STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
17 STATE HOUSE STATION | AUGUSTA, MAINE 04333-0017
DEPARTMENT ORDER

ecomaine **Cumberland County** **Portland, Maine** **A-283-77-4-A**	**Departmental** **Findings of Fact and Order** **NO_x RACT**

`Findings of Fact

After review of the air emission license application, staff investigation reports, and other documents in the applicant's file in the Bureau of Air Quality, pursuant to 38 Maine Revised Statutes (M.R.S.) § 344 and § 590, the Maine Department of Environmental Protection (the Department) finds the following facts:

I. Registration

A. Introduction

Facility	ecomaine
License Type	06-096 C.M.R. ch. 138, NO_x RACT
NAICS Codes	562213 Solid Waste Combustors and Incinerators
Nature of Business	Municipal Waste Combustion
Facility Location	64 Blueberry Road, Portland, Maine

B. NSR License Description

ecomaine has requested an amendment to its air emission license to address new requirements contained in *Reasonably Available Control Technology for Facilities that Emit Nitrogen Oxides (NO_x RACT),* 06-096 Code of Maine Rules (C.M.R.) ch. 138.

C. Emission Equipment

The following equipment is addressed in this NSR license:

NO_x Emitting Equipment

Equipment	Max. Heat Input Capacity (MMBtu/hr)	Fuel Type	Manufacture Date	Install Date
A-Boiler (Unit #1)	46.75 firing natural gas; 122 firing waste	Natural gas and municipal solid waste	1987	1988

Equipment	Max. Heat Input Capacity (MMBtu/hr)	Fuel Type	Manufacture Date	Install Date
B-Boiler (Unit #2)	46.75 firing natural gas; 122 firing waste	Natural gas and municipal solid waste	1987	1988
Emergency Generator	5.25	Distillate fuel	1988	1988
Diesel Fire Pump	1.43	Distillate fuel	1987	1988

D. Definitions

Distillate Fuel means the following:

- Fuel oil that complies with the specifications for fuel oil numbers 1 or 2, as defined by the American Society for Testing and Materials (ASTM) in ASTM D396;
- Diesel fuel oil numbers 1 or 2, as defined in ASTM D975;
- Kerosene, as defined in ASTM D3699;
- Biodiesel, as defined in ASTM D6751; or
- Biodiesel blends, as defined in ASTM D7467.

Mid-sized boiler means a steam generation unit that has a heat input equal to or greater than 50 MMBtu/hr and less than 1,500 MMBtu/hr.

Records or *Logs* mean either hardcopy or electronic records.

E. Application Classification

All rules, regulations, or statutes referenced in this air emission license refer to the amended version in effect as of the issued date of this license.

The application was submitted to comply with the requirements of 06-096 C.M.R. ch. 138, § 5(A) and has been processed pursuant to the requirements for minor modifications under *Minor and Major Source Air Emission License Regulations*, 06-096 C.M.R. ch. 115.

II. NO_x RACT Requirements

A. Introduction

Revisions to 06-096 C.M.R. ch. 138 went into effect May 7, 2025. These changes included the establishment of new standards for emission units located within the 2022 Ozone Transport Region, as defined in that chapter. ecomaine's facility is located within the 2022 Ozone Transport Region.

ecomaine must either comply with the new applicable standards in 06-096 C.M.R. ch. 138, § 4 by May 1, 2026, or apply for and receive approval for an alternative RACT determination pursuant to 06-096 C.M.R. ch. 138, § 4(H).

B. Exempt Equipment

The Emergency Generator and Diesel Fire Pump are emergency stationary internal combustion engines, which are exempt from the requirements of 06-096 C.M.R. ch. 138, pursuant to § 1(B)(2).

C. A-Boiler (Unit #1) and B-Boiler (Unit #2)

A-Boiler (Unit #1) and B-Boiler (Unit #2) are municipal waste combustors (MWC). They are mid-sized boilers with a heat input greater than 100 MMBtu/hr. Emissions from the MWCs exhaust through separate control equipment to a common stack with two flues. The boilers are licensed to combust natural gas and municipal solid waste.

