GVEA North Pole Power Plant Cover Page

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ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Air Permits Program

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION ADDENDUM
for
Golden Valley Electric Association
North Pole Power Plant

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Abbreviations/Acronyms

AAC ....Alaska Administrative Code
AAAQS ....Alaska Ambient Air Quality Standards
Department ....Alaska Department of Environmental Conservation
BACT ....Best Available Control Technology
CFB……………………Circulating Fluidized Bed
CFR. ....Code of Federal Regulations
Cyclones………………Mechanical Separators
DFP……………………Diesel Particulate Filter
DLN..............................Dry Low NOx
DOC…………………...Diesel Oxidation Catalyst
EPA ....Environmental Protection Agency
ESP……………………Electrostatic Precipitator
EU.................................Emission Unit
FITR…………………...Fuel Injection Timing Retard
GCPs…………………..Good Combustion Practices
HAP ....Hazardous Air Pollutant
ITR……………………Ignition Timing Retard
LEA……………………Low Excess Air
LNB……………………Low NOx Burners
MR&Rs ....Monitoring, Recording, and Reporting
NESHAPS ....National Emission Standards for Hazardous Air Pollutants
NSCR…………………Non-Selective Catalytic Reduction
NSPS ....New Source Performance Standards
ORL ....Owner Requested Limit
PSD...............................Prevention of Significant Deterioration
PTE...............................Potential to Emit
RICE, ICE ....Reciprocating Internal Combustion Engine, Internal Combustion Engine
SCR ....Selective Catalytic Reduction
SIP ....Alaska State Implementation Plan
SNCR…………………Selective Non-Catalytic Reduction
ULSD ....Ultra Low Sulfur Diesel

Units and Measures

gal/hr.............................gallons per hour
g/kWh ....grams per kilowatt hour
g/hp-hr ....grams per horsepower hour
hr/day............................hours per day
hr/yr ....hours per year
hp..................................horsepower
lb/hr ....pounds per hour
lb/MMBtu ....pounds per million British thermal units
lb/1000 gal....................pounds per 1,000 gallons
kW ....kilowatts
MMBtu/hr.....................million British thermal units per hour
MMscf/hr......................million standard cubic feet per hour
ppmv.............................parts per million by volume
tpy.................................tons per year

Pollutants

CO ....Carbon Monoxide
HAP ....Hazardous Air Pollutant
NOx ....Oxides of Nitrogen
SO_2 ....Sulfur Dioxide
$PM_{2.5}$..............................Particulate Matter with an aerodynamic diameter not exceeding 2.5 microns
PM_{10} ....Particulate Matter with an aerodynamic diameter not exceeding 10 microns

1. INTRODUCTION

The North Pole Power Plant (North Pole) is an electric generating facility that combusts distillate fuel in combustion turbines to provide power to the Golden Valley Electric Association (GVEA) grid. The power plant contains two fuel oil-fired simple cycle gas combustion turbines, two fuel oil-fired combined cycle gas combustion turbines, one fuel oil-fired emergency generator, and two propane fired boilers.

In a letter dated April 24, 2015, the Alaska Department of Environmental Conservation (Department) requested the stationary sources expected to be major stationary sources in the particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$) serious nonattainment area perform a voluntary Best Available Control Technology (BACT) review in support of the state agency's required SIP submittal once the nonattainment area is re-classified as a Serious $PM_{2.5}$ nonattainment area. The designation of the area as "Serious" with regard to nonattainment of the 2006 24-hour $PM_{2.5}$ ambient air quality standards was published in Federal Register Vol. 82, No. 89, May 10, 2017, pages 21703-21706, with an effective date of June 9, 2017. [1]

The initial BACT Determination for North Pole was included in Part 4 of Appendix III.D.7.07 Control Strategies Chapter, in the State Air Quality Control Plan adopted on November 19, 2019, with amendments adopted on November 18, 2020, as part of a complete SIP package.[2] The *EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour $PM_{2.5}$ Serious Area and 189(d) Plan*[3] published in the Federal Register on December 5, 2023 (*88 Fed. Reg. 84659*) disapproved of Alaska's initial BACT determinations for $PM_{2.5}$ and SO_2 controls. This BACT addendum addresses the EPA's disapproval of the significant emission units (EUs) listed in the North Pole Power Plant's operating permit AQ0110TVP04 Rev. 1. The BACT addendum also accounts for EPA's comments listed in Memorandum dated August 24, 2022 from Zach Hedgpeth, LSASD to Matthew Jentgen, ARD.[4] This BACT addendum provides the Department's review of the BACT analysis for $PM_{2.5}$, and the BACT analysis for sulfur dioxide (SO_2) emissions, which is a precursor pollutant that can form $PM_{2.5}$ in the atmosphere post combustion. Note that the section for oxides of nitrogen (NOx), which is also a precursor pollutant that can form $PM_{2.5}$ in the atmosphere post combustion, has been removed from this addendum because the EPA has approved[3] of the Department's comprehensive NOx precursor demonstration under 40 C.F.R. 51.1006(a)(1) and 51.1010(a)(2)(ii).

[1] Federal Register, Vol. 82, No. 89, Wednesday May 10, 2017 (https://dec.alaska.gov/air/anpms/comm/docs/2017-09391-CFR.pdf)

[2] Background and detailed information regarding Fairbanks $PM_{2.5}$ State Implementation Plan (SIP) can be found at http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip/.

[3] The EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour $PM_{2.5}$ Serious Area and 189(d) Plan can be found at https://www.regulations.gov/document/EPA-R10-OAR-2022-0115-0426.

[4] Document 000007_EPA Technical Support Document – GVEA BACT TSD v20220824: https://www.regulations.gov/document/EPA-R10-OAR-2022-0115-0214.

The following sections review GVEA's BACT analysis provided for the North Pole Power Plant for technical accuracy and adherence to accepted engineering cost estimation practices.

2. BACT EVALUATION

A BACT analysis is an evaluation of all available control options for equipment emitting the triggered pollutants and a process for selecting the best option based on feasibility, economics, energy, and other impacts. 40 CFR 52.21(b)(12) defines BACT as a site-specific determination on a case-by-case basis. The Department's goal is to: identify BACT for the permanent emission units (EUs) at the GVEA North Pole Power Plant that emit $PM_{2.5}$ and SO_2, establish emission limits which represent BACT, and assess the level of monitoring, recordkeeping, and reporting (MR&R) necessary to ensure GVEA applies BACT for the EUs. The Department based the BACT review on the five-step top-down approach set forth in Federal Register Volume 61, Number 142, July 23, 1996 (Environmental Protection Agency). Table A presents the EUs subject to BACT review.

Table A: Emission Units Subject to BACT Review

EU	EU Name	Description of EU	Rating/Size	Installation Date
1	GT#1	GE Frame 7, Series 7001, Fuel Oil-Fired Model BR Regenerative Simple Cycle Gas Turbine	672 MMBtu/hr (60.5 MW)	1976
2	GT#2	GE Frame 7, Series 7001, Fuel Oil-Fired Model BR Regenerative Simple Cycle Gas Turbine	672 MMBtu/hr (60.5 MW)	1977
5	GT#3	GE LM6000PC Combined Cycle Gas Turbine, Fuel 0-GT (naphtha/LSR fuel) Fired (with water injection for NOx control and CO oxidation catalyst)	455 MMBtu/hr (Higher Heating Value) 43 MW (nominal)	2005
6	GT#4	GE LM6000PC Combined Cycle Gas Turbine, Fuel 0-GT (naphtha/LSR fuel) Fired (with water injection for NOx control and CO oxidation catalyst)	455 MMBtu/hr (Higher Heating Value) 43 MW (nominal)	Est. 2015
7	Emergency Generator	IC Engine, Fuel-Oil Fired	400 kW	2005
11	Propane-Fired Boiler	Bryan Steam RV500 Heater, Gas Fuel-Fired	5.0 MMBtu/hr	2005
12	Propane-Fired Boiler	Bryan Steam RV500 Heater, Gas Fuel-Fired	5.0 MMBtu/hr	2005

GVEA did not include BACT analyses for EUs 3 and 4. These emission units are fuel storage tanks and do not have NOx, $PM_{2.5}$, or SO_2 emissions.

