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

DEPARTMENT ORDER

City of Augusta – Hatch Hill Landfill **Kennebec County** **Augusta, Maine** **A-1060-71-F-A**	**Departmental** **Findings of Fact and Order** **Air Emission License** **Amendment #1**

FINDINGS OF FACT

After review of the air emission license amendment 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 (Department) finds the following facts:

I. REGISTRATION

A. Introduction

The City of Augusta – Hatch Hill Landfill (Hatch Hill) was issued Air Emission License A-1060-71-E-R on April 18, 2017, for the operation of emission sources associated with their landfill facility.

Hatch Hill has requested an amendment to their license in order to install a landfill gas-to-energy system consisting of a landfill gas treatment system, pipeline and a landfill gas-fueled generator.

The equipment addressed in this license amendment is located at 112 Hatch Hill Road, Augusta, Maine.

B. Emission Equipment

The following equipment is addressed in this air emission license amendment:

Stationary Engines

Equipment	Max. Input Capacity (MMBtu/hr)	Rated Output Capacity (kW or HP)	Fuel Type	Firing Rate (scf/hr)	Date of Manuf.	Date of Install.	Stack #
Generator #1	5.0	500	Landfill Gas	18,000 (estimated)	2018	2018	1

C. 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 modification of a minor source is considered a major or minor modification based on whether or not expected emission increases exceed the "Significant Emission" levels as defined in the Department's *Definitions Regulation*, 06-096 Code of Maine Rules (C.M.R.) ch. 100. The emission increases are determined by subtracting the current licensed annual emissions preceding the modification from the future licensed annual emissions, as follows:

Pollutant	Current License (TPY)	Future License (TPY)	Net Change (TPY)	Significant Emission Levels
PM	0.5	3.1	2.6	100
PM_{10}	0.5	3.1	2.6	100
SO_2	1.3	3.9	2.6	100
NO_x	1.1	14.1	13.0	100
CO	21.2	53.6	32.4	100
VOC	3.7	10.2	6.5	50
CO_2e	-	-	-	100,000

This modification is determined to be a minor modification and has been processed as such.

The Department has determined the facility is a minor source, and the application has been processed through *Major and Minor Source Air Emission License Regulations*, 06-096 C.M.R. ch. 115.

Hatch Hill is licensed below the major source thresholds for hazardous air pollutants (HAP) and is considered an area source of HAP.

II. BEST PRACTICAL TREATMENT (BPT)

A. Introduction

In order to receive a license, the applicant must control emissions from each unit to a level considered by the Department to represent Best Practical Treatment (BPT), as defined in *Definitions Regulation*, 06-096 C.M.R. ch. 100. Separate control requirement categories exist for new and existing equipment.

BPT for new sources and modifications requires a demonstration that emissions are receiving Best Available Control Technology (BACT), as defined in *Definitions Regulation*, 06-096 C.M.R. ch. 100. BACT is a top-down approach to selecting air emission controls considering economic, environmental and energy impacts.

B. Project Description

Since 2012, Hatch Hill has owned and operated a landfill gas (LFG) flare system to control the buildup of LFG beneath the landfill cover system. Hatch Hill is now proposing to install an energy system designed to better utilize LFG by combusting it in a reciprocating internal combustion engine (RICE) to drive a generator and produce power for consumption at Hatch Hill or by the City of Augusta. In addition to a new LFG-fired generator (Generator #1), Hatch Hill will install a LFG treatment unit to remove water and contaminants from the LFG prior to combustion, and a gas transmission pipeline from the existing landfill gas collection system and flare. At the completion of the project, Hatch Hill will have the flexibility to fire LFG in either the flare or in Generator #1, or in both units concurrently.

At the time that the application for this amendment was written, the final engine selection had not been made. Therefore, the conditions of this amendment are based on proposed engine design criteria provided by the facility. If the relevant design information for the actual engine, once selected, differs from the information that was provided in the application and used to develop this amendment, Hatch Hill shall submit a new application for amendment of their air emission license to include the actual engine specifications and relevant information.

