ARIES PINE TREE LLC

MINOR SOURCE AIR LICENSE APPLICATION

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Prepared for:

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Sanford, Maine 04073

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Attachment A Completed Air Emission License Application Form
Attachment B Documentation of Right to the Site
Attachment C Process Flow Diagram
Attachment D U.S. EPA Determination Letters
Attachment E Site Plan
Attachment F Emission Calculations
Attachment G Ambient Air Modeling Report
Attachment H PFAS Stack Test Report (Linden NJ)
Attachment I Air Emission Control System Literature
Attachment J Documentation of Public Notice

1. INTRODUCTION

1.1 Introduction

Aries Pine Tree LLC is a biosolids gasification facility located on an 11-acre site identified as Lot 4 within the Cyro Road Industrial Park in Sanford, Maine. In brief: dewatered biosolids from regionally located municipal wastewater treatment facilities will be accepted by truck primarily from Maine, Southern New Hampshire and Eastern Massachusetts; after being dried, the biosolids are then gasified using a proprietary fluidized bed process, which reduces the biosolids to a useful biochar (collected by truck for off-site use or disposal) and a producer gas (combusted on-site using a thermal oxidizer, which removes pollutants and produces useful heat that is recycled within the facility.)

Aries Pine Tree LLC will be capable of receiving up to 500 wet tons per day of biosolids cake by truck and processing up to ~450 wet tons per day. No liquid or industrial biosolids will be accepted. The facility is equipped to operate 24 hours per day, 7 days per week, though in practice biosolids receiving and product loadout will generally be limited to the hours of 6:00 AM to 6:00 PM, Monday through Saturday. Acceptance of biosolids on Sundays may occasionally occur.

The facility will be constructed in a single phase, with a proposed start of construction in November 2026 and a proposed start of operation in August 2028. The project location is depicted in *Figure 1-1* (satellite view) and *Figure 1-2* (City of Sanford tax assessor GIS map).

Details presented herein are consistent with Aries and Epsilon's pre-application meeting with Maine DEP (Benjamin Goundie, Jane Gilbert, Eric Kennedy, Kevin Ostrowski, Lisa Higgins) on 10/8/2024. An air modeling protocol was submitted to Kevin Ostrowski on 12/11/2024 and approved with minor revisions on 1/29/2025. The air modeling report is found in *Attachment G*. An additional pre-application meeting was held with Maine DEP (Benjamin Goundie, Jane Gilbert, Eric Kennedy, Kevin Ostrowski) on 10/23/2025.

1.2 Application Type

Aries Pine Tree LLC is hereby applying for a Minor Source License as a new source in accordance with Chapter 115 of the MEDEP Air Rules, which requires an air emission license for any facility with:

- The uncontrolled potential to emit 10 lb/hr of any regulated air pollutant
- The uncontrolled potential to emit 100 lb/day of any regulated air pollutant
- Fuel-burning equipment (or combinations thereof) whose total maximum design heat input is equal to or greater than 10.0 MMBtu/hr (excluding fuel-burning equipment less than 1.0 MMBtu/hr).

The proposed Aries Pine Tree LLC facility will use fuel-burning equipment rated over 10 MMBTU/hr in total and will emit selected pollutants in excess of 10 lb/hr and/or 100 lb/day.

A summary of pollutants exceeding the 10 lb/hr and/or 100 lb/day licensing thresholds (from facility-wide processes excluding Ch. 115 Insignificant Activities) is provided in *Table 1-1*.

Table 1-1 Uncontrolled Emissions vs. Ch. 115 Permitting Thresholds

Pollutant	Lb/Hr (Limit = 10)	Lb/Day (Limit = 100)	Meets Ch. 115 Threshold?
VOC	2.1	51.4	No
CO	4.1	98.5	No
PM	**4,000**	**96,010**	**Yes**
SO2	**315.8**	**7,578**	**Yes**
NOx	**91.8**	**2202**	**Yes**
NH_3	0	0	No
HCl	**8.3**	**199.8**	**Yes**
Dioxin/Furan	1.9E-09	4.5E-08	No
H2S	2.7E-01	6.4	No

The facility therefore requires an air emission license due to emissions of PM, SO2, NOx, and HCl.

The facility will also qualify as a Minor Source, since its controlled potential to emit each of these four pollutants (assuming 8760 hours/year operation) is below the applicable significance threshold specified by Maine DEP. A summary of controlled emissions from facility-wide processes (excluding Ch. 115 Insignificant Activities) is provided in *Table 1-2*. NH_3, which is solely generated by the proposed NOx pollution control system, is also listed.

Table 1-2 Controlled Emissions vs. Minor Source Thresholds

Pollutant	Minor Source Threshold Tons/Year	Controlled Emissions Tons/Year
PM	100	35.1
SO_2	100	55.3
NOx	100	21.3
HCl	100	1.8
NH_3	100	4.9

It should be noted that VOC and CO emissions from Aries Pine Tree, LLC are minimal due to the presence of the gasification process's intrinsic thermal oxidizer, which combusts the producer gas to generate heat (analogous to a boiler) as depicted in the process flow diagram, *Attachment C*. The unit is operated in accordance with good combustion practices to limit products of incomplete combustion.

The facility-wide and process-specific emissions, including details on control devices and insignificant sources below licensing thresholds, are further detailed in Sections 2 and 3 of this Application. Emission calculations are listed in *Attachment F*.

1.3 Application Structure

As summarized in Table 1-3, this submittal contains all required elements for a Minor Source license application as specified in Chapter 115, subsection 4.C.4 of the MEDEP Air Rules.

Table 1-3 Required Application Elements

Requirement (Ch. 115, subsection 4.C.4)	Section of Application
The application form as specified in subsection 2(B) of this Chapter.	Attachment A
A description of the nature of the process, location of the source, plot plan, building dimensions, and any other information required by the Department.	Figure 1-1, 1-2 Section 2
A schedule for construction of the new minor source.	Section 1.1
Best Available Control Technology (BACT) analysis as described in subsection 4(A)(4)(d).	Section 4
If relevant, the innovative control technology waiver as specified in subsection 4(A)(4)(f).	N/A
All process control and compliance monitoring devices or activities, and any other emission reduction system planned by the owner or operator for a new minor source and such other information required to accurately establish emission estimates, and to document future compliance.	Section 3
Title, Right or Interest demonstration for new sources as specified in subsection 4(A)(4)(i).	Attachment B
The results of any ambient air quality impact analyses if required by the Department pursuant to Section 7 of this Chapter.	Attachment G
The certification of the responsible official as specified in subsection 2(C).	Attachment A
A copy of the published Public Notice of Intent to File as specified in subsection 2(D).	Attachment J

Figure 1-1 Project Location - Satellite

Figure 1-2 Project Location – City of Sanford GIS

Source: https://www.axisgis.com/sanfordme/

2. PROCESS AND FACILITY INFORMATION

2.1 Introduction

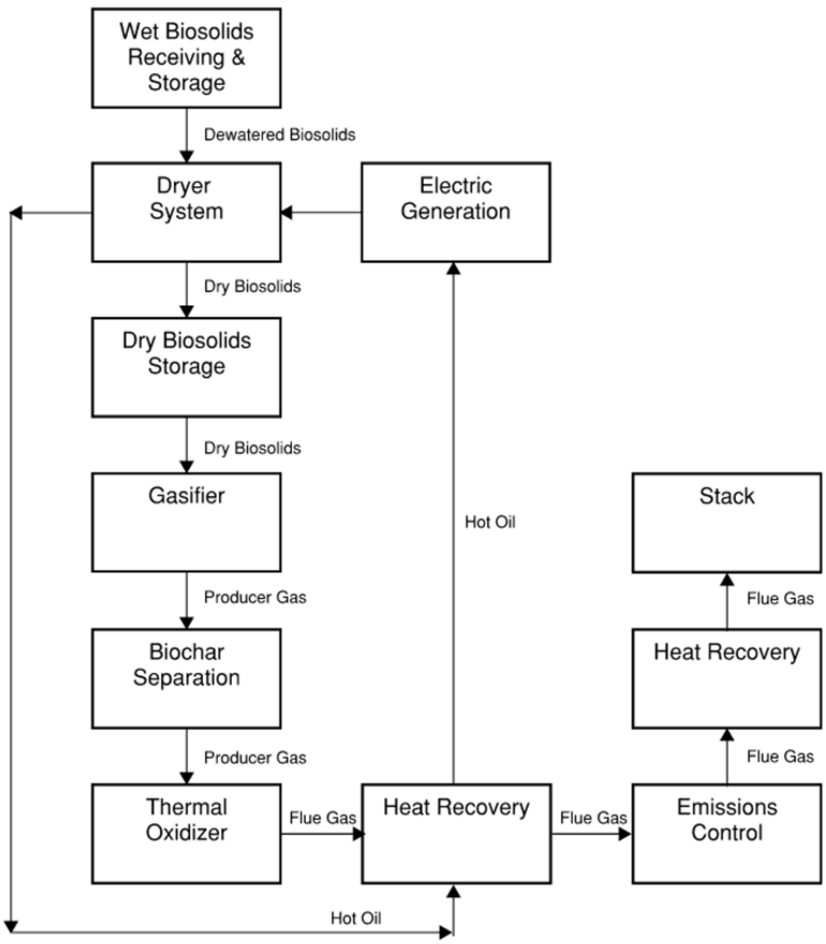
The proposed facility will receive biosolids in cake form and proceed to dry the biosolids in indirect dryers, reducing the water content to 5-15% for further processing. The plant will process dewatered domestic wastewater treatment wet biosolids that vary in moisture content from 70 to 84% with a design point of 78% moisture. The facility consists of wet biosolids receiving and storage, dryers, an Aries Clean Technologies proprietary Fluidized Bed Gasifier, cyclones, thermal oxidizer, heat recovery system, emissions control equipment, solids handling and power production area. The dried biosolids are converted in an Aries fluidized bed gasifier to make producer gas that provides heat for drying and renewable power.

A process flow diagram is included as *Attachment C*, and a simplified process block flow diagram is provided below as *Figure 2-1*.

There are no air emissions associated with drying, which occurs in an entirely closed-loop system. A fully enclosed receiving building will capture any odor and send it to the thermal oxidizer and to a carbon adsorption system for part of the flow since the thermal oxidizer will not accommodate all of the exhaust from the receiving building. If the thermal oxidizer is down, a backup carbon adsorption system will be used for the full flow from the receiving building.

The gasifier produces a biochar that will be sold as a concrete additive and other beneficial uses. Until it is qualified for these uses, it will be placed in super sacks for landfill disposal. The biochar will be stored in a silo and ultimately conveyed to a bulk truck for transport offsite to the buyer(s). Hydrated lime will be used as an acid gas sorbent (to neutralize SO_2, H_2SO_4, HF, and HCl from sulfur, fluoride and chlorides in the biosolids) prior to the ceramic filter for particulate matter control from the oxidizer. The spent sorbent and ash will be stored in a silo and then trucked out for proper disposal.

Figure 2-1 Simplified Process Block Flow Diagram



2.2 Biosolids Characteristics

The typical dewatered primary and secondary wet biosolids cake with 16 to 30% solids content are shown in *Table 2-1* which will be contracted for facility feedstock. The design basis is 22% solids content. Industrial sludges will be excluded. *Table 2-2* provides the basis for the summarized information in *Table 2-1*.

Table 2-1 Typical Dewatered Wet Biosolids Composition

Parameter	Average	Min	Max
Carbon, % dry	40.9	35.22	45.57
Hydrogen, % dry	6.26	5.51	7.06
Nitrogen, % dry	5.58	4.37	7.09
Sulfur, % dry	1.31	0.75	1.89
Ash, % dry	25.76	15.74	34.34
Oxygen, % dry	20.2	15.64	26.51
Moisture, % as received	78	70	84.16
HHV, Btu/lb dry	7587	6549	8621
LHV, Btu/lb dry	7008	7000	7985
Proximate Analysis	**Average**	**Min**	**Max**
Volatile, % dry	67.91	59.3	76.12
Fixed Carbon, % dry	6.33	3.86	8.14
Ash, % dry	25.76	15.74	34.34

Table 2-2 Maine and NJ Wet Sludge Sample Data

Wet Sludge Samples

Sample	Notes	Digested / undigested	% Moisture	% Volatile Dry Basis	% Fixed Carbon Dry Basis	HHV-BTU/lb Dry Basi	% Carbon Dry Bas	% Hydrogen Dry Basis	% Nitrogen Dry Basis	% Sulfur Dry Basis	% Ash Dry Basis	% Oxygen Dry Basis
Portland Sewerage 2- 6/24/25		Undigested	81.26	74.68	9.68	8,220	42.70	7.67	5.64	0.87	15.64	27.48
Portland Sewerage 1- 6/24/25		Undigested	81.93	72.92	11.58	9,360	42.30	7.86	5.65	0.89	15.51	27.79
Biddeford Sewerage 2- 6/24/25		Undigested	77.85	72.60	10.20	9,077	43.60	8.00	6.90	0.79	17.20	23.51
Biddeford Sewerage 1 - 6/24/25		Undigested	72.36	74.14	9.16	9,099	42.30	8.16	6.89	0.87	16.70	25.08
Sanford Sewerage 1- 6/24/25		Undigested	81.13	71.42	11.45	8,731	43.00	7.61	6.67	1.85	17.13	23.74
Sanford Sewerage 2- 6/24/25		Undigested	80.49	71.41	11.16	8,989	42.90	7.55	6.73	1.02	17.43	24.37
York Sewerage 1- 6/24/25		Undigested	81.40	74.55	11.42	8,001	43.50	7.70	7.91	1.17	13.13	26.59
York Sewerage 2- 6/24/25		Undigested	81.69	75.98	10.82	8,763	43.30	7.67	7.84	1.14	13.20	26.85
Wells Sanitation 1- 6/24/25		Undigested	80.73	80.02	10.59	9,483	44.70	8.55	8.31	1.17	9.39	27.88
Wells Sanitation 2- 6/24/25		Undigested	80.39	79.36	11.23	9,441	46.10	8.46	8.52	0.70	9.41	26.81
Middleton Sewage- 2019, Linden Area	Mostly omitted due to digested ma	Mixed								1.89		
Bayshore Regional Sewerage-2019, Linden Area	Moisture and nitrogen omitted due	Undigested		76.12	8.14	9,084	45.57	7.06		0.75	15.74	26.51
Two Rivers Water Reclamation-2019, Linden Area		Undigested	83.91	74.42	6.56	8,621	44.98	6.87	7.06	1.18	19.03	20.85
Rahway Valley Sewerage- 2019, Linden Area		Undigested	78.55	65.32	8.79	8,727	42.12	6.09	6.09	1.51	25.89	18.31
	Average		**80.14**	**74.07**	**10.06**	**8,892**	**43.62**	**7.63**	**7.02**	**1.13**	**15.80**	**25.06**
	Linden Design Basis Average		**79.97**	**67.39**	**6.82**	**7,640**	**41.14**	**6.22**	**5.68**	**1.35**	**25.79**	**19.82**
	Min		**72.36**	**65.32**	**6.56**	**7,000**	**42.12**	**6.09**	**5.64**	**0.70**	**9.39**	**18.31**
	Max		**83.91**	**80.02**	**11.58**	**9,483**	**46.10**	**8.55**	**8.52**	**1.89**	**25.89**	**27.88**
	Stdev		**2.90**	**3.72**	**1.53**	**446**	**1.31**	**0.66**	**0.97**	**0.38**	**4.24**	**2.89**
	Coeff of Var		**4%**	**5%**	**15%**	**5%**	**3%**	**9%**	**14%**	**34%**	**27%**	**12%**
Design Case Values (Note 1 and 2)			**78.00**	**74.07**	**10.06**	**8,000**	**43.62**	**7.63**	**7.02**	**1.13**	**15.80**	**24.80**

Notes

1. Linden actuals for moisture in 2024 were 75.5%, samples above are 80.1%. Sanford area samples only represent about 10% of the wet cake the plant will receive. 78% is selected for consistency as well as being reasonable.
2. Averages were used for the design case for all parameters except moisture, oxygen, and HHV. 8,000 btu/lb was selected for HHV and oxygen was adjusted by .26% to yield 100% in the design case.
3. The Linden Design Basis was included for comparison purposes to see how Pine Tree's design basis varies from the previous design.
4. It is critical that estimates are included in the HMB for heat loss to ambient. They will be more significant than typical liquid or high pressure gas processes where they are generally negligible.
5. The minimum HHV was adjusted to 7000 btu/lb as sludges with lower heating values than those tested are expected.

The Class A biosolids produced from the dryers shall:

- Have a moisture content of 15% or lower.
- At least 7,000 Btu/lb LHV dry (produced from undigested sludge)
(Note: This is contingent to the plant feed having at least 7000 Btu/lb LHV on dry basis)
- Meet EPA Section 40 Part 503.
(Note: This is contingent to the plant feed not exceeding the pollutant concentrations)
- Typically have a bulk density of approximately 45 lb/ft3.

2.3 Design Details

The facility design basis parameters are detailed in *Table 2-3* below.

Table 2-3 Design Data

Parameter	Value	Notes
Waste Processed	Dewatered Municipal Biosolids Cake	Undigested and Digested
Inbound Water Content	70-84% moisture	78% design average
Delivery Truck Capacity/Trucks per day	18-30 tons each	Maximum 24 trucks per day assuming 21 tons on average.
Hours of Process Operation	24 hrs/day, 7 days per week	
Hours of Receiving/Solids Out	6 am to 6 pm, 6 days per week	Monday thru Saturday, but available 24 x 7.
Wet Biosolids Storage Capacity	3 silos, each 300 tons	2 days of capacity
Daily Dryer Throughput	450 wet tpd in 3 x 150 wet tpd dryers	
Dried Biosolids Storage	100 tons	1 days capacity
Gasifier/startup burner	100 tpd of dried biosolids	9 MMBTU/hr startup burner
Biochar Production/ Loadout Silo	15-30 tpd /100 tons silo	Production rate varies with feedstock
Fresh Sorbent Bin	1	~4000 ft3 (4 days capacity)
Spent Sorbent Bin	1	100 tons (4 days capacity)
Condensate Holding	1	14,000 gal
Aqueous Ammonia Storage (19% concentration - below OSHA “PSM” and EPA “RMP” applicability thresholds)	~10,000 gallons (allowing delivery of bulk 6,000 gallons)	19% aqueous ammonia in double wall tank or single wall with dike for spill prevention or containment

2.4 Delivery

Dewatered biosolids cake will arrive in dump trailers with gasketed tailgates. The trucks are unloaded (dumped) into a receiving trough with an articulating cover, located in a totally enclosed building under negative air pressure. The receiving trough is located at the far end of the building (away from the two bay doors). The trough covers are typically only opened for the duration that it takes to unload a truck, i.e., estimated to be 15 to 20 minutes each hour. Once the truck is unloaded, the receiving trough covers are immediately closed, and the odors are contained. The bay doors will be normally opened only for truck arrival and departure. The trucks will back up into the receiving building and after testing for moisture content and confirming the absence of foreign object, the trucks will be unloaded. The building will be designed to accommodate unloading two trucks at a time.

Vents from the bins and the process are routed to and discharge into the thermal oxidizer, mixed with the flue gas, and treated through combustion or by a carbon filter. Odors will only be present in the immediate area of the receiving troughs located in the enclosed below grade vault. The totally enclosed receiving building under negative air pressure will not allow odors to escape the building, except for minor amounts which were accounted for in an Odor Study found in the Solid Waste Processing application.

2.5 Transfer and Storage

The live bottom floor in the receiving trough will feed shaftless screw conveyors that lift and distribute the wet biosolids to three rectangular above ground storage tanks. Equipment will include troughs and conveyances (with redundancy), nitrogen blanketed storage tanks with live bottoms, and discharge chutes with electrically operated slide gates. The storage tanks are completely covered vessels with sealed connections for receiving incoming wet biosolids cake, a nitrogen purge line, a vented line, and a sealed bottom. Negative air pressure is created to capture odors and nitrogen used as a sweep gas to displace air (oxygen) and to prevent build-up of gases. The odors, displaced gases, and nitrogen are vented to the thermal oxidizer or to the carbon adsorption system.

The dewatered biosolids storage tanks will be rectangular silos. The silos will have live bottoms with extraction screws that discharge into the intake of progressive cavity pumps. The pumps will convey the wet biosolids horizontally into each hollow flight dryer. Negative air pressure in the headspace or other provisions will be incorporated to capture odors and any potential buildup of flammable gases from the storage tanks and vent them to the thermal oxidizer or to the carbon odor filter if the thermal oxidizer is out of service. Throughout the day, wet biosolids cake is transferred from the storage tanks via pumps and enclosed pipe into the hollow flight dryers.

2.6 Drying

Three BCR hollow flight dryers (Bio-Scru Biosolids Dryer System | BCR Solid Solutions (bcrinc.com) or equal), will be used, each capable of drying 150 TPD of wet biosolids at 22% moisture. These dryers will produce approximately 108 tons per day of Class A dry biosolids at 5-15% moisture. The dryers can receive and dry wet biosolids from 16% solids to 30% solids, which is the typical range supplied by wastewater treatment plants.

The dryer is heated with hot oil at approximately 480° F. The heat for this oil is generated from the gasifier's producer gas as it is combusted in the thermal oxidizer. During startup, the thermal oxidizer can generate heat with natural gas to heat the dryers prior to the gasifier startup.

The dryers operate at a slight vacuum resulting in a mixture of slightly superheated steam and non-condensable gas flow that is extracted from the dryer and enters a 3-stage spray water condenser. The steam is condensed, and the non-condensable gases are extracted with a vacuum exhauster which sends the non-condensable gases to either the thermal oxidizer for destruction or through a carbon filter.

Dried biosolids are combustible just like sugar, flour and other natural products. While incidents are exceedingly rare with indirect dryers, the system must be treated with appropriate precautions to ensure that deflagrations and fires are avoided. The dryers will be equipped with oxygen monitors, nitrogen purge and water deluge capability to ensure there are no events that cannot be controlled without injury to personnel or equipment damage.

The dried biosolids exit the dryer, are cooled to approximately 120°F in a cooled screw conveyor and are pneumatically conveyed to the dried biosolids storage. Dried biosolids in the storage tanks are conveyed to the gasifier via screw conveyor. Additionally, dried biosolids may be loaded to trucks for offsite disposal. While this capability exists, the intent is to gasify all of the dried biosolids produced and to dispose of as little dried biosolids as possible.

2.7 Gasification

The gasifier is a proprietary Aries fluidized bed design that converts the dried biosolids into a producer gas in an oxygen-starved environment without combustion flame. The fluidized bed temperature is controlled between 1,250°F and 1,350°F by adjustment of the biosolids- to-air ratio and operates with an outlet pressure of approximately -1 inch w.c. The resulting producer gas is primarily N_2, H_2, CO, CH_4 and CO_2. The gasifier process typically does not require supplemental energy other than startup.

The effluent gas from the Gasifier carries solids to separation equipment to split into a stream of biochar powder consisting of 10-30% carbon with the remainder made up of minerals. (The biochar is cooled and conveyed to the Biochar loadout silo.) The producer gas has a higher heating value (HHV) of 100-150 BTU/scf and flows to the thermal oxidizer where it is combusted to heat hot oil used as a heat source for the dryers.

The Sand Tank and the Startup Burner are other pieces of gasifier support equipment. The Sand Tank is filled via pneumatic conveyance from trucks and uses gravity to feed sand into the gasifier. This sand makes up the fluidized bed prior to starting the gasifier and will periodically use additional sand, as small amounts of sand are carried out of the gasifier over time and end up in the Biochar.

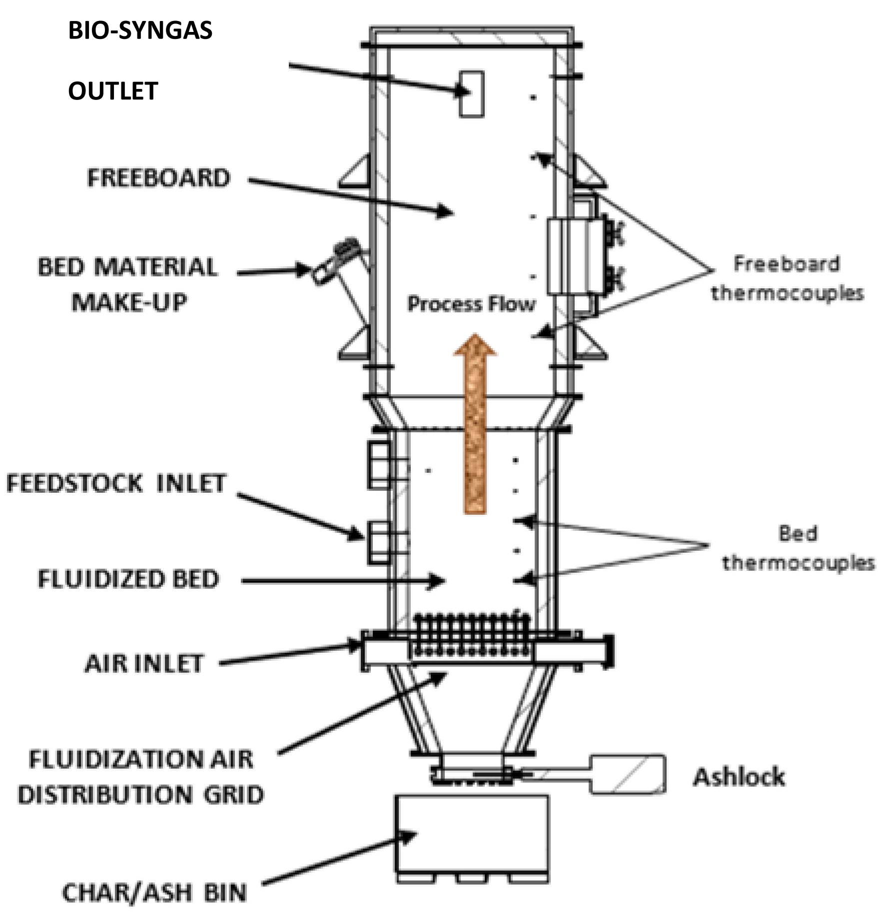
The startup burner provides heat to the Gasifier for start up to raise the temperature to 1000 °F. The burner has a maximum outlet temperature of 1400°F and a maximum firing rate of at 9.0 MMBtu/hr. See section 2.13 on Natural Gas for more details.

The key variables that affect the efficiency of gasifier operation include feedstock properties (particle size, moisture content, ash fusion temperatures, etc.), design of the feeding system, and fluidization parameters (fuel-to-air ratio, fluidization velocity, inert bed material, etc.)

The temperature is maintained at 1250°F to minimize potential clinker (stony residue) or agglomeration formation by alkali material in the biosolids. Biosolids typically contain certain constituents which can lead to the formation of eutectics (low melting point mixtures) in the bed. Fluidized bed gasification has certain advantages when processing this type of material. These advantages include a well-mixed bed with a uniform temperature and the capability to control the bed temperature to a level that is less than the melting point of the potential eutectics which is about 1350°F.

In the gasification unit, the dried biosolids are converted to a low heating value producer gas and biochar. The main constituents of the producer gas are H_2, CO, CH_4, carbon dioxide (CO_2), and nitrogen (N_2), with trace amounts of other hydrocarbons, tars, and particulate matter. The producer flows to the thermal oxidizer where it is combusted to produce the required heat source to heat the hot oil for the dryers via heat exchanger. Before reaching the thermal oxidizer, the producer gas is filtered to remove a portion of the particulate matter (PM) using a cyclone separator combined with a ceramic filter. This system has a PM removal efficiency of >99%.

Figure 2-2 Aries Fluidized Bed Gasifier



2.8 Thermal Recovery and Emissions Control

The project will use a direct fired thermal oxidizer. The thermal oxidizer is a refractory lined steel cylinder, which receives producer gas from the Gasifier mixed with the exhaust from the dryer and vessel vents in the plant. In addition to producer gas, the thermal oxidizer can operate on natural gas and can co-fire both gases. The thermal oxidizer operation allows proper mixing of the gases and sufficient residence time and temperature to destroy volatile organic compounds (VOCs), CO, PFAS, and odors.

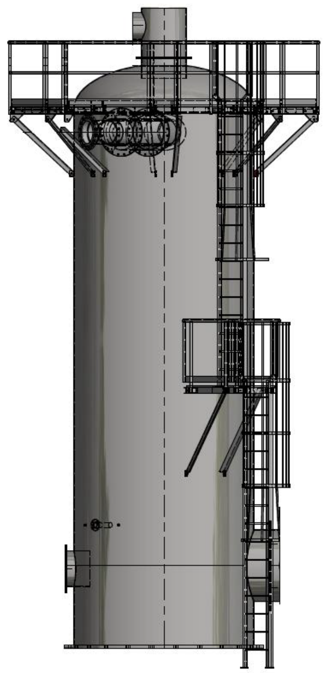
The heat from the oxidized gases is used in the heat recovery exchangers to heat oil for the dryers while also cooling the exhaust gas prior to it entering the emissions control unit. The flue gases are all contained and exhausted to the stack assisted by an induced draft fan.

Combustion air is added to the thermal oxidizer with a fan. An oxygen sensor is used to ensure that sufficient air is being added in the thermal oxidizer to facilitate control to complete combustion. Temperature sensors are mounted at the end of the thermal oxidizer to control temperature between 1800°F and 2200° F.

The heat recovery system uses the thermal oxidizer flue gas in a heat exchanger to raise the temperature of heat transfer fluid in a closed loop for the dryers and for the Organic Rankine Cycle (ORC) power generator. This heat exchanger reduces the temperature of the flue gas to ensure proper operation of the emissions control system. This ensures optimal temperature for the removal of sulfur oxides (SOx) and catalyzing of the nitrogen oxides (NOx). A fin fan cooler is included to reject excess heat in the thermal oil for upset conditions to ensure proper operation of the emissions control system.

The air emission control system will reduce the NOx, SOx and hydrogen chloride (HCl), hydrogen fluoride (HF), and particulate emissions. The system consists of an enclosed Selective Catalytic Reduction (SCR) system (aqueous ammonia injection to catalyst), ceramic filter, and dry sorbent injection (DSI).

Figure 2-3 Aries Thermal Oxidizer



Downstream of the emission control system, additional heat is recovered and the flue gas flows to an induced draft fan which discharges to the stack. The stack is designed for proper dispersion of the exhaust gases into the air and provides a location to measure exhaust flow and emission concentrations after control.

2.9 Loading and Transport of Biosolids and Biochar

The Class A intermediate biosolids produced in the dryers are cooled and conveyed to a storage silo with a 1-day capacity of 100 tons. These tanks are purged with nitrogen to reduce the risk of self-heating which can lead to ignition of the biosolids. Self-heating is a process where biosolids slowly react with air at low temperatures and release heat. This heat increases the temperature of the biosolids and accelerates the reactions until smoldering and even fire can occur. These reactions are very slow and take many hours or days to produce significant heat if exposed to air. In addition to eliminating potential combustion air by purging with nitrogen, the vessels have temperature sensors and alarms to indicate the need for additional nitrogen or water to cool the material and stop the self-heating long before there is a risk of fire.

The solid material left after gasification is referred to as Biochar (carbon and inert minerals). This material is inert and does not ignite. Biochar is removed from the producer gas with a high temperature filter and optionally a cyclone. The hot biochar is cooled from ~1,200°F to 140°F using a dry bulk heat exchanger similar to Solex^{tm} Thermal Science (solexthermal.com) or cooling screw equivalent, as it is conveyed to the 1-ton capacity biochar loadout silo. The selection of either cooling technology would be determined by the EPC Contractor based on safety, reliability and cost effectiveness. Both designs are very safe and have been used industrially for many decades. Dry bulk trucks and/or super sacks (with filters) will be filled from the storage silo and include dust collection systems to minimize fugitive emissions.

2.10 Differences between Gasification and Incineration

The key chemical difference between gasification and incineration is that gasification occurs in an oxygen-starved environment. No flame is applied to the biosolids in the gasifier, nor is a flame propagated as a result of the heating.

As the molecules in the biosolids break down due to the high temperatures, the main gasification reactions that occur are as follows:

Steam reforming: C (carbon) + H_2O (water) → CO+ H_2

Methanation: C + $2H_2$ → CH_4

Oxidation: C + O_2 (oxygen) → CO_2

Boudouard Equilibrium: CO_2 + C → 2CO

Water Gas Shift reaction: H_2O + CO → H_2+CO2

In contrast, incineration converts carbonaceous material to carbon dioxide exclusively using oxidation in the presence of excess oxygen and a flame.

Attachment D contains determination letters from EPA confirming that gasification is not incineration and noting that an incinerator is “an enclosed device or devices using controlled flame combustion” to burn the material, and notes that no flame is present in the gasifier.

2.11 Renewable Power

Renewable power will be generated using an Organic Rankine Cycle (ORC) package. In this cycle, an organic fluid is heated by the thermal oxidizer flue gas and passed through a turbine. The turbine rotates an electric generator to make electricity. Once the fluid exits the turbine, it is fully condensed and returns to be heated again in a closed-loop system, similar to what is done in an air conditioning unit.

The ORC will be a Turboden (or equal) ORC packaged sized for approximately 960 KW gross generation. The system is a complete enclosed package with all controls and equipment included to provide 3-phase, 480-volt, 60 Hz power to the internal plant power system. All ORC generated power will be internally consumed; the plant is not intended to export power to the grid. In addition to connecting the unit to the facilities electric system, hot oil and cooling are also provided to the unit.

