CHAPTER 115 MINOR NEW SOURCE LICENSE APPLICATION

Nordic Aquafarms Inc
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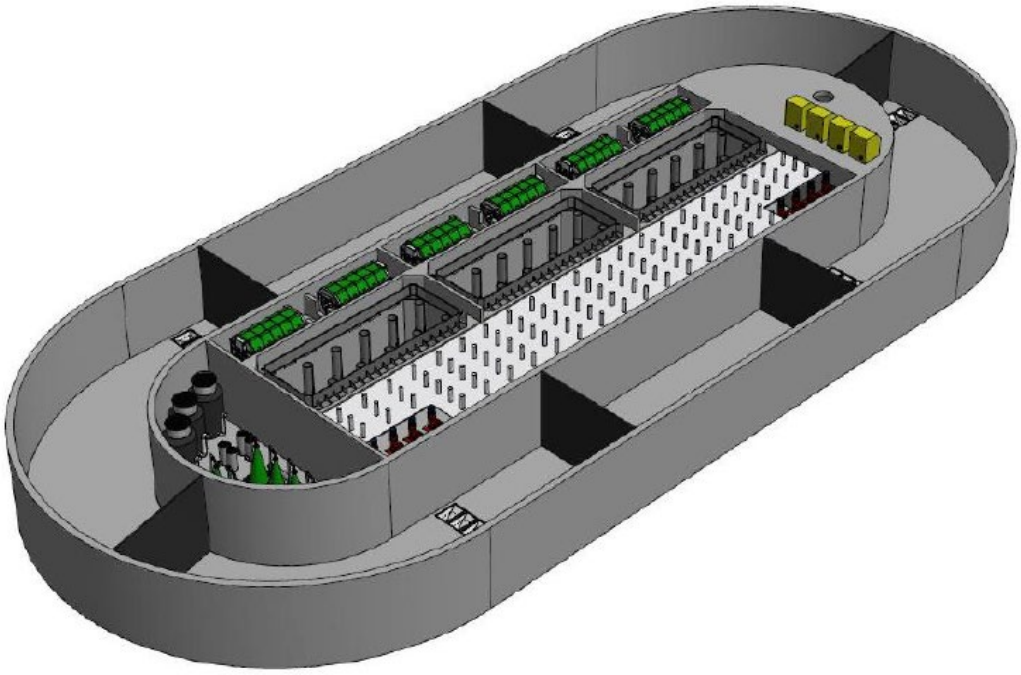
1. INTRODUCTION

Nordic Aquafarms Inc is proposing to construct a land-based salmon aquaculture farm on a 54-acre parcel located at 285 Northport Ave in Belfast, Maine. The facility will be an end-to-end operation, from eggs to market size salmon, using Recirculation Aquaculture System (RAS) tank technology for maintaining optimal water quality for fish production. Ultimately the plant will be designed to produce up to 33,000 tons per year of salmon. Provided in Figure 1 is a depiction of the RAS technology followed by a brief description.

Figure 1: Recirculation Aquaculture System Tank



The RAS includes mechanically forced cleaning and degassing/aeration to replace carbon dioxide with oxygen vital for fish health and growth. The RAS module's water circulation, cleaning, degassing, and aeration systems require electricity to operate. Plant electrical needs will mainly be supplied by the local utility; however, Nordic Aquafarms will supplement this with a 14 MW reciprocating engine bank. Facility building and process heating will be provided by electrical heaters. Licensable air emission units include the diesel engines identified in Section 1.2. Potential emissions will be limited by an annual fuel usage limit to ensure that potential emission remain below the "major" source thresholds. Accordingly, this application constitutes a Chapter 115 Minor New Source.

1.1 Report Organization

A description of the licensable equipment is provided in Section 1-2 followed by the construction schedule in Section 1-3. Section 2 identifies the project emission and licensing classification. Section 3 includes the required Best Available Control Technology analysis.

The required Maine DEP application forms, including the certification of a responsible official, are included in Appendix A. A copy of the Public Notice, run in the Bangor Daily News, is included in Appendix B. Copies of the return receipt from notification to the abutters can be found in the SLODA application filed concurrently with this application. Appendix C includes a Site Plan, and Title/Right/Interest is included in Appendix D.