C. Generator #1

1. BACT Analysis

a. Particulate matter emissions (PM) from the combustion of LFG are the result of incomplete combustion of the LFG, and trace noncombustible components in the gas stream. PM emissions are exacerbated by poor maintenance and rich burn combustion profiles. The proposed LFG-fired generator engine will be equipped with screens and a dehydration unit designed to remove large particles and water from the biogas prior to its combustion to maintain engine reliability and performance. Further PM reduction from the engine through the use of supplemental add-on pollution control equipment is not economically feasible, based on its size and projected emission levels. Therefore, the Department finds that the use of the proposed biogas screens, along with installing and operating an engine with a lean-burn combustion profile, and the use of good operating and maintenance practices represent BACT for control of PM emissions from the LFG-fired generator engine.

b. Sulfur Dioxide (SO_2)

Hydrogen sulfide (H_2S) gas and other sulfur compounds are formed during the bacterial decomposition of putrescible materials that are contained in the landfill. These gases and compounds are present in the LFG and become oxidized during the combustion process, resulting in the formation of SO_2. Sampling of the LFG over the past four years at Hatch Hill has demonstrated that the concentration of H_2S is variable, ranging anywhere from 30 ppmdv to 160 ppmdv. At these levels, the addition of external H_2S removal systems are not economically feasible. The Department finds that BACT for SO_2 at Hatch Hill shall be to continue the annual sampling of the LFG stream to monitor H_2S levels, and to comply with an SO_2 emission limit of 0.60 lb/hr based on a maximum concentration of 200 ppmdv H_2S.

c. Nitrogen Oxides (NO_X)

Emissions of nitrogen oxides from combustion are the result of three NO_X formation mechanisms: fuel NO_X, prompt NO_X and thermal NO_X. Fuel NO_X is generated when the elemental nitrogen bound in the fuel is released during combustion and is therefore directly related to the nitrogen (N_2) content of the fuel being fired. Prompt NO_X occurs when the N_2 present in the combustion air reacts with hydrocarbon radicals (C, CH and CH_2) found in the fuel being fired. NO_X emissions from these two mechanisms are usually negligible when compared to the thermal NO_X emissions.

Thermal NO_X is formed at temperatures above 2900 °F, from the disassociation of nitrogen (N_2) and oxygen (O_2) in the combustion air. The formation of thermal NO_X is a function of both high temperatures during combustion and residence time. NO_X generated from the thermal NO_X mechanism occurs in the high-temperature regions in the cylinder where there is a peak temperature fuel/air interface. NO_X emissions from reciprocating internal combustion engines can be controlled in two ways: add-on pollution control equipment or by optimizing combustion to limit NO_X formation.

Add-on pollution control options include Selective Catalytic Reduction (SCR) and Nonselective Catalytic Reduction (NSCR). NSCR uses a catalyst to oxidize excess hydrocarbons, carbon monoxide (CO) and NO_X into water (H_2O), carbon dioxide (CO_2) and N_2. However, the use of NSCR is limited to engines with high exhaust temperatures and tight air-to-fuel ratios to obtain control effectiveness while limiting hydrocarbon emissions, thus requiring a richer air-to-fuel ratio. The selected engine for this project is a lean-burn engine, eliminating NSCR from consideration as a viable option.

SCR is a NO_X add-on pollution control technology that is effective with lean-burn engines. Instead of using high temperatures across the catalyst to reduce NO_X to NO_2 like NSCR does, SCR uses urea or ammonia injection with a catalyst, thereby reducing the required exhaust gas temperature. However, the use of SCR comes with significant safety and environmental risks due to the potential for exposure or release of the urea or ammonia that is stored in bulk quantities at the facility, as well as emissions of any unreacted urea/ammonia slip. Additionally, catalysts are prone to contamination, plugging and fouling by a variety of contaminants including fine particulate, silicon compounds and salts. Since the LFG stream produced at the Hatch Hill landfill is inherently unpredictable and subject to change over time, the catalyst would likely require frequent replacement, rendering this option to be both economically and technically infeasible.

The Department finds that BACT for controlling NO_X emissions is the use of a lean-burn engine to drive the generator, ensuring that the engine is capable of minimally meeting the federal NO_X emission standard of 2.0 g/HP-hr from 40 C.F.R. Part 60, Subpart JJJJ, as well as the proper operation and maintenance of the engine and the utilization of good combustion practices.

d. Carbon Monoxide (CO) and Volatile Organic Compounds (VOC)

CO and VOC emissions result from incomplete fuel combustion, caused by conditions such as insufficient residence time or limited oxygen availability. CO and VOC emissions from engines are generally managed through good combustion practices and the proper operation and maintenance of the engine.

Add-on controls are also available for reducing CO and VOC emissions from lean-burn engines. One such option is catalytic oxidation which directs the exhaust gases through a precious metal catalyst and causes the hydrocarbons and CO contained in the exhaust gases to react with O_2 to form CO_2 and H_2O. However, as with SCR, the use of a catalyst on an inherently unpredictable biogas could result in significant fouling which would require frequent and costly catalyst replacement. As such, the use of a catalyst on a system of this size is neither economically nor technically feasible.