2.12 Emergency Generator

A natural gas fired 750 Kw Emergency Generator package will be included to provide power to the facility for safe operation and/or shutdown during emergency conditions as defined in Maine DEP regulations. The new engine will be provided in an enclosure to include a muffler on the exhaust and an exhaust stack extending vertically 5 ft above the roof of the enclosure. The maximum heat input to the engine will be 7.5 MMBTU/hr.

2.13 Natural Gas

Natural gas will be supplied to the site by the local utility (Unitil) at 30 psig and ambient temperature, and routed throughout the facility using a header. Natural gas is used during the startup of the plant after any outage, when the gasifier is not in operation, or when the moisture of the incoming wet biosolids is on the high end of the allowable range. The maximum flow rate required for fired burners during startup is estimated to be 53 MSCF/H dropping to ~3 MSCF/H during normal operation at capacity.

Each natural gas unit shall be equipped with low NOx burners (< 30 ppmv NOx). The supplied natural gas is pipeline quality, i.e., containing less than 0.5 grains/100 scf of total sulfur.

The facility will be equipped with the natural gas burning units listed below.

- The Gasifier Startup burner, rated at 9 MMBtu/hr, is only used to start up the gasifier to raise the bed temperature to around 1200F before introducing Class A biosolids into the gasifier. Once the gasifier is stabilized, then the burner is normally shut off. Startups of the gasifier from a cold temperature could typically take 12 to 18 hours. This may happen 6 times per year. This unit's emissions are vented through the 130-ft. main stack.

- The natural gas burner on the Thermal Oxidizer is rated at 45 MMBtu/hr and is only used for starting up the plant. A normal startup takes 12 to 18 hours to warm all systems up and after the gasifier comes on, then the natural gas use will ramp down as the producer gas to the Thermal Oxidizer increases. After the plant is on-line and stable, then there would be a continuous 3 MMBtu/hr natural gas operation for Thermal Oxidizer flame stability and as a pilot. These natural gas emissions are also vented through the 130-ft. main stack.

2.14 Insignificant Sources

The Facility will also utilize various insignificant emission sources, primarily related to the material storage & handling processes. Although these sources are included in the ambient air modeling effort (per *Attachment G)*, they each qualify as an insignificant activity per Appendix B of Ch. 115 licensing thresholds and are consequently not otherwise discussed further in this Application.

The following processes emit less than one ton per year of any single regulated criteria pollutant (per emission calculations provided in *Attachment F*):

- Sorbent (Lime) Bin Vent
- APC Residual (Spent Sorbent) Bin Vent and Loadout
- Dried Biosolids Loadout
- Dried Biosolids Bin Vents

- Biochar Bin Vent
- Gasifier Feed Bin Vents
- Sand Bin Vent

The following process is a combustion unit which is not an internal combustion engine and is rated below 1 MMBtu/hr.

- Admin Building Heater (Natural Gas)
- Control Room Heater (Natural Gas)

3.0 AIR EMISSION SOURCES

The majority of facility emissions are generated by biosolids gasification and by small-scale natural gas combustion in heaters. The specific processes that meet Ch. 115 air licensing thresholds are listed below.

Table 3-1 Ch. 115 Emission Sources

Process	Exhaust Point	Ch. 115 Pollutants Emitted
Biosolids Gasification Process	Main Stack	NOx, PM, SO_2, NH_3, HCl
Gasifier Startup Heater (Natural Gas, 9 MMBtu/hr)	Main Stack	NOx, PM, SO_2
Thermal Oxidizer (Natural Gas, 45 MMBtu/hr)	Main Stack	NOx, PM, SO_2
Emergency Generator	Engine Exhaust Stack	NOx, PM, SO_2

Locations are shown on the Site Plan (*Attachment E*) and a visual rendering of these exhaust points is shown in *Figure 3-1*. This section describes the nature of the regulated emissions, and a Best Achievable Control Technology (BACT) analysis follows in Section 4, demonstrating that emission rates represent best industry standards.

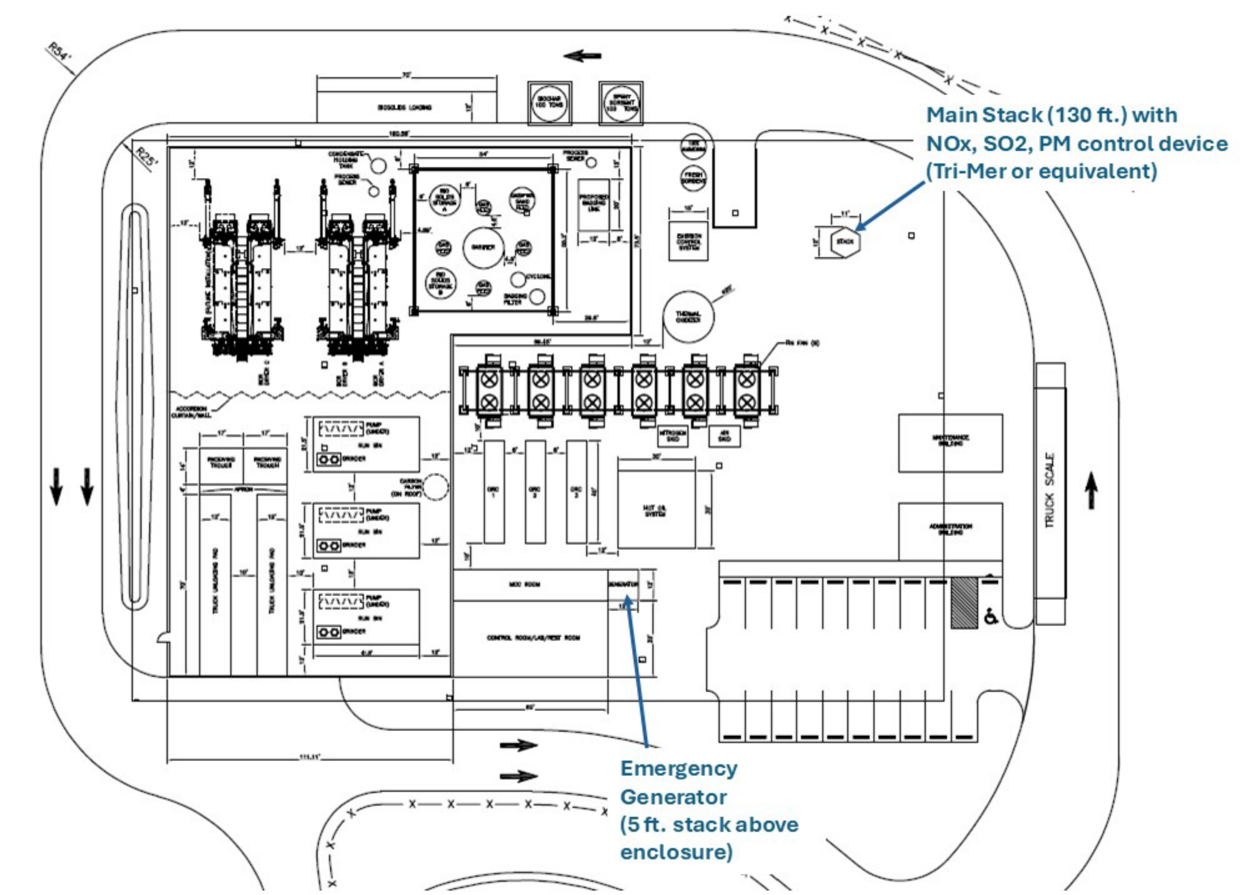
3.1 Biosolids Gasification Process

While the gasifier itself does not emit air pollutants, the thermal oxidizer downstream will emit air pollutants while combusting the producer gas produced in the gasifier from dried biosolids. These air pollutants can be generated by the combustion process in three ways. First, incomplete combustion can allow the emission of carbon monoxide (CO), volatile organic compounds (VOC), and particulate matter (PM). Second, high-temperature combustion can cause nitrogen in the air to burn, forming oxides of nitrogen (NO_x). Third, impurities in the fuel can allow emissions of sulfur dioxide (SO_2) and other acid gases like HCl and HF, NO_x, and PM including some heavy metals and PFAS found in the biosolids at trace concentrations. Post-combustion controls such as pollution control catalysts, filters and sorbents can remove these pollutants after they are formed. In addition to producer gas combustion, these pollutants will also be generated by natural gas combustion with the ancillary natural gas heaters identified in Section 2.13.

As noted in Section 1 of this Application, Aries Pine Tree LLC meets Ch. 115 air licensing thresholds for NO_x, SO_2, PM, and HCl; the other pollutants are emitted at lower levels. Emission calculations for all pollutants are provided in *Attachment F* and are quantified using methods established for the existing Aries project in Linden, NJ which uses comparable technology to Aries Pine Tree LLC. (*Note:* As Maine DEP is aware, the Linden facility is temporarily idled at the time of this Application; however, this is a material handling issue unrelated to air emissions, i.e., the facility is upgrading the sludge dryers at the front end of the plant. All indications from the Linden facility, and the Aries pilot plant in FL, are that the gasifier performs extremely well with respect to air emissions and that the proposed emissions can be achieved. The dryer improvements being designed for Linden are already included in the Aries Pine Tree design. Aries is also adding a filter to the Linden and Pine Tree facilities to prevent fouling in the heat recovery section after the gasifier.)

The 130-foot main stack serves the gasification process and the majority of the natural gas-fired heaters. The main stack will be equipped with a "Tri-MER" air pollution control system consisting of selective catalytic reduction (controlling NOx), dry sorbent injection (controlling SO2, H_2SO_4 HCl and HF), and a ceramic filter (controlling PM). Since the thermal oxidizer (which has the benefit of controlling CO and VOC including PFAS) is intrinsic to the plant design, it is not an add-on pollution control device for the purposes of this application.

Figure 3-1 Exhaust Points



3.1.1 Oxides of Nitrogen (NO_x) and Ammonia (NH_3)

NO_x is formed during the combustion process in the thermal oxidizer due to the reaction between nitrogen and oxygen in the combustion air at the high temperatures ("thermal NO_x") and the reaction of nitrogen bound in the fuel with oxygen ("fuel NO_x"). Fuel NO_x is minimal from the combustion of natural gas. NO_x can be controlled by low-NO_x combustion technology and SCR.

The uncontrolled NO_x from the thermal oxidizer is about 1.3 lb/MMBTU. This is due to the high nitrogen content of the fuel and the high oxidation temperature in the thermal oxidizer which also serves to oxidize VOC and organic HAPs, including PFAS. Each natural gas heater identified in Section 2.13 shall be equipped with low NOx burners (< 30 ppmv NOx).

SCR is an add-on pollution control technology that injects either anhydrous or aqueous ammonia into the flue gas over a catalyst. The NO_x within the flue gas combines with the ammonia to form water and nitrogen. The general chemical reaction is:

$$4\ NO + 4\ NH_3 + O_2 \rightarrow 4\ N_2 + 6\ H_2O$$

The reaction has a relatively narrow flue gas temperature window; the reaction does not progress if the temperature is too cool, and the catalyst is damaged if the temperature is too hot. The SCR process begins with the injection of ammonia into the flue gas stream by means of an injection grid upstream of a SCR section, in this case the catalyst is embedded in the ceramic filters used primarily for PM control. The injection grid and reactor are located within the optimum temperature range for the reaction (about 650°F-700°F).

The ammonia reagent for the SCR reaction will be stored in an on-site tank. Aries Pine Tree LLC will use 19% aqueous ammonia. Unreacted/excess ammonia emitted to the air is known as ammonia slip and will be limited to 10 ppmv at 15% O2.

3.1.2 Sulfur Dioxide (SO_2)

The producer gas has a relatively high level of sulfur from the gasification of the biosolids (maximum of 1.89% in the biosolids). This results in a high concentration of SO_2 in the oxidizer exhaust. This will be controlled with dry sorbent injection ahead of the ceramic filters. The sorbent collects as a cake on the filters and absorbs the SO_2. The reaction product, $CaSO_4$ is collected on the filter.

With regard to the natural gas heaters, the supplied natural gas is pipeline quality, i.e., containing less than 0.5 grains/100 scf of total sulfur; SO2 emissions are therefore insignificant.

3.1.3 Particulate Matter (PM)

The producer gas has a relatively high level of ash, sulfur, etc. that forms PM during combustion in the thermal oxidizer. A ceramic filter will be used to remove 99% of the PM at a high enough temperature to make capture of the heat for use in the biosolids dryer technically and economically feasible. Most of the solids going into the ceramic filter are recycled sorbent used to optimize the stoichiometry of the reaction of acid gases with the calcium in the sorbent. It is conservatively assumed throughout this application that PM / PM10 / PM2.5 are equivalent. PM refers to both filterable and condensable particulate matter combined.

3.1.4 Hydrochloric Acid (HCl)

The emissions of hydrogen chloride from the biosolids gasification process are based on stack testing from the Maxwest pilot facility in Sanford, Florida, combined with the efficiency of the gasifier's pollution control system (i.e., dry sorbent injection).

3.2 Air Emissions Control System

An emission control system will be installed before the main stack to reduce the NOx, SO_2 and HCl, HF, and particulate emissions from the biosolids gasification process. The emission control equipment selected for the project eliminates 99.8% of particulate matter (PM), 95% NOx, and 96% SO2 from the flue gas. The system consists of an enclosed Selective Catalytic Reduction, dry sorbent injection, and a ceramic filter house. The selected supplier is Tri-Mer Corporation (TMC) or equal who will provide their proprietary state of the art UltraCat Catalytic Filter (UCF) System or equivalent.

A detailed vendor presentation is provided as *Attachment I*. This system has been successfully installed at the analogous Aries biosolids gasification facility in Linden, NJ, and has also been selected to represent Best Available Control Technology (BACT) for Aries Pine Tree LLC, as detailed in Section 4.

3.2.1 Approach

The control system will utilize high temperature lightweight ceramic filters impregnated with catalyst as the primary method of treating the exhaust gas. The UltraCat filters are manufactured by starting as a slurry of refractory fibers and are "injection molded" into tube shapes that are 10 feet long and six inches across. The filters are lightweight, approximately 90% open, with very low pressure drop. They are robust, resistant to mechanical and thermal shock, and self-supporting without any filter cages.

When the UltraCat filters are manufactured (by injection molding), small pores are created on the outside of the filters, preventing penetration of particulates into the filter wall, and enhancing easy release of the particulate during the cleaning cycle. Other brands of ceramic filters are usually vacuum formed, which produce larger pores on the outer surface. This has been shown to seriously affect the ability to effectively clean the filters, and consequently increase operating pressure drop and reduce the filter life.

The UltraCat Catalytic filters have nano-bits of catalyst embedded in their 3/4-inch thick walls to facilitate the selective catalytic reduction (SCR) of NOx by NH_3. The nano-catalyst offers a 6X better utilization of the catalyst than for conventional block catalyst SCR reactors. In the filters, contact time between the gases and catalyst is not restricted by the required diffusion of the gases to the coated walls of the block reactor gas channels. This greater utilization of the catalyst allows good performance at lower temperatures with reasonable catalyst volumes and differential pressure.

The performance of all catalysts can be severely compromised by either physical blinding from particulates or chemical deactivation by either reactive particulates or gases. With the TMC UCF, particulate is captured on the surface of the filters. The nano-catalyst is completely protected inside the filter, eliminating the particulate-type interactions and extending the catalyst life.

High performance hydrated lime will be injected upstream of the filters to control SO_2 and any other acid gases present. Ammonia will also be injected upstream and the interaction with the catalyst embedded in the filters will convert a high percentage of the NOX emissions to nitrogen gas and water vapor, with low ammonia slip.

Advantages of the modularized UltraCat ceramic filter approach include:

- Performance - High removal of pollutants, superior overall.
- Redundancy - Built into the modular approach.
- Simplicity - PM, SO_x, and NOx are treated in the same unit.
- Maintenance - Fewer moving parts, less corrosion, no high voltage electrical.

TMC fabricates the filter housings in three sections and pre-assembles them in the factory for fit and completeness. To minimize complexity and risk, the sections are shipped to the job site on flatbed trucks where they are reassembled by a TMC team.

The TMC scope consists of the following major items:

- Filter housings with filters and all hardware and software required for operations;
- Sorbent injection system with ~4000 cu. ft. sorbent storage system;
- Particulate matter handling and capture system;
- Aqueous ammonia injection system and ~10,000-gallon storage tank;
- Interconnecting ductwork from tie-in point to UCF units;
- Controls system that integrates monitoring and control of components and systems listed above;
- Supervision during construction and startup.

3.2.2 Emissions Control System Description

Hydrated lime sorbent is delivered by truck to the site and unloaded into a ~4,000-cubic foot sorbent storage silo. Aqueous ammonia is delivered by truck in a 19% solution for storage in a ~10,000-gallon tank.

Hydrated lime sorbent and aqueous ammonia are injected into the flue gas stream as it flows into the ceramic filter house for SO2 and NOx reduction. The injection rate of dry sorbent is controlled based on the specified outlet emission limit.

The ammonia injection is accomplished through the use of air atomizing nozzles. The rate is controlled by measuring inlet mass rate of NOx. The rate is used to calculate the aqueous ammonia injection rate that is based on specified reduction percentage.

The SCR process uses a 19% aqueous ammonia solution as a reactant to remove NOx. NOx emissions are further reduced with some control of the gas temperatures and vanadium pentoxide as a catalyst embedded in the ceramic filters.

The combined exhaust gas containing the required levels of dry sorbent and aqueous ammonia flows to the inlet plenum of the UCF system. The retention within the duct provides vaporization of aqueous ammonia, mixing of sorbent and ammonia gas with the process gas, and the first step of acid gas reaction with the dry sorbent. The gas is then split across the filter housings within which it flows through the ceramic filter elements. The particulate matter (PM) is removed, the acid gas is more fully reacted by the sorbent cake that forms on the filters, and the NOx and ammonia are converted to nitrogen and water vapor by contact with the catalyst contained within the filter element walls.

An induced draft fan installed on the downstream side of the filter house provides for a continuous induced flow of air within the flue gas duct work and ancillary emissions control equipment. The exhaust or discharge side of the induction fan is connected directly to the 130 ft tall exhaust stack.

Process solids (spent sorbent material) generated by the system are cleaned from the filters using pulse jets to loosen the material from the filter so that it drops into the bottom of the housing and pneumatically conveyed to the spent sorbent storage silo. The contents of the storage silo are discharged into trucks as needed (“loadout”), for off-site disposal.

4. BEST AVAILABLE CONTROL TECHNOLOGY (BACT) ANALYSIS

As defined by Maine DEP, Best Available Control Technology (BACT) means an emission limitation based on the maximum degree of reduction which is achievable for each pollutant taking into account energy, environmental, and economic impacts and other costs.

The following subsections contain the information specified in Maine DEP's guidance document, "A Summary of EPA and Maine DEP BAQ Instructions for Conducting a BACT Analysis"[1] for the pollutants that meet Ch.115 licensing thresholds (NO_x, SO_2, PM, HCl). The analysis included a review of EPA's RACT/BACT/LAER Clearinghouse (RBLC) database and other available industry references, e.g. State-issued air permits, where applicable. However, it should also be noted that Aries Pine Tree LLC uses a proprietary and innovative biosolids gasification process with heat recovery; the only directly comparable process is at the Aries facility in Linden, NJ.

Table 4-1 BACT Selection

Pollutant	BACT Selection
SO2, HCl	Dry Sorbent Injection*, Combustion of Pipeline Quality Natural Gas
NOx	Selective Catalytic Reduction*, Low NOx Burners
PM	Catalytic Ceramic Filter*

* The Dry Sorbent Injection, Selective Catalytic Reduction, and Catalytic Ceramic Filter systems are to be within an integrated Tri-Mer or equal pollution control system as described in *Attachment I* (or equivalent), which has been successfully field-tested at the existing Aries biosolids gasification facility in Linden, NJ.

4.1 Sulfur Dioxide (SO_2)

Sulfur Dioxide (SO_2) results from oxidation of the sulfur in biosolids during combustion of the producer gas in the thermal oxidizer. Aries Pine Tree LLC proposes to limit SO2 to 12.63 lb/hr at the main stack using Dry Sorbent Injection (DSI) as described in Section 3.2 (a component of the Tri-Mer emission control system, ahead of the ceramic filter) to achieve 96% control. This was found to be the optimum technology when compared with other strategies that may offer similar or higher levels of SO_2 control, as described below. (*Note:* The dry sorbent injection system will also have the benefit of controlling HCl and any other acid gas emissions such as HF by a similar magnitude; Aries Pine Tree LLC proposes to limit HCl to 0.42 lb/hr at the main stack accordingly.)

4.1.1 Identification of Potential Control Strategies

SO_2 typically enters the air through the processing of fuels that contain a substantial Sulfur content (> 0.5%). Control technologies are well established industry-wide and are summarized in *Table 4-2*.

[1] https://www.maine.gov/dep/air/publications/docs/BACTGuidanceA-L-0082.pdf

4.1.2 Elimination of Technically Infeasible Options

The choice of the appropriate sulfur removal technology is influenced by the sulfur levels in the fuel. In general, fuel in refineries or coal plants contain sulfur levels in the typical range of 3-6%. Biosolids fuel used in the Aries gasification unit is typically around 1.65% Sulfur with a maximum of 1.89%. The lower concentration limits the choice of feasible sulfur removal technology that may be considered from the available technologies listed in Table 4-2.

Table 4-2 SO_2 Removal Technologies

Technology	Raw Materials Required	Byproducts	Maximum Fuel Sulfur Content	Maximum SO2 Removal Efficiency
Wet Scrubbers	Limestone, Lime, Water, Seawater	Gypsum, Sludge, Wastewater, Waste Seawater	3.5%	90-98%
Spray Dry Scrubbers	Lime, Calcium Oxide, Water	Calcium Sulfate, Sulfite and Fly ash	3.5%	90-95%
Dry Sorbent Injection	Hydrated Lime or Sodium based reagent	Calcium or Sodium Sulfate, Sulfite and Fly ash	3.5%	90-98%
Wet Sulfuric Acid Process	Natural Gas, Cooling Water, Catalyst	Steam, Sulfuric Acid, Spent Acid	3-6%	70-95%

Wet Scrubbers

Wet Scrubbing systems remove SOx from flue gas by providing intimate contact between the gas and a slurry of finely ground limestone or lime. The slurry is injected into a vessel designed for SOx removal and absorbs the SOx from the flue gas to form a mixture of calcium sulfite and calcium sulfate (gypsum). The process efficiency is generally stated to be up to 98% for medium to high sulfur fuels.

For wet scrubbers, the inlet gas temperature requirement ranges between 300-700°F. To be technically feasible, this would mean the wet scrubber would need to be installed in the Aries system downstream of the first heat recovery exchanger. However, due to the nature of the wet scrubbing process and the interaction of the flue gas with the injected lime or limestone a drop in temperature of 200-400°F will result across the system. This temperature drop is due to the requirement for the flue gas temperature to be slightly above the adiabatic saturation temperature to avoid wet solids deposit on downstream equipment.

The application of a wet scrubber is **not a technically feasible option** in Aries's system for two reasons; 1) The temperature drop in the scrubber would result in a loss of recoverable heat in the flue gas which is required for the dryer to dry the incoming biosolids, and; 2) The temperature drop would reduce the flue gas temperature outside the optimal operating range for the NOx removal system and achieving 95% NOx removal would not be possible.

Spray Dry Scrubbers

Spray dry absorber scrubbers are the next most widely used technology for SOx removal after wet scrubbing. The spray dry scrubbing process (also known as semi dry scrubbing) has some similarities to the wet scrubbing process. In this case however lime must be used because limestone is not suitable for this process. The lime is mixed with water to form a suspension which is injected into the absorber as a fine mist. The high surface area of the droplets reacts with the incoming flue gas to remove the SOx using flue gas distribution mechanisms to aid removal.

Similar to the wet scrubbing system, the spray dry scrubber requires a specific inlet flue gas temperature in order to operate effectively. The relative humidity in the unit is required to be held at a specific point (~6%) which requires the temperature of the inlet flue gas to be controlled at approximately 250-300°F. This is too low for the Aries process as the flue gas that would enter the scrubber is at a minimum ~500°F.

Wet Sulfuric Acid (WSA) Process

Flue gas is cleaned in an electrostatic precipitator and heated by feed/effluent heat exchange with the gas leaving the SO2 converter in a regenerative or recuperative heat exchanger. After the heat exchange, the gas is introduced to the SO2 converter which turns SO2 into SO3. The converted gas is then introduced to the effluent heat exchanger, and final cooling and condensation takes place in the WSA condenser where it is converted to sulfuric acid in the presence of water. The cleaned gas is sent directly to the stack, and the heated cooling air is returned to the boiler. The main by-product of this process is sulfuric acid, a highly corrosive liquid that requires special handling systems and procedures.

The WSA is typically used on higher sulfur content fuels in the order of 3-6% sulfur. This range is due to the requirement to keep the dew point of sulfuric acid between a certain range. If the sulfur content of the feed is too low or too high the conversion to sulfuric acid is reduced and therefore the removal efficiency is decreased. The Aries fuel is expected to have a maximum of 1.65% Sulfur in the feed and therefore is **not technically feasible** for this process.

Dry Sorbent Injection

Dry Sorbent Injection is the use of a calcium or sodium based sorbent by injection into the duct upstream of a filter, where the sorbent collects on the filter and reacts with SO2. No water is introduced. Higher stoichiometric ratios of sorbent are required than in wet or spray dry scrubbers, but this can be optimized by recycling of the sorbent.

4.1.3 Conclusion (SO2 BACT)

In summary, the only technically feasible control technology for biosolids gasification with heat recovery is Dry Sorbent Injection (DSI).

For small-scale natural gas combustion in the ancillary heaters, the planned usage of pipeline quality natural gas (< 0.5 grains sulfur per 100 scf) results in insignificant SO_2 emissions. The exhaust from selected heaters is also routed to the main stack's Tri-Mer pollution control system, therefore providing additional SO_2 control.

4.2 Oxides of Nitrogen (NOx)

Aries Pine Tree LLC proposes to limit NOx to 4.5 lb/hr at the main stack using Selective Catalytic Reduction (SCR) as described in Section 3.2 (a component of the Tri-Mer emission control system) to achieve 95% control. It is well established that SCR would be considered Best Available Control Technology (BACT) for control of NOx through the following control mechanisms. As SCR is the top-rated control technology for NOx, lesser-efficiency control devices are not evaluated herein.

The SCR system is a method for converting NOx generated from the biosolids gasification exhaust stream to diatomic nitrogen and water by reacting with NH_3 in the presence of a catalyst (e.g., Vanadium Pentoxide). NH_3 is vaporized and injected in the flue gas upstream of the catalyst, which, when passing over the catalyst, reacts with NOx to form N_2 and H2O.

The operating temperature and the flue gas properties are critical to both the performance and life of the catalyst. In this application, modules of the catalyst are installed downstream of the thermal oxidizer. The typical operational temperature range for base-metal catalysts is 600°F to 800°F. The key technical and economic issues are the performance and life of the catalyst.

Environmental impacts associated with SCR are emissions and storage of NH_3 and catalyst disposal. Low levels of NH_3 slip are to be considered in assessment of environmental impacts. Throughout the life span of the catalyst, maximum NH_3 slip will not exceed 10 ppmv at 15 percent O2. SCR can also result in some additional PM emissions in the form of ammonium bisulfate compounds, which typically increase as ammonia slip is reduced by adding catalyst. By balancing the allowable ammonia slip and the required catalyst necessary to achieve the required level of NOx control, the SCR system's contribution to the potential PM emissions of the proposed Facility is negligible.

Regarding the natural gas-fired ancillary heaters, low NOx burners (rated at 30 ppm NOx @ 3%O2) are proposed for use to represent the industry standard; no other evident strategies have been established for small-scale natural gas combustion. The exhaust from selected heaters is also routed to the main stack's Tri-Mer pollution control system, therefore providing additional NOx control.

4.3 Particulate Matter (PM)

Aries Pine Tree LLC proposes to limit PM to 8.0 lb/hr at the main stack using the ceramic cartridge filter described in Section 3.2 (a component of the Tri-Mer emission control system) to achieve 99.8% control. PM refers to both filterable and condensable particulate matter combined.

The producer gas has a relatively high level of PM that is inherent in the biosolids or formed during combustion in the thermal oxidizer, and a small amount of PM would also result from natural gas combustion in the ancillary heaters that vent through the main stack. Most of the PM entering the filters will be recycled sorbent. The ceramic cartridge filter described in Section 4.5 would be considered BACT for this source. As the ceramic cartridge filter is the top-rated PM control technology for biosolids gasification, lesser-efficiency control devices are not further evaluated herein.

Regarding the natural gas-fired ancillary heaters, the planned usage of pipeline quality natural gas is proposed for use to represent the industry standard; no other PM control strategies have been established for small-scale natural gas combustion. The exhaust from the heaters is also routed to the main stack's Tri-Mer pollution control system, therefore providing additional PM control.

4.4 BACT Summary

As detailed below and in *Attachment F*: the following emission rates from the main stack, from the gasification process and natural gas combustion combined and implementing add-on air emission controls, represent BACT for the five pollutants that meet Ch. 115 air licensing thresholds:

- SO2: 12.63 lb/hr
- NOx: 4.59 lb/hr
- NH3: 1.13 lb/hr
- PM: 8.0 lb/hr
- HCl: 0.42 lb/hr

5. PROPOSED COMPLIANCE MONITORING CONDITIONS

Based on the process details and BACT analysis in the preceding sections, as well as operational experience at the existing Aries facilities, it is proposed that the conditions in Table 5-1 represent best operating practices for compliance monitoring and recordkeeping.

Table 5-1 Proposed Compliance Conditions

Parameter	Proposed Compliance Conditions
SO_2 emissions from thermal oxidizer	Conduct biennial stack tests to demonstrate compliance with SO_2 BACT limit of 12.63 lb/hr at main stack
NO_x emissions from thermal oxidizer	Conduct biennial stack tests to demonstrate compliance with NO_x BACT limit of 4.59 lb/hr at main stack
NH_3 emissions from SCR system	Conduct biennial stack tests to demonstrate compliance with NH_3 BACT limit of 1.13 lb/hr at main stack
PM emissions from thermal oxidizer	Conduct biennial stack tests to demonstrate compliance with PM BACT limit of 8.0 lb/hr at main stack. [Compliance with this limit also assures compliance with *06-096 CMR 105*, General Process Source Particulate Emission Standard]
HCl emissions from thermal oxidizer	Conduct biennial stack tests to demonstrate compliance with HCl BACT limit of 0.42 lb/hr at main stack
Visible emissions from thermal oxidizer	Per *06-096 CMR 101*: Visible emissions at main stack shall not exceed 20 percent opacity on a six (6) minute block average basis, and shall be measured in accordance with 40 CFR 60, Appendix A, Method 9 during the biennial stack testing program.
NH_3 injection rate at selective catalytic reduction system	Monitor injection rate while in operation and maintain value within manufacturer's specified range
Lime injection rate at dry sorbent injection system	Monitor injection rate while in operation and maintain value within manufacturer's specified range
Inlet O_2 at thermal oxidizer	Monitor excess O_2 while in operation and maintain value within manufacturer's specified range
Exhaust temperature at thermal oxidizer	Monitor exhaust temperature while in operation and maintain value within manufacturer's specified range
Exhaust temperature at ceramic filter system	Monitor exhaust temperature while in operation and maintain value within manufacturer's specified range
Pressure drop at ceramic filter system	Monitor pressure drop while in operation and maintain value within manufacturer's specified range
NO_x emissions by natural gas external combustion devices	Use Low NO_x Burners (rated $\leq$ 30 ppm @ 3% O_2) on natural gas fired external combustion devices rated > 1 MMBtu/hr
SO_2 emissions by natural gas external combustion devices	Combust only pipeline quality natural gas containing less than 0.5 grains/100 scf of total sulfur

PM emissions by natural gas external combustion devices	Per *06-096 CMR 101*: Comply with PM emission limit of 0.12 lb/mmbtu at any natural gas fired external combustion devices rated ≥3 MMBtu/hr and <50 MMBtu/hr. [Combustion of pipeline quality natural gas assures compliance with this standard]
Biosolids throughput	Maintain records of the types, weights, and origins of all biosolids accepted at the facility.
Raw material throughput	Maintain records of the amounts of aqueous ammonia and lime sorbent accepted at the facility for pollution control device purposes.
Waste material output	Maintain records of the amounts of spent lime sorbent removed from the facility.
Facility-wide visible emissions	Per *06-096 CMR 101*: No visible emissions shall be caused within 20 feet of ground level, measured as any level of opacity and not including water vapor, beyond the legal boundary of the property on which such emissions occur. Compliance with this standard shall be determined pursuant to 40 C.F.R. Part 60, Appendix A, Method 22
Facility-wide PM	Per *06-096 CMR 101*: No fugitive dust emissions shall be caused during any period of construction, reconstruction, or operation without taking reasonable precautions. Such reasonable precautions shall be included in the facility's continuing program of best management practices for suppression of fugitive particulate matter and shall include, but not be limited to the following: (a) The use of water or other appropriate material to prevent airborne particulate matter generated by the demolition of buildings or other structures; construction operations; the clearing or grading of land; or the grading, construction, or improvement of roads; (b) The application of asphalt, water, suitable materials, wind barriers, or covers to material stockpiles, roads, and other surfaces that can be sources of airborne particulate matter; (c) The use of hoods, fans, suction devices, fabric filters, or other devices to enclose, vent, and control visible emissions from the handling of materials that can be the source of airborne particulate matter; (d) The covering, while in motion, of open-bodied trucks, open-bodied trailers, and railroad cars transporting materials that may be sources of airborne particulate matter; (e) The prompt removal of earth or other material deposited onto paved surfaces by trucking, earth moving equipment, erosion, or other means; and

	(f) The use of containment methods for sandblasting or similar operations.
Facility-wide	Per *06-096 CMR 137*: Submit emission statements by May 15 of each year in accordance with the format specified by Maine DEP.

