant and is not any of the listed industrial facilities with high purity CO_2 streams for which EPA considers CCS as "available". Therefore, CCS is considered not available for purposes of the proposed project and will not be considered further.

4.7.1.3 Low Carbon Fuels

The Drayton facility does not currently have sufficient natural gas service to accommodate all pulp drying needs. Further, an evaluation of a natural gas-fired pulp dryer would constitute a fundamental redesign of the proposed coal-fired pulp dryer, which EPA has indicated is not the intent of the BACT process. As such, the use of low carbon fuels is not considered a technically feasible option.

The proposed package boiler will utilize pipeline quality natural gas, which is a low carbon fuel.

4.7.1.4 SCR for N_2O

As summarized in Sections 4.2.3.1 and 4.3.3.1 SCR is either technically infeasible or cost prohibitive for NO_x (including N_2O).

4.7.1.5 Oxidation Catalyst and Thermal Oxidation for CH_4

As summarized in Sections 4.2.4.1 and 4.3.4.1oxidation catalysts and thermal oxidation are either technically infeasible or cost prohibitive for hydrocarbons (including CH_4).

4.7.2 Control Technology Evaluation

As a result of the type of combustion process and associated source-specific exhaust parameters, the only GHG control technology feasible for implementation on the pulp dryer and natural gas-fired package boiler is efficient design, which consists of the continued use of good combustion practice.

Energy: There are no significant energy penalties associated with the use combustion controls. Furthermore, there are no additional energy impacts associated with exhaust system modifications or ancillary equipment installations for the control technology.

Environmental: There are no detrimental environmental effects resulting from the use of combustion controls. The technology functions through strict control of air/fuel mixtures and combustion parameters and does not utilize chemical additives or contribute to the generation of potentially hazardous compounds not associated with the combustion process.

Economic: A detailed economic analysis addressing the use of combustion controls was not performed for this BACT analysis. Combustion controls are considered the baseline cost and emission scenario.

4.7.3 Proposed GHG BACT Selection

In light of the previous discussion, good combustion practice is proposed as BACT for the pulp dryer and natural gas-fired package boiler. CO emissions are an indicator of good combustion practice and the previously determined CO BACT limit is proposed as a surrogate indicator for GHG. Table 4.41 lists the GHG emission limitations proposed as BACT under typical operating ranges.

Table 4.41 – Proposed GHG BACT Emission Limit

Emission Unit	BACT Limit	Control Type
Pulp Dryer	458.3 lb/hr CO (7.0 lb/ton of pressed pulp) 3-hour average	Good combustion practice
Package Boiler	0.037 lb/MMBtu 3-hour average	Good Combustion Practice

4.7.4 RBLC Database Review

A search of EPA's RACT/BACT/LAER clearinghouse did not reveal any pulp dryer, package boiler or similar sources that have undergone BACT for GHG.

Chapter 5.0 – Air Quality Impact Analysis

5.1 Analysis Overview

Under PSD regulations, pollutants that trigger PSD review and that have applicable ambient air quality standards must be evaluated in the air quality impact analysis. As indicated in Section 3.2, pollutants triggering PSD review for the proposed modification are PM/PM_{10}/$PM_{2.5}$, NO_x, SO_2, VOC, CO, and GHGs.

The pollutants of PM (TSP), VOC and GHGs were not included in the dispersion modeling analysis because there are no current applicable ambient air quality standards for these pollutants.

The impacts of concern, with respect to state and national ambient air quality standards (NAAQS) for applicable criteria pollutant emissions, include contributions from the Drayton facility, as modified, plus nearby and distant background sources. Also of interest are impacts of emissions from sources modified after the applicable baseline trigger dates with respect to PSD Class II area allowable concentration increments. The nearest Class I area, Voyageurs National Park, is greater than 250 kilometers from the Drayton facility. Because of the relatively large distance to the Class I area, impacts of pollutants to the Class I area from the Drayton facility were not included in the dispersion modeling analysis and are anticipated to be negligible. Visibility impacts to Class I areas are discussed further in Section 6.0.

The following sections detail the methodology used to perform the ambient air quality compliance demonstration for the Drayton facility. The same general modeling methodology as used for the previous modeling analysis that was completed in 2016 and approved by NDDEQ was used for the current modeling analysis. A formal modeling protocol was not submitted.

5.1.1 Model Selection and Setup

Based on the need to evaluate structurally induced plume downwash from elevated point sources, the latest version of the AMS/EPA Regulatory Model (AERMOD) dispersion model was used for this analysis. The regulatory default mode was selected and rural dispersion parameters were selected based on land use within three kilometers of the Drayton facility. No complex terrain exists in the region included in the modeling analysis.

5.1.2 Structural Downwash Input Data

Building downwash effects on the point sources at the Drayton facility were accounted for in the modeling by using building dimension and stack location information processed with BPIP-PRIME. Building dimensions were obtained from scaled drawings of facility structures and previous modeling analyses. The parameters for the major facility structures were evaluated as single complex buildings with multiple tiers. Additional BPIP-PRIME processing was completed for baseline source parameters associated with increment concentration analysis where past stack parameters were available.

5.1.3 Background Concentrations

Background concentrations account for other sources in the region that are not included in the modeling analysis and that generally do not have significant concentration gradients near the facility under review. Table 5.1 provides a summary of final background concentrations obtained from the NDDEQ June 21, 2013 Air Quality Dispersion Modeling Analysis Guide.

Table 5.1 – Distant Background Concentrations

Pollutant	Averaging Period	Concentration (μg/m³)
PM_{10}	24-Hour	30
$PM_{2.5}$	24-Hour	13.7
	Annual	4.75
SO_2	1-Hour	13
	3-Hour	11
	24-Hour	9
	Annual	3
NO_2	1-Hour	35
	Annual	5
CO	1-Hour	1,149
	8-Hour	1,149

5.1.4 Preconstruction Monitoring Data

ACS requests that the NDDEQ grant a waiver of the preconstruction ambient monitoring requirements for the Drayton facility based on the availability of representative monitoring data for the region.

5.1.5 Elevation Data

United States Geological Survey (USGS) National Elevation Dataset (NED) data were downloaded from the USGS National Map Seamless Server for use in the AERMOD model. Utilizing the same coordinate system developed for the receptor grid, NED data with a 1-arc second resolution were downloaded and imported into the model after processing with AERMAP.

5.1.6 Receptor Grid

The receptor grid includes discrete receptors placed at 25-meter intervals along the Drayton facility fence line. In addition, the grid extends outward from the facility fence line as a Cartesian grid system at intervals of 50 meters from the fence line for a distance of 1,000 meters, at intervals of 100 meters out to a distance of 2,000 meters, and at intervals of 250 meters out to a distance of 5,000 meters and at intervals of 500 meters to a total distance of 10,000 meters in each direction from the fence line. The coordinate system is based on Universal Transverse Mercator (UTM) Zone 14 with the North American Datum of 1983 (NAD83). Figure 1 shows a graphical display of the receptor layout.

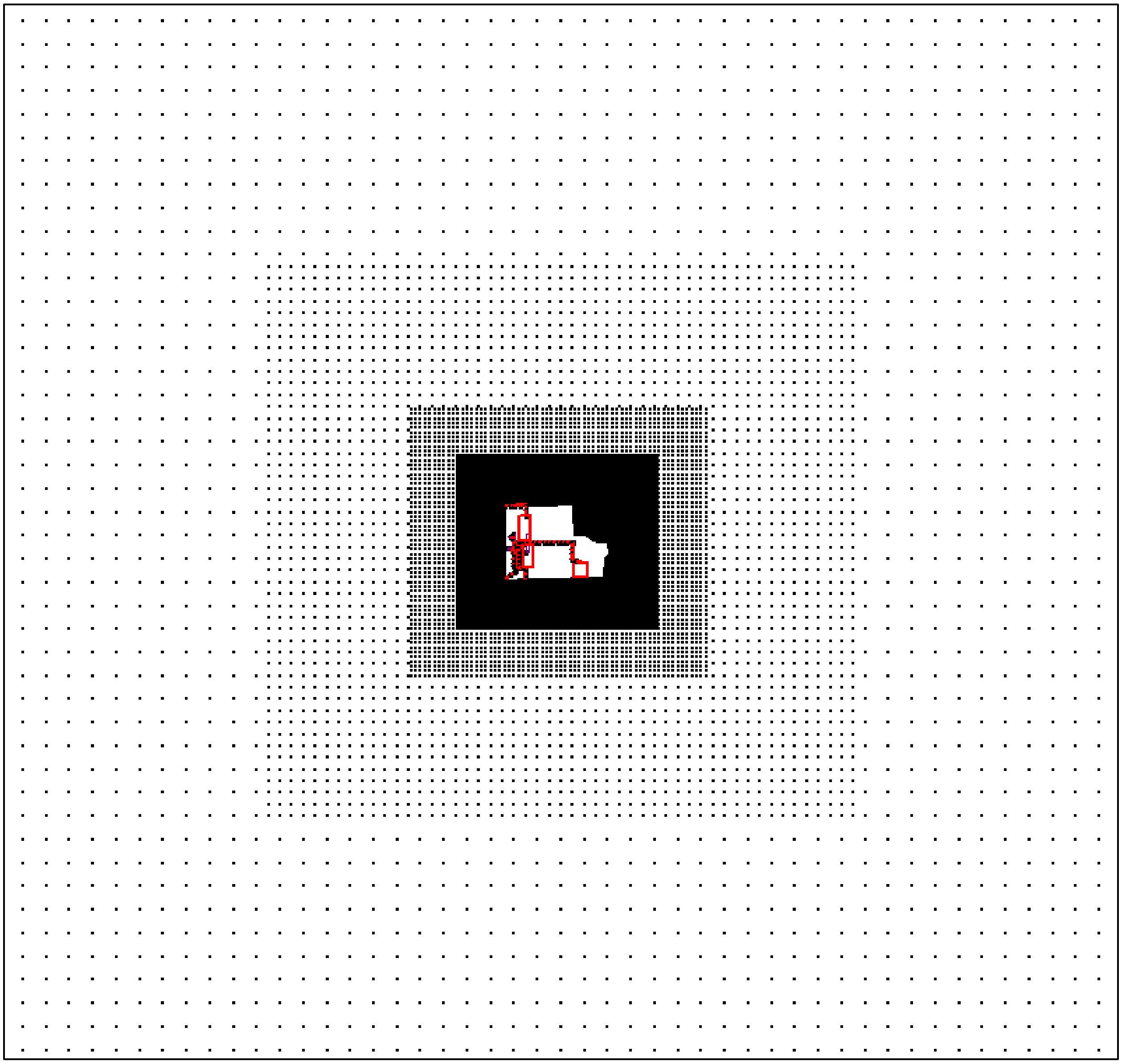

Figure 1. Proposed Receptor Grid Layout.

In order to verify the source and receptor coordinate system, the model input parameters were exported to Google Earth Pro and geo-referenced to UTM coordinates in NAD83, Zone 14. Figure 2 shows the geo-referenced aerial photo of the Drayton facility overlaid with model input data (i.e. fence line, unpaved roads, buildings, sources, etc.).

Figure 2. Geo-Referenced Fence Line Receptors and Sources.

5.1.7 Meteorological Data

The meteorological date used for this analysis consisted of five years, 2009-2013, of surface meteorological data recorded by the National Weather Service (NWS) at Grand Forks, North Dakota, and upper-air (mixing height) meteorological data recorded by the NWS at international Falls, Minnesota. The surface and upper-air met data sets were processed into a format usable by the model using the EPA computer program AERMET, after the surface data were preprocessed by AERMINUTE. An anemometer height of 10 meters was used. The surface station located in Hallock Minnesota was excluded from consideration for this analysis because it does not contain minute data to be used with AERMINUTE.

5.2 Model Input Data

5.2.1 Modeled Background Sources

Table 5.2 provides a list of nearby background sources included in the dispersion modeling analysis. Emission rate and release parameters were obtained from the NDDEQ. A detailed listing of stack parameters for each source is provided in Appendix E.

Table 5.2 – Nearby Background Sources

Model ID	Description	$PM/PM_{10}/PM_{2.5}$ (g/sec)	NO_x (g/sec)	SO_2 (g/sec)
ETH1	Ethanol Plant - DDG Dryer/Hot	0.277	1.31	2.293
ETH2	Ethanol Plant - Bio-Mass Boiler	0.025	0.983	1.046
ETH3	Ethanol Plant - Bio-Mass Boiler	0.025	0.983	1.046
ETH4	Ethanol Plant - DDG Dryer	0.14	-	-
ETH5	Ethanol Plant - Grain Handling	0.787	-	-
DEVP	Developmental Center - Boiler	4.173	4.047	12.56
SDC	SDC/LSaTC - Boiler	-	0.63	-

5.2.2 Modeled Drayton Sources

5.2.2.1 Source Identification

Table 5.3 provides list of Drayton facility emission sources, existing and new. Current operating permit (T5-X73015) and model identification numbers have been included to aid in source identification. The table also identifies the proposed post modification status of the emission sources and whether or not they were included in the modeling analysis.

Table 5.3 – Drayton Facility Sources

Model ID	Permit ID	Description	Status[A]
EP1	EU1/EP1	B&W Boiler	Existing Source
EP1a	EU1a/EP1a	Coal Handling Equipment	Existing Source
-	EU3/EP3&3a	Pulp Dryer No. 2	Removed From Service
EP4	EU4/EP4	Pulp Dryer No. 1	Existing Source
EP33	EU36/EP33	New Pulp Dryer No. 2	New Source
EP30	EU34/EP30	Pellet Mills & Cooler	Existing Source
EP9	EU9/EU11/EP9	Dry Pulp Belt Conveyor & Bucket Elevator	Existing Source
EP10	EU10/EP10	Dry Pulp Reclaim System	Existing Source
EP28	EU29/EP28	Sugar Dryer/Granulator	Existing Source
EP27a	EU28/EP27a	Lime Kiln	Existing Source
EU27b	EU28/EP27b	Carbonation Vent	Existing Source
-	EU28/EP27c	Carbonation Pressure Relief	Intermittent Source Not Modeled

Model ID	Permit ID	Description	Status[A]
-	EU28/EP27d	Kiln Startup Bypass	Intermittent Source Not Modeled
EP14a	EU14a/EP14a	MAC2 Flow Headhouse	Existing Source
EP14b	EU14b/EP14b	Old Hummer Room Pulsaire	Existing Source
-	EU14c/EP14c	Hummer Room MAC	Internally Vented Not Modeled
EP15	EU15/EP15	Pulp Pellet Bin No. 1	Existing Source
-	EU16/EP16	Pulp Pellet Bin No. 2	Not Modeled – See Note B
-	EU17/EP17	Pulp Pellet Bin No. 3	Not Modeled – See Note B
-	EU18/EP18	Sugar Warehouse (Hi-Vac)	Internally Vented Not Modeled
EP19a	EU19a/EP19a	Bulk Loading Pulsaire	Existing Source
-	EU19b/EP19b	North Bulk Sugar Loadout	Internally Vented Not Modeled
-	EU19c/EP19c	South Bulk Sugar Loadout	Internally Vented Not Modeled
EP20	EU20/EP20	Main Sugar Warehouse Pulsaire	Existing Source
-	EU21/EP21	Diesel Fire Suppression Pump	Intermittent Source Not Modeled
EP23	EU23/EP23	Pulp Dryer Coal Hopper	Existing Source
EP24	EU25/EP24	Flume Lime Slaker	Existing Source
EP29	EU30/EP29	Lime Slaker	Existing Source
EP31	EU32/EP31	Pellet Loadout	Existing Source
EP32	EU35/EP32	Natural Gas-Fired Package Boiler	New Source
FUG2	Fug2/NA	Coal Handling Emissions	Existing Source
FUG3	Fug3/NA	Lime Rock Handling Emissions	Existing Source
FUG4	Fug4/NA	Spent Lime Wind Erosion	Existing Source

[A] Status indicates changes to emission sources and if sources were excluded from modeling.
[B] The three pulp pellet bins do not operate simultaneously. Therefore, all emissions are represented from Pellet Bin No. 1 operating full time.

In addition to the sources listed in the above table, the Drayton facility also has several on-site unpaved roads that are traveled by vehicles as part of normal production operations. These operations include delivery of sugar beets from remote pile locations, daily delivery of coal, periodic delivery of limerock and coke/anthracite, and daily hauling of spent lime from the factory to the spent lime disposal area. Table 5.4 identifies the unpaved road fugitive dust sources included in the modeling analysis.

Table 5.4 – Unpaved Road Fugitive Dust Sources

Model ID	Description
RD001 – RD055	Unpaved road traffic from delivery of beets from off-site storage piles.
RD056 – RD113	Unpaved road traffic from transport of limerock, coke and anthracite.
RD114 – RD183	Unpaved road traffic from spent lime hauling from factory to disposal.

5.2.2.2 Post Modification Emission Rates and Parameters

Post modification emission rates are based directly on permitted emission limits for existing sources and proposed BACT emission limits for new sources. Table 5.5 provides a listing of the emission rates for sources included in the modeling analysis, except for unpaved roads, which are discussed later. A detailed listing of stack parameters for each source is provided in Appendix E.

Table 5.5 – Drayton Facility Emission Rates

Model ID	Description	PM_{10} (g/sec)[A]	$PM_{2.5}$ (g/sec)[A]	NO_x (g/sec)	SO_2 (g/sec)	CO (g/sec)
EP1	B&W Boiler	3.75	3.18	25.01	45.98	6.56
EP1a	Coal Handling Equipment	0.04	0.01	-	-	-
EP4	Pulp Dryer No. 1	11.19	10.28	6.84	5.87	57.33
EP30	Pellet Mills & Cooler	0.19	0.04	-	-	-
EP9	Dry Pulp Belt Conveyor	0.04	0.01	-	-	-
EP10	Dry Pulp Reclaim System	0.08	0.01	-	-	-
EP28	Sugar Dryer/Granulator	0.28	0.06	-	-	-
EP27a	Lime Kiln Balance Vent	1.38	0.84	1.01	0.42	19.68
EP27b	Carbonation Stack	-	-	2.36	0.05	45.92
EP14a	MAC2 Flow Headhouse	0.43	0.10	-	-	-
EP14b	Old Hummer Room Pulsaire	0.41	0.09	-	-	-
EP15	Pulp Pellet Bin No. 1	0.05	0.01	-	-	-
EP19a	Bulk Loading Pulsaire	0.01	0.004	-	-	-
EP20	Main Sugar Warehouse Pulsaire	0.06	0.01	-	-	-
EP23	Pulp Dryer Coal Hopper	0.11	0.03	-	-	-
EP24	Flume Lime Slaker	0.01	0.001	-	-	-
EP29	Lime Slaker	0.42	0.16	-	-	-

Model ID	Description	PM_{10} (g/sec)[A]	$PM_{2.5}$ (g/sec)[A]	NO_x (g/sec)	SO_2 (g/sec)	CO (g/sec)
EP31	Pulp Pellet Loadout	0.01	0.001	-	-	-
EP32	Natural Gas-Fired Package Boiler	0.34	0.34	0.91	0.03	1.67
EP33	Pulp Dryer No. 2	7.43	4.62	5.90	7.60	57.74
FUG2	Coal Handling Emissions	0.08	0.01	-	-	-
FUG3	Lime Rock Handling Emissions	0.01	0.000004	-	-	-
FUG4	Spent Lime Wind Erosion	0.03	0.01	-	-	-

[A] Modeled PM_{10} and $PM_{2.5}$ emissions may be higher than permitted PM emission limit due to the inclusion of condensable emissions depending on the source type. See detailed emission calculations in Appendix C.

As indicated in Table 5.4, fugitive dust emissions from Drayton facility traffic on on-site unpaved roads are also included in the dispersion modeling analysis. Volume sources were used to represent all vehicle traffic on haul roads. Production related traffic included the following:

- Southwest Unpaved Road Segment (RD001 – RD055):
  - Beet Delivery Trucks: 160 trucks per day delivering beets from remote pile locations to the factory for processing.
  - Coal Trucks: 13 trucks per day delivering coal from off-site storage to the factory boiler house.
  - The southern half of this segment (RD001 – RD020) will utilize the periodic application of magnesium or calcium chloride to maintain a control efficiency of 80% during unfrozen conditions.
- Northwest Unpaved Road Segment (RD056 – RD113):
  - Limerock Transport Trucks: 8 trucks per day maximum operations that occur periodically throughout campaign to move limerock to the limerock stockpile.
  - Coke/Anthracite Trucks: 8 trucks per day maximum operations that occur periodically throughout campaign to move coke/anthracite to the fuel stockpile.
- Northeast Unpaved Road Segment (RD114 – RD183):
  - Spent Lime Transport Trucks: 12 trucks per day transporting spent lime from the factory to the spent lime disposal area.

All vehicle traffic on unpaved road segments is included in the model for the months of August through November and March through May. During the months of December through February, the unpaved roads exhibit frozen conditions which inhibits the generation of significant fugitive emissions

Volume source parameters were determined following EPA guidance for haul roads. The guidance specifies the initial vertical dimension is calculated by multiplying the average vehicle height by 1.7 to account for vehicle induced turbulence. Using an average heavy-duty vehicle height of 4 meters, the initial vertical dimension would be 6.8 meters. To specify the initial vertical dispersion coefficient (δ_{zo}) in the model, the initial vertical dimension is divided by 2.15 for surface based sources (δ_{zo} = 3.16 meters).

The source release height for heavy-duty vehicles is 3.4 meters. This is the height representing the midpoint of the initial vertical dimension.

During the processing of the meteorological data used for the Drayton facility modeling, it was discovered that the downloaded land use surface characteristics for the site are predominately represented by row crops and grassland (surface roughness of 0.005 to 0.02). There was no representation of commercial/industrial structures (surface roughness of 0.7) within one kilometer of the area of evaluation.

A majority of the unpaved road sources at the Drayton facility are located in close proximity to the facility structures and will be affected by turbulence from building wake effects and increased plume mixing. Therefore, because the land use surface characteristics incorrectly represents land use within one kilometer of the site, surface based volume sources located within ½ kilometer of the primary Drayton facility structure (main factory building) utilize a initial vertical dimension(δ_{zo}) based on the building height divided by 2.15 to represent a source adjacent to a building (δ_{zo} = 11.77 meters). This allows some consideration of increased mixing at low levels that is not accounted for in the overly generalized land use characteristic data.

Detailed calculations of fugitive emissions related to vehicle traffic on unpaved roads have been included in Appendix C.

5.2.3 PSD Increment Consumption

In order to evaluate PSD Class II allowable increment impacts, the difference between the estimated impacts of the post-modified Drayton facility and the actual emissions at the time of the minor source baseline trigger dates for PM_{10}, $PM_{2.5}$, NO_2 and SO_2 was modeled. Baseline trigger dates for Pembina County are as follows: PM_{10} – January 13, 1978, $PM_{2.5}$ – August 23, 2012, NO_2 – October 1, 1989, and SO_2 – December, 19, 1977. No PSD increment consumption was evaluated in the modeling analysis for CO because there are no federal PSD Class II allowable increments for CO.

The modeling analysis evaluates both annual increment impacts and short-term 24-hour impacts associated with the proposed project. The majority of the facility will not experience an increase in maximum short-term (hourly) production capacity because the primary impact from the project will be greater annual utilization and more consistent daily utilization.

To evaluate PSD annual increment impacts as a result of the proposed project, the maximum allowable emission rates of facility sources were modeled with a positive emission rate and two-year average baseline emission rates for the period immediately preceding the baseline trigger date for each applicable pollutant were modeled with a negative emission rate. In this way the estimated actual impacts of the facility prior to the trigger date were evaluated in comparison to future potential operations.

To evaluate PSD 24-hour increment impacts as a result of the proposed project, the maximum allowable emission rates of facility sources were modeled with a positive emission rate and the maximum actual emission rate of each emission unit (based on an average of production data or available source test data) for the period immediately preceding the baseline trigger date for each applicable pollutant were modeled with a negative emission rate. Additionally, stack parameters as they existed prior to the trigger date were incorporated into the model for baseline emission to account for changes in dispersion characteristics that may impact increment consumption. In this way the actual impact of the facility prior to the trigger date were evaluated in comparison to future potential operations.

Fugitive emissions related to vehicle traffic are not included in the increment analysis. It is assumed that haul road emissions remained relatively unchanged since baseline trigger dates were set. Through ongoing efforts to pave roads and reduce fugitive emissions, post-modification fugitive dust emission levels are expected to be significantly lower than pre-baseline levels. Therefore, the exclusion of haul roads and potential credits due to the paving of roads presents a conservative analysis of increment. All of nearby background sources included in the analysis were conservatively assumed to consume increment.

A detailed listing of baseline emission rates and source parameters used in the increment analysis are included in Appendix E.

5.2.4 Model Adjustments

5.2.4.1 Tier II NO_x Analysis

The EPA-approved Tier 2 modeling methodology, ARM2, was used to determine the short-term (1-Hour) NO_2 impacts. Default in-stack NO_2/NO_x ratios of 0.5 minimum and 0.9 maximum were used. Annual NO_2 impacts were determined using Tier 1 methodology, which included no modeling adjustments.

5.2.4.2 $PM_{2.5}$ Secondary Formation

In order to account for secondary formation of $PM_{2.5}$ from precursor pollutant emissions of NO_x and SO_2, EPA guidance (EPA April 30, 2019) was followed to determine Modeled Emission Rates for Precursors (MERPs). The calculated MERPs values were added to the 24-Hour and Annual distant background values for $PM_{2.5}$ to account for total pollutant impacts.

The MERPs analysis consists of the following steps:

- A review of the project locale indicates that there are no unusual circumstances regarding complex terrain, proximity to very large sources of pollutants that impact atmospheric chemistry or meteorology.
- Utilizing the EPA's database of modeled sources (https://www.epa.gov/scram/merps-view-qlik), a hypothetical representative source in the upper Midwest was identified for Stutsman County, North Dakota.
- Project impacts for nitrates and sulfates were calculated by multiplying the project emission rate (tpy) by the ratio of the hypothetical source modeled impact to the hypothetical source emission rate (tpy).
- The worst-case (highest) project impact was chosen regardless of hypothetical stack height.

- Final project impacts were determined by adding the calculated project impact to the distant background value, which then were added to the site-specific project modeled impacts.

Table 5.6 provides a summary of the MERPs calculation results. Detailed MERPs calculations are included in Appendix E.

Table 5.6 – $PM_{2.5}$ MERPs Calculation Summary

Averaging Period	Precursor	Calculated Impact ($\mu g/m^3$)	Cumulative Impact ($\mu g/m^3$)
24-Hour	NO_x	0.12	2.16
	SO_2	2.04	
Annual	NO_x	0.008	0.06
	SO_2	0.052	

5.2.4.3 Secondary O_3 Formation

In order to account for secondary formation of O_3 from precursor pollutant emissions of NO_x and VOC, EPA guidance (EPA April 30, 2019) was followed to determine MERPs for O_3. The calculated MERPs value was added to the 3-year average monitored design concentration of O_3 in the project area to determine the potential for an exceedance.

The MERPs analysis consists of the following steps:

- A review of the project locale indicates that there are no unusual circumstances regarding complex terrain, proximity to very large sources of pollutants that impact atmospheric chemistry or meteorology.
- Utilizing the EPA's database of modeled sources (https://www.epa.gov/scram/merps-view-qlik), a hypothetical representative source in the upper Midwest was identified for Stutsman County, North Dakota.
- Project impacts for NO_x and VOC were calculated by multiplying the project emission rate (tpy) by the ratio of the hypothetical source modeled impact to the hypothetical source emission rate (tpy).
- The worst-case (highest) project impact was chosen regardless of hypothetical stack height.
- Final project impacts were determined by comparing the calculated MERPs to design concentration monitoring data.

Table 5.7 provides a summary of the MERPs calculation results. Detailed MERPs calculations are included in Appendix E.

Table 5.7 – O_3 MERPs Calculation Summary

Averaging Period	Precursor	Calculated Impact (ppb)	Cumulative Impact (ppb)
8-Hour	NO_x	1.52	1.75
	VOC	0.23	

Table 5.8 provides a summary of the 4th-High 8-Hour O_3 monitoring data for all sites in North Dakota. The data were obtained from Monitor Value Reports at https://www.epa.gov/outdoor-air-quality-data/monitor-values-report.

Table 5.8 – O_3 Monitoring Data Summary

County	2019 (ppm)	2020 (ppm)	2021 (ppm)	3-Year Average (ppm)
Billings	0.058	0.053	0.069	0.060
Burke	0.056	0.053	0.061	0.057
Cass	0.062	0.056	0.063	0.060
Dunn	0.063	0.054	0.068	0.062
McKenzie	0.060	0.051	0.064	0.058
Mercer	0.059	0.052	0.065	0.059
Oliver	0.061	0.055	0.065	0.060
Ward	0.063	0.051	0.057	0.057

As indicated in Table 5.8, the highest 3-year average O_3 concentration for any county in North Dakota is 0.062 ppm. Adding the calculated O_3 MERPs of 0.0018 ppm (1.75 ppb) to the monitor data results in a total O_3 concentration of 0.064 ppm. The total is less than the design concentration of 0.07 ppm for O_3, therefore the project impact is in compliance with the NAAQS.

5.3 Model Results

The maximum estimated impacts at or beyond the Drayton facility fence line, for each time averaging period for the five pollutants included in this analysis are summarized in the tables in the following section. Drayton facility sources were modeled with the nearby background sources for comparison to the state and federal AAQS and PSD Class II allowable concentration increments. Distant background concentration values were added to the maximum modeled concentrations for AAQS compliance determinations. State and federal AAQS for each pollutant and averaging period are also included in the results tables to provide a comparison for compliance demonstration purposes.

5.3.1 Post-Modification Emission Impacts

The maximum total impacts from PM_{10}, $PM_{2.5}$, SO_2, NO_2 and CO based on maximum potential emission rates are summarized in Table 5.9 for comparison to state and federal AAQS. The pollutant concentrations include impacts from nearby background and distant background sources.

Table 5.9 – Maximum Predicted Post-Modification Concentrations vs. AAQS

Pollutant		Met Year	Modeled Emissions (μg/m³)	Distant Background (μg/m³)[G]	Total Impact (μg/m³)	AAQS (μg/m³)	
						State	Federal
PM_{10}	24-Hour[A]	NA	111.5	30	141.5	150	150
$PM_{2.5}$	Annual[B]	2013	4.15	4.81	8.96	-	12
	24-Hour[C]	NA	18.6	15.9	34.5	-	35
SO_2	Annual[B]	2013	5.31	3	8.31	60	80
	24-Hour[D]	2010	71.5	9	80.5	260	365
	3-Hour[D]	2010	205.5	11	216.5	1,300	1,300
	1-Hour[E]	NA	151.3	13	164.3	715	196
NO_2	Annual[B]	2013	6.52	5	11.5	100	100
	1-Hour[F]	NA	123.5	35	158.5	-	188
CO	8-Hour[D]	2009	1,894	1,149	3,043	-	10,000
	1-Hour[D]	2010	4,734	1,149	5,883	-	40,000

[A] Modeled concentration is the highest-sixth-highest 24-hour average across five years of meteorological data.
[B] Modeled concentration is the highest annual average concentration of five modeled years of meteorological data.
[C] Modeled concentration is the 98th percentile (eighth-high) of the annual distribution of maximum 24-hour concentrations averaged across five years of meteorological data.
[D] Modeled concentration is the highest-second-high concentration of five modeled years of meteorological data.
[E] Modeled concentration is the 99th percentile (fourth-high) of the annual distribution of daily maximum 1-hour concentrations averaged across five years of meteorological data.
[F] Modeled concentration is the 98th percentile (eighth-high) of the annual distribution of daily maximum 1-hour concentrations averaged across five years of meteorological data.
[G] The distant background for $PM_{2.5}$ 24-Hour includes a MERP adjustment of 2.16 μg/m³ to account for secondary formation. The distant background for $PM_{2.5}$ Annual includes a MERP adjustment of 0.06 μg/m³ to account for secondary formation.

5.3.2 Maximum Predicted PSD Class II Increment Consumption

The maximum total impacts from $PM_{2.5}$, PM_{10}, SO_2 and NO_2 determined from the difference in concentrations due to future potential emissions (based on post-modification emission rates) versus past actual emission (based on pre-minor source baseline trigger date actual emissions) are summarized in Table 5.10 for comparison to federal PSD Class II annual allowable increment standards.

Table 5.10 – Maximum Predicted PSD Class II Increment Consumption

Pollutant		Met Year	Easting (m)	Northing (m)	Modeled Impact (µg/m³)	Class II Standard (µg/m³)
PM_{10}	Annual[A]	2010	625500.0	5373000.0	0.08	17
	24-Hour[B]	2010	634318.2	5383819.7	24.9	30
$PM_{2.5}$	Annual[A]	2013	634800.0	5383000.0	0.58	4
	24-Hour[B]	2010	633750.0	5384350.0	4.03	9
SO_2	Annual[A]	2011	624000.0	5373000.0	0.08	20
	24-Hour[B]	2012	624000.0	5377000.0	1.86	91
	3-Hour[B]	2012	624000.0	5376000.0	11.8	512
NO_2	Annual[A]	2010	634313.3	5384059.6	3.23	25

[A] Modeled concentration is the highest annual average concentration of five modeled years of meteorological data.

[B] Modeled concentration is the highest-second-high concentration of five modeled years of meteorological data.

5.4 Conclusions

The results presented in Section 5.3 and Appendix F indicate that the estimated impacts from the Drayton facility, plus nearby and distant background sources as applicable, comply with all state and federal AAQS and PSD Class II allowable increment standards.

A summary of model input and output data is provided in Appendix E.

Chapter 6.0 – Additional Impacts Analysis

The additional impacts analysis address air quality and related impacts due to associated growth and construction, as well as potential impacts of atmospheric emissions on soils, vegetation, and visibility impairment, in accordance with 40 CFR 52.21(o).

6.1 Growth Analysis

Elements of the growth analysis include 1) a projection of the associated industrial, commercial, and residential source growth that occur due to the source, and 2) an estimate of the air emissions generated by the associated growth.

The modification of the Drayton facility to increase the production capacity is expected to be accomplished using primarily the existing work force in the northeastern North Dakota and northwestern Minnesota area. There is currently no additional industry or commercial ventures expected as a result of the proposed project, such that "secondary emissions" sources would be created in the vicinity.

6.2 Growth and Construction Air Quality Impacts

Because no significant associated growth can be projected at this time, there is no basis for projecting any growth related ambient air quality impacts. Construction-related emissions will be limited to minor temporary fugitive dust and mobile-source combustion emissions. Given the temporary nature of these emissions and the ability to mitigate them as needed, these activities are not expected to significantly impact the air quality.

The results of a modeling analysis of the proposed facility, together with the current low background concentrations in the region, show total ground-level ambient concentrations below the applicable air quality standards.

6.3 Soils and Vegetation Impacts

The impacts of emissions from the proposed facility on soils and vegetation are expected to be negligible. The area surrounding the Drayton facility is primarily agricultural.

Ozone can be harmful to plants, but concentrations below the NAAQS of 0.07 ppm are considered protective of vegetation. Monitored ozone concentrations in the North Dakota are safely below the NAAQS for ozone. The VOC emissions associated with the project are very minimal. Therefore, the proposed project is not expected to significantly affect ozone concentrations in the immediate project area or in the region. While NO_x emissions are also an ozone precursor, the effect on increase of ozone levels occurs far downwind. Given the relatively small actual increase in NO_x emissions expected with this project and the dispersion over long distances, the project would have negligible impacts on ozone levels regionally.

6.4 Odor Impacts

Odors can be associated with a number of activities at a sugar beet processing plant. Most of the odors generated by the plant are quickly dispersed before traveling far off-site. Odors generated by wastewater treatment lagoons can be a more significant concern, depending on weather conditions and the proximity of residential areas. The quality of the beets being processed in any given year has a significant impact on odor generation from the wastewater ponds. An increase of mud on the beets or a decrease in beet integrity will tend to increase the quantity of organics in the wastewater and tend to produce more odors. The proposed project is anticipated to have little to no impact on odors generated compared to current Drayton operations.

6.5 Visibility Impacts

Visible emissions due to operation of the proposed modified facility are expected to be limited primarily to water vapor emissions, as with the existing facility. The coal-fired pulp dryers are the major source of these water vapor emissions. The tall stacks on the pulp dryers minimize the visibility impacts of the water vapor emissions, so that they will not become a concern for ground level fogging in cooler weather.

The nearest Class I areas to the Drayton facility are the Voyageurs National Park and the Boundary Waters Canoe Area National Wilderness, both of which are located in Minnesota and are greater than 250 kilometers away. All other Class I areas in North Dakota and South Dakota are greater than 500 kilometers from the Drayton facility. Because of the relatively large distances to the Class I areas, impacts to the Class I areas from the proposed Drayton facility modification are anticipated to be negligible.

Visibility impacts to Class II areas are anticipated to remain unchanged as a result of the proposed project. The proposed project will not significantly affect short-term maximum (24-hour) emissions for the majority of facility emission units, but will only increase emissions from the installation of a new natural gas-fired package boiler and a new pulp dryer (which will be offset by the removal of an existing pulp dryer). Visibility impacts to Class II areas are evaluated based on 24-hour emission levels. Because 24-hour emission levels will only increase slightly, no additional evaluation is necessary to conclude that the project will not result in a measurable change in local visibility, which is currently not adversely impacted by the facility.

6.6 Additional Impacts Summary

As described above, the proposed Drayton facility modification is not anticipated to cause significant impacts due to growth or construction. Impacts of the proposed project on soils, vegetation, and visibility from atmospheric emissions are expected to be insignificant.

Chapter 7.0 – Proposed Permit Limitations

Table 7.1 provides a summary of the proposed permit limitations for emission units affected by the proposed modification at the Drayton facility. The limitations listed in this table include limitations proposed to comply with BACT, ambient air quality standards and PSD concentration increments.