1.2 Regulated Equipment Description

Nordic Aquafarms is planning to install Eight 2-MW reciprocating diesel engine sets. The power plant will be designed to generate 14 MWs of electricity using seven of the eight engines. The eighth engine will be installed as a back-up. Diesel fuel usage will be limited to 900,000 gallons annually.

Regulated fuel burning equipment details are included in Tables 1-1 below.

Table 1-1: Fuel Burning Equipment

Equipment ID	Make/Model	Maximum Design Capacity	Electrical Generating Capacity	Fuel Type (Sulfur Content)	Maximum Hourly Fuel Usage	Control Equipment
		[MMBtu/hr]		[-]	[gal]	[-]
Engines #1 - #8	Caterpillar 3516C Tier 4F **or equivalent**	19.53	2 MW	Diesel, 15 ppm sulfur	139.5	SCR, Oxidation Catalyst, & Particulate Filter

1.3 Construction Schedule

This schedule will commence upon final receipt of all necessary permits and approvals for the project.

1. Construction start within 1-3 months of completion of permitting. Initial construction efforts will include infrastructure connection to site, sitework, the Smolt 1 facility and waste water treatment plant, and supporting facilities and utilities
2. Construction start of grow-out modules will occur within approximately 6 months of the beginning of development. The total period for construction of the first 3 modules and fish processing is projected to be about 24 months.
3. Timeline for Phase 2 expansion (Smolt 2 and remaining 3 grow-out modules), will be decided once Phase 1 development is complete and sufficient time has been allocated for operational startup and optimization

2. PROJECT CLASSIFICATION

2.1 Overview

This application qualifies as a New Source Review (NSR) Chapter 115 Minor New Source. As discussed in Section 1 of this application, Nordic Aquafarms is proposing to limit its fuel usage for the eight diesel engines so that potential emissions will remain below the major source and air dispersion modeling thresholds. Provided in the tables below are proposed short term emission rates for each of the proposed fuel burning sources and the corresponding potential emissions. Table 2-1 includes emissions for the eight engines and Table 2-2 includes facility wide emissions and the corresponding major source and modeling thresholds.

2.2 Equipment and Project Emissions

Nordic Aquafarms is proposing to install Eight 2-MW diesel engines with a total annual diesel fuel limit of 900,000 gallons. The engines are subject to 40 CFR Part 60 Subpart IIII and as such must meet the applicable Tier 4 manufacturer emission standards which are identified in 40 CFR 1039.101 and described in Section 2.3. Table 2-1 includes a summary of the diesel engine equipment specifications, proposed fuel cap, and the proposed emission limits.

Table 2-2 includes a summary of facility wide total emissions as compared to the modeling and major source thresholds. Total facility wide emissions are below the applicable modeling and major source thresholds.

Table 2-1: Proposed Engines #1 - 8 Specifications and Emissions

Proposed Engines #1-8 Specifications and Emissions

Generator Make & Model:	Caterpillar 3516C Tier 4F (Or Equivalent)
Fuel Type:	Diesel
Max Fuel Consumption (gal/hr):	139.5
Max Heat Input (MMBtu/hr):	19.53
Engine Power (kW):	2,000
Proposed Fuel Limit (gal):	900,000

Pollutant	Tier 4 Emission Limit (g/kw-hr)	Emission Factor (lb/MMBtu)	Proposed Limit (lb/hr)	PTE (TPY)
NOx	3.5	0.79	**15.4**	49.8
PM**	0.1	**0.02**	**0.4**	1.4
*PM_{10} & $PM_{2.5}$		0.03	**0.6**	1.9
CO	3.5	0.79	**15.4**	49.8
VOC	0.19	0.04	**0.8**	2.7
*SO_2		0.00	**0.03**	0.1
*CO_2e		165	3,222.5	10,395.0

*AP-42 Emission Factors
**Alternate FEL standard may apply.See 40 CFR 1039.101 (d)(2)
Note: Proposed Limits are highlighted.