Five-Step BACT Determinations

The following sections explain the steps used to determine BACT for $PM_{2.5}$ and SO_2 for the applicable equipment.

Step 1 Identify All Potentially Available Control Technologies
The Department identifies all available control technologies for the EUs and the pollutant under consideration. This includes technologies used throughout the world or emission reductions through the application of available control techniques, changes in process design, and/or operational limitations. To assist in identifying available controls, the Department reviews available controls listed on the Reasonably Available Control Technology (RACT), BACT, and Lowest Achievable Emission Rate (LAER) Clearinghouse (RBLC). The RBLC is an EPA database where permitting agencies nationwide post imposed BACT for PSD sources. It is usually the first stop for BACT research. In addition to the RBLC search, the Department used several search engines to look for emerging and tried technologies used to control $PM_{2.5}$ and SO_2 emissions from equipment similar to those listed in Table A.

Step 2 Eliminate Technically Infeasible Control Technologies
The Department evaluates the technical feasibility of each control option based on source specific factors in relation to each EU subject to BACT. Based on sound documentation and demonstration, the Department eliminates control technologies deemed technically infeasible due to physical, chemical, and engineering difficulties.

Step 3 Rank the Remaining Control Technologies by Control Effectiveness
The Department ranks the remaining control technologies in order of control effectiveness with the most effective at the top.

Step 4 Evaluate the Most Effective Controls and Document the Results as Necessary
The Department reviews the detailed information in the BACT analysis about the control efficiency, emission rate, emission reduction, cost, environmental, and energy impacts for each option to decide the final level of control. The analysis must present an objective evaluation of both the beneficial and adverse energy, environmental, and economic impacts. A proposal to use the most effective option does not need to provide the detailed information for the less effective options. If cost is not an issue, a cost analysis is not required. Cost effectiveness for a control option is defined as the total net annualized cost of control divided by the tons of pollutant removed per year. Annualized cost includes annualized equipment purchase, erection, electrical, piping, insulation, painting, site preparation, buildings, supervision, transportation, operation, maintenance, replacement parts, overhead, raw materials, utilities, engineering, start-up costs, financing costs, and other contingencies related to the control option. Sections 4 and 5 present the Department's BACT Determinations for $PM_{2.5}$ and SO_2.

Step 5 Select BACT
The Department selects the most effective control option not eliminated in Step 4 as BACT for the pollutant and EU under review. The Department lists the final BACT requirements determined for each EU in this step. A project may achieve emission reductions through the application of available technologies, changes in process design, and/or operational limitations. The Department reviewed GVEA's BACT analysis and made BACT determinations for $PM_{2.5}$ and SO_2 for the North Pole Power Plant. These BACT determinations are based on the information submitted by GVEA in their analysis, information from vendors, suppliers, sub-contractors, RBLC, and an exhaustive internet search.

3. BACT DETERMINATION FOR NOx

As discussed in the Section 1 Introduction, this BACT addendum has removed the previous NOx BACT determinations included in the State Air Quality Control Plan adopted on November 19, 2019, with amendments adopted on November 18, 2020,[2] because the optional comprehensive precursor demonstration (as allowed under 40 C.F.R. 51.1006(1) and 51.1010(a)(2)(ii)) for the precursor gas NOx for point sources illustrates that NOx controls are not needed. The Department submitted with the Serious SIP a final comprehensive precursor demonstration as justification not to require post emission controls for NOx. Please see the precursor demonstration for NOx in the Serious SIP Modeling Chapter III.D.7.8.[2] The $PM_{2.5}$ NAAQS Final SIP Requirements Rule states if the state determines through a precursor demonstration that controls for a precursor gas are not needed for attaining the standard, then the controls identified as BACT/BACM or Most Stringent Measure for the precursor gas are not required to be implemented.[5] The Department's NOx precursor demonstration was approved in *EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour $PM_{2.5}$ Serious Area and 189(d) Plan*[3] published in the Federal Register on December 5, 2023 (*88 Fed. Reg. 84659*).

4. BACT DETERMINATION FOR $PM_{2.5}$

The Department based its $PM_{2.5}$ assessment on BACT determinations found in the RBLC, internet research, and BACT analyses submitted to the Department by GVEA for the North Pole Power Plant and Zehnder Facility, Aurora for the Chena Power Plant, US Army for Fort Wainwright, and UAF for the Combined Heat and Power Plant.

4.1 $PM_{2.5}$ BACT for the Fuel Oil-Fired Simple Cycle Gas Turbines (EUs 1 and 2)

Possible $PM_{2.5}$ emission control technologies for the fuel oil-fired simple cycle gas turbines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 15.110 Simple Cycle Gas Turbines (rated at 25 MW or more) The search results for simple cycle gas turbines are summarized in Table 4-1.

Table 4-1. RBLC Summary of $PM_{2.5}$ Control for Simple Cycle Gas Turbines

Control Technology	Number of Determinations	Emission Limits
Good Combustion Practices	25	0.0038 – 0.0076 lb/MMBtu
Clean Fuels	12	5 – 14 lb/hr

RBLC Review

A review of similar units in the RBLC indicates restrictions on fuel sulfur contents and good combustion practices are the principle PM control technologies installed on simple cycle gas turbines. The lowest $PM_{2.5}$ emission rate listed in the RBLC is 0.0038 lb/MMBtu.

Step 1 - Identification of $PM_{2.5}$ Control Technology for the Simple Cycle Gas Turbines

From research, the Department identified the following technologies as available for control of $PM_{2.5}$ emissions from fuel oil-fired simple cycle gas turbines:

[5] https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf

(a) Low Sulfur Fuel
Low sulfur fuel has been known to reduce particulate matter emissions. $PM_{2.5}$ emission rates for low sulfur fuel are not available and therefore a BACT emissions rate cannot be set for low sulfur fuel. The Department does not consider low sulfur fuel a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(b) Low Ash Fuel
Residual fuels and crude oil are known to contain ash forming components, while refined fuels are low ash. Fuels containing ash can cause excessive wear to equipment and foul combustion components. EUs 1 and 2 are fired exclusively on distillate fuel which is a form of refined fuel, and potential $PM_{2.5}$ emissions are based on emission factors for distillate fuel. The Department considers low ash fuel a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(c) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. Due to EUs 1 and 2 currently operating under limits, the Department considers limited operation as a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(d) Good Combustion Practices (GCPs)
GCPs typically include the following elements:

1. **Sufficient residence time to complete combustion;**
2. **Providing and maintaining proper air/fuel ratio;**
3. **High temperatures and low oxygen levels in the primary combustion zone;**
4. **High enough overall excess oxygen levels to complete combustion and maximize thermal efficiency.**

Combustion efficiency is dependent on the gas residence time, the combustion temperature, and the amount of mixing in the combustion zone. GCPs are accomplished primarily through combustion chamber design as it relates to residence time, combustion temperature, air-to-fuel mixing, and excess oxygen levels. Proper management of the combustion process will result in a reduction of $PM_{2.5}$ emissions. The Department considers GCPs a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

Step 2 - Eliminate Technically Infeasible $PM_{2.5}$ Technologies for the Simple Cycle Gas Turbines
As explained in Step 1 of Section 4.1, the Department does not consider low sulfur fuel as a technically feasible technology to control $PM_{2.5}$ emissions from the fuel oil-fired simple cycle gas turbines.