Table 7.1 – Proposed Permit Limitations

Emission Unit/Source	Proposed Limit	Comments
New Pulp Dryer	PM: 31.9 lb/hr (0.49 lb/ton of pressed pulp) 3-hour average condensable only	BACT – Cyclone & Wet Scrubber
	PM_{10}: 59.0 lb/hr (0.91 lb/ton of pressed pulp) 3-hour average filterable and condensable	BACT – Cyclone & Wet Scrubber
	$PM_{2.5}$: 36.7 lb/hr (0.56 lb/ton of pressed pulp) 3-hour average filterable and condensable	BACT – Cyclone & Wet Scrubber
	SO_2: 60.3 lb/hr (0.93 lb/ton of pressed pulp) 3-hour average	BACT – Low Sulfur Coal
	NO_x: 46.8 lb/hr (0.72 lb/ton of pressed pulp) 3-hour average	BACT – Good Combustion Practice
	CO: 458.3 lb/hr (7.0 lb/ton of pressed pulp) 3-hour average	BACT – Good Combustion Practice
	VOC: 78.2 lb/hr (1.20 lb/ton of pressed pulp) 3-hour average	BACT – Good Combustion Practice
Package Boiler	$PM/PM_{10}/PM_{2.5}$: 0.0075 lb/MMBtu 3-hour average	BACT – Good Combustion Practice
	SO_2: 0.0006 lb/MMBtu 3-hour average	BACT – Low Sulfur Fuels
	NO_x: 0.02 lb/MMBtu 3-hour average	BACT – ULNB
	CO: 0.037 lb/MMBtu 3-hour average	BACT – Good Combustion Practice
	VOC: 0.005 lb/MMBtu 3-hour average	BACT – Good Combustion Practice

Appendix A

NPPD Construction Permit Application Forms

PERMIT APPLICATION FOR AIR CONTAMINANT SOURCES
NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8516 (9-2021)

SECTION A - FACILITY INFORMATION

Name of Firm or Organization American Crystal Sugar Company				
Applicant's Name Mr. Dave Braseth				
Title Vice President of Operations		Telephone Number (218) 236-4322	E-mail Address dbraseth@crystalsugar.com	
Contact Person for Air Pollution Matters Dan Weber				
Title Enironmental Specialist		Telephone Number (218) 236-4304	E-mail Address dweber@crystalsugar.com	
Mailing Address (Street & No.) 101 North 3rd Street				
City Moorhead		State MN		ZIP Code 56560
Facility Name American Crystal Sugar Company - Drayton				
Facility Address (Street & No.) County Highway 44, P.O. Box 190				
City Drayton		State ND		ZIP Code 58225
County Pembina	Coordinates NAD 83 in Decimal Degrees (to forth decimal degree) Latitude 48.59280000		Longitude 97.17610000	
Legal Description of Facility Site				
Quarter NE	Quarter SE	Section 14	Township 159N	Range 51W
Land Area at Facility Site 1280 Acres (or) ________ Sq. Ft.		MSL Elevation at Facility 800		

SECTION B – GENERAL NATURE OF BUSINESS

Describe Nature of Business	North American Industry Classification System Number	Standard Industrial Classification Number (SIC)
Beet Sugar Processing	311313	2063

SECTION C – GENERAL PERMIT INFORMATION

Type of Permit? ☒ Permit to Construct (PTC) ☐ Permit to Operate (PTO)

If application is for a Permit to Construct, please provide the following data:

Planned Start Construction Date	Planned End Construction Date
08/2023	08/2028

SECTION D – SOURCE IDENTIFICATION AND CATEGORY OF EACH SOURCE INCLUDED ON THIS PERMIT APPLICATION

		Permit to Construct				Minor Source Permit to Operate						
Your Source ID Number	Source or Unit (Equipment, Machines, Devices, Boilers, Processes, Incinerators, Etc.)	New Source	Existing Source Modification	Existing Source Expansion	Existing Source Change of Location	New Source	Existing Source Initial Application	Existing Source After Modification	Existing Source After Expansion	Existing Source After Change of Location	Existing Source After Change of Ownership	Other
32	Boiler	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐
33	Pulp Dryer	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
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		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Add additional pages if necessary

SECTION D2 – APPLICABLE REGULATIONS

Source ID No.	Applicable Regulations (NSPS/MACT/NESHAP/etc.)
Facility-wide	40 CFR 63, Subpart DDDDD, NDAC 33.1-15
32	40 CFR 60, Subpart Db, NDAC 33.1-15
33	NDAC 33.1-15

SECTION E – TOTAL POTENTIAL EMISSIONS

Pollutant	Amount (Tons Per Year)
NO_x	1462
CO	6582
PM	829

Pollutant	Amount (Tons Per Year)
PM_{10} (filterable and condensable)	994
$PM_{2.5}$ (filterable and condensable)	699
SO_2	2085
VOC	709
GHG (as CO_2e)	929356
Largest Single HAP	3.80
Total HAPS	10.8

*If performance test results are available for the unit, submit a copy of test with this application. If manufacturer guarantee is used provide spec sheet.

SECTION F1 – ADDITIONAL FORMS

Indicate which of the following forms are attached and made part of the application

■ Air Pollution Control Equipment (SFN 8532)	■ Fuel Burning Equipment Used for Indirect Heating (SFN 8518)
☐ Construct/Operate Incinerators (SFN 8522)	☐ Hazardous Air Pollutant (HAP) Sources (SFN 8329)
☐ Natural Gas Processing Plants (SFN 11408)	■ Manufacturing or Processing Equipment (SFN 8520)
☐ Glycol Dehydration Units (SFN 58923)	☐ Volatile Organic Compounds Storage Tank (SFN 8535)
☐ Flares (SFN 59652)	☐ Internal Combustion Engines and Turbines (SFN 8891)
☐ Grain, Feed, and Fertilizer Operations (SFN 8524)	☐ Oil/Gas Production Facility Registration (SFN 14334)

SECTION F2 – OTHER ATTACHMENTS INCLUDED AS PART OF THIS APPLICATION

1.	Description of Modification	4.	Additional Impacts Analysis
2.	BACT Analysis	5.	Emission Calculations
3.	Ambient Air Quality Analysis	6.	

I, the undersigned applicant, am fully aware that statements made in this application and the attached exhibits and statements constitute the application for Permit(s) to Construct and/or Operate Air Contaminant sources from the North Dakota Department of Environmental Quality and certify that the information in this application is true, correct and complete to the best of my knowledge and belief. Further, I agree to comply with the provisions of Chapter 23.1-06 of the North Dakota Century Code and all rules and regulations of the Department, or revisions thereof. I also understand the permit is nontransferable and, if granted a permit, I will promptly notify the Department upon sale or legal transfer of this permitted establishment.

Signature	Date
David Braseth V.P. Operations	12/23/2022

PERMIT APPLICATION FOR MANUFACTURING OR PROCESSING EQUIPMENT

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8520 (9-2021)

NOTE: READ INSTRUCTIONS BEFORE COMPLETING THIS FORM.
- Must include SFN 8516 or SFN 52858

SECTION A – GENERAL INFORMATION

Equipment items operating as a functional unit may be grouped as one application	
Name of Firm or Organization American Crystal Sugar Company	Facility Name American Crystal Sugar Company - Drayton

SECTION B – EQUIPMENT INFORMATION

Source ID Number (From SFN 8516) 33		
Type of Unit or Process (rotary dryer, cupola furnace, crusher, pelletizer, etc.) Rotary Pulp Dryer		
Make Promill	Model TBD	Date Installed 08/20/2003
Capacity (manufacturer's or designer's guaranteed maximum) 65	Operating Capacity (specific units) ton per hour pressed pulp	
Brief description of operation of unit or process: Coal-fired rotary pulp dryer.		

SECTION C – NORMAL OPERATING SCHEDULE

Hours Per Day	Days Per Week	Weeks Per Year	Peak Production Season (if any)	Dates of Annual Shutdown
24	7	40	Fall/Winter	May-July

SECTION D – RAW MATERIALS INTRODUCED INTO UNIT OR PROCESS

Include solid fuels such as coke or coal. *Exclude* indirect heat exchangers from this section
For indirect heat exchangers, complete form SFN 8518

Material	Hourly Process Weight (Pounds Per Hour) Average	Maximum	Minimum	Average Annual (Specify Units)	Intermittent Operation Only (Average Hours Per Week)
Pressed Pulp	90000	130000	60000	569400 ton/yr	
Coal	12000	17200	8000	75485 ton/yr	

SECTION E – PRODUCTS OF UNIT OR PROCESS

Include all, even those not usable because they do not meet specifications

Material	Hourly Process Weight (Pounds Per Hour)			Average Annual (Specify Units)	Intermittent Operation Only (Average Hours Per Week)
	Average	Maximum	Minimum		
Dried Pulp	27000	39000	18000	170820 ton/yr	

SECTION F – FUELS USED

Coal (Tons/Yr)	% Sulfur	% Ash	Oil (Gal/Yr)	% Sulfur	Grade No.
75485	0.5	NA	0	NA	NA

Natural Gas (Thousand CF/Yr)	LP Gas (Gal/Yr)	Other (Specify)
344,000	0	NA

SECTION G – EMISSION POINTS

List each point separately, number each and locate on attached flow chart

Number	Stack Height (ft)	Stack Diameter (ft at top)	Gas Volume (ACFM)	Exit Temp (°F)	Gas Velocity (fps)
33	180	5.5	100000	258	70

SECTION H – AIR CONTAMINANTS EMITTED

Known or Suspected - Use same identification number as above

Number	Pollutant	Amount		Basis of Estimate
		Pounds/Hr	Tons/Yr	
33	-	-	-	See Attached Calcs

SECTION I – VOLATILE ORGANIC COMPOUNDS

Are any volatile organic compounds (VOCs) stored on premises? ☒ No ☐ Yes – List Below
See 40 CFR 51.100(s) for classes of compounds covered

Material Stored	Size Tank (Gallons)	Vapor Control Device

SECTION J – ORGANIC SOLVENTS

Are any organic solvents used or produced? ■ No (None or less than 50 gal/yr) ☐ Yes – List Below

Type	Principal Use	Gallons/Yr Consumed	Gallons/Yr Produced

SECTION K – AIR POLLUTION CONTROL EQUIPMENT

Is any air pollution control equipment installed on this unit or process? ☐ No ■ Yes
If 'Yes' attach form SFN 8532

SECTION L – MATERIAL STORAGE

Does the input material or product from this process contain finely divided material which could become airborne? ☐ No ■ Yes

Describe storage methods used:
Dried product is milled/pelletized and stored in existing on-site bins (EU 15, 16 & 17).

Storage Piles	Type of Material	Particle Diameter (Avg. or Screen Size)	Pile Size Average Tons	Pile Wetted	Pile Covered

Describe any fugitive dust problems:
Dired pulp handling and transport is controlled by existing bagfilters.

Attach additional sheets if needed to explain any answers. Use separate form for each contaminant emitting process

SEND COMPLETED APPLICATION AND ALL ATTACHMENTS TO:

North Dakota Department of Environmental Quality
Division of Air Quality
4201 Normandy Street, 2nd Floor
Bismarck, ND 58503-1324
(701)328-5188

PERMIT APPLICATION FOR AIR POLLUTION CONTROL EQUIPMENT

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8532 (9-2021)

NOTE: READ INSTRUCTIONS BEFORE COMPLETING THIS FORM.
- Must also include forms SFN 8516 or SFN 52858

SECTION A – GENERAL INFORMATION

Name of Firm or Organization	Facility Name
American Crystal Sugar Company	American Crystal Sugar Company - Drayton
Source ID No. of Equipment being Controlled: 33	

SECTION B – EQUIPMENT

Type: ☒ Cyclone ☐ Multiclone ☐ Baghouse ☐ Electrostatic Precipitator
☒ Wet Scrubber ☐ Spray Dryer ☐ Flare/Combustor
☐ Other – Specify:

Name of Manufacturer	Model Number	Date to Be Installed
TBD	TBD	8/2023

Application: ☐ Boiler ☐ Kiln ☐ Engine ☒ Other – Specify: Rotary Dryer

Pollutants Removed	PM	PM10	PM2.5	
Design Efficiency (%)	90	90	80	
Operating Efficiency (%)				

Describe method used to determine operating efficiency:
Engineering Estimate

SECTION CD – GAS CONDITIONS

Gas Conditions	Inlet	Outlet
Gas Volume (SCFM; 68°F; 14.7 psia)	100000	100000
Gas Temperature (°F)	300	258
Gas Pressure (in. H_2O)		
Gas Velocity (ft/sec)	70	70

Pollutant Concentration (Specify Pollutant and Unit of Concentration)	Pollutant	Unit of Concentration	Inlet	Outlet

Pressure Drop Through Gas Cleaning Device (in. H_2O)
TBD

PERMIT APPLICATION FOR FUEL BURNING EQUIPMENT FOR INDIRECT HEATING

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8518 (9-2021)

NOTE: READ INSTRUCTIONS BEFORE COMPLETING THIS FORM.
- Must include SFN 8516 or SFN 52858

SECTION A - GENERAL INFORMATION

Name of Firm or Organization	Facility Name
American Crystal Sugar Company	American Crystal Sugar Company - Drayton

SECTION B – EQUIPMENT

Source ID No. (From form SFN 8516) 32	Name of Manufacturer TBD
Rated Capacity/Maximum Input 300 kpph	Model Number TBD

Purpose: Space Heat ______ % ; Process Heat 100 % ; Power Generation ______ % ; Other (Specify % if Multi-Purpose) ______ %

SECTION C – TYPE OF COMBUSTION UNIT AND FUEL FEEDING METHOD

Coal (If other solid fuel, specify here)

- ☐ Pulverized
- ☐ General
- ☐ Dry Bottom
- ☐ Wet Bottom with Fly Ash Reinjection
- ☐ Wet Bottom without Fly Ash Reinjection
- ☐ Other – Specify:
- ☐ Spreader Stoker with Fly Ash Reinjection
- ☐ Spreader Stoker without Fly Ash Reinjection
- ☐ Fluidized Bed
- ☐ Cyclone
- ☐ Hand-Fired

Fuel Oil

- ☐ Horizontally Fired
- ☐ Tangentially Fired
- ☐ Other – Specify:

Gas

- ☐ Horizontally Fired
- ☐ Tangentially Fired
- ■ Other – Specify:

Ultra Low NOx Burner with FGR

SECTION D – NORMAL SCHEDULE OF OPERATION

Hours Per Day	Days Per Week	Weeks Per Year	Hours Per Year Total	Peak Season (Specify Months)
24	7	40	6500	Fall/Winter

SECTION E – FUEL USE EXPECTED IN A CALENDAR YEAR

Year 2026

Primary Fuels			Standby Fuels		
Type: Natural Gas			Type: None		
Quantity Per Year: 2290	Units of Measure: MMSCF		Quantity Per Year:	Units of Measure:	
Percent Ash (Solid Fuels Only)					
Minimum	Maximum	Average	Minimum	Maximum	Average
0	0	0			
Percent Sulfur					
Minimum	Maximum	Average	Minimum	Maximum	Average
0.2 gr/100 SCF	0.5 gr/100 SCF	0.35 gr/100 SCF			
Btu Per Unit of Measure (e.g. lb, gal, etc. - Specify)					
Minimum	Maximum	Average	Minimum	Maximum	Average
950 Btu/SCF	1050 Btu/SCF	1020 Btu/SCF			

Describe Fuel Transport and Storage Methods:

Direct pipeline.

SECTION F – COMBUSTION AIR

☐ Natural Draft ☐ Induced ☒ Forced ☐ Other – Specify:

SECTION G – STACK DATA

Inside Diameter (ft) 4.5	Height Above Grade (ft) 120
Gas Temperature at Exit (Avg. °F) 350	Gas Velocity at Exit (Avg. ft/sec) 110
Are Emission Control Devices in Place? If YES – Complete SFN 8532 ☐ Yes ☒ No	
Stack Exit Gas Flow Rate	
Average (ACFM) 105000	Average (DSCFM) 67400
Maximum (ACFM) 105000	Maximum (DSCFM) 67400
Are sampling ports available? ☐ No ☒ Yes – Describe: Sample ports will be provide per EPA recommendation.	

SECTION H – NEARBY BUILDINGS

Attach drawings which show the plan and elevation views of any nearby buildings including the building that houses the fuel-fired equipment.

SECTION I – AIR CONTAMINANTS EMITTED

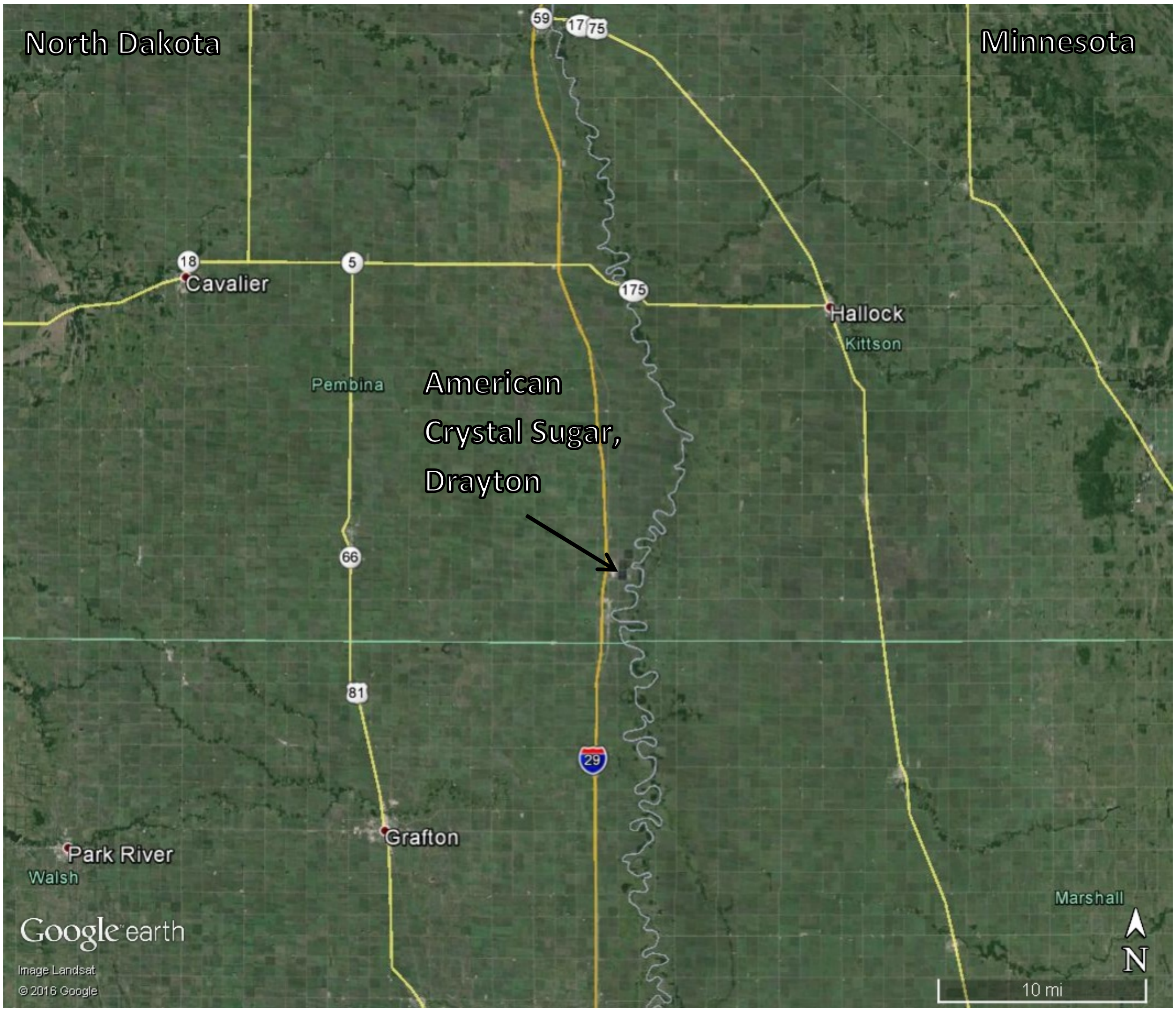
Pollutant	Maximum Pounds Per Hour	Amount (Tons Per Year)	Basis of Estimate*
NO_x			See Attached Calcs
CO			
PM			
PM_{10} (filterable and condensable)			
$PM_{2.5}$ (filterable and condensable)			
SO_2			

Pollutant	Maximum Pounds Per Hour	Amount (Tons Per Year)	Basis of Estimate*
VOC			
GHG (as CO_2e)			
Largest Single HAP			
Total HAPS			

*If performance test results are available for the unit, submit a copy of test with this application. If manufacturer guarantees are used provide spec sheet.

Appendix B

Site Location Map and Facility Layout Diagram



American Crystal Sugar- Drayton
Facility Location

C:\pwworking\oma\d1629150\DTN-CS001.dwg, CS001, 7/5/2016 8:00:49 AM, TLEMKE

HDR

ISSUE	DATE	DESCRIPTION
-	-	-

PROJECT MANAGER

PROJECT NUMBER 0000000000241591

AMERICAN CRYSTAL SUGAR CO.
DRAYTON, NORTH DAKOTA

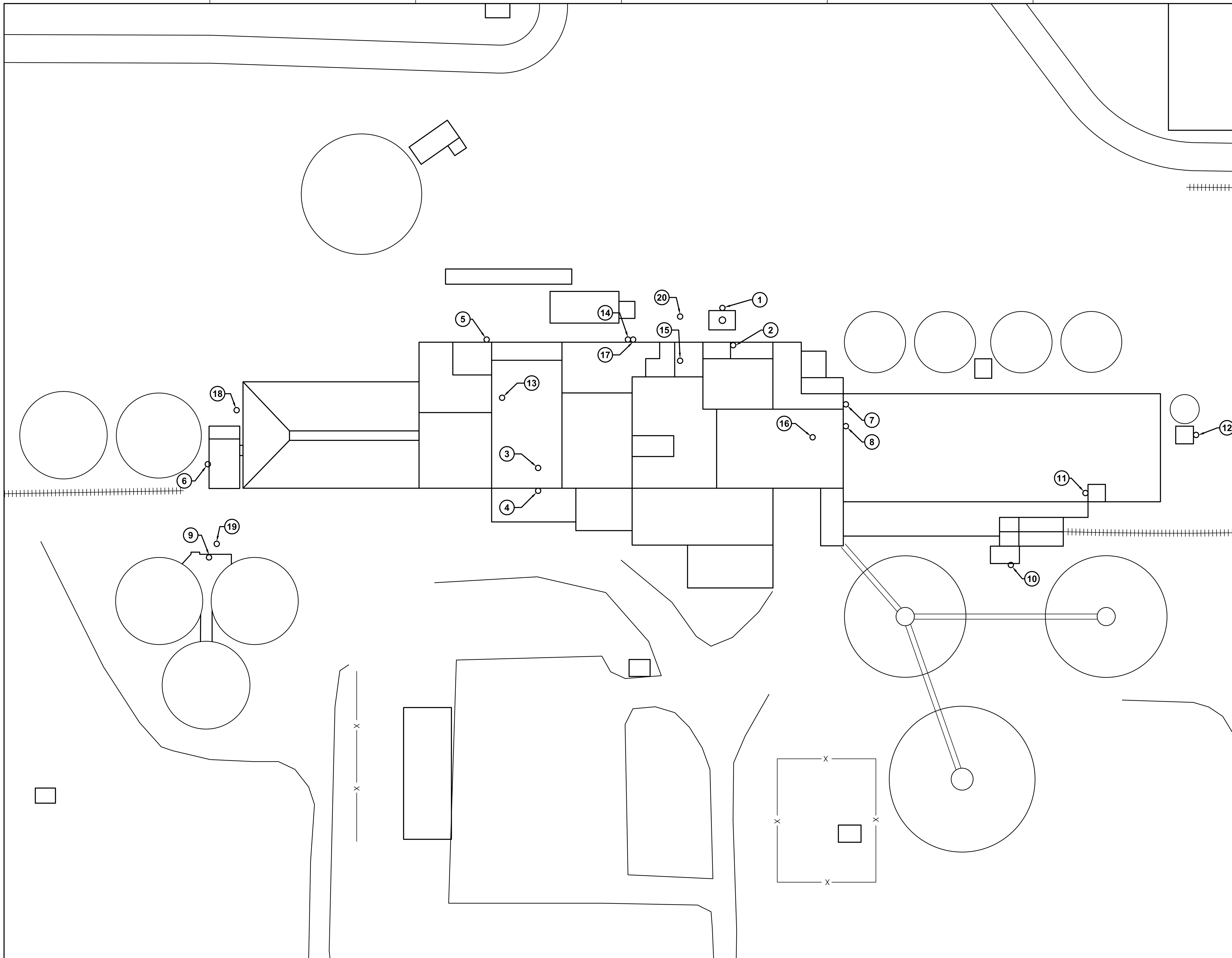
SITE PLAN
AMERICAN CRYSTAL SUGAR COMPANY
DRAYTON, NORTH DAKOTA

0 1" 2"

FILENAME DTN-CS001.dwg

SCALE 1:300

SHEET CS001



POINT NO.	NO.	Description
1	EP1 / UE1	Main Boiler
2	EP1a / EU1a	Coal Handling Equipment for boiler house
3	EP33 / EU36	Pulp Dryer No. 2
4	EP4 / EU4	Pulp Dryer No. 1
5	EP9 / EU9, EU11	Dry Pulp Belt Conveyors / Bucket Elevator
6	EP10 / EU10	Dry Pulp Reclaim System
7	EP14a / EU14a	MAC 2 Flow Headhouse
8	EP14b / EU14b	Old Hummer Room Pulsaire
9	EP15-17 / EU15-17	Pellet Storage Bin
10	EP19a / EU19a	Bulk Loading Pulsaire
11	EP20 / EU20	Main Sugar Warehouse Pulsaire
12	EP21 / EU21	Diesel Fire Suppression Pump Engine
13	EP23 / EU23	Pulp Dryer Coal Hopper
14	EP24 / EU25	Flume Lime Slaker
15	EP27 / EU28	Lime Kiln
16	EP28 / EU29	Sugar Dryer/Granulator
17	EP29 / EU30	Lime Slaker
18	EP30 / EU31	Pellet Mill / Cooler
19	EP31 / EU32	Pulp Pellet Loadout
20	EP32 / EU35	Package Boiler

N

60 0 60 120
SCALE IN FEET

PROJECT MANAGER

ISSUE DATE DESCRIPTION

PROJECT NUMBER 0000000000241591

AMERICAN CRYSTAL SUGAR CO.
DRAYTON, NORTH DAKOTA

EMISSION POINT LOCATION PLAN

FILENAME DTN-SC102.dwg
SCALE 1:60

SHEET
CS102

Appendix C

Emission Calculations

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Potential Emissions	Computed	GJR
Task	Emission Summary	Checked	KB
		Sheets	NA

Nitrogen Oxides (NO_x) **Emission Unit**		**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler		869.44	514.64	354.80
EU3/EP3 Pulp Dryer No. 2	TO BE REMOVED	0.00	35.85	-35.85
EU4/EP4 Pulp Dryer No. 1		237.97	43.09	194.88
EU28/EP27a-d Natural Gas-Fired Lime Kiln		118.19	0.00	118.19
EU13/EP13a-f Belgian Lime Kiln	REMOVED	0.00	68.78	-68.78
NEW Natural Gas-Fired Package Boiler (EU35)		31.47	0.00	31.47
NEW Pulp Dryer No. 2 (EU36)		205.08	0.00	205.08
Total		**1462**	**662**	**800**
PSD Significant Emission Rate (tpy)				**40**
Major Modification				**Yes**

Carbon Monoxide (CO) **Emission Unit**		**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler		228.32	271.57	-43.25
EU3/EP3 Pulp Dryer No. 2	TO BE REMOVED	0.00	540.30	-540.30
EU4/EP4 Pulp Dryer No. 1		1992.90	504.28	1488.62
EU28/EP27a-d Natural Gas-Fired Lime Kiln		2295.88	0.00	2295.88
EU13/EP13a-f Belgian Lime Kiln	REMOVED	0.00	1272.40	-1272.40
NEW Natural Gas-Fired Package Boiler (EU35)		58.07	0.00	58.07
NEW Pulp Dryer No. 2 (EU36)		2007.33	0.00	2007.33
Total		**6582**	**2589**	**3994**
PSD Significant Emission Rate (tpy)				**100**
Major Modification				**Yes**

Volatile Organic Compounds (VOC) **Emission Unit**		**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler		4.57	2.72	1.85
EU3/EP3 Pulp Dryer No. 2	TO BE REMOVED	0.00	24.67	-24.67
EU4/EP4 Pulp Dryer No. 1		341.66	34.54	307.12
EU28/EP27a-d Natural Gas-Fired Lime Kiln		12.03	0.00	12.03
EU13/EP13a-f Belgian Lime Kiln	REMOVED	0.00	1.18	-1.18
NEW Natural Gas-Fired Package Boiler (EU35)		8.48	0.00	8.48
NEW Pulp Dryer No. 2 (EU36)		342.58	0.00	342.58
Total		**709**	**63**	**646**
PSD Significant Emission Rate (tpy)				**40**
Major Modification				**Yes**

Sulfur Dioxide (SO_2) **Emission Unit**		**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler		1598.23	322.15	1276.08

EU3/EP3 Pulp Dryer No. 2 TO BE REMOVED	0.00	19.56	-19.56
EU4/EP4 Pulp Dryer No. 1	203.89	27.82	176.07
EU28/EP27a-d Natural Gas-Fired Lime Kiln	17.68	0.00	17.68
EU13/EP13a-f Belgian Lime Kiln REMOVED	0.00	50.61	-50.61
NEW Natural Gas-Fired Package Boiler (EU35)	0.93	0.00	0.93
NEW Pulp Dryer No. 2 (EU36)	264.20	0.00	264.20
Total	**2085**	**420**	**1665**
PSD Significant Emission Rate (tpy)			**40**
Major Modification			**Yes**

Lead (Pb) **Emission Unit**	**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler	0.04	0.02	0.01
EU3/EP3 Pulp Dryer No. 2 TO BE REMOVED	0.00	0.00	0.00
EU4/EP4 Pulp Dryer No. 1	0.01	0.00	0.01
EU28/EP27a-d Natural Gas-Fired Lime Kiln	0.00	0.00	0.00
EU13/EP13a-f Belgian Lime Kiln REMOVED	0.00	0.01	-0.01
NEW Natural Gas-Fired Package Boiler (EU35)	0.00	0.00	0.00
NEW Pulp Dryer No. 2 (EU36)	0.02	0.00	0.02
Total	**0.06**	**0.04**	**0.02**
PSD Significant Emission Rate (tpy)			**0.6**
Major Modification			**No**

Sulfuric Acid Mist (H_2SO_4) **Emission Unit**	**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler	4.63	0.93	3.70
EU3/EP3 Pulp Dryer No. 2 TO BE REMOVED	0.00	0.06	-0.06
EU4/EP4 Pulp Dryer No. 1	0.59	0.08	0.51
EU28/EP27a-d Natural Gas-Fired Lime Kiln	0.00	0.00	0.00
EU13/EP13a-f Belgian Lime Kiln REMOVED	0.00	0.00	0.00
NEW Natural Gas-Fired Package Boiler (EU35)	0.00	0.00	0.00
NEW Pulp Dryer No. 2 (EU36)	0.77	0.00	0.77
Total	**5.99**	**1.07**	**5**
PSD Significant Emission Rate (tpy)			**7**
Major Modification			**No**

Fluorides (measured as HF) **Emission Unit**	**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler	0.07	0.04	0.03
EU3/EP3 Pulp Dryer No. 2 TO BE REMOVED	0.00	0.24	-0.24
EU4/EP4 Pulp Dryer No. 1	0.77	0.24	0.53
EU28/EP27a-d Natural Gas-Fired Lime Kiln	0.00	0.00	0.00
EU13/EP13a-f Belgian Lime Kiln REMOVED	0.00	0.00	0.00
NEW Natural Gas-Fired Package Boiler (EU35)	0.00	0.00	0.00
NEW Pulp Dryer No. 2 (EU36)	1.00	0.00	1.00
Total	**1.84**	**0.52**	**1**
PSD Significant Emission Rate (tpy)			**3**
Major Modification			**No**

Carbon Dioxide Equivalent (CO_2e) **Emission Unit**	**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**

EU1/EP1 B&W Boiler		440511.66	261979.23	178532.43
EU3/EP3 Pulp Dryer No. 2	TO BE REMOVED	0.00	21456.31	-21456.31
EU4/EP4 Pulp Dryer No. 1		105728.68	21049.50	84679.18
EU28/EP27a-d Natural Gas-Fired Lime Kiln		70360.77	0.00	70360.77
EU13/EP13a-f Belgian Lime Kiln	REMOVED	0.00	37394.70	-37394.70
NEW Natural Gas-Fired Package Boiler (EU35)		186174.81	0.00	186174.81
NEW Pulp Dryer No. 2 (EU36)		126579.76	0.00	126579.76
Total		**929356**	**341880**	**587476**
PSD Significant Emission Rate (tpy)				**75000**
Major Modification				**Yes**

Particulate Matter (PM) **Emission Unit**		**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler		68.50	6.79	61.71
EU1a/EP1a Coal Handling Dust Collector		1.28	0.99	0.29
EU3/EP3 Pulp Dryer No. 2	TO BE REMOVED	0.00	108.25	-108.25
EU4/EP4 Pulp Dryer No. 1		210.24	126.60	83.64
EU5 & EU24/EP5 Lime Mixing Tank and Lime Kiln Cooler	REMOVED	0.00	28.29	-28.29
EU6/EP6 Pellet Mill No. 1	REMOVED	0.00	12.17	-12.17
EU7/EP7 Pellet Mill No. 2	REMOVED	0.00	12.17	-12.17
EU8/EP8 Pellet Mill No. 3	REMOVED	0.00	12.17	-12.17
EU9 & EU11/EP9 Dry Pulp Belt Conveyors & Elevator		1.13	3.95	-2.82
EU10/EP10 Dry Pulp Reclaim System		2.65	1.97	0.68
EU12/EP12 Sugar Dryer	REMOVED	0.00	10.16	-10.16
EU13/EP13a-f Belgian Lime Kiln	REMOVED	0.00	10.50	-10.50
EU14a/EP14a MAC 2 Flow Headhouse		15.02	15.02	0.00
EU14b & EU 14c/EP14b Hummer Pulsaire and MAC		14.27	14.27	0.00
EU15/EP15 Pulp Pellet Bin No. 1		1.61	1.61	0.00
EU16/EP16 Pulp Pellet Bin No. 2		1.61	1.61	0.00
EU17/EP17 Pulp Pellet Bin No. 3		1.61	1.61	0.00
EU19a/EP19a Bulk Loading Pulsaire		0.48	0.48	0.00
EU19b/EP19b North Bulk Sugar Loadout		2.25	2.25	0.00
EU19c/EP19c South Bulk Sugar Loadout		1.88	1.88	0.00
EU20/EP20 Main Sugar Warehouse Pulsaire		1.97	1.97	0.00
EU22/EP22 Pulp Pellet Mill & Cooler	REMOVED	0.00	0.80	-0.80
EU23/EP23 Pulp Dryer Coal Hopper		3.90	2.93	0.97
EU25/EP24 Flume Lime Slaker		0.18	0.00	0.18
EU26/EP25 Lime Slaker	REMOVED	0.00	3.14	-3.14
EU28/EP27a-d Natural Gas-Fired Lime Kiln		52.42	0.00	52.42
EU29/EP28 Sugar Dryer Granulator		9.73	0.00	9.73
EU30/EP29 Lime Slaker		14.58	0.00	14.58
EU31, EU33, EU34/EP30 Pulp Pellet Mills & Cooler		6.57	0.00	6.57
EU32/EP31 Pellet Loadout		0.19	0.00	0.19
NEW Natural Gas-Fired Package Boiler (EU35)		11.72	0.00	11.72
NEW Pulp Dryer No. 2 (EU36)		139.72	0.00	139.72
Fug 1 Pellet Loadout Area	REMOVED	0.00	1.49	-1.49
Fug 2a Coal Handling Emissions		0.15	0.09	0.06
Fug 2b Coal Handling Wind Erosion		2.67	2.67	0.00
Fug 3 Limerock Handling Emissions		0.44	0.15	0.28
Fug 4 Spent Lime Wind Erosion		1.08	1.08	0.00
Fugitive Emissions from Unpaved Roads		261.03	202.75	58.28

Total		**829**	**590**	**239**
PSD Significant Emission Rate (tpy)				**25**
Major Modification				**Yes**