The Department finds that BACT for CO and VOC emissions from the generator engine shall be the proper operation and maintenance of the unit and the use of good combustion practices.

2. BACT Findings

The BACT emission limits for the engine for Generator #1 were based on the following:

Landfill Gas

PM/PM_{10}	-	0.12 lb/MMBtu, based on 06-096 C.M.R. ch. 115, BACT
SO_2	-	0.60 lb/hr, based on actual annual test data assuming 200 ppmdv H_2S content in LFG
NO_X	-	2.0 grams/HP-hr, based on 40 C.F.R. Part 60, Subpart JJJJ, Table 1 for LFG lean burn engine
CO	-	5.0 grams/HP-hr, based on 40 C.F.R. Part 60, Subpart JJJJ, Table 1 for LFG lean burn engine
VOC	-	1.0 grams/HP-hr, based on 40 C.F.R. Part 60, Subpart JJJJ, Table 1 for LFG lean burn engine
Visible Emissions	-	06-096 C.M.R. ch. 101

The BACT emission limits for the engine for Generator #1 were based on the following:

Unit	PM/PM_{10} (lb/hr)	SO2 (lb/hr)	NOC (lb/hr)	CO (lb/hr)	VOC (lb/hr)	HAP (lb/hr)
Generator #1	0.58	0.60	2.95	7.38	1.48	0.35

Visible emissions from Generator #1 shall not exceed 10% opacity on a six-minute block average basis.

3. New Source Performance Standards (NSPS)

Generator #1 will be located at Hatch Hill, which is an area source of hazardous air pollutants (HAP). Generator #1 will be driven by a new, stationary spark ignition internal combustion engine that will have been manufactured after January 1, 2008. It will be a lean-burn engine fired by LFG and will be capable of producing more than 25 HP.

Since Generator #1 will have been manufactured after January 1, 2008, it will be subject to the New Source Performance Standards (NSPS) *Standards of Performance for Spark Ignition Internal Combustion Engines (SI ICE),* 40 C.F.R. Part 60, Subpart JJJJ. [40 C.F.R. § 60.4230(a)(4)(ii)]

Hatch Hill shall operate and maintain the engine for Generator #1 to achieve the federal emission standards as required by Subpart JJJJ over the entire life of the engine.

4. Performance Testing

Hatch Hill shall conduct an initial performance test for NO_X, CO and VOC in accordance with the requirements of Table 2 to Subpart JJJJ of Part 60 – *Requirements of Performance Tests.* The initial performance test shall take place within 1 year of engine startup, and subsequent performance testing shall be conducted every 8,760 hours of operation or 3 years, whichever comes first thereafter, to demonstrate ongoing compliance.

5. Notification

If Hatch Hill should deem it necessary to rebuild or overhaul the engine for Generator #1, the facility shall notify the Department in writing prior to the engine being rebuilt or overhauled.

D. Annual Emissions

Hatch Hill shall be restricted to the following annual emissions, based on a calendar year total. The tons per year limits were calculated based on both the existing flare and the proposed Generator #1 firing LFG concurrently with no operating hour restrictions.

Total Licensed Annual Emissions for the Facility
Tons/year

	PM	PM_{10}	SO_2	NO_x	CO	VOC	HAP
LFG Flare	0.5	0.5	1.3	1.1	21.2	3.7	3.7
Generator #1	2.6	2.6	2.6	13.0	32.4	6.5	1.5
Total TPY	**3.1**	**3.1**	**3.9**	**14.1**	**53.6**	**10.2**	**5.2**

III. AMBIENT AIR QUALITY ANALYSIS

The level of ambient air quality impact modeling required for a minor source is determined by the Department on a case-by case basis. In accordance with 06-096 C.M.R. ch. 115, an ambient air quality impact analysis is not required for a minor source if the total licensed annual emissions of any pollutant released do not exceed the following levels and there are no extenuating circumstances:

Pollutant	Tons/Year
PM_{10}	25
SO_2	50
NO_x	50
CO	250

The total licensed annual emissions for Hatch Hill will remain below the emission levels contained in the table above and there are no extenuating circumstances; therefore, an ambient air quality impact analysis is not required as part of this license.

ORDER

Based on the above Findings and subject to conditions listed below, the Department concludes that the emissions from this source:

- will receive Best Practical Treatment,
- will not violate applicable emission standards, and
- will not violate applicable ambient air quality standards in conjunction with emissions from other sources.

