AIR QUALITY EFFECTS ANALYSIS
FOR
PERMIT TO CONSTRUCT
ACP-18252 v1.0

Applicant:

Crusoe Energy Systems, Inc.
255 Fillmore Street
Denver, CO 80206

Facility Location:

Engine Fleet
Portable
Various Counties in North Dakota

Introduction and Background:

Crusoe Energy Systems, Inc. (Crusoe) submitted a request to the North Dakota Department of Environmental Quality – Division of Air Quality (Department) on August 20, 2024, for changes to their current individual engine permits (ENG-01 through ENG-43). See the individual permit to operate numbers below.

Each engine (EUs ENG-01 through ENG-43) currently operates under individual Air Permit to Operate Nos. AOP-28049 v1.0 through AOP-28058 v1.0 (ENG-01 through ENG-10), AOP-28070 v1.0 through AOP-28079 v1.0 (ENG-11 through ENG-20), AOP-28505 v1.0 (ENG-21), AOP-28496 v1.0 through AOP-28498 v1.0 (ENG-22 through ENG-24), AOP-28506 v1.0 (ENG-25), AOP-28500 v1.0 (ENG-26), AOP-28501 v1.0 (ENG-27), AOP-28507 v1.0 (ENG-28), AOP-28508 v1.0 (ENG-29), AOP-28504 v1.0 (ENG-30), AOP-28521 v1.1 through AOP-28530 v1.1 (ENG-31 through ENG-40), AOP-28547 v1.0 (ENG-41), AOP-28548 v1.0 (ENG-42), and AOP-28550 v1.0 (ENG-43), respectively. Upon review, the Department determined that it would be more appropriate to permit the engines as one source on a combined synthetic minor permit.

Crusoe requested new emissions limits for the fleet of Waukesha natural gas-fired engines (Engine Fleet or facility), to increase the number of units to be located at any single site to 10 engines, and to lower the hydrogen sulfide content in the fuel gas to 100 ppm.

The engines (EUs ENG-01 through ENG-43) will be set up at various well sites in North Dakota. The well sites are not owned or operated by Crusoe. The engines burn gas that is used to power the engines for Bitcoin mining. The gas would otherwise be sent back to the producer flare(s) which are not owned or operated by Crusoe. This practice results in decreased emissions in the area due less gas being flared.

There are no physical equipment changes or increases to emissions with this permit action. Additionally, there are no changes to regulatory applicability with this permit action. The Engine Fleet is a synthetic minor source.

Table 1 lists the emissions units associated with the Engine Fleet.

Table 1 - Source-wide Permitted Equipment.

Emission Unit Description [A]	**Emission Unit (EU)**	**Emission Point (EP)**	**Air Pollution Control Equipment**
Waukesha VHP-9394GSI (4SRB) natural gas-fired engine rated 2,500 bhp (NSPS JJJJ & MACT ZZZZ)	ENG-01 through ENG-43	ENG-01 through ENG-43	3-Way Catalyst and Air-Fuel Ratio Control

[A] All emission unit ratings are considered nominal ratings.

Facility Wide Emissions Profile
Potential to Emit (PTE)

Table 2 - PTE (tons per year) [A]

Emission Unit Description	Number of units	CO	NO_X	SO_2	VOCs	PM	PM_{10}	$PM_{2.5}$	Total HAPs	Formaldehyde (Largest HAP)
Waukesha engine	1	7.2	3.6	1.3	0.7	0.8	0.8	0.8	1.0	0.0
5 Waukesha engines	5	36.2	18.1	6.7	3.6	4.1	4.1	4.1	5.0	0.1
10 (max) Waukesha engines [B]	10	72.4	36.2	13.4	7.2	8.1	8.1	8.1	9.9	0.2

[A] Abbreviations:
PM: filterable and condensable particulate matter
$PM_{2.5}$: filterable and condensable particulate matter with an aerodynamic diameter less than or equal to 2.5 microns (≤2.5 µm)
PM_{10}: filterable and condensable particulate matter with an aerodynamic diameter less than or equal to 10 microns (≤10 µm) including $PM_{2.5}$
SO_2: sulfur dioxide
NO_X: oxides of nitrogen
CO: carbon monoxide
VOCs: volatile organic compounds
HAPs: hazardous air pollutants as defined in Section 112(b) of the Clean Air Act

[B] Limited to ten engines to be located at any site. This potential to emit represents the maximum emissions allowed at any single site.