Particulate Matter < 10 Microns (PM $_{10}$) **Emission Unit**		**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler		130.32	48.42	81.90
EU1a/EP1a Coal Handling Dust Collector		1.28	0.99	0.29
EU3/EP3 Pulp Dryer No. 2	TO BE REMOVED	0.00	200.26	-200.26
EU4/EP4 Pulp Dryer No. 1		388.94	234.22	154.73
EU5 & EU24/EP5 Lime Mixing Tank and Lime Kiln Cooler	REMOVED	0.00	18.73	-18.73
EU6/EP6 Pellet Mill No. 1	REMOVED	0.00	12.17	-12.17
EU7/EP7 Pellet Mill No. 2	REMOVED	0.00	12.17	-12.17
EU8/EP8 Pellet Mill No. 3	REMOVED	0.00	12.17	-12.17
EU9 & EU11/EP9 Dry Pulp Belt Conveyors & Elevator		1.13	3.95	-2.82
EU10/EP10 Dry Pulp Reclaim System		2.65	1.97	0.68
EU12/EP12 Sugar Dryer	REMOVED	0.00	10.16	-10.16
EU13/EP13a-f Belgian Lime Kiln	REMOVED	0.00	10.50	-10.50
EU14a/EP14a MAC 2 Flow Headhouse		15.02	15.02	0.00
EU14b & EU 14c/EP14b Hummer Pulsaire and MAC		14.27	14.27	0.00
EU15/EP15 Pulp Pellet Bin No. 1		1.61	1.61	0.00
EU16/EP16 Pulp Pellet Bin No. 2		1.61	1.61	0.00
EU17/EP17 Pulp Pellet Bin No. 3		1.61	1.61	0.00
EU19a/EP19a Bulk Loading Pulsaire		0.48	0.48	0.00
EU19b/EP19b North Bulk Sugar Loadout		2.25	2.25	0.00
EU19c/EP19c South Bulk Sugar Loadout		1.88	1.88	0.00
EU20/EP20 Main Sugar Warehouse Pulsaire		1.97	1.97	0.00
EU22/EP22 Pulp Pellet Mill & Cooler	REMOVED	0.00	0.80	-0.80
EU23/EP23 Pulp Dryer Coal Hopper		3.90	2.93	0.97
EU25/EP24 Flume Lime Slaker		0.18	0.00	0.18
EU26/EP25 Lime Slaker	REMOVED	0.00	3.14	-3.14
EU28/EP27a-d Natural Gas-Fired Lime Kiln		52.42	0.00	52.42
EU29/EP28 Sugar Dryer Granulator		9.73	0.00	9.73
EU30/EP29 Lime Slaker		14.58	0.00	14.58
EU31, EU33, EU34/EP30 Pulp Pellet Mills & Cooler		6.57	0.00	6.57
EU32/EP31 Pellet Loadout		0.19	0.00	0.19
NEW Natural Gas-Fired Package Boiler (EU35)		11.72	0.00	11.72
NEW Pulp Dryer No. 2 (EU36)		258.49	0.00	258.49
Fug 1 Pellet Loadout Area	REMOVED	0.00	1.49	-1.49
Fug 2a Coal Handling Emissions		0.15	0.09	0.06
Fug 2b Coal Handling Wind Erosion		2.67	2.67	0.00
Fug 3 Limerock Handling Emissions		0.44	0.15	0.28
Fug 4 Spent Lime Wind Erosion		1.08	1.08	0.00
Fugitive Emissions from Unpaved Roads		66.53	51.67	14.85
Total		**994**	**670**	**323**
PSD Significant Emission Rate (tpy)				**15**
Major Modification				**Yes**

Particulate Matter < 2.5 Microns (PM $_{2.5}$) **Emission Unit**	**Potential (tpy)**	**Actual (tpy)**	**Net Increase (tpy)**
EU1/EP1 B&W Boiler	110.46	45.90	64.56

EU1a/EP1a Coal Handling Dust Collector		0.30	0.23	0.07
EU3/EP3 Pulp Dryer No. 2	TO BE REMOVED	0.00	124.49	-124.49
EU4/EP4 Pulp Dryer No. 1		357.41	215.23	142.18
EU5 & EU24/EP5 Lime Mixing Tank and Lime Kiln Cooler	REMOVED	0.00	10.50	-10.50
EU6/EP6 Pellet Mill No. 1	REMOVED	0.00	1.86	-1.86
EU7/EP7 Pellet Mill No. 2	REMOVED	0.00	1.86	-1.86
EU8/EP8 Pellet Mill No. 3	REMOVED	0.00	1.86	-1.86
EU9 & EU11/EP9 Dry Pulp Belt Conveyors & Elevator		0.26	0.91	-0.65
EU10/EP10 Dry Pulp Reclaim System		0.61	0.46	0.16
EU12/EP12 Sugar Dryer	REMOVED	0.00	1.55	-1.55
EU13/EP13a-f Belgian Lime Kiln	REMOVED	0.00	1.26	-1.26
EU14a/EP14a MAC 2 Flow Headhouse		3.48	3.48	0.00
EU14b & EU 14c/EP14b Hummer Pulsaire and MAC		3.30	3.30	0.00
EU15/EP15 Pulp Pellet Bin No. 1		0.24	0.24	0.00
EU16/EP16 Pulp Pellet Bin No. 2		0.24	0.24	0.00
EU17/EP17 Pulp Pellet Bin No. 3		0.24	0.24	0.00
EU19a/EP19a Bulk Loading Pulsaire		0.11	0.11	0.00
EU19b/EP19b North Bulk Sugar Loadout		0.52	0.52	0.00
EU19c/EP19c South Bulk Sugar Loadout		0.43	0.43	0.00
EU20/EP20 Main Sugar Warehouse Pulsaire		0.46	0.46	0.00
EU22/EP22 Pulp Pellet Mill & Cooler	REMOVED	0.00	0.12	-0.12
EU23/EP23 Pulp Dryer Coal Hopper		0.90	0.68	0.23
EU25/EP24 Flume Lime Slaker		0.07	0.00	0.07
EU26/EP25 Lime Slaker	REMOVED	0.00	1.17	-1.17
EU28/EP27a-d Natural Gas-Fired Lime Kiln		31.70	0.00	31.70
EU29/EP28 Sugar Dryer Granulator		1.99	0.00	1.99
EU30/EP29 Lime Slaker		5.41	0.00	5.41
EU31, EU33, EU34/EP30 Pulp Pellet Mills & Cooler		1.52	0.00	1.52
EU32/EP31 Pellet Loadout		0.04	0.00	0.04
NEW Natural Gas-Fired Package Boiler (EU35)		11.72	0.00	11.72
NEW Pulp Dryer No. 2 (EU36)		160.68	0.00	160.68
Fug 1 Pellet Loadout Area	REMOVED	0.00	0.02	-0.02
Fug 2a Coal Handling Emissions		0.00	0.00	0.00
Fug 2b Coal Handling Wind Erosion		0.40	0.40	0.00
Fug 3 Limerock Handling Emissions		0.00	0.00	0.00
Fug 4 Spent Lime Wind Erosion		0.16	0.16	0.00
Fugitive Emissions from Unpaved Roads		6.65	5.17	1.49
Total		**699**	**423**	**276**
PSD Significant Emission Rate (tpy)				**10**
Major Modification				**Yes**

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU1/EP1 B&W Boiler
Computed	GJR
Checked	KB
Sheets	NA

Hours	Steam Output (pph)	Heat Content (Btu/lb)	Heat Input (MMBtu/hr)	Firing Rate (ton/hr)	Fuel Use (ton/yr)
8760	300,000	9,400	392	20.9	182,655

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)[a]	10102-43-9	9.52	198.5	869.4
Carbon Monoxide (CO)[b]	630-08-0	2.50	52.1	228.3
Particulate Matter (PM)[c]	-	0.75	15.6	68.5
Particulate Matter < 10 Microns (PM_{10})[d]	-	1.43	29.8	130.3
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[e]	-	1.21	25.2	110.5
Volatile Organic Compounds (VOC)[f]	-	0.05	1.0	4.6
Sulfur Dioxide (SO_2)[g]	7446-09-5	17.50	364.9	1,598
Sulfuric Acid Mist (H_2SO_4)[h]	-	0.05	1.1	4.6
Fluorides (measured as HF)[i]	-	0.0007	0.0	0.1
Lead (Pb)[j]	7439-92-1	0.0004	0.0	0.0
Carbon Dioxide (CO_2)[k]	124-38-9	4,810	100,294	439,286
Methane (CH_4)[f]	74-82-8	0.06	1.3	5.5
Nitrous Oxide (N_2O)[f]	10024-97-2	0.04	0.8	3.7
Carbon Dioxide Equivalent (CO_2e)[l]	-	NA	100,573	440,512

Hazardous Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Organic Compounds:				
Acetaldehyde[m]	75-07-0	5.70E-04	1.19E-02	5.21E-02
Acetophenone[m]	98-86-2	1.50E-05	3.13E-04	1.37E-03
Acrolein[m]	107-02-8	2.90E-04	6.05E-03	2.65E-02
Benzene[m]	71-43-2	1.30E-03	2.71E-02	1.19E-01
Benzyl chloride[m]	100-44-7	7.00E-04	1.46E-02	6.39E-02
Bis(2-ethylhexyl)phthalate (DEHP)[m]	117-81-7	7.30E-05	1.52E-03	6.67E-03
Bromoform[m]	75-25-2	3.90E-05	8.13E-04	3.56E-03
Carbon disulfide[m]	75-15-0	1.30E-04	2.71E-03	1.19E-02
2-Chloroacetophenone[m]	532-27-4	7.00E-06	1.46E-04	6.39E-04
Chlorobenzene[m]	108-90-7	2.20E-05	4.59E-04	2.01E-03
Chloroform[m]	67-66-3	5.90E-05	1.23E-03	5.39E-03
Cumene[m]	98-82-8	5.30E-06	1.11E-04	4.84E-04
Cyanide[m]	57-12-5	2.50E-03	5.21E-02	2.28E-01
2,4-Dinitrotoluene[m]	121-14-2	2.80E-07	5.84E-06	2.56E-05
Dimethyl sulfate[m]	77-78-1	4.80E-05	1.00E-03	4.38E-03
Ethylbenzene[m]	100-41-4	9.40E-05	1.96E-03	8.58E-03
Ethyl chloride[m]	75-00-3	4.20E-05	8.76E-04	3.84E-03
Ethylene dichloride[m]	107-06-2	4.00E-05	8.34E-04	3.65E-03
Ethylene dibromide[m]	106-93-4	1.20E-06	2.50E-05	1.10E-04
Formaldehyde[m]	50-00-0	2.40E-04	5.00E-03	2.19E-02

Hexane[m]	110-54-3	6.70E-05	1.40E-03	6.12E-03
Isophorone[m]	78-59-1	5.80E-04	1.21E-02	5.30E-02
Methyl bromide[m]	74-83-9	1.60E-04	3.34E-03	1.46E-02
Methyl chloride[m]	74-87-3	5.30E-04	1.11E-02	4.84E-02
Methyl hydrazine[m]	60-34-4	1.70E-04	3.54E-03	1.55E-02
Methyl methacrylate[m]	80-62-6	2.00E-05	4.17E-04	1.83E-03
Methyl tert butyl ether[m]	1634-04-4	3.50E-05	7.30E-04	3.20E-03
Methylene chloride[m]	75-09-2	2.90E-04	6.05E-03	2.65E-02
Phenol[m]	108-95-2	1.60E-05	3.34E-04	1.46E-03
Propionaldehyde[m]	123-38-6	3.80E-04	7.92E-03	3.47E-02
Tetrachlorethylene (Perc)[m]	127-18-4	4.30E-05	8.97E-04	3.93E-03
Toluene[m]	108-88-3	2.40E-04	5.00E-03	2.19E-02
1,1,1-Trichloroethane (methyl chloroform)[m]	71-55-6	2.00E-05	4.17E-04	1.83E-03
Styrene[m]	100-42-5	2.50E-05	5.21E-04	2.28E-03
Vinyl acetate[m]	108-05-4	7.60E-06	1.58E-04	6.94E-04
Xylenes[m]	1330-20-7	3.70E-05	7.71E-04	3.38E-03
Dioxins/Furans (PCDD/PCDF)[n]	-	1.76E-09	3.67E-08	1.61E-07
Polynuclear Aromatic Hydrocarbons (PAH)[o]	-	2.08E-05	4.34E-04	1.90E-03
HCl (Hydrochloric acid)[p]	7647-01-0	2.40E-02	5.00E-01	2.19E+00
HF (Hydrofluoric acid)[i]	7664-39-3	7.36E-04	1.53E-02	6.72E-02
Antimony[j]	7440-36-0	1.80E-05	3.75E-04	1.64E-03
Arsenic[j]	7440-38-2	4.10E-04	8.55E-03	3.74E-02
Beryllium[j]	7440-41-7	2.10E-05	4.38E-04	1.92E-03
Cadmium[j]	7440-43-9	5.10E-05	1.06E-03	4.66E-03
Chromium[j]	7440-47-3	2.60E-04	5.42E-03	2.37E-02
Cobalt[j]	7440-48-4	1.00E-04	2.09E-03	9.13E-03
Lead[j]	7439-92-1	4.20E-04	8.76E-03	3.84E-02
Manganese[j]	7439-96-5	4.90E-04	1.02E-02	4.48E-02
Mercury[q]	7439-97-6	1.07E-04	2.23E-03	9.77E-03
Nickel[j]	7440-02-0	2.80E-04	5.84E-03	2.56E-02
Selenium[j]	7782-49-2	1.30E-03	2.71E-02	1.19E-01
			Total HAPs =	**3.4**

Notes:

[a] NO_x emissions based on 01/2006 source test (0.508 lb/MMBtu)

[b] 40 CFR 63, Subpart DDDDD, 160 ppm @ 3%O2 (0.133 lb/MMBtu)

[c] 40 CFR 63, Subpart DDDDD, 0.04 lb/MMBtu filterable only

[d] AP42 (9/98) Tables 1.1-5 and 1.1-9, condensable PM is 0.04 lb/MMBtu, PM_{10} is 90% of PM

[e] AP42 (9/98) Tables 1.1-5 and 1.1-9, condensable PM is 0.04 lb/MMBtu, $PM_{2.5}$ is 61% of PM

[f] AP42 (9/98) Table 1.1-19

[g] AP42 (9/98) Table 1.1-3, maximum sulfur content of 0.5 percent

[h] EPRI (3/12) Estimating Total Sulfuric Acid Emissions from Stationary Power Plants, 0.29% of SO_2

[i] EPA MACT Floor Analysis - data request for ESP controlled, subbituminous-fired boilers.

[j] AP42 (9/98) Table 1.1-18

[k] AP-42 (9/98) Table 1.1-20

[l] 40 CFR 98, Subpart A, GWP CH_4 25, N_2O 298

[m] AP-42 (9/98) Table 1.1-14

[n] AP-42 (9/98) Table 1.1-12

[o] AP-42 (9/98) Table 1.1-13

[p] Spring Creek Mine Coal Specification, 16.65 ppm Cl

[q] 40 CFR 63, Subpart DDDDD, 5.7E-06 lb/MMBtu

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU1a/EP1a Coal Handling Dust Collector

Hours	Throughput (tph)	Flowrate (acfm)
8760	20.9	1,700

PSD Regulated Air Pollutants	CAS#	Emission Factor (gr/cf)	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Particulate Matter (PM)[a]	-	0.020	0.29	1.3
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.29	1.3
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.005	0.07	0.3

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU4/EP4 Pulp Dryer No. 1

Computed	GJR
Checked	KB
Sheets	NA

Hours	Pressed Pulp (tph)	Heat Content (Btu/lb)	Heat Input (MMBtu/hr)	Firing Rate (ton/hr)	Fuel Use (ton/yr)
8760	65.0	9,400	125	6.65	58,254

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)[b]	10102-43-9	8.17	54.3	238.0
Carbon Monoxide (CO)[b]	630-08-0	7.00	455.0	1992.9
Particulate Matter (PM)[c]	-	7.22	48.0	210.2
Particulate Matter < 10 Microns (PM_{10})[d]	-	13.35	88.8	388.9
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[e]	-	12.27	81.6	357.4
Volatile Organic Compounds (VOC)[a]	-	11.73	78.0	341.7
Sulfur Dioxide (SO_2)[f]	7446-09-5	7.00	46.6	204
Sulfuric Acid Mist (H_2SO_4)[g]	-	0.02	0.1	0.6
Fluorides (measured as HF)[h]	-	0.03	0.2	0.8
Lead (Pb)[i]	7439-92-1	0.0004	0.0	0.0
Carbon Dioxide (CO_2)[a]	124-38-9	3,617	24,050	105,338
Methane (CH_4)[j]	74-82-8	0.06	0.4	1.7
Nitrous Oxide (N_2O)[j]	10024-97-2	0.04	0.3	1.2
Carbon Dioxide Equivalent (CO_2e)[k]	-	NA	24,139	105,729

Hazardous Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Organic Compounds:				
Acetaldehyde[m]	75-07-0	5.70E-04	3.79E-03	1.66E-02
Acetophenone[m]	98-86-2	1.50E-05	9.98E-05	4.37E-04
Acrolein[m]	107-02-8	2.90E-04	1.93E-03	8.45E-03
Benzene[m]	71-43-2	1.30E-03	8.65E-03	3.79E-02
Benzyl chloride[m]	100-44-7	7.00E-04	4.66E-03	2.04E-02
Bis(2-ethylhexyl)phthalate (DEHP)[m]	117-81-7	7.30E-05	4.85E-04	2.13E-03
Bromoform[m]	75-25-2	3.90E-05	2.59E-04	1.14E-03
Carbon disulfide[m]	75-15-0	1.30E-04	8.65E-04	3.79E-03
2-Chloroacetophenone[m]	532-27-4	7.00E-06	4.66E-05	2.04E-04
Chlorobenzene[m]	108-90-7	2.20E-05	1.46E-04	6.41E-04
Chloroform[m]	67-66-3	5.90E-05	3.92E-04	1.72E-03
Cumene[m]	98-82-8	5.30E-06	3.52E-05	1.54E-04
Cyanide[m]	57-12-5	2.50E-03	1.66E-02	7.28E-02
2,4-Dinitrotoluene[m]	121-14-2	2.80E-07	1.86E-06	8.16E-06
Dimethyl sulfate[m]	77-78-1	4.80E-05	3.19E-04	1.40E-03
Ethylbenzene[m]	100-41-4	9.40E-05	6.25E-04	2.74E-03
Ethyl chloride[m]	75-00-3	4.20E-05	2.79E-04	1.22E-03
Ethylene dichloride[m]	107-06-2	4.00E-05	2.66E-04	1.17E-03
Ethylene dibromide[m]	106-93-4	1.20E-06	7.98E-06	3.50E-05

Formaldehyde[m]	50-00-0	2.40E-04	1.60E-03	6.99E-03
Hexane[m]	110-54-3	6.70E-05	4.46E-04	1.95E-03
Isophorone[m]	78-59-1	5.80E-04	3.86E-03	1.69E-02
Methyl bromide[m]	74-83-9	1.60E-04	1.06E-03	4.66E-03
Methyl chloride[m]	74-87-3	5.30E-04	3.52E-03	1.54E-02
Methyl hydrazine[m]	60-34-4	1.70E-04	1.13E-03	4.95E-03
Methyl methacrylate[m]	80-62-6	2.00E-05	1.33E-04	5.83E-04
Methyl tert butyl ether[m]	1634-04-4	3.50E-05	2.33E-04	1.02E-03
Methylene chloride[m]	75-09-2	2.90E-04	1.93E-03	8.45E-03
Phenol[m]	108-95-2	1.60E-05	1.06E-04	4.66E-04
Propionaldehyde[m]	123-38-6	3.80E-04	2.53E-03	1.11E-02
Tetrachlorethylene (Perc)[m]	127-18-4	4.30E-05	2.86E-04	1.25E-03
Toluene[m]	108-88-3	2.40E-04	1.60E-03	6.99E-03
1,1,1-Trichloroethane (methyl chloroform)[m]	71-55-6	2.00E-05	1.33E-04	5.83E-04
Styrene[m]	100-42-5	2.50E-05	1.66E-04	7.28E-04
Vinyl acetate[m]	108-05-4	7.60E-06	5.05E-05	2.21E-04
Xylenes[m]	1330-20-7	3.70E-05	2.46E-04	1.08E-03
Dioxins/Furans (PCDD/PCDF)[n]	-	1.76E-09	1.17E-08	5.13E-08
Polynuclear Aromatic Hydrocarbons (PAH)[o]	-	2.08E-05	1.38E-04	6.06E-04
HCl (Hydrochloric acid)[p]	7647-01-0	2.40E-02	1.60E-01	6.99E-01
HF (Hydrofluoric acid)[h]	7664-39-3	2.65E-02	1.76E-01	7.72E-01
Antimony[i]	7440-36-0	1.80E-05	1.20E-04	5.24E-04
Arsenic[i]	7440-38-2	4.10E-04	2.73E-03	1.19E-02
Beryllium[i]	7440-41-7	2.10E-05	1.40E-04	6.12E-04
Cadmium[i]	7440-43-9	5.10E-05	3.39E-04	1.49E-03
Chromium[i]	7440-47-3	2.60E-04	1.73E-03	7.57E-03
Cobalt[i]	7440-48-4	1.00E-04	6.65E-04	2.91E-03
Lead[i]	7439-92-1	4.20E-04	2.79E-03	1.22E-02
Manganese[i]	7439-96-5	4.90E-04	3.26E-03	1.43E-02
Mercury[i]	7439-97-6	8.30E-05	5.52E-04	2.42E-03
Nickel[i]	7440-02-0	2.80E-04	1.86E-03	8.16E-03
Selenium[i]	7782-49-2	1.30E-03	8.65E-03	3.79E-02
			Total HAPs =	**1.8**

Notes:

[a] AP42 (3/97) Table 9.10.1.2-2, VOC 1.2 lb/ton pulp, CO_2 370 lb/ton pulp

[b] ACS HLB stack test 7.0 lb CO/ton pressed pulp, HLB BACT limit 100 lb/hr NO_x.

[c] NDAC 33-15-05-01.2, E (lb/hr) = $55.0p^{0.11} - 40$, p = ton pressed pulp + fuel

[d] PM_{10} assumed to be 100% of PM plus condensable fraction equal to 85% of PM_{10}

[e] Based on test data $PM_{2.5}$ equal to be 85% of PM_{10} plus condensable fraction equal to 85% of PM_{10}

[f] AP42 (9/98) Table 1.1-3, maximum sulfur content of 0.5 percent and 60% inherent control

[g] EPRI (3/12) Estimating Total Sulfuric Acid Emissions from Stationary Power Plants, 0.29% of SO_2

[h] Spring Creek Mine Coal Specification, 41.9 ppm F as HF. Also incorporates 60% inherent control.

[i] AP42 (9/98) Table 1.1-18

[j] AP42 (9/98) Table 1.1-19

[k] 40 CFR 98, Subpart A, GWP CH_4 25, N_2O 298

[m] AP-42 (9/98) Table 1.1-14

[n] AP-42 (9/98) Table 1.1-12

[o] AP-42 (9/98) Table 1.1-13

[p] Spring Creek Mine Coal Specification, 16.65 ppm Cl

HDR Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Potential Emissions	Computed	GJR
Task	EU9 & EU11/EP9 Dry Pulp Belt Conveyors & Elevator	Checked	KB
		Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	16.8	6,000

PSD Regulated Air Pollutants	CAS#	Emission Factor (lb/ton)	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Particulate Matter (PM)[a]	-	0.005	0.3	1.1
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.3	1.1
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.060	0.3

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU10/EP10 Dry Pulp Reclaim System

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	16.8	3,500

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.036	0.6	2.6
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.036	0.6	2.6
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.008	0.1	0.6

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Potential Emissions	Computed	GJR
Task	EU14a/EP14a MAC 2 Flow Headhouse	Checked	KB
		Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	20,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	3.43	15.0
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	3.43	15.0
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.005	0.79	3.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU14b & EU 14c/EP14b Hummer Pulsaire and MAC

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	19,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	3.26	14.3
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	3.26	14.3
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.005	0.75	3.3

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

HDR **Computation**

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU15/EP15 Pulp Pellet Bin No. 1

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	2,140

PSD Regulated Air Pollutants	CAS#	Emission Factor (gr/cf)	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Particulate Matter (PM)[a]	-	0.020	0.37	1.6
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.37	1.6
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.003	0.06	0.2

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15% of PM_{10} filterable based on AP42 Chapter 13.2.4

[d] Source is uncontrolled, flowrate based on material displacement

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU16/EP16 Pulp Pellet Bin No. 2

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	2,140

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	0.37	1.6
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.37	1.6
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.003	0.06	0.2

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15% of PM_{10} filterable based on AP42 Chapter 13.2.4

[d] Source is uncontrolled, flowrate based on material displacement

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Potential Emissions	Computed	GJR
Task	EU17/EP17 Pulp Pellet Bin No. 3	Checked	KB
		Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	2,140

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	0.37	1.6
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.37	1.6
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.003	0.06	0.2

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15% of PM_{10} filterable based on AP42 Chapter 13.2.4

[d] Source is uncontrolled, flowrate based on material displacement

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU19a/EP19a Bulk Loading Pulsaire

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	2,560

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	0.11	0.5
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.11	0.5
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.03	0.1

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Potential Emissions	Computed	GJR
Task	EU19b/EP19b North Bulk Sugar Loadout	Checked	KB
		Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	12,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	0.51	2.3
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.51	2.3
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.12	0.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU19c/EP19c South Bulk Sugar Loadout

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	10,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	0.43	1.9
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.43	1.9
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.10	0.4

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU20/EP20 Main Sugar Warehouse Pulsaire

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	10,500

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	0.45	2.0
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.45	2.0
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.10	0.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU23/EP23 Pulp Dryer Coal Hopper

Hours	Throughput (tph)	Flowrate (acfm)
8760	NA	5,200

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	0.89	3.9
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.89	3.9
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.005	0.21	0.9

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU25/EP24 Flume Lime Slaker

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	0.5	NA

PSD Regulated Air Pollutants	CAS#	Emission Factor (lb/ton)	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Particulate Matter (PM)[a]	-	0.08	0.04	0.18
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.08	0.04	0.18
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.03	0.01	0.07

Notes:

[a] AP42 Table 11.17-2

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ filterable is 37.1% of PM based on the average parameters listed below

[d] Air Emission Permit No. T5-X73015 - insignificant activity

[e] Flowrate is passive as a result of exothermic process

AP-42, Appendix B, Particle Size Distribution For Multiclone And Scrubber Controlled Sources:

Section	Source Type	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	11.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	11.0
10.50	Woodworking Waste Collection Operations	29.5
11.10	Coal Cleaning: Thermal Dryer	53.0
11.10	Coal Processing: Thermal Incinerator	21.3
11.20	Lightweight Aggregate (Clay): Rotary Kiln	55.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	19.3
11.20	Lightweight Aggregate (Slate): Rotary Kiln	33.0
11.21	Phosphate Rock Processing: Calciner	94.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	89.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	15.7
11.21	Phosphate Rock Processing: Ball Mill	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	21.0
12.10	Primary Aluminum Production: Bauxite Processing	60.5
Average Particle Size Distribution		**37.1**

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Potential Emissions	Computed	GJR
Task	EU28/EP27a-d Natural Gas-Fired Lime Kiln	Checked	KB
		Sheets	NA

New Kiln - Ofenmantel GDS-4.3 (Natural gas-fired) Production Parameters

Hours	Limerock Throughput[a] (tpd)	Fuel Per Limerock[b] (MMBtu/ton)	Fuel Throughput (MMBtu/day)	Fuel Heat Content[c] (Btu/scf)	Max Heat Input (MMBtu/hr)	Lime Production[d] (tpd)
8,760	892	2.28	2,034	1,020	84.7	500

[a] Maximum limerock througput capacity based on kiln design.
[b] Fuel per limerock percentage is based on observed performance test parameters.
[c] Maximum heat content applies to coke, anthracite would result in lower maximum heat input.
[d] Theoretcial lime production is based on 100% pure limerock and full calcination.

Potential Start-Up Emissions: Limited by process to 120 hours (5 days) per year at 50% capacity.
(Historical start-up operations are 3-days at 50% capacity)

Criteria Air Pollutants	CAS#	Combustion Emission Factor		Maximum Design Uncontrolled Emissions		Startup Emissions (bypass stack)	
		(value)	(units)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)[a]	10102-43-9	1.29	lb/ton lime	26.8	117.4	13.4	0.80
Carbon Monoxide (CO)[b]	630-08-0	25.00	lb/ton lime	520.6	2280.3	260.3	15.62
Particulate Matter (PM)[c]	-	7.02	lb/ton lime	146.2	640.5	73.1	4.39
Particulate Matter < 10 Microns (PM_{10})[c]	-	7.02	lb/ton lime	146.2	640.5	73.1	4.39
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[d]	-	4.25	lb/ton lime	88.4	387.3	44.2	2.65
Volatile Organic Compounds (VOC)[e]	-	0.131	lb/ton lime	2.7	11.9	1.4	0.08
Carbon Dioxide (CO_2)[f]	-	2,047	lb/ton lime	42,627	186,708	21,314	1,279
Sulfur Dioxide (SO_2)[g]	7446-09-5	2.14	lb/ton lime	44.6	195.2	22.3	1.34
Lead (Pb)[h]	7439-92-1	1.99E-06	lb/ton lime	4.14E-05	1.82E-04	2.07E-05	1.24E-06
Acid Gases (F, H_2SO_4, H_2S)[i]		negl.	lb/ton lime	0.000	0.000	0.000	0.000

[a] NO_x emissions based on maximum of European vertical shaft kiln data, which ranges from 5.36 to 26.79 lb/hr.
[b] CO emissions based on maximum European kiln data multiplied by safety factor of 2.0 to reflect spot testing and engineering estimate.
[c] PM/PM_{10} emissions calculated from maximum venturi controlled European test data. Includes condensable portion (0.082 lb/ton lime) from AP42, Table 11.17-2.
[d] $PM_{2.5}$ emissions are calculated as 60% of PM_{10} emissions using particle size distribution for rotary kilns, AP42, Table 11.17-7, plus condensable.
[e] VOC emissions based on AP42, Table 1.4-2, for natural gas combustion multipled by a safety factor of 3.0 percent to account for different combustion process.
[f] CO_2 emissions based AP42, Table 1.4-2, for natural gas combustion plus mass balance of calcined limerock.
[g] SO_2 emissions based AP42, Table 1.4-2 for natural gas combustion.
[h] Pb emissions based on AP42, Table 1.4-2, for natural gas combustion.
[i] Based on the high retention of SO_2 in the combustion process and the preferential removal of acid gases, emissions are anticipated to be negligible.

Balance Vent Emissions: 30% of combustion gas flow after gas-washer control.

Criteria Air Pollutants	CAS#	Uncontrolled Emissions		Gas Washer Control[a]	Amount of Flow	Balance Vent Emissions (normal operations)	
		(lb/hr)	(tpy)	(%)	(%)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)	10102-43-9	26.8	117.4	0%	30%	8.0	35.22
Carbon Monoxide (CO)	630-08-0	520.6	2280.3	0%	30%	156.2	684.08
Particulate Matter (PM)	-	146.2	640.5	75%	30%	11.0	48.04
Particulate Matter < 10 Microns (PM_{10})	-	146.2	640.5	75%	30%	11.0	48.04
Particulate Matter < 2.5 Microns ($PM_{2.5}$)	-	88.4	387.3	75%	30%	6.6	29.05
Volatile Organic Compounds (VOC)	-	2.7	11.9	0%	30%	0.8	3.58
Carbon Dioxide (CO_2)	-	42,627	186,708	0%	30%	12,788	56012.39
Sulfur Dioxide (SO_2)	7446-09-5	44.6	195.2	75%	30%	3.3	14.64
Lead (Pb)	7439-92-1	0.000	0.000	75%	30%	0.000	0.00
Acid Gases (HF, H_2SO_4)		0.000	0.000	0%	30%	0.000	0.000

[a] Gas washer control efficiency for PM is 70%. Lead is controlled as a particulate. SO_2 emissions are controlled 75% due to the combination of lime dust in the exhuast gas and the wet scrubber. Acid gases are negligible due to preferential removal.

Carbonation Vent Emissions: Remaining 70% of combustion gas flow after gas-washer control.

Criteria Air Pollutants	CAS#	Gas Washer Controlled Emissions		Carbonation Control[a]	Amount of Flow	Carbonation Process Emissions	
		(lb/hr)	(tpy)	(%)	(%)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)	10102-43-9	26.8	117.4	0%	70%	18.8	82.17
Carbon Monoxide (CO)	630-08-0	520.6	2280.3	0%	70%	364.4	1596.18

Particulate Matter (PM)	-	36.6	160.1	100.0%	70%	0.00	0.00
Particulate Matter < 10 Microns (PM_{10})	-	36.6	160.1	100.0%	70%	0.00	0.00
Particulate Matter < 2.5 Microns ($PM_{2.5}$)	-	22.1	96.8	100.0%	70%	0.00	0.00
Volatile Organic Compounds (VOC)	-	2.7	11.9	0%	70%	1.9	8.36
Carbon Dioxide (CO_2)	-	42,627	186708.0	90%	70%	2,984	13,070
Sulfur Dioxide (SO_2)	7446-09-5	11.1	48.8	95%	70%	0.4	1.71
Lead (Pb)	7439-92-1	0.000	0.0	100.0%	70%	0.000	0.000
Acid Gases (HF, H_2SO_4)		0.000	0.0	95%	70%	0.000	0.000

[a] Carbonation process controls 100% of remaining particulate matter and 95% of remaining SO_2/acid gases. 90% of CO_2 is abosorbed in the carbonation process and recombined with CaO to form $CaCO_3$.

Total KR6.5 Lime Kiln Emissions

Criteria Air Pollutants	Start Up Emissions (bypass stack)		Balance Vent Emissions (normal operations)		Carbonation Process Emissions		Total Emissions
	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(tpy)
Nitrogen Oxides (NO_x)	13.40	0.8	8.04	35.2	18.76	82.2	118.19
Carbon Monoxide (CO)	260.30	15.6	156.18	684.1	364.43	1596.2	2295.88
Particulate Matter (PM)	73.11	4.4	10.97	48.0	0.00	0.0	52.42
Particulate Matter < 10 Microns (PM_{10})	73.11	4.4	10.97	48.0	0.00	0.0	52.42
Particulate Matter < 2.5 Microns ($PM_{2.5}$)	44.21	2.7	6.63	29.0	0.00	0.0	31.70
Volatile Organic Compounds (VOC)	1.36	0.1	0.82	3.6	1.91	8.4	12.03
Carbon Dioxide (CO_2)	21,314	1,279	12,788	56,012	2,984	13,070	70,361
Sulfur Dioxide (SO_2)	22.28	1.3	3.34	14.6	0.39	1.7	17.7
Lead (Pb)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Acid Gases (HF, H_2SO_4)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU29/EP28 Sugar Dryer Granulator

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (dscfm)
8760	100.0	38,000

PSD Regulated Air Pollutants	CAS#	Emission Factor (gr/scf)	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Particulate Matter (PM)[a]	-	0.008	2.2	9.7
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.008	2.2	9.7
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.002	0.5	2.0

Notes:

[a] PM emissions based on manufactuer data (32,381 dscfm)

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU30/EP29 Lime Slaker

Hours	Throughput (tph)	Flowrate (acfm)
8760	20.8	3,000

PSD Regulated Air Pollutants	CAS#	Emission Factor (lb/ton)	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Particulate Matter (PM)[a]	-	0.16	3.33	14.58
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.16	3.33	14.58
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.06	1.24	5.41

Notes:

[a] AP42 Table 11.17-2 incorporating a 200% safety factor for variable process

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ filterable is 37.1% of PM based on the average parameters listed below

[d] Flowrate is passive as a result of exothermic process

AP-42, Appendix B, Particle Size Distribution For Multiclone And Scrubber Controlled Sources:

Section	Source Type	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	11.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	11.0
10.50	Woodworking Waste Collection Operations	29.5
11.10	Coal Cleaning: Thermal Dryer	53.0
11.10	Coal Processing: Thermal Incinerator	21.3
11.20	Lightweight Aggregate (Clay): Rotary Kiln	55.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	19.3
11.20	Lightweight Aggregate (Slate): Rotary Kiln	33.0
11.21	Phosphate Rock Processing: Calciner	94.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	89.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	15.7
11.21	Phosphate Rock Processing: Ball Mill	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	21.0
12.10	Primary Aluminum Production: Bauxite Processing	60.5
Average Particle Size Distribution		**37.1**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU31, EU33, EU34/EP30 Pulp Pellet Mills & Cooler

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	30.0	35,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/scf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	1.50	6.6
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	1.50	6.6
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.35	1.5

Notes:

[a] PM emissions based on manufactuer data (35,000 dscfm)

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	EU32/EP31 Pellet Loadout
Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8760	16.8	1,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	0.04	0.2
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.04	0.2
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.01	0.0

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

HDR Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	NEW Natural Gas-Fired Package Boiler (EU35)

Computed	GJR
Checked	KB
Sheets	NA

Hours	Capacity (%)	Production (pph)	Heat Content (Btu/scf)	Input MMBtu/hr	Fuel Input (scf/hr)	Fuel Use (MMscf/yr)
8,760	100	300,000	1,020	359.28	352,237	3,086

Criteria Air Pollutants & GHG	CAS#	Emission Factor	Potential Emissions	
		(lb/MMBtu)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)[a]	10102-43-9	2.00E-02	7.19	31.47
Carbon Monoxide (CO)[b]	630-08-0	3.69E-02	13.26	58.07
Particulate Matter (PM)[c]	-	7.45E-03	2.68	11.72
Particulate Matter < 10 Microns (PM_{10})[c]	-	7.45E-03	2.68	11.72
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	7.45E-03	2.68	11.72
Volatile Organic Compounds (VOC)[c]	-	5.39E-03	1.94	8.48
Sulfur Dioxide (SO_2)[c]	7446-09-5	5.88E-04	0.21	0.93
Carbon Dioxide (CO_2)[c]	-	1.18E+02	42,251	185,062
Nitrous Oxide (N_2O)[c]	-	2.16E-03	0.78	3.40
Methane (CH_4)[c]	74-82-8	2.55E-03	0.92	4.01
Carbon Dioxide Equivalent (CO_2e)[d]	-	NA	42,506	186,175

Hazardous Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/MMBtu)	(lb/hr)	(tpy)
Lead[c]	NA	4.90E-07	1.76E-04	7.71E-04
Polycyclic Organic Matter (POM)[e]	NA	8.60E-08	3.09E-05	1.35E-04
Benzene[e]	71-43-2	2.06E-06	7.40E-04	3.24E-03
Dichlorobenzene[e]	25321-22-6	1.18E-06	4.23E-04	1.85E-03
Formaldehyde[e]	50-00-0	7.35E-05	2.64E-02	1.16E-01
Hexane[e]	110-54-3	1.76E-03	6.34E-01	2.78E+00
Naphthalene[e]	91-20-3	5.98E-07	2.15E-04	9.41E-04
Toluene[e]	108-88-3	3.33E-06	1.20E-03	5.24E-03
Arsenic[f]	7440-38-2	1.96E-07	7.04E-05	3.08E-04
Beryllium[f]	7440-41-7	1.20E-08	4.31E-06	1.89E-05
Cadmium[f]	7440-43-9	1.08E-06	3.87E-04	1.70E-03
Chromium[f]	7440-47-3	1.37E-06	4.93E-04	2.16E-03
Cobalt[f]	7440-48-4	8.20E-08	2.95E-05	1.29E-04
Manganese[f]	7439-96-5	3.73E-07	1.34E-04	5.87E-04
Mercury[f]	7439-97-6	2.55E-07	9.16E-05	4.01E-04
Nickel[f]	7440-02-0	2.06E-06	7.40E-04	3.24E-03
Selenium[f]	7782-49-2	2.40E-08	8.62E-06	3.78E-05
Total HAPs				2.91E+00

[a] ULNB+FGR equipped. 17 ppm NO_x @ 3% O_2 (0.0364 lb/MMBtu).