A-Boiler and B-Boiler are subject to a NO_x emission limit of 180 ppmdv corrected to 7% O_2 on a 24 hour daily arithmetic average based on a previous NO_x RACT established in 1995. This standard applies to A-Boiler and B-Boiler until a different emission limit becomes effective in accordance with this NO_x RACT license.

Beginning on May 1, 2026, A-Boiler and B-Boiler become subject to NO_x RACT standards for emission units located within the 2022 Ozone Transport Region. Pursuant to 06-096 C.M.R. ch. 138 § 4, ecomaine must comply with one of the following for A-Boiler and B-Boiler.

- A NO_x emission limit of 110 ppmvd, corrected to 7% O_2, on a 24-hour block average basis. Compliance shall be demonstrated through the use of a CEMS operated pursuant to the requirements of 06-096 C.M.R. ch. 117. [06-096 C.M.R. ch. 138 § 4(D)]

- ecomaine may request an alternative RACT determination in lieu of the applicable requirements of the rule, as provided by 06-096 C.M.R. ch. 138, § 4(H).

ecomaine has requested an alternative RACT determination and has submitted a RACT analysis for control of NO_x emissions from A-Boiler and B-Boiler. Following is a summary of that analysis.

1. Identify Potential Control Options

   ecomaine identified the use of low NO_x burners, overfire air, flue gas recirculation, alternative fuels, selective non-catalytic reduction (SNCR), advanced SNCR, and selective catalytic reduction (SCR) as potential control options.

   a. Low NO_x Burners

      Low NO_x burners (LNB) are designed to reduce the peak flame temperature in the burner, minimizing the formation of thermal NO_x. The center of the flame is fed by a rich fuel/air mixture that contains insufficient oxygen for complete combustion, thereby limiting the combustion temperature. Additional combustion air is then added to the flame in stages in order to complete the combustion process.

   b. Overfire Air

      Overfire air introduces a second stream of combustion air above the MSW bed, with the primary air being fed below the MSW bed. Limiting the flow rate of the primary combustion air serves to reduce the combustion temperature, which reduces thermal NO_x formation. The overfire air provides additional oxygen and creates turbulence within the combustion gas to allow for more complete combustion.

   c. Flue Gas Recirculation

      Flue gas recirculation (FGR) is a technique that involves routing a portion of the exhaust gas stream back into the combustion air intake. Similar to LNB and overfire air, FGR reduces the formation of thermal NO_x by reducing the oxygen concentration in the combustion chamber and thereby reducing the peak flame temperature.

   d. Selective Non-Catalytic Reduction

      Selective non-catalytic reduction (SNCR) is a post-combustion control technology that reduces NO_x in the exhaust gas by injecting ammonia (NH_3) or urea into a high temperature zone of the boiler. NH3 or urea reacts with the primary constituents of NO_x (NO and NO_2) to produce elemental nitrogen and water in a reducing reaction. The reaction takes place within a specific temperature window, and the availability of this window and the residence time of the exhaust gas impacts the achievable NO_x reduction. SNCR has the benefit of not requiring a catalyst bed, which simplifies operation and reduces maintenance costs. However, the reduction reaction

is generally limited to 50% in MWCs, and a portion of the injected NH_3 remains unreacted in the exhaust gas and is released to the atmosphere, which is known as “ammonia slip.”

e. Advanced SNCR

Advanced SNCR is a modified version of the SNCR technology that can achieve greater control efficiencies than standard SNCR systems, potentially achieving a NO_x control effectiveness of up to 60 percent or greater. This increased control effectiveness is achieved by adding one or more additional rows of injection lances to create multiple injection zones. Each injection zone is monitored with multiple temperature sensors to create a two-dimensional “map” of the temperature profile within the boiler chamber, which is used to adjust the ammonia or urea flow rate to individual injection lances in real time, thereby improving the efficiency of the reducing reaction.

f. Selective Catalytic Reduction

Selective Catalytic Reduction (SCR) is a post-combustion technology that removes NO_x from a hot exhaust gas by reacting it with NH_3 in the presence of a catalyst to produce elemental nitrogen and water.