As shown in Table 2, the PTE for ten engines is below 100 tons per year (tpy) for all criteria air pollutants, below 10 tpy for any single hazardous air pollutant (HAP), and below 25 tpy for the combined HAP emissions. The Department has reviewed these calculations and believes they accurately represent the proposed facility operations.

The facility PTE is based on enforceable emissions restrictions put in place on each of the 43 natural gas-fired engines limiting the allowable amount of NO_X, CO, and VOC. Additionally, the facility is limited to a maximum of 10 engines to be located at any single site. These restrictions mean the facility will be a synthetic minor source of air pollution, as the emissions are limited to below major source thresholds for both the prevention of significant deterioration (PSD) and Title V programs.

Rules Analysis
Potentially Applicable Rules and Expected Compliance Status

A. NDAC 33.1-15-01 – General Provisions:

Multiple topics are included in the General Provisions chapter: entry onto premises - authority, variances, circumvention, severability, land use plans and zoning regulations (only to provide air quality information), measurement of air contaminants, shutdown and malfunction of an installation - requirements for notification, time schedule for compliance, prohibition of air pollution, confidentiality of records, enforcement, and compliance certifications.

Applicability and Expected Compliance

Based on the review of the information provided, the facility will comply with all applicable sections of this rule.

B. NDAC 33.1-15-02 – Ambient Air Quality Standards:

The facility must comply with the North Dakota and Federal Ambient Air Quality Standards (AAQS). In addition to these standards, compliance with the "Criteria Pollutant Modeling Requirements for a Permit to Construct" guidelines[1].

Applicability and Expected Compliance

The facility is not subject to PSD nor does the facility's PTE trigger the modeling thresholds listed in the "Criteria Pollutant Modeling Requirements for a Permit to Construct", therefore, preconstruction modeling for this facility was not required. Based on the facility PTE and proposed stack heights, compliance with the ambient air quality standards is expected to be maintained.

C. NDAC 33.1-15-03 – Restriction of Emission of Visible Air Contaminants:

This chapter requires all non-flare sources from new facilities to comply with an opacity limit of 20% except for one six-minute period per hour when 40% opacity is permissible. This chapter also requires facility flares to comply with an opacity limit of 20% except for one six-minute period per hour when 60% opacity is permissible. Lastly, this chapter restricts the opacity of fugitive emissions transported off property to 40% except for one six-minute period per hour when 60% opacity is permissible. This chapter also contains exceptions under certain circumstances and provides the method of measurement to determine compliance with the referenced limits.

[1] See October 6, 2014, Criteria Pollutant Modeling Requirements for a Permit to Construct. Available at: https://www.deq.nd.gov/publications/AQ/policy/Modeling/Criteria_Modeling_Memo.pdf

Applicability and Expected Compliance

Based on Department experience with the non-flare sources, the facility is expected to comply with the 20% opacity limit.

D. NDAC 33.1-15-04 – Open Burning:

No person may dispose of refuse and other combustible material by open burning, or cause, allow, or permit open burning of refuse and other combustible material, except as provided for in Section 33.1-15-04-02 or 33.1-15-10-02, and no person may conduct, cause, or permit the conduct of a salvage operation by open burning.

Applicability and Expected Compliance

The facility is subject to this chapter and will comply with all open burning regulations.

E. NDAC 33.1-15-05 – Emissions of Particulates Matter Restricted:

This chapter establishes particulate matter emission limits and restrictions for industrial process equipment and fuel burning equipment used for indirect heating.

Applicability and Expected Compliance

Since the fuel burning equipment used for indirect heating is fired on gaseous fuels, the particulate matter limits in this chapter do not apply. It should be noted that combustion of gaseous fuels in the units is expected to result in extremely low particulate matter emissions that are well below the allowable levels established by this chapter.

F. NDAC 33.1-15-06 – Emissions of Sulfur Compounds Restricted:

This chapter applies to any installation in which fuel is burned and the SO_2 emissions are substantially due to the sulfur content of the fuel; and in which the fuel is burned primarily to produce heat. This chapter is not applicable to installations which are subject to an SO_2 emission limit under Chapter 33.1-15-12, Standards for Performance for New Stationary Sources, or installations which burn pipeline quality natural gas.