[b] ULNB+FGR equipped. 50 ppm CO @ 3% O_2 (0.0369 lb/MMBtu).

[c] Emission factors from AP-42 (07/98), Chapter 1.4, Table 1.4-2.

[d] Global warming potential from 40 CFR 98, Table A-1 (CH_4: 25, N_2O: 298).

[e] Emission factors from AP-42 (07/98), chapter 1.4, Table 1.4-3.

[f] Emission factors from AP-42 (07/98), chapter 1.4, Table 1.4-4.

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	NEW Pulp Dryer No. 2 (EU36)

Hours	Pressed Pulp (tph)	Fuel Type	Heat Content (Btu/lb, Btu/scf)	Heat Input (MMBtu/hr)	Firing Rate (ton/hr, scf/hr)	Fuel Use (ton/yr, MMscf/yr)
8760	65.0	Coal	9,400	162	8.6	75,485
		Natural Gas	1,020	40	39,215.7	344

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton, lb/10^6 scf)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)[a] - coal	10102-43-9	0.66	46.8	205.1
Nitrogen Oxides (NO_x)[b] - gas	10102-43-9	100.00		
Carbon Monoxide (CO)[c] - coal	630-08-0	7.00	458.3	2007.3
Carbon Monoxide (CO)[b] - gas	630-08-0	84.00		
Particulate Matter (PM)[d] - coal + gas	-	0.49	31.9	139.7
Particulate Matter < 10 Microns (PM_{10})[e]	-	0.91	59.0	258.5
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[f]	-	0.56	36.7	160.7
Volatile Organic Compounds (VOC)[a] - coal	-	1.20	78.2	342.6
Volatile Organic Compounds (VOC)[g] - gas	-	5.50		
Sulfur Dioxide (SO_2)[h] - coal + gas	7446-09-5	0.93	60.3	264
Sulfuric Acid Mist (H_2SO_4)[i] - coal + gas	-	0.00	0.2	0.8
Fluorides (measured as HF)[j] - coal + gas	-	0.03	0.2	1.0
Lead (Pb)[k] - coal	7439-92-1	0.0004	0.0	0.0
Lead (Pb)[g] - gas		0.0005		
Carbon Dioxide (CO_2)[a] - coal	124-38-9	370	28,756	125,951
Carbon Dioxide (CO_2)[g] - gas	124-38-9	120,000		
Methane (CH_4)[l] - coal	74-82-8	0.06	0.6	2.7
Methane (CH_4)[g] - gas	74-82-8	2.30		
Nitrous Oxide (N_2O)[l] - coal	10024-97-2	0.04	0.4	1.9
Nitrous Oxide (N_2O)[g] - gas	10024-97-2	2.20		
Carbon Dioxide Equivalent (CO_2e)[m]	-	NA	28,899	126,580

Hazardous Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton, lb/10^6 scf)	(lb/hr)	(tpy)
Organic Compounds:				
Acetaldehyde[n]	75-07-0	5.70E-04	4.91E-03	2.15E-02
Acetophenone[n]	98-86-2	1.50E-05	1.29E-04	5.66E-04
Acrolein[n]	107-02-8	2.90E-04	2.50E-03	1.09E-02
Benzene[n] - coal	71-43-2	1.30E-03	1.13E-02	4.94E-02
Benzene[r] - gas	71-43-2	2.10E-03		
Benzyl chloride[n]	100-44-7	7.00E-04	6.03E-03	2.64E-02
Bis(2-ethylhexyl)phthalate (DEHP)[n]	117-81-7	7.30E-05	6.29E-04	2.76E-03
Bromoform[n]	75-25-2	3.90E-05	3.36E-04	1.47E-03
Carbon disulfide[n]	75-15-0	1.30E-04	1.12E-03	4.91E-03
2-Chloroacetophenone[n]	532-27-4	7.00E-06	6.03E-05	2.64E-04
Chlorobenzene[n]	108-90-7	2.20E-05	1.90E-04	8.30E-04
Chloroform[n]	67-66-3	5.90E-05	5.08E-04	2.23E-03
Cumene[n]	98-82-8	5.30E-06	4.57E-05	2.00E-04
Cyanide[n]	57-12-5	2.50E-03	2.15E-02	9.44E-02
Dichlorobenzene[r] - gas	25321-22-6	1.20E-03	4.71E-05	2.06E-04
2,4-Dinitrotoluene[n]	121-14-2	2.80E-07	2.41E-06	1.06E-05

Dimethyl sulfate[n]	77-78-1	4.80E-05	4.14E-04	1.81E-03
Ethylbenzene[n]	100-41-4	9.40E-05	8.10E-04	3.55E-03
Ethyl chloride[n]	75-00-3	4.20E-05	3.62E-04	1.59E-03
Ethylene dichloride[n]	107-06-2	4.00E-05	3.45E-04	1.51E-03
Ethylene dibromide[n]	106-93-4	1.20E-06	1.03E-05	4.53E-05
Formaldehyde[n] - coal	50-00-0	2.40E-04	5.01E-03	2.19E-02
Formaldehyde[r] - gas	50-00-0	7.50E-02		
Hexane[n] - coal	110-54-3	6.70E-05	7.12E-02	3.12E-01
Hexane[r] - gas	110-54-3	1.80E+00		
Isophorone[n]	78-59-1	5.80E-04	5.00E-03	2.19E-02
Methyl bromide[n]	74-83-9	1.60E-04	1.38E-03	6.04E-03
Methyl chloride[n]	74-87-3	5.30E-04	4.57E-03	2.00E-02
Methyl hydrazine[n]	60-34-4	1.70E-04	1.46E-03	6.42E-03
Methyl methacrylate[n]	80-62-6	2.00E-05	1.72E-04	7.55E-04
Methyl tert butyl ether[n]	1634-04-4	3.50E-05	3.02E-04	1.32E-03
Methylene chloride[n]	75-09-2	2.90E-04	2.50E-03	1.09E-02
Phenol[n]	108-95-2	1.60E-05	1.38E-04	6.04E-04
Propionaldehyde[n]	123-38-6	3.80E-04	3.27E-03	1.43E-02
Tetrachlorethylene (Perc)[n]	127-18-4	4.30E-05	3.71E-04	1.62E-03
Toluene[n] - coal	108-88-3	2.40E-04	2.20E-03	9.64E-03
Toluene[r] - gas	108-88-3	3.40E-03		
1,1,1-Trichloroethane (methyl chloroform)[n]	71-55-6	2.00E-05	1.72E-04	7.55E-04
Styrene[n]	100-42-5	2.50E-05	2.15E-04	9.44E-04
Vinyl acetate[n]	108-05-4	7.60E-06	6.55E-05	2.87E-04
Xylenes[n]	1330-20-7	3.70E-05	3.19E-04	1.40E-03
Dioxins/Furans (PCDD/PCDF)[o]	-	2.44E-07	2.10E-06	9.21E-06
PAH[p] - coal	-	2.08E-05	2.07E-04	9.05E-04
PAH[r] - gas	-	6.98E-04		
HCl (Hydrochloric acid)[q]	7647-01-0	2.40E-02	2.07E-01	9.06E-01
HF (Hydrofluoric acid)[j]	7664-39-3	2.65E-02	2.29E-01	1.00E+00
Antimony[k]	7440-36-0	1.80E-05	1.55E-04	6.79E-04
Arsenic[k] - coal	7440-38-2	4.10E-04	3.54E-03	1.55E-02
Arsenic[s] - gas	7440-38-2	2.00E-04		
Beryllium[k] - coal	7440-41-7	2.10E-05	1.81E-04	7.95E-04
Beryllium[s] - gas	7440-41-7	1.20E-05		
Cadmium[k] - coal	7440-43-9	5.10E-05	4.83E-04	2.11E-03
Cadmium[s] - gas	7440-43-9	1.10E-03		
Chromium[k] - coal	7440-47-3	2.60E-04	2.30E-03	1.01E-02
Chromium[s] - gas	7440-47-3	1.40E-03		
Cobalt[k] - coal	7440-48-4	1.00E-04	8.65E-04	3.79E-03
Cobalt[s] - gas	7440-48-4	8.40E-05		
Lead[k] - coal	7439-92-1	4.20E-04	3.64E-03	1.59E-02
Lead[g] - gas	7439-92-1	5.00E-04		
Manganese[k] - coal	7439-96-5	4.90E-04	4.24E-03	1.86E-02
Manganese[s] - gas	7439-96-5	3.80E-04		
Mercury[k] - coal	7439-97-6	8.30E-05	7.25E-04	3.18E-03
Mercury[s] - gas	7439-97-6	2.60E-04		
Nickel[k] - coal	7440-02-0	2.80E-04	2.50E-03	1.09E-02
Nickel[s] - gas	7440-02-0	2.10E-03		
Selenium[k] - coal	7782-49-2	1.30E-03	1.12E-02	4.91E-02
Selenium[s] - gas	7782-49-2	2.40E-05		
			Total HAPs =	**2.7**

Notes:

[a] AP42 Table 9.10.1.2-2, NO_x 0.66 lb/ton pulp, VOC 1.2 lb/ton pulp, CO_2 370 lb/ton pulp, SO_2 0.79 lb/ton pulp

[b] AP42 Table 1.4-1, NOx 100 lb/10^6 scf, CO 84 lb/10^6scf

[c] ACS HLB stack test 7.0 lb CO/ton wet pulp

[d] Manufacturer specification plus 10% safety factor

[e] PM_{10} assumed to be 100% of PM plus condensable fraction equal to 85% of PM_{10}

[f] PM2.5 assumed to be 30% of PM (AP42, Appendix B average) plus condensable fraction

[g] AP42 Table 1.4-2, VOC 5.5 lb/10^6 scf, CO_2 120,000 lb/10^6scf, CH_4 2.3 lb/10^6scf, N_2O 2.2 lb/10^6scf

[h] AP42 (9/98) Table 1.1-3, maximum sulfur content of 0.5 percent and 60% inherent control

[i] EPRI (3/12) Estimating Total Sulfuric Acid Emissions from Stationary Power Plants, 0.29% of SO_2

[j] Spring Creek Mine Coal Specification, 41.9 ppm F as HF. Also incorporates 60% inherent control.

[k] AP42 (9/98) Table 1.1-18

[l] AP42 (9/98) Table 1.1-19

[m] 40 CFR 98, Subpart A, GWP CH_4 25, N_2O 298

[m] AP-42 (9/98) Table 1.1-14

[o] AP-42 (9/98) Table 1.1-12

[p] AP-42 (9/98) Table 1.1-13

[q] Spring Creek Mine Coal Specification, 16.65 ppm Cl

[r] AP42 Table 1.4-3

[s] AP42 Table 1.4-4

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Potential Emissions
Task	Fug 2a Coal Handling Emissions

Computed	GJR
Checked	KB
Sheets	NA

Calculation Assumptions:

Material throughput (maximum):	36.1 ton/hr
Moisture content[a]:	4.50 %
Mean wind speed:	10.3 mph (Grand Forks, ND)

Material Handling Emission Factor[a]:

$$E = k(0.0032) \frac{(U/5)^{1.3}}{(M/2)^{1.4}}$$

E = emission factor (lb/ton)
$k\ (PM_{10})$ = particle size constant (0.35)
$k\ (PM_{2.5})$ = particle size constant (0.053)
U = mean wind speed (mph)
M = material moisture content (%)

Material handling emission factor (PM_{10}):	9.21E-04 lb/ton
Material handling emission factor ($PM_{2.5}$):	2.57E-06 lb/ton

Material Handling (Dumping) Potentilal Emissions:

Material dump emissions (PM_{10})[C]:	0.033 lb/hr	0.146 ton/yr
Material dump emissions ($PM_{2.5}$)[C]:	0.0001 lb/hr	0.0004 ton/yr

[a] AP-42, Chapter 13.2.4, Aggregate Handling and Storage Piles
[c] Potential emissions based on a single dump operation of total material throughput

Computation

Project	American Crystal Sugar Company		Job No.	10352890
Subject	Drayton Expansion 2022 - Potential Emissions		Computed	GJR
Task	Fug 2b Coal Handling Wind Erosion		Checked	KB
			Sheets	NA

Storage Pile Data:

Active Spent Lime Disposal Area: 1.0 acres
Short Term Emission Basis: 10 percent of pile disturbed daily

Emission Factor Calculation[a]:

Maximum 2-min wind speed (U_{10})[b]: 19.7 m/sec
Threshold friction velocity (U_t)[c] 0.55 m/sec
Pile Orientation (A)[d] conical
PM_{10} multiplier (k): 0.5 constant
$PM_{2.5}$ multiplier (k): 0.075 constant

Pile Subarea U_s/U_r (na)	Wind Speed U_{10} (m/s)	Surface Wind Speed U_s [$U_{10}(U_s/U_r)$] (m/s)	Friction Velocity U* [$0.1U_s$] (m/s)	Friction Threshold U_t (m/s)	Threshold Comparison Yes or No [U* > U_t] (na)	Pile Area (%)	Subarea Pile Size (m^2)
0.2	19.7	3.94	0.394	0.55	No	5	202
0.2	19.7	3.94	0.394	0.55	No	35	1,416
0.6	19.7	11.82	1.182	0.55	Yes	48	1,943
0.9	19.7	17.73	1.773	0.55	Yes	12	486

For $U^*>U_t$: $P\ (g/m^2) = 58(U^* - U_t)^2 + 25(U^* - U_t)$
E (lb/disturbance) = (k)(P)(Area)/(453.59 g/lb)

Pile Subarea U_s/U_r	P (g/m^2)	E PM_{10} (lb/dist.)	E $PM_{2.5}$ (lb/dist.)
0.2	0.0	0.0	0.0
0.2	0.0	0.0	0.0
0.6	39.0	83.4	12.5
0.9	117.3	62.8	9.4
Total Pile Emissions		146.2	21.9

Emission Rate Calculation:

Emissions based on 5% of pile disturbed per 24-hrs:	PM_{10}		$PM_{2.5}$	
	0.61	lb/hr	0.09	lb/hr
	2.67	tons/yr	0.40	tons/yr

[a] AP-42, Chapter 13.2.5, Industrial Wind Erosion
[b] Grand Forks, ND, fastest mile
[c] AP-42, Table 13.2.5-2, Ground Coal
[d] AP-42, Figure 13.2.5-2, Contours of normalized surface windspeeds.

Computation

Job No.	10352890

Project	American Crystal Sugar Company	Computed	GJR
Subject	Drayton Expansion 2022 - Potential Emissions	Checked	KB
Task	Fug 3 Limerock Handling Emissions	Sheets	NA

Calculation Assumptions:

Material throughput (maximum):	37.2	ton/hr
Moisture content[a]:	2.10	%
Mean wind speed:	10.3	mph (Grand Forks, ND)

Material Handling Emission Factor[a]:

$$E = k(0.0032)\frac{(U/5)^{1.3}}{(M/2)^{1.4}}$$

E = emission factor (lb/ton)
k (PM_{10}) = particle size constant (0.35)
k ($PM_{2.5}$) = particle size constant (0.053)
U = mean wind speed (mph)
M = material moisture content (%)

Material handling emission factor (PM_{10}):	2.68E-03	lb/ton
Material handling emission factor ($PM_{2.5}$):	9.18E-07	lb/ton

Material Handling (Dumping) Potentilal Emissions:

Material dump emissions (PM_{10})[C]:	0.099	lb/hr	0.436	ton/yr
Material dump emissions ($PM_{2.5}$)[C]:	0.00003	lb/hr	0.0001	ton/yr

[a] AP-42, Chapter 13.2.4, Aggregate Handling and Storage Piles
[c] Potential emissions based on a single dump operation of total material throughput

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Potential Emissions	Computed	GJR
Task	Fug 4 Spent Lime Wind Erosion	Checked	KB
		Sheets	NA

Storage Pile Data:

Active Spent Lime Disposal Area: 3.0 acres

Short Term Emission Basis: 5 percent of pile disturbed daily

Emission Factor Calculation[a]:

Maximum 2-min wind speed (U_{10})[b]: 19.7 m/sec

Threshold friction velocity (U_t)[c] 1.02 m/sec

Pile Orientation (A)[d] conical

PM_{10} multiplier (k): 0.5 constant

$PM_{2.5}$ multiplier (k): 0.075 constant

Pile Subarea U_s/U_r (na)	Wind Speed U_{10} (m/s)	Surface Wind Speed U_s [$U_{10}(U_s/U_r)$] (m/s)	Friction Velocity U* [$0.1U_s$] (m/s)	Friction Threshold U_t (m/s)	Threshold Comparison Yes or No [U* > U_t] (na)	Pile Area (%)	Subarea Pile Size (m^2)
0.2	19.7	3.94	0.394	1.02	No	5	607
0.2	19.7	3.94	0.394	1.02	No	35	4,249
0.6	19.7	11.82	1.182	1.02	Yes	48	5,828
0.9	19.7	17.73	1.773	1.02	Yes	12	1,457

For $U^* > U_t$: $P\ (g/m^2) = 58(U^* - U_t)^2 + 25(U^* - U_t)$

E (lb/disturbance) = (k)(P)(Area)/(453.59 g/lb)

Pile Subarea U_s/U_r	P (g/m^2)	E PM_{10} (lb/dist.)	E $PM_{2.5}$ (lb/dist.)
0.2	0.0	0.0	0.0
0.2	0.0	0.0	0.0
0.6	5.6	35.8	5.4
0.9	51.7	83.0	12.5
Total Pile Emissions		118.8	17.8

Emission Rate Calculation:

Emissions based on 5% of pile disturbed per 24-hrs:	PM_{10}		$PM_{2.5}$	
	0.25	lb/hr	0.04	lb/hr
	1.08	tons/yr	0.16	tons/yr

[a] AP-42, Chapter 13.2.5, Industrial Wind Erosion

[b] Grand Forks, ND, fastest mile

[c] AP-42, Table 13.2.5-2, Overburden

[d] AP-42, Figure 13.2.5-2, Contours of normalized surface windspeeds.

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Potential Emissions	Computed	GJR
Task	Unpaved Road Fugitive Emissions	Checked	KB
		Sheets	NA

PM Emissions

Vehicle Type	Vehicles Per Day	Mean Wt. (tons)	Round Trip (miles)	Silt Content (%)	PM (lb/VMT)	PM (lb/hr)	PM (tpy)
Beet Truck	160	25	1.025	4.8	6.77	49.99	218.98
Coal Truck	13	32.5					
Coke Truck	8	32.5	1.081	4.8	7.54	5.43	23.80
Anthracite Truck	8	32.5					
Spent Lime	12	22.5	1.305	4.8	6.39	4.17	18.26
Totals						**59.60**	**261.03**

PM_{10} Emissions

Vehicle Type	Vehicles Per Day	Mean Wt. (tons)	Round Trip (miles)	Silt Content (%)	PM_{10} (lb/VMT)	PM_{10} (lb/hr)	PM_{10} (tpy)
Beet Truck	160	25	1.025	4.8	1.72	12.74	55.81
Coal Truck	13	32.5					
Coke Truck	8	32.5	1.081	4.8	1.92	1.38	6.06
Anthracite Truck	8	32.5					
Spent Lime	12	22.5	1.305	4.8	1.63	1.06	4.65
Totals						**15.19**	**66.53**

$PM_{2.5}$ Emissions

Vehicle Type	Vehicles Per Day	Mean Wt. (tons)	Round Trip (miles)	Silt Content (%)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$ (lb/hr)	$PM_{2.5}$ (tpy)
Beet Truck	160	25	1.025	4.8	0.17	1.27	5.58
Coal Truck	13	32.5					
Coke Truck	8	32.5	1.081	4.8	0.19	0.14	0.61
Anthracite Truck	8	32.5					
Spent Lime	12	22.5	1.305	4.8	0.16	0.11	0.47
Totals						**1.52**	**6.65**

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project: American Crystal Sugar Company
Subject: Drayton Expansion 2022 - Past Actual Emissions
Task: EU1/EP1 B&W Boiler

Hours	Steam Output (pph)	Heat Content (Btu/lb)	Heat Input (MMBtu/hr)	Firing Rate (ton/hr)	Fuel Use (ton/yr)
6,804	300,000	9,326	392	16.0	108,628

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)[b]	10102-43-9	9.48	151.3	514.6
Carbon Monoxide (CO)[c]	630-08-0	5.00	79.8	271.6
Particulate Matter (PM)[c]	-	0.12	2.0	6.8
Particulate Matter < 10 Microns (PM_{10})[e]	-	0.89	14.2	48.4
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[f]	-	0.85	13.5	45.9
Volatile Organic Compounds (VOC)[g]	-	0.05	0.8	2.7
Sulfur Dioxide (SO_2)[h]	7446-09-5	5.93	94.7	322
Sulfuric Acid Mist (H_2SO_4)[i]	-	0.02	0.3	0.9
Fluorides (measured as HF)[j]	-	0.0007	0.0	0.0
Lead (Pb)[k]	7439-92-1	0.0004	0.0	0.0
Carbon Dioxide (CO_2)[l]	124-38-9	4,810	76,793	261,250
Methane (CH_4)[g]	74-82-8	0.06	1.0	3.3
Nitrous Oxide (N_2O)[g]	10024-97-2	0.04	0.6	2.2
Carbon Dioxide Equivalent (CO_2e)[m]	-	NA	77,007	261,979

Hazardous Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Organic Compounds:				
Acetaldehyde[n]	75-07-0	5.70E-04	9.10E-03	3.10E-02
Acetophenone[n]	98-86-2	1.50E-05	2.39E-04	8.15E-04
Acrolein[n]	107-02-8	2.90E-04	4.63E-03	1.58E-02
Benzene[n]	71-43-2	1.30E-03	2.08E-02	7.06E-02
Benzyl chloride[n]	100-44-7	7.00E-04	1.12E-02	3.80E-02
Bis(2-ethylhexyl)phthalate (DEHP)[n]	117-81-7	7.30E-05	1.17E-03	3.96E-03
Bromoform[n]	75-25-2	3.90E-05	6.23E-04	2.12E-03
Carbon disulfide[n]	75-15-0	1.30E-04	2.08E-03	7.06E-03
2-Chloroacetophenone[n]	532-27-4	7.00E-06	1.12E-04	3.80E-04
Chlorobenzene[n]	108-90-7	2.20E-05	3.51E-04	1.19E-03
Chloroform[n]	67-66-3	5.90E-05	9.42E-04	3.20E-03
Cumene[n]	98-82-8	5.30E-06	8.46E-05	2.88E-04
Cyanide[n]	57-12-5	2.50E-03	3.99E-02	1.36E-01
2,4-Dinitrotoluene[n]	121-14-2	2.80E-07	4.47E-06	1.52E-05
Dimethyl sulfate[n]	77-78-1	4.80E-05	7.66E-04	2.61E-03
Ethylbenzene[n]	100-41-4	9.40E-05	1.50E-03	5.11E-03
Ethyl chloride[n]	75-00-3	4.20E-05	6.71E-04	2.28E-03
Ethylene dichloride[n]	107-06-2	4.00E-05	6.39E-04	2.17E-03
Ethylene dibromide[n]	106-93-4	1.20E-06	1.92E-05	6.52E-05
Formaldehyde[n]	50-00-0	2.40E-04	3.83E-03	1.30E-02

Hexane[n]	110-54-3	6.70E-05	1.07E-03	3.64E-03
Isophorone[n]	78-59-1	5.80E-04	9.26E-03	3.15E-02
Methyl bromide[n]	74-83-9	1.60E-04	2.55E-03	8.69E-03
Methyl chloride[n]	74-87-3	5.30E-04	8.46E-03	2.88E-02
Methyl hydrazine[n]	60-34-4	1.70E-04	2.71E-03	9.23E-03
Methyl methacrylate[n]	80-62-6	2.00E-05	3.19E-04	1.09E-03
Methyl tert butyl ether[n]	1634-04-4	3.50E-05	5.59E-04	1.90E-03
Methylene chloride[n]	75-09-2	2.90E-04	4.63E-03	1.58E-02
Phenol[n]	108-95-2	1.60E-05	2.55E-04	8.69E-04
Propionaldehyde[n]	123-38-6	3.80E-04	6.07E-03	2.06E-02
Tetrachlorethylene (Perc)[n]	127-18-4	4.30E-05	6.87E-04	2.34E-03
Toluene[n]	108-88-3	2.40E-04	3.83E-03	1.30E-02
1,1,1-Trichloroethane (methyl chloroform)[n]	71-55-6	2.00E-05	3.19E-04	1.09E-03
Styrene[n]	100-42-5	2.50E-05	3.99E-04	1.36E-03
Vinyl acetate[n]	108-05-4	7.60E-06	1.21E-04	4.13E-04
Xylenes[n]	1330-20-7	3.70E-05	5.91E-04	2.01E-03
Dioxins/Furans (PCDD/PCDF)[o]	-	1.76E-09	2.81E-08	9.56E-08
Polynuclear Aromatic Hydrocarbons (PAH)[p]	-	2.08E-05	3.32E-04	1.13E-03
HCl (Hydrochloric acid)[q]	7647-01-0	2.40E-02	3.83E-01	1.30E+00
HF (Hydrofluoric acid)[j]	7664-39-3	7.36E-04	1.18E-02	4.00E-02
Antimony[k]	7440-36-0	1.80E-05	2.87E-04	9.78E-04
Arsenic[k]	7440-38-2	4.10E-04	6.55E-03	2.23E-02
Beryllium[k]	7440-41-7	2.10E-05	3.35E-04	1.14E-03
Cadmium[k]	7440-43-9	5.10E-05	8.14E-04	2.77E-03
Chromium[k]	7440-47-3	2.60E-04	4.15E-03	1.41E-02
Cobalt[k]	7440-48-4	1.00E-04	1.60E-03	5.43E-03
Lead[k]	7439-92-1	4.20E-04	6.71E-03	2.28E-02
Manganese[k]	7439-96-5	4.90E-04	7.82E-03	2.66E-02
Mercury[k]	7439-97-6	8.30E-05	1.33E-03	4.51E-03
Nickel[k]	7440-02-0	2.80E-04	4.47E-03	1.52E-02
Selenium[k]	7782-49-2	1.30E-03	2.08E-02	7.06E-02
			Total HAPs =	**2.0**

Notes:

[a] Production parameters based on 2017/2018 operating year average

[b] NO_x emissions based on 2006 source test (0.508 lb/MMBtu)

[c] AP42 (9/98) Table 1.1-3

[d] PM filterable emissions based on 2018 source test (0.0067 lb/MMBtu)

[e] PM_{10} filterable emissions based on 2015 source test (0.0078 lb/MMBtu) and PM condensable emissions based on AP42 (9/98) Table 1.1-5 (0.04 lb/MMBtu)

[f] AP42 (9/98) Tables 1.1-5 and 1.1-9, condensable PM is 0.04 lb/MMBtu, $PM_{2.5}$ is 68% of PM10

[g] AP42 (9/98) Table 1.1-19

[h] SO_2 emissions based on 2015 source test (0.318 lb/MMBtu)

[i] EPRI (3/12) Estimating Total Sulfuric Acid Emissions from Stationary Power Plants, 0.29% of SO_2

[j] EPA MACT Floor Analysis - data request for ESP controlled, subbituminous-fired boilers.

[k] AP42 (9/98) Table 1.1-18

[l] AP-42 (9/98) Table 1.1-20

[m] 40 CFR 98, Subpart A, GWP CH_4 25, N_2O 298

[n] AP-42 (9/98) Table 1.1-14

[o] AP-42 (9/98) Table 1.1-12

[p] AP-42 (9/98) Table 1.1-13

[q] Spring Creek Mine Coal Specification, 16.65 ppm Cl

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU1a/EP1a Coal Handling Dust Collector
Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,804	16.0	1,700

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	0.29	1.0
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.29	1.0
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.005	0.07	0.2

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU3/EP3 Pulp Dryer No. 2

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Heat Content (Btu/lb)	Heat Input (MMBtu/hr)	Firing Rate (ton/hr)	Fuel Use (ton/yr)
6,579	21.9	9,326	100	2.7	18,081

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)[b]	10102-43-9	3.97	10.9	35.9
Carbon Monoxide (CO)[c]	630-08-0	7.50	164.3	540.3
Particulate Matter (PM)[d]	-	11.97	32.9	108.2
Particulate Matter < 10 Microns (PM_{10})[e]	-	22.15	60.9	200.3
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[f]	-	13.77	37.8	124.5
Volatile Organic Compounds (VOC)[g]	-	2.73	7.5	24.7
Sulfur Dioxide (SO_2)[h]	7446-09-5	2.16	5.9	20
Sulfuric Acid Mist (H_2SO_4)[i]	-	0.01	0.0	0.1
Fluorides (measured as HF)[j]	-	0.03	0.1	0.2
Lead (Pb)[k]	7439-92-1	0.0004	0.0	0.0
Carbon Dioxide (CO_2)[l]	124-38-9	2,360	6,486	21,335
Methane (CH_4)[m]	74-82-8	0.06	0.2	0.5
Nitrous Oxide (N_2O)[m]	10024-97-2	0.04	0.1	0.4
Carbon Dioxide Equivalent (CO_2e)[n]	-	NA	6,523	21,456

Hazardous Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Organic Compounds:				
Acetaldehyde[o]	75-07-0	5.70E-04	1.57E-03	5.15E-03
Acetophenone[o]	98-86-2	1.50E-05	4.12E-05	1.36E-04
Acrolein[o]	107-02-8	2.90E-04	7.97E-04	2.62E-03
Benzene[o]	71-43-2	1.30E-03	3.57E-03	1.18E-02
Benzyl chloride[o]	100-44-7	7.00E-04	1.92E-03	6.33E-03
Bis(2-ethylhexyl)phthalate (DEHP)[o]	117-81-7	7.30E-05	2.01E-04	6.60E-04
Bromoform[o]	75-25-2	3.90E-05	1.07E-04	3.53E-04
Carbon disulfide[o]	75-15-0	1.30E-04	3.57E-04	1.18E-03
2-Chloroacetophenone[o]	532-27-4	7.00E-06	1.92E-05	6.33E-05
Chlorobenzene[o]	108-90-7	2.20E-05	6.05E-05	1.99E-04
Chloroform[o]	67-66-3	5.90E-05	1.62E-04	5.33E-04
Cumene[o]	98-82-8	5.30E-06	1.46E-05	4.79E-05
Cyanide[o]	57-12-5	2.50E-03	6.87E-03	2.26E-02
2,4-Dinitrotoluene[o]	121-14-2	2.80E-07	7.70E-07	2.53E-06
Dimethyl sulfate[o]	77-78-1	4.80E-05	1.32E-04	4.34E-04
Ethylbenzene[o]	100-41-4	9.40E-05	2.58E-04	8.50E-04
Ethyl chloride[o]	75-00-3	4.20E-05	1.15E-04	3.80E-04
Ethylene dichloride[o]	107-06-2	4.00E-05	1.10E-04	3.62E-04
Ethylene dibromide[o]	106-93-4	1.20E-06	3.30E-06	1.08E-05
Formaldehyde[o]	50-00-0	2.40E-04	6.60E-04	2.17E-03

Hexane[o]	110-54-3	6.70E-05	1.84E-04	6.06E-04
Isophorone[o]	78-59-1	5.80E-04	1.59E-03	5.24E-03
Methyl bromide[o]	74-83-9	1.60E-04	4.40E-04	1.45E-03
Methyl chloride[o]	74-87-3	5.30E-04	1.46E-03	4.79E-03
Methyl hydrazine[o]	60-34-4	1.70E-04	4.67E-04	1.54E-03
Methyl methacrylate[o]	80-62-6	2.00E-05	5.50E-05	1.81E-04
Methyl tert butyl ether[o]	1634-04-4	3.50E-05	9.62E-05	3.16E-04
Methylene chloride[o]	75-09-2	2.90E-04	7.97E-04	2.62E-03
Phenol[o]	108-95-2	1.60E-05	4.40E-05	1.45E-04
Propionaldehyde[o]	123-38-6	3.80E-04	1.04E-03	3.44E-03
Tetrachlorethylene (Perc)[o]	127-18-4	4.30E-05	1.18E-04	3.89E-04
Toluene[o]	108-88-3	2.40E-04	6.60E-04	2.17E-03
1,1,1-Trichloroethane (methyl chloroform)[o]	71-55-6	2.00E-05	5.50E-05	1.81E-04
Styrene[o]	100-42-5	2.50E-05	6.87E-05	2.26E-04
Vinyl acetate[o]	108-05-4	7.60E-06	2.09E-05	6.87E-05
Xylenes[o]	1330-20-7	3.70E-05	1.02E-04	3.34E-04
Dioxins/Furans (PCDD/PCDF)[p]	-	1.76E-09	4.84E-09	1.59E-08
Polynuclear Aromatic Hydrocarbons (PAH)[q]	-	2.08E-05	5.72E-05	1.88E-04
HCl (Hydrochloric acid)[r]	7647-01-0	2.40E-02	6.60E-02	2.17E-01
HF (Hydrofluoric acid)[j]	7664-39-3	2.65E-02	7.29E-02	2.40E-01
Antimony[s]	7440-36-0	1.80E-05	4.95E-05	1.63E-04
Arsenic[s]	7440-38-2	4.10E-04	1.13E-03	3.71E-03
Beryllium[s]	7440-41-7	2.10E-05	5.77E-05	1.90E-04
Cadmium[s]	7440-43-9	5.10E-05	1.40E-04	4.61E-04
Chromium[s]	7440-47-3	2.60E-04	7.15E-04	2.35E-03
Cobalt[s]	7440-48-4	1.00E-04	2.75E-04	9.04E-04
Lead[s]	7439-92-1	4.20E-04	1.15E-03	3.80E-03
Manganese[s]	7439-96-5	4.90E-04	1.35E-03	4.43E-03
Mercury[s]	7439-97-6	8.30E-05	2.28E-04	7.50E-04
Nickel[s]	7440-02-0	2.80E-04	7.70E-04	2.53E-03
Selenium[s]	7782-49-2	1.30E-03	3.57E-03	1.18E-02
			Total HAPs =	**0.6**

Notes:

[a] Production parameters based on 2017/2018 operating year average

[b] NO_x emissions based on 1997 source test (10.9 lb/hr)

[c] ACS HLB stack test 7.0 lb CO/ton pressed pulp

[d] PM emissions based on 2015 source test (32.91 lb/hr)

[e] PM_{10} assumed to be 100% of PM plus condensable fraction equal to 85% of PM_{10}

[f] $PM_{2.5}$ assumed to be 30% of PM (AP42, Appendix B average) plus condensable fraction

[g] VOC emissions based on 2006 source test at HLB (7.5 lb/hr)

[h] SO_2 emissions based on 2015 source test (0.116 lb/MMBtu)

[i] EPRI (3/12) Estimating Total Sulfuric Acid Emissions from Stationary Power Plants, 0.29% of SO_2

[j] Spring Creek Mine Coal Specification, 41.9 ppm F as HF. Also incorporates 60% inherent control.