6. AMBIENT AIR QUALITY ANALYSIS

6.1 Ambient Air Quality Modeling

Air dispersion modeling was conducted to evaluate maximum off-site ambient pollutant concentrations, consistent with the air modeling protocol submitted to Kevin Ostrowski of Maine DEP on 12/11/2024 and approved with minor revisions on 1/29/2025. A table with changes since then as requested is provided in *Attachment G*. The modeled pollutants are summarized below; a full modeling report is included as *Attachment G* and demonstrates compliance with all applicable State and Federal limits.

6.1.1 Criteria Air Pollutants

As required by the Clean Air Act, EPA has promulgated National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants: nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM10, PM2.5), carbon monoxide (CO), ozone (O_3), and lead (Pb). Though the NAAQS are based on NO_2 concentrations, most nitrogen oxides (NOx) emissions are in the form of nitric oxide (NO) rather than NO_2; therefore, a conversion of NOx to NO_2 was applied for modeling purposes.

The NAAQS specify concentration levels for various averaging times and include both "primary" and "secondary" standards. Primary standards are intended to protect human health, whereas secondary standards are intended to protect public welfare from any known or anticipated adverse effects associated with the presence of air pollutants, such as damage to vegetation. The more stringent of the primary or secondary standards were applied for comparison to the modeling results for this Project. Background concentrations of criteria pollutants were included where made available from MEDEP.

6.1.2 Maine Ambient Air Standards

MEDEP's Chronic Ambient Air Guidelines (AAGs)[2] represent chemical concentrations in ambient air, below which there is minimal risk of a deleterious health effect resulting from long-term inhalation exposure. Furthermore, additional concentration limits apply for chromium and lead, which are designated as Maine Ambient Air Quality Standards (MAAQS).

Air dispersion modeling was conducted to evaluate maximum concentrations of State-listed chemicals emitted by the proposed facility, which was compared to the referenced AAGs and MAAQS. Further details, including the specific State-listed chemicals to be modeled (broken down by process) are provided in *Attachment G*.

Furthermore, Maine DEP has provided guidance that Aries Pine Tree LLC is located in an area designated as a Class II Air Quality Control Region for Prevention of Significant Deterioration (PSD) purposes. In such cases, Maine requires increment modeling to be performed for all sources, regardless of size, which includes new minor sources or existing minor sources undergoing a minor modification. Since Aries Pine Tree LLC is a new source, its emissions would be considered entirely increment consuming, as they did not

[2] https://www.maine.gov/dep/air/monitoring/docs/ME_DEP_AAG_LIST_2025_FINAL_with%20notes.pdf

exist during any of the baseline years (1977, 1987 or 2010). The Class II increment standards are included in *Attachment G*.

6.1.3 PFAS Deposition

Municipal biosolids are known to contain Per-and polyfluoroalkyl substances (PFAS), which are a group of synthetic chemicals that are found in many products and are known as "forever chemicals." In the process of drying, gasifying and oxidizing biosolids these PFAS are destroyed or removed at rates exceeding 95%. The remaining PFAS exit the stack and are dispersed into the ambient air, and some are also deposited on the ground by wet or dry deposition.

This ambient air modeling effort also considered dry and wet deposition of PFAS compounds generated by the facility process. Two pathways were considered. First, Epsilon reviewed and selected standards for safe levels of PFAS in ambient air. Second, Epsilon evaluated standards for concentrations in water, looking at the pathway of deposition from the air onto the ground and from there into groundwater or surface water.

Neither the US EPA nor the Maine DEP have any PFAS ambient air quality standards. Epsilon therefore reviewed rules and guidelines from other jurisdictions and selected the most stringent health-based standards (from Michigan) for comparison. The maximum modeled concentration from Aries Pine Tree LLC, at any location, was over 20 times lower than the most stringent Michigan standard. This modeling was based on testing of the exhaust stack at the similar Aries Linden, NJ facility, which showed that total PFAS emissions are less than four ten-thousandths of a pound per hour (<0.0004 lb/hr). These test results from Linden, NJ are provided in *Attachment H.*

Similarly, the EPA and the Maine DEP do not propose any methodology to assess PFAS emissions impacts on groundwater or surface water; therefore Epsilon used a methodology from a different jurisdiction (New Hampshire) that requires consideration of deposition of PFAS to evaluate potential impacts. Using this methodology, Epsilon conservatively assumed that all the PFAS that deposits on the ground is transferred to the rainwater that soaks into the ground and could potentially impact groundwater. At the single location with the maximum modeled deposition, if all of the PFAS was transferred to the water that soaks through the ground, that water would have PFAS concentrations over 100 times lower than the most stringent EPA or Maine DEP drinking water standard.

Further details on the air and water PFAS deposition modeling, including tables of results, are provided in the facility's ambient air modeling report (*Attachment G).*

Attachment A

Completed Air Emission License Application Form

CHAPTER 115
AIR EMISSION LICENSE APPLICATION FORM

State of Maine
Department of Environmental Protection
Bureau of Air Quality
17 State House Station
Augusta, Maine 04333-0017
Phone: (207) 287-7688 Fax: (207) 287-7641

Section A: FACILITY INFORMATION

Owner or Operator (*Legal name as registered with the Secretary of State*):
Aries Pine Tree LLC

Facility Site Name: Aries Pine Tree LLC

Facility Site Address (*Physical, no post office boxes*): Cyro Road Lot 4

City/Town: Sanford Zip Code: 04073 County: York

Facility Description: Biosolids Gasification Facility using Fluidized Bed Gasifier and Thermal Oxidizer

Application Description:
Minor Source License Application for New Source

Current License #: A- ______ - ______ - ______ - ______

Check When Done:

All Sources

✓	Application Completed
✓	Copy Sent to Town (date sent: 1/28/2026)
✓	Public Notice Published paper name & date: Sanford Springvale News 1/23/2026
✓	Enclosed Public Notice Tear Sheet
✓	Signed Signatory Form (Section K)

Additional Requirements for New Sources

✓	Schedule for construction or installation of equipment
✓	Title, Right, or Interest (e.g. copy of deed or lease)
✓	Check for Fee

Additional Requirements for New Major Sources and Major Modifications

	Notify Abutting Landowners

For Department Use

Application #: A- ______ - ______ - ______ - ______

App Track #: ________________

Facility Contact:

Name: Mark Lyons Title: Director, Business Development/Feedstock
Company: Aries Pine Tree LLC
Mailing Address: 4037 Rural Plains Circle, Suite 290

City/Town: Franklin State: TN Zip Code: 37064
Phone: (603) 498-6525 Fax:
e-mail: mark.lyons@ariescleantech.com

Application Contact:

Name: Mark Lyons Title: Director, Business Development/Feedstock
Company: Aries Pine Tree LLC
Mailing Address: 4037 Rural Plains Circle, Suite 290

City/Town: Franklin State: TN Zip Code: 37064
Phone: (603) 498-6525 Fax:
e-mail: mark.lyons@ariescleantech.com

Billing Contact:

Name: Mark Lyons Title: Director, Business Development/Feedstock
Company: Aries Pine Tree LLC
Mailing Address: 4037 Rural Plains Circle, Suite 290

City/Town: Franklin State: TN Zip Code: 37064
Phone: (603) 498-6525 Fax:
e-mail: mark.lyons@ariescleantech.com

Section B1: STATIONARY FUEL BURNING EQUIPMENT

(List equipment such as boilers, hot water heaters, etc.)

Emission Unit ID	Type of Equipment (boiler, water heater, etc.)	Maximum Design Capacity	Maximum Firing Rate	Fuel Type	% Sulfur	Date of Manufacture	Date of Installation	Stack #
Boiler #1 (Example)	*asphalt heater (Example)*	*5.0 MMBtu/hr (Example)*	*35.7 gal/hr (Example)*	*#2 fuel oil (Example)*	*0.35% (Example)*	*1984 (Example)*	*1990 (Example)*	*#1 (Example)*
Gas-Heater	Gasifier Startup Heater	9 MMBTU/hr	0.0088 MMCF/hr	Natural Gas	~0.04 gr/100 scf	TBD (new)	TBD	Main
TO-Heater	Oxidizer Startup Heater	45 MMBTU/hr	0.044 MMCF/hr	Natural Gas	~0.04 gr/100 scf	TBD (new)	TBD	Main

Section B2: INTERNAL COMBUSTION ENGINES

(List equipment such as generators, diesel drive units, fire pumps, etc. Do not list wheeled mobile equipment such as loaders, backhoes, trucks, etc.)

											Spark Ignition Engines Only			
Emission Unit ID	Serial Number	Maximum Design Heat Input Capacity (MMBtu/hr)	Maximum Output Capacity (kW or Hp)	Maximum Firing Rate	Fuel Type	% Sulfur	Date of Manf	Date of Installation	Portable	Stationary	2-Stroke	4-Stroke	Rich Burn	Lean Burn
Generator #1 (Example)	*123ABC456 (Example)*	*5.0 MMBtu/hr (Example)*	*512 kW (Example)*	*35.7 gal/hr (Example)*	*Diesel (Example)*	*0.0015% (Example)*	*1984 (Example)*	*1990 (Example)*	*X*			*X*	*X*	
Emergency	TBD	~7.5	~750	~0.007 mmcf/hr	Natural Gas	~0.04 gr/100 scf	TBD (new)	TBD		X				X

Does your facility participate in a Demand Response program in which the generator(s) may be operated for more than 15 hours per calendar year?
☐ yes ☒ no

If yes, what units? ______________________________

Control Equipment for Fuel Burning Equipment

If applicable, indicate the types of required/operated add-on pollution control equipment, including baghouses, cyclones/multiclones, SCR, SNCR, etc.

Emission Unit	Type of Control	Pollutant Controlled	Control Efficiency
Boiler #1 (Example)	*Cyclone (Example)*	*PM (Example)*	*90% (Example)*
Gasifier	Dry Sorbent Injection	SO2, HCl	96%
Gasifier	Selective Catalytic Red.	NOx	95%
Gasifier	Ceramic Filter	PM	99.8%

Monitors for Fuel Burning Equipment:

If applicable, indicate types of required/operated monitors, including Continuous Emission Monitors (CEM), Continuous Opacity Monitors (COM), parameter monitors for operational purposes, etc.

Emission Unit	Type of Monitor	Data Measured
Boiler #1 (Example)	*CEM (Example)*	*NO_x (Example)*
Boiler #1 (Example)	*Parameter – operational (Example)*	*Temperature (Example)*
Gasifier (Oxidizer)	Parameter- Operational	Inlet O2
Gasifier (Oxidizer)	Parameter- Operational	Exhaust Temperature
Gasifier (SCR)	Parameter- Operational	NH3 Injection Rate
Gasifier (DSI)	Parameter- Operational	Lime Injection Rate
Gasifier (Ceramic Filter	Parameter- Operational	Exhaust Temperature
Gasifier (Ceramic Filter	Parameter- Operational	Pressure Drop

Section C: INCINERATORS

	Incinerator Unit 1	Incinerator Unit 2
Incinerator Type (medical waste, municipal, etc.)	NONE	
Waste Type		
Make (Shenandoah, Crawford, etc.)		
Model Number		
Date of Manufacture		
Date of Installation		
Number of Chambers		
Max. Initial Charge	lb	lb
Max. Design Combustion Rate	lb/hr	lb/hr
Heat Recovery? (Yes or No)		
Retention Time of Exhaust Gases	seconds	seconds
Automatic Feeder? (Yes or No)		
Temperature Range Primary	to °F	to °F
Secondary	to °F	to °F
Auxiliary Burner - Primary Chamber max. rating (MMBtu/hr)		
type of fuel used		
Auxiliary Burner - Secondary Chamber max. rating (MMBtu/hr)		
type of fuel used		
Annual Waste Combusted for _____(yr)		
Pollution Control Equipment (if any)		
Stack Number		
Monitors (ie - temperature recorder)		

Section D: PROCESS EQUIPMENT

Emission Unit ID	Type of Equipment	Maximum Raw Material Process Rate (name and rate)	Maximum Finished Material Process Rate (name and rate)	Date of Manufacture	Date of Installation	Stack #	Control Device
Kilns (Example)	*Drying Kilns (Example)*	*N/A (Example)*	*25 MMBF/year (Example)*	*1990 (Example)*	*1990 (Example)*	*fugitive (Ex.)*	*none (Example)*
PB#1 (Example)	*Paint Booth (Example)*	*10 gal/hr (Example)*	*N/A (Example)*	*2001 (Example*	*2001 (Example)*	*#4 (Ex.)*	*Paper Filters (Example)*
GS	Gasifier	450 wet tons/day	15-30 tons/day	TBD (New)	TBD	Main	DSI + SCR + Filter

<u>Solvent Cleaners</u>
(Also known as Parts Washers and/or Solvent Degreasers)

Emission Unit ID	Capacity (gallons)	Solvent Used	Solvent % VOC
Degreaser #1 (Example)	*15 (Example)*	*Kerosene (Example)*	*100% (Example)*
NONE			

PROCESS EQUIPMENT (section D cont'd)

Chemical Usage

Note: Complete this section for any chemicals integral to your process, for example, a cementing process for outersoles, dyes, surface coating, printing, cleaning, etc. Attach additional pages or MSDS sheets as needed.

Process	Chemical substance used in process	Actual Usage (gal or lb for yr _____)	Hazardous chemical(s) in substance	Percent VOC[1] (%)	Percent HAP[2] (%)	Total VOC emitted (lb/year)	Total HAP emitted (lb/year)
Gasifier (SCR)	19% Aqueous NH_3	N/A (new unit)	Ammonia	0	0	0	0
Gasifier (DSI)	Sorbent (Lime)	N/A (new unit)	None	0	0	0	0

[1] Volatile Organic Compounds
[2] Hazardous Air Pollutants

Describe method of record keeping (ie. monthly calculations from purchase records, flow monitors on solvent tanks, etc.)

Automatic data logger for process parameters, including but not limited to: inlet O2 at thermal oxidizer, oxidizer exhaust temperature, ammonia injection rate at SCR, lime injection rate at DSI, ceramic filter exhaust temperature, pressure drop across ceramic filters, etc.

Other records will be maintained per standard corporate practices, including but not limited to: types, weights, and origins of all biosolids and raw materials accepted at the facility; types and weights of biochar and waste materials produced, etc.

Describe methods used to calculate VOC/HAP emitted (ie – test results, if control equipment was taken into account; if conditions exist where solvents remain in the substrate rather than complete volatilization, etc.)

For biosolids gasification, data from Aries pilot projects in NJ and FL using the same proprietary gasification process were referenced. For natural gas combustion, AP-42 emission factors from were applied. (See Appendix F)

Section E: STACK DATA

Stack #	Height Above Ground (ft)	Inside Diameter (ft)	Exit Temperature °F	Exhaust Flow Rate (ft^3/s) [indicate actual or standard]
Main	130	4	298	779 (actual)

Section F: ANNUAL FACILITY FUEL USE

Total Fuel Consumption by Month for: _________ (year)

	Fuel type: N/A (new unit)	Fuel type: ___________	Fuel type: ____________
Avg % sulfur (oil)	______	______	______
Avg % moisture (wood)	______	_____	_____
	(circle one: gal, tons, scf)	(circle one: gal, tons, scf)	(circle one: gal, tons, scf)
January	___________	___________	___________
February	___________	___________	___________
March	___________	___________	___________
April	___________	___________	___________
May	___________	___________	___________
June	___________	___________	___________
July	___________	___________	___________
August	___________	___________	___________
September	___________	___________	___________
October	___________	___________	___________
November	___________	___________	___________
December	___________	___________	___________
Total	___________	___________	___________
Proposed Annual Limit	___________	___________	___________

Section G: LIQUID ORGANIC MATERIAL STORAGE

Tank #	NONE					
Capacity (gallons)						
Materials Stored						
Reid Vapor Pressure (RVP)						
Annual Throughput						
Above or Below Ground?						
Tank Type (floating or fixed, riveted or bolted, etc.)						
Physical Description – year installed						
Physical Description – color						
Dimensions - height (ft)						
Dimensions - Diameter (ft)						
Construction Material						
Control Device						

Section H: MISCELLANEOUS

Note: Use this section to describe any equipment, activities, or other air emission sources that did not fit in any of the above categories. Include descriptions of the associated emissions. Attach additional pages if necessary.

Please refer to attached Narrative and attachments:
Attachment A Completed Air Emission License Application Form
Attachment B Documentation of Right to the Site
Attachment C Process Flow Diagram
Attachment D U.S. EPA Determination Letters
Attachment E Site Plan
Attachment F Emission Calculations
Attachment G Ambient Air Modeling Report
Attachment H PFAS Stack Test Report (Linden NJ)
Attachment I Air Emission Control System Literature

Section I: BPT/BACT AND OTHER ATTACHMENTS

BPT/BACT Analysis:

For a license renewal for existing equipment, the applicant is required to submit a Best Practical Treatment (BPT) analysis to the Department. A BPT analysis establishes what equipment or requirements are appropriate for control or reduction of emissions of regulated pollutants to the lowest possible level considering the existing state of technology, the effectiveness of available alternatives, and the economic feasibility.

For a new license or the addition of new equipment to an existing license, the applicant is required to submit a Best Available Control Technology (BACT) analysis. A BACT analysis is a top-down approach to selecting air emission controls. It is done on a case-by-case basis and develops emission limits based on the maximum degree of reduction for each pollutant emitted taking into account economic, environmental and energy impacts.

☐ I certify that, to the best of my knowledge, the control equipment, fuel limitations, and process constraints outlined in this application represent BPT / BACT for the equipment and processes listed.

OR

☑ I have attached a separate BPT / BACT analysis to this application.

Other Attachments:

Please list any other attachments included with this application.

Please refer to attached Narrative and attachments:
Attachment A Completed Air Emission License Application Form
Attachment B Documentation of Right to the Site
Attachment C Process Flow Diagram
Attachment D U.S. EPA Determination Letters
Attachment E Site Plan
Attachment F Emission Calculations
Attachment G Ambient Air Modeling Report
Attachment H PFAS Stack Test Report (Linden NJ)
Attachment I Air Emission Control System Literature
Attachment J Documentation of Public Notice

Section J: APPLICABLE RULES

Please indicate any rules you believe may be applicable to your facility by checking the associated box.

	Citation	Title
✓	06-096 CMR 101	Visible Emissions
✓	06-096 CMR 103	Fuel Burning Equipment Particulate Emission Standard
	06-096 CMR 104	Incinerator Particulate Emission Standard
✓	06-096 CMR 105	General Process Source particulate Emission Standard
	06-096 CMR 106	Low Sulfur Fuel Regulation
	06-096 CMR 111	Petroleum Liquid Storage Vapor Control
	06-096 CMR 112	Bulk Terminal Petroleum Liquid Transfer Requirements
	06-096 CMR 117	Source Surveillance
	06-096 CMR 118	Gasoline Dispensing Facilities Vapor Control
	06-096 CMR 121	Emission Limitations and Emission Testing of Resource Recovery Facilities
	06-096 CMR 123	Paper Coating Regulation
	06-096 CMR 124	Total Reduced Sulfur Control from Kraft Mills
	06-096 CMR 125	Perchloroethylene Dry Cleaner Regulation
	06-096 CMR 126	Capture Efficiency Test Proceedures
	06-096 CMR 129	Surface Coating Facilities
	06-096 CMR 130	Solvent Degreasers
	06-096 CMR 131	Cutback Asphalt and Emulsified Asphalt
	06-096 CMR 132	Graphic Arts – Rotogravure and Flexography
	06-096 CMR 133	Petroleum Liquids Transfer Vapor Recovery at Bulk Gasoline Plants
	06-096 CMR 134	Reasonably Available Control Technology for Facilities That Emit Volatile Organic Compounds
✓	06-096 CMR 137	Emission Statements
	06-096 CMR 138	Reasonably Available Control Technology for Facilities That Emit Nitrogen Oxides
	06-096 CMR 140	Part 70 Air Emission License Regulations
	06-096 CMR 145	NOx Control Program
	06-096 CMR 153	Mobile Equipment Repair and Refinishing
	06-096 CMR 159	Control of Volatile Organic Compounds from Adhesives and Sealants
	06-096 CMR 161	Graphic Arts – Offset Lithography and Letterpress Printing
	40 CFR Part 60	New Source Performance Standards (NSPS) (please list Subpart(s):)
	40 CFR Part 63	National Emission Standards for Hazardous Air Pollutants (NESHAP) (please list Subpart(s):)
	Other (list)	
	Other (list)	

Section K: SIGNATORY REQUIREMENT

Each application submitted to the Department must include the following certification signed by a Responsible Official*:

"I certify under penalty of law that, based on information and belief formed after reasonable inquiry, I believe the information included in the attached document is true, complete, and accurate."

[signature] 1/23/26

Responsible Official Signature | Date

Kari Mueller | Senior Vice President, Operations

Responsible Official (Printed or Typed) | Title

* A Responsible Official is defined by MEDEP Rule, Chapter 100 as:

A. For a corporation: a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit and either:

(1) The facilities employ more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars); or

(2) The delegation of authority to such representatives is approved in advance by the permitting authority;

B. For a partnership or sole proprietorship: a general partner or the proprietor, respectively;

C. For a municipality, State, Federal, or other public agency: Either a principal executive officer or ranking elected official. For the purposes of this part, a principal executive officer of a Federal agency includes the chief executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., a Regional Administrator of EPA).

Attachment B

Documentation of Right to the Site

PURCHASE AND SALE AGREEMENT

This Purchase and Sale Agreement ("Agreement") is made and entered into as of this 10th day of October, 2024 (the "Effective Date"), by and between **Aries Clean Technologies LLC**, a Delaware LLC with a mailing address of 4037 Rural Plains Circle, Suite 290, Franklin TN 37064 ("Buyer") and **Industrial Development Corporation of Sanford**, a Maine non-profit corporation with a mailing address of 917 Main St, Ste D, Sanford, ME 04073 ("Seller").

In consideration of the mutual covenants and promises hereinafter set forth, Seller and Buyer agree as follows:

1. Property. Seller agrees to sell and Buyer agrees to purchase, on the terms and conditions contained in this Agreement the parcel of land located at or near Lot 4 Cryo Road Extension in Sanford, York County, Maine and all improvements thereon, systems and utilities associated therewith and all rights, easements and interests appurtenant thereto (the "Property"). The Property is depicted on **Exhibit A** attached hereto and is further described in those certain deed recorded in the York County Registry of Deeds in Book 239, Page 33 and as amended in Plan Book 389, Page 50. The description of the Property as described above and on Exhibit A is understood to be general in nature and the description in the deed of conveyance contemplated herein shall be subject to approval by Buyer.

2. Purchase Price. Subject to any adjustments and prorations hereinafter described, Buyer agrees to pay for the Property **Four Hundred Thousand U.S. Dollars ($ 400,000.00)** (the "Purchase Price") payable as follows:

(a) Deposit. Within five (5) business days of the Effective Date, earnest money deposit in the sum of One Hundred Thousand Dollars ($100,000.00) (the "Deposit") in part payment of the purchase price is to be delivered to The Boulos Company as Escrow Agent. The Deposit shall be held in a non-interest bearing escrow account and applied against the Purchase Price at closing or otherwise distributed pursuant to the terms and conditions of this Agreement and Buyer and Seller shall simultaneously execute an escrow agreement with Escrow Agent.

(b) Cash at Closing. The balance of the Purchase Price, Three Hundred Thousand Dollars ($300,000.00) is to be paid by wired funds at Closing (hereinafter defined).

3. Title. Seller shall convey the Property to Buyer at the Closing in fee simple with good and marketable title free and clear of all liens and mortgages, except for liens for real estate taxes not yet due and payable, covenants pertaining to the Property as described in **Exhibit B** as modified as described in Section 4 below, and Permitted Encumbrances (hereinafter defined).

Within sixty (60) days of the Effective Date (the "Title Review Period"), Buyer shall notify Seller in writing (the "Title Objection Notice") of matters of record at the York County Registry of Deeds adversely affecting title to the Property that are objectionable to Buyer in Buyer's sole discretion ("Unpermitted Encumbrances"). Buyer shall be deemed to have waived the right to object to any matter affecting title as of the Effective Date, excluding any mortgage, tax lien or mechanics' lien, or judgment lien, for which no title objection is required, if Buyer fails to specifically identify such matters in the Title Objection Notice (each matter not objected to being a "Permitted Encumbrance"). Seller may, but shall have no obligation to, eliminate, modify or remove the Unpermitted Encumbrances, if any; provided, however, that Seller agrees to remove and eliminate any and all monetary liens affecting the Property before Closing. Seller shall, within thirty (30) days after receipt of Buyer's Title Objection Notice, deliver to Buyer written notice that either (i) Seller will, at Seller's expense, cure or remove each of the items to which objection has been made by Buyer before Closing, or (ii) Seller is unable or unwilling to cure or remove any one or more of said items objected to by Buyer. If Seller is unable or unwilling to eliminate, modify or remove the Unpermitted Encumbrances within said thirty (30) day period (or if Seller does not timely respond, it shall be deemed to have refused to take further action), Buyer, as Buyer's sole and exclusive remedy, shall have the right to terminate this Agreement by giving written notice of such election within fifteen (15) days thereafter. If Buyer so terminates this Agreement, Fifty Thousand Dollars ($50,000.00) shall be returned to Buyer, Seller shall be entitled to retain the remaining Deposit, and neither party shall have any further rights, duties or obligations hereunder. If Buyer does not so terminate this Agreement, then Buyer shall be deemed to have waived Buyer's rights to object to the Unpermitted Encumbrances to which Seller has not expressly agreed to cure by written notice to Buyer (which will then become Permitted Encumbrances).

4. Inspection Contingency Period.

(a) Within three (3) business days following the Effective Date, Seller shall deliver to Buyer copies of any and all documents in Seller's possession relating to the Property including, but not limited to, any and all licenses, occupancy agreements, permits, engineering reports, environmental reports, title policies, surveys, site plans, building plans, property tax statements for the past twelve (12) months, a copy of any notices of claims, demands, or lawsuits related to or affecting the Property that have not been finally resolved beyond any appeal periods (collectively, the "Due Diligence Documents"). Buyer is encouraged to seek information from professionals regarding any specific issue of concern. Buyer shall have a period of twenty-four months (24) months from the Effective Date (the "Inspection Contingency Period") to examine and inspect the Property and such Due Diligence Documents. Subject to the foregoing, during the Inspection Contingency Period, Seller shall allow Buyer or Buyer's agents access to the Property to conduct a non-invasive inspection of the Property as Buyer deems necessary to determine the feasibility of the Property for Buyer's intended use and Buyer shall bear all costs and expenses of its investigation. Buyer acknowledges that all inspections, of whatever kind or character, performed on the Property during the Inspection Contingency Period are Buyer's sole responsibility.

(b) If Buyer finds the Due Diligence Documents and/or the Property unacceptable for any reason or no reason, then Buyer, at Buyer's sole discretion, shall have the right to terminate this Agreement by written notice, which notice must be received by Seller on or before the expiration of the Inspection Contingency Period. If Buyer so terminates this Agreement, Fifty Thousand Dollars ($50,0000.00) of the Deposit shall be returned to Buyer, Seller shall be entitled to retain the remaining Deposit, and thereafter neither party shall have any further rights, duties or obligations to the other hereunder, except for the obligations which are expressly stated herein to survive the Closing or termination of this Agreement. If the Buyer does not notify the Seller that an inspection is unacceptable within the Inspection Contingency Period, this contingency is waived by the Buyer.

(c) Seller acknowledges and agrees that Buyer's obligations here under are conditioned upon modifications to the covenants in Exhibit B permitting Buyer's proposed use of the Property being accepted and ratified by those lot owners entitled to enforce said covenants. If the covenants are not modified to Buyer's satisfaction prior to the end of the Inspection Contingency Period, Buyer may terminate this Agreement and be entitled to the return of Fifty Thousand Dollars ($50,0000.00) of the Deposit, Seller shall be entitled to retain the remaining Deposit, and thereafter neither party shall have any further rights, duties or obligations to the other hereunder, except for the obligations which are expressly stated herein to survive the Closing or termination of this Agreement.

5. Representations and Warranties.

(a) Seller. Except as actually known to Buyer prior to Closing as a result of Buyer's investigations of the Property, Seller warrants and represents, to its actual knowledge, to Buyer as follows as of the date hereof and as of the date of Closing, which representations and warranties shall survive Closing for a period of twelve (12) months:

(i) Seller has the legal right, power and authority to enter into this Agreement and to perform all of its obligations hereunder, and the execution and delivery of this Agreement and the performance by Seller of its obligations hereunder will not conflict with, or result in breach of any regulation, order, judgment, injunction or decree of any court or governmental authority or any agreement or instrument to which Seller is a party or by which it is bound.

(ii) There are no leases, tenancies, occupancies or licenses encumbering the Property.

(iv) There are no options to purchase, rights of first refusal, or other pre-emptive purchase rights with respect to the Property.

(v) There are no disputes regarding the location of the boundaries of the Property or claims of adverse possession or prescriptive easement with respect to the Property.

(vi) The Property is in compliance with applicable laws, ordinances, and regulations.

(vii) The Property either abuts or has a deeded right of way to public roads for purposes of pedestrian, vehicular, and utility access.

(b) Buyer. Buyer has the legal right, power and authority to enter into this Agreement and to perform all of its obligations hereunder, and the execution and delivery of this Agreement and the performance by Buyer of its obligations hereunder will not conflict with, or result in breach of any regulation, order, judgment, injunction or decree of any court or governmental authority or any agreement or instrument to which Buyer is a party or by which it is bound.

6. Affirmative Covenants of Seller.

(a) Prior to Closing Seller shall pay, when due, all taxes and assessments of every type or nature levied or assessed against the Property and any valid lien against the Property.

(b) Seller (i) shall not commit or suffer waste and (ii) shall materially comply with all laws, ordinances, regulations, covenants, conditions and restrictions affecting the Property and will not suffer or permit any material violation thereof.

(c) At all times from the execution of this Agreement to the Closing, Seller shall maintain the Property in the same condition as the same is in as of the date of this Agreement.

(d) From and after the date hereof through the Closing, Seller shall not (i) enter into any new leases affecting the Property or any portion thereof, or (ii) modify, amend, cancel, terminate, extend or change the terms of any lease affecting the Property, or any portion thereof, or any Permitted Encumbrance, or (iii) enter into any other agreements with respect to the sale, lease, or occupancy of the Property or any portion thereof, in each case without the prior written consent of Buyer, which may be withheld in Buyer's sole discretion.

(d) From and after the date hereof through the Closing, Seller shall not enter into any new contracts or agreements or place any encumbrance on the Property, without the prior written consent of Buyer which may be granted or withheld in Buyer's sole discretion.

(e) From and after the date hereof and continuing post-Closing, Seller, as a continuing member of the Cryo Road Industrial Park, shall not unreasonably withhold its approval and consent to the location of Buyer's external processing equipment, nor shall Seller support, propose, or impose unreasonable screening requirements for said external processing equipment.

7. Closing; Deed.

(a) The closing shall take place on or before the date that is ninety (90) days after the issuance of building permits for construction; (the "Closing") at Bernstein, Shur, Sawyer & Nelson, 100 Middle Street, Portland, Maine; or if the Buyer and Seller shall mutually agree in advance in writing, at another time and place. Buyer may extend the Closing for up to thirty (30) days by providing notice to the Seller of such election to exercise such extension prior to the commencement of the extension being exercised.

(b) At the Closing, Seller shall execute and deliver to Buyer, or Buyer's nominee, against payment of the balance of the purchase price, a Quitclaim Deed with Covenant for the

Property in accordance with the Short Form Deeds Act, 33 M.R.S. 761 et seq. (the "Deed"). Seller also shall execute and deliver to Buyer at the Closing an assignment of any and all permits, licenses, approvals and warranties relating to the Property, to the extent assignable; customary and reasonable title insurance Seller's Affidavit regarding persons in possession and mechanics' liens; a 1099-S data form; REW-3; W-9 form; an underground storage tank affidavit to comply with 38 M.R.S. § 563(6); a road disclosure affidavit to comply with 32 M.R.S. § 193; evidence of Seller's existence and authority to satisfy the customary seller authority requirements for issuance of an owner's title insurance policy; an affidavit that Seller is not a foreign entity as defined in Section 1445 of the Internal Revenue Code; a real estate transfer tax declaration of value form; a certificate confirming the representations in Section 5 are true as of the date of Closing; and such other documents as Buyer, Buyer's counsel and/or Buyer's title insurance company may reasonably require in order to consummate the transactions contemplated by this Agreement; and a settlement statement.

8. Adjustments, Prorations and Closing Costs.

(a) Real estate taxes and municipal assessments shall be prorated as of the Closing on the basis of the latest available tax bill based on the current municipality tax year.