Table 2-2: Facility Wide Annual Potential To Emit (TPY) & Regulatory Thresholds

Pollutant	Engines 1 - 8 PTE	Modeling Threshold	Major Source Threshold	Major/Minor Designation
NOx	49.8	50	100	**Minor**
PM	1.4	n/a	100	**Minor**
PM_{10} & $PM_{2.5}$	1.9	25/15	100	**Minor**
CO	49.8	250	100	**Minor**
VOC	2.7	n/a	50	**Minor**
SO_2	0.1	50.0	100	**Minor**
CO_2e	10395.0	-	-	-

2.3 Regulatory Overview - Engines

2.3.1 Engine NESHAP & NSPS Applicability

The Engines at Nordic Aquafarms are Non-Emergency Compression Ignition (CI) New Stationary Engines Located at Area Source of Hazardous Air Pollutants (HAP), constructed on or after June 12, 2006 and are subject to 40 CFR part 60, subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines).

Provided below is a summary overview of the applicable Requirements of 40 CFR part 60, subpart IIII for Nordic Aquafarms' proposed engines.

Emission Standards: 60.4201(a)

Stationary CI internal combustion engine manufacturers must certify their 2007 model year and later non-emergency stationary CI ICE with a maximum engine power less than or equal to 2,237 kilowatt (KW) (3,000 horsepower (HP)) and a displacement of less than 10 liters per cylinder to the certification emission standards for new nonroad CI engines in 40 CFR 89.112, 40 CFR 89.113, 40 CFR 1039.101, 40 CFR 1039.102, 40 CFR 1039.104, 40 CFR 1039.105, 40 CFR 1039.107, and 40 CFR 1039.115, as applicable, for all pollutants, for the same model year and maximum engine power. Table 3-1 includes the applicable pollutant standards.

Table 3-1: NSPS Subpart IIII Engine Manufacturer Emission Standards

Pollutant	Tier 4 Emission Limit (g/kw-hr)
NOx*	3.5
PM*	0.1
CO	3.5
VOC	0.19

*Alternate FEL standard may apply. See 40 CFR 1039.101 (d)(2)

Fuel Requirements: 60.4207(b)

Owners and operators of stationary CI ICE subject to this subpart with a displacement of less than 30 liters per cylinder that use diesel fuel must purchase diesel fuel that meets the requirements of 40 CFR 80.510(b) for nonroad diesel fuel. (i.e., 15 ppm maximum)

Monitoring Requirements: § 60.4209(b)

Owners or operators of a stationary CI internal combustion engine equipped with a diesel particulate filter necessary to comply with the emission standards in § 60.4204 must be fitted with a backpressure monitor that notifies the owner or operator when the high backpressure limit of the engine is approached.

Compliance Requirements: §60.4204, 60.4211(a) & (c), 60.4206

Owners and operators of stationary CI ICE must operate and maintain stationary CI ICE that achieve the emission standards as required in §60.4204 over the entire life of the engine.

If you are an owner or operator you must:

(1) Operate and maintain the stationary CI internal combustion engine and control device according to the manufacturer's emission-related written instructions; and

(2) Change only those emission-related settings that are permitted by the manufacturer.

Notification, Reporting, and Recordkeeping: §§60.1 & 60.4214 (b) & (c)

The General Provisions of CFR part 60.1 apply to Nordic Aquafarms proposed engines.

For CI internal combustion engines equipped with a diesel particulate filter, the owner or operator must keep records of any corrective action taken after the backpressure monitor has notified the owner or operator that the high backpressure limit of the engine is approached.

2.3.2 State DEP Regulations

The proposed Engines are subject to visible emission, particulate matter, and fuel sulfur and limits established in Maine Department of Environmental Protection Regulation Chapters 101, 103, and 106, respectively.

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Chapter 101 - Visible Emissions

Stationary internal combustion engines manufactured after the year 2000 are subject to an opacity limit of 20 percent on a six (6) minute block average basis, except for no more than two (2) six (6) minute block averages in a 3-hour period. See Ch. 101 § (2)(B)(1)(d).

Chapter 103 - Particulate Emission Standard

The proposed engines are subject to the 0.12 lb/MMBtu particulate matter (PM) emission limit. See Ch. 103 § (2)(B)(1)(a).