Step 3 - Rank the Remaining $PM_{2.5}$ Control Technologies for the Simple Cycle Gas Turbines
The following control technologies have been identified and ranked by efficiency for the control of $PM_{2.5}$ emissions from the fuel oil-fired simple cycle gas turbines:

(d) Good Combustion Practices (Less than 40% Control)
(b) Low Ash Fuel (0% Control)
(c) Limited Operation (0% Control)

Control technologies already in practice at the stationary source or included in the design of the EU are considered 0% control for the purpose of the SIP BACT for existing stationary sources.

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA proposes the following as BACT for $PM_{2.5}$ emissions from the fuel oil-fired simple cycle gas turbines:

(a) $PM_{2.5}$ emissions from EUs 1 and 2 shall not exceed 0.012 lb/MMBtu over a 4-hour averaging period; and

(b) Maintain good combustion practices.

Step 5 - Selection of $PM_{2.5}$ BACT for the Simple Cycle Gas Turbines

The Department's finding is that BACT for $PM_{2.5}$ emissions from the fuel oil-fired simple cycle gas turbine is as follows:

(a) $PM_{2.5}$ emissions from EU 1 shall be limited by complying with the combined annual NOx limit for EUs 1, 5, and 6, listed in Condition 16.1a, and the MR&R listed in Conditions 16.1 through 16.4 of Construction Permit AQ0110CPT01 Rev. 1;

(b) $PM_{2.5}$ emissions from EU 2 shall be limited by complying with the 7,992 hour NOx limit listed in Condition 16.1 of Construction Permit AQ0110CPT01 Rev. 1 and the MR&R listed in Conditions 19.1 through 19.4 of Operating Permit AQ0110TVP04;

(c) $PM_{2.5}$ emissions from EUs 1 and 2 shall be controlled by combusting only low ash fuel;

(d) Maintain good combustion practices at all times of operation by following the manufacturer's operation and maintenance procedures;

(e) $PM_{2.5}$ emissions from EUs 1 & 2 shall not exceed 0.012 lb/MMBtu[6] over a 3-hour averaging period; and

(f) Initial compliance with the proposed $PM_{2.5}$ emission limit will be demonstrated by conducting a performance test to obtain an emission rate.

Table 4-2 lists the proposed $PM_{2.5}$ BACT determination for this facility along with those for other fuel oil-fired simple cycle gas turbines located in the Serious $PM_{2.5}$ nonattainment area.

Table 4-2. Comparison of $PM_{2.5}$ BACT for Simple Cycle Gas Turbines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
GVEA – North Pole	Two Fuel Oil-Fired Simple Cycle Gas Turbines	1,344 MMBtu/hr	0.012 lb/MMBtu[6] (3-hour averaging period)	Good Combustion Practices
GVEA – Zehnder	Two Fuel Oil-Fired Simple Cycle Gas Turbines	536 MMBtu/hr	0.012 lb/MMBtu[6] (3-hour averaging period)	Good Combustion Practices

[6] Table 3.1-2a of US EPA's AP-42 Emission Factors. https://www3.epa.gov/ttnchie1/ap42/ch03/final/c03s01.pdf

4.2 $PM_{2.5}$ BACT for the Combined Cycle Gas Turbines (EUs 5 and 6)

Possible $PM_{2.5}$ emission control technologies for the fuel oil-fired combined cycle gas turbines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 15.210, Liquid Fuel-Fired Combined Cycle Combustion Turbines (rated at 25 MW or more). The search results for combined cycle gas turbines are summarized in Table 4-3.

Table 4-3. RBLC Summary for $PM_{2.5}$ Control for the Combined Cycle Gas Turbines

Control Technology	Number of Determinations	Emission Limits
Good Combustion Practices	9	4 – 19.35 lb/hr
Clean Fuels	12	4.7 – 60.6 lb/hr

RBLC Review
A review of similar units in the RBLC indicates good combustion practices and clean fuels are the principle $PM_{2.5}$ control technologies installed on fuel oil-fired combined cycle gas turbines. The lowest NOx emission rate listed in the RBLC is 4 lb/hr.

Step 1 - Identification of $PM_{2.5}$ Control Technology for the Combined Cycle Gas Turbines
From research, the Department identified the following technologies as available for control of $PM_{2.5}$ emissions from fuel oil-fired combined cycle gas turbines rated at 25 MW or more:

(a) Low Sulfur Fuel
Low sulfur fuel has been known to reduce particulate matter emissions. The Department considers low sulfur fuel a technically feasible control technology for the fuel oil-fired combined cycle gas turbines.

(b) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. EUs 5 and 6 currently operate under a combined ORL with EU 1 to restrict the combined NOx emissions from these three units to no more than 1,600 tons per 12 month rolling period. The Department considers limited operation a technically feasible control technology for the fuel oil-fired combined cycle gas turbines.

(c) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of particulate matter. The Department considers GCPs a technically feasible control technology for the fuel oil-fired combined cycle turbines.

Step 2 - Eliminate Technically Infeasible $PM_{2.5}$ Controls for the Combined Cycle Gas Turbines
As explained in Step 1 of Section 4.1, the Department does not consider low sulfur fuel as technically feasible technology to control $PM_{2.5}$ emissions from the fuel oil-fired combined cycle gas turbines.

Step 3 - Rank the Remaining $PM_{2.5}$ Controls for the Combined Cycle Gas Turbines
The following control technologies have been identified and ranked by efficiency for the control of $PM_{2.5}$ emissions from the combined cycle gas turbines:

(c) Good Combustion Practices (Less than 40% Control)
(b) Limited Operation (0% Control)

Control technologies already in practice at the stationary source or included in the design of the EU are considered 0% control for the purpose of the SIP BACT for existing stationary sources.

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA proposes the following as BACT for $PM_{2.5}$ emissions from the fuel oil-fired combined cycle gas turbines:

(a) $PM_{2.5}$ emissions shall not exceed 0.012 lb/MMBtu over a 4-hour averaging period; and

(b) Maintain good combustion practices.

Department Evaluation of BACT for $PM_{2.5}$ Emissions from the Combined Cycle Gas Turbines

The Department reviewed GVEA's proposal and found that in addition to maintaining good combustion practices, limited operation is also a technically feasible control technology.

Step 5 - Selection of $PM_{2.5}$ BACT for the Combined Cycle Gas Turbines
The Department's finding is that BACT for $PM_{2.5}$ emissions from the combined cycle gas turbines is as follows:

(a) $PM_{2.5}$ emissions from EUs 5 and 6 shall be limited by complying with the combined annual NOx limit listed in **Condition 16.1a, and the MR&R listed in Conditions 16.1 through 16.4 of Construction Permit AQ0110CPT01;**

(b) $PM_{2.5}$ emissions from EUs 5 and 6 shall not exceed 0.012 lb/MMBtu[6] over a 3-hour averaging period;

(c) Initial compliance with the proposed $PM_{2.5}$ emission limit will be demonstrated by conducting a performance test to obtain an emission rate; and

(d) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation.