(b) Metered utilities, such as water and sewer, shall be paid by Seller through date of closing.

(c) The Maine real estate transfer tax shall be paid equally by Seller and Buyer in accordance with 36 M.R.S. Section 4641-A.

(d) The recording fee for the deed of conveyance and any expenses related to any financing for Buyer in connection with the purchase of the Property shall be paid by Buyer.

(e) A portion of the purchase price shall be withheld at the Closing by Buyer if required by 36 M.R.S. § 5250-A.

9. Possession; Risk of Loss. Seller shall deliver possession of the Property to Buyer immediately at the Closing, free of all leases, tenancies or occupancies. Seller warrants and represents that there are no current leases to the property.

Seller shall maintain insurance on the Property at current levels through and including the date of Closing, and, upon execution of this Agreement, Seller shall provide Buyer with an insurance certificate evidencing the same. The risk of loss or damage to the Property by fire or other casualty, or condemnation, prior to the date of Closing is assumed by Seller. If all or any portion of the Property shall be condemned or taken by right of eminent domain prior to the closing or if Seller receives any notice of such taking prior to the closing (a copy of which Seller shall immediately deliver to Buyer), or if all or a portion of the Property should be destroyed or damaged by fire or other casualty, Buyer may, at its option, terminate this Agreement by written notice delivered to Seller at or prior to the Closing upon which both parties shall be discharged from all further obligations; or Buyer may accept assignment of insurance or condemnation proceeds and proceed with purchasing the Property, or if the Property is damaged by fire or other casualty, Seller shall have the option of restoring the property to its former condition prior to closing.

10. Default; Remedies; Mediation. In the event that Buyer defaults in any part of its obligations to close this transaction as provided in this Agreement, Seller may terminate this Agreement by written notice to Buyer and thereupon Seller shall be entitled to the Deposit as Seller's sole and exclusive remedy for Buyer's breach, and Escrow Agent shall be authorized to disburse the entire Deposit to Seller. Seller and Buyer acknowledge and agree that the damages for Buyer's breach of this Agreement are difficult to calculate and that the Deposit is a reasonable estimate of such damages. In the event that Seller breaches this Agreement for a reason other than the default of Buyer, Buyer shall be entitled to either (i) terminate this Agreement by written notice to the Seller, in which case Buyer shall be entitled to a return of the entire Deposit, and the Escrow Agent shall be authorized to disburse the Deposit to Buyer, or (ii) pursue the remedy of specific performance. In the event of litigation regarding breach of this Agreement by either party, the party who obtains a final, un-appealable judgment in its favor shall be entitled to collect its reasonable attorneys' and paralegals' fees and court costs from the other party.

Any dispute or claim arising out of or relating to this Agreement or the premises addressed in this Contract shall be submitted to mediation in accordance with the Maine Residential Real Estate Mediation Rules of the American Arbitration Association. This clause shall survive the closing of this transaction.

11. Brokerage. Seller and Buyer each acknowledge that Buyer is represented in this transaction by Reese McFarlane of Boulos Company acting as Buyer's agent (the "Broker"). Buyer agrees to indemnify and hold Seller harmless from any claims made by any broker other than Broker should Buyer's representation in this Paragraph be false. Seller agrees to indemnify and hold Buyer harmless from any claims made by any broker other than Broker should Seller's representation in this Paragraph shall be false. The foregoing indemnities shall include all reasonable legal fees and costs incurred in defense against any such claim.

12. Miscellaneous.

(a) Time. Time is of the essence of this Agreement.

(b) Notices. Except as expressly provided to the contrary in this Agreement, all notices, demands and other communications hereunder shall be in writing and shall be given by electronic mail: if to Seller: Attorney David Ferguson (_david@dfdnlaw.com__________________), and if to Buyer slowell@bernsteinshur.com, with a copy of such notice to Seller or Buyer at their addresses set forth in the preamble to this Agreement sent by certified mail, return receipt requested. All notices shall be deemed to have been duly given if the electronic mail time stamp is prior to the expiration date and time specified herein. Attorneys are authorized to give notices on behalf of their clients. Either party may change the notice electronic mail addresses and certified mail notice addresses for purposes of this subparagraph by giving the other party notice of the new address in the manner described herein.

(c) Assignment. Buyer may assign or transfer its rights under this Agreement to an affiliate in which the principals of Buyer have a substantial (direct or indirect) economic interest, successor by operation of law, wholly owned subsidiary, entity controlled by Buyer or under common control with Buyer and to any entity owning all or substantially all of the assets of Buyer. The covenants and agreements contained in this Agreement shall extend to and be obligatory upon the permitted successors and assigns of the respective parties to this Agreement.

(d) Entire Agreement. This Agreement constitutes the entire agreement between Seller and Buyer with respect to the sale of the Property, and there are no representations, warranties, agreements or understandings between the parties except as set forth herein.

(e) Construction. This Agreement shall be governed by and construed in accordance with the laws of Maine, without taking into account choice of law principles. If any provision of this Agreement is determined to be invalid or unenforceable, it shall not affect the validity or enforcement of the remaining provisions hereof.

(f) Counterpart Execution. This Agreement may be executed in one or more counterpart signatures, and together the signed counterparts shall be deemed to be a fully-executed contract.

[Remainder of Page Intentionally Left Blank; Signatures Follow]

IN WITNESS WHEREOF, Seller and Buyer have executed this Agreement as of the date first above written.

Seller: Industrial Development Corporation of Sanford

By: ______________________
Name: Robert Hardison
Title: President

Buyer: Aries Clean Technologies LLC

Signed by:
By: Jonathan B Cozens
0D1C7A5FA9B54E1...
Name: Jonathan B Cozens
Title: Chief Executive Officer

EXHIBIT A

Lot 4 Cyro Road Extension

Lot 4 as described in “Plan of Cyro Road Extension Sanford Industrial Park” as recorded in York County Registry of Deeds at Plan Book 239, Page 33, and as amended in Plan Book 389, Page 50, said land being located at the westerly sideline of Cyro Road, in the City of Sanford, County of York and State of Maine, and more particularly bounded and described as follows:

Beginning at the westerly sideline of Cyro Road at a granite monument set as the southeasterly corner of the herein conveyed lot and the northeasterly corner of land now or formerly of RJDJ Associates LLC as described in a deed recorded in the York County Registry of Deeds at Book 14883, Page 802, said corner being the northeasterly corner of Lot 5 described in a “Plan of Cyro Road Extension Sanford Industrial Development Park” as recorded in said Registry at Plan Book 239, Page 33.

Thence S 74° 44’ 11” W 550.13 feet along said land of RJDJ Associates LLC to a found #5 steel rod set at land now or formerly of Sanford-Springvale Mousam Way Land Trust as described in a deed recorded in said Registry at Book 11427, Page 222.

Thence along said Sanford-Springvale Mousam Way Land Trust land the following six courses:

N 21° 22’ 37” W 233.20 feet;

N 04° 36’ 08” W 216.90 feet;

N 16° 14’ 18” E 129.10 feet;

N 47° 13’ 05” E 118.53 feet;

N 63° 07’ 19” E 199.83 feet;

N 67° 13’ 40” E 554.98 feet; to other land of the Grantor. Said other land being the northwesterly corner of Lot 3 shown on a “Plan of Cyro Road Extension Sanford Industrial Development Park” as recorded in said Registry at Plan Book 239, Page 33.

Thence running S 04° 51’ 42” W 587.00 feet along said other land of the Grantor to the easterly side of Cyro Road and a granite monument set as a corner.

Thence running 401.52 feet along Cyro Road and a curve to the left with a radius of 125.00 feet and a cord angle of S 31° 24’ 00” W and a cord length of 249.84 feet to a granite monument and point and place begun at.

The above parcel, Lot 4 on said Plan is subject to a water line easement granted to the Sanford Water District as follows:

The easement area is all land conveyed above that is located easterly of the following line. Beginning at a point on the northerly sideline of Cyro Road, said point being located westerly of the granite monument set at the southeasterly corner of the above lot, an arc distance of 32.42 feet on a curve to the left with a radius of 125.00 feet and a cord angle of N 62° 15’ 30” W and a cord length of 32.33 feet; thence running N 05° 52’ 08” E 297.86 feet to a point; thence running N 13° 54’ 29” E 104.91 feet to a point; thence running N 38° 14’ 28 E 15 feet, more or less, to other land of the Grantor.

Being and intending to convey all of Lot 4 as shown on Amended Subdivision “Plan of Cyro Road Extension Sanford Industrial Park” as recorded in said Registry at Plan Book 389, Page 50.

Said premises are SUBJECT TO the “General Notes” and conditions as more particularly appear on said Plans, above-referenced.

Said premises are SUBJECT TO those certain findings of fact, order and standard conditions of the Department of Environmental Protection, dated October 24, 1997, and recorded in the York County Registry of Deeds in Book 8537, Page 212 and Order, dated February 2, 1998, and recorded in said Registry at Book 8670, Page 330.

Being a portion of the same premises conveyed to Industrial Development Corporation of Sanford by Trustees Deed under a Testamentary Trust of Edward H. Emery, Sanford Trust Company Trustee, dated May 3, 1961, and recorded in the York County Registry of Deeds in Book 1461, Page 171, and a portion of the same premises conveyed to Industrial Development Corporation of Sanford by Warranty Deeds of Gerard R. Genest and John E. Garnsey, dated May 22, 1990, and recorded in said Registry of Deeds in Book 5406, Pages 86 and 88 respectively.

TOGETHER WITH the right to use with others, for all purposes of ingress and egress to said premises including the installation of utilities, certain roads and/or rights-of-way being more particularly shown and designated on said Plan as Cyro Road Extension.

SUBJECT TO the covenants, conditions, restrictions, and reservations which run with the land and which are for the benefit of other land of the Grantor herein, its successors and assigns, within said Sanford Industrial Park and for the benefit of owners of other lots in said Sanford Industrial Development Park as recorded in the York County Registry of Deeds in Book 18096, Page 354 and set forth in Schedule A attached herein and incorporated herein by reference.

SUBJECT TO a Deed of Easement granted from CRME, LLC to SANFORD AIRPORT SOLAR, LLC, dated October 1, 2019 and recorded in the York County Registry of Deed, Book 18214, Page 742.

Being the same premises conveyed to Industrial Development Corporation of Sanford by CRME, LLC by its deed dated April 5, 2024 and recorded in the York County Registry of Deeds at Book 19429, Page 340.

<u>Exhibit B</u>

COVENANTS PERTAINING TO PROPERTY OF THE SUBDIVISION PLAN CYRO ROAD EXTENSION, SANFORD INDUSTRIAL DEVELOPMENT PARK

Attach here

AMENDED COVENANTS AS AGREED TO BY ALL OWNERS OF RECORD AND RECORDED IN YORK COUNTY REGISTRY OF DEEDS AT BOOK 18096, PAGE 354

Schedule A
COVENANTS PERTAINING TO PROPERTY OF THE SUBDIVISION PLAN CYRO ROAD EXTENSION, SANFORD INDUSTRIAL DEVELOPMENT PARK

PURPOSE
The purpose of the covenants, conditions, and restrictions is to ensure the proper use of land within the Sanford Industrial Development Park and to protect the owners of individual lots within the Park against inappropriate uses while promoting attractive, high quality development throughout the Park.

1. **LAND USE** - Shall be per the Zoning Ordinance for the Town of Sanford, Maine, Section 280-11-7. Industrial Business Zone (IB). Table of Land Uses, 280 Attachment 1A & 1 B.

No site or lot shall be used for any retailing purpose or business. The following types of industry and/or business shall be prohibited in the Sanford Industrial Development Park; namely tanneries, glue factories, fertilizer plants, cement plants, oil refineries, soap or fat rendering plants, fish processing plants, stockyards, and artificial gas manufacturing plants. The property shall not be used as space for storage of scrap metal or other used materials commonly classified as junk. Notwithstanding any language contained herein to the contrary, use of Lot 3 for the construction of a "Substation" and/or Solar Panels (as more fully defined herein), shall be deemed permitted uses and purposes within the Sanford Industrial Development Park.

All manufacturing and processing conducted by any owner or lessee shall be conducted entirely within the enclosed area of buildings. If outside processing is unavoidable and approved by the Industrial Development Corporation of Sanford, it shall be concealed from view by a screen, ornamental in design and/or conforming to the design of the building provided however, that the Substation and /or Solar Panels proposed for Lot 3 has no requirement that said improvements be enclosed, concealed or to otherwise comply with these requirements.

No site or lot shall be used for any purpose or business which is considered dangerous or unsafe, or which constitutes a nuisance, or is noxious, or offensive by reason of emission of dust, odor, gas, smoke, fumes, or noise provided however, that the Substation and /or Solar Panels proposed for Lot 3 shall not be deemed a violation of or otherwise inconsistent with this provision.

2. **PARKING** - No parking shall be permitted on any of the streets or ways within the Sanford Industrial Development Park, so-called. Off-street employee and visitor automobile parking facilities shall be provided and shall be in conformity with the applicable ordinances of the Town of Sanford, Maine, and all parking areas shall be paved. Freight cars or truck storage shall be separately provided, and areas for maneuvering and unloading trucks shall be provided in addition to space provided for employee and visitor parking. Notwithstanding any language contained herein to the contrary, Lot 3 has no requirement to comply with this provision regarding "Parking" during the construction, replacement or removal of the Substation.

3. **STORAGE** - All outdoor storage shall be restricted to the side yard and rear yard areas and, in any event, no outside storage of any kind shall be permitted unless the stored materials are neatly arranged and properly screened with suitable fencing. The manner, place, and fencing of stored materials must be approved in writing by the Board of Directors of the Industrial Development Corporation of Sanford, as hereinafter set forth. No waste material or refuse shall be dumped upon or be permitted to remain upon any part of any site or lot outside of a building constructed thereon. No subsurface or surface disposal will be allowed for sanitary wastes, cooling water, sump and

floor drain discharges, or industrial wastes. Below ground tanks shall be constructed and installed as per Maine Department of Environmental Protection rules and regulations. Above ground tanks shall be properly screened and may be contained by dikes designed to hold the contents of the storage tanks. Design of the tanks, dikes, and enclosures is subject to approval by the Sanford Water District and the Maine DEP. Notwithstanding any language contained herein to the contrary, Lot 3 has no requirement to comply with this provision regarding "Storage" however, any materials (unattached and not appurtenant to the Substation and/or Solar Panels) stored outside on Lot 3 shall be arranged neatly and properly secured.

4. **APPROVAL OF PLANS** -

(a) No construction or alteration of any building, enclosure, fence, loading dock, parking facility, storage yard, or any other structure or permanent improvement on any site or lot shall be commenced or permitted unless and until site plans or plans and specifications therefore showing plot layout and all exterior elevations and colors thereof and structure design, fencing, landscaping and parking shall have been submitted to and approved in writing by the Industrial Development Corporation of Sanford and comply with the requirements of Sanford Zoning ordinances, and in particular Site Plan Review.

(b) All such site plans or plans and specifications shall be submitted in writing and signed by the owner or the authorized agent of the owner of the site or lot on which the proposed construction or alteration is to be located.

(c) Approval shall be based upon the following considerations: adequacy of site dimensions; adequacy of structural design; conformity and harmony of external design with neighboring structures; effect of location and use of improvements on neighboring sites, improvements, operations and uses; relation of topography, grade and finished ground elevation of the site being improved to that of neighboring sites; proper facing of main elevation with respect to nearby streets; conformity of the plans and specifications to the purpose and general plan and intent of these restrictions; and the effect of unusual, unique or distinguishing characteristics of the site or lot upon the location and use of proposed improvements; the appropriateness of the building design, material and workmanship to the building function on said site. In addition, exterior materials used in the construction of any building or other structure or improvements on any site or lot shall be of a permanent type and of good quality. There is reserved to the directors of the Industrial Development Corporation of Sanford the right to base its approval of such plans and specifications upon such other considerations as it deems necessary or appropriate under the then-prevailing circumstances.

(d) The Industrial Development Corporation of Sanford will not arbitrarily or unreasonably withhold its approval of such plans and specifications.

(e) Any change in such plans and specifications subsequent to the initial written approval of the Board of Directors of the Industrial Development Corporation of Sanford must be re-submitted for the written approval of said Board of Directors.

(f) Neither the members of the Board of Directors of the Industrial Development Corporation of Sanford, nor that Corporation or its successors and assigns, shall be liable in damages to anyone submitting plans and specifications for approval, or to any negligence or non-feasance arising out of or in connection with the approval or disapproval or failure to approve any such plans and specifications. Every person or entity who submits plans for approval agrees, by submission of such plans, and every owner of any of said property, by acquiring title thereto, agrees that he will not bring any action to recover any such damages.

(g) Notwithstanding any language to the contrary contained in this Section 4(a)-4(f), without any prior or continuing approval of the Board of Directors of the Industrial Development Corporation, Lot 3 may be used for the construction, operation, maintenance and removal of a "**Substation**" which collectively means, (a) Collection Facilities, (b) Substation Facilities, (c) Transmission Facilities; and (d) any other structures appurtenant to the Substation including without limitation, fencing, loading, docking, parking and storage. The term "**Collection Facilities**" means all improvements, fixtures, and other properties whose purpose is to gather and deliver electrical power to an electrical power grid or other system, including, without limitation, transformers, overhead and underground collection lines, junction boxes, interconnection facilities and all necessary and proper improvements and fixtures for use in connection therewith. The term "**Substation Facilities**" means one or more standalone electrical lines and cables, meters, monitoring and control equipment, switches, transformers, batteries and other devices for storage of electrical energy, all improvements, structures, equipment, enclosures, fencing, security devices, and all electrical and communications equipment necessary to condition and increase the voltage of electricity to make it suitable for transmission on, and to deliver it to, Transmission Facilities connected to an electric power grid or other system. The term "***Transmission Facilities***" means all improvements whose purpose is to deliver electrical power to an electrical power grid or other system, including without limitation transformers, overhead and underground electrical transmission lines, interconnection facilities, guys, anchors, wires, poles, towers, foundations, footings, cross arms and other structures related to the transmission of electrical power. Without any prior or continuing approval of the Board of Directors of the Industrial Development Corporation, Lot 3 may also be used to install "**Solar Panels**" which means, any photovoltaic energy system designed for the generation of electrical power from the collection of sunlight, including without limitation, the photovoltaic panels, foundations, support structures, braces and related equipment. And, for greater clarity, any change in the plans and specifications to the Substation and/or the Solar Panels shall not require any approval of said Board of Directors.

5. **RESERVED**.

6. **LANDSCAPING** - Landscaping shall be a priority and will extend to the roadway and shall be properly maintained at all times. All lots including visible sides of buildings, driveway entrances, and road frontage shall be well landscaped so as to embrace the aesthetic integrity of the Park. Trees shall be preserved to the extent that they do not interfere with the buildings or pavements. All cleared areas will be landscaped and maintained. Tree planting and shrubbery shall be planted along the side areas of the building and along driveways. Plantings shall be required along the building edge where foundations are exposed and/or where building facades consist of long unbroken or bland walls. Dumpsters, transformers, and HVAC units shall be screened from view with appropriate landscaping. Notwithstanding any language contained herein to the contrary, Lot 3 shall be permitted to maintain landscaping that is in accordance with the visual mitigation plan approved under the Maine Site Location of Development Act, the City of Sanford's Code of Ordinance and based on standards that are safe and compatible, and which do not create an interference, with the facilities comprising the Substation and/or the Solar Panels. At all times Lot 3 shall have the right to remove landscapingand shall not be required to maintain landscaping that is unsafe, incompatible or creates an unsafe or hazardous situation with the facilities comprising the Substation and/or the Solar Panels.

7. **SIGNS** - Plans and specifications for the construction, installation, or alteration of all outdoor signs shall be first submitted to and have the written approval of the Industrial Development Corporation of Sanford. As to each such sign, approval shall be based upon the following considerations: the quality of materials used in its construction; the harmony of its design with other signs within the Park; its size and relationship to the size of the buildings or improvements located on, or proposed to be located upon the site or lot, and its relationship and harmony with other signs located within the Park. In any event, no billboards or flashing or moving signs shall be permitted. All lot owners in the Sanford Industrial Development Park will be held responsible for a percentage

of costs related to park entrance signage including electricity and maintenance. These costs will be divided equally among the owners of the lots in the Park. Notwithstanding any language contained herein to the contrary, Lot 3 shall be permitted, without any prior consent or approval, to maintain signs that are required or desired for the health, safety and welfare of others.

8. **<u>CONDITION OF PROPERTY</u>** - The owner of any site or lot shall at all times keep the premises, buildings, improvements, and appurtenances in a safe, clean, wholesome condition and comply in all respects with all government, health, fire, and police requirements and regulations, and the owner will remove at his or its own expense any rubbish of any character whatsoever which may accumulate on such site or lot. In the event such owner fails to comply with any or all of such specifications or requirements, then the Industrial Development Corporation of Sanford, or its successors and assigns, shall have the right, privilege, and license to enter upon such premises and make any and all corrections or improvements that may be necessary to meet such standards and to charge such owner the expenses incurred in doing so. Each owner shall be responsible for the maintenance of any drainage ditch which abuts or passes through the property. Notwithstanding any language contained herein to the contrary, due to the nature of the equipment to be installed on Lot 3 and for the health, safety and welfare of others, the Industrial Development Corporation of Sanford, its successors, assigns, licensees, agents and invitees shall have no right, privilege, and license to enter upon to Lot 3 to make any corrections or improvements.

9. **<u>CONSTRUCTION PERIOD AND OPTION TO REPURCHASE</u>** -

(a) If after the expiration of two (2) years from the date of conveyance of a site or lot within the Park, the Grantee of such site or lot shall not have begun in good faith the construction of a permanent building upon such site or lot, the Industrial Development Corporation of Sanford retains the right and option for a period of sixty (60) days next following said two (2) years from the date of such conveyance to demand in writing a reconveyance of said site or lot. The price to be paid shall be the purchase price of the site or lot paid by the Grantee for such site or lot when originally acquired from the Industrial Development Corporation of Sanford less remediation costs if any.

(b) For a period of two (2) years after the date of conveyance of a site or lot lying within the Park, the Grantee of such site or lot shall not be able to sell such site or lot without first offering it to the Industrial Development Corporation of Sanford at the same price paid by such Grantee for such site or lot when originally acquired from the Industrial Development Corporation of Sanford. Such offer shall be made to the Industrial Development Corporation of Sanford in writing and sent by registered mail. The Industrial Development Corporation of Sanford shall have a period of sixty (60) days from the date of receipt of such offer in which to accept such offer and in the absence of a written acceptance sent by the Industrial Development Corporation of Sanford, the Grantee shall be free to sell such site or lot to any person at any price deemed desirable bysuch Grantee.

(c) In the event any owner of site or lot lying within the Park shall at any time desire to sell all or any part of such site or lot which at the time is unimproved, then, in such event, the Industrial Development Corporation of Sanford shall have the prior right and option to purchase the unimproved premises proposed to be sold at the same price per acre paid by the Grantee of said site or lot when originally acquired from the Industrial Development Corporation of Sanford. Prior to any sale of such site or lot, the owner of such site or lot shall notify the Industrial Development Corporation of Sanford, in writing, by registered mail, of such intention to sell, describing the premises to be sold, and the Industrial Development Corporation of Sanford shall have sixty (60) days from the date of receipt of such notice to exercise said option, such owner shall be free to sell such site or lot to any person at any price deemed desirable to such owner.

(d) Notwithstanding any language contained herein to the contrary, this Section 9 shall not apply to Lot

3.

10. ENFORCEMENT - Enforcement of these covenants and restrictions shall be by any proceeding at law or in equity against any person, firm or corporation violating or attempting to violate any covenant or restriction, either to restrain violation or to recover damages, and against the land to enforce any lien created by these covenants; and failure by the Industrial Development Corporation of Sanford to enforce any covenant or restriction herein contained shall in no event be deemed a waiver of the right to do so thereafter.

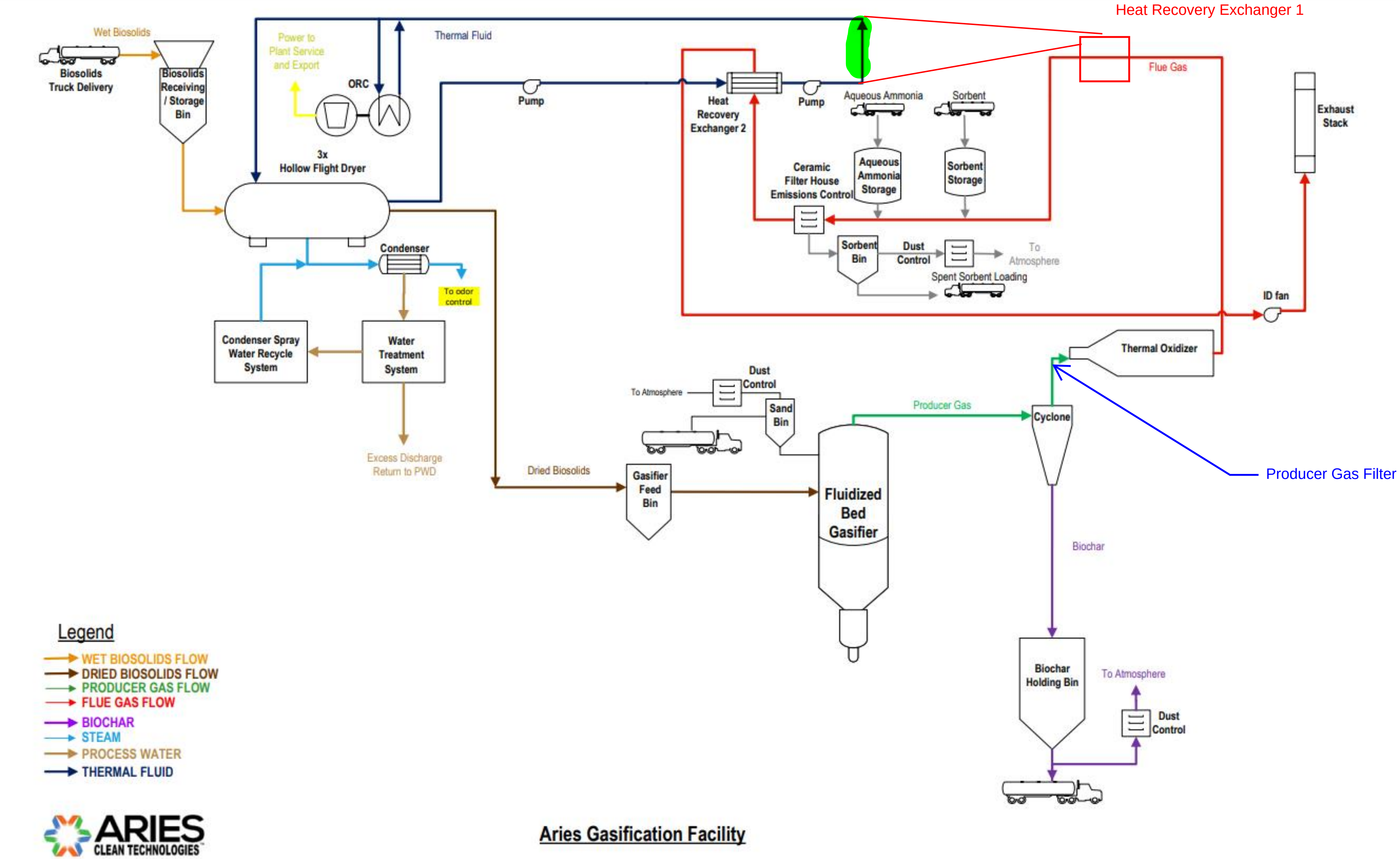
11. RIGHT OF MODIFICATION - The Industrial Development Corporation of Sanford hereby waives the right to alter, amend, change, cancel, release, nullify, revoke or modify any one or all of the terms and conditions hereinbefore recited without the consent of all of the owners of the Industrial Development Corporation of Sanford.

12. SEVERABILITY - Invalidation of any one of these covenants or restrictions by judgment or court order shall in no way affect any other provisions which shall remain in full force and effect.

Attachment C

Process Flow Diagram

Aries Facility Process Flow Diagram



Attachment D

U.S. EPA Determination Letters

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

September 9, 2021

Mr. Dale G. Mullen
Whiteford Taylor Preston, LLP
Two James Center
1021 East Cary Street
Suite 1700
Richmond, Virginia 23219

Email via dmullen@wtplaw.com

Dear Mr. Mullen:

This letter is in response to your letter of September 2, 2020, requesting an applicability determination by the U.S. Environmental Protection Agency (EPA) for a biosolids gasification unit designed by Ecoremedy, LLC (Ecoremedy) and proposed for construction at the wastewater treatment facility of the City of Edmonds, Snohomish County, Washington. Specifically, your letter requested that EPA make a determination regarding applicability of 40 CFR Part 60, Subpart LLLL – Standards of Performance for New Sewage Sludge Incineration Units (SSI NSPS) – to the gasifier system proposed by the City of Edmonds, Washington. You assert that the SSI NSPS does not apply to this facility because it uses gasification, rather than incineration, to treat sewage sludge.

In relevant part, the SSI NSPS apply to sewage sludge incineration units, as defined in Subpart LLLL. 40 CFR 60.4770(b). As discussed in more detail later in this letter, sewage sludge incineration units are units "combusting sewage sludge." Based on the information provided in connection with your request and as discussed later, EPA concludes that the Ecoremedy gasifier unit as proposed would not combust sewage sludge as defined in the pertinent regulations and that the SSI NSPS would not apply to the biosolids gasification unit that is proposed for construction at the wastewater treatment facility of the City of Edmonds, Snohomish County, Washington because the unit would not be an SSI unit as defined in 40 CFR 60.4930. *See* 40 CFR 60.4770(b). This determination is based on the technical information Ecoremedy provided to show the specific gasification unit is not currently covered under the SSI rules.[1] If any changes are made to the unit or the manner by which is operated, it may require a new determination of applicability.

The Ecoremedy Biosolids Gasification Unit

In your September 2, 2020, letter, you assert that SSI units, as defined by Subpart LLLL, must combust sewage sludge. You further assert, again as defined by Subpart LLLL, that sewage sludge does not include gases of any kind. Accordingly, you submit that units that only combust gases do not combust sewage sludge and, therefore, are not SSI units.

With respect to Ecoremedy's gasifier unit, you generally contend that the unit combusts only syngas and that the unit is designed so that no combustion or burning of any solid, semi-solid, or liquid can occur. You emphasize that "only syngas . . . is combusted – not biosolids." You also state that the sludge is converted to syngas in an "oxygen-deficient environment." More specifically describing the gasifier unit you state, in part:

> Ecoremedy's proprietary gasification technology converts biosolids to renewable thermal energy and recycled beneficial products suitable for land application as a stand-alone fertilizer, fertilizer blending agent, soil conditioner, and/or a renewable fuel product. The gasification process begins with a process of converting biosolids into feedstock through a mixing and drying process. The feedstock is entered into the gasifier and brought to a high temperature in an oxygen deficient environment. This causes the feedstock to break down into synthetic gas ("syngas") while ensuring that combustion cannot occur. The gasification process is flameless; the point of gasification is to prevent, not achieve, combustion. Next, residual solids such as ash and char are removed. The syngas is then sent to an oxidizer where air is introduced, combusting the syngas and creating thermal energy. The gases then move through a drum dryer, where they dry incoming biosolids. It then enters a cyclone, which removes particulate matter, before being sent to a wet scrubber for sulfur dioxide and odor treatment.

On September 30, 2020, in response to your request for an applicability determination, EPA requested additional information from Ecoremedy. You sent another letter dated November 17, 2020 (via email), which substantially reiterated your September 2, 2020, description of the gasifier unit. Also, Ecoremedy provided additional information on November 17, 2020, January 19, 2021, February 2, 2021, May 20, 2021, June 9, 2021, June 10, 2021, June 11, 2021, and August 3, 2021.

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[1] As you note in your letter to us, EPA has issued other applicability determinations for similar gasification and/or pyrolysis sources. Importantly, such EPA determinations are specific to the existing SSI NSPS regulations addressing sewage sludge combustion units and do not rule out the applicability of regulations for gasification units issued by EPA in the future. We have limited information on the emissions from gasification and/or pyrolysis sources. For that reason, we have begun a process to request additional information about these processes and their associated emissions. Please refer to https://www.govinfo.gov/content/pkg/FR-2021-09-08/pdf/2021-19390.pdf. This may result in a future standard that could apply to and require additional controls for the facility owned by the City of Edmonds. The information gathering, and potential rulemaking process will likely take some time to complete, and we do not currently have enough information to predict the outcome.

According to information provided by Ecoremedy, the gasification process proposed is a continuously moving, horizontally configured, updraft gasification technology that mimics mini-updraft gasifiers in succession as the fuel bed travels over zones provided with limited air from under the grate. From the supporting information depiction, the gasification system proposed is comprised of a lower and upper chamber correspondingly referred to as the gasifier and oxidizer. There is also a rotary drum dryer physically and operationally connected to the oxidizer and gasifier.

Based on information provided by Ecoremedy on the proposed emission units, we have summarized our understanding of the process as follows.