Chapter 106 – Fuel Sulfur Standard

Beginning January 1, 2018, sources must limit fuel sulfur contents to 0.0015% by weight (ultra-low sulfur diesel - ULSD).

3. BEST AVAILABLE CONTROL TECHNOLOGY

3.1 Overview

The proposed installation of Eight 2-MW diesel fired engine sets represents a minor new source in accordance with Maine DEP Chapter 115 regulations. As such Nordic Aquafarms must demonstrate that the emissions from the proposed air emission units will receive Best Available Control Technology (BACT) as defined in Maine DEP Chapter 100 regulations. See Maine DEP Regulation Chapter 115 § 4(A)(4)(d). BACT is defined as:

> An emission limitation (including a visible emissions standard) based on the maximum degree of reduction for each pollutant emitted from or which results from the new or modified emissions unit which the Department on a case by case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for such emissions unit through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combination techniques for control of each pollutant. In no event shall application of BACT result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR Part 60 and 61 or any applicable emission standard established by the Department. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results. (Maine DEP Regulation Chapter 100 § 18)

The proposed engine sets have the potential to emit the following criteria air pollutants: Volatile organic compounds (VOCs), particulate matter (PM/PM_{10}/$PM_{2.5}$), nitrous oxides (NOx), carbon monoxide (CO), and sulfur dioxide (SO_2). The BACT review prepared for the proposed Engines has been prepared in accordance with the Northeast States for Coordinated Air Use Management (NESCAUM) BACT Guideline. There are five key steps in the BACT Procedure:

1. Identify all control technologies applicable to the process;
2. Eliminate technically infeasible options;
3. Rank remaining control technologies by control effectiveness;
4. Evaluate technically feasible control alternatives (energy, environmental, and economic impacts) if a control technology less effective than the top option is proposed as BACT; and
5. Select BACT in consideration of energy, environmental, and economic impacts.

Provided in the following sections is a detailed BACT analysis for the proposed emission units.

3.2 Control of Air Pollutants from Generator #1-8

The air pollution control options available for generators of this size include the installation of add-on pollution control devices, the use of clean fuels, and good combustion practices. The technologies listed in Table 3-1 are determined to be potentially available control technologies for emissions from diesel engines. The technologies are listed by order of effectiveness and described in greater detail in following subsections.

Table 3-1: Control Technology Options for Diesel Engines

Pollutant	Control Technology
NOx	• Add-On Controls (i.e., Selective Catalytic Reduction) • Combustion Control Technologies
PM/PM_{10}/$PM_{2.5}$	• Add-On Controls (i.e., particulate filter) • Combustion Control Technologies
CO	• Oxidation Catalyst • Combustion Control Technologies
VOCs	• Oxidation Catalyst • Combustion Control Technologies
SO_2	• Low Sulfur Fuel

The non-emergency engines proposed for Nordic Aquafarms are subject to 40 C.F.R. 60 Subpart IIII. New non-emergency engines must meet stringent emission standards which require state-of-the-art pollution controls to meet applicable NOx, PM, CO, and VOC emission manufacturing standards. Fuel sulfur content rules require the use of 15 ppm sulfur fuel, thereby almost eliminating SO_2 emissions. Provided in the following paragraphs is a description of the top-level pollution control selected (essentially mandated by rule) for each pollutant.

3.2.1 Control of Nitrogen Oxides (NOx)

NO_x emission may be created through the conversion and release of nitrogen bound in the fuel (i.e., Fuel NOx) and/or by the thermal combustion process (i.e. Thermal NOx).

Fuel NO_x is produced from the reaction of fuel-bound nitrogen compounds with oxygen and is typically in very small quantities in clean diesel fuel. Low nitrogen content diesel releases minimal fuel NOx and is not a focus of controls as compared to thermal NOx.

Thermal NO_x is the primary mechanism of NO_x formation from diesel fuel oil combustion. Thermal NO_x arises from reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion of air and is formed at elevated temperatures and pressures and increases with combustion temperature.

Control technologies for NO_x emissions from diesel fired engines may include: 1. add-on controls such as Selective Catalytic Reduction (SCR); 2. combustion control techniques (i.e., injection timing retard, air/fuel ratio optimization, cooled intake air); and 3. combustion of clean fuels.