The Department hereby grants Air Emission License Amendment A-1060-71-F-A subject to the conditions found in Air Emission License A-1060-71-E-R and the following conditions.

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

The following new specific condition shall be added to Air License A-1060-071-E-R (April 18, 2017) for Hatch Hill:

(22) **Generator #1**

A. The final equipment selection for this project has not yet been made. The conditions in this license amendment are based on equipment design specifications detailed in the amendment application. If the specifications for the selected equipment should differ from those that were listed in the application for this amendment, and those differences impact the applicability of the conditions contained in this amendment, Hatch Hill shall submit a new application for amendment including the actual equipment specifications and shall secure a new air license amendment prior to beginning construction. [06-096 C.M.R. ch. 115, BACT]

B. Hatch Hill shall utilize a lean burn engine to combust the LFG and provide the motive force to drive Generator #1. [06-096 C.M.R. ch. 115, BACT]

C. The engine shall comply with the federal emission standards for Landfill/Digester Gas Lean Burn Engines manufactured after July 10, 2010, and having a rated engine power of between 500 HP and 1350 HP as specified by 40 C.F.R. Part 60, Subpart JJJJ, Table 1. [40 C.F.R. § 60.4233(e)]

D. Hatch Hill shall operate and maintain the engine for Generator #1 to achieve the federal emission standards as required by 40 C.F.R. § 60.4233 over the entire life of the engine. [40 C.F.R. § 60.4234]

E. Hatch Hill shall only fire LFG gas in the engine for Generator #1 with a measured H_2S content of 200 ppmdv or less, as determined through the LFG sampling and testing as required by Specific Condition (18) of air license A-1060-71-E-R (April 18, 2017). [06-096 C.M.R. ch. 115, BACT]

F. Hatch Hill shall install and operate an LFG treatment unit to remove contaminants and water from the gas stream prior to combustion. [06-096 C.M.R. ch. 115, BACT]

G. Emissions shall not exceed the following:

Unit	Pollutant	lb/MMBtu	Origin and Authority
Generator #1	PM	0.12	06-096 C.M.R. ch. 115, BACT

H. Emissions shall not exceed the following: [40 C.F.R. § 60.4233(e) and 06-096 C.M.R. ch. 115, BACT]

Unit	PM/PM_{10} (lb/hr)	SO_2 (lb/hr)	NO_X (lb/hr)	CO (lb/hr)	VOC (lb/hr)	HAP (lb/hr)
Generator #1	0.58	0.60	2.95	7.38	1.48	0.35

I. Visible emissions from Generator #1 shall not exceed 10% opacity on a six-minute block average basis. [06-096 C.M.R. ch. 115, BACT]

J. Hatch Hill shall demonstrate compliance with the emission standards of 40 C.F.R. § 60.4233(e) by purchasing an engine certified according to procedures specified in 40 C.F.R. Part 60, Subpart JJJJ, for the same model year and demonstrating compliance by:

1. Maintaining documentation from the manufacturer that the generator is certified to meet the applicable emission standards.
2. Keeping a maintenance plan and records of conducted maintenance on the engine.
3. To the extent practicable, maintain and operate the engine and control device in a manner consistent with good air pollution control practice for minimizing emissions.
4. Conduct an initial performance test for NO_X, CO and VOC within 1 year of engine startup, in accordance with the requirements of Table 2 to Subpart JJJJ of Part 60 – *Requirements of Performance Tests*, and conduct subsequent performance testing every 8,760 hours of operation or 3 years, whichever comes first, thereafter to demonstrate ongoing compliance.

[40 C.F.R. § 60.4243(b)(1)]

K. Prior to commencing the rebuild or overhaul of the Generator #1 engine, Hatch Hill shall notify the Department in writing. [06-096 C.M.R. ch. 115, BACT]

DONE AND DATED IN AUGUSTA, MAINE THIS 9 DAY OF February , 2018.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY: Marc Allen Robert Cuzze for
PAUL MERCER, COMMISSIONER

The term of this amendment shall be concurrent with the term of Air Emission License A-1060-71-E-R.

PLEASE NOTE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES

Date of initial receipt of application: November 15, 2017
Date of application acceptance: November 17, 2017

Date filed with the Board of Environmental Protection:

This Order prepared by Patric J. Sherman, Bureau of Air Quality.

Filed
FEB 12 2018
State of Maine
Board of Environmental Protection