2. Eliminate Infeasible Control Options

a. Low NO_x Burners

Because the ecomaine units are mass burn units that burn MSW on an open combustion bed, the potential use of LNB would be limited to the auxiliary natural gas burners that operate during startup events and at other times as required to stabilize the combustion process. The auxiliary burners are limited to a maximum annual capacity factor of 10 percent of the total potential heat input for each MWC, but in practice the rolling average annual capacity factor for the auxiliary burners has been approximately 1.0 percent over the five-year period from 2020-2025, which is approximately 1.1 percent of the actual annual heat input for each unit. Retrofitting the existing auxiliary burners with LNBs could provide a small potential reduction in exhaust NO_x concentrations during startup events and periods of boiler stabilization. However, because the auxiliary burners are limited to very brief periods of operation, replacing the existing burners with LNBs would not provide any NO_x reduction benefit during the majority of each unit’s operating hours. Therefore, LNBs are not considered to be economically feasible as a means of achieving compliance with the 2022 NO_x RACT standard.

b. Flue Gas Recirculation

ecomaine commissioned a study in 2011 that investigated the feasibility of adding FGR to A-Boiler and B-Boiler. The study concluded that the only feasible location for a flue gas off-take would be at the discharge of the ESP upstream of the induced draft fan, which would require a very long process train to convey flue gas back to a suitable injection point. The size of the ESP duct would make it difficult to draw a uniform flue gas stream, and the increased gas flow at the injection point would cause changes to the temperatures, pressures, and flow rates through the entire exhaust train, potentially requiring multiple portions of the combustion and control systems to be redesigned. Due to the complexity of reconfiguring the existing units for FGR, the study recommended that an FGR retrofit should not be pursued. FGR is therefore not considered to be technically feasible.

c. Use of Alternative Fuels

The use of alternative fuels is not technically feasible as a replacement for the MSW currently burned on the open combustion beds in each MWC unit, because the combustion of MSW is inherent to the purpose of the MWC units. There is no alternative fuel that would allow the MWC units to perform their intended function, which is to dispose of MSW through the process of combustion.

Consideration of alternative fuels would therefore be limited to the auxiliary burners that currently burn natural gas during startup events and at other times as required to stabilize the combustion process. However, as explained in the discussion of LNBs, the auxiliary burners are limited to very brief periods of operation, and selecting an alternative fuel in place of natural gas would not provide any NO_x reduction benefit during the majority of the operating hours for each MSW unit at ecomaine. Therefore, the use of alternative fuels is not considered to be either technically or economically feasible.

d. Advanced SNCR

ecomaine performed a feasibility assessment for installation of a retrofitted Advanced SNCR system on the ecomaine MWC units, based on cost factors and formulas provided in USEPA's Air Pollution Control Cost Manual, 7th edition. The total annual cost for installing and operating a retrofitted Advanced SNCR system was applied to the additional NO_x emission reduction from the current controlled rate, which would reduce actual emissions from approximately 155 ppmdv at 7% O_2 on a 12-month rolling average basis, to 120 ppmdv at 7% O_2 based on 60% reduction from

the uncontrolled rate of 300 ppmdv. The potential tons of NO_x reduced were based on both MWCs operating at full load combusting MSW only for 8,760 hours per year, with the calculated potential emissions reduced from the current maximum license allowed emissions of 317.6 tpy (assumes emissions of 180 ppmdv, 24 hours per day, 365 days per year) to 211.7 tpy (assumes emissions of 120 ppmdv, 24 hours per day, 365 days per year), for a total potential emissions reduction of 105.9 tpy. The resulting incremental control cost was estimated to be approximately $16,633 per ton, which is not considered to be economically feasible.

e. SCR

Compared to SNCR, SCR allows the reducing reaction to occur at a lower exhaust temperature than SNCR, but the catalyst bed introduces increased backpressure, which results in slightly lower boiler efficiency. The SCR catalyst also requires periodic maintenance and replacement, which results in higher operating costs. The catalyst material is also vulnerable to fouling by particulate matter, poisoning by trace heavy metals present in the exhaust stream, sulfur compounds such as SO_2 that can react with NH_3 to form crystallized deposits of ammonium sulfate on the catalyst surface, and acid gases such as HCl, which can deactivate the catalyst. These contaminants can all reduce the performance of the catalyst, resulting in increased NH_3 consumption to achieve the target NO_x emission rate and increased NH_3 slip. Due to these concerns, SCR would need to be installed downstream from the other emissions controls, which would require supplemental fuel firing to heat the exhaust gas to the operating temperature window of the SCR catalyst. This supplemental fuel firing would increase emissions of other criteria pollutants and greenhouse gases. In addition, the existing ESPs at ecomaine would need to be replaced with fabric filters to reduce the potential for catalyst fouling.