Applicability and Expected Compliance

The facility is subject to the requirements of this chapter. Each engine (EUs ENG-01 through ENG-43) will be fired on gas containing no more than 100 ppm H_2S. This chapter requires fuel to be less than 3 lb SO_2/MMBtu and the fuel for this facility will equate to approximately 0.0165 lb SO_2/MMBtu at 1020 Btu per standard cubic feet (scf).

G. NDAC 33.1-15-07 – Control of Organic Compounds Emissions:

This chapter establishes requirements for the construction of organic compound facilities and the disposal of organic compounds gas and vapor generated as waste resulting from storage, refining, or processing operations at the facility.

Applicability and Expected Compliance

The facility is not an organic compounds facility and is not subject to the requirements of this chapter.

H. NDAC 33.1-15-08 – Control of Air Pollution from Vehicles and Other Internal Combustion Engines:

This chapter restricts the operation of internal combustion engines which emit from any source unreasonable and excessive smoke, obnoxious or noxious gas, fumes or vapor. This chapter also prohibits the removal or disabling of motor vehicle pollution control devices.

Applicability and Expected Compliance

The engines (EUs ENG-01 through ENG-43) are also subject to opacity requirements under NDAC 33.1-15-03-02 and subject to the requirements of NSPS Subpart JJJJ. As a result of expected compliance with these provisions, the engines are not expected to emit any unreasonable and excessive smoke, obnoxious or noxious gases, fumes, or vapor.

I. NDAC 33.1-15-09 – [repealed]

J. NDAC 33.1-15-10 – Control of Pesticides:

This chapter provides restrictions on pesticide use and restrictions on the disposal of surplus pesticides and empty pesticide containers.

Applicability and Expected Compliance

The facility is subject to this chapter and is expected to comply with all applicable requirements should pesticides be used.

K. NDAC 33.1-15-11 – Prevention of Air Pollution Emergency Episodes:

When an air pollution emergency episode is declared by the Department, the facility shall comply with the requirements in Chapter 33.1-15-11 of the North Dakota Air Pollution Control (NDAPC) rules.

L. NDAC 33.1-15-12 – Standards of Performance for New Stationary Sources [40 Code of Federal Regulations Part 60 (40 CFR Part 60)]:

This chapter adopts most of the Standards of Performance for New Stationary Sources (NSPS) under 40 CFR Part 60. The facility is subject to the following subparts under 40 CFR Part 60 which have been adopted by North Dakota as of July 1, 2019:

Subpart A – General Provisions

Subpart A contains general requirements for plan reviews, notification, recordkeeping, performance tests, reporting, monitoring and general control device requirements.

Applicability and Expected Compliance

The facility will comply with the general provisions of Subpart A through submission of timely notifications, performance testing, reporting, and following the general control device and work practice requirements under Subpart A. In addition, any changes to the facility after it is built will be evaluated with respect to this subpart as well as others.

Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

Subpart JJJJ establishes emissions standards (NO_X, CO, VOC) and compliance schedules for all new, modified and reconstructed stationary spark ignition (SI) internal combustion engines (ICE) and equipment manufactured on or after July 1, 2007, regardless of size. The subpart applies to manufactures, owners, and operators of such engines and equipment. SI ICE are categorized in this subpart by usage, size and fuel type.

Applicability and Expected Compliance

The natural gas-fired engines (EUs ENG-01 through ENG-43) are subject to the requirements of NSPS Subpart JJJJ. The facility engines are each rated at 2,500 brake horsepower (bhp) and will be equipped with 3-way catalyst and air-fuel ratio control.

Subpart JJJJ requires each engine to comply with the following emissions standards:

- NOx of 1.0 g/hp-hr or 82 ppmvd @ 15% O_2
- CO of 2.0 g/hp-hr or 270 ppmvd @ 15% O_2
- VOC of 0.7 g/hp-hr or 60 ppmvd @ 15% O_2

Beyond the Subpart JJJJ limits, the facility is restricted to lower engine emissions limits to avoid major source thresholds under Title V. As a result, Condition 3 of ACP-18252 v1.0 established the following limits:

- NOx of 0.15 g/hp-hr
- CO of 0.30 g/hp-hr
- VOC of 0.03 g/hp-hr

To demonstrate compliance with the above limits, the facility must conduct emissions testing every 8,760 hours of operations or every three years, whichever comes first.