[k] AP42 (9/98) Table 1.1-18

[l] AP42 (3/97) Table 9.10.1.2-2, CO_2 370 lb/ton pulp

[m] AP42 (9/98) Table 1.1-19

[n] 40 CFR 98, Subpart A, GWP CH_4 25, N_2O 298

[o] AP-42 (9/98) Table 1.1-14

[p] AP-42 (9/98) Table 1.1-12

[q] AP-42 (9/98) Table 1.1-13

[r] Spring Creek Mine Coal Specification, 16.65 ppm Cl

[s] AP42 (9/98) Table 1.1-18

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU4/EP4 Pulp Dryer No. 1
Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Heat Content (Btu/lb)	Heat Input (MMBtu/hr)	Firing Rate (ton/hr)	Fuel Use (ton/yr)
6,579	21.9	9,326	125	2.7	18,081

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)[b]	10102-43-9	4.77	13.1	43.1
Carbon Monoxide (CO)[c]	630-08-0	7.00	153.3	504.3
Particulate Matter (PM)[d]	-	14.00	38.5	126.6
Particulate Matter < 10 Microns (PM_{10})[e]	-	25.91	71.2	234.2
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[f]	-	23.81	65.4	215.2
Volatile Organic Compounds (VOC)[g]	-	3.82	10.5	34.5
Sulfur Dioxide (SO_2)[h]	7446-09-5	3.08	8.5	28
Sulfuric Acid Mist (H_2SO_4)[i]	-	0.01	0.0	0.1
Fluorides (measured as HF)[j]	-	0.03	0.1	0.2
Lead (Pb)[k]	7439-92-1	0.0004	0.0	0.0
Carbon Dioxide (CO_2)[l]	124-38-9	2,315	6,363	20,928
Methane (CH_4)[m]	74-82-8	0.06	0.2	0.5
Nitrous Oxide (N_2O)[m]	10024-97-2	0.04	0.1	0.4
Carbon Dioxide Equivalent (CO_2e)[n]	-	NA	6,399	21,049

Hazardous Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Organic Compounds:				
Acetaldehyde[o]	75-07-0	5.70E-04	1.57E-03	5.15E-03
Acetophenone[o]	98-86-2	1.50E-05	4.12E-05	1.36E-04
Acrolein[o]	107-02-8	2.90E-04	7.97E-04	2.62E-03
Benzene[o]	71-43-2	1.30E-03	3.57E-03	1.18E-02
Benzyl chloride[o]	100-44-7	7.00E-04	1.92E-03	6.33E-03
Bis(2-ethylhexyl)phthalate (DEHP)[o]	117-81-7	7.30E-05	2.01E-04	6.60E-04
Bromoform[o]	75-25-2	3.90E-05	1.07E-04	3.53E-04
Carbon disulfide[o]	75-15-0	1.30E-04	3.57E-04	1.18E-03
2-Chloroacetophenone[o]	532-27-4	7.00E-06	1.92E-05	6.33E-05
Chlorobenzene[o]	108-90-7	2.20E-05	6.05E-05	1.99E-04
Chloroform[o]	67-66-3	5.90E-05	1.62E-04	5.33E-04
Cumene[o]	98-82-8	5.30E-06	1.46E-05	4.79E-05
Cyanide[o]	57-12-5	2.50E-03	6.87E-03	2.26E-02
2,4-Dinitrotoluene[o]	121-14-2	2.80E-07	7.70E-07	2.53E-06
Dimethyl sulfate[o]	77-78-1	4.80E-05	1.32E-04	4.34E-04
Ethylbenzene[o]	100-41-4	9.40E-05	2.58E-04	8.50E-04
Ethyl chloride[o]	75-00-3	4.20E-05	1.15E-04	3.80E-04
Ethylene dichloride[o]	107-06-2	4.00E-05	1.10E-04	3.62E-04
Ethylene dibromide[o]	106-93-4	1.20E-06	3.30E-06	1.08E-05
Formaldehyde[o]	50-00-0	2.40E-04	6.60E-04	2.17E-03

Hexane[o]	110-54-3	6.70E-05	1.84E-04	6.06E-04
Isophorone[o]	78-59-1	5.80E-04	1.59E-03	5.24E-03
Methyl bromide[o]	74-83-9	1.60E-04	4.40E-04	1.45E-03
Methyl chloride[o]	74-87-3	5.30E-04	1.46E-03	4.79E-03
Methyl hydrazine[o]	60-34-4	1.70E-04	4.67E-04	1.54E-03
Methyl methacrylate[o]	80-62-6	2.00E-05	5.50E-05	1.81E-04
Methyl tert butyl ether[o]	1634-04-4	3.50E-05	9.62E-05	3.16E-04
Methylene chloride[o]	75-09-2	2.90E-04	7.97E-04	2.62E-03
Phenol[o]	108-95-2	1.60E-05	4.40E-05	1.45E-04
Propionaldehyde[o]	123-38-6	3.80E-04	1.04E-03	3.44E-03
Tetrachlorethylene (Perc)[o]	127-18-4	4.30E-05	1.18E-04	3.89E-04
Toluene[o]	108-88-3	2.40E-04	6.60E-04	2.17E-03
1,1,1-Trichloroethane (methyl chloroform)[o]	71-55-6	2.00E-05	5.50E-05	1.81E-04
Styrene[o]	100-42-5	2.50E-05	6.87E-05	2.26E-04
Vinyl acetate[o]	108-05-4	7.60E-06	2.09E-05	6.87E-05
Xylenes[o]	1330-20-7	3.70E-05	1.02E-04	3.34E-04
Dioxins/Furans (PCDD/PCDF)[p]	-	1.76E-09	4.84E-09	1.59E-08
Polynuclear Aromatic Hydrocarbons (PAH)[q]	-	2.08E-05	5.72E-05	1.88E-04
HCl (Hydrochloric acid)[r]	7647-01-0	2.40E-02	6.60E-02	2.17E-01
HF (Hydrofluoric acid)[j]	7664-39-3	2.65E-02	7.29E-02	2.40E-01
Antimony[s]	7440-36-0	1.80E-05	4.95E-05	1.63E-04
Arsenic[s]	7440-38-2	4.10E-04	1.13E-03	3.71E-03
Beryllium[s]	7440-41-7	2.10E-05	5.77E-05	1.90E-04
Cadmium[s]	7440-43-9	5.10E-05	1.40E-04	4.61E-04
Chromium[s]	7440-47-3	2.60E-04	7.15E-04	2.35E-03
Cobalt[s]	7440-48-4	1.00E-04	2.75E-04	9.04E-04
Lead[s]	7439-92-1	4.20E-04	1.15E-03	3.80E-03
Manganese[s]	7439-96-5	4.90E-04	1.35E-03	4.43E-03
Mercury[s]	7439-97-6	8.30E-05	2.28E-04	7.50E-04
Nickel[s]	7440-02-0	2.80E-04	7.70E-04	2.53E-03
Selenium[s]	7782-49-2	1.30E-03	3.57E-03	1.18E-02
			Total HAPs =	**0.6**

Notes:

[a] Production parameters based on 2017/2018 operating year average

[b] NO_x emissions based on 1997 source test (13.1 lb/hr)

[c] ACS HLB stack test 7.0 lb CO/ton wet pulp

[d] PM emissions based on 2015 source test (38.49 lb/hr)

[e] PM_{10} assumed to be 100% of PM plus condensable fraction equal to 85% of PM_{10}

[f] Based on test data $PM_{2.5}$ equal to be 85% of PM_{10} plus condensable fraction equal to 85% of PM_{10}

[g] VOC emissions based on 2006 source test at HLB (10.5 lb/hr)

[h] SO_2 emissions based on 2015 source test (0.165 lb/MMBtu)

[i] EPRI (3/12) Estimating Total Sulfuric Acid Emissions from Stationary Power Plants, 0.29% of SO_2

[j] Spring Creek Mine Coal Specification, 41.9 ppm F as HF. Also incorporates 60% inherent control.

[k] AP42 (9/98) Table 1.1-18

[l] AP42 (3/97) Table 9.10.1.2-2, CO_2 370 lb/ton pulp

[m] AP42 (9/98) Table 1.1-19

[n] 40 CFR 98, Subpart A, GWP CH_4 25, N_2O 298

[o] AP-42 (9/98) Table 1.1-14

[p] AP-42 (9/98) Table 1.1-12

[q] AP-42 (9/98) Table 1.1-13

[r] Spring Creek Mine Coal Specification, 16.65 ppm Cl

[s] AP42 (9/98) Table 1.1-18

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU5 & EU24/EP5 Lime Mixing Tank and Lime Kiln Cooler
Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	11.9	8,500

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.72	8.6	28.3
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.48	5.7	18.7
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.27	3.2	10.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is 66.2% of PM based on the average parameters listed below

[c] $PM_{2.5}$ filterable is 37.1% of PM based on the average parameters listed below

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Multiclone And Scrubber Controlled Sources:

Section	Source Type	PM_{10} (% less than)	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	52.0	11.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	92.0	11.0
10.50	Woodworking Waste Collection Operations	52.9	29.5
11.10	Coal Cleaning: Thermal Dryer	91.0	53.0
11.10	Coal Processing: Thermal Incinerator	43.7	21.3
11.20	Lightweight Aggregate (Clay): Rotary Kiln	84.0	55.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	56.7	19.3
11.20	Lightweight Aggregate (Slate): Rotary Kiln	39.0	33.0
11.21	Phosphate Rock Processing: Calciner	98.0	94.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	96.6	89.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	58.3	15.7
11.21	Phosphate Rock Processing: Ball Mill	30.8	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	62.0	21.0
12.10	Primary Aluminum Production: Bauxite Processing	70.0	60.5
Average Particle Size Distribution		**66.2**	**37.1**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU6/EP6 Pellet Mill No. 1

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	5.0	11,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.74	3.7	12.2
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.74	3.7	12.2
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.11	0.6	1.9

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15.3% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Multiclone Controlled Sources:

Section	Source Type	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	8.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	1.0
10.50	Woodworking Waste Collection Operations	29.5
11.10	Coal Processing: Thermal Incinerator	21.3
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	19.3
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	15.7
11.21	Phosphate Rock Processing: Ball Mill	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	21.0
Average Particle Size Distribution		**15.3**

Computation

Job No.	10352890

Project	American Crystal Sugar Company		Computed	GJR
Subject	Drayton Expansion 2022 - Past Actual Emissions		Checked	KB
Task	EU7/EP7 Pellet Mill No. 2		Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	5.0	11,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.74	3.7	12.2
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.74	3.7	12.2
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.11	0.6	1.9

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15.3% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Multiclone Controlled Sources:

Section	Source Type	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	8.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	1.0
10.50	Woodworking Waste Collection Operations	29.5
11.10	Coal Processing: Thermal Incinerator	21.3
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	19.3
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	15.7
11.21	Phosphate Rock Processing: Ball Mill	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	21.0
Average Particle Size Distribution		**15.3**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU8/EP8 Pellet Mill No. 3

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	5.0	11,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.74	3.7	12.2
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.74	3.7	12.2
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.11	0.6	1.9

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15.3% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Multiclone Controlled Sources:

Section	Source Type	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	8.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	1.0
10.50	Woodworking Waste Collection Operations	29.5
11.10	Coal Processing: Thermal Incinerator	21.3
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	19.3
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	15.7
11.21	Phosphate Rock Processing: Ball Mill	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	21.0
Average Particle Size Distribution		**15.3**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU9/EP9 Dry Pulp Belt Conveyors

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	16.8	3,500

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.036	0.6	2.0
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.036	0.6	2.0
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.008	0.1	0.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU10/EP10 Dry Pulp Reclaim System

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	16.8	3,500

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.036	0.6	2.0
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.036	0.6	2.0
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.008	0.1	0.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU11/EP9 Dry Pulp Bucket Elevator

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	16.8	3,500

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.036	0.6	2.0
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.036	0.6	2.0
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.008	0.1	0.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU12/EP12 Sugar Dryer

Hours	Throughput (tph)	Flowrate (acfm)
6,579	48.2	18,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.064	3.1	10.2
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.064	3.1	10.2
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.010	0.5	1.6

Notes:

[a] AP42, Table 9.10.1.2-1

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15.3% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Multiclone Controlled Sources:

Section	Source Type	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	8.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	1.0
10.50	Woodworking Waste Collection Operations	29.5
11.10	Coal Processing: Thermal Incinerator	21.3
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	19.3
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	15.7
11.21	Phosphate Rock Processing: Ball Mill	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	21.0
Average Particle Size Distribution		**15.3**

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project: American Crystal Sugar Company
Subject: Drayton Expansion 2022 - Past Actual Emissions
Task: EU13/EP13a-f Belgian Lime Kiln

Production Parameters

Operating Scenario	Hours	Fuel Throughput (tph)	Fuel Heat Content (Btu/lb)	Max Heat Input (MMBtu/hr)	Limerock Throughput (tph)	Lime Production (tph)
Startup	72	0.48	13,300	12.7	4.8	2.7
Normal	6,579	1.19	13,300	31.7	11.9	6.7

Kiln Vent Emissions: 40% of combustion gas flow.

Criteria Air Pollutants	CAS#	Combustion Emission Factor		Kiln Vent		Kiln Vent Emissions	
		(value)	(units)	(lb/hr)	(% flow)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)[a]	10102-43-9	1.753	lb/ton limerock	20.9	40%	8.4	27.51
Carbon Monoxide (CO)[b]	630-08-0	32.432	lb/ton limerock	386.8	40%	154.7	508.96
Particulate Matter (PM)[c]	-	0.669	lb/ton limerock	8.0	40%	3.2	10.50
Particulate Matter < 10 Microns (PM_{10})[c]	-	0.669	lb/ton limerock	8.0	40%	3.2	10.50
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[d]	-	0.080	lb/ton limerock	1.0	40%	0.4	1.26
Volatile Organic Compounds (VOC)[e]	-	0.030	lb/ton limerock	0.4	40%	0.1	0.47
Carbon Dioxide (CO_2)[f]	-	1,733	lb/ton limerock	20670.5	40%	8268.2	27,196
Sulfur Dioxide (SO_2)[g]	7446-09-5	3.000	lb/ton limerock	35.8	40%	14.3	47.08
Lead (Pb)[h]	7439-92-1	8.89E-04	lb/ton limerock	0.0	40%	0.0	0.014
Acid Gases (HF, H_2SO_4)[i]		negl.	lb/ton limerock	0.000	40%	0.0	0.000

[a] NO_x emissions based on maximum of European kiln data, which ranges from 3.89 to 19.46 lb/hr
[b] CO emissions based on engineering test of similar kiln (HLB), 360 lb/hr
[c] PM/PM_{10} emissions based on 2007 source test (7.423 lb/hr)
[d] $PM_{2.5}$ emissions are calculated as 12% of PM_{10} emissions using particle size distribution for rotary kilns, AP42, Table 11.17-7. Condensables, AP42, Table 11.17-2
[e] VOC emissions based on AP42, Table 1.2-6, for anthracite coal combustion.
[f] CO_2 emissions based on manufacturer mass balance production information for similar kiln
[g] SO_2 emissions based on 1.5% sulfur fuel and an assumed 50% retention for combustion process. This is equivalent to AP42, Table 11.17-6, for rotary kilns.
[h] Pb emissions based on AP42, Table 1.2-3, for anthracite coal combustion.
[i] Based on the high retention of SO_2 in the combustion process and the preferential removal of acid gases, emissions are anticipated to be negligible.

Carbonation Vent Emissions: Remaining 60% of combustion gas flow after carbonation process control.

Criteria Air Pollutants	CAS#	Uncontrolled Emissions		Carbonation Control[a]	Amount of Flow	Carbonation Process Emissions	
		(lb/hr)	(tpy)	(%)	(%)	(lb/hr)	(tpy)
Nitrogen Oxides (NO_x)	10102-43-9	20.9	68.78	0%	60%	12.5	41.27
Carbon Monoxide (CO)	630-08-0	386.8	1272.40	0%	60%	232.1	763.44
Particulate Matter (PM)	-	8.0	26.25	100.0%	60%	0.0	0.00
Particulate Matter < 10 Microns (PM_{10})	-	8.0	26.25	100.0%	60%	0.0	0.00
Particulate Matter < 2.5 Microns ($PM_{2.5}$)	-	1.0	3.15	100.0%	60%	0.0	0.00
Volatile Organic Compounds (VOC)	-	0.4	1.18	0%	60%	0.2	0.71
Carbon Dioxide (CO_2)	-	20670.5	67,990	75%	60%	3,101	10,199
Sulfur Dioxide (SO_2)	7446-09-5	35.8	117.70	95%	60%	1.1	3.53
Lead (Pb)	7439-92-1	0.0	0.03	100.0%	60%	0.000	0.000
Acid Gases (HF, H_2SO_4)		0.0	0.000	95%	60%	0.000	0.000

[a] Carbonation process controls 100% of remaining particulate matter and 95% of remaining SO_2/acid gases. 75% of CO_2 is abosorbed in the carbonation process and recombined with CaO to form $CaCO_3$.

EUI 11 Lime Kiln Past Actual Emissions

Criteria Air Pollutants	Kiln Vent Emissions (normal operations)		Carbonation Process Emissions		Total Emissions
	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(tpy)
Nitrogen Oxides (NO_x)	8.36	27.5	12.55	41.3	68.78
Carbon Monoxide (CO)	154.73	509.0	232.10	763.4	1272.40
Particulate Matter (PM)	3.19	10.5	0.00	0.0	10.50
Particulate Matter < 10 Microns (PM_{10})	3.19	10.5	0.00	0.0	10.50
Particulate Matter < 2.5 Microns ($PM_{2.5}$)	0.38	1.3	0.00	0.0	1.26
Volatile Organic Compounds (VOC)	0.14	0.5	0.21	0.7	1.18
Carbon Dioxide (CO_2)	8268.19	27196.1	3,101	10,199	37394.70
Sulfur Dioxide (SO_2)	14.31	47.1	1.07	3.5	50.61
Lead (Pb)	0.00	0.0	0.000	0.000	0.01
Acid Gases (HF, H_2SO_4)	0.00	0.0	0.000	0.000	0.00

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU14a/EP14a MAC 2 Flow Headhouse
Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8,760	NA	20,000

PSD Regulated Air Pollutants	CAS#	Emission Factor (gr/cf)	Potential Emissions (lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	3.4	15.0
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	3.4	15.0
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.005	0.8	3.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Project	American Crystal Sugar Company		Job No.	10352890
Subject	Drayton Expansion 2022 - Past Actual Emissions		Computed	GJR
Task	EU14b & EU 14c/EP14b Hummer Pulsaire and MAC		Checked	KB
			Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8,760	NA	19,000

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	3.3	14.3
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	3.3	14.3
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.005	0.8	3.3

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU15/EP15 Pulp Pellet Bin No. 1

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8,760	NA	2,140

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	0.367	1.6
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.367	1.6
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.003	0.055	0.2

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15% of PM_{10} filterable based on AP42 Chapter 13.2.4

[d] Source is uncontrolled, flowrate based on material displacement

[e] Production parameters based on 2017/2018 operating year average

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU16/EP16 Pulp Pellet Bin No. 2

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8,760	NA	2,140

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	0.367	1.6
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.367	1.6
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.003	0.055	0.2

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15% of PM_{10} filterable based on AP42 Chapter 13.2.4

[d] Source is uncontrolled, flowrate based on material displacement

[e] Production parameters based on 2017/2018 operating year average

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU17/EP17 Pulp Pellet Bin No. 3
Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8,760	NA	2,140

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	0.367	1.6
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.367	1.6
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.003	0.055	0.2

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15% of PM_{10} filterable based on AP42 Chapter 13.2.4

[d] Source is uncontrolled, flowrate based on material displacement

[e] Production parameters based on 2017/2018 operating year average

Computation

			Job No.	10352890
Project	American Crystal Sugar Company		Computed	GJR
Subject	Drayton Expansion 2022 - Past Actual Emissions		Checked	KB
Task	EU19a/EP19a Bulk Loading Pulsaire		Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8,760	NA	2,560

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	0.110	0.5
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.110	0.5
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.025	0.1

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU19b/EP19b North Bulk Sugar Loadout

Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8,760	NA	12,000

PSD Regulated Air Pollutants	CAS#	Emission Factor (gr/cf)	Potential Emissions (lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	0.514	2.3
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.514	2.3
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.119	0.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU19c/EP19c South Bulk Sugar Loadout
Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8,760	NA	10,000

PSD Regulated Air Pollutants	CAS#	Emission Factor (gr/cf)	Potential Emissions (lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	0.429	1.9
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.429	1.9
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.099	0.4

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Project	American Crystal Sugar Company		Job No.	10352890
Subject	Drayton Expansion 2022 - Past Actual Emissions		Computed	GJR
Task	EU20/EP20 Main Sugar Warehouse Pulsaire		Checked	KB
			Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
8,760	NA	10,500

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.005	0.450	2.0
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.005	0.450	2.0
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.001	0.104	0.5

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890

Project	American Crystal Sugar Company	Computed	GJR
Subject	Drayton Expansion 2022 - Past Actual Emissions	Checked	KB
Task	EU22/EP22 Pulp Pellet Mill & Cooler	Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	15.0	9,998

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.02	0.24	0.8
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.02	0.24	0.8
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.002	0.04	0.1

Notes:

[a] PM emissions based on 2008 source test (0.243 lb/hr)

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 15.3% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Multiclone Controlled Sources:

Section	Source Type	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	8.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	1.0
10.50	Woodworking Waste Collection Operations	29.5
11.10	Coal Processing: Thermal Incinerator	21.3
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	19.3
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	15.7
11.21	Phosphate Rock Processing: Ball Mill	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	21.0
Average Particle Size Distribution		**15.3**

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU23/EP23 Pulp Dryer Coal Hopper
Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	NA	5,200

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(gr/cf)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.020	0.89	2.9
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.020	0.89	2.9
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.005	0.21	0.7

Notes:

[a] Air Emission Permit No. T5-X73015

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ emissions are 23.2% of PM filterable based on following average parameters:

[d] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Fabric Filter Controlled Sources:

Section	Source Type	$PM_{2.5}$ (%less than)
8.XX	Boric Acid Dryer	3.3
8.XX	Potash (Postassium Sulfate) Dryer	18.0
10.50	Woodworking Waste Collection Operations	14.3
11.10	Coal Cleaning: Dry Process	16.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	39.0
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	25.0
11.XX	Nonmetalic Minerals: Fluorspar Ore Rotary Drum Dryer	10.0
12.10	Primary Aluminum Production: Bauxite Ore Storage Storage	50.0
12.15	Storage Battery Production: Lead Oxide Mill	32.8
Average Particle Size Distribution		**23.2**

Computation

Job No.	10352890
Computed	GJR
Checked	KB
Sheets	NA

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU25/EP24 Flume Lime Slaker

Hours	Throughput (tph)	Flowrate (acfm)
0	0.5	NA

DID NOT OPERATE DURING BASELINE PERIOD

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.08	0.04	0.00
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.08	0.04	0.00
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.03	0.01	0.00

Notes:

[a] AP42 Table 11.17-2

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ filterable is 37.1% of PM based on the average parameters listed below

[d] Air Emission Permit No. T5-X73015 - insignificant activity

[e] Flowrate is passive as a result of exothermic process

[f] Did not operate during baseline period

AP-42, Appendix B, Particle Size Distribution For Multiclone And Scrubber Controlled Sources:

Section	Source Type	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	11.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	11.0
10.50	Woodworking Waste Collection Operations	29.5
11.10	Coal Cleaning: Thermal Dryer	53.0
11.10	Coal Processing: Thermal Incinerator	21.3
11.20	Lightweight Aggregate (Clay): Rotary Kiln	55.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	19.3
11.20	Lightweight Aggregate (Slate): Rotary Kiln	33.0
11.21	Phosphate Rock Processing: Calciner	94.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	89.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	15.7
11.21	Phosphate Rock Processing: Ball Mill	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	21.0
12.10	Primary Aluminum Production: Bauxite Processing	60.5
Average Particle Size Distribution		**37.1**

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	EU26/EP25 Lime Slaker
Computed	GJR
Checked	KB
Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6,579	11.9	4,500

PSD Regulated Air Pollutants	CAS#	Emission Factor (lb/ton)	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Particulate Matter (PM)[a]	-	0.08	0.95	3.14
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.08	0.95	3.14
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.03	0.35	1.17

Notes:

[a] AP42 Table 11.17-2

[b] PM_{10} filterable is equal to PM filterable

[c] $PM_{2.5}$ filterable is 37.1% of PM based on the average parameters listed below

[d] Flowrate is passive as a result of exothermic process

[e] Production parameters based on 2017/2018 operating year average

AP-42, Appendix B, Particle Size Distribution For Multiclone And Scrubber Controlled Sources:

Section	Source Type	$PM_{2.5}$ (% less than)
9.70	Cotton Ginning: Battery Condensor	11.0
9.70	Cotton Ginning: Lint Cleaner Air Exhaust	11.0
10.50	Woodworking Waste Collection Operations	29.5
11.10	Coal Cleaning: Thermal Dryer	53.0
11.10	Coal Processing: Thermal Incinerator	21.3
11.20	Lightweight Aggregate (Clay): Rotary Kiln	55.0
11.20	Lightweight Aggregate (Clay): Reciprocating Grate Clinker Cooler	19.3
11.20	Lightweight Aggregate (Slate): Rotary Kiln	33.0
11.21	Phosphate Rock Processing: Calciner	94.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	89.0
11.21	Phosphate Rock Processing: Oil-Fired Rotary Drier	15.7
11.21	Phosphate Rock Processing: Ball Mill	6.5
11.21	Phosphate Rock Processing: Roller Mill and Bowl Mill Grinding	21.0
12.10	Primary Aluminum Production: Bauxite Processing	60.5
Average Particle Size Distribution		**37.1**

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Past Actual Emissions	Computed	GJR
Task	Fug 1 Pellet Loadout Area	Checked	KB
		Sheets	NA

Hours	Throughput (tph)	Flowrate (acfm)
6579	16.8	NA

PSD Regulated Air Pollutants	CAS#	Emission Factor	Potential Emissions	
		(lb/ton)	(lb/hr)	(tpy)
Particulate Matter (PM)[a]	-	0.027	0.45	1.49
Particulate Matter < 10 Microns (PM_{10})[b]	-	0.027	0.45	1.49
Particulate Matter < 2.5 Microns ($PM_{2.5}$)[c]	-	0.00037	0.01	0.02

Notes:

[a] AP-42, Chapter 9.9.1, Grain Elevators and Process, Rail Car Shipping/Loading

[b] Air Emission Permit No. T5-X73015 - insignificant activity

[c] Potential emissions based on a single dump/loading operation of total material throughput

[d] Production parameters based on 2017/2018 operating year average

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	Fug 2a Coal Handling Emissions

Computed	GJR
Checked	KB
Sheets	NA

Calculation Assumptions:

Material throughput (maximum):	21.5 ton/hr
Moisture content[a]:	4.50 %
Mean wind speed:	10.3 mph (Grand Forks, ND)

Material Handling Emission Factor[a]:

$$E = k(0.0032) \frac{(U/5)^{1.3}}{(M/2)^{1.4}}$$

E = emission factor (lb/ton)
k (PM_{10}) = particle size constant (0.35)
k ($PM_{2.5}$) = particle size constant (0.053)
U = mean wind speed (mph)
M = material moisture content (%)

Material handling emission factor (PM_{10}):	9.21E-04 lb/ton
Material handling emission factor ($PM_{2.5}$):	5.33E-06 lb/ton

Material Handling (Dumping) Potentilal Emissions:

Material dump emissions (PM_{10})[C]:	0.020 lb/hr	0.087 ton/yr
Material dump emissions ($PM_{2.5}$)[C]:	0.000 lb/hr	0.001 ton/yr

[a] AP-42, Chapter 13.2.4, Aggregate Handling and Storage Piles
[c] Potential emissions based on a single dump operation of total material throughput

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Past Actual Emissions	Computed	GJR
Task	Fug 2b Coal Handling Wind Erosion	Checked	KB
		Sheets	NA

Storage Pile Data:

Active Spent Lime Disposal Area: 1.0 acres

Short Term Emission Basis: 10 percent of pile disturbed daily

Emission Factor Calculation[a]:

Maximum 2-min wind speed (U_{10})[b]: 19.7 m/sec

Threshold friction velocity (U_t)[c] 0.55 m/sec

Pile Orientation (A)[d] conical

PM_{10} multiplier (k): 0.5 constant

$PM_{2.5}$ multiplier (k): 0.075 constant

Pile Subarea U_s/U_r (na)	Wind Speed U_{10} (m/s)	Surface Wind Speed U_s [$U_{10}(U_s/U_r)$] (m/s)	Friction Velocity U* [$0.1U_s$] (m/s)	Friction Threshold U_t (m/s)	Threshold Comparison Yes or No [U* > U_t] (na)	Pile Area (%)	Subarea Pile Size (m^2)
0.2	19.7	3.94	0.394	0.55	No	5	202
0.2	19.7	3.94	0.394	0.55	No	35	1,416
0.6	19.7	11.82	1.182	0.55	Yes	48	1,943
0.9	19.7	17.73	1.773	0.55	Yes	12	486

For $U^*>U_t$: $P\ (g/m^2) = 58(U^* - U_t)^2 + 25(U^* - U_t)$

E (lb/disturbance) = (k)(P)(Area)/(453.59 g/lb)

Pile Subarea U_s/U_r	P (g/m^2)	E PM_{10} (lb/dist.)	E $PM_{2.5}$ (lb/dist.)
0.2	0.0	0.0	0.0
0.2	0.0	0.0	0.0
0.6	39.0	83.4	12.5
0.9	117.3	62.8	9.4
Total Pile Emissions		146.2	21.9

Emission Rate Calculation:

Emissions based on 5% of pile disturbed per 24-hrs:	PM_{10}		$PM_{2.5}$	
	0.61	lb/hr	0.09	lb/hr
	2.67	tons/yr	0.40	tons/yr

[a] AP-42, Chapter 13.2.5, Industrial Wind Erosion

[b] Grand Forks, ND, fastest mile

[c] AP-42, Table 13.2.5-2, Ground Coal

[d] AP-42, Figure 13.2.5-2, Contours of normalized surface windspeeds.

Computation

Job No.	10352890

Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	Fug 3 Limerock & Coke Handling Emissions

Computed	GJR
Checked	KB
Sheets	NA

Calculation Assumptions:

Material throughput (maximum):	13.1 ton/hr
Moisture content[a]:	2.10 %
Mean wind speed:	10.3 mph (Grand Forks, ND)

Material Handling Emission Factor[a]:

$$E = k(0.0032)\frac{(U/5)^{1.3}}{(M/2)^{1.4}}$$

E = emission factor (lb/ton)
k (PM_{10}) = particle size constant (0.35)
k ($PM_{2.5}$) = particle size constant (0.053)
U = mean wind speed (mph)
M = material moisture content (%)

Material handling emission factor (PM_{10}):	2.68E-03 lb/ton
Material handling emission factor ($PM_{2.5}$):	3.94E-06 lb/ton

Material Handling (Dumping) Potentilal Emissions:

Material dump emissions (PM_{10})[C]:	0.035 lb/hr	0.154 ton/yr
Material dump emissions ($PM_{2.5}$)[C]:	0.000 lb/hr	0.000 ton/yr

[a] AP-42, Chapter 13.2.4, Aggregate Handling and Storage Piles
[c] Potential emissions based on a single dump operation of total material throughput

Computation

Job No.	10352890

Project	American Crystal Sugar Company		Computed	GJR
Subject	Drayton Expansion 2022 - Past Actual Emissions		Checked	KB
Task	Fug 4 Spent Lime Wind Erosion		Sheets	NA

Storage Pile Data:

Active Spent Lime Disposal Area:	3.0 acres
Short Term Emission Basis:	5 percent of pile disturbed daily

Emission Factor Calculation[a]:

Maximum 2-min wind speed (U_{10})[b]:	19.7 m/sec
Threshold friction velocity (U_t)[c]	1.02 m/sec
Pile Orientation (A)[d]	conical
PM_{10} multiplier (k):	0.5 constant
$PM_{2.5}$ multiplier (k):	0.075 constant

Pile Subarea U_s/U_r (na)	Wind Speed U_{10} (m/s)	Surface Wind Speed U_s [$U_{10}(U_s/U_r)$] (m/s)	Friction Velocity U^* [$0.1U_s$] (m/s)	Friction Threshold U_t (m/s)	Threshold Comparison Yes or No [$U^* > U_t$] (na)	Pile Area (%)	Subarea Pile Size (m^2)
0.2	19.7	3.94	0.394	1.02	No	5	607
0.2	19.7	3.94	0.394	1.02	No	35	4,249
0.6	19.7	11.82	1.182	1.02	Yes	48	5,828
0.9	19.7	17.73	1.773	1.02	Yes	12	1,457

For $U^*>U_t$: $P\ (g/m^2) = 58(U^* - U_t)^2 + 25(U^* - U_t)$

E (lb/disturbance) = (k)(P)(Area)/(453.59 g/lb)

Pile Subarea U_s/U_r	P (g/m^2)	E PM_{10} (lb/dist.)	E $PM_{2.5}$ (lb/dist.)
0.2	0.0	0.0	0.0
0.2	0.0	0.0	0.0
0.6	5.6	35.8	5.4
0.9	51.7	83.0	12.5
Total Pile Emissions		118.8	17.8

Emission Rate Calculation:

	PM_{10}		$PM_{2.5}$	
Emissions based on 5% of pile disturbed per 24-hrs:	0.25	lb/hr	0.04	lb/hr
	1.08	tons/yr	0.16	tons/yr

[a] AP-42, Chapter 13.2.5, Industrial Wind Erosion
[b] Grand Forks, ND, fastest mile
[c] AP-42, Table 13.2.5-2, Overburden
[d] AP-42, Figure 13.2.5-2, Contours of normalized surface windspeeds.

HDR

Computation

Job No.	10352890
Project	American Crystal Sugar Company
Subject	Drayton Expansion 2022 - Past Actual Emissions
Task	Unpaved Road Fugitive Emissions
Computed	GJR
Checked	
Sheets	NA

PM Emissions

Vehicle Type	Vehicles Per Day	Mean Wt. (tons)	Round Trip (miles)	Silt Content (%)	PM (lb/VMT)	PM (lb/hr)	PM (tpy)
Beet Truck	160	25	1.025	4.8	6.77	49.99	170.08
Coal Truck	13	32.5					
Coke Truck	8	32.5	1.081	4.8	7.54	5.43	18.48
Anthracite Truck	8	32.5					
Spent Lime	12	22.5	1.305	4.8	6.39	4.17	14.18
Totals						**59.60**	**202.75**

PM_{10} Emissions

Vehicle Type	Vehicles Per Day	Mean Wt. (tons)	Round Trip (miles)	Silt Content (%)	PM_{10} (lb/VMT)	PM_{10} (lb/hr)	PM_{10} (tpy)
Beet Truck	160	25	1.025	4.8	1.72	12.74	43.35
Coal Truck	13	32.5					
Coke Truck	8	32.5	1.081	4.8	1.92	1.38	4.71
Anthracite Truck	8	32.5					
Spent Lime	12	22.5	1.305	4.8	1.63	1.06	3.61
Totals						**15.19**	**51.67**

$PM_{2.5}$ Emissions

Vehicle Type	Vehicles Per Day	Mean Wt. (tons)	Round Trip (miles)	Silt Content (%)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$ (lb/hr)	$PM_{2.5}$ (tpy)
Beet Truck	160	25	1.025	4.8	0.17	1.27	4.33
Coal Truck	13	32.5					
Coke Truck	8	32.5	1.081	4.8	0.19	0.14	0.47
Anthracite Truck	8	32.5					
Spent Lime	12	22.5	1.305	4.8	0.16	0.11	0.36
Totals						**1.52**	**5.17**

Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion 2022 - Past Actual Emissions	Computed	GJR
Task	Baseline Production Data	Checked	KB
		Sheets	NA

Production Data		2012		2013		2014		2015		2016		Baseline Years 2017		Baseline Years 2018		2019		2020		2021		Baseline Average	
Unit	Description	(hrs)	(tons)	(hrs)	(tons)	(hrs)	(tons)	(hrs)	(tons)	(hrs)	(tons)	(hrs)	(tons)	(hrs)	(tons)	(hrs)	(tons)	(hrs)	(tons)	(hrs)	(tons)	(hrs)	(tons)
EU1	Boiler	6,480	104,114	6,552	106,972	6,648	104,250	6,072	97,095	6,840	96,477	6,840	108,125	6,768	109,130	6,624	104,435	6,624	89,045	6,624	98,282	6,804	108,628
EU3	Pulp Dryer 2	6,432	14,866	6,552	16,274	6,648	17,077	6,072	16,507	6,456	15,346	6,509	18,026	6,648	18,135	6,504	14,331	5,712	12,404	5,568	13,697	6,579	18,081
EU4	Pulp Dryer 1	6,432	14,866	6,552	16,274	6,648	17,077	6,072	16,507	6,456	15,346	6,509	18,026	6,648	18,135	6,504	21,497	5,712	18,605	5,568	20,545	6,579	18,081
EU1a	Coal Handling	6,480	104,114	6,552	106,972	6,648	104,250	6,072	97,095	6,840	96,477	6,840	108,126	6,768	109,130	6,624	104,435	6,624	89,045	6,624	98,282	6,804	108,628
EU5	Lime Mixing Tank	6,384	67,688	6,552	81,433	6,648	74,485	6,072	62,754	6,672	76,528	6,509	75,635	6,648	81,296	6,504	83,277	5,712	65,856	-	-	6,579	78,466
EU6	Pellet Mills	6,384	-	6,552	-	6,648	-	6,072	-	6,456	-	6,509	-	6,648	-	6,504	-	5,712	-	5,568	-	6,579	-
EU7	Pellet Mills	6,384	-	6,552	-	6,648	-	6,072	-	6,456	-	6,509	-	6,648	-	6,504	-	5,712	-	5,568	-	6,579	-
EU8	Pellet Mills	6,384	-	6,552	-	6,648	-	6,072	-	6,456	-	6,509	-	6,648	-	6,504	-	5,712	-	5,568	-	6,579	-
EU9	Dry Pulp Conveyor	6,384	-	6,552	-	6,648	-	6,072	-	6,456	-	6,509	-	6,648	-	6,504	-	5,712	-	5,568	-	6,579	-
EU10	Dry Pulp Reclaim	6,324	-	6,552	-	6,648	-	6,072	-	6,456	-	6,509	-	6,648	-	6,504	-	5,712	-	5,568	-	6,579	-
EU11	Dry Pulp Bucket Elevator	6,324	-	6,552	-	6,648	-	6,072	-	6,456	-	6,509	-	6,648	-	6,504	-	5,712	-	5,568	-	6,579	-
EU12	Sugar Dryer/Granulator	6,384	252,898	6,552	264,538	6,648	273,468	6,072	256,005	6,456	292,255	6,509	290,998	6,648	343,750	3,288	155,460	-	-	-	-	6,579	317,374
EU13	Lime Kiln	6,384	67,688	6,552	81,433	6,648	74,485	6,072	62,754	6,456	76,528	6,509	75,635	6,648	81,296	6,504	83,277	5,712	65,856	1,540	22,118	6,579	78,466
EU14a	MAC2 Flow Headhouse	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU14b	Hummer Room Pulsaire	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU14c	Hummer Room MAC	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU15	Pellet Storage 1	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU16	Pellet Storage 2	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU17	Pellet Storage 3	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU19a	Bulk Loading	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU19b	North Bulk Sugar Loadout	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU19c	South Bulk Sugar Loadout	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU20	Main Sugar Warehouse	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-	8,760	-
EU21	Fire Pump	27	-	27	-	27	-	15	-	28	-	24	-	24	-	24	-	24	-	24	-	24	-
EU22	Pellet Mill/Cooler	6,432	-	6,552	-	6,648	-	6,072	-	6,456	-	6,509	-	6,648	-	6,504	-	5,712	-	5,568	-	6,579	-
EU23	Pulp Dryer Coal Hopper	6,432	-	6,552	-	6,648	-	6,072	-	6,456	-	6,509	-	6,648	-	6,624	-	5,712	-	5,568	-	6,579	-
EU25	Flume Lime Slaker	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
EU26	Lime Slaker	6,384	67,688	6,552	81,433	6,648	74,485	6,072	62,754	6,672	76,528	6,509	75,635	6,648	81,296	6,504	83,277	5,712	65,856	1,540	22,118	6,579	78,466
EU28	Lime Kiln	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,028	57,852	-	-
EU29	Sugar Dryer/Granulator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,288	147,282	5,712	-	5,568	NA	-	-
EU30	Lime Slaker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,568	57,852	-	-
EU32	Pellet Loadout	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,504	-	5,712	-	5,568	-	-	-