Sludge is put in the rotary drum dryer. Initially, a natural gas burner is used to provide heated air to the dryer containing the sludge. Dried sludge from the dryer is mixed with wet sludge and fed to the gasifier, where, at least initially, another natural gas burner is used to preheat the gasifier prior to introducing the sludge mix to the chamber. Once heated, the sludge mixture breaks down in the gasifier, which creates its own heat through exothermic reactions and, at this point, the natural gas burner initially used for the gasifier chamber is no longer needed. Along with heat, syngas is also created in the gasifier and the heat and syngas are drawn into the oxidizer. As the heat and syngas from the gasifier enters the oxidizer, enough air is added ("overfire") to combust the syngas to maintain the temperature of the oxidizer chamber without the need for natural gas. Heat is generated in the oxidizer from the combustion of the syngas and the heat is drawn into the dryer to dry the incoming sludge, thereby eliminating the need for the further use of natural gas to externally heat the dryer. Once the process reaches this stage, combustion of the syngas in the oxidizer is self-sustaining and provides the high temperature heat necessary for the gasifier and oxidizer and the rotary drum dryer, without any supplemental heat inputs from natural gas burners.

We understand that, in its initial startup, the rotary drum dryer may be operated independent of the gasifier and oxidizer for several days to produce the needed dried sludge to create the fuel necessary for startup of the gasifier. In addition, the dryer will be operated by itself when the gasifier and oxidizer are down for maintenance. When the dryer is operated by itself, a natural gas burner is used continuously to provide all the heat necessary to dry the incoming sewage sludge.

The additional information provided by Ecoremedy included information relating to your assertion that the gasifier is an "oxygen-deficient environment." The controls on the amount of air in the gasifier include the fan design which limits the total amount of preheated air available for the gasification process and the air distribution system which apportions air by zones according to the processing stage of the organic matter in the sludge. The additional information provided by Ecoremedy also indicated that no overfire air is added to the gasifier. However, overfire air is added to the thermal oxidizer to ensure complete combustion of the syngas in the thermal oxidizer.

Subpart LLLL Applicability Criteria and Determination

Subpart LLLL applies to new “SSI units” that are not otherwise exempt. 40 CFR §60.4770. The request contends that the Ecoremedy gasification unit does not meet the definition of an SSI unit.[2]

"Sewage sludge incineration (SSI) unit" is defined in 40 CFR §60.4930 as:

> an incineration unit combusting sewage sludge for the purpose of reducing the volume of the sewage sludge by removing combustible matter. Sewage sludge incineration unit designs include fluidized bed and multiple hearth. A SSI unit also includes, but is not limited to, the sewage sludge feed system, auxiliary fuel feed system, grate system, flue gas system, waste heat recovery equipment, if any, and bottom ash system. The SSI unit includes all ash handling systems connected to the bottom ash handling system. The combustion unit bottom ash system ends at the truck loading station or similar equipment that transfers the ash to final disposal. The SSI unit does not include air pollution control equipment or the stack.

“Sewage sludge” is defined as:

> solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incineration unit or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works.

In addition, in publishing the final Subpart LLLL, EPA described an SSI unit as "an enclosed device or devices using controlled flame combustion that burns sewage sludge for the purpose of reducing the volume of sewage sludge by removing combustible matter." 76 FR 15372, 15376 (March 21, 2011).

Based on all the information provided in connection with your request for an applicability determination, we conclude that Subpart LLLL does not apply to the proposed Ecoremedy gasification unit for the City of Edmonds because the unit is not an “SSI unit.” It is not an SSI unit, as defined in 40 CFR §60.4930, because it does not combust sewage, also as defined in section 60.4930.

A key part of the definition of sewage sludge describes the state of the material as “solid, semi-solid, or liquid residue.” A key part of the definition of an SSI unit, is an incineration unit “combusting sewage sludge.” There appears to be no question that the Ecoremedy gasification unit receives sewage sludge. As detailed in your September 2, 2020, letter which states that the unit

[2] The request does not question or dispute that the gasification unit is or would be a new unit. The request also does not make any question or raise any claim about the application of any of the exemptions in 40 CFR § 60.4789. Accordingly, those issues are not addressed here and it is assumed that the gasification unit in question is or would be a new unit and that it is not otherwise exempt.

will be constructed at a wastewater treatment facility in Edmonds, Washington and further explains that "biosolids," after some drying and mixing, are fed into the gasifier. We are satisfied from the information provided that the biosolids to be fed into the gasifier are sewage sludge.

You further describe that the sewage sludge that is fed into the gasifier is not combusted, and, indeed, that "combustion cannot occur." As previously described, an SSI unit is an incineration unit "combusting sewage sludge." Accordingly, if the gasification unit does not combust the sewage sludge that is fed into it, it is not an SSI unit. In general, there are two main phases to the processes that occur after the sewage sludge is fed into the gasifier: first, the sewage sludge in the gasifier is subjected to heat (and also generates heat through an exothermic reaction), where the solid, semi-solid or liquid sludge material is reduced and where gases, including syngas, are generated and second, the syngas is fed from the gasifier into the oxidizer, where it is, as you concede, combusted.

Addressing, first, the second phase of the process—the admitted combustion of the syngas derived from the sewage sludge, we conclude that this phase is not "combusting sewage sludge." Although there is combustion, the syngas derived from the sewage sludge is not, itself, sewage sludge nor a "material derived from sewage sludge." As previously described, sewage sludge is "solid, semi-solid, or liquid residue." The syngas, although derived from sewage sludge, is gaseous, not solid, semi-solid, or liquid. The initial, primary definition of sewage sludge does not mention gases, but only solids, semi-solids or liquids. "Material" derived from solids, semi-solids, and liquids, in our view was intended, here, only to include solids, semi-solids, and liquids, not gases.[3]

As to the first phase of the process the sewage sludge is converted to feedstock through mixing and drying and fed into the gasifier where an oxygen-deficient environment is maintained to prevent combustion. Inside the gasifier, under high-temperature, feedstock decomposes and produces syngas. Ecoremedy has confirmed that the gasification process is flameless, and the gasifier prevents combustion by limiting the airflow into the gasifier.[4] Therefore, we believe the gasifier does not use controlled flame combustion of sewage sludge, and is not an SSI.

This response was coordinated with the Office of General Counsel and the Office of Enforcement and Compliance Assurance and is based on the information provided by Ecoremedy and its counsel. EPA may alter this determination in accordance with applicable regulations, new

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[3] *See*, e.g., applicability determination for Max West Environmental Systems, dated December 19, 2013, which explains EPA's view that "[t]he definition of sewage sludge is expressly limited to the "solid, semisolid, or liquid residue generated during the treatment of domestic sludge in a treatment works.' Since syngas is a gas, and not a solid, semisolid, or liquid, it does not meet the definition of sewage sludge in the SSI EG rule (even though it is derived from sewage sludge)."
https://cfpub.epa.gov/adi/index.cfm?fuseaction=home.dsp_show_file_contents&CFID=126652990&CFTOKEN=98981573&id=FP00004

[4] *See*, preamble to March 21, 2011, final rule which describes an SSI unit as "an enclosed device or devices using controlled flame combustion that burns sewage sludge for the purpose of reducing the volume of sewage sludge by removing combustible matter." *See* 76 FR 15372.

information, or other good cause. If you have any additional questions, please contact Nabanita Modak of my staff, at (919) 541-5572 or by email at: *Modak.Nabanita@epa.gov*..

Sincerely,

Michael Koerber for

Peter Tsirigotis
Director

cc: Dave Mooney, President, Ecoremedy, LLC via email dmooney@ecoremedyllc.com
John Dawson, Engineering Manager, Puget Sound Clean Air Agency via email JohnD@pscleanair.gov

DEC 19 2013

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

Jeff Snyder
Chief Marketing Officer
MaxWest Environmental Systems Incorporated
1485 International Parkway
Suite 1031
Lake Mary, Florida 32746

RE: Request for Determination of Applicability under 40 CFR Part 60, Subpart MMMM - Emissions Guidelines and Compliance Timelines for Existing Sewage Sludge Incineration Units

Dear Mr. Snyder:

This letter is in response to your email of November 7, 2013, in which you inquired on the status of a September 24, 2013, request for applicability submitted on behalf of MaxWest Environmental Systems, Incorporated (MaxWest) by Ms. Bernadette Rappold, of McGuire Woods. Ms. Rappold requested a determination of applicability under 40 CFR Part 60, Subpart MMMM - Emissions Guidelines and Compliance Timelines for Existing Sewage Sludge Incineration Units (SSI EG Rule) for a sewage sludge gasifier located in Sanford, Florida and owned by MaxWest. Your November 7, 2013 email confirms that the McGuire Woods' request for applicability is being made on behalf of MaxWest.

For the reasons stated below, the Environmental Protection Agency (EPA) believes that the neither the MaxWest sewage sludge gasifier nor thermal oxidizer process heater are subject to the SSI EG Rule.

Background

According to the McGuire Woods' request, MaxWest constructed a fixed bed downdraft gasifier for processing biosolids[1] in late 2008. Operation began during September 2009. The original fixed bed downdraft gasifier was replaced with a fluidized bed design; construction on this unit began September 26, 2011[2]. According to information provided in your letter, the current process involves a continuous feed of dried biosolids into the gasifier. The gasifier is operated in an oxygen-starved environment at a temperature of approximately 704 degrees celcius (°C). No flame is applied to the sewage sludge in the gasifier, nor is a flame propogated as a result of the heating. The gasifier produces what is called a synthetic gas or "syngas." Once the syngas exits the gasifier, it is routed through a particulate matter cyclone and then to a process heater and heat exchanger for heat recovery. The

[1] MaxWest provides that the biosolid feed to the gasifier is sewage sludge.
[2] In determining applicability to Subpart MMMM, the EPA used the "commenced construction" dates as provided by MaxWest. In other words, we did not determine if the applicability of Subpart LLLL at Section 60.4775 applies instead.

syngas is combusted in the process heater to generate the heat needed to dry new incoming sludge. The flue gas exiting the process heater and heat exchanger is routed to a baghouse and a wet scrubber.

EPA Response

As means of background, an emissions guideline (such as the SSI EG) does not apply directly to a source. Instead, the emissions guideline applies to Administrators of air quality programs in a state or in a United States protectorate. The emissions guideline directs those Administrators on the content, timing, and requirements for developing a state plan in order to implement the guideline. A state is required to submit a plan for approval to EPA, to implement and enforce the EG, not later than 1 year after EPA promulgates the EG. See U.S.C. §7429(b)(2). If a state has not submitted an approvable plan within two years after the date of promulgation of an EG, then the EPA shall develop, implement and enforce a federal plan. See U.S.C. §7429(b)(3). Emissions guidelines are not enforceable until the EPA approves a state plan (or adopts a federal plan that implements and enforces the guideline), and the state (or federal) plan has become effective. The SSI EG was promulgated on March 21, 2011, and Florida did not submit a state plan for the SSI EG by the March 21, 2012, deadline. See Section 60.5005(b). EPA is currently drafting a proposed federal implementation plan.

For the purposes of this response, we are determining whether MaxWest owns and operates an SSI as that term is defined in the SSI EG Rule, and therefore, whether the SSI Federal Plan would be applicable, once finalized.

According to Section 60.5060, the SSI EG rule applies to SSI units that are constructed on or before October 14, 2010, or modified on or before September 21, 2011.

An SSI unit is defined at Section 60.5250 as:

> . . . an incineration unit combusting sewage sludge for the purpose of reducing the volume of the sewage sludge by removing combustible matter. Sewage sludge incineration unit designs include fluidized bed and multiple hearth. A SSI unit also includes, but is not limited to, the sewage sludge feed system, auxiliary fuel feed system, grate system, flue gas system, waste heat recovery equipment, if any, and bottom ash system. The SSI unit includes all ash handling systems connected to the bottom ash handling system. The combustion unit bottom ash system ends at the truck loading station or similar equipment that transfers the ash to final disposal. The SSI unit does not include air pollution control equipment or the stack.

Sewage sludge is also defined at Section 60.5250 as:

> . . . [a] solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash

generated during the firing of sewage sludge in a sewage sludge incineration unit or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works.

The preamble to March 21, 2011, final rule describes an SSI unit as "an enclosed device or devices using controlled flame combustion that burns sewage sludge for the purpose of reducing the volume of sewage sludge by removing combustible matter." See 76 FR 15372. According to the information provided by MaxWest, no flame is applied or propogated in the gasifier and the gasifier prevents combustion by limiting the air-to-sludge ratio such that combustion cannot occur. Therefore, we do not believe that the gasifier is an SSI, because it does not combust sewage sludge.

With regard to the thermal oxidizer process heater, combustion of the syngas does take place in this unit. The definition of sewage sludge at Section 60.3930 includes "material derived from sewage sludge." According to the information provided by Maxwest, the syngas is derived from sewage sludge through the gasification process. The definition of sewage sludge is expressly limited to the "solid, semisolid, or liquid residue generated during the treatment of domestic sludge in a treatment works." Since syngas is a gas, and not a solid, semisolid, or liquid, it does not meet the definition of sewage sludge in the SSI EG rule (even though it is derived from sewage sludge). Therefore, EPA believes that the combustion of the syngas in MaxWest's thermal oxidizer process heater is not subject to the SSI EG Rule.

On December 7, 2010, EPA issued an applicability determination under 40 CFR 61, Subpart E, for MaxWest's Sanford fixed bed downdraft gasifier and thermal oxidizer process heater. See enclosure. See also Control Number Z130001 at: www.epa.gov/compliance/monitoring/programs/caa/adi.html. EPA promulgated the Part 61 emissions standards in 1975 under the authority of Section 112 (hazardous air pollutants) that existed at that time and prior to the enactment of Section 129 in the 1990 Clean Air Act Amendments. The provisions of the Part 61 regulations continue to apply as described in that determination and are unrelated to the SSI EG rule.

This response was coordinated with the Office of General Counsel, EPA Region 4, and the Office of Air Quality Planning and Standards, and is based on the information provided by MaxWest and counsel. If you have any additional questions, please contact Marcia Mia of my staff, at:
(202) 564-7042 or by email at: mia.marcia@epa.gov.

Sincerely,

Edward J Messina

Edward Messina, Director
Monitoring, Assistance, and Media Programs Division
Office of Compliance

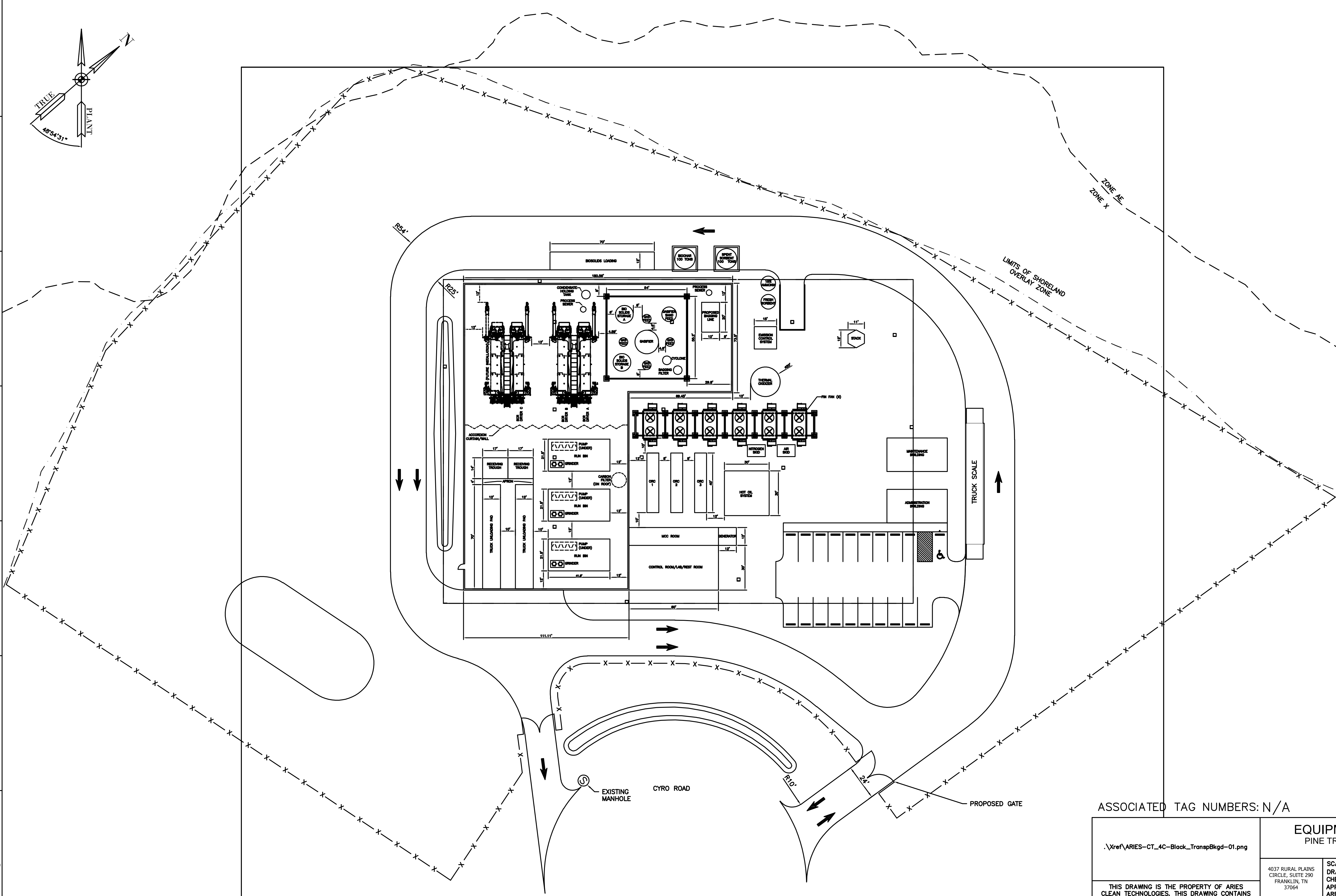
Enclosure

cc: Bernadette Rappold, McGuire Woods
Cameron Prell, McGuire Woods
Lisa Sharp, McGuire Woods

Attachment E

Site Plan

REVISIONS	A	ISSUED FOR APPROVAL MDC/CC 11/10/2025



PRELIMINARY NOT FOR CONSTRUCTION

ISSUED FOR DEP PERMIT APPROVAL

hargrove engineers & constructors

Hargrove and Associates Inc.
20 S Royal St. Mobile, Al 36602
251.476.0605 - hargrove-epc.com

ASSOCIATED TAG NUMBERS: N/A

.\Xref\ARIES-CT_4C-Block_TranspBkgd-01.png

EQUIPMENT ARRANGEMENT

PINE TREE BIOSOLIDS GASIFICATION
SANFORD, MAINE

4037 RURAL PLAINS CIRCLE, SUITE 290 FRANKLIN, TN 37064

SCALE: 1"=30'
DRAWN BY: TRK DATE: 6/9/25
CHECKED BY: JAC DATE: 8/6/25
APPROVED BY: CKN DATE: 8/14/25
AREA:

SIZE: D
DWG NO. MESA-PLP-PCS-0001
REV: B

PROJECT# MESA2401
SHEET 1 OF

Attachment F

Emission Calculations

Aries Pine Tree LLC - Facility-Wide Emissions

UNCONTROLLED

Facility-Wide Totals (TPY)

VOC	10.0	
CO	20.4	
PM/PM10/PM2.5	17521.8	
SO2	1383.1	
NOx	403.1	
NH3	N/A	
HCl	36.5	HAP
Dioxin/Furan	8.3E-09	
H2S	1.2	
HF	2.4	HAP
Arsenic	8.4E-03	HAP
Beryllium	4.6E-04	HAP
Cadmium	3.4E-03	HAP
Chromium	9.7E-02	HAP
Lead	3.6E-02	HAP
Mercury	1.0E-02	HAP
Nickel	5.9E-02	HAP
Antimony	2.6E-03	HAP
Selenium	8.4E-03	HAP

Facility-Wide Totals

	LB/HR*	LB/DAY*	TPY
VOC	2.1	51.4	10.0
CO	4.1	98.5	20.4
PM/PM10/PM2.5	4000.4	96009.7	17521.8
SO2	315.8	7578.4	1383.1
NOx	91.8	2202.2	403.1
NH3	N/A	N/A	N/A
HCl	8.3	199.8	36.5
Dioxin/Furan	1.9E-09	4.5E-08	8.3E-09
H2S	2.7E-01	6.4E+00	1.2E+00
Max. Single HAP	8.3	199.8	36.5
Total HAPs	n/a	n/a	2.66

CONTROLLED

Facility-Wide Totals (TPY)

VOC	10.0	
CO	20.4	
PM/PM10/PM2.5	35.1	
SO2	55.3	
NOx	21.3	
NH3	4.9	
HCl	1.8	HAP
Dioxin/Furan	8.3E-09	
H2S	5.9E-02	
HF	1.2E-01	HAP
Arsenic	3.0E-05	HAP
Beryllium	1.6E-06	HAP
Cadmium	1.2E-05	HAP
Chromium	1.6E-04	HAP
Lead	1.4E-04	HAP
Mercury	1.0E-02	HAP
Nickel	1.2E-04	HAP
Antimony	9.4E-06	HAP
Selenium	3.0E-05	HAP

Facility-Wide Totals

	LB/HR	LB/DAY	TPY	Major Source Threshold (TPY)
VOC	2.1	51.4	10.0	50
CO	4.1	98.5	20.4	100
PM/PM10/PM2.5	8.0	192.2	35.1	100
SO2	12.6	303.1	55.3	100
NOx	4.6	110.1	21.3	100
NH3	1.1	27.1	4.9	100
HCl	0.4	10.0	1.8	100
Dioxin/Furan	1.9E-09	4.5E-08	8.3E-09	100
Hydrogen Sulfide	1.3E-02	3.2E-01	5.9E-02	100
Max. Single HAP	4.2E-01	1.0E+01	1.8	10
Total HAPs	n/a	n/a	0.13	25

***MEDEP air permitting required if uncontrolled emissions >10 lb/hr or >100 lb/day, excluding Ch. 115 "Insignificant Activities"**

Notes:
The Thermal Oxidizer is intrinsic to the plant design and is not considered a Control Device for purposes of this Application
Emergency Generator emissions are excluded from lb/hr and lb/day calculations; included in TPY totals.
Ch. 115 Insignficant Activities are excluded from calculations.

Aries Pine Tree LLC - Stack Parameters

Stacks:

Parameter	Units	Main Stack	Emergency Generator Stack	Sorbent Tank Vent (rectangle)	Spent Sorbent Tank Vent (rectangle)	Dried Biosolids Bin Vent A (rectangle)	Dried Biosolids Bin Vent B (rectangle)	Gasifier Feed Bin Vent A (rectangle)	Gasifier Feed Bin Vent B (rectangle)	Gasifier Feed Bin Vent C (rectangle)	Gasifier Feed Bin Vent D (rectangle)	Biochar Bin Vent (rectangle)	Sand Bin Vent (rectangle)	Bisolids Loadout (rectangle)	Spend Sorbent Loadout (rectangle)
Exhaust Flow	acfm	46,747	6,955	300	50	100	100	2	2	2	2	50	300	N/A	N/A
	m3/h	79,424	11,817	509.7	84.95	169.90	169.90	3.40	3.40	3.40	3.40	84.95	509.70	12.74	12.74
Exhaust Flow Orientation	N/A	Vertical	Vertical	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal
Temperature	°F	298	953	Ambient + 9F	Ambient + 9F	Ambient + 9F	Ambient + 9F	130	130	130	130	100	Ambient + 9F	Ambient + 9F	Ambient + 9F
	K	421	785	Ambient + 5K	Ambient + 5K	Ambient + 5K	Ambient + 5K	328	328	328	328	311	Ambient + 5K	Ambient + 5K	Ambient + 5K
Height (AGL)	ft	130	14	70	70	70	70	70	70	70	70	70	70	14	14
	m	39.6	4.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	4.3	4.3
ID	inches	48	12	4"x6"	4"x6"	4"x6"	4"x6"	4"x6"	4"x6"	4"x6"	4"x6"	4"x6"	4"x6"	12.7 ft x 3 ft	12.7 ft x 3 ft
	m	1.22	0.30	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Exit Cross-Sectional Area	ft2	12.57	0.79	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	38.10	38.10
	m2	1.17	0.07	0.015	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	3.54	3.54
Equivalent Diameter	inches	48.00	12.00	5.53	5.53	5.53	5.53	5.53	5.53	5.53	5.53	5.53	5.53	83.58	83.58
	ft	4.00	1.00	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	6.96	6.96
	m	1.22	0.30	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	2.12	2.12
Exit Velocity	fps	62.00	147.59	30.00	5.000	10.00	10.00	0.200	0.200	0.200	0.200	5.000	30.00	N/A	N/A
	m/s	18.90	44.99	9.14	1.5240	3.048	3.048	0.061	0.061	0.061	0.061	1.524	9.14	0.001	0.001

Note: Vent flows for material handling based on typical conveying rates during service.

Fugitive Sources:

Biosolids Receiving Area Bay Doors (2):

Parameter	Units	Value
Width	ft	12
	m	3.66
Height	ft	14
	m	4.27

Truck Loadouts (Dried Biosolids Loadout, Spent Sorbent Loadout):

Height	ft	14
	m	4.27

Aries Pine Tree LLC - Modeled Emission Rates

Criteria Pollutants

Source	CO	PM/PM10/PM2.5	NOx	SO2	
	g/s	g/s	g/s	g/s	
Main Stack	0.52	1.01	0.58	1.59	
Emergency Generator Stack	1.2378	9.46E-03	3.53E-02	5.57E-04	short-term
	7.06E-02	5.40E-04	3.53E-02	3.18E-05	long-term
Sorbent Tank Vent	--	1.62E-03	--	--	
Spent Sorbent Tank Vent	--	2.70E-04	--	--	
Dried Biosolids Bin Vent A	--	5.40E-04	--	--	
Dried Biosolids Bin Vent B	--	5.40E-04	--	--	
Gasifier Feed Bin Vent A	--	1.08E-05	--	--	
Gasifier Feed Bin Vent B	--	1.08E-05	--	--	
Gasifier Feed Bin Vent C	--	1.08E-05	--	--	
Gasifier Feed Bin Vent D	--	1.08E-05	--	--	
Biochar Bin Vent	--	2.70E-04	--	--	
Sand Bin Vent	--	3.15E-02	--	--	
Spent Sorbent Loadout	--	3.46E-04	--	--	
Dried Biosolids Loadout	--	4.84E-04	--	--	

AAGs (Toxics)

Pollutant	Main Stack	Spent Sorbent Tank Vent	Dried Biosolids Bin Vent A	Dried Biosolids Bin Vent B	Gasifier Feed Bin Vent A	Gasifier Feed Bin Vent B	Gasifier Feed Bin Vent C	Gasifier Feed Bin Vent D	Biochar Bin Vent	Spent Sorbent Loadout	Dried Biosolids Loadout	Biosolids Receiving Doors
	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s
HCl	5.24E-02	--	--	--	--	--	--	--	--	--	--	--
HF	3.50E-03	--	--	--	--	--	--	--	--	--	--	--
Arsenic	8.55E-07	3.97E-10	--	--	--	--	--	--	--	5.09E-10	--	--
Beryllium	4.68E-08	2.18E-11	--	--	--	--	--	--	--	2.79E-11	--	--
Cadmium	3.50E-07	1.51E-10	7.02E-10	7.02E-10	1.40E-11	1.40E-11	1.40E-11	1.40E-11	1.80E-10	1.94E-10	6.29E-10	--
Chromium	4.73E-06	4.60E-09	--	--	--	--	--	--	--	5.89E-09	--	--
Lead	4.03E-06	1.72E-09	1.84E-08	1.84E-08	3.67E-10	3.67E-10	3.67E-10	3.67E-10	5.13E-09	2.20E-09	5.72E-07	--
Mercury	2.92E-04	0.00E+00	3.94E-10	3.94E-10	7.88E-12	7.88E-12	7.88E-12	7.88E-12	2.54E-10	0.00E+00	1.23E-08	--
Nickel	3.41E-06	2.77E-09	--	--	--	--	--	--	--	3.55E-09	--	--
Antimony	2.70E-07	1.26E-10	--	--	--	--	--	--	--	1.61E-10	--	--
Selenium	8.58E-07	4.01E-10	--	--	--	--	--	--	--	5.14E-10	--	--
Ammonia	1.42E-01	--	--	--	--	--	--	--	--	--	--	--
Hydrogen Sulfide	1.69E-03	--	--	--	--	--	--	--	--	--	--	1.69E-03
Dioxin/Furan (TEQ)	2.38E-10	--	--	--	--	--	--	--	--	--	--	--

Aries Pine Tree LLC - Gasifier Emissions

Criteria Pollutants

Pollutant	lb/hr At Inlet	Removal %	lb/hr Stack Exit	g/sec Stack Exit	Hours of Operation	TPY
VOC	428	99.50%	**2.14**	**0.27**	8,760	**9.38**
CO	4,316	99.905%	**4.10**	**0.52**	8,760	**17.96**
PM2.5	4,000	99.80%	**8.00**	**1.01**	8,760	**35.04**
PM10	4,000	99.80%	**8.00**	**1.01**	8,760	**35.04**
Total PM	4,000	99.80%	**8.00**	**1.01**	8,760	**35.04**
SO2	315.7	96.00%	**12.63**	**1.59**	8,760	**55.32**
NOx	89.8	95.00%	**4.49**	**0.57**	8,760	**19.66**

PM, CO modeled by Aries in Jan-2026

Volatile Organic Compounds:

Oxidizer Inlet
lb/hr
428.2

*Value is based on 100 TPD dried biosolids @ 10% moisture throughput
*Newark Mass Balance has ~3.1 vol% CH4 in stream 20 (Producer Gas from Gasifier) and assumes the amount of VOC is equal to the amount of CH4

Sulfur Dioxide:

Sulfur Concentration in Feed	Dried Solids Feed Rate to Gasifier	Sulfur in Feed	MW S	MW SO2	Inlet SO2
wt. %	lb/hr	lb/hr	lb/lbmol	lb/lbmol	lb/hr
1.89	8,361.1	158.0	32.065	64.066	315.7

*Sulfur Concentration in Feed is worst case modeled by Aries in Jan-2026

Nitrogen Oxides:

NOx Inlet Emissions	Exhaust Flow Rate	MW NO2	Inlet NOx
ppmv	dscfm	lb/lbmol	lb/hr
610	20,555	46.0	89.8

*NOx inlet emission concentration is modeled in Aspen

AAG-Listed and MAAQS Chemicals (Toxics)

AAG	Uncontrolled	Average Flowrate	MW	Uncontrolled	Control Efficiency	Controlled Emissions	Controlled Emissions	Hours of Operation	Controlled Emissions	Controlled Emissions
	ppmvd	DSCFM	lb/lb-mol	lb/hr	%	lb/hr	g/s	hr/yr	lb/yr	TPY
HCl	5.20E+01	28,206	36.46	8.32E+00	95%	**4.16E-01**	**5.24E-02**	8,760	3,645.55	**1.82**
HF	6.31E+00	28,206	20.02	5.55E-01	95%	**2.77E-02**	**3.50E-03**	8,760	243.04	**1.22E-01**

AAG	Biosolids Concentration	Metals Feed Rate to Gasifier	Gasifier Removal Efficiency	Metals Feed Rate to APC	APC Removal Efficiency	Controlled Emissions	Controlled Emissions	Hours of Operation	Controlled Emissions	Controlled Emissions
	(mg/kg, dry basis)	(lb/hr)	(percent)	(lb/hr)	(percent)	lb/hr	g/s	hr/yr	lb/yr	TPY
Arsenic	6.94	5.783E-02	96.7%	1.905E-03	99.6%	**6.75E-06**	**8.50E-07**	8,760	5.91E-02	**2.96E-05**
Beryllium	0.38	3.167E-03	96.7%	1.043E-04	99.6%	**3.70E-07**	**4.66E-08**	8,760	3.24E-03	**1.62E-06**
Cadmium	2.64	2.200E-02	96.7%	7.247E-04	99.6%	**2.57E-06**	**3.24E-07**	8,760	2.25E-02	**1.12E-05**
Chromium	80.16	6.680E-01	96.7%	2.201E-02	99.8%	**3.74E-05**	**4.71E-06**	8,760	3.28E-01	**1.64E-04**
Lead	76.19	6.349E-01	98.7%	8.234E-03	99.6%	**3.20E-05**	**4.03E-06**	8,760	2.80E-01	**1.40E-04**
Mercury	2.00	1.667E-02	86.2%	2.304E-03	0.0%	**2.30E-03**	**2.90E-04**	8,760	2.02E+01	**1.01E-02**
Nickel	48.32	4.027E-01	96.7%	1.326E-02	99.8%	**2.69E-05**	**3.38E-06**	8,760	2.35E-01	**1.18E-04**
Antimony	2.20	1.833E-02	96.7%	6.039E-04	99.6%	**2.14E-06**	**2.70E-07**	8,760	1.87E-02	**9.37E-06**
Selenium	7.00	5.833E-02	96.7%	1.922E-03	99.6%	**6.81E-06**	**8.58E-07**	8,760	5.96E-02	**2.98E-05**

AAG	Uncontrolled	Average Flowrate	MW	Uncontrolled	Control Efficiency	Controlled Emissions	Controlled Emissions	Hours of Operation	Controlled Emissions	Controlled Emissions
	ppmvd @ 15% O2	DSCFM @ 15% O2	lb/lb-mol	lb/hr	%	lb/hr	g/s	hr	lb/yr	TPY
Ammonia (Slip)	10	42,557	17.031	1.13E+00	0%	**1.13E+00**	**1.42E-01**	8,760	9,884.48	**4.94**