4.3 $PM_{2.5}$ BACT for the Large Diesel-Fired Engine (EU 7)

Possible $PM_{2.5}$ emission control technologies for the large diesel-fired engine were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 17.110-17.190, Large Internal Combustion Engines (>500 hp). The search results for large diesel-fired engines are summarized in Table 4-5.

Table 4-5. RBLC Summary of $PM_{2.5}$ Control for Large Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Federal Emission Standards	12	0.03 – 0.02

Good Combustion Practices	28	0.03 – 0.24
Limited Operation	11	0.04 – 0.17
Low Sulfur Fuel	14	0.15 – 0.17
No Control Specified	14	0.02 – 0.15

RBLC Review
A review of similar units in the RBLC indicates that good combustion practices, compliance with the federal emission standards, low ash/sulfur diesel, and limited operation are the principle $PM_{2.5}$ control technologies installed on large diesel-fired engines. The lowest $PM_{2.5}$ emission rate in the RBLC is 0.02 g/hp-hr.

Step 1 - Identification of $PM_{2.5}$ Control Technology for the Large Diesel-Fired Engine
From research, the Department identified the following technologies as available for controls of $PM_{2.5}$ emissions from diesel fired engines rated at 500 hp or greater:

(a) Diesel Particulate Filter (DPF)
DPFs are a control technology that is designed to physically filter particulate matter from the exhaust stream. Several designs exist which require cleaning and replacement of the filter media after soot has become caked onto the filter media. Regenerative filter designs are also available that burn the soot on a regular basis to regenerate the filter media. DPF can reduce $PM_{2.5}$ emissions by 85%. The Department considers DPF a technically feasible control technology for the large diesel-fired engine.

(b) Diesel Oxidation Catalyst (DOC)
DOC can reportedly reduce $PM_{2.5}$ emissions by 30% and PM emissions by 50%. A DOC is a form of “bolt on” technology that uses a chemical process to reduce pollutants in the diesel exhaust resulting in decreased concentrations. They replace mufflers on vehicles, and require no modifications. More specifically, this is a honeycomb type structure that has a large area coated with an active catalyst layer. As CO and other gaseous hydrocarbon particles travel along the catalyst, they are oxidized thus reducing pollution. The Department considers DOC a technically feasible control technology for the large diesel-fired engine.

(c) Positive Crankcase Ventilation
Positive crankcase ventilation is the process of re-introducing the combustion air into the cylinder chamber for a second chance at combustion after the air has seeped into and collected in the crankcase during the downward stroke of the piston cycle. This process allows any unburned fuel to be subject to a second combustion opportunity. Any combustion products act as a heat sink during the second pass through the piston, which will lower the temperature of combustion and reduce the thermal NOx formation. Positive crankcase ventilation is included in the design of EU 7. The Department considers positive crankcase ventilation a technically feasible control technology for the large diesel-fired engine.

(d) Low Sulfur Fuel

Low sulfur fuel has been known to reduce particulate matter emissions. The Department considers low sulfur fuel as a technically feasible control technology for the large diesel-fired engine.

(e) Low Ash Diesel
Residual fuels and crude oil are known to contain ash forming components, while refined fuels are low ash. Fuels containing ash can cause excessive wear to equipment and foul engine components. EU 7 is fired exclusively on distillate fuel which is a form of refined fuel. The potential $PM_{2.5}$ emissions are based on emission factors for distillate fuel. The Department considers low ash diesel a technically feasible control technology for the large diesel-fired engine.

(f) Federal Emission Standards
<u>RBLC determinations for federal emission standards require the engines meet the requirements of 40 C.F.R. 60 NSPS Subpart IIII, 40 C.F.R 63 Subpart ZZZZ, non-road engines (NREs), or EPA tier certifications. NSPS Subpart IIII applies to stationary compression ignition internal combustion engines that are manufactured or reconstructed after July 11, 2005.</u> Due to EU 7 not being subject to either 40 C.F.R. 60 Subpart IIII or 40 C.F.R. 63 Subpart ZZZZ the Department does not consider federal emission standards a technically feasible control technology for the large diesel-fired engine.

(g) Limited Operation
<u>Limiting the operation of emissions units reduces the potential to emit of those units.</u> Due to EU 7 currently operating under an annual hour limit of no more than 52 hours per 12 month rolling period, the Department considers limited operation a technically feasible control technology for the large diesel-fired engine.

(h) Good Combustion Practices
The theory of GCPs was discussed in detail in the **<u>$PM_{2.5}$ BACT section</u>** for the fuel oil-fired simple cycle turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of NOx emissions. The Department considers GCPs a technically feasible control technology for the large diesel-fired engine.

Step 2 - Eliminate Technically Infeasible $PM_{2.5}$ Control Technologies for the Large Engine
$PM_{2.5}$ emission rates for low sulfur fuel are not available and therefore a BACT emissions rate cannot be set for low sulfur fuel. Low sulfur fuel is not a technically feasible control technology. As explained in Step 1 of Section 4.3, federal emission standards are not technically feasible control technology for control of $PM_{2.5}$ emissions from the large diesel-fired engine.

Step 3 - Rank the Remaining $PM_{2.5}$ Control Technologies for the Large Diesel-Fired Engine
The following control technologies have been identified and ranked by efficiency for the control of $PM_{2.5}$ emissions from the large diesel-fired engines:

(a)	Diesel Particulate Filters	(85% Control)
(g)	Good Combustion Practices	(Less than 40% Control)
(b)	Positive Crankcase Ventilation	(0% Control)

(d) Low Ash Diesel (0% Control)
(f) Limited Operation (0% Control)

Control technologies already in practice at the stationary source or included in the design of the EU are considered 0% control for the purpose of the SIP BACT for existing stationary sources.

Step 4 - Evaluate the Most Effective Controls

GVEA Proposal

GVEA provided an economic analysis for the installation of diesel particulate filter. A summary of the analysis for is shown below:

Table 4-6. GVEA Economic Analysis for Technically Feasible $PM_{2.5}$ Controls

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annual Costs ($/year)	Cost Effectiveness ($/ton)
Diesel Particulate Filter	0.035	0.03	$30,229	$4,304	$143,008
Capital Recovery Factor = 0.1424 (7% interest rate for a 10 year equipment life)					

GVEA contends that the economic analysis indicates that the level of $PM_{2.5}$ reduction does not justify the use of a diesel particulate filter based on the excessive cost per ton of $PM_{2.5}$ removed per year.

GVEA proposes the following as BACT for $PM_{2.5}$ emissions from the large diesel-fired engine:

(a) $PM_{2.5}$ emissions from EU 7 shall be controlled by operating with positive crankcase ventilation;

(b) Maintaining good combustion practices;

(c) $PM_{2.5}$ emissions from EU 7 shall be controlled by limiting operation to no more than 52 hours per 12 month rolling period; and

(d) $PM_{2.5}$ emissions from EU 7 shall not exceed 0.0022 lb/hp-hr[7] over a 4-hour averaging period.

Department Evaluation of BACT for $PM_{2.5}$ Emissions from the Large Diesel-Fired Engine
The Department reviewed GVEA's proposal for the large diesel-fired engine and finds that installing a diesel particulate filter is an economically infeasible control technology. The Department does not agree with some of the assumptions provided in GVEA's cost analysis that cause an overestimation of the cost effectiveness. However, since EU 7 is limited to 52 hours per year, the Department finds it unnecessary to revise the cost analysis as a decrease in 0.03 tpy of $PM_{2.5}$ from EU 7 will not be cost effective for installing a diesel particulate filter.