Nordic Aquafarms has selected non-emergency engines that comply with EPA's Tier 4 emission standards for 40 CFR Part 60 N.S.P.S. Subpart IIII Engines.

Each engine will be fitted with a SCR catalyst, Ammonia Oxidation Catalyst (AMOX) and the Pump Electronics Tank Unit (PETU). These systems use a small amount of Diesel Exhaust Fluid (DEF) to convert NOx emissions in the exhaust into nitrogen and water. DEF is a solution of urea dissolved in deionized water to produce a concentration that is about 1/3 urea and 2/3 water.

In order to ensure sufficient NOx reduction, a small amount of excess DEF is injected into the exhaust stream. This excess DEF may pass through the SCR catalyst as ammonia. To prevent excess ammonia from entering the atmosphere, the exhaust gas flows through an Ammonia Oxidation Catalyst where the ammonia reacts with oxygen in the presence of this catalyst to form nitrogen and water.

Each Engine will meet the manufacturer mandated Tier 4 NOx standards using state of the art pollution controls, which include SCR, AMOX, and DEF. Each engine will meet a limit of 15.4 lb/hr. The proposed state of the art controls and NOx limit meet BACT.

3.2.2 Control of Particulate Matter ($PM/PM_{10}/PM_{2.5}$)

PM from fuel combustion is formed from non-combustible material in the fuel and from incomplete combustion. Potential control technologies for PM emissions from diesel engines include: 1. Add-on control (i.e., filter); and 2. good combustion practices.

Nordic Aquafarms has selected to control $PM/PM_{10}/PM_{2.5}$ emission from each of the engine sets using a Diesel Particulate Filter (DPF). A DPF traps particulate matter that's carried in the exhaust stream, preventing it from being released into the atmosphere. Inside the DPF, particulate matter, sometimes referred to as "soot," is trapped until it is oxidized during regeneration.

Nordic Aquafarms will meet BACT for the engines by fitting them with top level particulate controls and meeting limits of 0.4 and 0.6 lb/hr (includes filterable plus condensable) for PM and $PM_{10}/PM_{2.5}$, respectively.

3.2.3 Control of Carbon Monoxide (CO) & Volatile Organic Compounds (VOCs)

Carbon monoxide (CO) and Volatile Organic Compound (VOC) emissions result from incomplete combustion of fuels. CO/VOC emissions result when there is insufficient residence time or oxygen available to complete the final step in oxidation.

Potential control technologies for CO and VOC emissions from diesel fired engines include: 1. Add-on controls such as Catalytic Oxidation; and 2. Combustion Control Techniques (i.e., fuel injection timing, air to fuel ratios, cooled intake air, etc.).

Nordic Aquafarms has selected a Tier 4 compliant non-emergency engines which use start-of-the-art Diesel Oxidation Catalysts (DOC). The DOC is the top level of control available and uses a chemical process to reduce hydrocarbons and carbon monoxide in the exhaust stream.

Use of the DOC control technology and limits of 15.4 and 0.8 lb/hr, for CO and VOC, respectively, meet BACT.

3.2.4 Control of Sulfur Dioxide (SO2)

Nordic Aquafarms will use ultra-low sulfur diesel (ULSD) with a sulfur content less than or equal to 15 ppm. Burning ULSD fuel represents BACT.

3.3 BACT Summary

Nordic Aquafarms is proposing to install engine sets that will each meet manufacturer mandated Tier 4 standards using state-of-the-art air pollution controls, which include Selective Catalytic Reduction, Oxidation Catalysts, and Particulate Filters. Provided in Table 3-3 is a summary of the proposed lb/hr BACT emission limits.

Table 3-3: Proposed BACT Limits

Pollutant	Engines 1-8 [lb/hr]
NOx	15.4
PM	0.4
PM_{10} & $PM_{2.5}$	0.6
CO	15.4
VOC	0.8
SO_2	0.03

APPENDIX A: MAINE DEP CHAPTER 140 FORMS

APPENDIX B: PUBLIC NOTICE AND COVER LETTERS TO TOWN OF BELFAST

APPENDIX C: SITE PLAN

APPENDIX D: TITLE, RIGHT, & INTEREST

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