AAG	Controlled	Average Flowrate	Average Flowrate	Controlled	Control Efficiency	Controlled Emissions	Controlled Emissions	Hours of Operation	Controlled Emissions	Controlled Emissions
	ng/dscm @ 7% O2	DSCFM @ 7% O2	DSCMH	g/hr	%	lb/hr	g/s	hr	lb/yr	TPY
Dioxin/Furan (TEQ)	0.0285	17,706	30,083	8.56E-07	N/A	**1.89E-09**	**2.38E-10**	8,760	1.65E-05	**8.27E-09**

Main Stack H2S:				
Gasifier Operational				
	H2S			
Amount to TO/APC	0.03374	g/s	1.17	tpy
TO/APC Control	95%			
Amount at Stack	**0.001687**	**g/s**	0.06	tpy
Gasifier Down				
	H2S			
Amount to TO/APC	0.03374	g/s	1.17	tpy
TO/APC Control	95%			
Amount at Stack	**0.001687**	**g/s**	0.06	tpy

Aries Pine Tree LLC - Natural Gas Heater Emissions (> 1 MMBTU/hr)

9	mmbtu/hr, gasifier startup burner
45	mmbtu/hr, thermal oxidizer
54	mmbtu/hr, total rated natural gas usage
1020	btu/scf, typical gas heat
52941	scf/hr, total natural gas usage
0.053	mmcf/hr, total natural gas usage
0.053	mmcf/hr, natural gas combustion venting to main stack via APC inlet
0.000	mmcf/hr, natural gas combustion not venting to main stack via APC inlet

Criteria Pollutant Emissions

Pollutant	Inlet Rate (lb/mmcf)	Removal Efficiency	Stack Exit Rate (lb/mmcf)	Inlet Rate (lb/hr)	Stack Exit Rate (lb/hr)	Inlet Rate (g/s)	Stack Exit Rate (g/s)	Inlet Potential (tpy)	Stack Exit Potential (tpy)
NOx	37.2	95.00%	1.858	1.967	0.098	2.48E-01	1.24E-02	8.62	4.31E-01
PM	7.6	99.80%	0.015	0.402	0.001	5.07E-02	1.01E-04	1.76	3.52E-03
SO2	0.6	96.00%	0.024	0.032	0.001	4.01E-03	1.60E-04	0.14	5.57E-03
VOC	5.5	99.50%	0.028	0.291	0.001	3.67E-02	1.84E-04	1.28	6.38E-03
CO	84	99.91%	0.080	4.447	0.004	5.61E-01	5.33E-04	19.48	1.85E-02

Uncontrolled NOx rates based on intrinsic Low NOx Burners (30 ppm @ 3%O2) and Eq. F-5 of 40 CFR 75

Uncontrolled PM, SO2, VOC, CO rates derived from AP-42, Ch. 1-4

AAGs (Toxics) Emissions

Pollutant	Inlet Rate (lb/mmcf)	Control Efficiency	Stack Exit Rate (lb/mmcf)	Inlet Rate (lb/hr)	Stack Exit Rate (lb/hr)	Inlet Rate (g/s)	Stack Exit Rate (g/s)	Inlet Potential (tpy)	Stack Exit Potential (tpy)
Arsenic	2.00E-04	99.65%	7.09E-07	1.06E-05	3.75E-08	1.34E-06	4.73E-09	4.64E-05	1.64E-07
Beryllium	1.20E-05	99.65%	4.25E-08	6.35E-07	2.25E-09	8.01E-08	2.84E-10	2.78E-06	9.86E-09
Cadmium	1.10E-03	99.65%	3.90E-06	5.82E-05	2.06E-07	7.34E-06	2.60E-08	2.55E-04	9.04E-07
Chromium	1.40E-03	99.83%	2.38E-06	7.41E-05	1.26E-07	9.35E-06	1.59E-08	3.25E-04	5.52E-07
Mercury	2.60E-04	0.00%	2.60E-04	1.38E-05	1.38E-05	1.74E-06	1.74E-06	6.03E-05	6.03E-05
Nickel	2.10E-03	99.80%	4.25E-06	1.11E-04	2.25E-07	1.40E-05	2.84E-08	4.87E-04	9.86E-07
Selenium	2.40E-05	99.65%	8.50E-08	1.27E-06	4.50E-09	1.60E-07	5.68E-10	5.57E-06	1.97E-08

AP-42, Ch. 1-4

Aries Pine Tree LLC - Emergency Generator Emissions

Engine Information			
Designation		EGEN	
Description		Natural Gas Engine	
Number		1	
Electrical output	e-kilowatts	750	Estimated
Make		CAT	Assumed
Model		G3512	Assumed
Engine Horsepower	BHP	1,114	Estimated
Engine power	m-kilowatts	831	calculated (1 mHp = 0.7457 kWm)
Efficiency	%	90%	calculated
Fuel consumption @full load	Btu/ekWh	10,025	CAT G3512 Specification Sheet
Heat Input	MMBTU/hr	7.52	calculated
Operating Time	hr/yr	500	Assumed
Stack Parameters			
Exhaust Temperature	°F	953	Assumed
Exhaust Temperature	°K	784.8	calculated
Total Exhaust Flow	ACFM (ft^3/min)	6,955	Assumed
Selected exhaust diameter	in	12	Assumed
Actual exhaust opening area	sq. ft each	0.79	calculated
Actual velocity	fpm each	8,855	calculated
Actual velocity	fps each	147.6	calculated
Primary Building/Enclosure Height	ft	9.00	Specs emailed 12/10/2025
Stack Height (above roof or enclosure)	ft	5.00	Specs emailed 12/10/2025
Stack height (above ground)	ft	*14.00*	calculated
Stack Height	m	*4.27*	calculated
Emission Factors			
Pollutant	**Emission factor unit**	**Emission factor**	**Higher of MFG reported or Tier Limit x 1.25**
NOx	g/BHP-hr	2.00	40 CFR 60 Subpart JJJJ Table 1
CO	g/BHP-hr	4.00	40 CFR 60 Subpart JJJJ Table 1
VOC	g/BHP-hr	1.00	40 CFR 60 Subpart JJJJ Table 1
PM10	lb/MMBTU	9.99E-03	Assumed 4SLB AP-42
PM2.5	lb/MMBTU	9.99E-03	Assumed 4SLB AP-42
SO2	lb/MMBTU	5.88E-04	Assumed 4SLB AP-42
CO2	lb/MMBTU	116.98	40 CFR 98 Table A-1
Short Term Emission Rate for Modeling			
NOx	g/s	0.0353	calculated, uses EPA intermittent factor (500 hrs/yr)
CO	g/s	1.2378	calculated
VOC	g/s	0.3094	calculated
PM10	g/s	0.0095	calculated
PM2.5	g/s	0.0095	calculated
SO2	g/s	0.00056	calculated
Long Term Emission Rate for Modeling			
NOx	g/s	0.0353	calculated
CO	g/s	0.0706	calculated
VOC	g/s	0.0177	calculated
PM10	g/s	0.00054	calculated
PM2.5	g/s	0.00054	calculated
SO2	g/s	0.000032	calculated
Short Term Emission Rate			
NOx	lb/hr	4.91	calculated
CO	lb/hr	9.82	calculated
VOC	lb/hr	2.46	calculated
PM10	lb/hr	0.075	calculated
PM2.5	lb/hr	0.075	calculated
SO2	lb/hr	0.0044	calculated
CO2	lb/hr	880	calculated
Long Term Emission Rate			
NOx	TPY	1.23	calculated
CO	TPY	2.46	calculated
VOC	TPY	0.61	calculated
PM10	TPY	0.02	calculated
PM2.5	TPY	0.02	calculated
SO2	TPY	0.0011	calculated
CO2	TPY	220	calculated

Aries Pine Tree, LLC - Facility-Wide Storage and Loadout Emissions

New Sorbent Use Rate						
lb/hr	**hr/day**	**lb/day**	**day/wk**	**lb/wk**	**wk/yr**	**lb/yr**
4,000	24	96,000	7	672,000	52	34,944,000
ton/hr	**hr/day**	**ton/day**	**day/wk**	**ton/wk**	**wk/yr**	**ton/yr**
2.00	24	48	7	336	52	17,472

Spent Sorbent Generation Rate						
lb/hr	**hr/day**	**lb/day**	**day/wk**	**lb/wk**	**wk/yr**	**lb/yr**
1,293	24	31,037	7	217,262	52	11,297,650
ton/hr	**hr/day**	**ton/day**	**day/wk**	**ton/wk**	**wk/yr**	**ton/yr**
0.65	24	16	7	109	52	5,649

*Sorbent Use Rate modeled by Aries in Jan-2026

Sorbent Tank Vent w/ Filter Maine Ch. 115 Insignificant Activity (PTE < 1 TPY)

Exhaust Flow	Grain Loading	Short-Term Emissions		Long-Term Emissions	
acfh	**gr/cf**	**gr/hr**	**lb/hr**	**hr/yr**	**TPY**
18,000	0.005	90.000	1.29E-02	180	1.16E-03

Pollutant	Emissions (lb/hr)	Emissions (g/s)	Exhaust Flow (acfm)	Operating Hours (hr/yr)	Emissions (TPY)
PM/PM10/PM2.5	**1.29E-02**	**1.62E-03**	300.00	180	**1.16E-03**

Spent Sorbent Tank Vent w/ Filter Maine Ch. 115 Insignificant Activity (PTE < 1 TPY)

Exhaust Flow	Grain Loading	Short-Term Emissions		Long-Term Emissions	
acfh	**gr/cf**	**gr/hr**	**lb/hr**	**hr/yr**	**TPY**
3,000	0.005	15.000	2.14E-03	8,760	9.39E-03

Pollutant	Emissions (lb/hr)	Emissions (g/s)	Exhaust Flow (acfm)	Operating Hours (hr/yr)	Emissions (TPY)
PM/PM10/PM2.5	**2.14E-03**	**2.70E-04**	50.00	8,760	**9.39E-03**

AAG Toxic	Uncontrolled	Control Efficiency	Controlled Emissions	AAG in Spent Sorbent	% of Spent Sorbent Emitted	AAG Emitted	AAG Emitted	AAG Emitted
	lb/hr	**%**	**lb/hr**	**lb/hr**	**%**	**lb/hr**	**g/s**	**TPY**
Arsenic	1.91E-03	99.6%	6.75E-06	1.90E-03	0.00016615%	3.15E-09	3.97E-10	1.38E-08
Beryllium	1.04E-04	99.6%	3.70E-07	1.04E-04	0.00016615%	1.73E-10	2.18E-11	7.56E-10
Cadmium	7.25E-04	99.6%	2.57E-06	7.22E-04	0.00016615%	1.20E-09	1.51E-10	5.26E-09
Chromium	2.20E-02	99.8%	3.74E-05	2.20E-02	0.00016615%	3.65E-08	4.60E-09	1.60E-07
Lead	8.23E-03	99.6%	3.20E-05	8.20E-03	0.00016615%	1.36E-08	1.72E-09	5.97E-08
Mercury	2.30E-03	0.0%	2.30E-03	0.00E+00	0.00016615%	0.00E+00	0.00E+00	0.00E+00
Nickel	1.33E-02	99.8%	2.69E-05	1.32E-02	0.00016615%	2.20E-08	2.77E-09	9.63E-08
Antimony	6.04E-04	99.6%	2.14E-06	6.02E-04	0.00016615%	1.00E-09	1.26E-10	4.38E-09
Selenium	1.92E-03	99.6%	6.81E-06	1.91E-03	0.00016615%	3.18E-09	4.01E-10	1.39E-08

*AAG emitted is based on the total AAG removed from process into sorbent multiplied by the ratio of PM emitted to total spent sorbent generated

Dried Biosolids Bin Vents w/ Filters Maine Ch. 115 Insignificant Activity (PTE < 1 TPY)

Exhaust Flow	Grain Loading	Short-Term Emissions		Long-Term Emissions	
acfh	**gr/cf**	**gr/hr**	**lb/hr**	**hr/yr**	**TPY**
12,000	0.005	60.000	8.57E-03	8,760	3.75E-02

*Dried Biosolids flow is max hourly from mass balance conservatively assumed over 8,760 hours per year, this product will not be loaded out when the gasifier is operating

Pollutant	Emissions (lb/hr)	Emissions (g/s)	Exhaust Flow (acfm)	Operating Hours (hr/yr)	Emissions (TPY)
PM/PM10/PM2.5	**8.57E-03**	**1.08E-03**	200.00	8,760	**3.75E-02**

AAG Toxic	PM Emitted from Bin Vent	AAG Concentration in Dried Biosolids		Short-Term Emissions	
	lb/hr	**ug/g**	**lb/lb**	**lb/hr**	**g/s**
Mercury	8.57E-03	0.73	7.30E-07	6.26E-09	7.88E-10

Cadmium	8.57E-03	1.3	1.30E-06	1.11E-08	1.40E-09
Lead	8.57E-03	34.0	3.40E-05	2.91E-07	3.67E-08

Biosolids toxic concentrations in ug/g derived from MaxWest stack test report

Gasifier Feed Bin Vents w/ Filters Maine Ch. 115 Insignificant Activity (PTE < 1 TPY)

Exhaust Flow	Grain Loading	Short-Term Emissions		Long-Term Emissions	
acfh	gr/cf	gr/hr	lb/hr	hr/yr	TPY
480	0.005	2.400	3.43E-04	8,760	1.50E-03

Pollutant	Emissions (lb/hr)	Emissions (g/s)	Exhaust Flow (acfm)	Operating Hours (hr/yr)	Emissions (TPY)
PM/PM10/PM2.5	**3.43E-04**	**4.32E-05**	8.00	8,760	**1.50E-03**

AAG Toxic	PM Emitted from Bin Vent	AAG Concentration in Dried Biosolids		Short-Term Emissions	
	lb/hr	ug/g	lb/lb	lb/hr	g/s
Mercury	3.43E-04	0.73	7.30E-07	2.50E-10	3.15E-11
Cadmium	3.43E-04	1.30	1.30E-06	4.46E-10	5.62E-11
Lead	3.43E-04	34.00	3.40E-05	1.17E-08	1.47E-09

Biosolids toxic concentrations in ug/g derived from MaxWest stack test report

Biochar Bin Vent w/ Filter Maine Ch. 115 Insignificant Activity (PTE < 1 TPY)

Exhaust Flow	Grain Loading	Short-Term Emissions		Long-Term Emissions	
acfh	gr/cf	gr/hr	lb/hr	hr/yr	TPY
3,000	0.005	15.000	2.14E-03	8,760	9.39E-03

*Dried Biosolids and Biochar will not be produced at the same time, however Epsilon conservatively accounted for both

Pollutant	Emissions (lb/hr)	Emissions (g/s)	Exhaust Flow (acfm)	Operating Hours (hr/yr)	Emissions (TPY)
PM/PM10/PM2.5	**2.14E-03**	**2.70E-04**	50.00	8,760	**9.39E-03**

AAG Toxic	PM Emitted from Bin Vent	AAG Concentration in Biochar		Short-Term Emissions	
	lb/hr	ug/g	lb/lb	lb/hr	g/s
Mercury	2.14E-03	0.94	9.40E-07	2.01E-09	2.54E-10
Cadmium	2.14E-03	0.7	6.67E-07	1.43E-09	1.80E-10
Lead	2.14E-03	19.0	1.90E-05	4.07E-08	5.13E-09

*Product Bin Vent AAG Emissions are insignificant and excluded from modeling

Sand Bin Vent Maine Ch. 115 Insignificant Activity (PTE < 1 TPY)

Sand Delivered	No. of Deliveries	Sand Bin Throughput	PM Factor*	PM Emissions				Sand Density	Exhaust Flow
tons/truck	trucks/year	tons/yr	lb/ton	hr/yr	lb/yr	lb/hr	g/s	lb/ft3	acfh
20	4	80	0.025	8	2	2.50E-01	3.15E-02	100	18,000

* Using AP-42 Table 9.9.1-1 for grain elevator storage bin vents. Units are lb PM / tons of bin throughput

Pollutant	Emissions (lb/hr)	Emissions (g/s)	Exhaust Flow (acfm)	Operating Hours (hr/yr)	Emissions (TPY)
PM/PM10/PM2.5	**2.50E-01**	**3.15E-02**	300.00	8	**1.00E-03**

Spent Sorbent Loadout

Spent Sorbent Flow	Hours / year	Days / yr	Fines %	Fines as Dust	Uncontrolled	Capture %	Fugitive
TPD loaded					TPY		TPY
15.5	8,760	365	N/A	N/A	N/A	N/A	0.012

Pollutant	Uncontrolled	Capture	Fugitive	Fugitive	Loadouts			Fugitive	Fugitive
	lb/hr	Efficiency	lb/hr	g/s	hrs/day	days/yr	hrs/yr	lb/yr	TPY
PM/PM10/PM2.5	N/A	N/A	**0.00275**	**0.00035**	24	365	8,760	24.06	**0.012**

AAG Toxic	Uncontrolled	Control Efficiency	Controlled Emissions	AAG in Spent Sorbent	% of Spent Sorbent Emitted	AAG Emitted	AAG Emitted	AAG Emitted
	lb/hr	%	lb/hr	lb/hr	%	lb/hr	g/s	TPY
Arsenic	1.91E-03	99.6%	6.75E-06	1.90E-03	0.00%	4.04E-09	5.09E-10	1.77E-08
Beryllium	1.04E-04	99.6%	3.70E-07	1.04E-04	0.00%	2.21E-10	2.79E-11	9.70E-10
Cadmium	7.25E-04	99.6%	2.57E-06	7.22E-04	0.00%	1.54E-09	1.94E-10	6.74E-09
Chromium	2.20E-02	99.8%	3.74E-05	2.20E-02	0.00%	4.68E-08	5.89E-09	2.05E-07
Lead	8.23E-03	99.6%	3.20E-05	8.20E-03	0.00%	1.75E-08	2.20E-09	7.65E-08
Mercury	2.30E-03	0.0%	2.30E-03	0.00E+00	0.00%	0.00E+00	0.00E+00	0.00E+00
Nickel	1.33E-02	99.8%	2.69E-05	1.32E-02	0.00%	2.82E-08	3.55E-09	1.23E-07
Antimony	6.04E-04	99.6%	2.14E-06	6.02E-04	0.00%	1.28E-09	1.61E-10	5.61E-09
Selenium	1.92E-03	99.6%	6.81E-06	1.91E-03	0.00%	4.08E-09	5.14E-10	1.79E-08

*AAG emitted is based on the total AAG removed from process into sorbent multiplied by the ratio of PM emitted to total spent sorbent generated

Dried Biosolids Loadout Maine Ch. 115 Insignificant Activity (PTE < 1 TPY)

Dried Biosolids Flow	Hours / year	Days / yr	Fines %	Fines as Dust	Uncontrolled	Capture %	Fugitive
TPD loaded					TPY		TPY
21.7	8,760	365	N/A	N/A	N/A	N/A	0.017

Pollutant	Uncontrolled	Capture	Fugitive	Fugitive	Loadouts			Fugitive	Fugitive
	lb/hr	Efficiency	lb/hr	g/s	hrs/day	days/yr	hrs/yr	lb/yr	TPY
PM/PM10/PM2.5	N/A	N/A	**0.0038**	**0.00048**	24	365	8760	33.64	**0.02**

AAG Toxic	PM Emitted from Loadout	AAG Concentration in Dried Biosolids		Short-Term Emissions		Long-Term Emissions	
	lb/hr	ug/g	lb/lb	lb/hr	g/s	hr/yr	TPY
Mercury	0.0038	0.73	7.30E-07	2.80E-09	3.53E-10	8,760	1.23E-08
Cadmium	0.0038	1.3	1.30E-06	4.99E-09	6.29E-10	8,760	2.19E-08
Lead	0.0038	34.0	3.40E-05	1.31E-07	1.65E-08	8,760	5.72E-07

Biosolids toxic concentrations in ug/g derived from MaxWest stack test report

*34 TPD derived from the max capacity of a bulk solids carrier and assumed 1 truck per day, this product will not be loaded out
*Bulk Solids Carrier capacity is 1500 ft3 times bulk density of 45 lb/ft3 equals 34 Tons per truck
*Dried Biosolids and Biochar will not be produced at the same time, however Epsilon conservatively accounted for both

Sulfides Calculations for Cake Receiving

	1,500 D/T		odor strength, estimated		
	H2S	Carbonyl Sulfide	Carbon Disulfide	Ammonia	
	1,000	10	10	3	ppb associated with 500 D/T
	3,000	30	30	9	ppb based on 500 D/T vs 1,500 D/T by ratio of odor concentration

Exhaust flow to TO from Cake Receiving Area

17,200	ft3/min, actual at 80oF and 14.7 psia
35.31	ft3/m3
8.119	m3/sec

Sulfides Mass Rates in Receiving Building

	H2S	ppb	
	3000	molecular weight (lb/lb mol)	
	34.1	lb/hr (m = PV MW / RT)	
	0.2677	g/s	
	0.03374	ppb	
Odor threshold	2.0	ppb	(range of 0.5-300 ppb in literature)
D/T	1,500		

Exhaust flow from Cake Receiving Area

17,200	ft3/min, actual at 80oF and 14.7 psia
35.31	ft3/m3
8.119	m3/sec

Sulfides Mass Rates in Receiving Building

H2S	
3000	ppb
34.1	molecular weight (lb/lb mol)
0.26774	lb/hr (m = PV MW / RT)
0.03374	g/s

Face Velocity at Receiving Building Roll Up Doors

12	ft x	14	ft =	168	ft2 one door face area
17,200	ft3/min				
102	fpm through door				
5%	assumed odor rate escaping from one door open				

Hydrogen Sulfide Mass Rate at Roll Up Door

0.0017 g/sec

Hazardous Air Pollutants / AAG-Listed and MAAQS Chemicals (AAGs)

HAP	Uncontrolled	Volumetric Flowrate	MW	Uncontrolled	Notes
	lb/hr	DSCFM	lb/lbmol	ppm	
HCl	4.50E-01	1,525	36.46	5.20E+01	2
HF	3.00E-02	1,525	20.02	6.31E+00	2
Arsenic	1.19E-05	1,525	74.92	6.69E-04	1
Beryllium	5.59E-07	1,525	9.01	2.61E-04	1
Cadmium	5.73E-05	1,525	112.411	2.15E-03	1
Chromium	2.33E-02	1,525	51.996	1.89E+00	1
Lead	5.90E-04	1,525	207.2	1.20E-02	1
Mercury	1.35E-04	1,525	200.59	2.83E-03	1
Nickel	1.22E-02	1,525	58.693	8.76E-01	1

1 - Values from Florida MaxWest Stack Test Report, June 15, 2011, Table 6-1

2 - Values from Florida MaxWest Stack Test Report Acid Gas Correction Letter, August 10, 2011, Table 6-1

Exhaust Flow Rate for Dioxin/Furan and Ammonia Slip

Exhaust Flow Rate	Exhaust Temperature	Exhaust Moisture	Stack O2	Exhaust Pressure	Exhaust Density
lb/hr	F	%	% O2	psia	lb/cf
106,000	343.0	13.8%	12.1%	15.7	0.038

*Values from Aries Linden stack test and design flow

Exhaust Flow Rate	Exhaust Flow Rate	Exhaust Flow Rate	Exhaust Flow Rate	Exhaust Flow Rate
acfh	acfm	dscfm @ Stack O2	dscfm @ 7% O2	dscfm @ 15% O2
2,796,415	46,607	28,206	17,706	42,557

Ammonia Slip

Ammonia Slip	Exhaust Flow Rate
ppmvd @ 15% O2	dscfm @ 15% O2
10.0	42,557

*Ammonia Slip based on Aries Linden Sludge Processing Plant specification

Air Mass Emission Rates by Biosolids Metals Mass Balance

Biosolids Throughput (dry pounds per hour) 8,333

HAP Metals	Biosolids Concentration (mg/kg, dry basis)	Metals Feed Rate to Gasifier (lb/hr)	Gasifier Removal Efficiency (percent)	Metals Feed Rate to APC (lb/hr)	APC Removal Efficiency (percent)	Mass Rate to Air (lb/hr)	Mass Rate to Air (g/sec)
Arsenic	6.94	5.783E-02	96.7%	1.905E-03	99.6%	6.750E-06	8.504E-07
Cadmium	2.64	2.200E-02	96.7%	7.247E-04	99.6%	2.568E-06	3.235E-07
Chromium	80.16	6.680E-01	96.7%	2.201E-02	99.8%	3.740E-05	4.712E-06
Lead	76.19	6.349E-01	98.7%	8.234E-03	99.6%	3.196E-05	4.027E-06
Mercury	2.00	1.667E-02	86.2%	2.304E-03	0.0%	2.304E-03	2.903E-04
Nickel	48.32	4.027E-01	96.7%	1.326E-02	99.8%	2.686E-05	3.384E-06
Selenium	7.00	5.833E-02	96.7%	1.922E-03	99.6%	6.808E-06	8.578E-07
Antimony	2.20	1.833E-02	96.7%	6.039E-04	99.6%	2.140E-06	2.696E-07
Beryllium	0.38	3.167E-03	96.7%	1.043E-04	99.6%	3.696E-07	4.657E-08

Notes:

1) Biosolids elemental concentration based on 2015 NEBRA Study "Metals & Other Contaminants in Biosolids, Other Soil Amendments, & Fertilizers - Comparison" - Mean US Sewage Sludge concentrations from USEPA 2009 TNSSS except for Mercury. Mercury biosolids elemental concentration based on 2015 NEBRA Study - New England range 1 - 2 mg/kg

2) Gasifier removal rate based on Florida gasifier removal rate for cadmium (MaxWest stack test), or if a specific metal removal is available from the Florida test that is used instead

3) Air pollution control (APC) removal rate based on Florida gasifier removal rate for cadmium and for lead, or if a specific metal removal is available from the Florida test that is used instead

4) Florida APC for Mercury differs from Sanford-ME APC, Florida APC temperature is lower which favors more removal of mercury. Florida test APC removal efficiency of 83.4% for Hg is not used. Assumed 0% control instead due to higher stack temperature for Sanford-ME compared to Florida.

Florida Stack Test Report Summary

	Run 1	Run 2	Run 3	Average
D/F Total (ng/dscm)	3.92	4.56	7.15	5.21
D/F TEQ (ng/dscm)	0.0144	0.0105	0.0605	0.03
D/F Total (pg)	700	832	1300	944.00
D/F Total (ng)	0.7	0.832	1.3	0.94
dscm	0.179	0.182	0.182	0.181
D/F TEQ (pg)	2.57	1.91	11	5.16
D/F TEQ (ng)	0.00257	0.00191	0.011	0.01
dscm	0.178	0.182	0.182	0.18

*Epsilon calculated dscm using the individual run ng/dscm and pg values from the Florida Stack Test Report

Dioxin and Furan Speciated Stack Test Results from Florida

Isomer	Run 1			Run 2			Run 3		
	pg	dscm	ng/dscm	pg	dscm	ng/dscm	pg	dscm	ng/dscm
2,3,7,8-TCDD	1.84	0.179	0.0103	EMPC	0.182	0.0000	3.37	0.182	0.0185
Other TCDD	370	0.179	2.0726	358	0.182	1.9651	490	0.182	2.6950
1,2,3,7,8-PeCDD	ND	0.179	0.0000	EMPC	0.182	0.0000	4.11	0.182	0.0226
Other PeCDD	127	0.179	0.7114	217	0.182	1.1911	358	0.182	1.9690
1,2,3,4,7,8-HxCDD	ND	0.179	0.0000	ND	0.182	0.0000	ND	0.182	0.0000
1,2,3,7,8,9-HxCDD	EMPC	0.179	0.0000	3.33	0.182	0.0183	8.13	0.182	0.0447
1,2,3,6,7,8-HxCDD	1.21	0.179	0.0068	5.17	0.182	0.0284	11.9	0.182	0.0655
Other HxCDD	1.31	0.179	0.0073	15.1	0.182	0.0829	50.2	0.182	0.2761
1,2,3,4,6,7,8-HpCDD	2.95	0.179	0.0165	6.82	0.182	0.0374	15.1	0.182	0.0831
Other HpCDD	2.86	0.179	0.0160	7.29	0.182	0.0400	19.4	0.182	0.1067
OCDD	10.4	0.179	0.0583	15.6	0.182	0.0856	38.9	0.182	0.2140
2,3,7,8-TCDF	4.36	0.179	0.0244	3.58	0.182	0.0197	6.01	0.182	0.0331
Other TCDF	130	0.179	0.7282	121	0.182	0.6642	154	0.182	0.8470
2,3,4,7,8-PeCDF	ND	0.179	0.0000	EMPC	0.182	0.0000	4.49	0.182	0.0247
1,2,3,7,8-PeCDF	ND	0.179	0.0000	ND	0.182	0.0000	2.86	0.182	0.0157
Other PeCDF	38.9	0.179	0.2179	63	0.182	0.3458	101	0.182	0.5555
1,2,3,4,7,8-HxCDF	EMPC	0.179	0.0000	1.96	0.182	0.0108	3.26	0.182	0.0179
1,2,3,6,7,8-HxCDF	1.03	0.179	0.0058	2.14	0.182	0.0117	EMPC	0.182	0.0000
1,2,3,7,8,9-HxCDF	ND	0.179	0.0000	ND	0.182	0.0000	ND	0.182	0.0000
2,3,4,6,7,8-HxCDF	EMPC	0.179	0.0000	1.72	0.182	0.0094	EMPC	0.182	0.0000
Other HxCDF	1.73	0.179	0.0097	4.72	0.182	0.0259	16.4	0.182	0.0902
1,2,3,4,6,7,8-HpCDF	2.72	0.179	0.0152	4.02	0.182	0.0221	10.1	0.182	0.0556
1,2,3,4,7,8,9-HpCDF	ND	0.179	0.0000	ND	0.182	0.0000	ND	0.182	0.0000
Other HpCDF	0.873	0.179	0.0049	1.34	0.182	0.0074	0	0.182	0.0000
OCDF	2.17	0.179	0.0122	EMPC	0.182	0.0000	4.29	0.182	0.0236

Attachment G

Ambient Air Modeling Report

Aries Pine Tree LLC

Air Dispersion Modeling Report

Prepared for:

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January 2026

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1. INTRODUCTION

1.1 Project Description

Aries Pine Tree LLC is a biosolids gasification facility located on an 11-acre site identified as Lot 4 within the Cyro Road Industrial Park in Sanford, Maine. Air modeling was conducted to support submission of the minor source air emissions license application to the Maine Department of Environmental Protection (MEDEP).

Aries Pine Tree LLC will be capable of receiving up to 500 wet tons per day of biosolids cake by truck and processing up to ~450 wet tons per day. No liquid biosolids will be accepted. The proposed facility will consist of a biosolids receiving/storage bin, hollow flight dryers to dry the incoming biosolids, a gasifier to produce a syngas from the biosolids and reduce it to biochar, a thermal oxidizer heated by the producer gas (see Section 3.1) or backup natural gas, heat recovery to use the oxidizer heat to feed the drum dryers, and an air quality control system. This report conservatively assumes that the facility will operate 24 hours per day, 7 days per week, though in practice biosolids receiving and product loadout will generally be limited to the hours of 6:00 AM to 6:00 PM, Monday through Saturday.

The Project will be located near a wastewater treatment plant, and the Sanford Seacoast Regional Airport is located approximately 1.5 km south of the project site. The Mousam River flows to the west of the Project Site.

The use of a highly efficient gasification process with heat recovery and an extensive air quality control system will minimize Project air impacts. This air modeling report documents that the Project will not cause or significantly contribute to any violation of the National Ambient Air Quality Standards (NAAQS), Maine Ambient Air Quality Standards (MAAQS), and Maine Chronic Ambient Air Guidelines (AAGs). The project location is shown in **Figure 1**, and the draft site plan is shown in **Figure 2**. Modeling details presented herein are consistent with the air modeling protocol submitted to Kevin Ostrowski of Maine DEP on 12/11/2024 and approved with minor revisions on 1/29/2025.

1.2 Report Structure

Section 2 provides a description of the air quality standards that were used to show the Project's regulatory compliance, as well as background air pollutant concentrations. Section 3 describes the source, emissions calculation methodology and exhaust parameters. Section 4 describes the air modeling analysis methodology, showing specific model options, describes the meteorological data, and presents the area for analysis. Section 5 presents a Significant Impact Analysis (SIL) performed as an initial screening and the modeling results.

As summarized in Table 1-1, this report contains all required elements as specified in Chapter 115, subsection 7(6) of the MEDEP Air Rules.