Step 5 - Selection of $PM_{2.5}$ BACT for the Large Diesel-fired Engine

[7] Emissions Inventory Data: http://dec.alaska.gov/Applications/Air/airtoolsweb/PointSourceEmissionInventory/XmlInventory?reportingYear=2017&organizationKey=10&facilityKey=110&addEmissionUnits=0&addReleasePoints=0

The Department's finding is that the BACT for $PM_{2.5}$ emissions from the large diesel-fired engine is as follows:

(a) $PM_{2.5}$ emissions from EU 7 shall be controlled by operating with positive crankcase ventilation;

(b) $PM_{2.5}$ emissions from EU 7 shall be controlled by limiting operation to no more than 52 hours per 12 month rolling period;

(c) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation;

(d) $PM_{2.5}$ emissions from EU 7 shall not exceed 0.32 g/hp-hr[8] over a 3-hour averaging period; and

(e) Demonstrate compliance with the numerical BACT emission limit by complying with 40 C.F.R 63 Subpart ZZZZ

Table 4-7 lists the proposed $PM_{2.5}$ BACT determination for the facility along with those for other diesel-fired engines rated at more than 500 hp located in the Serious $PM_{2.5}$ nonattainment area.

Table 4-7. Comparison of $PM_{2.5}$ BACT for the Large Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
UAF	Large Diesel-Fired Engine	**> 500 hp**	**0.05 – 0.32 g/hp-hr**	Positive Crankcase Ventilation Limited Operation **Ultra-Low Sulfur Diesel**
Fort Wainwright	8 Large Diesel-Fired Engines	> 500 hp	0.15 – 10.9 g/hp-hr	Limited Operation Ultra-Low Sulfur Diesel Federal Emission Standards Good Combustion Practices
GVEA North Pole	Large Diesel-Fired Engine	600 hp	0.32 g/hp-hr	Positive Crankcase Ventilation Limited Operation Good Combustion Practices
GVEA Zehnder	2 Large Diesel-Fired Engines	11,000 hp (each)	0.32 g/hp-hr	Limited Operation Good Combustion Practices

4.5 $PM_{2.5}$ BACT for the Propane-Fired Boilers (EUs 11 and 12)

Possible $PM_{2.5}$ emission control technologies for the propane-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13.310, Gas-Fired Boilers (<100 MMBtu/hr). The search results for gas-fired boilers are summarized in Table 4-8.

Table 4-8. RBLC Summary of $PM_{2.5}$ Control for Gas-Fired Boilers

Control Technology	Number of Determinations	Emission Limits (lb/MMBtu)
Good Combustion Practices	49	0.0019 – 0.0095

[8] Table 3.4-1 of US EPA's AP-42 Emission Factors (PM). https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf.

Electrostatic Precipitator	3	0.015 – 0.032

RBLC Review
A review of similar units in the RBLC indicates that good combustion practices and electrostatic precipitators are the principle $PM_{2.5}$ control technology determined for propane-fired boilers. The lowest $PM_{2.5}$ emission rate listed in the RBLC is 0.0019 lb/MMBtu.

Step 1 - Identification of $PM_{2.5}$ Control Technology for the Propane-Fired Boilers
From research, the Department identified the following technologies as available for control of $PM_{2.5}$ emissions from propane-fired boilers:

(a) Low Sulfur Fuel
The boilers (EUs 11 and 12) are fired using propane, which is an inherently low sulfur fuel. Condition 11 of AQ0110TVP03 limits the sulfur content of the propane combusted in the boilers to 120 ppmv. Recent tests indicate that the propane fired in the boilers contains less than 3 ppm H_2S as determined by the length-of-stain methodology. The Department considers low sulfur fuel a technically feasible control technology for the propane-fired boilers.

(b) Flue Gas Recirculation
Flue gas recirculation (FGR) involves recycling a portion of the combustion gases from the stack to the boiler combustion air intake. The combustion products are low in oxygen, and when mixed with the combustion air, lower the overall excess oxygen concentration. This process acts as a heat sink to lower the peak flame temperature as well as the residence time at peak flame temperature. These effects work together to limit thermal NOx formation. FGR also increases the amount of combustion, which lowers PM emissions. The Department considers FGR to be a technically feasible control technology for the propane-fired boilers.

(c) Baghouse
Baghouses are comprised of an array of filter bags contained in housing. Air passes through the filter media from the "dirty" to the "clean" side of the bag. These devices undergo periodic bag cleaning based on the build-up of filtered material on the bag as measured by pressure drop across the device. The cleaning cycle is set to allow operation within a range of design pressure drop. Baghouses are characterized by the type of cleaning cycle - mechanical-shaker, pulse-jet, and reverse-air. Fabric filter systems have control efficiencies of 95% to 99.9% [9] and are generally specified to meet a discharge concentration of filterable particulate (e.g., 0.01 grains per dry standard cubic feet). The only entry for a baghouse in the RBLC was for a 30 MMBtu/hr furnace for glass melting at an insulation manufacturing facility and the unit is subject to the PM emission standards under 40 C.F.R. 63 Subpart NNN. EUs 11 and 12 are much smaller units at 5 MMBtu/hr, are used for providing space heating, and have a much lower working temperature. Due to the differences in size, purpose, and operating temperatures, the

[9] https://www3.epa.gov/ttn/catc/dir1/ff-shaker.pdf
https://www3.epa.gov/ttn/catc/dir1/ff-pulse.pdf
https://www3.epa.gov/ttn/catc/dir1/ff-revar.pdf

Department does not consider a baghouse a technically feasible control technology for the propane-fired boilers.

(d) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. EUs 11 and 12 are the only sources of heat for the North Pole Power Plant. Therefore, it is not appropriate to limit the operation of these units. The Department does not consider the use of limited operation a technically feasible control technology for the propane-fired boilers.

(e) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle gas turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of $PM_{2.5}$ emissions. The Department considers GCPs a technically feasible control technology for the propane-fired boiler.

Step 2 - Eliminate Technically Infeasible $PM_{2.5}$ technologies for the Propane-Fired Boilers
As explained in Step 1 of Section 4.5, the Department does not consider a baghouse and limited operation as technically feasible $PM_{2.5}$ control technologies. Flue gas recirculation is not recommended by the vendor as a control technology for EUs 11 and 12, and therefore is not considered a technically feasible control technology.

Step 3 - Rank the Remaining $PM_{2.5}$ Control Technologies for the Propane-Fired Boilers
GVEA has accepted the only technically feasible control technology for EUs 11 and 12. Therefore, ranking is not required.

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA proposes the following as BACT for the propane-fired boilers:

(a) Burn low sulfur fuel in EUs 11 and 12;

(b) $PM_{2.5}$ emissions from EUs 11 and 12 shall not exceed 0.7 lb/1000 gal over a 4-hour averaging period; and

(c) Compliance with the emission limit will be demonstrated with records of maintenance following original equipment manufacturer recommendations for operation and maintenance and periodic measurements of O_2 balance.

Department Evaluation of BACT for $PM_{2.5}$ Emissions from the Propane-Fired Boilers
The Department reviewed GVEA's proposal for EUs 11 and 12 and finds that an emission rate achievable with good combustion practices is also BACT for the propane-fired boilers.