A third-party assessment of ecomaine's current and future operations was performed in 2022 and included a review of potential pollution control technologies. The study identified only one MWC combustion facility in the U.S. that was equipped with SCR, which is currently used to control emissions on three MWC units at the Palm Beach Renewable Energy Park in Palm Beach County, Florida. It was concluded that due to the very limited performance history of SCR for control of MWC NO_x emissions, the significant additional costs related to catalyst operation and maintenance, and the physical space constraints for installation of SCR at the ecomaine facility, the use of SCR is not technically feasible.

Additionally, ecomaine performed a cost analysis of the installation of a retrofit SCR and associated retrofitted baghouse, based on cost factors and

formulas of USEPA's Air Pollution Control Cost Manual, 7th edition. The total annual cost for installing and operating the SCR and baghouse were summed together and applied to the NO_x emission reduction from the current controlled (actual baseline) rate, which is equivalent to approximately 155 ppmdv at 7% O_2 on a 12-month rolling average basis, to the numeric value of the 2022 NO_x RACT standard of 110 ppmdv at 7% O_2, but on a 12-month rolling average basis. The potential tons of NO_x reduced were based on both MWCs operating at full load combusting only MSW for 8,760 hours per year, for a total potential emissions reduction of 123.6 tpy. The resulting incremental control cost was estimated to be approximately $43,860 per ton, which is not considered to be economically feasible.

3. Ranking of Control Options

   ecomaine identified overfire air and SNCR as both technically and economically feasible options for the control of NO_x. Both techniques are already in use on A-Boiler and B-Boiler.

4. Proposed Emission Limits

   A review of historical ecomaine CEMS data from the five most recent calendar years (2020-2025) indicates that the MWC units are capable of achieving compliance with the following NO_x emission limits:

   - 180 ppmdv corrected to 7% O_2, on a 24-hour daily block average basis;
   - 160 ppmdv corrected to 7% O_2, on a 30-day rolling average basis; and
   - 155 ppmdv corrected to 7% O_2, on a 12-month rolling average basis.

   ecomaine has proposed the inclusion of these limits in its air emission license as NO_x RACT.

5. Determination

   The Department finds RACT for NO_x from A-Boiler and B-Boiler to the continued use of overfire air and SNCR and the emission limits in the below table.

NO_x Emission Limits for A-Boiler and B-Boiler

NO_x Limit	Averaging Time
180 ppmdv @ 7% O_2	24-hour daily block average
160 ppmdv @ 7% O_2	30-day rolling average
155 ppmdv @ 7% O_2	12-month rolling average

Ecomaine shall demonstrate compliance with the NO_x emission limits above through use of a CEMS operated pursuant to the requirements of 06-096 C.M.R. ch. 117.

ecomaine has also proposed to conduct SNCR performance trials to determine whether additional NO_x reductions can be achieved with its existing SNCR system through adjustments to SNCR operation. Adjustments to SNCR operation may include, but are not limited to, increasing the urea injection rate by up to 10 percent (on a gallons of urea per pound of steam basis) based on baseload operating conditions. ecomaine proposes to conduct the performance trials over a 12-month study period, in order to capture the considerable variability of the MSW fuel composition over time. The existing NO_x CEMS would be used to measure and record NO_x stack outlet concentrations during the performance trials. ecomaine would also ensure that the urea injection rate would be increased by an amount representative of the trial, not to exceed 10 percent, during the routinely scheduled annual NH_3 performance test, in order to identify any possible effects on ammonia slip. ecomaine shall submit a report indicating the results of the NO_x RACT study within 90 days of the completion of the performance trials. The NO_x RACT study shall assess the feasibility of modified SNCR operation and propose revised NO_x and ammonia emission limits as appropriate.