Table 1-1 Required Report Elements

Requirement (Ch. 115, subsection 7 (6)	Section of Report
(a) Introduction (briefly give an overview of the project, the analyses conducted, and the results)	Section 1
(b) Site and surroundings (describe the topography, demography, air quality control region and compliance status (attainment/nonattainment); include a topographic map section showing the site and a properly scaled plot plan of the proposed facility; include rural/urban classification and simple/complex terrain determination), topography and land-use need to be described in sufficient detail to specify roughness length if roughness length is a required input for the modeling system used in the analysis	Section 2 and 4
(c) Source description (provide an overview of the source, describe the process(es) involved)	Section 3
(d) Description of each emission unit at the source (describe the equipment/operations, emission controls, emission limits; list emissions and stack parameters for each emission unit in English and metric units)	Section 3
(e) Screening modeling (describe the screening analyses performed) including: Modeling approach/model(s) used; Model version used; Model switch selections; Source data (affected source and other nearby sources); Meteorological data; Receptor data; Screening results	Section 4 and 5
(f) Final compliance modeling analysis (describe in detail modeling performed and results): Modeling approach/model(s) used; Model version used; Model switch selections; Source data (affected source and other nearby sources); Meteorological database; Receptor data map; and modeling results.	Section 4 and 5
All input files needed to duplicate the final compliance model runs and all final compliance model output and diagnostic files shall be submitted on media approved by the Department.	Submitted separately
(g) Compliance demonstration (describe how the predicted concentrations comply with all applicable ambient air quality standards and ambient increments): Background determination (include table of values); Compliance with ambient air quality standards; and Compliance with Class II Prevention of Significant Deterioration (PSD) increments (if applicable).	Section 5
(h) Class I area impact assessment (if required), (describe any analyses made for federal Class I areas)	Not Applicable

1.3 Summary of Changes to Modeling Protocol

The modeling strategy is consistent with the air modeling protocol submitted to Kevin Ostrowski of Maine DEP on 12/11/2024 and approved with minor revisions on 1/29/2025. The following minor changes were applied, primarily due to refinements in the facility's engineered layout:

Table 1-2 Summary of Changes to Protocol

Protocol	Change in Report
AERMOD/AERMET/AERMAP v. 23132 to be used	AERMOD/AERMET/AERMAP v. 24142 (most recent) used
Site plan / source list includes Cooling Tower and does not include Emergency Generator	Site plan / source list does not include Cooling Tower and includes Emergency Generator (see Figures 2 and 7)
PSD Class II Increment Standards not included	PSD Class II Increment Standards included (see Table 2-1)
Easting coordinates, Northing coordinates and base elevations of all stacks not included.	Includes Easting coordinates, Northing coordinates and base elevations of all stacks being modeled.
Main Stack Diameter = 3'	Main Stack Diameter = 4' (see Table 3-1)
Ancillary Process Parameters (bin vents, loadouts, etc.) as listed in protocol Table 5b	Ancillary Process Parameters (bin vents, loadouts, etc.) as listed in Table 3-2; includes adjusted inventory and exhaust parameters
Modeled emission rates as listed in protocol Tables 6a, 6b	Adjusted modeled emission rates as listed in Tables 3-1, 3-2
Building/structure dimensions as listed in protocol Table 9	Adjusted building/structure dimensions as listed in Table 4-3 (including new structure to contain dryers)
SIL Modeling Results as listed in protocol Table 10	Adjusted SIL Modeling Results as listed in Table 5-1
Receptor Grid as listed in protocol Figure 6	Adjusted Receptor Grid as listed in revised Figure 6 (implemented property line and extended SO2 modeling; see Section 4.5)

2. NATIONAL AMBIENT AIR QUALITY STANDARDS, BACKGROUND CONCENTRATIONS, AND MAINE AMBIENT AIR STANDARDS

Background air quality concentrations and federal/state air quality standards were utilized to evaluate the air quality impacts associated with the Project. Air quality standards have been developed by the EPA and the State to protect human health against adverse health effects with a margin of safety. Typically, the modeled maximum criteria air pollutant concentrations associated with the Project are added to monitored background values and then compared to the National Ambient Air Quality Standards (NAAQS). Modeled maximum concentrations for chemicals listed in the Maine Chronic Ambient Air Guidelines (AAGs), Maine Ambient Air Quality Standards (MAAQS), and Maine Prevention of Significant Deterioration (PSD) Class II Standards are compared with the applicable limits to demonstrate compliance. The air dispersion modeling methodologies are developed in accordance with the latest MEDEP modeling policies[1] and federal modeling guidelines.[2] The following sections outline the NAAQS and detail the sources of background air quality data. This project modeled criteria air pollutants (CO, NO_2, PM_{10}, $PM_{2.5}$, and SO_2) and applicable State-listed chemicals.

2.1 National Ambient Air Quality Standards

The 1970 Clean Air Act was enacted by the U.S. Congress to protect the health and welfare of the public from the adverse effects of air pollution. As required by the Clean Air Act, EPA has promulgated NAAQS for the following criteria pollutants: nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM_{10}, $PM_{2.5}$), carbon monoxide (CO), ozone (O_3), and lead (Pb).[3] The NAAQS are listed in

-1.

The NAAQS specify concentration levels for various averaging times and include both “primary” and “secondary” standards. Primary standards are intended to protect human health, whereas secondary standards are intended to protect public welfare from any known or anticipated adverse effects associated with the presence of air pollutants, such as damage to vegetation. The more stringent of the primary or secondary standards were applied for comparison to the modeling results for this Project.

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1 https://www.maine.gov/dep/air/meteorology/introduction.html. Accessed October 28, 2024

2 40 CFR 51 Appendix W, Guideline on Air Quality Models, 82 FR 5182, Jan. 17, 2017

3 40 CFR 50, National Primary and Secondary Ambient Air Quality Standards.

The NAAQS also reflect various durations of exposure. The non-probabilistic short-term periods (24-hours or less) refer to exposure levels not to be exceeded more than once a year. Long-term periods refer to limits that cannot be exceeded for exposure averaged over three months or longer.

Note: the NAAQS specified in *Table 2-1* below (sourced from U.S. EPA) represent the most current applicable ambient air quality standards for this project, superseding the ambient air quality standards for the referenced pollutants as listed in Chapter 110 of the Maine DEP Air Rules[4].

According to U.S. EPA data (https://www3.epa.gov/airquality/greenbook/anayo_me.html), York County, Maine is in attainment for all criteria pollutants.

2.2 Background Concentrations of Criteria Air Pollutants

Background air quality levels characterize the existing ambient air near the proposed Project. Modeled concentrations due to emissions from the Project are added to ambient background concentrations to obtain total concentrations for comparison against the NAAQS.

Background concentrations were obtained from the MEDEP from available monitoring stations. For PM_{10}, background data was obtained from the Augusta monitoring station. For SO_2, NO_2, CO, and $PM_{2.5}$, the background data were obtained from the Presque Isle monitoring station, which is approximately 262 miles northeast of the Project Site. Background concentrations are shown in *Table 2-2* for the relevant criteria pollutants.

Though the NAAQS are based on NO_2 concentrations, most nitrogen oxides (NOx) emissions are in the form of nitric oxide (NO) rather than NO_2. Oxides of nitrogen undergo chemical conversion with atmospheric ozone to form NO_2. US EPA allows the use of the Ambient Ratio Method (ARM2) without prior approval from the regulatory agency. For this analysis, ARM2 (Tier 2) with the default minimum and maximum NO2/NOx values of 0.5 and 0.9, was used.

2.3 Maine Ambient Air Quality Standards

MEDEP's 2025 Chronic Ambient Air Guidelines (AAGs)[5] represent chemical concentrations in ambient air, below which there is minimal risk of a deleterious health effect resulting from long-term inhalation exposure. Furthermore, additional concentration limits apply for chromium and lead, which are designated as Maine Ambient Air Quality Standards (MAAQS).[6]

[4] https://www.maine.gov/sos/cec/rules/06/096/096c110.docx

[5] https://www.maine.gov/dep/air/monitoring/docs/ME_DEP_AAG_LIST_2025_FINAL_with%20notes.pdf

[6] https://www.maine.gov/dep/air/meteorology/protocol.html

Air dispersion modeling was conducted to evaluate maximum concentrations of State-listed chemicals emitted by the proposed facility and compared to the referenced AAGs and MAAQS. Further details, including the specific State-listed chemicals to be modeled (broken down by process) are provided in Section 3.

Furthermore, Maine DEP has provided guidance that Aries Pine Tree LLC is located in an area designated as a Class II Air Quality Control Region for Prevention of Significant Deterioration (PSD) purposes. In such cases, Maine requires increment modeling to be performed for all sources, regardless of size, which includes new minor sources or existing minor sources undergoing a minor modification. Since Aries Pine Tree LLC is a new source, its emissions would be considered entirely increment consuming, as they did not exist during any of the baseline years (1977, 1987 or 2010). The Class II increment standards are included in *Table 2-1*.

Table 1-1 National Ambient Air Quality Standards (NAAQS) and PSD Class II Standards

Pollutant	Averaging Period	NAAQS[7] (µg/m³)		PSD Class II Increment Standard[8] (µg/m³)
		Primary	Secondary	
NO_2	Annual (1)	100	Same	25
	1-hour (2)	188	None	None
SO_2	3-hour (3)	None	1300	512
	1-hour (4)	196	None	None
$PM_{2.5}$	Annual (1)	9	15	4
	24-hour (5)	35	Same	9
PM_{10}	24-hour (3)	150	Same	30
CO	8-hour (3)	10,000	Same	None
	1-hour (3)	40,000	Same	None
Ozone	8-hour (6)	137	Same	None
Pb	3-month (1)	0.15	Same	None

(1) Not to be exceeded.
(2) 98th percentile of one-hour daily maximum concentrations, averaged over three years.
(3) Not to be exceeded more than once per year.
(4) 99th percentile of one-hour daily maximum concentrations, averaged over three years.
(5) 98th percentile, averaged over three years.

[7] https://www.epa.gov/criteria-air-pollutants/naaqs-table
[8] https://www.maine.gov/dep/air/meteorology/protocol.html

(6) Annual fourth-highest daily maximum eight-hour concentration, averaged over three years.

Table 2-2 Background Concentration for Criteria Air Pollutants

Pollutant	Averaging Period	Background Concentration (ug/m^3)	Monitoring Station
SO_2	1-hour	5	Presque Isle
	3-hour	4	
PM_{10}	24-hour	37	Augusta
$PM_{2.5}$	24-hour	12	Presque Isle
	Annual	4	
NO_2	1-hour	40	Presque Isle
	Annual	4	
CO	1-hour	1102	Presque Isle
	8-hour	789	

2.4 Per- and polyfluoroalkyl substances (PFAS) Modeling

The AERMOD model was used to estimate dry and wet deposition of per- and polyfluoroalkyl substances (PFAS) compounds generated by the facility process as well as potential PFAS air concentrations emitted from the main stack. Details regarding deposition using AERMOD are described in the EPA model formulation guidance [9]. The annual emissions in this study were based on the stack tests from the similar Linden, NJ facility.

Modeling was conducted to evaluate the potential impact of 8 PFAS (perfluorooctanoic acid [PFOA], perfluorooctanoic sulfonic acid [PFOS], Perfluorohexanesulfonic acid [PFHxS], Perfluorononanoic acid [PFNA], hexafluoropropylene oxide dimer acid [HFPO-DA], Perfluorobutanesulfonic acid [PFBS], Perfluoroheptanoic acid [PFHpA], and Perfluorodecanoic Acid [PFDA]) from stack emissions to water quality. Consistent with the procedures specified by the New Hampshire Department of Environmental Services for the recent PFAS testing by Saint-Gobain Plastics in Merrimack, NH[10] [11], the location with the maximum modeled deposition rate was evaluated, conservatively assuming that all the PFAS transfers from the ground into rainwater that infiltrates into the ground and could potentially impact groundwater. This maximum potential water concentration of each species was compared to the

[9] EPA, 2003: AERMOD Deposition Algorithms - Science Document (Revised Draft). U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711.

[10] https://www4.des.state.nh.us/OneStopPub/Air/330110016522-0092TypeCalculations.pdf

[11] https://www4.des.state.nh.us/OneStopPub/Air/330110016522-0092TypeSummary.pdf

relevant health-based EPA[12] [13] and Maine DEP[14] drinking water standards. Although runoff could also impact surface water, any runoff would be further diluted and would result in a lower PFAS concentration in the water, therefore the analysis is conservative.

Air quality (inhalation) impacts associated with potential PFAS emission from the Facility were compared with the most stringent air standards for PFAS. A compilation of all state regulatory and guidance PFAS standards is available through the Interstate Technology & Regulatory Council (ITRC)[15]. Based on Epsilon's review of these standards and guidelines, the most stringent existing state standards were found to be for the State of Michigan. Michigan has derived an Initial Threshold Screening Level (ITSL) for PFOS and PFOA of 0.0004 µg/m³ and 0.0001 µg/m³, respectively for a 24-hour averaging time[16]. Epsilon selected these standards as the basis for evaluating potential ambient air quality impacts.

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[12] https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

[13] https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas#Summary

[14] https://www.maine.gov/dhhs/mecdc/environmental-health/dwp/pws/pfas.shtml

[15] PFAS — Per- and Polyfluoroalkyl Substances

[16] https://www.egle.state.mi.us/aps/downloads/ATSL/1763-23-1/1763-23-1_24hr_ITSL.pdf

3. PROCESS, EMISSIONS, AND SOURCE PARAMETERS

3.1 Process Description

Wet residuals are received from trucks and deposited into biosolids receiving or storage bins. From the residual storage bins, the wet residuals go into three hollow flight dryers. The dryers are heated with hot oil from heat exchangers with a thermal oxidizer. Steam and non-condensable gases are extracted under a slight vacuum from the hollow flight dryers to a 3-stage spray condenser. The steam is condensed and the non-condensable gases proceed to the oxidizer for destruction (or to a backup carbon filter for odor removal if the dryer is operating, but the oxidizer is out of service). Process water from the condenser goes to the water treatment system and later to the condenser spray water recycle system.

Also, dried biosolids flowing out of the hollow flight dryer are collected in a gasifier feed bin and then flow into a fluidized bed gasifier. The gasification system consists of the Aries proprietary fluidized bed gasifier and a cyclone attached to it. The gasifier is a refractory lined steel vessel in which the gasification reactions take place at ambient pressure. The biosolids are converted to molecules of methane, carbon monoxide, hydrogen, and other minor species to form a low energy producer gas. The gasifier uses sand as an input material, which is received by truck and transferred into a sand storage bin using dust controls.

Aside from the producer gas, the gasifier process also produces biochar, which is transferred to the cyclone. From the cyclone, the separated biochar is cooled and sent to the biochar holding silo with dust control equipment and then transferred by gravity to pneumatic dry bulk trailer trucks.

The producer gas flows to a thermal oxidizer where it is combusted to produce the required heat for the dryers. Therefore, the thermal oxidizer will normally operate continuously, utilizing producer gas from the gasifier as a fuel source. When the gasifier is not in operation, and/or producer gas is not available, the thermal oxidizer can operate utilizing natural gas. Heated flue gas from the thermal oxidizer is routed through the ceramic filter house emissions control unit to the heat recovery exchanger #2 before exhausting the cooled flue gas through the stack. In addition to providing heat for the process, the thermal oxidizer effectively destroys carbon monoxide, other organic compounds, and odor. (All emission rates listed in this protocol are "controlled", i.e., including the thermal oxidizer. However, it should be noted that the thermal oxidizer is intrinsic to the plant design and is not an add-on pollution control device.)

An emission control system will be installed to reduce NOx, SO_2, hydrogen chloride (HCl), particulate matter, and dioxin/furan emissions. The system consists of an enclosed Selective Catalytic Reduction (SCR) system, dry sorbent injection, and a ceramic filter house.

Hydrated lime sorbent and aqueous ammonia will be injected upstream of the ceramic filter house to control SO_2 and NOx respectively. There will be a vent on the sorbent storage silo as well as a vent for the displacement of air generated by spent sorbent on the filter house, both venting to the atmosphere. Process solids (spent sorbent material) will be collected in a container and trucked offsite.

3.2 Emissions and Stack Parameters

The physical parameters and emission rates from the main stack and each of the ancillary processes are summarized in the Tables below. (Parameters listed therein are automatically converted between Metric and Imperial units within the Lakes Environmental AERMOD viewer used by Epsilon; only one format is shown in each Table for purposes of legibility.)

The main stack emission rates presented herein are based on full load operation by the gasifier. In practice, the gasifier may run as low as 70 percent load (the thermal oxidizer will adjust accordingly for the lower flow rate). Based on engineering judgment, it is reasonable to assume a linear extrapolation in gas characteristics (temperatures, compositions, etc.) when comparing the 70 percent and full load scenarios, therefore emissions are not expected to increase at lower load levels. The emission rates herein for ancillary processes (bin vents, etc.) are also based on maximum operation and will not feasibly increase at lower production levels. Per guidance received from MEDEP, dust from paved roads and activities classified as Categorically Exempt under Ch. 115 of the Air Rules (e.g., vehicle emissions) are not included herein.

Physical stack height, diameter, and other source parameters are presented in *Table 3-1* and *Table 3-2*. All bin vent stacks are 4” x 6” rectangles. Base elevations for all sources were derived from AERMAP.

Table 3-1 Stack Parameters

Stack	Base Elevation (ft)	UTM East (m)	UTM North (m)	Release Height (ft)	Gas Exit Temp. (°F)	Diameter (ft)	Gas Exit Velocity (ft/s)	Gas Exit Flow Rate (ft^3/min)
Main Stack	225	361352	4808134	130	298	4	62	46747
Emergency Generator Stack	231	361368	4808072	14	953	1	148	6955

Table 3-2 Ancillary Process Parameters

Process	Base Elevation (ft)	UTM East (m)	UTM North (m)	Release Height (ft)	Gas Exit Temp. (°F)	Diameter (ft)	Gas Exit Velocity (ft/s)	Gas Exit Flow Rate (ft^3/min)
Sorbent Tank Vent	223.5	361330	4808122	70	Ambient + 9 deg F (or + 5 deg K)	0.46	30	300
Spent Sorbent Tank Vent	222.5	361313	4808122	70	Ambient + 9 deg F (or + 5 deg K)	0.46	5	50
Dried Biosolids Bin Vent A	224.3	361310	4808096	70	Ambient + 9 deg F (or + 5 deg K)	0.46	10	100
Dried Biosolids Bin Vent B	225.8	361320	4808086	70	Ambient + 9 deg F (or + 5 deg K)	0.46	10	100
Gasifier Feed Bin Vent A	225.2	361318	4808093	70	130	0.46	0.2	2
Gasifier Feed Bin Vent B	225.7	361327	4808093	70	130	0.46	0.2	2
Gasifier Feed Bin Vent C	224.8	361327	4808103	70	130	0.46	0.2	2
Gasifier Feed Bin Vent D	224.4	361318	4808102	70	130	0.46	0.2	2
Biochar Bin Vent	222.5	361305	4808113	70	100	0.46	5	50
Sand Bin Vent	224.2	361321	4808108	70	Ambient + 9 deg F (or + 5 deg K)	0.46	30	300
Biosolids Loadout	223.1	361291	4808096	14	Ambient + 9 deg F (or + 5 deg K)	6.96	0.003	7.49
Spent Sorbent Loadout	222.6	361313	4808121	14	Ambient + 9 deg F (or + 5 deg K)	6.96	0.003	7.49
Biosolid Receiving Area Bay Door	230.1	361347	4808025	In Building with 14'H x 12'W bay door	Ambient	N/A	N/A	N/A

Annual emission rates for all pollutants are shown in *Table 3-3* and *Table 3-4*. Since it is conservatively assumed that the facility operates 24/7/365, the listed emission rates also apply to air pollutants where the ambient air standard is based on a short-term concentration (e.g., 1 hour). With regard to specific pollutants:

- All PM is conservatively modeled as PM_{10} or $PM_{2.5}$, for each source, and includes both filterable and condensable PM combined.
- Hydrogen Fluoride (HF) is the only fluoride emission from the project, maximum modeled concentrations are compared against the ME AAG limit for "Fluorides".
- Total Antimony emissions from the project are conservatively assumed to be Antimony Trioxide for modeling purposes, since the ME AAG limit only applies to Antimony Trioxide.
- Worst case hydrogen sulfide results during "gasifier down" conditions; the modeling conservatively assumes this occurs 8,760 hours/year.

Table 3-3 Air Pollutant Emission Rates from Main Stack and Emergency Generator Stack

Pollutant	Main Stack Emission Rate (g/s)	Emergency Generator Stack Emission Rate (g/s)[17]
CO	0.52	1.2378 (short-term)
		7.06E-02 (long-term)
$PM_{2.5}/PM_{10}$	1.01	9.46E-03 (short-term)
		5.40E-04 (short-term)
NO_x	0.58	3.53E-02 (short-term)
		3.53E-02 (long-term)
SO_2	1.59	5.57E-04 (short-term)
		3.18E-05 (long-term)
HCl	5.24E-02	N/A
Fluorides (as HF)	3.50E-03	N/A
Arsenic	8.55E-07	N/A
Beryllium	4.68E-08	N/A
Cadmium	3.50E-07	N/A
Chromium	4.73E-06	N/A
Lead	4.03E-06	N/A

[17] Long-term rates assume 500 operating hours per year; short-term rates are one-hour averages (except NOx which applies the EPA intermittent factor of 500 hours/year).

Mercury	2.92E-04	N/A
Nickel	3.41E-06	N/A
Antimony	2.70E-07	N/A
Selenium	8.58E-07	N/A
Ammonia	1.42E-01	N/A
Hydrogen Sulfide	1.69E-03	N/A
Dioxin/Furan (as 2,3,7,8-TCDD)	2.38E-10	N/A

Table 3-4 Air Pollutant Emission Rates from Ancillary Processes

Process	Pollutant	Emission Rate (g/s)
Sorbent Tank Vent	$PM_{2.5}/PM_{10}$	1.62E-03
Spent Sorbent Tank Vent	$PM_{2.5}/PM_{10}$	2.70E-04
	Arsenic	3.97E-10
	Beryllium	2.18E-11
	Cadmium	1.51E-10
	Chromium	4.60E-09
	Lead	1.72E-09
	Mercury	0.00E+00
	Nickel	2.77E-09
	Antimony	1.26E-10
	Selenium	4.01E-10
Dried Biosolids Bin Vent A	$PM_{2.5}/PM_{10}$	5.40E-04
	Cadmium	7.02E-10
	Lead	1.84E-08
	Mercury	3.94E-10
Dried Biosolids Bin Vent B	$PM_{2.5}/PM_{10}$	5.40E-04
	Cadmium	7.02E-10
	Lead	1.84E-08
	Mercury	3.94E-10
Gasifier Feed Bin Vent A	$PM_{2.5}/PM_{10}$	1.08E-05
	Cadmium	1.40E-11
	Lead	3.67E-10
	Mercury	7.88E-12
Gasifier Feed Bin Vent B	$PM_{2.5}/PM_{10}$	1.08E-05
	Cadmium	1.40E-11
	Lead	3.67E-10

	Mercury	7.88E-12
Gasifier Feed Bin Vent C	$PM_{2.5}/PM_{10}$	1.08E-05
	Cadmium	1.40E-11
	Lead	3.67E-10
	Mercury	7.88E-12
Gasifier Feed Bin Vent D	$PM_{2.5}/PM_{10}$	1.08E-05
	Cadmium	1.40E-11
	Lead	3.67E-10
	Mercury	7.88E-12
Biochar Bin Vent	$PM_{2.5}/PM_{10}$	2.70E-04
	Cadmium	1.80E-10
	Lead	5.13E-09
	Mercury	2.54E-10
Sand Bin Vent	$PM_{2.5}/PM_{10}$	3.15E-02
Spent Sorbent Loadout	$PM_{2.5}/PM_{10}$	3.46E-04
	Arsenic	5.09E-10
	Beryllium	2.79E-11
	Cadmium	1.94E-10
	Chromium	5.89E-09
	Lead	2.20E-09
	Mercury	0.00E+00
	Nickel	3.55E-09
	Antimony	1.61E-10
	Selenium	5.14E-10
Dried Biosolids Loadout	$PM_{2.5}/PM_{10}$	4.84E-04
	Cadmium	6.29E-10
	Lead	5.72E-07
	Mercury	1.23E-08
Biosolids Receiving Door	Hydrogen Sulfide	1.69E-03

4. AIR QUALITY ANALYSIS METHODOLOGY

Air dispersion modeling was performed to assess compliance with the applicable Federal and State standards based on emissions data.

4.1 General Methodology

The EPA's most current AERMOD model (Version 24142) was used to estimate pollutant concentrations and deposition from the stack. AERMOD is the EPA's preferred model for regulatory applications. The use of AERMOD provides the benefits of using the most current algorithms available for steady state dispersion modeling.

The AERMOD View graphical user interface (GUI) Version 12.0.0, created by Lakes Environmental, was used to facilitate model setup and post-processing of data. The AERMOD model was selected for this analysis because it:

- is the recommended EPA model for all refined regulatory analyses for receptors within 50 km of a source;
- is a refined model for facilities with multiple sources, source types, and building-induced downwash;
- uses actual representative hourly meteorological data;
- incorporates direction-specific building parameters which can be used to predict impacts within the wake region of nearby structures;
- allows the modeling of multiple sources together to predict cumulative downwind impacts, if needed;
- provides for variable emission rates;
- provides options to select multiple averaging periods between one-hour and one year (scaling factors can be applied to adjust the one-hour impact to a peak impact less than one-hour); and,
- allows the use of large Cartesian, polar, nested and multi-tier receptor grids, as well as discrete receptor locations.

A complete description of the AERMOD dispersion model may be found in the AERMOD User's guide[18] and the AERMOD model implementation guide.[19]

4.2 Urban/Rural Determination

The AERMOD model can assign sources to a rural or urban category to allow specified urban sources to use the effects of increased surface heating under stable atmospheric conditions. The USGS topographic quadrangle map in the vicinity of the Project is typically used to determine whether the land-use pattern in the environments of the Project is urban or rural for modeling purposes. The EPA recommended procedure in The Guideline on Air Quality Models was used to determine urban/rural classification using the Auer land use technique. The land use within 3 km of the site has been classified using the land use typing scheme shown in *Table 4-1* and Auer land use map is shown in **Figure 4**. Based on the Auer analysis with 90% rural, the rural dispersion classification was selected.

Table 4-1 Auer Land Use

Type	Acres	Auer
Barren Land	68.60	Rural
Cultivated Crops	10.91	Rural
Deciduous Forest	172.83	Rural
Developed, High Intensity	279.78	Urban
Developed, Low Intensity	570.40	Rural
Developed, Medium Intensity	408.76	Urban
Developed, Open Space	452.52	Rural
Emergent Herbaceous Wetlands	160.14	Rural
Evergreen Forest	575.11	Rural
Hay/Pasture	88.62	Rural
Herbaceous	311.25	Rural
Mixed Forest	1890.63	Rural
Shrub/Scrub	122.80	Rural
Woody Wetlands	1650.34	Rural

[18] EPA, 2023a: User's Guide for the AMS/EPA Regulatory Model – AERMOD. EPA-454/B-23-008. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

[19] EPA, 2023b: AERMOD Implementation Guide. EPA-454/B-23-009. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711.

4.3 Meteorological Data

Surface meteorological data is automatically sampled at various locations, primarily at airports. The data includes measurements of temperature, moisture, wind speed and direction, and other parameters all measured once every minute. The National Weather Service (NWS) operates more than 900 Automated Surface Observing System (ASOS) stations in the Unites States.

Upper air data is sampled at far fewer locations. These data are sampled using a measurement apparatus (radiosonde) tethered to a large balloon and radioed back to the ground observer. As the balloon rises, the radiosonde samples temperature and moisture. Its location in time indicates the wind speed and direction aloft. There are only 92 upper air monitoring locations in North America.

The meteorological data required to run AERMOD includes five years of representative surface and upper air observations. The regional meteorology in Sanford, ME is best approximated with surface meteorological data collected by the National Weather Service (NWS) Automated Surface Observing System (ASOS) station at the Skyhaven Airport (KDAW), Rochester, NH located approximately 14 miles southwest of the Project Site. NWS ASOS stations collect hourly observations of wind, temperature, humidity, and pressure. Upper air soundings are taken twice daily from far fewer locations than surface data. For this Project, upper air data from Gray, ME was used. Consistent with the recommendation from MEDEP staff, the five-year period between 2012-2016 was used for both surface and upper air data. These data were provided by MEDEP.

Surface data and upper air sounding data have been processed into AERMOD-ready input files using the current version of AERMET (v. 24142). Based on EPA's Appendix W *-Guideline on Air Quality Models,* the U-star adjustment was used.[20] Raw 1-minute and 5-minute data were included using version 15272 of the AERMINUTE preprocessor to reduce the incidence of "calm" winds (< 0.5 m/s wind speed).

Analyses of the processed meteorological data found that within the five-year period of 43,848 total hours, 457 calm hours (1.04 %) were identified, and 148 (0.33%) missing hours were identified. Thus, these data are deemed complete and representative for air quality modeling of the project.

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[20] EPA 2017. Appendix W Final Rule. Federal Register vol 82, No 10, pg 5187. https://www.epa.gov/sites/default/files/2020-09/documents/appw_17.pdf

A wind rose showing the frequency distribution of wind speed and direction for the five years of data is presented in **Figure 5**. The wind rose shows that the prevailing wind direction for the five-year period originated from the northwest.

4.4 Terrain Effects

Source and receptor terrain elevations are included in the analysis, as is required for regulatory refined modeling. One-third arc-second terrain data was obtained from the U.S.G.S. National Map Seamless Server according to guidance set forth by EPA.[21] Receptor elevations was processed using the AERMAP (version 24142) processor by way of the Lakes AERMOD View interface. Building, stack and receptor base elevations was obtained from the AERMAP outputs.

4.5 Receptors

Cartesian receptors were placed every 10 m by an enclosed bounding box (60 ft by 100 ft) inside the facility. Cartesian receptors also were placed in a nested grid beyond the bounding box (60 ft by 100 ft) using 20 m spacing up to 200 m, 50 m spacing up to 500 m, 100 m spacing up to 1000 m, 200 m spacing up to 2000 m, and 500 m spacing up to 10000 m from the facility. Additionally, receptors were placed every 10 m on the property line. On-site receptors were turned off. The receptor grid is shown in **Figure 6**.

To get the significant impact area for SO_2, the receptor grid was extended to 15 km in both directions with 1000 m spacing.

Table 4-2 Receptor Spacing

Extent(m)	Spacing (m)
Property Line	10
Bounding box (60 ft by 100 ft)	10
200 m from the bounding box	20
200-500 m	50
500-1000 m	100
1000-2000 m from the bounding box	200
2000-10000 m from the bounding	500
10000-15000 m (only for SO_2)	1000

[21] EPA, 2023b: AERMOD Implementation Guide. EPA-454/B-23-009. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711.

4.6 Building Downwash

AERMOD requires direction specific building parameters to adequately incorporate the aerodynamic effects of buildings on pollutant plume dispersion. The most recent version (04274) of the Building Profile Input Program with the Prime downwash algorithms (BPIP-Prime) was used to calculate these parameters. BPIP-Prime uses the stack information, as well as the height information of nearby buildings to calculate the required heights, widths, and setbacks required to account for building downwash.

The Good Engineering Practice (GEP) stack height evaluation of the facility requires to follow the EPA revised Guidelines for Determination of Good Engineering Practice Stack Height[22]. For this project, the stack height is selected as 130 feet (40 m), which is consistent with the highest GEP Formula Height listed in Section 4.6.1 below.

4.6.1 Good Engineering Practice Stack Height Determination

The Good Engineering Practice (GEP) stack height evaluation of the facility has been conducted in accordance with the EPA revised Guidelines for Determination of Good Engineering Practice Stack Height (EPA, 1985). The "GEP stack height" is defined as the greater of 65 meters or the formula height. The formula height, as defined by the EPA guidelines, is:

HGEP = Hb + 1.5L

where HGEP = GEP formula height,

Hb = Height of adjacent or nearby structures,

L = Lesser of height or maximum projected width of adjacent or nearby building, i.e., the critical dimension, and

Nearby = Within 5L of the stack from downwind (trailing edge) of the building.

For a squat structure, i.e., height less than projected width, the formula reduces to:

HGEP = 2.5Hb

The latest version of the EPA Building Profile Input Program (BPIP-Prime) was run for the combined stack and buildings in the vicinity of the project to create the building parameter inputs to AERMOD to evaluate potential downwash from nearby structures. Wind direction specific building parameters generated by BPIP-Prime were input into AERMOD to account for

[22] EPA, 1985. "Guideline for Determination of Good Engineering Practice Stack Height", EPA-450/4-80-023R.

potential downwash from nearby structures in the dispersion calculations. **Figure 7** shows buildings and heights (feet) used in BPIP, and sources. *Table 4-3* presents the GEP stack height analysis for the main stack.

Table 4-3 Good Engineering Practice (GEP) Stack Height Analysis for the Main Stack

Bldg #	Building Name [1]	Height (ft)	Height (m)	Length (m)	Width (m)	MPW [2] (m)	GEP Formula Height (m)	5L [3] (m)	Distance to Stack (m)	Stack Potentially Affected by Downwash [4]
BLD_1	Control Room	20	6	24.46	12	27.2	15	30	68	No
BLD-2	MCC Room	20	6	24.46	5	25.0	15	30	63.7	No
BLD_3	Receiving Building	55	17	44	44	62.2	42	84	68	Yes
BLD_4	Dryer	20	6	44	37.8	58.0	15	30	62.3	No
BLD_5	Maintenance Building	20	6	16.3	8.9	18.6	15	30	27.75	Yes
BLD_6	Admin Building	20	6	16.3	9	18.6	15	30	43	No
BLD_7	Biochar Bin	70	21	5	5	7.1	32	35	50	No
BLD_8	Spent Sorbent Bin	70	21	5	5	7.1	32	35	40	No
BLD_9	Sorbent Bin	70	21	3.66	3.66	5.2	29	26	25	Yes
BLD_10	Emergency Generator Enclosure	9	3	5.5	2.7	6.1	7	14	62	No
BLD_11	Gasifier	75	23	6.20	6.20	8.8	36	44	44.5	No
BLD_12	Gasifier Building	60	18	27.5	29.25	40.1	46	91	34.5	Yes

Notes:

1. All other structures near the stack location have been determined to be too short to influence the stacks.
2. Maximum projected width.
3. Maximum influence distance is 5L, where L = the lesser of the MPW or height.
4. Dependent on structure distance from stack.