Step 5 - Selection of $PM_{2.5}$ BACT for the Propane-Fired Boilers
The Department's finding is that BACT for $PM_{2.5}$ emissions from the propane-fired boilers is as follows:

(a) Burn only propane as fuel in EUs 11 and 12;

(b) $PM_{2.5}$ emissions from the operation of the propane-fired boilers shall be controlled with good combustion practices;

(c) $PM_{2.5}$ emissions from EUs 11 and 12 shall not exceed 0.008 lb/MMBtu[10] over a 3-hour averaging period; and

(d) Compliance with the emission limit will be demonstrated with records of maintenance following original equipment manufacturer recommendations for operation and maintenance and periodic measurements of O_2 balance.

5. BACT DETERMINATION FOR SO_2

The Department based its SO_2 assessment on BACT determinations found in the RBLC, internet research, and BACT analyses submitted to the Department by GVEA for the North Pole Power Plant and Zehnder Facility, Aurora for the Chena Power Plant, US Army for Fort Wainwright, and UAF for the Combined Heat and Power Plant.

5.1 SO_2 BACT for the Fuel Oil-Fired Simple Cycle Gas Turbines (EUs 1 and 2)

Possible SO_2 emission control technologies for the fuel oil-fired simple cycle gas turbines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 15.190 for Simple Cycle Gas Turbines (rated at 25 MW or more) The search results for simple cycle gas turbines are summarized in Table 5-1.

Table 5-1. RBLC Summary of SO_2 Controls for Fuel Oil-Fired Simple Cycle Gas Turbines

Control Technology	Number of Determinations	Emission Limits
Ultra-Low Sulfur Diesel	7	0.0015 % S by wt.
Fuel Oil (0.05 % S by wt.)	2	0.0026 – 0.055 lb/MMBtu
Good Combustion Practices	3	0.6 lb/hr

RBLC Review

A review of similar units in the RBLC indicates that limiting the sulfur content of fuel and good combustion practices are the principle SO_2 control technologies determined as BACT for fuel oil-fired simple cycle gas turbines. The lowest SO_2 emission rate listed in the RBLC is combustion of ULSD at 0.0015 % S by wt.

Step 1 - Identification of SO_2 Control Technology for the Simple Cycle Gas Turbines

From research, the Department identified the following technologies as available for control of SO_2 emissions from fuel oil-fired simple cycle gas turbines rated at 25 MW or greater:

(a) Ultra Low Sulfur Diesel (ULSD)
ULSD has a fuel sulfur content of 0.0015 percent sulfur by weight or less. Using ULSD would reduce SO_2 emissions because the fuel oil-fired simple cycle gas turbines are combusting standard diesel that has a sulfur content of up to 0.5 percent sulfur by weight. Switching to ULSD could reach a greater than 99 percent decrease in SO_2 emissions from the fuel oil-fired simple cycle gas turbines. The Department considers ULSD a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

[10] Emission factor derived from AP-42 Table 1.5-1 for propane-fired boilers (0.7 lb/1,000 gal) converted to lb/MMbtu.

(b) Low Sulfur Fuel (No. 1 Fuel Oil)
No. 1 fuel oil fuel has a sulfur content of approximately 0.1 percent sulfur by weight. Using No. 1 fuel oil would reduce SO_2 emissions because the fuel oil-fired simple cycle gas turbines are allowed to combust standard No. 2 fuel oil that has a sulfur content of up to 0.5 percent sulfur by weight. Switching to No. 1 fuel oil could reach an 80 percent decrease in SO_2 emissions from the fuel oil-fired simple cycle gas turbines during non-startup operation. The Department considers No. 1 fuel oil a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(c) Limited Operation
Limiting the operation of emissions units reduces the potential to emit of those units. Due to EUs 1 and 2 currently operating under limits, the Department considers limited operation a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(d) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle gas turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2. The Department considers GCPs a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

Step 2 - Eliminate Technically Infeasible SO_2 Technologies for the Simple Cycle Gas Turbines
All control technologies identified are technically feasible for the fuel oil-fired simple cycle gas turbines.

Step 3 - Rank the Remaining SO_2 Control Technologies for the Simple Cycle Gas Turbines
The following control technologies have been identified and ranked for control of SO_2 from the fuel oil-fired simple cycle gas turbines:

(a)	Ultra Low Sulfur Diesel	(99.7% Control)
(b)	Low Sulfur Fuel **(No. 1 Fuel Oil)**	**(80% Control)**
(d)	Good Combustion Practices	(Less than 40% Control)
(c)	Limited Operation	(0% Control)

Control technologies already in practice at the stationary source or included in the design of the EU are considered 0% control for the purpose of the SIP BACT for existing stationary sources.

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA provided an economic analysis for switching the fuel combusted in the simple cycle gas turbines to ultra-low sulfur diesel. A summary of the analyses for each of EUs 1 and 2 is shown below:

Table 5-2. GVEA Economic Analysis for Technically Feasible SO_2 Controls for EU 1

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD (0.0015 % S wt.)	1,486.4	1,481.9	$21,750,638	$20,661,330	$13,942
Capital Recovery Factor = 0.0944 (7% interest rate for a 20 year equipment life)					

Table 5-3. GVEA Economic Analysis for Technically Feasible SO_2 Controls for EU 2

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD (0.0015 % S wt.)	1,356.1	1,352.0	$8,674,362	$18,978,063	$14,037
Capital Recovery Factor = 0.0944 (7% interest rate for a 20 year equipment life)					

GVEA contends that the economic analysis indicates the level of SO_2 reduction does not justify the fuel switch to ULSD or Low Sulfur Fuel in the simple cycle turbines based on the excessive cost per ton of SO_2 removed per year.

GVEA proposes the following as BACT for SO_2 emissions from the simple cycle gas turbines:

(a) SO_2 emissions from the fuel oil-fired simple cycle gas turbines will be controlled by complying with NOx limits for EUs 1 and 2 listed in Operating Permit AQ0110TVP03 Conditions 13 and 12, respectively;

(b) SO_2 emissions from the fuel oil-fired simple cycle gas turbines will be limited by maintain good combustion practices; and

(c) Restricting the sulfur content to 500 ppm in fuel.

Department Evaluation of BACT for SO_2 Emissions from the Simple Cycle Gas Turbines
The Department revised the cost analyses provided by GVEA for the fuel switch to ULSD in the simple cycle gas turbines using an interest rate of **8.5%** (current bank prime interest rate), **a 30-year equipment life, and a cost range for switching from No. 2 fuel oil to ULSD of $0.185/gallon to $0.424/gallon at the North Pole Power Plant based on updated data provided by GVEA. This includes the average price per gallon difference of $0.424/gallon covering the period from January 2017 through October 2018 that was used in the Department's previous analysis, as well as an average price per gallon difference of $0.185/gallon for September 2019 through October 2020, and $0.358 for October 2021 through April 2023. Additionally, the Department reviewed the cost information provided by GVEA to appropriately evaluate the total capital investment of installing two new 1.5-million-gallon ULSD storage tanks at GVEA's North Pole Power Plant.** A summary of these analyses is shown in Table 5-4 and Table 5-5.

Table 5-4. Department Economic Analysis for Technically Feasible SO_2 Controls for EU 1

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD	1,486.4	1481.9	10,875,319	**9,824,223 – 20,646,731**	**6,629 – 13,932**
Capital Recovery Factor = 0.0931 (8.5% interest rate for a 30-year equipment life)					

Table 5-5. Department Economic Analysis for Technically Feasible SO_2 Controls for EU 2

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD	1,356.1	1,352.0	10,875,319	**9,089,779 – 18,963,464**	**6,723 – 14,026**
Capital Recovery Factor = **0.0931 (8.5%** interest rate for a 30-year equipment life)					

The Department's economic analysis indicates the level of SO_2 reduction justifies the use of ULSD as BACT for the fuel oil-fired simple cycle gas turbines located in the Serious $PM_{2.5}$ nonattainment area.