D. Incorporation Into the Part 70 Air Emission License

Pursuant to *Part 70 Air Emission License Regulations*, 06-096 C.M.R. ch. 140 § 1(C)(8), for a modification at the facility that has been processed through 06-096 C.M.R. ch. 115, the source must apply for an amendment to their Part 70 license within one year of commencing the proposed operations, as provided in 40 C.F.R. Part 70.5. An application to incorporate the requirements of this NSR license into the Part 70 air emission license has been submitted to the Department.

E. Annual Emissions

The table below provides an estimate of facility-wide annual emissions for the purposes of calculating the facility's annual air license fee and establishing the facility's potential to emit (PTE). Only licensed equipment is included, i.e., emissions from insignificant activities are excluded. Similarly, unquantifiable fugitive particulate matter emissions are not included except when required by state or federal regulations. Maximum potential emissions were calculated based on the following assumptions:

- Operation of each of the MWC units at rated capacity for 8,760 hours/year; and
- Operating the Emergency Generator and Fire Pump each for 100 hrs/yr of non-emergency operation;

This information does not represent a comprehensive list of license restrictions or permissions. That information is provided in the Order section of this license, previously issued NSR licenses, and the facility's Part 70 license and amendments to that license.

Total Licensed Annual Emissions for the Facility
Tons/year
(used to calculate the annual license fee)

	PM	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC
A-Boiler and B-Boiler, combined total	30.04	30.04	30.04	96.8	371.3	145.8	13.14
Emergency Generator	0.03	0.03	0.03	--	0.8	0.2	0.02
Fire Pump	0.01	0.01	0.01	--	0.3	0.1	0.03
Total TPY	**30.08**	**30.08**	**30.08**	**96.8**	**372.4**	**146.1**	**13.2**

Pollutant	Tons/year
Single HAP	9.9
Total HAP	24.9

Order

The Department hereby grants NO_x RACT amendment A-283-77-4-A pursuant to the licensing requirements of 06-096 C.M.R. ch. 115 and subject to the specific conditions below.

Severability. The invalidity or unenforceability of any provision of this License Amendment or part thereof shall not affect the remainder of the provision or any other provisions. This

License Amendment shall be construed and enforced in all respects as if such invalid or unenforceable provision or part thereof had been omitted.

Specific Conditions

(1) **A-Boiler and B-Boiler**

A. Emissions from A-Boiler and B-Boiler shall each not exceed the following [06-096 C.M.R. ch. 138, § 4(H)]:

NO_x Emission Limits for A-Boiler and B-Boiler

NO_x Limit	Averaging Time
180 ppmdv @ 7% O_2	24-hour daily block average
160 ppmdv @ 7% O_2	30-day rolling average
155 ppmdv @ 7% O_2	12-month rolling average

B. ecomaine shall continue to utilize SNCR and overfire air at all times A-Boiler or B-Boiler are in operation. [06-096 C.M.R. ch. 138, § 4(H)]

C. Ecomaine shall demonstrate compliance with the NO_x emission limits above through use of a CEMS operated pursuant to the requirements of 06 096 C.M.R. ch. 117. [06-096 C.M.R. ch. 138, § 4(A)(2)]

D. ecomaine shall conduct SNCR performance trials to determine if additional NO_x reductions can be achieved with the existing SNCR system by adjusting SNCR operation. The trial shall be authorized for a 12-month period and shall begin no more than 90 days after issuance of this license.

ecomaine shall ensure that the urea injection rate is increased by an amount representative of the SNCR performance trials, up to a 10 percent increase, on a gallons of urea per pound of steam basis, during the routinely scheduled annual NH_3 performance test in order to identify any possible effects on ammonia slip.

ecomaine shall submit a report of the results of the SNCR performance trials within 90 days of completion of the performance trials. The NO_x RACT study and report shall assess the feasibility of modified SNCR operation attaining additional, meaningful NO_x reductions and propose revised NO_x and/or ammonia emission limits, as appropriate.

Done and Dated in Augusta, Maine this 11th day of AUGUST, 2026.

Department of Environmental Protection

BY: _____
for Melanie Loyzim, Commissioner

Please note attached sheet for guidance on appeal procedures.

Date of initial receipt of application: October 27, 2025
Date of application acceptance: October 28, 2025

This Order prepared by Benjamin Goundie, Bureau of Air Quality.