5. MODELING RESULTS

5.1 Significant Impact Limit (SIL) Modeling

Using the parameters listed in the preceding sections, Epsilon has conducted Significant Impact Level (SIL) modeling of all sources combined, as an initial screening to determine if impacts from the facility are significant for any pollutant/averaging period (requiring cumulative impact modeling), and to determine significant impact areas for any such pollutants.

SIL modeling results are presented in *Table 5-1*. Significant impact area distance was taken from the centroid of the emitting sources for each pollutant.

Table 5-1 SIL Modeling Results

Pollutant	Averaging Time	Form	Maximum Modeled Conc. (µg/m³)	SIL (µg/m³)	% of SIL	Significant Impact Area (km)	AERMOD Option
SO_2	1-hr	H1H[f]	29.3	7.8	376%	17.8	
	3-hr	H1H[a]	14.4	25	58%	N/A	
NO_2	1-hr	H1H[g]	27.3	7.5	363%	5.3	Tier 2
	Annual	H1H[h]	0.478	1	48%	N/A	Tier 2
CO	1-hr	H1H[b]	1085	2000	54%	N/A	
	8-hr	H1H[c]	902	500	180%	0.11	
$PM_{2.5}$	24-hr	H1H[d]	15.6	1.2	1303%	1.3	
	Annual	H1H[i]	2.8	0.2	1390%	1.0	
PM_{10}	24-hr	H1H[e]	18.3	5	366%	0.18	

Notes:

H1H[a] = Highest 3-Hour modeled concentration
H1H[b] = Highest 1-Hour modeled concentration
H1H[c] = Highest 8-Hour modeled concentration
H1H[d] = Maximum 1st - highest 24-Hour modeled concentration, averaged over 5 years
H1H[e] = Highest 24-Hour modeled concentration
H1H[f] = Maximum 1st-highest max daily 1- Hour averaged over 5 years
H1H[g] = Maximum 1st-highest max daily 1- Hour averaged over 5 years
H1H[h] = Maximum annual averaged over 5 years
H1H[i] = Maximum annual averaged over 5 years

Note: The current federal SILs are shown in the table above. Maine DEP also lists PSD Class II SILs[23] which are not shown since they are equal to or greater than the federal SILs for the listed pollutants, therefore not affecting the modeling result.

SIL modeling showed that some air pollutants exceeded the SIL, but only SO_2 was associated with a large significant impact area. Based on the submitted protocol, MEDEP determined that no additional sources needed to be included in the air modeling analysis.

5.2 Criteria and State Pollutant Modeling

Maximum modeled criteria air pollutant concentrations were added to background and compared against the NAAQS and the maximum State-listed chemical concentrations were compared against the MEDEP AAGs[24] and MAAQS to show compliance.

Table 5-2 Criteria Pollutants Modeling Results

Pollutant	Averaging Time	Form	Maximum Modeled Concentration (µg/m^3)	Background Concentration (µg/m^3)	Total Concentration (µg/m^3)	NAAQS (µg/m^3)	% of NAAQS
SO_2	1-hr	H4H	24	5	29	196	15%
	3-hr	H2H	11	4	15	1300	1%
NO_2	1-hr	H8H	25	40	65	188	35%
	Annual	H1H	0.5	4	4.5	100	4%
CO	1-hr	H2H	1078	1102	2180	40000	5%
	8-hr	H2H	806	789	1595	10000	16%
$PM_{2.5}$	24-hr	H8H	12	12	24	35	68%
	Annual	H1H	2.8	4	6.8	9	75%
PM_{10}	24-hr	H6H	15	37	52	150	34%

A unit emissions rate was used to calculate the maximum modeled annual air toxics concentration for several air toxics that were emitted solely from the main stack, including HCL, HF, Ammonia, and Dioxin/Furan (as 2,3,7,8-TCDD). The maximum annual concentration based on the unit emission rate was 0.241 (µg/m^3) per (g/s). The remaining air toxics were modeled separately to account for all the different emission sources. The results are shown in *Table 5-3*.

[23] https://www.maine.gov/dep/air/meteorology/protocol.html

[24] https://www.maine.gov/dep/air/monitoring/docs/ME_DEP_AAG_LIST_2025_FINAL_with%20notes.pdf

Table 5-3 Air Toxics Modeling Results

Air Toxics	Emission rate	Annual Concentration (µg/m³)	NAAQS/MAAQS (µg/m³)	MEDEP 2025 AAG (µg/m³)
HCl	Table 3-3	1.26E-02		2.00E+01
HF	Table 3-3	8.42E-04		1.30E+01
Ammonia	Table 3-3	3.43E-02		5.00E+02
Dioxin/Furan (as 2,3,7,8-TCDD)	Table 3-3	5.73E-11		2.63E-07
Arsenic	Table 3-3 and Table 3-4	2.13E-07		2.33E-03
Beryllium	Table 3-3 and Table 3-4	1.17E-08		4.17E-03
Cadmium	Table 3-3 and Table 3-4	4.14E-07		5.56E-03
Chromium	Table 3-3 and Table 3-4	1.82E-06	0.05	8.84E-04
Lead	Table 3-3 and Table 3-4	2.80E-04	0.15	
Mercury	Table 3-3 and Table 3-4	7.04E-05		3.00E-01
Nickel	Table 3-3 and Table 3-4	1.10E-06		1.00E-02
Antimony	Table 3-3 and Table 3-4	6.73E-08		2.00E-01
Selenium	Table 3-3 and Table 3-4	2.14E-07		2.00E+01
Hydrogen Sulfide	Table 3-3 and Table 3-4	1.47E+00		2.00E+00

The air toxics results show that the maximum modeled concentrations were all well below the respective NAAQS/MAAQS or MEDEP 2025 AAGs.

5.3 PFAS Results

As described in *Section 2.4*: air quality (inhalation) impacts associated with potential PFAS emission from Aries Pine Tree LLC were compared with the most stringent air standards for PFAS (State of Michigan). The modeled air deposition results as compared to these standards are summarized in *Table 5-4* below.

Table 5-4 PFAS Air Modeling Results

PFAS	Actual Emission Rate (lb/hr) from stack test	Actual Emission Rate (g/s) from stack test	H1H 24-hr Max Concentration (µg/m3) per g/s	Actual Concentration (µg/m3)	Michigan 24-hr Limits in Air (µg/m3)
PFOA	4.10E-06	5.17E-07	2.72	1.41E-06	1.0E-04
PFOS	6.00E-08	7.56E-09	2.72	2.06E-08	4.0E-04

The air modeling results show that estimated maximum PFAS concentrations are several orders of magnitude lower than the stringent Michigan air limits. Therefore, PFAS emission will not adversely impact air quality.

Also as described in *Section 2.4*: water deposition impacts associated with potential emissions of 8 PFAS species (PFOA, PFOS, PFHxS, PFNA, HFPO-DA, PFBS, PFHpA, and PFDA) from Aries Pine Tree LLC were compared with Maine and EPA drinking water standards, consistent with the procedures established by the New Hampshire Department of Environmental Services. The modeled water deposition results as compared to these standards are summarized in *Table 5-5* below. The results show that even assuming that all PFAS infiltrates to the groundwater, the concentrations are well below Maine and EPA health-protective drinking water standards.

Table 5-5 PFAS Deposition Results

Aries Pine Tree LLC Deposition Modeling Results for PFAS Compared to Maine and EPA Drinking Water Standards

Air Modeling Result 0.014 g/m2/yr per g/s Based on Method 1

PFC	Lowest Concentration Minimum Reporting Limits (LCMRL)for Lab Analysis (ng/L) or (ppt) or (µg/m3) [1]	Maximum Concentration of PFC (MC_{PFC}) infiltrating to groundwater (ng/L) or (ppt) or (µg/m3) [2]	Maximum Deposition Rate (MDR_{PFC}) (µg/m2/yr) [3]	Maximum Annualized Emission Rate (g/s) [4]	Maximum Allowed Annualized Emission Rate (lb/hr) [5]	Maximum Allowed Annualized Emission Rate (lb/yr) [6]	Annual Emssion Rate Based on Stack Tests	Annual Emission Rate Below Maximum Annualized Emission Rate?	Maine Drinking Water Standard (ppt)**	EPA Drinking Water Standard (ppt)*	Aries Sanford Max impact (ppt)
PFOA	0.82	0.82	0.4	3.10E-05	2.46E-04	2.16	0.036	Yes	20	4	0.014
PFOS	2.7	2.7	1.4	1.02E-04	8.11E-04	7.11	0.00053	Yes	20	4	0.0002
PFHxS	2.4	2.4	1.3	9.09E-05	7.21E-04	6.32	0.00020	Yes	20	10 and H1=1	0.00008
PFNA	0.83	0.83	0.4	3.14E-05	2.49E-04	2.18	0.010	Yes	20	10 and HI=1	0.004
HFPO-DA (	4.3	4.3	2.3	1.63E-04	1.29E-03	11.32	0.004	Yes	20	10	0.001
PFBS	6.3	6.3	3.3	2.39E-04	1.89E-03	16.58	0.00074	Yes	20	HI = 1	0.0003
PFHpA	0.63	0.63	0.3	2.39E-05	1.89E-04	1.66	0.019	Yes	20	None	0.007
PFDA	3.3	3.3	1.7	1.25E-04	9.91E-04	8.69	0.011	Yes	20	HI=1	0.004
										HI	0.001

[1] LCMRLs used from Table 5 from the March 2020 EPA document Method 537.1: Determination of Per- and Polyfluoroalkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry ."

[2] The maximum concentration of PFC (MCPFC) infiltrating to groundwater needs to be less than the LCMRL to demonstrate no impact to groundwater.

[3] MDRPFC ((µg/m2)/yr) = MCPFC (µg/m3 or ppt) * IR (m/yr) Precipitation Infiltration Rate (IR) (m/yr) 0.53

[4] Maximum Annualized Emission Rate (g/s) = MDRPFC ((µg/m2)/yr) / (UIR (g/m2/yr per g/s) * 1,000,000 (µg/g))

Unit Impact Rate (UIR) (g/m2/yr per g/s) at maximum impact receptor 1.1E-06

[5] Maximum Annualized Emission Rate (lb/hr) = Maximum Annualized Emission Rate (g/s) * 3600 s/hr * 1 lb/453.6 g/lb

[6] Maximum Annualized Emission Rate (lb/yr) = Maximum Annualized Emission Rate (lb/hr) * 8760 hr/yr

* The Hazard Index [HI] is used to assess the risks from mixtures of PFAS, the concentration is the sum of the PFAS concentrations in water divided by the drinking standard for each PFAS. See https://www.epa.gov/system/files/documents/2024-04/pfas-npdwr_fact-sheet_hazard-index_4.8.24.pdf and https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas#Summary

** https://www.mainelegislature.org/legis/bills/getPDF.asp?paper=SP0064&item=3&snum=130 (individually or in combination)

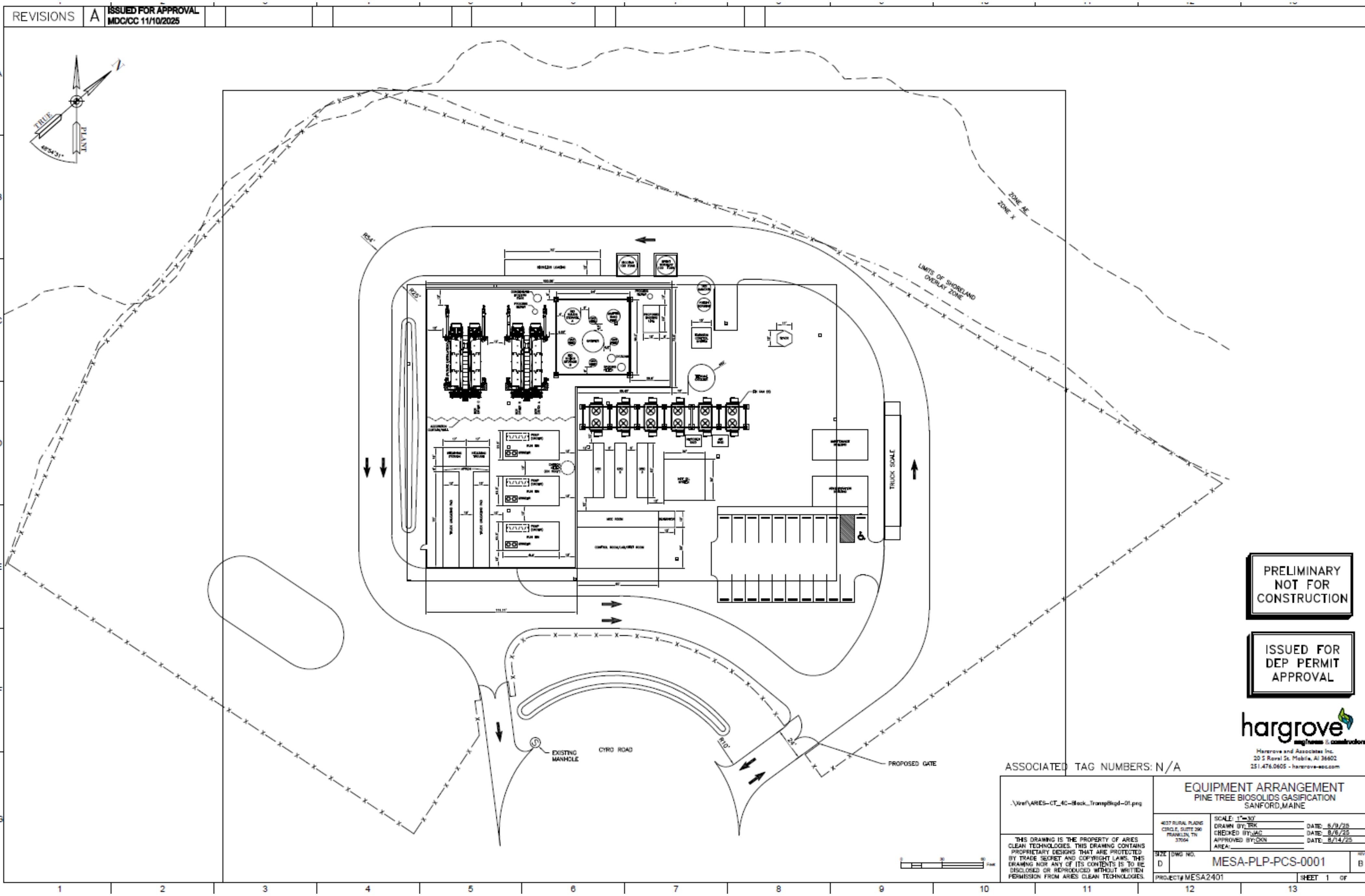
Figures

Aries Pine Tree LLC Sanford, Maine

Epsilon ASSOCIATES INC.

Figure 1

Project Location

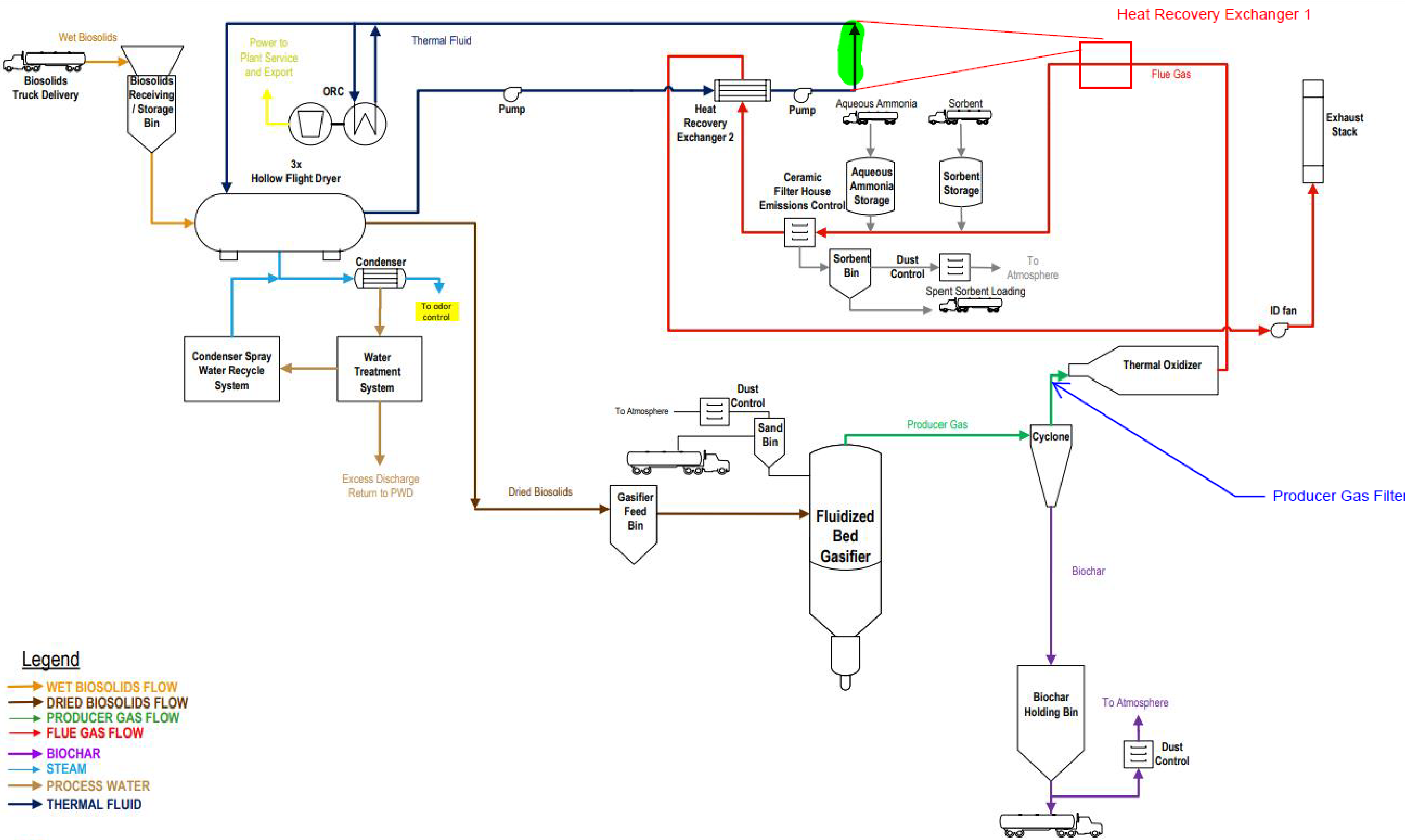


Aries Pine Tree LLC Sanford, Maine

Epsilon ASSOCIATES INC.

Figure 2

Site Plan

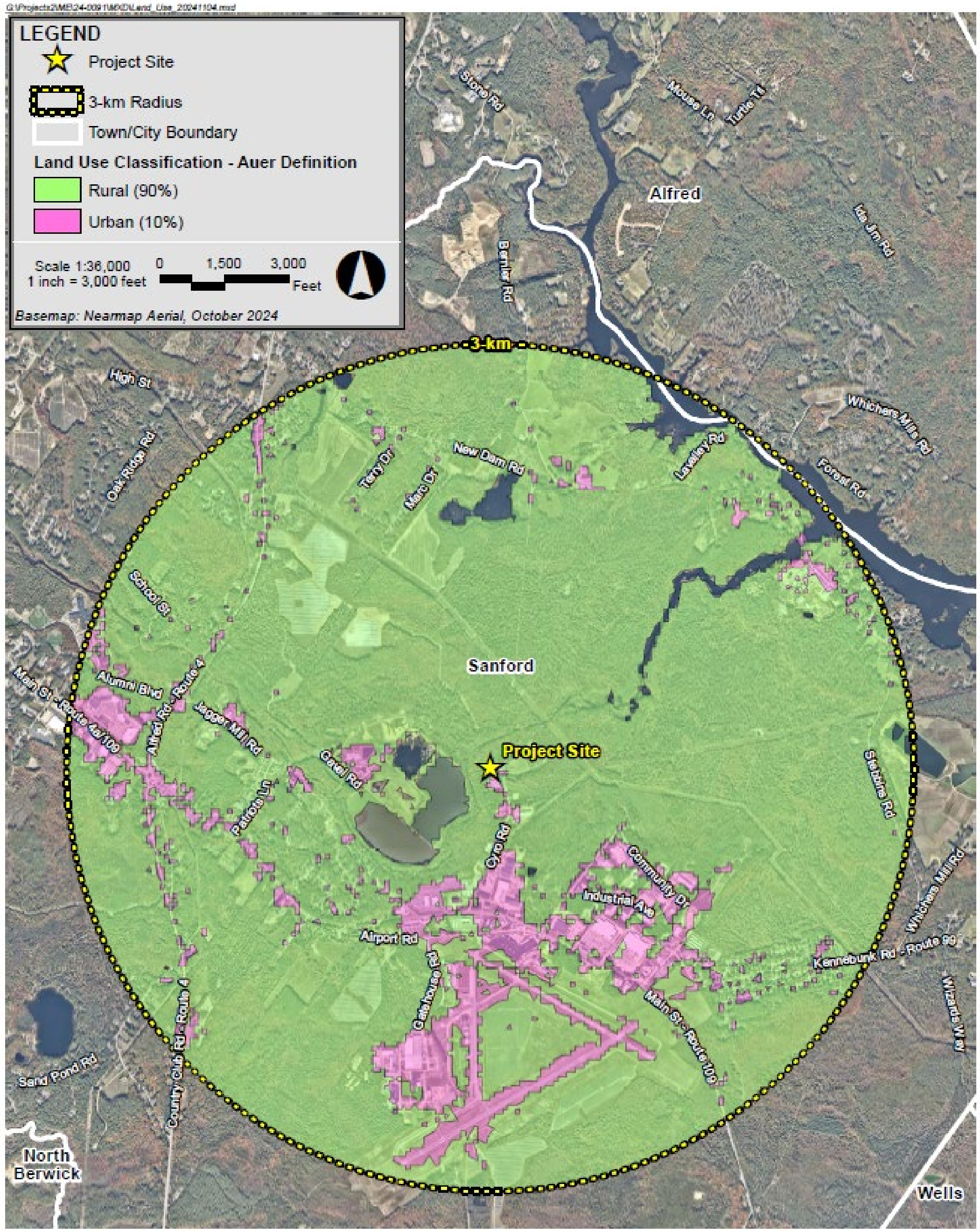


Aries Pine Tree LLC Sanford, Maine

Epsilon ASSOCIATES INC.

Figure 3

Process Flow Diagram of the Proposed System



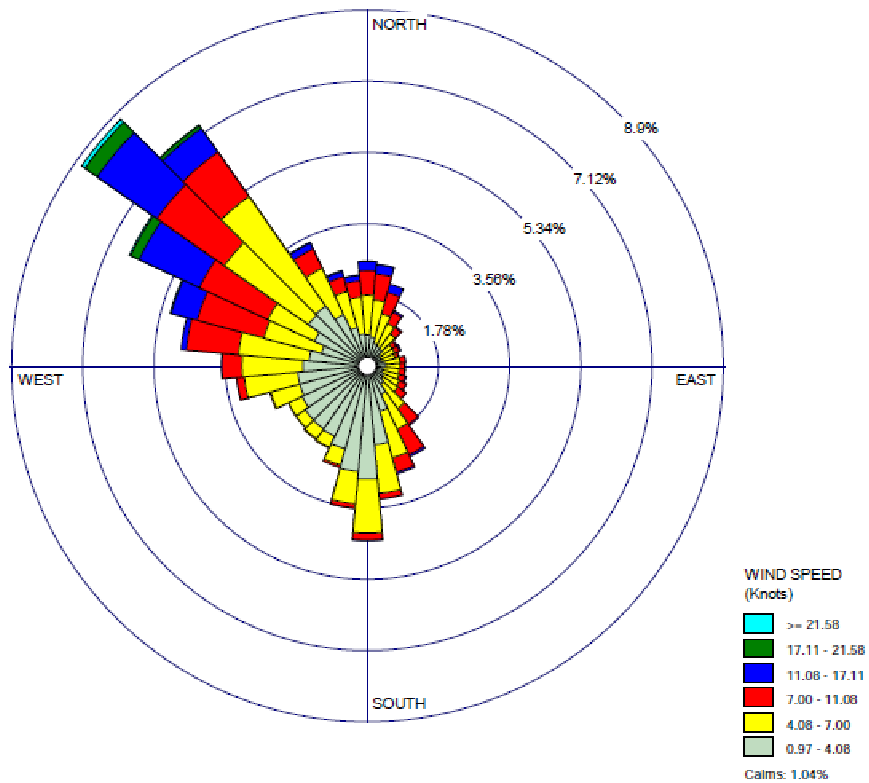
Aries Pine Tree LLC **Sanford, Maine**

Epsilon ASSOCIATES INC.

Figure 4
Auer Land Use

WIND ROSE PLOT:
Station #54791

DISPLAY:
Wind Speed
Direction (blowing from)



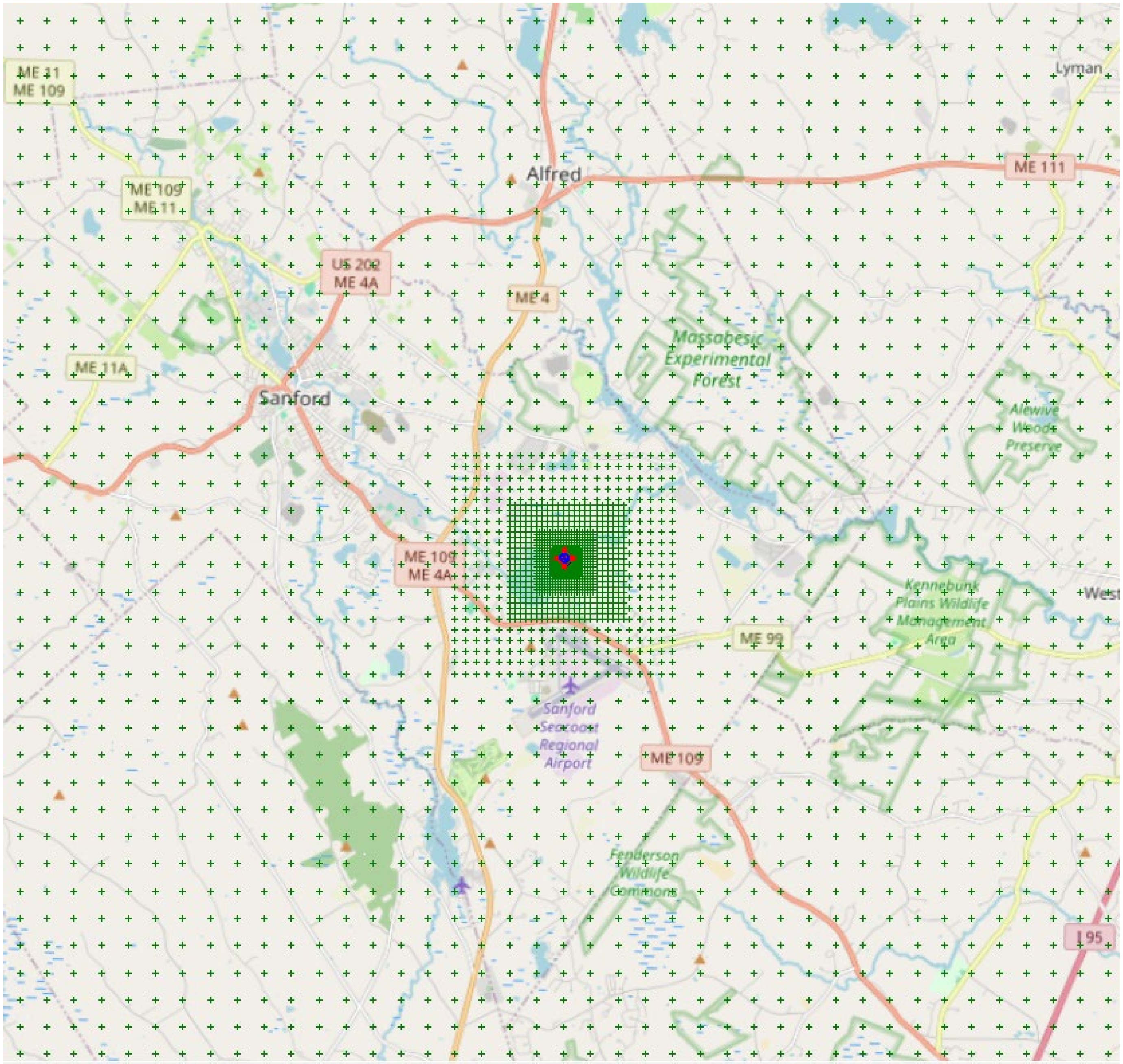
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2012 - 00:00 **End Date: 12/31/2016 - 23:59**	MODELER:	
	CALM WINDS: **1.04%**	TOTAL COUNT: **43700 hrs.**	
	AVG. WIND SPEED: **5.37 Knots**	DATE: **11/5/2024**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Aries Pine Tree LLC   Sanford, Maine

Epsilon ASSOCIATES INC.

Figure 5
2012-2016 Skyhaven Airport Wind Rose



Aries Pine Tree LLC Sanford, Maine

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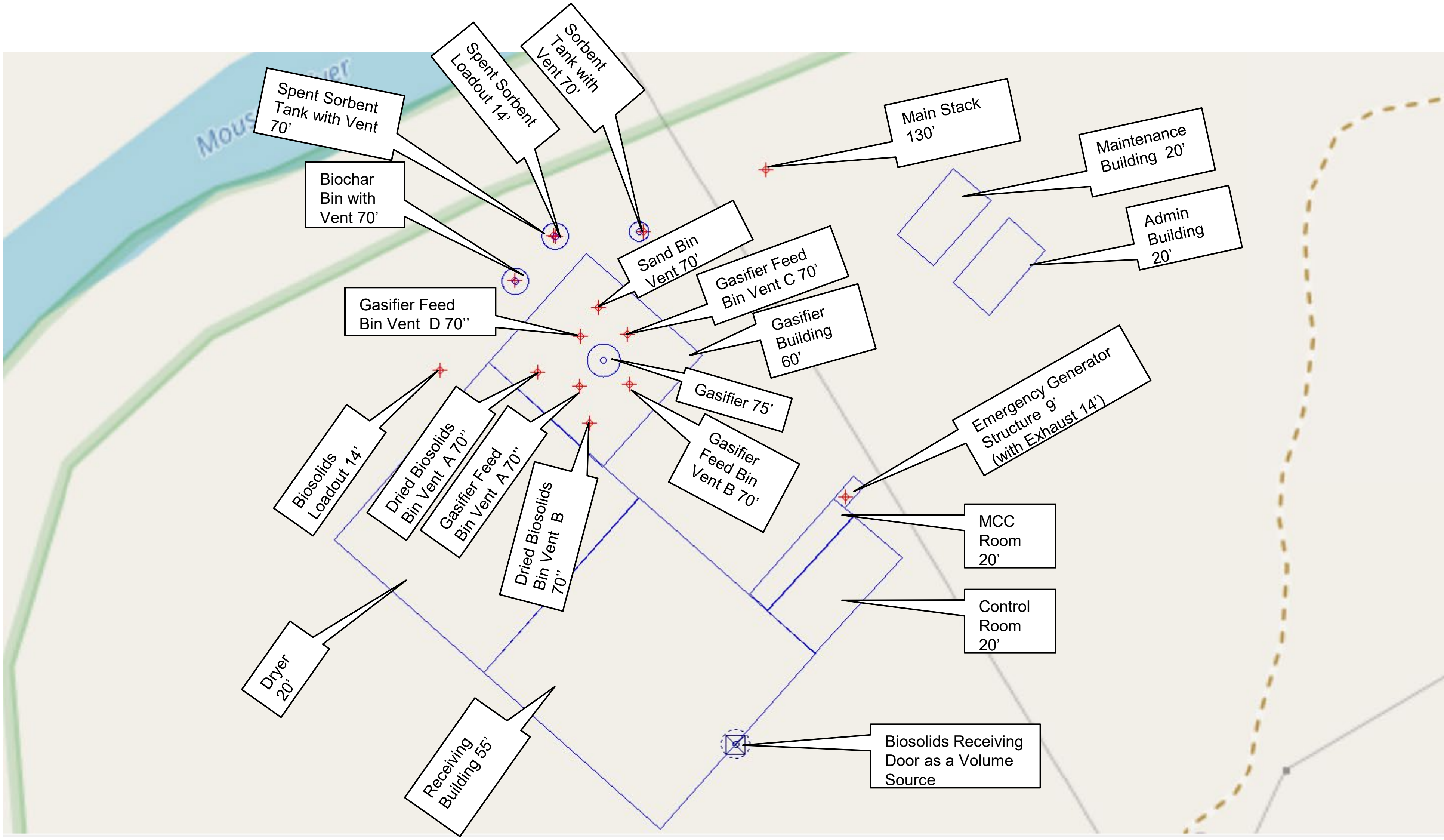
Figure 6
Receptor Grids



Aries Pine Tree LLC Sanford, Maine

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Figure 7

AERMOD Sources, Buildings, and Heights (feet)