Step 5 - Selection of SO_2 BACT for the Simple Cycle Gas Turbines

The Department's finding is that BACT for SO_2 emissions from the fuel oil-fired simple cycle gas turbines is as follows:

(a) SO_2 emissions from EUs 1 and 2 shall be controlled by limiting the sulfur content of fuel combusted in the turbines to no more than 0.0015 percent by weight;

(b) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation; and

(c) Compliance with the proposed fuel sulfur content limit will be demonstrated with fuel shipment receipts and/or fuel test results for sulfur content.

Table 5-6 lists the proposed SO_2 BACT determination for this facility along with those for other fuel oil-fired simple cycle gas turbines located in the Serious $PM_{2.5}$ nonattainment area.

Table 5-6. Comparison of SO_2 BACT for Simple Cycle Gas Turbines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
GVEA – North Pole	Two Fuel Oil-Fired Simple Cycle Gas Turbines	1,344 MMBtu/hr	0.0015 % S wt.	ULSD
GVEA – Zehnder	Two Fuel Oil-Fired Simple Cycle Gas Turbines	536 MMBtu/hr	0.0015 % S wt.	ULSD

5.2 SO_2 BACT for the Fuel Oil-Fired Combined Cycle Gas Turbines (EUs 5 and 6)

Possible SO_2 emission control technologies for the fuel oil-fired combined cycle gas turbines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 15.290 for Liquid Fuel-Fired Combined Cycle Gas Turbines rated at 25 MW or more. The search results for combined cycle gas turbines are summarized in Table 5-7.

Table 5-7. RBLC Summary of SO_2 Control for Oil-Fired Combined Cycle Gas Turbines

Control Technology	Number of Determinations	Emission Limits
Ultra-Low Sulfur Diesel	1	6.7 lb/hr

RBLC Review
A review of similar units in the RBLC indicates combustion of ultra-low sulfur diesel is the principle SO_2 control technology installed on fuel oil-fired combined cycle gas turbines. The SO_2 emission rate listed in the RBLC is 6.7 lb/hr.

Step 1 - Identification of SO_2 Control Technology for the Combined Cycle Gas Turbines
From research, the Department identified the following technologies as available for the control of SO_2 emissions from the fuel oil-fired combined cycle gas turbines:

(a) Ultra-Low Sulfur Diesel
The theory of ULSD was discussed in detail in the SO_2 BACT for the fuel oil-fired simple cycle turbines and will not be repeated here. The Department considers ULSD a technically feasible control technology for the fuel oil-fired combined cycle gas turbines.

(b) Light Straight Run Turbine Fuel (LSR)
EU 5 typically combusts LSR when not in startup. EU 6 will also combust LSR when not in startup when installed. The sulfur content of the LSR is limited to no more than 0.05 percent by weight as required by Condition 15.1 of Operating Report AQ0110TVP03. The Department considers operating LSR a technically feasible control technology for the fuel oil-fired combined cycle gas turbines.

(c) Low Sulfur Fuel
The theory of low sulfur fuel was discussed in detail in the SO_2 BACT for the fuel oil-fired simple cycle turbines and will not be repeated here. The Department considers low sulfur fuel a technically feasible control technology for the fuel oil-fired combined cycle gas turbines.

(d) Limited Operation
Limiting the operation of emissions units reduces the potential to emit of those units. Due to EUs 5 and 6 currently operating under limits, the Department considers limited operation a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(e) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired combined cycle gas turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2 emissions. The Department considers GCPs a technically feasible control technology for the fuel oil-fired combined cycle gas turbines.

Step 2 - Eliminate Technically Infeasible SO_2 Technologies for the Combined Cycle Gas Turbines
All control technologies identified are technically feasible for the fuel oil-fired combined cycle gas turbines.

Step 3 - Rank the Remaining SO_2 Control Technologies for the Combined Cycle Gas Turbines
The following control technologies have been identified and ranked by efficiency for control of SO_2 emissions from the fuel oil-fired combined cycle gas turbines:

(a) Ultra-Low Sulfur Diesel (50% Control)
(e) Good Combustion Practices (Less than 40% Control)
(b) Light Straight Run Turbine Fuel (0% Control)
(d) Limited Operation (0% Control)
(c) Low Sulfur Fuel (0% Control)

Control technologies already in practice at the stationary source or included in the design of the EU are considered 0% control for the purpose of the SIP BACT for existing stationary sources.

Low sulfur fuel is listed as 0% control as it has the same fuel sulfur content requirements as the light straight run turbine fuel that is currently combusted in the fuel oil-fired combined cycle gas turbines.

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA provided an economic analysis for switching the fuel combusted in the combined cycle gas turbines to ultra-low sulfur diesel. A summary of the analyses for EUs 5 and 6 is shown below:

Table 5-8. GVEA Economic Analysis for Technically Feasible SO_2 Control for EUs 5 and 6

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD	6.0	3.0	--	$34,247,220	$11,415,740
Capital Recovery Factor = 0.1424 (7% interest rate for a 10 year equipment life)					

GVEA contends that the economic analysis indicates the level of SO_2 reduction does not justify the use of ULSD or low sulfur fuel based on the excessive cost per ton of SO_2 removed per year.

GVEA proposes the following as BACT for SO_2 emissions from the combined cycle gas turbines:

(a) SO_2 emissions from EUs 5 and 6 shall combust Light Straight Run Turbine Fuel (30 ppm S in fuel)

Department Evaluation of BACT for SO_2 Emissions from the Combined Cycle Gas Turbines
The Department revised the cost analysis provided for the fuel switch to ULSD in the combined cycle gas turbines by splitting apart normal operations which consume LSR with a maximum sulfur content of 0.005 % by weight, and startup operations which already use ULSD, the top SO_2 control, and therefore do not require an economic analysis. For normal operations, the Department used data provided by GVEA for the difference in the average fuel cost between ULSD and LSR Naphtha delivered to the North Pole Power Plant between January 2017 through October 2018 ($1.117/gallon) and January 2019 through October 2020 ($0.588/gal). Since there is no capital cost involved with the fuel switch to ULSD, the only value driving the cost for the evaluation was the cost difference in the fuel prices between the fuel types which is shown as a range. A summary of the analysis for the two turbines under normal operations is shown in Table 5-9:

Table 5-9. Department Economic Analysis for Technically Feasible SO_2 Controls for Turbines Under Normal Operations

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD	**9.5**	**6.7**	**--**	**17,085,516 – 32,456,669**	**2,559,025 – 4,861,277**
Capital Recovery Factor = **0.0931 (8.5% interest rate for a 30-year** equipment life)					

The Department's economic analysis indicates the level of SO_2 reduction does not justify the use of ULSD as BACT during normal operations for the fuel oil-fired combined cycle gas turbines located in the Serious $PM_{2.5}$ nonattainment area. **However, the Department notes that according to assessable emissions data submitted to the Department by GVEA, EU 5 (currently the only installed EU in the group) has already been combusting ULSD exclusively during startup for at least the past 5 calendar years (2023-2019).**

Step 5 - Selection of SO_2 BACT for the Combined Cycle Gas Turbines
The Department's finding is that BACT for SO_2 emissions from the fuel oil-fired combined cycle gas turbines is as follows:

(a) Except during startup, SO_2 emissions from EUs 5 and 6 shall be controlled by limiting the fuel combusted in the turbines to light straight run turbine fuel (50 ppmw S in fuel);

(b) During startup, SO_2 emission from EUs 5 and 6 shall be controlled by limiting the sulfur content of fuel combusted in the turbines to no more than 0.0015 percent by weight (ULSD);

(c) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation; and

(d) Compliance with the proposed fuel sulfur content limit will be demonstrated with fuel shipment receipts and/or fuel test results for sulfur content.