Note: 2019 to 2021 were transition years for first Drayton Expansion. EU28, EU29 and EU30 were brought online to replace EU12, EU13 and EU2€

Stack Test Results		PM		PM10		SO2		NOx		VOC	
EU1	Boiler	0.0724 lb/MMBtu	5/10/2011	0.0463 lb/MMBtu	3/8/2011	0.29 lb/MMBtu	4/1/2006	0.508 lb/MMBtu	4/1/2006		
EU1	Boiler	0.0106 lb/MMBtu	10/1/2015	0.0078 lb/MMBtu	10/1/2015	0.318 lb/MMBtu	10/1/2015				
EU1	Boiler	0.0067 lb/MMBtu	1/1/2018								
EU3	Pulp Dryer 2	22.08 lb/hr	3/1/2011			10.68 lb/hr	3/1/2011	10.9 lb/hr	11/1/1997	7.5 lb/hr	11/1/2006
EU3	Pulp Dryer 2	32.91 lb/hr	10/1/2015			0.116 lb/MMBtu	10/1/2015				
EU4	Pulp Dryer 1	32.197 lb/hr	3/1/2011			16.67 lb/hr	3/1/2011	13.1 lb/hr	11/1/1997	10.5 lb/hr	11/1/2006
EU4	Pulp Dryer 1	38.49 lb/hr	10/1/2015			0.165 lb/MMBtu	10/1/2015				
EU5	Lime Mixing Tank	0.257 lb/hr	2/1/2015								
EU22	Pellet Mill/Cooler	0.234 lb/hr	1/1/2008								
EU13	Lime Kiln	7.423 lb/hr	9/1/2007								

Appendix D

Air Toxics Analysis

Computation

Project	American Crystal Sugar Company
Subject	Drayton Expansion Phase II - Toxics Review
Task	Proposed Package Boiler

Job No.	10352890
Computed	GJR
Checked	MKD
Sheets	NA

Hours	Production (pph)	Fuel Type	Heat Content (Btu/scf)	Heat Input (MMBtu/hr)	Firing Rate (scf/hr)	Fuel Use (10^6 scf/yr)
8760	300,000	Natural Gas	1,020	359	352,237	3,086

Data and Constants Used in Calculating MICR and HI

Vent	Step 3 SCREEN3 in mg/m^3	Flow	PM Control	Acid Control		Multipliers Converting 1-Hour Concentrations			Conversion Factors	
						70-year	8-hour			
Boiler	0.008	100%	0%	0%		0.08	0.7		3600	Seconds Per Hour
									453.59	Grams Per Pound
									1000	µg Per mg

Hazardous Air Pollutants	CAS#	Emission Factor	Pollutant Emissions	
Organic Compounds:		**(lb/10^6 scf)**	**(lb/hr)**	**(TPY)**
Nitrous Oxide (N_2O)[a]	10024-97-2	2.20	7.75E-01	3.39E+00
Benzene[b]	71-43-2	2.10E-03	7.40E-04	3.24E-03
Dichlorobenzene[b]	25321-22-6	1.20E-03	4.23E-04	1.85E-03
Formaldehyde[b]	50-00-0	7.50E-02	2.64E-02	1.16E-01
Hexane[b]	110-54-3	1.80E+00	6.34E-01	2.78E+00
Toluene[b]	108-88-3	3.40E-03	1.20E-03	5.25E-03
POM/Dioxins/Furans:		**(lb/10^6 scf)**	**(lb/hr)**	**(TPY)**
Acenaphthene[b]	83-32-9	1.80E-06	6.34E-07	2.78E-06
Acenaphthylene[b]	203-96-8	1.80E-06	6.34E-07	2.78E-06
Anthracene[b]	120-12-7	2.40E-06	8.45E-07	3.70E-06
Benzo(a)anthracene[b]	56-55-3	1.80E-06	6.34E-07	2.78E-06
Benzo(a)pyrene[b]	50-32-8	1.20E-06	4.23E-07	1.85E-06
Benzo(b,j,k)fluoranthene[b]	205-99-2	1.80E-06	6.34E-07	2.78E-06
Benzo(g,h,i)perylene[b]	191-24-2	1.20E-06	4.23E-07	1.85E-06
Benzo(k)fluoranthene[b]	207-08-9	1.80E-06	6.34E-07	2.78E-06
Chrysene[b]	218-01-9	1.80E-06	6.34E-07	2.78E-06
Dibenzo(a,h)anthracene[b]	53-70-3	1.20E-06	4.23E-07	1.85E-06
7,12-Dimethylbenzene(a)anthracene[b]	NA	1.60E-05	5.64E-06	2.47E-05
Fluoranthene[b]	206-44-0	3.00E-06	1.06E-06	4.63E-06
Fluorene[b]	86-73-7	2.80E-06	9.86E-07	4.32E-06
Indeno(1,2,3-cd)pyrene[b]	193-39-5	1.80E-06	6.34E-07	2.78E-06
3-Methylcholanthrene[b]	56-49-5	1.80E-06	6.34E-07	2.78E-06
2-Methylnaphthalene[b]	91-57-6	2.40E-05	8.45E-06	3.70E-05
Naphthalene[b]	91-20-3	6.10E-04	2.15E-04	9.41E-04
Phenanathrene[b]	85-01-8	1.70E-05	5.99E-06	2.62E-05
Pyrene[b]	129-00-0	5.00E-06	1.76E-06	7.71E-06
Metals:		**(lb/10^6 scf)**	**(lb/hr)**	**(TPY)**
Arsenic[c]	7440-38-2	2.00E-04	7.04E-05	3.09E-04
Beryllium[c]	7440-41-7	1.20E-05	4.23E-06	1.85E-05
Cadmium[c]	7440-43-9	1.10E-03	3.87E-04	1.70E-03
Chromium[c]	7440-47-3	1.40E-03	4.93E-04	2.16E-03
Cobalt[c]	7440-48-4	8.40E-05	2.96E-05	1.30E-04
Lead[c]	7439-92-1	5.00E-04	1.76E-04	7.71E-04
Manganese[c]	7439-96-5	3.80E-04	1.34E-04	5.86E-04
Mercury[c]	7439-97-6	2.60E-04	9.16E-05	4.01E-04
Nickel[c]	7440-02-0	2.10E-03	7.40E-04	3.24E-03
Selenium[c]	7782-49-2	2.40E-05	8.45E-06	3.70E-05
			Total HAPs =	**2.9**

Hazardous Air Pollutants	Guideline Concentrations (GC) 1-Hour	Guideline Concentrations (GC) 8-Hour	Unit Risk Factor for Carcinogens	PM or Acid	Step 5 Pulp: Max 1-Hour Emission Rate	Step 5 Pulp: Off-Property 1-Hour Conc.	Step 6 Total Dryer Off-Property 1-Hour Conc. (MC)	Step 7a 70-Year Average Conc.	Step 7b MICR	Step 8a Total Dryer Off-Property 8-Hour Conc. (MC)	Step 8b 1-Hour MC/GC	Step 8b 8-Hour MC/GC	Step 8c Hazard Index
Organic Compounds:	**(mg/m^3)**	**(mg/m^3)**	**(m^3/µg)**		**(g/sec)**	**(mg/m^3)**	**(mg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(mg/m^3)**			
Nitrous Oxide (N_2O)[a]		1.80E+00			9.76E-02	7.47E-04	7.47E-04	5.98E-02		5.23E-04		2.91E-04	2.91E-04
Benzene[b]	1.60E-01	3.19E-02	7.80E-06		9.32E-05	7.13E-07	7.13E-07	5.71E-05	4.45E-10	4.99E-07	4.46E-06	1.57E-05	1.57E-05
Dichlorobenzene[b]	6.01E+00	3.01E+00			5.33E-05	4.08E-07	4.08E-07	3.26E-05		2.85E-07	6.78E-08	9.49E-08	9.49E-08
Formaldehyde[b]	7.37E-03		1.30E-05		3.33E-03	2.55E-05	2.55E-05	2.04E-03	2.65E-08	1.78E-05	3.46E-03		3.46E-03
Hexane[b]		3.53E+00			7.99E-02	6.12E-04	6.12E-04	4.89E-02		4.28E-04		1.21E-04	1.21E-04
Toluene[b]		1.51E+00			1.51E-04	1.16E-06	1.16E-06	9.24E-05		8.09E-07		5.37E-07	5.37E-07
POM/Dioxins/Furans:	**(mg/m^3)**	**(mg/m^3)**	**(m^3/µg)**		**(g/sec)**	**mg/m^3**	**mg/m^3**	**(µg/m^3)**	**(µg/m^3)**	**mg/m^3**			
Acenaphthene[b]													
Acenaphthylene[b]													
Anthracene[b]													
Benzo(a)anthracene[b]			1.10E-04		7.99E-08	6.12E-10	6.12E-10	4.89E-08	5.38E-12	4.28E-10			
Benzo(a)pyrene[b]			1.10E-03		5.33E-08	4.08E-10	4.08E-10	3.26E-08	3.59E-11	2.85E-10			
Benzo(b,j,k)fluoranthene[b]			1.10E-04		7.99E-08	6.12E-10	6.12E-10	4.89E-08	5.38E-12	4.28E-10			
Benzo(g,h,i)perylene[b]													
Benzo(k)fluoranthene[b]			1.10E-04		7.99E-08	6.12E-10	6.12E-10	4.89E-08	5.38E-12	4.28E-10			
Chrysene[b]			1.10E-05		7.99E-08	6.12E-10	6.12E-10	4.89E-08	5.38E-13	4.28E-10			
Dibenzo(a,h)anthracene[b]			1.20E-03		5.33E-08	4.08E-10	4.08E-10	3.26E-08	3.91E-11				
7,12-Dimethylbenzene(a)anthracene[b]			7.10E-02		7.10E-07	5.44E-09	5.44E-09	4.35E-07	3.09E-08	3.81E-09			
Fluoranthene[b]													
Fluorene[b]													
Indeno(1,2,3-cd)pyrene[b]			1.10E-04		7.99E-08	6.12E-10	6.12E-10	4.89E-08	5.38E-12	4.28E-10			
3-Methylcholanthrene[b]			6.30E-03		7.99E-08	6.12E-10	6.12E-10	4.89E-08	3.08E-10	4.28E-10			
2-Methylnaphthalene[b]													
Naphthalene[b]	1.57E+00	1.05E+00	3.40E-05		2.71E-05	2.07E-07	2.07E-07	1.66E-05	5.64E-10	1.45E-07	1.32E-07	1.38E-07	1.38E-07
Phenanathrene[b]													
Pyrene[b]													
Metals:	**(mg/m^3)**	**(mg/m^3)**	**(m^3/µg)**		**(g/sec)**	**mg/m^3**	**mg/m^3**	**(µg/m^3)**	**(µg/m^3)**	**mg/m^3**			
Arsenic[c]		2.00E-04	4.30E-03	PM	8.88E-06	6.79E-08	6.79E-08	5.44E-06	2.34E-08	4.76E-08		2.38E-04	2.38E-04
Beryllium[c]		1.00E-06	2.40E-03	PM	5.33E-07	4.08E-09	4.08E-09	3.26E-07	7.83E-10	2.85E-09		2.85E-03	2.85E-03
Cadmium[c]		2.00E-04	1.80E-03	PM	4.88E-05	3.74E-07	3.74E-07	2.99E-05	5.38E-08	2.62E-07		1.31E-03	1.31E-03
Chromium[c]		1.00E-02		PM	6.21E-05	4.76E-07	4.76E-07	3.81E-05		3.33E-07		3.33E-05	3.33E-05
Cobalt[c]		4.00E-04		PM	3.73E-06	2.85E-08	2.85E-08	2.28E-06		2.00E-08		4.99E-05	4.99E-05
Lead[c]		1.00E-03		PM	2.22E-05	1.70E-07	1.70E-07	1.36E-05		1.19E-07		1.19E-04	1.19E-04
Manganese[c]		4.00E-03		PM	1.69E-05	1.29E-07	1.29E-07	1.03E-05		9.04E-08		2.26E-05	2.26E-05
Mercury[c]		5.00E-04		PM	1.15E-05	8.83E-08	8.83E-08	7.07E-06		6.18E-08		1.24E-04	1.24E-04
Nickel[c]		3.00E-02		PM	9.32E-05	7.13E-07	7.13E-07	5.71E-05		4.99E-07		1.66E-05	1.66E-05
Selenium[c]		4.00E-03		PM	1.07E-06	8.15E-09	8.15E-09	6.52E-07		5.71E-09		1.43E-06	1.43E-06
								Dryer MICR =	**1.37E-07**			**Dryer HI =**	**8.65E-03**

Notes:

[a] AP42 (7/98) Table 1.4-2

[b] AP42 (7/98) Table 1.4-3

[c] AP42 (7/98) Table 1.4-4

Computation

Project	American Crystal Sugar Company
Subject	Drayton Expansion Phase II - Toxics Review
Task	Proposed New Pulp Dryer

Job No.	10352890
Computed	GJR
Checked	MKD
Sheets	NA

Hours	Throughput (tph)	Fuel Type	Heat Content (Btu/lb, Btu/scf)	Heat Input (MMBtu/hr)	Firing Rate (ton/hr, scf/hr)	Fuel Use (ton/yr, 10^6 scf/yr)
8760	65.0	Coal Natural Gas	9,400 1,020	162 40	8.6 39,216	75,485 344

Data and Constants Used in Calculating MICR and HI

Vent	Step 3 SCREEN3 in mg/m^3	Flow	PM Control	Acid Control[i]		Multipliers Converting 1-Hour Concentrations			Conversion Factors	
						70-year	8-hour			
Pulp	0.004	100%	0%	60%		0.08	0.7		3600	Seconds Per Hour
									453.59	Grams Per Pound
									1000	µg Per mg

Hazardous Air Pollutants	CAS#	Emission Factor	Pollutant Emissions		Guideline Concentrations (GC) 1-Hour	Guideline Concentrations (GC) 8-Hour	Unit Risk Factor for Carcinogens	PM or Acid	Step 5 Pulp: Max 1-Hour Emission Rate	Step 5 Pulp: Off-Property 1-Hour Conc.	Step 6 Total Dryer Off-Property 1-Hour Conc. (MC)	Step 7a 70-Year Average Conc.	Step 7b MICR	Step 8a Total Dryer Off-Property 8-Hour Conc. (MC)	Step 8b 1-Hour MC/GC	Step 8b 8-Hour MC/GC	Step 8c Hazard Index
Organic Compounds:		(lb/ton, lb/10^6 scf)	(lb/hr)	(TPY)	(mg/m^3)	(mg/m^3)	(m^3/µg)		(g/sec)	(mg/m^3)	(mg/m^3)	(µg/m^3)	(µg/m^3)	(mg/m^3)			
Nitrous Oxide (N_2O)[a] - coal	10024-97-2	0.04	4.31E-01	1.89E+00		1.80E+00			5.43E-02	2.03E-04	2.03E-04	1.62E-02		1.42E-04		7.88E-05	7.88E-05
Nitrous Oxide (N_2O)[j] - gas	10024-97-2	2.20															
Sulfuric Acid Mist (H_2SO_4)[b]	-	0.02	1.75E-01	7.66E-01		4.00E-03			2.20E-02	8.23E-05	8.23E-05	6.58E-03		5.76E-05		1.44E-02	1.44E-02
Acetaldehyde[c]	75-07-0	5.70E-04	4.91E-03	2.15E-02	9.01E-01		2.20E-06		6.19E-04	2.31E-06	2.31E-06	1.85E-04	4.07E-10	1.62E-06	2.56E-06		2.56E-06
Acetophenone[c]	98-86-2	1.50E-05	1.29E-04	5.66E-04		9.83E-01			1.63E-05	6.08E-08	6.08E-08	4.86E-06		4.26E-08		4.33E-08	4.33E-08
Acrolein[c]	107-02-8	2.90E-04	2.50E-03	1.09E-02	4.59E-03				3.15E-04	1.18E-06	1.18E-06	9.41E-05		8.23E-07	2.56E-04		2.56E-04
Benzene[c] - coal	71-43-2	1.30E-03	1.13E-02	4.94E-02	1.60E-01	3.19E-02	7.80E-06		1.42E-03	5.31E-06	5.31E-06	4.25E-04	3.31E-09	3.72E-06	3.32E-05	1.17E-04	1.17E-04
Benzene[k] - gas	71-43-2	2.10E-03															
Benzyl chloride[c]	100-44-7	7.00E-04	6.03E-03	2.64E-02	5.75E-02		4.90E-05		7.60E-04	2.84E-06	2.84E-06	2.27E-04	1.11E-08	1.99E-06	4.94E-05		4.94E-05
Bis(2-ethylhexyl)phthalate (DEHP)[c]	117-81-7	7.30E-05	6.29E-04	2.76E-03		1.00E-01	2.40E-06		7.93E-05	2.96E-07	2.96E-07	2.37E-05	5.68E-11	2.07E-07		2.07E-06	2.07E-06
Bromoform[c]	75-25-2	3.90E-05	3.36E-04	1.47E-03		1.03E-01	1.10E-06		4.23E-05	1.58E-07	1.58E-07	1.26E-05	1.39E-11	1.11E-07		1.07E-06	1.07E-06
Carbon disulfide[c]	75-15-0	1.30E-04	1.12E-03	4.91E-03	6.20E-02				1.41E-04	5.27E-07	5.27E-07	4.22E-05		3.69E-07	8.50E-06		8.50E-06
2-Chloroacetophenone[c]	532-27-4	7.00E-06	6.03E-05	2.64E-04		6.32E-03			7.60E-06	2.84E-08	2.84E-08	2.27E-06		1.99E-08		3.14E-06	3.14E-06
Chlorobenzene[c]	108-90-7	2.20E-05	1.90E-04	8.30E-04		9.21E-01			2.39E-05	8.92E-08	8.92E-08	7.14E-06		6.24E-08		6.78E-08	6.78E-08
Chloroform[c]	67-66-3	5.90E-05	5.08E-04	2.23E-03		9.77E-01	2.30E-05		6.41E-05	2.39E-07	2.39E-07	1.91E-05	4.40E-10	1.67E-07		1.71E-07	1.71E-07
Cumene[c]	98-82-8	5.30E-06	4.57E-05	2.00E-04		4.92E+00			5.75E-06	2.15E-08	2.15E-08	1.72E-06		1.50E-08		3.06E-09	3.06E-09
Cyanide[c]	57-12-5	2.50E-03	2.15E-02	9.44E-02		1.00E-01			2.71E-03	1.01E-05	1.01E-05	8.11E-04		7.09E-06		7.09E-05	7.09E-05
Dichlorobenzene[k] - gas	25321-22-6	1.20E-03	4.71E-05	2.06E-04	6.01E+00	3.01E+00			5.93E-06	2.21E-08	2.21E-08	1.77E-06		1.55E-08	3.68E-09	5.16E-09	5.16E-09
2,4-Dinitrotoluene[c]	121-14-2	2.80E-07	2.41E-06	1.06E-05		4.00E-03	8.90E-05		3.04E-07	1.14E-09	1.14E-09	9.08E-08	8.08E-12	7.95E-10		1.99E-07	1.99E-07
Dimethyl sulfate[c]	77-78-1	4.80E-05	4.14E-04	1.81E-03		1.03E-02			5.21E-05	1.95E-07	1.95E-07	1.56E-05		1.36E-07		1.32E-05	1.32E-05
Ethylbenzene[c]	100-41-4	9.40E-05	8.10E-04	3.55E-03	1.09E+01	8.68E+00	2.50E-06		1.02E-04	3.81E-07	3.81E-07	3.05E-05	7.62E-11	2.67E-07	3.51E-08	3.07E-08	3.51E-08
Ethyl chloride[c]	75-00-3	4.20E-05	3.62E-04	1.59E-03		5.28E+00			4.56E-05	1.70E-07	1.70E-07	1.36E-05		1.19E-07		2.26E-08	2.26E-08
Ethylene dichloride[c]	107-06-2	4.00E-05	3.45E-04	1.51E-03		8.09E-01	2.60E-05		4.34E-05	1.62E-07	1.62E-07	1.30E-05	3.37E-10	1.14E-07		1.40E-07	1.40E-07
Ethylene dibromide[c]	106-93-4	1.20E-06	1.03E-05	4.53E-05			6.00E-04		1.30E-06	4.86E-09	4.86E-09	3.89E-07	2.34E-10	3.41E-09			
Formaldehyde[c] - coal	50-00-0	2.40E-04	5.01E-03	2.19E-02	7.37E-03		1.30E-05		6.31E-04	2.36E-06	2.36E-06	1.89E-04	2.45E-09	1.65E-06	3.20E-04		3.20E-04
Formaldehyde[k] - gas	50-00-0	7.50E-02															
Hexane[c] - coal	110-54-3	6.70E-05	7.12E-02	3.12E-01		3.53E+00			8.97E-03	3.35E-05	3.35E-05	2.68E-03		2.34E-05		6.65E-06	6.65E-06
Hexane[k] - gas	110-54-3	1.80E+00															
Isophorone[c]	78-59-1	5.80E-04	5.00E-03	2.19E-02	5.65E-01		2.70E-07		6.30E-04	2.35E-06	2.35E-06	1.88E-04	5.08E-11	1.65E-06	4.16E-06		4.16E-06
Methyl bromide[c]	74-83-9	1.60E-04	1.38E-03	6.04E-03		7.77E-02			1.74E-04	6.49E-07	6.49E-07	5.19E-05		4.54E-07		5.84E-06	5.84E-06
Methyl chloride[c]	74-87-3	5.30E-04	4.57E-03	2.00E-02	4.13E+00	2.07E+00			5.75E-04	2.15E-06	2.15E-06	1.72E-04		1.50E-06	5.20E-07	7.28E-07	7.28E-07
Methyl hydrazine[c]	60-34-4	1.70E-04	1.46E-03	6.42E-03		3.80E-04	3.10E-04		1.85E-04	6.89E-07	6.89E-07	5.51E-05	1.71E-08	4.82E-07		1.27E-03	1.27E-03
Methyl methacrylate[c]	80-62-6	2.00E-05	1.72E-04	7.55E-04	8.19E+00	4.10E+00			2.17E-05	8.11E-08	8.11E-08	6.49E-06		5.68E-08	9.90E-09	1.39E-08	1.39E-08
Methyl tert butyl ether[c]	1634-04-4	3.50E-05	3.02E-04	1.32E-03		3.61E+00	2.60E-07		3.80E-05	1.42E-07	1.42E-07	1.14E-05	2.95E-12	9.93E-08		2.75E-08	2.75E-08
Methylene chloride[c]	75-09-2	2.90E-04	2.50E-03	1.09E-02			4.70E-07		3.15E-04	1.18E-06	1.18E-06	9.41E-05	4.42E-11	8.23E-07			
Phenol[c]	108-95-2	1.60E-05	1.38E-04	6.04E-04		3.85E-01			1.74E-05	6.49E-08	6.49E-08	5.19E-06		4.54E-08		1.18E-07	1.18E-07
Propionaldehyde[c]	123-38-6	3.80E-04	3.27E-03	1.43E-02		9.51E-01			4.13E-04	1.54E-06	1.54E-06	1.23E-04		1.08E-06		1.13E-06	1.13E-06
Tetrachlorethylene (Perc)[c]	127-18-4	4.30E-05	3.71E-04	1.62E-03	1.36E+01	3.39E+00			4.67E-05	1.74E-07	1.74E-07	1.39E-05		1.22E-07	1.29E-08	3.60E-08	3.60E-08
Toluene[c] - coal	108-88-3	2.40E-04	2.20E-03	9.64E-03		1.51E+00			2.77E-04	1.04E-06	1.04E-06	8.29E-05		7.25E-07		4.81E-07	4.81E-07
Toluene[k] - gas	108-88-3	3.40E-03															
1,1,1-Trichloroethane (methyl chloroform)[c]	71-55-6	2.00E-05	1.72E-04	7.55E-04	4.91E+01	3.82E+01	1.60E-05		2.17E-05	8.11E-08	8.11E-08	6.49E-06	1.04E-10	5.68E-08	1.65E-09	1.49E-09	1.65E-09
Styrene[c]	100-42-5	2.50E-05	2.15E-04	9.44E-04	3.41E+00	1.70E+00			2.71E-05	1.01E-07	1.01E-07	8.11E-06		7.09E-08	2.97E-08	4.16E-08	4.16E-08
Vinyl acetate[c]	108-05-4	7.60E-06	6.55E-05	2.87E-04	1.06E+00	7.04E-01			8.25E-06	3.08E-08	3.08E-08	2.46E-06		2.16E-08	2.92E-08	3.06E-08	3.06E-08
Xylenes[c]	1330-20-7	3.70E-05	3.19E-04	1.40E-03	1.30E+01	8.68E+00			4.02E-05	1.50E-07	1.50E-07	1.20E-05		1.05E-07	1.15E-08	1.21E-08	1.21E-08
POM/Dioxins/Furans:		(lb/ton, lb/10^6 scf)	(lb/hr)	(TPY)	(mg/m^3)	(mg/m^3)	(m^3/µg)		(g/sec)	mg/m^3	mg/m^3	(µg/m^3)	(µg/m^3)	mg/m^3			
Acenaphthene[d] - coal	83-32-9	5.10E-07	4.47E-06	1.96E-05													
Acenaphthene[k] - gas	83-32-9	1.80E-06															
Acenaphthylene[d] - coal	203-96-8	2.50E-07	2.22E-06	9.74E-06													
Acenaphthylene[k] - gas	203-96-8	1.80E-06															

Anthracene[d] - coal	120-12-7	2.10E-07	1.90E-06	8.34E-06													
Anthracene[k] - gas	120-12-7	2.40E-06															
Benzo(a)anthracene[d] - coal	56-55-3	8.00E-08	7.60E-07	3.33E-06			1.10E-04		9.58E-08	3.58E-10	3.58E-10	2.86E-08	3.15E-12	2.50E-10			
Benzo(a)anthracene[k] - gas	56-55-3	1.80E-06															
Benzo(a)pyrene[d] - coal	50-32-8	3.80E-08	3.75E-07	1.64E-06			1.10E-03		4.72E-08	1.76E-10	1.76E-10	1.41E-08	1.55E-11	1.23E-10			
Benzo(a)pyrene[k] - gas	50-32-8	1.20E-06															
Benzo(b,j,k)fluoranthene[d] - coal	205-99-2	1.10E-07	1.02E-06	4.46E-06			1.10E-04		1.28E-07	4.79E-10	4.79E-10	3.83E-08	4.22E-12	3.35E-10			
Benzo(b,j,k)fluoranthene[k] - gas	205-99-2	1.80E-06															
Benzo(g,h,i)perylene[d] - coal	191-24-2	2.70E-08	2.80E-07	1.23E-06													
Benzo(g,h,i)perylene[k] - gas	191-24-2	1.20E-06															
Benzo(k)fluoranthene[k] - gas	207-08-9	1.80E-06	7.06E-08	3.09E-07			1.10E-04		8.89E-09	3.32E-11	3.32E-11	2.66E-09	2.92E-13	2.32E-11			
Biphenyl[d]	92-52-4	1.70E-06	1.46E-05	6.42E-05		2.50E-02			1.85E-06	6.89E-09	6.89E-09	5.51E-07		4.82E-09		1.93E-07	1.93E-07
Chrysene[d] - coal	218-01-9	1.00E-07	9.32E-07	4.08E-06			1.10E-05		1.17E-07	4.39E-10	4.39E-10	3.51E-08	3.86E-13	3.07E-10			
Chrysene[k] - gas	218-01-9	1.80E-06															
Dibenzo(a,h)anthracene[k] - gas	53-70-3	1.20E-06	4.71E-08	2.06E-07			1.20E-03		5.93E-09	2.21E-11	2.21E-11	1.77E-09	2.13E-12				
7,12-Dimethylbenzene(a)anthracene[k] - gas	NA	1.60E-05	6.27E-07	2.75E-06			7.10E-02		7.91E-08	2.95E-10	2.95E-10	2.36E-08	1.68E-09	2.07E-10			
Fluoranthene[d] - coal	206-44-0	7.10E-07	6.24E-06	2.73E-05													
Fluoranthene[k] - gas	206-44-0	3.00E-06															
Fluorene[d] - coal	86-73-7	9.10E-07	7.95E-06	3.48E-05													
Fluorene[k] - gas	86-73-7	2.80E-06															
Indeno(1,2,3-cd)pyrene[d] - coal	193-39-5	6.10E-08	5.96E-07	2.61E-06			1.10E-04		7.51E-08	2.81E-10	2.81E-10	2.24E-08	2.47E-12	1.96E-10			
Indeno(1,2,3-cd)pyrene[k] - gas	193-39-5	1.80E-06															
5-Methyl chrysene[d]	3697-24-3	2.20E-08	1.90E-07	8.30E-07			1.10E-03		2.39E-08	8.92E-11	8.92E-11	7.14E-09	7.85E-12	6.24E-11			
3-Methylcholanthrene[k] - gas	56-49-5	1.80E-06	7.06E-08	3.09E-07			6.30E-03		8.89E-09	3.32E-11	3.32E-11	2.66E-09	1.67E-11	2.32E-11			
2-Methylnaphthalene[k] - gas	91-57-6	2.40E-05	9.41E-07	4.12E-06													
Naphthalene[d] - coal	91-20-3	1.30E-05	1.12E-04	4.91E-04	1.57E+00	1.05E+00	3.40E-05		1.41E-05	5.27E-08	5.27E-08	4.22E-06	1.43E-10	3.69E-08	3.35E-08	3.52E-08	3.52E-08
Naphthalene[k] - gas	91-20-3	6.10E-04	2.39E-05	1.05E-04													
Phenanathrene[d] - coal	85-01-8	2.70E-06	2.39E-05	1.05E-04													
Phenanathrene[k] - gas	85-01-8	1.70E-05															
Pyrene[d] - coal	129-00-0	3.30E-07	3.04E-06	1.33E-05													
Pyrene[k] - gas	129-00-0	5.00E-06															
Total TCDD[e]	-	3.93E-10	3.39E-09	1.48E-08			3.30E+01		4.27E-10	1.59E-12	1.59E-12	1.27E-10	4.21E-09	1.12E-12			
Total HxCDD[e]	-	3.00E-09	2.59E-08	1.13E-07			1.30E+00		3.26E-09	1.22E-11	1.22E-11	9.73E-10	1.26E-09	8.51E-12			
Acid Gases:		**(lb/ton)**	**(lb/hr)**	**(TPY)**	**(mg/m^3)**	**(mg/m^3)**	**$(m^3/\mu g)$**		**(g/sec)**	**mg/m^3**	**mg/m^3**	**$(\mu g/m^3)$**	**$(\mu g/m^3)$**	**mg/m^3**			
HCl (Hydrochloric acid)[f]	7647-01-0	2.40E-02	2.07E-01	9.06E-01	0.0597			Acid	1.04E-02	3.89E-05	3.89E-05	3.11E-03		2.72E-05	6.52E-04		6.52E-04
HF (Hydrofluoric acid)[g]	7664-39-3	2.65E-02	2.29E-01	1.00E+00	0.0327	0.00818		Acid	1.15E-02	4.30E-05	4.30E-05	3.44E-03		3.01E-05	1.32E-03	3.68E-03	3.68E-03
Metals:		**$(lb/ton, lb/10^6 scf)$**	**(lb/hr)**	**(TPY)**	**(mg/m^3)**	**(mg/m^3)**	**$(m^3/\mu g)$**		**(g/sec)**	**mg/m^3**	**mg/m^3**	**$(\mu g/m^3)$**	**$(\mu g/m^3)$**	**mg/m^3**			
Antimony[h]	7440-36-0	1.80E-05	1.55E-04	6.79E-04		1.00E-02		PM	1.95E-05	7.30E-08	7.30E-08	5.84E-06		5.11E-08		5.11E-06	5.11E-06
Arsenic[h] - coal	7440-38-2	4.10E-04	3.54E-03	1.55E-02		2.00E-04	4.30E-03	PM	4.46E-04	1.67E-06	1.67E-06	1.33E-04	5.73E-07	1.17E-06		5.83E-03	5.83E-03
Arsenic[l] - gas	7440-38-2	2.00E-04															
Beryllium[h] - coal	7440-41-7	2.10E-05	1.81E-04	7.95E-04		1.00E-06	2.40E-03	PM	2.29E-05	8.54E-08	8.54E-08	6.83E-06	1.64E-08	5.98E-08		5.98E-02	5.98E-02
Beryllium[l] - gas	7440-41-7	1.20E-05															
Cadmium[h] - coal	7440-43-9	5.10E-05	4.83E-04	2.11E-03		2.00E-04	1.80E-03	PM	6.08E-05	2.27E-07	2.27E-07	1.82E-05	3.27E-08	1.59E-07		7.95E-04	7.95E-04
Cadmium[l] - gas	7440-43-9	1.10E-03															
Chromium[h] - coal	7440-47-3	2.60E-04	2.30E-03	1.01E-02		1.00E-02		PM	2.89E-04	1.08E-06	1.08E-06	8.64E-05		7.56E-07		7.56E-05	7.56E-05
Chromium[l] - gas	7440-47-3	1.40E-03															
Cobalt[h] - coal	7440-48-4	1.00E-04	8.65E-04	3.79E-03		4.00E-04		PM	1.09E-04	4.07E-07	4.07E-07	3.26E-05		2.85E-07		7.12E-04	7.12E-04
Cobalt[l] - gas	7440-48-4	8.40E-05															
Lead[h] - coal	7439-92-1	4.20E-04	3.64E-03	1.59E-02		1.00E-03		PM	4.58E-04	1.71E-06	1.71E-06	1.37E-04		1.20E-06		1.20E-03	1.20E-03
Lead[l] - gas	7439-92-1	5.00E-04															
Manganese[h] - coal	7439-96-5	4.90E-04	4.24E-03	1.86E-02		4.00E-03		PM	5.34E-04	1.99E-06	1.99E-06	1.59E-04		1.40E-06		3.49E-04	3.49E-04
Manganese[l] - gas	7439-96-5	3.80E-04															
Mercury[h] - coal	7439-97-6	8.30E-05	7.25E-04	3.18E-03		5.00E-04		PM	9.14E-05	3.41E-07	3.41E-07	2.73E-05		2.39E-07		4.78E-04	4.78E-04
Mercury[l] - gas	7439-97-6	2.60E-04															
Nickel[h] - coal	7440-02-0	2.80E-04	2.50E-03	1.09E-02		3.00E-02		PM	3.14E-04	1.17E-06	1.17E-06	9.39E-05		8.22E-07		2.74E-05	2.74E-05
Nickel[l] - gas	7440-02-0	2.10E-03															
Selenium[h] - coal	7782-49-2	1.30E-03	1.12E-02	4.91E-02		4.00E-03		PM	1.41E-03	5.27E-06	5.27E-06	4.22E-04		3.69E-06		9.22E-04	9.22E-04
Selenium[l] - gas	7782-49-2	2.40E-05															
			Total HAPs =	**2.7**								**Dryer MICR =**	**6.65E-07**			**Dryer HI =**	**9.11E-02**

Notes:

[a] AP42 (9/98) Table 1.1-19

[b] AP42 (9/98) Table 1.1-3, maximum sulfur content of 0.5 percent and 60% inherent control
EPRI (3/12) Estimating Total Sulfuric Acid Emissions from Stationary Power Plants, 0.29% of SO_2

[c] AP-42 (9/98) Table 1.1-14

[d] AP-42 (9/98) Table 1.1-13

[e] AP-42 (9/98) Table 1.1-12

[f] Spring Creek Mine Coal Specification, 16.65 ppm Cl

[g] Spring Creek Mine Coal Specification, 41.9 ppm F as HF. Also incorporates 60% inherent control.

[h] AP42 (9/98) Table 1.1-18

[i] The pulp dryer represents 60% control of acid gases (and SO_2) provided by inherent scrubbing properties of the pulp.