The facility is also expected to comply with Subpart JJJJ requirements by properly maintaining and operating an air-to-fuel ratio controller and keeping a maintenance plan and records of conducted maintenance and, to the extent practicable, will maintain and operate the engines in a manner consistent with good air pollution control for minimizing emissions.

M. NDAC 33.1-15-13 – Emission Standards for Hazardous Air Pollutants [40 Code of Federal Regulations Part 61 (40 CFR Part 61)]:

This chapter discusses emission standards for hazardous air pollutants. It specifically incorporates a majority of the subparts and appendices of the National Emission Standards for Hazardous Air Pollutants (NESHAP) under 40 CFR Part 61 as of July 2, 2010.

Applicability and Expected Compliance

The facility does not appear to have any applicable requirements under this chapter.

N. NDAC 33.1-15-14 – Designated Air Contaminant Sources, Permit to Construct, Minor Source Permit to Operate, Title V Permit to Operate:

This chapter designates that federally regulated sources are required to obtain a Permit to Construct and a Permit to Operate and comply with specific emission control and air quality standards.

Applicability and Expected Compliance

The facility has met all requirements necessary to obtain a permit to construct. The facility will be considered a synthetic minor source via federally enforceable restrictions limiting the criteria air pollutants PTE below 100 tons per year (NOx, CO, and VOC).

The permit must undergo public comment per NDAC 33.1-15-14-06.5.a.

The facility will be issued a permit to operate by the Department upon issuance of Air Permit to Construct No. ACP-18252 v1.0.

O. NDAC 33.1-15-15 – Prevention of Significant Deterioration of Air Quality [40 CFR 52.21]:

This chapter adopts the federal provisions of the Prevention of Significant Deterioration of air quality (PSD) program (40 CFR 52.21). A facility is subject to PSD review if it is classified as a "major stationary source" under Chapter 33.1-15-15.

Applicability and Expected Compliance

This facility is not classified as a "major stationary source" under 40 CFR 52.21(b)(1)(i)(a) and is therefore only subject to PSD review if emissions of a regulated new source review (NSR) pollutant[2] exceed 250 tpy (excluding fugitive emissions). The PTE for this facility, as shown in Table 2, is below the 250 tpy threshold and therefore not subject to PSD review.

[2] See 40 CFR 52.21(b)(50). Available at: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-52/subpart-A/section-52.21#p-52.21(b)(50)

P. NDAC 33.1-15-16 – Restriction of Odorous Air Contaminants:

This chapter restricts the discharge of objectionable odorous air contaminants which measures seven odor concentration units or greater outside the property boundary. The emission of hydrogen sulfide is also addressed with strict concentration limitations. The chapter also establishes the method of measurement using certified inspectors, scentometers, and other approved instruments.

Applicability and Expected Compliance

Based on Department experience with sources having similar emission units, processes, and low hydrogen sulfide concentrations, the facility is expected to comply with this chapter.

Q. NDAC 33.1-15-17 – Restriction of Fugitive Emissions:

This Chapter restricts fugitive emissions from particulate matter or other visible air contaminates and gaseous emissions that would violate Chapter 2 (ambient air quality standards), Chapter 15 (PSD), Chapter 16 (odor), or Chapter 19 (visibility).

Applicability and Expected Compliance

The facility will be required to take reasonable precautions to prevent fugitive emissions in violation of the above referenced NDAC chapters.

R. NDAC 33.1-15-18 – Stack Heights:

This chapter restricts the use of stack heights above good engineering practices (GEP). The chapter primarily adopts federal regulations listed under 40 CFR 51.100(ii). This chapter also restricts the use of dispersion techniques to affect the concentration of a pollutant in the ambient air. Demonstrations of good engineering practice stack heights must be made available for review.

Applicability and Expected Compliance

The facility is composed of various portable engines (EUs ENG-01 through ENG-43), with no building structures. The facility engines will be operated as a portable source with emissions less than major source thresholds.[3] The source will be reducing overall local area emissions resulting from uncontrolled oil field flaring (which is a permitted activity). Based on the portable nature of the Engine Fleet, there are no stack height requirements for this source.

S. NDAC 33.1-15-19 – Visibility Protection:

This chapter outlines regulations regarding visibility protection and applies to new major stationary sources as defined in Section 33.1-15-15-01. It contains provisions regarding visibility impact analysis, visibility models, notification requirements for permit

[3] Limited to no more than ten engines to be located at any single site.

applications, review by federal land managers, permit issuance criteria, and visibility monitoring.

Applicability and Expected Compliance

The facility is not a new major stationary source and therefore is not subject to the requirements of this chapter. Given the minor source levels of the visibility impairing air pollutants, such as NO_X, SO_2, and $PM_{2.5}$, it is expected that the facility will not adversely contribute to visibility impairment within the three units of the Theodore Roosevelt National Park (nearest federal Class I areas) or at the Lostwood National Wildlife Refuge.

T. NDAC 33.1-15-20 – Control of Emissions from Oil and Gas Well Production Facilities:

The facility is not an oil or gas well facility and is therefore not subject to the requirements of this chapter.

U. NDAC 33.1-15-21 – Acid Rain Program:

This chapter adopts the acid rain provisions of the Clean Air Act specified under 40 CFR Parts 72-78. The facility is not subject to the acid rain provision as they are not an electric utility.

V. NDAC 33.1-15-22 – Emissions Standards for Hazardous Air Pollutants for Source Categories [40 Code of Federal Regulations Part 63 (40 CFR Part 63)]:

This chapter adopts most of the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Source Categories under 40 CFR Part 63. These standards typically apply to major sources of air pollution that are in a regulated source category. In addition to the major source requirements, some of the regulations have "area source" standards (for non-major sources). Some of the area source standards have not been adopted by the Department and compliance will be determined by the United States Environmental Protection Agency (USEPA) (i.e. 40 CFR 63, Subpart ZZZZ area source provisions have not been adopted by the Department).

Applicability

The facility's potential HAP emissions for ten engines are less than 10 tons/year of any single HAP and are less than 25 tons/year of any combination of HAPs, so the facility is an area (minor) source of HAPs. As shown in the Table 2, total potential HAPs for a total of ten engines from the facility are approximately 9.9 tons/year. The greatest single potential HAP is formaldehyde at approximately 0.2 tons/year.

Subpart A – General Provisions

Subpart A contains general requirements for prohibited activities and circumvention, preconstruction review and notification, standards and maintenance requirements, performance tests, monitoring, recordkeeping, reporting, and control device work practice requirements.

Applicability and Expected Compliance

The facility will comply with the general provisions of Subpart A through submission of timely notifications, performance testing, monitoring, recordkeeping, reporting, and following the control device work practice requirements under Subpart A.

Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

Subpart ZZZZ establishes national emission limitations and operating limitations for hazardous air pollutants (HAP) emissions from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations.

Applicability and Expected Compliance

The facility has engines (EUs ENG-01 through ENG-43) subject to the requirements under this subpart. The requirements of Subpart ZZZZ for the engines are met by complying with the requirements of NDAC 33.1-15-12 [40 CFR 60], Subpart JJJJ.

W. NDAC 33.1-15-23 – Fees:

This chapter requires a filing fee of $325 for permit to construct applications, plus any additional fees based on actual processing costs. The additional fees based on processing costs will be assessed upon issuance of the draft permit to construct. The annual operating permit fee is also applicable.

The Department is waiving the applicating filing fee of $325 since this permit action resulted from discussions between Crouse and the Department. Crusoe will be required to pay the annual operating fee once a permit to operate is issued.

X. NDAC 33.1-15-24 – Standards for Lead-Based Paint Activities:

The facility will not perform any lead-based painting and is therefore not subject to this chapter.

Y. NDAC 33.1-15-25 – Regional Haze Requirements:

This chapter is specific to existing stationary sources or groups of sources which have the potential to "contribute to visibility impairment" as defined in Section 33.1-15-25-01.2. Existing stationary sources or groups of sources determined to contribute to visibility impairment may be required to implement emissions reduction measures to help the Department make reasonable progress toward North Dakota's reasonable progress goals established in accordance with 40 CFR 51.308.

Applicability and Expected Compliance

The facility is not a new source and based on low PTE of visibility impairment pollutants is not expected to contribute to visibility impairment. Therefore, the facility is not subject to the requirements of this chapter.

Summary:

A complete review of the proposed project indicates that the facility is expected to comply with the applicable federal and state air pollution rules and regulations. The Department will make a final recommendation on the issuance of a Permit to Construct for the Engine Fleet following completion of a 30-day public comment period. The public comment period will run from October 30, 2024, through November 29, 2024.

Update post comment period:
[Reserved]

Date of Draft Analysis: October 30, 2024
Date of Final Analysis: [Reserved]

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