[j] AP42 (7/98) Table 1.4-2

[k] AP42 (7/98) Table 1.4-3

[l] AP42 (7/98) Table 1.4-4

HDR Computation

Project	American Crystal Sugar Company	Job No.	10352890
Subject	Drayton Expansion Phase II - Toxics Review	Computed	GJR
Task	Proposed New Dryer and Package Boiler	Checked	MKD
		Sheets	NA

Total Project Emissions From:
Proposed New Dryer
Proposed New Package Boiler

Constants Used in Calculating MICR and HI				
Multipliers Converting 1-Hour Concentrations			Conversion Factors	
70-year	8-hour		3600	Seconds Per Hour
0.08	0.7		453.59	Grams Per Pound
			1000	µg Per mg

Hazardous Air Pollutants	CAS#	Pollutant Emissions		Guideline Concentrations (GC)		Unit Risk Factor for Carcinogens	PM or Acid	Step 6	Step 7a	Step 7b	Step 8a	Step 8b		Step 8c
								Total Off-Property 1-Hour Conc. (MC)	70-Year Average Conc.	MICR	Total Off-Property 8-Hour Conc. (MC)	1-Hour MC/GC	8-Hour MC/GC	Hazard Index
		lb/hr	TPY	1-Hour	8-Hour									
Organic Compounds:				(mg/m^3)	(mg/m^3)	(m^3/µg)		mg/m^3	(µg/m^3)	(µg/m^3)	mg/m^3			
Nitrous Oxide (N_2O)	10024-97-2	1.21E+00	5.28E+00		1.8			9.50E-04	7.60E-02		6.65E-04		3.70E-04	3.70E-04
Sulfuric Acid Mist (H_2SO_4)	-	1.75E-01	7.66E-01		0.004			8.23E-05	6.58E-03		5.76E-05		1.44E-02	1.44E-02
Acetaldehyde	75-07-0	4.91E-03	2.15E-02	0.901		2.20E-06		2.31E-06	1.85E-04	4.07E-10	1.62E-06	2.56E-06		2.56E-06
Acetophenone	98-86-2	1.29E-04	5.66E-04		0.983			6.08E-08	4.86E-06		4.26E-08		4.33E-08	4.33E-08
Acrolein	107-02-8	2.50E-03	1.09E-02	0.00459				1.18E-06	9.41E-05		8.23E-07	2.56E-04		2.56E-04
Benzene	71-43-2	1.20E-02	5.27E-02	0.16	0.0319	7.80E-06		6.02E-06	4.82E-04	3.76E-09	4.22E-06	3.76E-05	1.32E-04	1.32E-04
Benzyl chloride	100-44-7	6.03E-03	2.64E-02	0.0575		4.90E-05		2.84E-06	2.27E-04	1.11E-08	1.99E-06	4.94E-05		4.94E-05
Bis(2-ethylhexyl)phthalate	117-81-7	6.29E-04	2.76E-03			2.40E-06		2.96E-07	2.37E-05	5.68E-11	2.07E-07			
Bromoform	75-25-2	3.36E-04	1.47E-03		0.103	1.10E-06		1.58E-07	1.26E-05	1.39E-11	1.11E-07		1.07E-06	1.07E-06
Carbon disulfide	75-15-0	1.12E-03	4.91E-03	0.062				5.27E-07	4.22E-05		3.69E-07	8.50E-06		8.50E-06
2-Chloroacetophenone	532-27-4	6.03E-05	2.64E-04		0.00632			2.84E-08	2.27E-06		1.99E-08		3.14E-06	3.14E-06
Chlorobenzene	108-90-7	1.90E-04	8.30E-04		0.921			8.92E-08	7.14E-06		6.24E-08		6.78E-08	6.78E-08
Chloroform	67-66-3	5.08E-04	2.23E-03		0	2.30E-05		2.39E-07	1.91E-05	4.40E-10	1.67E-07			
Cumene	98-82-8	4.57E-05	2.00E-04		4.916			2.15E-08	1.72E-06		1.50E-08		3.06E-09	3.06E-09
Cyanide	57-12-5	2.15E-02	9.44E-02		0.1			1.01E-05	8.11E-04		7.09E-06		7.09E-05	7.09E-05
Dichlorobenzene	25321-22-6	4.70E-04	2.06E-03	6.01E+00	3.01E+00			4.08E-07	3.26E-05		2.85E-07	6.78E-08	9.49E-08	9.49E-08
2,4-Dinitrotoluene	121-14-2	2.41E-06	1.06E-05		0.004	8.90E-05		1.14E-09	9.08E-08	8.08E-12	7.95E-10		1.99E-07	1.99E-07
Dimethyl sulfate	77-78-1	4.14E-04	1.81E-03		0.0103			1.95E-07	1.56E-05		1.36E-07		1.32E-05	1.32E-05
Ethylbenzene	100-41-4	8.10E-04	3.55E-03	10.855	8.684	2.50E-06		3.81E-07	3.05E-05	7.62E-11	2.67E-07	3.51E-08	3.07E-08	3.51E-08
Ethyl chloride	75-00-3	3.62E-04	1.59E-03		5.278			1.70E-07	1.36E-05		1.19E-07		2.26E-08	2.26E-08
Ethylene dichloride	107-06-2	3.45E-04	1.51E-03		0.809	2.60E-05		1.62E-07	1.30E-05	3.37E-10	1.14E-07		1.40E-07	1.40E-07
Ethylene dibromide	106-93-4	1.03E-05	4.53E-05			6.00E-04		4.86E-09	3.89E-07	2.34E-10	3.41E-09			
Formaldehyde	50-00-0	3.14E-02	1.38E-01	0.00737		1.30E-05		2.78E-05	2.23E-03	2.90E-08	1.95E-05	3.78E-03		3.78E-03
Hexane	110-54-3	7.05E-01	3.09E+00		3.525			6.45E-04	5.16E-02		4.52E-04		1.28E-04	1.28E-04
Isophorone	78-59-1	5.00E-03	2.19E-02	0.565		2.70E-07		2.35E-06	1.88E-04	5.08E-11	1.65E-06	4.16E-06		4.16E-06
Methyl bromide	74-83-9	1.38E-03	6.04E-03		0.0777			6.49E-07	5.19E-05		4.54E-07		5.84E-06	5.84E-06
Methyl chloride	74-87-3	4.57E-03	2.00E-02	4.13	2.065			2.15E-06	1.72E-04		1.50E-06	5.20E-07	7.28E-07	7.28E-07
Methyl hydrazine	60-34-4	1.46E-03	6.42E-03		0.00038	3.10E-04		6.89E-07	5.51E-05	1.71E-08	4.82E-07		1.27E-03	1.27E-03
Methyl methacrylate	80-62-6	1.72E-04	7.55E-04	8.191	4.095			8.11E-08	6.49E-06		5.68E-08	9.90E-09	1.39E-08	1.39E-08
Methyl tert butyl ether	1634-04-4	3.02E-04	1.32E-03		3.606	2.60E-07		1.42E-07	1.14E-05	2.95E-12	9.93E-08		2.75E-08	2.75E-08
Methylene chloride	75-09-2	2.50E-03	1.09E-02			4.70E-07		1.18E-06	9.41E-05	4.42E-11	8.23E-07			
Phenol	108-95-2	1.38E-04	6.04E-04		0.385			6.49E-08	5.19E-06		4.54E-08		1.18E-07	1.18E-07
Propionaldehyde	123-38-6	3.27E-03	1.43E-02		0.951			1.54E-06	1.23E-04		1.08E-06		1.13E-06	1.13E-06
Tetrachlorethylene (Perc)	127-18-4	3.71E-04	1.62E-03	13.562	3.391			1.74E-07	1.39E-05		1.22E-07	1.29E-08	3.60E-08	3.60E-08
Toluene	108-88-3	3.40E-03	1.49E-02		1.507			2.19E-06	1.75E-04		1.53E-06		1.02E-06	1.02E-06
1,1,1-Trichloroethane (methyl chloroform)	71-55-6	1.72E-04	7.55E-04	49.112	38.198			8.11E-08	6.49E-06		5.68E-08	1.65E-09	1.49E-09	1.65E-09
Styrene	100-42-5	2.15E-04	9.44E-04	3.408	1.704			1.01E-07	8.11E-06		7.09E-08	2.97E-08	4.16E-08	4.16E-08
Vinyl acetate	108-05-4	6.55E-05	2.87E-04	1.056	0.704			3.08E-08	2.46E-06		2.16E-08	2.92E-08	3.06E-08	3.06E-08
Xylenes	1330-20-7	3.19E-04	1.40E-03	13.026	8.684			1.50E-07	1.20E-05		1.05E-07	1.15E-08	1.21E-08	1.21E-08
POM/Dioxins/Furans:				(mg/m^3)	(mg/m^3)	(m^3/µg)		mg/m^3	(µg/m^3)	(µg/m^3)	mg/m^3			
Benzo(a)anthracene	56-55-3	1.39E-06	6.11E-06			1.10E-04		9.69E-10	7.75E-08	8.53E-12	6.78E-10			
Benzo(a)pyrene	50-32-8	7.97E-07	3.49E-06			1.10E-03		5.84E-10	4.67E-08	5.14E-11	4.09E-10			

Benzo(b,j,k)fluoranthene	205-99-2	1.65E-06	7.24E-06			1.10E-04		1.09E-09	8.73E-08	9.60E-12	7.63E-10			
Benzo(k)fluoranthene	207-08-9	6.34E-07	2.78E-06			1.10E-04		6.12E-10	4.89E-08	5.38E-12	4.28E-10			
Biphenyl	92-52-4	1.46E-05	6.42E-05		0.025			6.89E-09	5.51E-07		4.82E-09		1.93E-07	1.93E-07
Chrysene	218-01-9	1.57E-06	6.86E-06			1.10E-05		1.05E-09	8.40E-08	9.24E-13	7.35E-10			
Dibenzo(a,h)anthracene	53-70-3	4.23E-07	1.85E-06			1.20E-03		4.08E-10	3.26E-08	3.91E-11	2.85E-10			
7,12-Dimethylbenzene(a)anthracene	NA	5.64E-06	2.47E-05			7.10E-02		5.44E-09	4.35E-07	3.09E-08	3.81E-09			
Indeno(1,2,3-cd)pyrene	193-39-5	1.23E-06	5.39E-06			1.10E-04		8.92E-10	7.14E-08	7.85E-12	6.24E-10			
5-Methyl chrysene	3697-24-3	1.90E-07	8.30E-07			1.10E-03		8.92E-11	7.14E-09	7.85E-12	6.24E-11			
3-Methylcholanthrene	56-49-5	6.34E-07	2.78E-06			6.30E-03		6.12E-10	4.89E-08	3.08E-10	4.28E-10			
Naphthalene	91-20-3	3.27E-04	1.43E-03	1.573	1.0486	3.40E-05		2.60E-07	2.08E-05	7.07E-10	1.82E-07	1.65E-07	1.74E-07	1.74E-07
Total TCDD	NA	3.39E-09	1.48E-08			3.30E+01		1.59E-12	1.27E-10	4.21E-09	1.12E-12			
Total HxCDD	NA	2.59E-08	1.13E-07			1.30E+00		1.22E-11	9.73E-10	1.26E-09	8.51E-12			
Acid Gases:				**(mg/m^3)**	**(mg/m^3)**	**(m^3/µg)**		**mg/m^3**	**(µg/m^3)**	**(µg/m^3)**	**mg/m^3**			
HCl (Hydrochloric acid)	7647-01-0	2.07E-01	9.06E-01	0.0597			Acid	3.89E-05	3.11E-03		2.72E-05	6.52E-04		6.52E-04
HF (Hydrofluoric acid)	7664-39-3	2.29E-01	1.00E+00	0.0327	0.00818		Acid	4.30E-05	3.44E-03		3.01E-05	1.32E-03	3.68E-03	3.68E-03
Metals:				**(mg/m^3)**	**(mg/m^3)**	**(m^3/µg)**		**mg/m^3**	**(µg/m^3)**	**(µg/m^3)**	**mg/m^3**			
Antimony	7440-36-0	1.55E-04	6.79E-04		0.01		PM	7.30E-08	5.84E-06		5.11E-08		5.11E-06	5.11E-06
Arsenic	7440-38-2	3.61E-03	1.58E-02		0.0002	4.30E-03	PM	1.73E-06	1.39E-04	5.96E-07	1.21E-06		6.07E-03	6.07E-03
Beryllium	7440-41-7	1.86E-04	8.13E-04		0.000001	2.40E-03	PM	8.94E-08	7.15E-06	1.72E-08	6.26E-08		6.26E-02	6.26E-02
Cadmium	7440-43-9	8.70E-04	3.81E-03		0.0002	1.80E-03	PM	6.01E-07	4.81E-05	8.65E-08	4.21E-07		2.10E-03	2.10E-03
Chromium	7440-47-3	2.79E-03	1.22E-02		0.01		PM	1.56E-06	1.24E-04		1.09E-06		1.09E-04	1.09E-04
Cobalt	7440-48-4	8.95E-04	3.92E-03		0.0004		PM	4.35E-07	3.48E-05		3.05E-07		7.62E-04	7.62E-04
Lead	7439-92-1	3.81E-03	1.67E-02		0.001		PM	1.88E-06	1.51E-04		1.32E-06		1.32E-03	1.32E-03
Manganese	7439-96-5	4.37E-03	1.91E-02		0.004		PM	2.12E-06	1.70E-04		1.49E-06		3.71E-04	3.71E-04
Mercury	7439-97-6	8.17E-04	3.58E-03		0.0005		PM	4.30E-07	3.44E-05		3.01E-07		6.01E-04	6.01E-04
Nickel	7440-02-0	3.23E-03	1.42E-02		0.03		PM	1.89E-06	1.51E-04		1.32E-06		4.40E-05	4.40E-05
Selenium	7782-49-2	1.12E-02	4.91E-02		0.004		PM	5.28E-06	4.22E-04		3.70E-06		9.24E-04	9.24E-04
		Total HAPs =	**5.607**						**Total MICR =**	**8.00E-07**			**Total HI =**	**9.97E-02**

12/22/22
12:59:56

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 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 13043 ***

ACS Drayton Phase II Boiler

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE              =        POINT
   EMISSION RATE (G/S)      =     1.000000
   STACK HEIGHT (M)         =      36.5760
   STK INSIDE DIAM (M)      =       1.3720
   STK EXIT VELOCITY (M/S)=      33.5380
   STK GAS EXIT TEMP (K)    =     449.8200
   AMBIENT AIR TEMP (K)     =     293.0000
   RECEPTOR HEIGHT (M)      =       0.0000
   URBAN/RURAL OPTION       =        RURAL
   BUILDING HEIGHT (M)      =      25.3000
   MIN HORIZ BLDG DIM (M) =      69.0000
   MAX HORIZ BLDG DIM (M) =     320.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =   53.957 M**4/S**3;  MOM. FLUX =  344.787 M**4/S**2.

*** FULL METEOROLOGY ***

*********************************
*** SCREEN DISCRETE DISTANCES ***
*********************************

*** TERRAIN HEIGHT OF     0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
205.	6.405	4	15.0	18.2	4800.0	37.25	15.94	17.43	SS
225.	6.832	4	15.0	18.2	4800.0	37.38	17.35	18.30	SS
250.	7.235	4	15.0	18.2	4800.0	37.56	19.12	19.40	SS
275.	7.655	4	15.0	18.2	4800.0	37.76	20.87	20.69	SS
300.	7.488	4	15.0	18.2	4800.0	37.97	22.61	21.41	SS
350.	7.115	4	15.0	18.2	4800.0	38.44	26.05	22.83	SS
400.	6.715	4	15.0	18.2	4800.0	38.97	29.45	24.23	SS
450.	6.309	4	15.0	18.2	4800.0	39.54	32.82	25.61	SS
500.	5.913	4	15.0	18.2	4800.0	40.16	36.15	26.97	SS
550.	5.534	4	15.0	18.2	4800.0	40.82	39.45	28.32	SS
600.	5.203	4	15.0	18.2	4800.0	41.40	42.72	29.65	SS

```
 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
****************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)      =    0.000       CONC (UG/M**3)      =    0.000
  CRIT WS @10M (M/S) =    99.99       CRIT WS @10M (M/S) =    99.99
  CRIT WS @ HS (M/S) =    99.99       CRIT WS @ HS (M/S) =    99.99
  DILUTION WS (M/S)  =    99.99       DILUTION WS (M/S)  =    99.99
  CAVITY HT (M)      =    26.47       CAVITY HT (M)      =    25.30
  CAVITY LENGTH (M)  =   134.55       CAVITY LENGTH (M)  =    71.80
  ALONGWIND DIM (M)  =    69.00       ALONGWIND DIM (M)  =   320.00

CAVITY CONC NOT CALCULATED FOR CRIT WS > 20.0 M/S.  CONC SET = 0.0

****************************************
      END OF CAVITY CALCULATIONS
****************************************


     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION         MAX CONC    DIST TO   TERRAIN
  PROCEDURE         (UG/M**3)    MAX (M)    HT (M)
--------------    -----------  ---------   -------
SIMPLE TERRAIN       7.655         275.        0.


***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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12/22/22
12:57:20

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 13043 ***

ACS Drayton Phase II Pulp Dryer

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	POINT
EMISSION RATE (G/S)	=	1.000000
STACK HEIGHT (M)	=	54.8680
STK INSIDE DIAM (M)	=	1.6760
STK EXIT VELOCITY (M/S)	=	21.3820
STK GAS EXIT TEMP (K)	=	398.7100
AMBIENT AIR TEMP (K)	=	293.0000
RECEPTOR HEIGHT (M)	=	0.0000
URBAN/RURAL OPTION	=	RURAL
BUILDING HEIGHT (M)	=	25.3000
MIN HORIZ BLDG DIM (M)	=	69.0000
MAX HORIZ BLDG DIM (M)	=	320.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 39.039 M**4/S**3; MOM. FLUX = 235.937 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
151.	1.898	6	4.0	10.2	10000.0	69.93	7.34	23.13	HS
175.	2.372	6	4.0	10.2	10000.0	71.51	8.32	24.81	HS
200.	2.853	6	4.0	10.2	10000.0	73.06	9.31	26.54	HS
225.	3.311	6	4.0	10.2	10000.0	74.55	10.29	28.26	HS
250.	3.733	6	4.0	10.2	10000.0	75.98	11.25	29.99	HS
275.	3.734	6	4.0	10.2	10000.0	77.37	12.20	31.11	HS
300.	3.203	6	4.0	10.2	10000.0	78.71	13.14	31.28	HS
350.	2.420	6	4.0	10.2	10000.0	81.29	14.99	31.63	HS
400.	2.042	4	15.0	19.4	4800.0	68.76	29.77	33.69	HS
450.	2.343	1	3.0	3.4	960.0	153.88	106.41	91.30	NO
500.	2.723	1	3.0	3.4	960.0	153.88	116.52	108.41	NO
550.	2.858	1	3.0	3.4	960.0	153.88	126.22	131.13	NO

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   600.    2.849       1     2.5    2.8   800.0  173.68  137.14  157.64    NO

 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
****************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    0.000        CONC (UG/M**3)     =    0.000
  CRIT WS @10M (M/S) =    99.99        CRIT WS @10M (M/S) =    99.99
  CRIT WS @ HS (M/S) =    99.99        CRIT WS @ HS (M/S) =    99.99
  DILUTION WS (M/S)  =    99.99        DILUTION WS (M/S)  =    99.99
  CAVITY HT (M)      =    26.47        CAVITY HT (M)      =    25.30
  CAVITY LENGTH (M)  =   134.55        CAVITY LENGTH (M)  =    71.80
  ALONGWIND DIM (M)  =    69.00        ALONGWIND DIM (M)  =   320.00

CAVITY CONC NOT CALCULATED FOR CRIT WS > 20.0 M/S.  CONC SET = 0.0

****************************************
      END OF CAVITY CALCULATIONS
****************************************


     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------  ---------   -------
SIMPLE TERRAIN       3.734         275.        0.


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** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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Appendix E

Model Parameter Data

American Crystal Sugar Company
Drayton, ND
Modeling Source Parameters - Phase II Expansion

Emission Point	Description	UTM Coordinates x (m)	y (m)	Elev. (m)	Height (m)	Temp (K)	Flow (acfm)	Velocity (m/s)	Dia. (m)	Orient. (vert/horz)	Notes
EP1	B&W Boiler	634,538.2	5,383,772.1	243.8	45.72	533.2	207,000	22.5	2.35	Vertical	
EP1a	Coal Handling Equipment	634,518.7	5,383,766.2	243.8	25.91	294.3	1,700	0.001	0.001	Horizontal	
~~EP3~~	~~Pulp Dryer No. 2~~	~~634,468.5~~	~~5,383,839.7~~	~~243.8~~	~~64.01~~	~~398.7~~	~~50,000~~	~~20.2~~	~~1.22~~	~~Vertical~~	Removed from service as part of current project.
EP4	Pulp Dryer No. 1	634,464.9	5,383,839.7	243.8	54.87	384.8	127,000	33.0	1.52	Vertical	Modified as part of 2016 expansion.
~~EP5~~	~~Lime Mixing Tank & Kiln Cooler~~	~~634,519.2~~	~~5,383,802.3~~	~~243.8~~	~~9.45~~	~~399.8~~	~~8,500~~	~~0.001~~	~~0.001~~	~~Horizontal~~	Removed from service as part of 2016 expansion.
~~EP6~~	~~Pellet Mill No. 1~~	~~634,476.4~~	~~5,383,941.2~~	~~243.8~~	~~23.77~~	~~310.9~~	~~7,952~~	~~3.21~~	~~1.22~~	~~Vertical~~	Removed from service as part of 2016 expansion.
EP30	Pulp Pellet Mills/Cooler	634,495.0	5,383,941.4	243.8	7.01	294.3	35,000	36.22	0.76	Vertical	New emission unit.
~~EP7~~	~~Pellet Mill No. 2~~	~~634,476.1~~	~~5,383,943.9~~	~~243.8~~	~~23.77~~	~~310.9~~	~~11,000~~	~~4.45~~	~~1.22~~	~~Vertical~~	Removed from service as part of 2016 expansion.
~~EP8~~	~~Pellet Mill No. 3~~	~~634,481.4~~	~~5,383,943.8~~	~~243.8~~	~~23.77~~	~~310.9~~	~~11,000~~	~~4.45~~	~~1.22~~	~~Vertical~~	Removed from service as part of 2016 expansion.
EP9	Dry Pulp Belt Conveyor	634,518.0	5,383,849.8	243.8	6.71	310.9	6,000	0.001	0.001	Horizontal	
EP10	Dry Pulp Reclaim System	634,473.3	5,383,946.8	243.8	7.31	310.9	3,500	0.001	0.001	Horizontal	
~~EP11~~	~~Dry Pulp Bucket Elevator~~	~~634,518.6~~	~~5,383,844.1~~	~~243.8~~	~~17.37~~	~~310.9~~	~~3,500~~	~~0.001~~	~~0.001~~	~~Horizontal~~	Emissions routed to EP9 as part of 2016 expansion.
~~EP12~~	~~Sugar Dryer~~	~~634,478.4~~	~~5,383,733.8~~	~~243.8~~	~~27.43~~	~~312.0~~	~~18,000~~	~~0.001~~	~~0.76~~	~~Horizontal~~	Removed from service as part of 2016 expansion.
EP28	Sugar Dryer	634,478.4	5,383,733.8	243.8	27.43	329.2	38,000	15.38	1.22	Vertical	Added as part of 2016 expansion.
~~EP13~~	~~Belgian Lime Kiln~~	~~634,514.1~~	~~5,383,784.2~~	~~243.8~~	~~38.71~~	~~376.5~~	~~3,242~~	~~21.0~~	~~0.30~~	~~Vertical~~	Removed from service as part of 2016 expansion.
EP27a	Kiln Balance Vent	634,565.9	5,383,761.9	243.8	53.34	317.0	4,531	16.2	0.41	Vertical	Added as part of 2016 expansion.
EP27b	Kiln Carbonation Vent	634,512.6	5,383,797.1	243.8	33.53	358.1	8,662	6.3	0.91	Vertical	Added as part of 2016 expansion. No particulate emissions.
EP27c	Kiln CO2 Pressure Vent	634,515.9	5,383,797.1	243.8	33.53	313.2	492	4.6	0.25	Vertical	Added as part of 2016 expansion. Intermittent operation - not modeled.
EP27d	Kiln Startup Bypass	634,570.9	5,383,761.9	243.8	65.84	448.2	11,734	19.0	0.61	Vertical	Added as part of 2016 expansion. Intermittent operation - not modeled.
EP14a	MAC2 Flow Headhouse	634,494.1	5,383,726.9	243.8	26.22	302.6	20,000	0.001	0.001	Horizontal	
EP14b	Old Hummer Room Pulsaire	634,488.6	5,383,726.9	243.8	22.25	302.6	19,000	0.001	0.001	Horizontal	
EP14c	Hummer Room MAC	-	-	-	-	-	-	-	-	-	Emission unit vents Internally - no external stack.
EP15	Pulp Pellet Bin No. 1	634,426.9	5,383,932.8	243.8	18.90	294.3	NA	0.001	0.001	Horizontal	Only one emission unit operated at any time.
~~EP16~~	~~Pulp Pellet Bin No. 2~~	~~634,440.2~~	~~5,383,949.1~~	~~243.8~~	~~18.90~~	~~294.3~~	~~NA~~	~~0.001~~	~~0.001~~	~~Horizontal~~	Only one emission unit operated at any time.
~~EP17~~	~~Pulp Pellet Bin No. 3~~	~~634,440.2~~	~~5,383,949.1~~	~~243.8~~	~~18.90~~	~~294.3~~	~~NA~~	~~0.001~~	~~0.001~~	~~Horizontal~~	Only one emission unit operated at any time.
EP18	Sugar Warehouse (Hi-Vac)	-	-	-	-	-	-	-	-	-	Emission unit vents Internally - no external stack.
EP19a	Bulk Loading Pulsaire	634,436.9	5,383,673.3	243.8	4.72	294.3	NA	0.001	0.001	Horizontal	
EP19b	North Bulk Sugar Loadout	-	-	-	-	-	-	-	-	-	Emission unit vents Internally - no external stack.
EP19c	South Bulk Sugar Loadout	-	-	-	-	-	-	-	-	-	Emission unit vents Internally - no external stack.
EP20	Main Sugar Warehouse Pulsaire	634,469.5	5,383,641.9	243.8	12.19	294.3	10,500	0.001	0.001	Horizontal	
EP21	Diesel Fire Suppression Pump	-	-	-	-	-	-	-	-	-	Intermittent/emergency operation - not modeled.
~~EP22~~	~~Pulp Pellet Mill & Cooler~~	~~634,478.8~~	~~5,383,945.3~~	~~243.8~~	~~24.99~~	~~294.3~~	~~9,998~~	~~28.7~~	~~0.46~~	~~Vertical~~	Removed from service as part of 2016 expansion.
EP23	Pulp Dryer Coal Hopper	634,497.6	5,383,847.8	243.8	23.16	294.3	5,200	0.001	0.001	Horizontal	
EP24	Flume Lime Slaker	634,519.2	5,383,801.5	243.8	6.10	294.3	NA	0.001	0.001	Horizontal	
~~EP25~~	~~Lime Slaker~~	~~634,519.4~~	~~5,383,800.4~~	~~243.8~~	~~15.24~~	~~294.3~~	~~4,500~~	~~0.001~~	~~0.001~~	~~Horizontal~~	Removed from service as part of 2016 expansion.
EP29	New Lime Slaker	634,574.4	5,383,753.0	243.8	24.38	337.6	3,000	2.75	0.81	Vertical	Added as part of 2016 expansion.
EP31	Pulp Pellet Loadout	634,444.4	5,383,949.7	243.8	7.62	294.3	1,000	10.11	0.24	Vertical	
EP32	Package Boiler	634,524.1	5,383,784.2	243.8	36.58	449.8	105,000	33.54	1.37	Vertical	New emission unit.
EP33	New Pulp Dryer No. 2	634,468.5	5,383,839.7	243.8	54.86	398.7	100,000	21.38	1.68	Vertical	New emission unit.

Emission Point	Description	UTM Coordinates x (m)	y (m)	Elev. (m)	Rel. Ht. (m)	E. Length (m)	N. Length (m)	Angle (°)	Init. Vert. (m)	Note
~~Fug 1~~	~~Pellet Loadout Emissions~~	~~634,446.8~~	~~5,383,938.7~~	~~243.8~~	~~3.66~~	~~5.0~~	~~20.0~~	~~-2.0~~	~~11.77~~	Replaced with pellet loadout baghouse.
Fug 2	Coal Handling Emissions	634,518.2	5,383,428.4	243.8	3.05	18.5	115.0	-2.0	1.52	Fugitive source.
Fug 3	Lime Rock Handling Emissions	634,582.6	5,383,680.6	243.8	1.83	45.0	60.0	-2.0	0.91	Fugitive source.
Fug 4	Spent Lime Wind Erosion	635,097.1	5,384,717.2	243.8	1.83	70.0	125.0	-2.0	0.91	Fugitive source.

American Crystal Sugar Company
Drayton, ND
$PM/PM_{10}/PM_{2.5}$ Modeling Parameters - Phase II Expansion

Emission	Description	UTM Coordinates		Elev.	Height	Temp	Flow	Velocity	Dia.	Orient.	PM	PM_{10}	PM_{10}	$PM_{2.5}$	$PM_{2.5}$
Point		x (m)	y (m)	(m)	(m)	(K)	(acfm)	(m/s)	(m)	(vert/horz)	(lb/hr)	(lb/hr)	(g/sec)	(lb/hr)	(g/sec)
EP1	B&W Boiler	634,538.2	5,383,772.1	243.8	45.72	559.3	207,000	22.5	2.35	Vertical	15.60	29.80	3.75	25.20	3.18
EP1a	Coal Handling Equipment	634,518.7	5,383,766.2	243.8	25.91	294.3	1,700	0.001	0.001	Horizontal	0.29	0.29	0.04	0.07	0.01
EP4	Pulp Dryer No. 1	634,464.9	5,383,839.7	243.8	54.86	384.8	127,000	33.0	1.52	Vertical	48.00	88.80	11.19	81.60	10.28
EP30	New Pulp Pellet Mills & Cooler	634,495.0	5,383,941.4	243.8	7.01	294.3	35,000	36.2	0.76	Vertical	1.50	1.50	0.19	0.35	0.04
EP9	Dry Pulp Belt Conveyor & Bucket	634,518.0	5,383,849.8	243.8	6.71	310.9	6,000	0.001	0.001	Horizontal	0.30	0.30	0.04	0.06	0.01
EP10	Dry Pulp Reclaim System	634,473.3	5,383,946.8	243.8	7.31	310.9	3,500	0.001	0.001	Horizontal	0.60	0.60	0.08	0.10	0.01
EP28	Sugar Dryer	634,478.4	5,383,733.8	243.8	27.43	329.2	38,000	15.4	1.22	Vertical	2.20	2.20	0.28	0.50	0.06
EP27a	Kiln Balance Vent	634,565.9	5,383,761.9	243.8	53.34	317.0	4,531	16.2	0.41	Vertical	10.97	10.97	1.38	6.63	0.84
EP14a	MAC2 Flow Headhouse	634,494.1	5,383,726.9	243.8	26.22	302.6	20,000	0.001	0.001	Horizontal	3.43	3.43	0.43	0.79	0.10
EP14b	Old Hummer Room Pulsaire	634,488.6	5,383,726.9	243.8	22.25	302.6	19,000	0.001	0.001	Horizontal	3.26	3.26	0.41	0.75	0.09
EP15	Pulp Pellet Bin No. 1	634,426.9	5,383,932.8	243.8	18.90	294.3	2,140	0.001	0.001	Horizontal	0.37	0.37	0.05	0.06	0.01
EP19a	Bulk Loading Pulsaire	634,436.9	5,383,673.3	243.8	4.72	294.3	2,560	0.001	0.001	Horizontal	0.11	0.11	0.01	0.03	0.004
EP20	Main Sugar Warehouse Pulsaire	634,469.5	5,383,641.9	243.8	12.19	294.3	10,500	0.001	0.001	Horizontal	0.45	0.45	0.06	0.10	0.01
EP23	Pulp Dryer Coal Hopper	634,497.6	5,383,847.8	243.8	23.16	294.3	5,200	0.001	0.001	Horizontal	0.89	0.89	0.11	0.21	0.03
EP24	Flume Lime Slaker	634,519.2	5,383,801.5	243.8	6.10	294.3	NA	0.001	0.001	Horizontal	0.04	0.04	0.01	0.01	0.001
EP29	New Lime Slaker	634,574.4	5,383,753.0	243.8	24.38	337.6	3,000	2.7	0.81	Vertical	3.33	3.33	0.42	1.24	0.16
EP31	Pulp Pellet Loadout	634,444.4	5,383,949.7	243.8	7.62	294.3	1,000	10.11	0.24	Vertical	0.04	0.04	0.01	0.01	0.001
EP32	Package Boiler	634,524.1	5,383,784.2	243.8	36.58	449.8	105,000	33.54	1.37	Vertical	2.68	2.68	0.34	2.68	0.34
EP33	New Pulp Dryer No. 2	634,468.5	5,383,839.7	243.8	54.86	398.7	100,000	21.38	1.68	Vertical	31.90	59.00	7.43	36.70	4.62

Emission	Description	UTM Coordinates		Elev.	Rel. Ht.	E. Length	N. Length	Angle	Init. Vert.	Orient.	PM	PM_{10}	PM_{10}	$PM_{2.5}$	$PM_{2.5}$
Point		x (m)	y (m)	(m)	(m)	(m)	(m)	(°)	(m)		(lb/hr)	(lb/hr)	(g/sec)	(lb/hr)	(g/sec)
Fug 2	Coal Handling Emissions	634,518.2	5,383,428.4	243.8	3.05	18.5	115.0	-2.0	1.52	Fugitive	0.64	0.64	0.08	0.09	0.01
Fug 3	Lime Rock Handling Emissions	634,582.6	5,383,680.6	243.8	1.83	45.0	60.0	-2.0	0.91	Fugitive	0.10	0.10	0.01	3.41E-05	4.30E-06
Fug 4	Spent Lime Wind Erosion	635,097.1	5,384,717.2	243.8	1.83	70.0	125.0	-2.0	0.91	Fugitive	0.25	0.25	0.03	0.04	0.01

Emission	Description	UTM Coordinates		Elev.	Height	Temp	Flow	Velocity	Dia.	Orient.	PM	PM_{10}	PM_{10}	$PM_{2.5}$	$PM_{2.5}$
Point		x (m)	y (m)	(m)	(m)	(K)	(acfm)	(m/s)	(m)	(vert/horz)	(lb/hr)	(lb/hr)	(g/sec)	(lb/hr)	(g/sec)
ETH1	Background - DDG Dryer 1	617538.1	5364872.0	251.2	24.38	399.8	30000	21.56	0.91	Vertical	2.20	2.20	0.28	2.20	0.28
ETH2	Background - Biomass Boiler 1	617538.1	5364872.0	251.2	24.38	505.4	17550	12.61	0.91	Vertical	0.20	0.20	0.03	0.20	0.03
ETH3	Background - Biomass Boiler 2	617538.1	5364872.0	251.2	24.38	505.4	17550	12.61	0.91	Vertical	0.20	0.20	0.03	0.20	0.03
ETH4	Background - DDG Dryer 2	617506.8	5364866.6	251.2	10.67	410.9	13000	21.02	0.61	Vertical	1.11	1.11	0.14	1.11	0.14
ETH5	Background - Grain Handling	617566.0	5364904.7	251.2	12.19	293.0	NA	0.01	0.30	Horizontal	6.25	6.25	0.79	6.25	0.79
DEVP	Background - Boiler	516654.0	5363730.0	254.5	45.72	433.0	26552	2.68	2.44	Vertical	33.12	33.12	4.17	33.12	4.17

American Crystal Sugar Company
Drayton, ND
NO_x Modeling Parameters - Phase II Expansion

Emission Point	Description	UTM Coordinates x (m)	y (m)	Elev. (m)	Height (m)	Temp (K)	Flow (acfm)	Velocity (m/s)	Dia. (m)	Orient. (vert/horz)	NO_x (lb/hr)	NO_x (g/sec)
EP1	B&W Boiler	634,538.2	5,383,772.1	243.8	45.72	559.3	207,000	22.5	2.35	Vertical	198.5	25.01
EP4	Pulp Dryer No. 1	634,464.9	5,383,839.7	243.8	54.86	384.8	127,000	33.0	1.52	Vertical	54.3	6.84
EP27a	Kiln Balance Vent	634,565.9	5,383,761.9	243.8	53.34	317.0	4,531	16.2	0.41	Vertical	8.04	1.01
EU28b	Kiln Carbonation Vent	634,512.6	5,383,797.1	243.8	33.53	358.1	8,662	6.3	0.91	Vertical	18.76	2.36
EP32	Package Boiler	634,524.1	5,383,784.2	243.8	36.58	449.8	105,000	33.54	1.37	Vertical	7.2	0.91
EP33	New Pulp Dryer No. 2	634,468.5	5,383,839.7	243.8	54.86	398.7	100,000	21.38	1.68	Vertical	46.8	5.90

Emission Point	Description	UTM Coordinates x (m)	y (m)	Elev. (m)	Height (m)	Temp (K)	Flow (acfm)	Velocity (m/s)	Dia. (m)	Orient. (vert/horz)	NO_x (lb/hr)	NO_x (g/sec)
ETH1	Background - DDG Dryer 1	617538.1	5364872.0	251.2	24.38	399.8	30000	21.56	0.91	Vertical	10.40	1.31
ETH2	Background - Biomass Boiler 1	617538.1	5364872.0	251.2	24.38	505.4	17550	12.61	0.91	Vertical	7.80	0.98
ETH3	Background - Biomass Boiler 2	617538.1	5364872.0	251.2	24.38	505.4	17550	12.61	0.91	Vertical	7.80	0.98
DEVP	Background - Boiler	516654.0	5363730.0	254.5	45.72	433.0	26552	2.68	2.44	Vertical	32.12	4.05
SDC	Background - Boiler	616553.4	5364016.7	254.5	45.72	533.0	18428	1.86	2.44	Vertical	5.00	0.63

American Crystal Sugar Company
Drayton, ND
SO_2 Modeling Parameters - Phase II Expansion

Emission Point	Description	UTM Coordinates x (m)	UTM Coordinates y (m)	Elev. (m)	Height (m)	Temp (K)	Flow (acfm)	Velocity (m/s)	Dia. (m)	Orient. (vert/horz)	SO_2 (lb/hr)	SO_2 (g/sec)
EP1	B&W Boiler	634,538.2	5,383,772.1	243.8	45.72	559.3	207,000	22.5	2.35	Vertical	364.9	45.98
EP4	Pulp Dryer No. 1	634,464.9	5,383,839.7	243.8	54.86	384.8	127,000	33.0	1.52	Vertical	46.6	5.87
EP27a	Kiln Balance Vent	634,565.9	5,383,761.9	243.8	53.34	317.0	4,531	16.2	0.41	Vertical	3.34	0.42
EU28b	Kiln Carbonation Vent	634,512.6	5,383,797.1	243.8	33.53	358.1	8,662	6.3	0.91	Vertical	0.39	0.05
EP32	Package Boiler	634,524.1	5,383,784.2	243.8	36.58	449.8	105,000	33.54	1.37	Vertical	0.21	0.03
EP33	New Pulp Dryer No. 2	634,468.5	5,383,839.7	243.8	54.86	398.7	100,000	21.38	1.68	Vertical	60.30	7.60

Emission Point	Description	UTM Coordinates x (m)	UTM Coordinates y (m)	Elev. (m)	Height (m)	Temp (K)	Flow (acfm)	Velocity (m/s)	Dia. (m)	Orient. (vert/horz)	SO_2 (lb/hr)	SO_2 (g/sec)
ETH1	Background - DDG Dryer 1	617538.1	5364872.0	251.2	24.38	399.8	30000	21.56	0.91	Vertical	18.20	2.29
ETH2	Background - Biomass Boiler 1	617538.1	5364872.0	251.2	24.38	505.4	17550	12.61	0.91	Vertical	8.30	1.05
ETH3	Background - Biomass Boiler 2	617538.1	5364872.0	251.2	24.38	505.4	17550	12.61	0.91	Vertical	8.30	1.05
DEVP	Background - Boiler	516654.0	5363730.0	254.5	45.72	433.0	26552	2.68	2.44	Vertical	99.68	12.56

American Crystal Sugar Company
Drayton, ND
CO Modeling Parameters - Phase II Expansion

Emission Point	Description	UTM Coordinates x (m)	UTM Coordinates y (m)	Elev. (m)	Height (m)	Temp (K)	Flow (acfm)	Velocity (m/s)	Dia. (m)	Orient. (vert/horz)	CO (lb/hr)	CO (g/sec)
EP1	B&W Boiler	634,538.2	5,383,772.1	243.8	45.72	559.3	207,000	22.5	2.35	Vertical	52.1	6.56
EP4	Pulp Dryer No. 1	634,464.9	5,383,839.7	243.8	54.86	384.8	127,000	33.0	1.52	Vertical	455.0	57.33
EP27a	Kiln Balance Vent	634,565.9	5,383,761.9	243.8	53.34	317.0	4,531	16.2	0.41	Vertical	156.2	19.68
EU28b	Kiln Carbonation Vent	634,512.6	5,383,797.1	243.8	33.53	358.1	8,662	6.3	0.91	Vertical	364.4	45.92
EP32	Package Boiler	634,524.1	5,383,784.2	243.8	36.58	449.8	105,000	33.54	1.37	Vertical	13.3	1.67
EP33	New Pulp Dryer No. 2	634,468.5	5,383,839.7	243.8	54.86	398.7	100,000	21.38	1.68	Vertical	458.3	57.74

American Crystal Sugar Company
Drayton, ND
PM_{10} Baseline Increment Modeling Parameters (Minor Source Baseline Date Jan 13, 1978)

											24-Hour		Annual	
Emission Point	**Description**	**UTM Coordinates x (m)**	**y (m)**	**Elev. (m)**	**Height (m)**	**Temp (K)**	**Flow (acfm)**	**Velocity (m/s)**	**Dia. (m)**	**Orient. (vert/horz)**	**PM_{10} (lb/hr)**	**PM_{10} (g/sec)**	**PM_{10} (lb/hr)**	**PM_{10} (g/sec)**
PEP1	B&W Boiler	634,538.2	5,383,772.1	243.8	36.57	490.2	172,306	18.6	2.36	Vertical	-37.52	-4.73	-26.34	-3.32
PEP1a	Coal Handling Equipment	634,518.7	5,383,766.2	243.8	25.91	294.3	1,700	0.001	0.001	Horizontal	-0.29	-0.04	-0.16	-0.02
PEP2	Startup Boiler	634,504.0	5,383,770.4	243.8	30.50	566.1	19,431	14.1	0.91	Vertical	-1.62	-0.20	0.00	0.00
PEP3A	Pulp Dryer No. 2 Stack 1	634,488.9	5,383,845.1	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-18.70	-2.36	-10.14	-1.28
PEP3B	Pulp Dryer No. 2 Stack 2	634,485.4	5,383,845.0	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-18.70	-2.36	-10.14	-1.28
PEP3C	Pulp Dryer No. 2 Stack 3	634,481.7	5,383,844.8	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-18.70	-2.36	-10.14	-1.28
PEP3D	Pulp Dryer No. 2 Stack 4	634,478.2	5,383,844.8	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-18.70	-2.36	-10.14	-1.28
PEP4A	Pulp Dryer No. 1 Stack 1	634,489.0	5,383,841.9	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-25.39	-3.20	-13.76	-1.73
PEP4B	Pulp Dryer No. 1 Stack 2	634,485.5	5,383,841.7	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-25.39	-3.20	-13.76	-1.73
PEP4C	Pulp Dryer No. 1 Stack 3	634,481.8	5,383,841.5	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-25.39	-3.20	-13.76	-1.73
PEP4D	Pulp Dryer No. 1 Stack 4	634,478.2	5,383,841.5	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-25.39	-3.20	-13.76	-1.73
PEP4E	Pulp Dryer No. 1 Stack 5	634,474.7	5,383,841.5	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-25.39	-3.20	-13.76	-1.73
PEP5	Lime Mixing Tank	634,519.2	5,383,802.3	243.8	9.45	399.8	8,500	0.001	0.001	Horizontal	-0.65	-0.08	-0.54	-0.07
PEP6	Pellet Mill No. 1	634,476.4	5,383,941.2	243.8	23.77	310.9	11,007	4.45	1.22	Vertical	-3.7	-0.47	-2.01	-0.25
PEP7	Pellet Mill No. 2	634,476.1	5,383,943.9	243.8	23.77	310.9	11,007	4.45	1.22	Vertical	-3.7	-0.47	-2.01	-0.25
PEP8	Pellet Mill No. 3	634,481.4	5,383,943.8	243.8	23.77	310.9	11,007	4.45	1.22	Vertical	-3.7	-0.47	-2.01	-0.25
PEP9	Dry Pulp Belt Conveyor	634,518.0	5,383,849.8	243.8	20.42	310.9	3,500	0.001	0.001	Horizontal	-0.60	-0.08	-0.33	-0.04
PEP10	Dry Pulp Reclaim System	634,473.3	5,383,946.8	243.8	7.31	310.9	3,500	0.001	0.001	Horizontal	-0.60	-0.08	-0.33	-0.04
PEP11	Dry Pulp Bucket Elevator	634,518.6	5,383,844.1	243.8	17.37	310.9	3,500	0.001	0.001	Horizontal	-0.60	-0.08	-0.33	-0.04
PEP12	Sugar Dryer	634,478.4	5,383,733.8	243.8	27.43	312.0	18,000	0.001	0.76	Horizontal	-1.58	-0.20	-0.85	-0.11
PEP13	Belgian Lime Kiln	634,514.1	5,383,784.2	243.8	38.71	376.5	3,242	21.0	0.30	Vertical	-2.97	-0.37	-1.61	-0.20
PEP14	Weibull Bin	634,441.5	5,383,675.5	243.8	6.10	302.6	NA	0.001	0.001	Horizontal	-3.40	-0.43	-1.84	-0.23
PEP15	Pulp Pellet Bin No. 1, 2, 3	634,440.2	5,383,949.1	243.8	18.90	294.3	NA	0.001	0.001	Horizontal	-0.37	-0.05	-0.20	-0.03
PEP18	Sugar Warehouse	634,474.2	5,383,675.5	243.8	10.1	294.3	6,900	17.9	0.5	Vertical	-0.11	-0.014	-0.06	-0.008

Emission Point	**Description**	**UTM Coordinates x (m)**	**y (m)**	**Elev. (m)**	**Rel. Ht. (m)**	**Sigma Y (m)**	**Sigma Z (m)**	**PM_{10} (lb/hr)**	**PM_{10} (g/sec)**	**PM_{10} (lb/hr)**	**PM_{10} (g/sec)**
PEP19	Sugar Loadout	634,436.9	5,383,673.3	243.8	4.72	0.23	2.20	-0.11	-0.01	-0.06	-0.01
PEP20	Sugar Screening	634,458.6	5,383,667.2	243.8	18.29	0.23	8.51	-0.45	-0.06	-0.24	-0.03

Emission Point	**Description**	**UTM Coordinates x (m)**	**y (m)**	**Elev. (m)**	**Rel. Ht. (m)**	**E. Length (m)**	**N. Length (m)**	**Angle (°)**	**Init. Vert. (m)**	**PM_{10} (lb/hr)**	**PM_{10} (g/sec)**	**PM_{10} (lb/hr)**	**PM_{10} (g/sec)**
PFug 1	Pellet Loadout Emissions	634,446.8	5,383,938.7	243.8	3.66	5.0	20.0	-2.0	1.86	-0.45	-0.06	-0.24	-0.03

American Crystal Sugar Company
Drayton, ND
$PM_{2.5}$ Baseline Increment Modeling Parameters (Minor Source Baseline Date Aug 23, 2012)

Emission Point	Description	UTM Coordinates x (m)	UTM Coordinates y (m)	Elev. (m)	Height (m)	Temp (K)	Flow (acfm)	Velocity (m/s)	Dia. (m)	Orient. (vert/horz)	24-Hour $PM_{2.5}$ (lb/hr)	24-Hour $PM_{2.5}$ (g/sec)	Annual $PM_{2.5}$ (lb/hr)	Annual $PM_{2.5}$ (g/sec)
PEP1	B&W Boiler	634,538.2	5,383,772.1	243.8	36.57	490.2	172,306	18.6	2.36	Vertical	-20.92	-2.64	-15.31	-1.93
PEP1a	Coal Handling Equipment	634,518.7	5,383,766.2	243.8	25.91	294.3	1,700	0.001	0.001	Horizontal	-0.07	-0.01	-0.05	-0.01
PEP2	Startup Boiler	634,504.0	5,383,770.4	243.8	30.50	566.1	19,431	14.1	0.91	Vertical	-1.18	-0.15	-0.01	-0.001
PEP3	Pulp Dryer No. 2	634,468.5	5,383,839.7	243.8	51.82	398.7	50,000	20.2	1.22	Vertical	-25.39	-3.20	-18.33	-2.31
PEP4	Pulp Dryer No. 1	634,464.9	5,383,839.7	243.8	51.82	388.7	85,000	22.0	1.52	Vertical	-37.03	-4.67	-26.73	-3.37
PEP5	Lime Mixing Tank & Kiln Cooler	634,519.2	5,383,802.3	243.8	9.45	399.8	8,500	0.001	0.001	Horizontal	-1.33	-0.17	-0.95	-0.12
PEP6	Pellet Mill No. 1	634,476.4	5,383,941.2	243.8	23.77	310.9	7,952	3.21	1.22	Vertical	-0.57	-0.07	-0.41	-0.05
PEP7	Pellet Mill No. 2	634,476.1	5,383,943.9	243.8	23.77	310.9	4,943	2.00	1.22	Vertical	-0.57	-0.07	-0.41	-0.05
PEP8	Pellet Mill No. 3	634,481.4	5,383,943.8	243.8	23.77	310.9	5,881	2.38	1.22	Vertical	-0.57	-0.07	-0.41	-0.05
PEP9	Dry Pulp Belt Conveyor	634,518.0	5,383,849.8	243.8	17.37	310.9	3,500	0.001	0.001	Horizontal	-0.14	-0.02	-0.10	-0.01
PEP10	Dry Pulp Reclaim System	634,473.3	5,383,946.8	243.8	7.31	310.9	3,500	0.001	0.001	Horizontal	-0.14	-0.02	-0.10	-0.01
PEP11	Dry Pulp Bucket Elevator	634,518.6	5,383,844.1	243.8	17.37	310.9	3,500	0.001	0.001	Horizontal	-0.14	-0.02	-0.10	-0.01
PEP12	Sugar Dryer	634,478.4	5,383,733.8	243.8	27.43	312.0	18,000	0.001	0.76	Horizontal	-0.41	-0.05	-0.30	-0.04
PEP13	Belgian Lime Kiln	634,514.1	5,383,784.2	243.8	38.71	376.5	3,242	21.0	0.30	Vertical	-0.31	-0.04	-0.22	-0.03
PEP14a	MAC2 Flow Headhouse	634,494.1	5,383,726.9	243.8	26.22	302.6	20,000	0.001	0.001	Horizontal	-0.79	-0.10	-0.79	-0.10
PEP14b	Old Hummer Room Pulsaire	634,488.6	5,383,726.9	243.8	22.25	302.6	19,000	0.001	0.001	Horizontal	-0.77	-0.10	-0.77	-0.10
PEP15	Pulp Pellet Bin No. 1	634,440.2	5,383,949.1	243.8	18.90	294.3	NA	0.001	0.001	Horizontal	-0.06	-0.01	-0.06	-0.01
PEP19a	Bulk Loading Pulsaire	634,436.9	5,383,673.3	243.8	4.72	294.3	NA	0.001	0.001	Horizontal	-0.03	0.00	-0.03	-0.004
PEP20	Main Sugar Warehouse Pulsaire	634,469.5	5,383,641.9	243.8	12.19	294.3	10,500	0.001	0.001	Horizontal	-0.1	-0.01	-0.10	-0.01
PEP22	Pulp Pellet Mill & Cooler	634,478.8	5,383,945.3	243.8	24.99	294.3	9,998	28.7	0.46	Vertical	-0.04	-0.01	-0.03	-0.004
PEP23	Pulp Dryer Coal Hopper	634,497.6	5,383,847.8	243.8	23.16	294.3	5,200	0.001	0.001	Horizontal	-0.21	-0.03	-0.15	-0.02
PEP25	Lime Slaker	634,519.4	5,383,800.4	243.8	15.24	294.3	4,500	0.001	0.001	Horizontal	-0.28	-0.04	-0.20	-0.03

Emission Point	Description	UTM Coordinates x (m)	UTM Coordinates y (m)	Elev. (m)	Rel. Ht. (m)	E. Length (m)	N. Length (m)	Angle (°)	Init. Vert. (m)	$PM_{2.5}$ (lb/hr)	$PM_{2.5}$ (g/sec)	$PM_{2.5}$ (lb/hr)	$PM_{2.5}$ (g/sec)
PFug 1	Pellet Loadout Emissions	634,446.8	5,383,938.7	243.8	3.66	5.0	20.0	-2.0	1.86	-0.014	-0.002	-0.010	-0.001

American Crystal Sugar Company
Drayton, ND
SO_2 Baseline Increment Modeling Parameters (Minor Source Baseline Date Dec 19, 1977)

Emission Point	Description	UTM Coordinates x (m)	y (m)	Elev. (m)	Height (m)	Temp (K)	Flow (acfm)	Velocity (m/s)	Dia. (m)	Orient. (vert/horz)	SO_2 (lb/hr)	SO_2 (g/sec)
PEP1	B&W Boiler	634,538.2	5,383,772.1	243.8	36.57	490.2	172,306	18.6	2.36	Vertical	-358.7	-45.20
PEP3A	Pulp Dryer No. 2 Stack 1	634,488.9	5,383,845.1	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-5.45	-0.69
PEP3B	Pulp Dryer No. 2 Stack 2	634,485.4	5,383,845.0	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-5.45	-0.69
PEP3C	Pulp Dryer No. 2 Stack 3	634,481.7	5,383,844.8	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-5.45	-0.69
PEP3D	Pulp Dryer No. 2 Stack 4	634,478.2	5,383,844.8	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-5.45	-0.69
PEP4A	Pulp Dryer No. 1 Stack 1	634,489.0	5,383,841.9	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-5.44	-0.69
PEP4B	Pulp Dryer No. 1 Stack 2	634,485.5	5,383,841.7	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-5.44	-0.69
PEP4C	Pulp Dryer No. 1 Stack 3	634,481.8	5,383,841.5	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-5.44	-0.69
PEP4D	Pulp Dryer No. 1 Stack 4	634,478.2	5,383,841.5	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-5.44	-0.69
PEP4E	Pulp Dryer No. 1 Stack 5	634,474.7	5,383,841.5	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-5.44	-0.69
PEP13	Belgian Lime Kiln	634,514.1	5,383,784.2	243.8	38.71	376.5	3,242	21.0	0.30	Vertical	-14.50	-1.83

American Crystal Sugar Company
Drayton, ND
NO_x Baseline Increment Modeling Parameters (Minor Source Baseline Date Oct 1, 1989)

Emission Point	Description	UTM Coordinates x (m)	y (m)	Elev. (m)	Height (m)	Temp (K)	Flow (acfm)	Velocity (m/s)	Dia. (m)	Orient. (vert/horz)	NO_x (lb/hr)	NO_x (g/sec)
PEP1	B&W Boiler	634,538.2	5,383,772.1	243.8	36.57	490.2	172,306	18.6	2.36	Vertical	-85.50	-10.77
PEP3A	Pulp Dryer No. 2 Stack 1	634,488.9	5,383,845.1	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-1.58	-0.20
PEP3B	Pulp Dryer No. 2 Stack 2	634,485.4	5,383,845.0	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-1.58	-0.20
PEP3C	Pulp Dryer No. 2 Stack 3	634,481.7	5,383,844.8	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-1.58	-0.20
PEP3D	Pulp Dryer No. 2 Stack 4	634,478.2	5,383,844.8	243.8	24.69	373.3	14,539	5.87	1.22	Vertical	-1.58	-0.20
PEP4A	Pulp Dryer No. 1 Stack 1	634,489.0	5,383,841.9	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-1.50	-0.19
PEP4B	Pulp Dryer No. 1 Stack 2	634,485.5	5,383,841.7	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-1.50	-0.19
PEP4C	Pulp Dryer No. 1 Stack 3	634,481.8	5,383,841.5	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-1.50	-0.19
PEP4D	Pulp Dryer No. 1 Stack 4	634,478.2	5,383,841.5	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-1.50	-0.19
PEP4E	Pulp Dryer No. 1 Stack 5	634,474.7	5,383,841.5	243.8	24.69	380.4	19,691	7.95	1.22	Vertical	-1.50	-0.19
PEP13	Belgian Lime Kiln	634,514.1	5,383,784.2	243.8	38.71	376.5	3,242	21.0	0.30	Vertical	-4.60	-0.58

American Crystal Sugar Company
Drayton Expansion Phase II
Air Quality Construction Permit Application
Modeled Emission Rates of Precursors (MERP) Analysis

Project PTE (tpy)	
VOC	646.0
NOx	826
SO2	1665

Hypothetical Site Information[a]								Calculated PLC Integrated Site Impact (ppb)	Cumulative PLC Integrated Site Impact (ppb)[b]
State	County	Metric	Precursor	Emissions (tpy)	Stack Height (m)	MERP	Concentration (ppb)		
North Dakota	Stutsman	8-hr Ozone	NOx	1000	10	551	1.82	1.50	1.75
North Dakota	Stutsman	8-hr Ozone	NOx	1000	90	544	1.84	1.52	
North Dakota	Stutsman	8-hr Ozone	VOC	500	10	2,858	0.17	0.226	
Hypothetical Site Information[a]								Calculated PLC Integrated Site Impact ($\mu g/m^3$)	Cumulative PLC Integrated Site Impact ($\mu g/m^3$)[c]
State	County	Metric	Precursor	Emissions (tpy)	Stack Height (m)	MERP	Concentration ($\mu g/m^3$)		
North Dakota	Stutsman	Daily PM2.5	NOx	1000	10	8,006	0.15	0.12	2.16
North Dakota	Stutsman	Daily PM2.5	NOx	1000	90	11,034	0.11	0.09	
North Dakota	Stutsman	Daily PM2.5	SO2	1000	10	980	1.22	2.04	
North Dakota	Stutsman	Daily PM2.5	SO2	1000	90	2,056	0.58	0.97	
Hypothetical Site Information[a]								Calculated PLC Integrated Site Impact ($\mu g/m^3$)	Cumulative PLC Integrated Site Impact ($\mu g/m^3$)[c]
State	County	Metric	Precursor	Emissions (tpy)	Stack Height (m)	MERP	Concentration ($\mu g/m^3$)		
North Dakota	Stutsman	Annual PM2.5	NOx	1000	10	20,318	0.010	0.008	0.061
North Dakota	Stutsman	Annual PM2.5	NOx	1000	90	42,447	0.005	0.004	
North Dakota	Stutsman	Annual PM2.5	SO2	1000	10	6,355	0.031	0.052	
North Dakota	Stutsman	Annual PM2.5	SO2	1000	90	14,824	0.013	0.022	

[a] Refined hypothetical modeling results for the nearst site, obtained from EPA's SCRAM (https://www.epa.gov/scram/merps-view-qlik), accessed 12/13/2022.
[b] Sum of the maximum NO_x impact plus the VOC impact.
[c] Sum of the maximum NO_x impact plus the maximum SO_2 impact.

Appendix F

Modeling File Summary Data

American Crystal Sugar Company – Drayton
PM_{10} and $PM_{2.5}$ NAAQS

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                              *** THE SUMMARY OF HIGHEST 24-HR RESULTS ***
                                    ** CONC OF PM-10     IN MICROGRAMS/M**3                          **

                                                               DATE                                                           NETWORK
GROUP ID                          AVERAGE CONC      (YYMMDDHH)             RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   6TH HIGH VALUE IS     111.49699  ON 10090524: AT (  634318.00,  5383829.70,   243.59,   243.59,    0.00)  DC
```

```
                              *** THE SUMMARY OF MAXIMUM   8TH-HIGHEST 24-HR RESULTS AVERAGED OVER   5 YEARS ***
                                    ** CONC OF PM-2.5    IN MICROGRAMS/M**3                          **

                                                                                                           NETWORK
GROUP ID                       AVERAGE CONC                RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL        1ST HIGHEST VALUE IS      18.63039 AT (  634686.10,  5383058.50,   243.50,   243.50,    0.00)  DC
```

```
                                  *** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER   1 YEARS ***
                                    ** CONC OF PM-2.5    IN MICROGRAMS/M**3                          **

                                                                                                           NETWORK
GROUP ID                       AVERAGE CONC                RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

2009       1ST HIGHEST VALUE IS       3.79903 AT (  634751.00,  5383060.00,   243.76,   243.76,    0.00)  DC
2010       1ST HIGHEST VALUE IS       3.17667 AT (  634315.20,  5383969.60,   243.48,   243.48,    0.00)  DC
2011       1ST HIGHEST VALUE IS       2.92562 AT (  634751.00,  5383060.00,   243.76,   243.76,    0.00)  DC
2012       1ST HIGHEST VALUE IS       3.11249 AT (  634751.00,  5383060.00,   243.76,   243.76,    0.00)  DC
2013       1ST HIGHEST VALUE IS       4.14996 AT (  634686.10,  5383058.50,   243.50,   243.50,    0.00)  DC
```

American Crystal Sugar Company – Drayton
SO_2 NAAQS

*** THE SUMMARY OF MAXIMUM 4TH-HIGHEST MAX DAILY 1-HR RESULTS AVERAGED OVER 5 YEARS ***
** CONC OF SO2 IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC		RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)					OF TYPE	NETWORK GRID-ID
ALL	**1ST HIGHEST VALUE IS**	**151.27750**	**AT (**	**634050.00,**	**5384150.00,**	**243.80,**	**243.80,**	**0.00)**	**DC**	

*** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER 1 YEARS ***
** CONC OF SO2 IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC		RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)					OF TYPE	NETWORK GRID-ID
2009	1ST HIGHEST VALUE IS	4.70032	AT (	634676.30,	5383058.20,	243.64,	243.64,	0.00)	DC	
2010	1ST HIGHEST VALUE IS	3.59279	AT (	634686.10,	5383058.50,	243.50,	243.50,	0.00)	DC	
2011	1ST HIGHEST VALUE IS	3.55726	AT (	634695.90,	5383058.70,	243.32,	243.32,	0.00)	DC	
2012	1ST HIGHEST VALUE IS	3.88971	AT (	634751.00,	5383060.00,	243.76,	243.76,	0.00)	DC	
2013	**1ST HIGHEST VALUE IS**	**5.30734**	**AT (**	**634686.10,**	**5383058.50,**	**243.50,**	**243.50,**	**0.00)**	**DC**	

*** THE SUMMARY OF HIGHEST 3-HR RESULTS ***
** CONC OF SO2 IN MICROGRAMS/M**3 **

GROUP ID			AVERAGE CONC	DATE (YYMMDDHH)		RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)					OF TYPE	NETWORK GRID-ID
2009	HIGH	2ND HIGH VALUE IS	198.79346	ON 09032218:	AT (	634200.00,	5384050.00,	244.00,	244.00,	0.00)	DC	
2010	**HIGH**	**2ND HIGH VALUE IS**	**205.54562**	**ON 10041318:**	**AT (**	**634150.00,**	**5384050.00,**	**243.12,**	**243.12,**	**0.00)**	**DC**	
2011	HIGH	2ND HIGH VALUE IS	112.99196	ON 11061718:	AT (	634000.00,	5384100.00,	243.74,	243.74,	0.00)	DC	
2012	HIGH	2ND HIGH VALUE IS	135.01224	ON 12071518:	AT (	634050.00,	5384150.00,	243.80,	243.80,	0.00)	DC	
2013	HIGH	2ND HIGH VALUE IS	146.06627	ON 13030412:	AT (	634150.00,	5384050.00,	243.12,	243.12,	0.00)	DC	

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***
** CONC OF SO2 IN MICROGRAMS/M**3 **

GROUP ID			AVERAGE CONC	DATE (YYMMDDHH)		RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)					OF TYPE	NETWORK GRID-ID
2009	HIGH	2ND HIGH VALUE IS	55.75224	ON 09093024:	AT (	634100.00,	5384150.00,	243.82,	243.82,	0.00)	DC	
2010	**HIGH**	**2ND HIGH VALUE IS**	**71.47240**	**ON 10090924:**	**AT (**	**634100.00,**	**5384100.00,**	**243.75,**	**243.75,**	**0.00)**	**DC**	
2011	HIGH	2ND HIGH VALUE IS	51.34286	ON 11052324:	AT (	634656.70,	5383057.80,	243.75,	243.75,	0.00)	DC	
2012	HIGH	2ND HIGH VALUE IS	43.69395c	ON 12101924:	AT (	634686.10,	5383058.50,	243.50,	243.50,	0.00)	DC	
2013	HIGH	2ND HIGH VALUE IS	50.11500	ON 13033124:	AT (	634715.50,	5383059.10,	243.01,	243.01,	0.00)	DC	

American Crystal Sugar Company – Drayton
NO_x NAAQS

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                      *** THE SUMMARY OF MAXIMUM   8TH-HIGHEST MAX DAILY  1-HR RESULTS AVERAGED OVER   5 YEARS ***
                                  ** CONC OF NO2      IN MICROGRAMS/M**3                          **

                                                                                                             NETWORK
GROUP ID                        AVERAGE CONC                RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL       1ST HIGHEST VALUE IS     123.45170 AT (  634311.90,  5384129.50,   243.37,   243.37,    0.00)  DC


                                  *** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER   1 YEARS ***
                                  ** CONC OF NO2      IN MICROGRAMS/M**3                          **

                                                                                                             NETWORK
GROUP ID                        AVERAGE CONC                RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

2009      1ST HIGHEST VALUE IS       5.94309 AT (  634310.70,  5384189.50,   243.31,   243.31,    0.00)  DC
2010      1ST HIGHEST VALUE IS       6.33237 AT (  634313.30,  5384059.60,   243.44,   243.44,    0.00)  DC
2011      1ST HIGHEST VALUE IS       5.75027 AT (  634309.10,  5384269.50,   243.28,   243.28,    0.00)  DC
2012      1ST HIGHEST VALUE IS       6.49745 AT (  634312.50,  5384099.60,   243.43,   243.43,    0.00)  DC
2013      1ST HIGHEST VALUE IS       6.52257 AT (  634695.90,  5383058.70,   243.32,   243.32,    0.00)  DC
```

American Crystal Sugar Company – Drayton
CO NAAQS

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***

** CONC OF CO IN MICROGRAMS/M**3 **

GROUP ID			AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR,	YR,	ZELEV,	ZHILL,	ZFLAG)	OF TYPE	NETWORK GRID-ID
2009	HIGH	2ND HIGH VALUE IS	3966.49863	ON 09102221: AT (	634250.00,	5383900.00,	244.13,	244.13,	0.00)	DC	
2010	**HIGH**	**2ND HIGH VALUE IS**	**4733.50799**	**ON 10042122: AT (**	**634050.00,**	**5384050.00,**	**243.74,**	**243.74,**	**0.00)**	**DC**	
2011	HIGH	2ND HIGH VALUE IS	3394.94590	ON 11072924: AT (	634311.90,	5384129.50,	243.37,	243.37,	0.00)	DC	
2012	HIGH	2ND HIGH VALUE IS	3458.23465	ON 12082221: AT (	634300.00,	5384150.00,	244.30,	244.30,	0.00)	DC	
2013	HIGH	2ND HIGH VALUE IS	3801.76483	ON 13010607: AT (	634100.00,	5383950.00,	243.91,	243.91,	0.00)	DC	

*** THE SUMMARY OF HIGHEST 8-HR RESULTS ***

** CONC OF CO IN MICROGRAMS/M**3 **

GROUP ID			AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR,	YR,	ZELEV,	ZHILL,	ZFLAG)	OF TYPE	NETWORK GRID-ID
2009	**HIGH**	**2ND HIGH VALUE IS**	**1894.45177m**	**ON 09041608: AT (**	**634313.70,**	**5384039.60,**	**243.46,**	**243.46,**	**0.00)**	**DC**	
2010	HIGH	2ND HIGH VALUE IS	1843.65824	ON 10022608: AT (	634312.70,	5384089.60,	243.43,	243.43,	0.00)	DC	
2011	HIGH	2ND HIGH VALUE IS	1837.21577	ON 11051708: AT (	634300.00,	5384050.00,	244.57,	244.57,	0.00)	DC	
2012	HIGH	2ND HIGH VALUE IS	1786.31047	ON 12040524: AT (	634300.00,	5384050.00,	244.57,	244.57,	0.00)	DC	
2013	HIGH	2ND HIGH VALUE IS	1753.33753	ON 13052408: AT (	634313.50,	5384049.60,	243.45,	243.45,	0.00)	DC	

American Crystal Sugar Company – Drayton
PM_{10} Increment

```
                                  *** THE SUMMARY OF HIGHEST 24-HR RESULTS ***
                        ** CONC OF PM_10     IN MICROGRAMS/M**3                          **

                                                 DATE                                                          NETWORK
GROUP ID                          AVERAGE CONC      (YYMMDDHH)             RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

2009       HIGH   2ND HIGH VALUE IS      17.65801  ON 09122324: AT (  634319.60,  5383749.80,    243.71,    243.71,     0.00)  DC
2010       HIGH   2ND HIGH VALUE IS      24.87948  ON 10041924: AT (  634318.20,  5383819.70,    243.60,    243.60,     0.00)  DC
2011       HIGH   2ND HIGH VALUE IS      13.14751  ON 11122724: AT (  634320.40,  5383709.80,    243.73,    243.73,     0.00)  DC
2012       HIGH   2ND HIGH VALUE IS      14.22323  ON 12013024: AT (  634316.00,  5383929.70,    243.51,    243.51,     0.00)  DC
2013       HIGH   2ND HIGH VALUE IS      11.41567c ON 13030724: AT (  634316.40,  5383909.70,    243.59,    243.59,     0.00)  DC
```

```
                       *** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER    1 YEARS ***
                        ** CONC OF PM_10     IN MICROGRAMS/M**3                          **

                                                                                                      NETWORK
GROUP ID                       AVERAGE CONC               RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

2009         1ST HIGHEST VALUE IS       0.07529 AT (  624000.00,  5373000.00,    246.41,    246.41,     0.00)  DC
2010         1ST HIGHEST VALUE IS       0.07628 AT (  625500.00,  5373000.00,    247.10,    247.10,     0.00)  DC
2011         1ST HIGHEST VALUE IS       0.07054 AT (  624500.00,  5373000.00,    247.82,    247.82,     0.00)  DC
2012         1ST HIGHEST VALUE IS       0.06562 AT (  624000.00,  5373000.00,    246.41,    246.41,     0.00)  DC
2013         1ST HIGHEST VALUE IS       0.07023 AT (  624000.00,  5373000.00,    246.41,    246.41,     0.00)  DC
```

American Crystal Sugar Company – Drayton
$PM_{2.5}$ Increment

```
                                   *** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER   1 YEARS ***
                                     ** CONC OF PM_2.5   IN MICROGRAMS/M**3                          **

                                                                                                         NETWORK
GROUP ID                      AVERAGE CONC              RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

2009      1ST HIGHEST VALUE IS       0.49640 AT (  634850.00,  5382800.00,    243.30,    243.30,    0.00)  DC
2010      1ST HIGHEST VALUE IS       0.44855 AT (  634200.00,  5384500.00,    243.82,    243.82,    0.00)  DC
2011      1ST HIGHEST VALUE IS       0.48467 AT (  634250.00,  5384600.00,    243.86,    243.86,    0.00)  DC
2012      1ST HIGHEST VALUE IS       0.54879 AT (  634788.90,  5383060.80,    243.58,    243.58,    0.00)  DC
2013      1ST HIGHEST VALUE IS       0.57983 AT (  634800.00,  5383000.00,    243.55,    243.55,    0.00)  DC


                                               *** THE SUMMARY OF HIGHEST 24-HR RESULTS ***
                                     ** CONC OF PM_2.5   IN MICROGRAMS/M**3                          **

                                                         DATE                                                               NETWORK
GROUP ID                         AVERAGE CONC      (YYMMDDHH)             RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

2009     HIGH   2ND HIGH VALUE IS       3.19458  ON 09082124: AT (  635050.00,  5382750.00,   243.34,   243.34,    0.00)  DC
2010     HIGH   2ND HIGH VALUE IS       4.02571  ON 10090924: AT (  633750.00,  5384350.00,   243.67,   243.67,    0.00)  DC
2011     HIGH   2ND HIGH VALUE IS       3.66914c ON 11060824: AT (  634700.00,  5382750.00,   243.54,   243.54,    0.00)  DC
2012     HIGH   2ND HIGH VALUE IS       3.28441  ON 12090124: AT (  634100.00,  5384650.00,   243.60,   243.60,    0.00)  DC
2013     HIGH   2ND HIGH VALUE IS       2.98486  ON 13050124: AT (  635128.50,  5383067.60,   246.13,   246.13,    0.00)  DC
```

American Crystal Sugar Company – Drayton
NO_x Increment

*** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER 1 YEARS ***

** CONC OF NOX IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC		RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)					OF TYPE	NETWORK GRID-ID
2009	1ST HIGHEST VALUE IS	2.89490	AT (	634313.10,	5384069.60,	243.43,	243.43,	0.00)	DC	
2010	**1ST HIGHEST VALUE IS**	**3.22945**	**AT (**	**634313.30,**	**5384059.60,**	**243.44,**	**243.44,**	**0.00)**	**DC**	
2011	1ST HIGHEST VALUE IS	2.71383	AT (	634313.30,	5384059.60,	243.44,	243.44,	0.00)	DC	
2012	1ST HIGHEST VALUE IS	3.15182	AT (	634313.30,	5384059.60,	243.44,	243.44,	0.00)	DC	
2013	1ST HIGHEST VALUE IS	2.68889	AT (	634686.10,	5383058.50,	243.50,	243.50,	0.00)	DC	

American Crystal Sugar Company – Drayton
SO_2 Increment

*** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER 1 YEARS ***
** CONC OF SO2 IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC		RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)					OF TYPE	NETWORK GRID-ID
2009	1ST HIGHEST VALUE IS	0.06309	AT (	624000.00,	5373500.00,	248.92,	248.92,	0.00)	DC	
2010	1ST HIGHEST VALUE IS	0.07564	AT (	626000.00,	5373000.00,	247.14,	247.14,	0.00)	DC	
2011	**1ST HIGHEST VALUE IS**	**0.08360**	**AT (**	**624000.00,**	**5373000.00,**	**246.41,**	**246.41,**	**0.00)**	**DC**	
2012	1ST HIGHEST VALUE IS	0.07433	AT (	624000.00,	5376000.00,	251.37,	251.37,	0.00)	DC	
2013	1ST HIGHEST VALUE IS	0.07132	AT (	624000.00,	5385500.00,	246.40,	246.40,	0.00)	DC	

*** THE SUMMARY OF HIGHEST 3-HR RESULTS ***
** CONC OF SO2 IN MICROGRAMS/M**3 **

GROUP ID			AVERAGE CONC	DATE (YYMMDDHH)		RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)					OF TYPE	NETWORK GRID-ID
2009	HIGH	2ND HIGH VALUE IS	8.58731	ON 09112209:	AT (	624000.00,	5373500.00,	248.92,	248.92,	0.00)	DC	
2010	HIGH	2ND HIGH VALUE IS	8.91066	ON 10021712:	AT (	626500.00,	5373000.00,	246.76,	246.76,	0.00)	DC	
2011	HIGH	2ND HIGH VALUE IS	8.66945	ON 11042406:	AT (	624500.00,	5373000.00,	247.82,	247.82,	0.00)	DC	
2012	**HIGH**	**2ND HIGH VALUE IS**	**11.76170**	**ON 12100703:**	**AT (**	**624000.00,**	**5376000.00,**	**251.37,**	**251.37,**	**0.00)**	**DC**	
2013	HIGH	2ND HIGH VALUE IS	8.88838	ON 13032912:	AT (	624000.00,	5375000.00,	249.93,	249.93,	0.00)	DC	

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***
** CONC OF SO2 IN MICROGRAMS/M**3 **

GROUP ID			AVERAGE CONC	DATE (YYMMDDHH)		RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)					OF TYPE	NETWORK GRID-ID
2009	HIGH	2ND HIGH VALUE IS	1.84055	ON 09111524:	AT (	624500.00,	5373500.00,	248.20,	248.20,	0.00)	DC	
2010	HIGH	2ND HIGH VALUE IS	1.64711	ON 10051424:	AT (	624000.00,	5373000.00,	246.41,	246.41,	0.00)	DC	
2011	HIGH	2ND HIGH VALUE IS	1.70166	ON 11020324:	AT (	624000.00,	5373000.00,	246.41,	246.41,	0.00)	DC	
2012	**HIGH**	**2ND HIGH VALUE IS**	**1.86379**	**ON 12100624:**	**AT (**	**624000.00,**	**5377000.00,**	**250.69,**	**250.69,**	**0.00)**	**DC**	
2013	HIGH	2ND HIGH VALUE IS	1.69471	ON 13111224:	AT (	624000.00,	5384500.00,	246.97,	246.97,	0.00)	DC	