5.3 SO_2 BACT for the Large Diesel-Fired Engine (EU 7)

Possible SO_2 emission control technologies for large engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 17.100 to 17.190, Large Internal Combustion Engines (>500 hp). The search results for large diesel-fired engines are summarized in Table 5-10.

Table 5-10. RBLC Summary Results for SO_2 Control for Large Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Low Sulfur Diesel	27	0.005 – 0.02
Federal Emission Standards	6	0.001 – 0.005
Limited Operation	6	0.005 – 0.006
Good Combustion Practices	3	None Specified
No Control Specified	11	0.005 – 0.008

RBLC Review
A review of similar units in the RBLC indicates combustion of low sulfur fuel, limited operation, good combustion practices, and compliance with the federal emission standards are the principle SO_2 control technologies installed on large diesel-fired engines. The lowest SO_2 emission rate listed in the RBLC is 0.001 g/hp-hr.

Step 1 - Identification of SO_2 Control Technology for the Large Diesel-Fired Engine
From research, the Department identified the following technologies as available for control of SO_2 emissions from diesel-fired engines rated at 500 hp or greater:

(a) Ultra-Low Sulfur Diesel
The theory of ULSD was discussed in detail in the SO_2 BACT for the fuel oil-fired simple cycle gas turbines and will not be repeated here. The Department considers ULSD a technically feasible control technology for the large diesel-fired engine.

(b) Federal Emission Standards
The theory of federal emission standards was discussed in detail in the $PM_{2.5}$ BACT section for the large diesel-fired engine and will not be repeated here. The Department does not consider federal emission standards a feasible control technology for the large diesel-fired engine.

(c) Limited Operation
<u>Limiting the operation of emissions units reduces the potential to emit of those units</u>. The Department considers limited operation as a technically feasible control technology for the large diesel-fired engine.

(d) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle turbines and will not be repeated here. Proper management of the

combustion process will result in a reduction of NOx emissions. The Department considers GCPs a technically feasible control technology for the large diesel-fired engine.

Step 2 - Eliminate Technically Infeasible SO_2 Control Technologies for the Large Engine
As explained in Step 1 of Section 5.3, the Department does not consider federal emission standards a technically feasible control technology to control SO_2 emissions from the large diesel-fired engine.

Step 3 - Rank the Remaining SO_2 Control Technologies for the Large Diesel-Fired Engine
The following control technologies have been identified and ranked by efficiency for the control of SO_2 emissions from the large diesel-fired engine:

(a) Ultra-Low Sulfur Diesel (99% Control)
(d) Good Combustion Practices (Less than 40% Control)
(c) Limited Operation (0% Control)

Control technologies already in practice at the stationary source or included in the design of the EU are considered 0% control for the purpose of the SIP BACT for existing stationary sources.

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA provided an economic analysis of the control technologies available for the large diesel-fired engine to demonstrate that the use of ULSD with limited operation is not economically feasible on these units. A summary of the analysis for EU 7 is shown below:

Table 5-11. GVEA Economic Analysis for Technically Feasible SO_2 Controls

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD	0.01005	0.0099	--	$444	$45,072
Capital Recovery Factor = 0.1424 (7% interest rate for a 10 year equipment life)					

GVEA contends that the economic analysis indicates the level of SO_2 reduction does not justify the use of ULSD based on the excessive cost per ton of SO_2 removed per year.

GVEA proposed the following as BACT for SO_2 emissions from the diesel-fired engine:

(a) SO_2 emissions from the large diesel-fired engine shall not exceed 0.05 weight percent sulfur; and

(b) Maintain good combustion practices.

<u>Department Evaluation of BACT for SO_2 Emissions from the Large Diesel-Fired Engine</u>
<u>The Department reviewed GVEA's proposal for the large diesel-fired engine and revised the cost analysis for the fuel switch to ULSD. The Department used the difference in the</u>

average fuel cost between ULSD versus No. 1 fuel oil delivered to the North Pole Power Plant between January 2019 through October 2020, of $0.223/gallon and between October 2021 and April 2023, of $0.651/gallon. For baseline emissions, the Department used the existing fuel sulfur limit of 0.1 percent by weight contained in Condition 5 of Construction Permit AQ0110CPT01, March 3, 2006 (incorporated into Operating Permit AQ0110TVP04 Rev. 1 as Condition 15), as well as the existing 52-hour yearly limit from Conditions 6 and 15 of the construction and operating permit, respectively. Since there is no capital cost involved with the fuel switch from fuel oil with a sulfur content of 0.1 percent by weight to ULSD, the only value driving the cost for the evaluation was the yearly cost difference in the fuel prices between the two fuel types. A summary of the analysis for the large diesel-fired engine is shown below in Table 5-12.

Table 5-12. Department Economic Analysis for Technically Feasible SO_2 Controls

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD	0.0118	0.0116	--	444 – 1,083	38,150 – 93,086
Capital Recovery Factor = 0.0931 (8.5% interest rate for a 30-year equipment life)					

The Department's economic analysis indicates the level of SO_2 reduction does not justify the use of ULSD as BACT for the large diesel fired engine located in the Serious $PM_{2.5}$ nonattainment area.

Step 5 - Selection of SO_2 BACT for the Large Diesel-Fired Engine

The Department's finding is that the BACT for SO_2 emissions from the diesel-fired engine is as follows:

(a) SO_2 emissions from EU 7 shall be controlled by combusting fuel that does not exceed **0.05 weight percent sulfur (500 ppmw)** at all time the unit is in operation;

(b) SO_2 emissions from EU 7 shall be controlled by limiting operation to no more than 52 hours per 12 month rolling period;

(c) Compliance with the SO_2 emission limit while firing diesel fuel will be demonstrated by fuel shipment receipts and/or fuel test results for sulfur content; and

(d) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation.

The following table lists the proposed BACT determination for this facility along with those for other diesel-fired engines rated at more than 500 hp in the Serious $PM_{2.5}$ nonattainment area.

Table 5-13. Comparison of SO_2 BACT for Large Diesel-Fired Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	8 Large Diesel-Fired Engines	> 500 hp	15 ppmw S in fuel	Limited Operation Good Combustion Practices Ultra-Low Sulfur Diesel

Facility	Process Description	Capacity	Limitation	Control Method
UAF	Large Diesel-Fired Engine	13,266 hp	15 ppmw S in fuel	Limited Operation Good Combustion Practices Ultra-Low Sulfur Diesel
GVEA North Pole	Large Diesel-Fired Engine	600 hp	500 ppmw S in fuel	Limited Operation **Low Sulfur Diesel** Good Combustion Practices
GVEA Zehnder	2 Large Diesel-Fired Engines	11,000 hp	15 ppmw S in fuel	Good Combustion Practices Ultra-Low Sulfur Diesel

5.4 SO_2 BACT for the Propane-Fired Boilers (EUs 11 and 12)

Possible SO_2 emission control technologies for the propane-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13.310, Gas-Fired Boilers (<100 MMBtu/hr). The search results for gas-fired boilers are summarized in Table 5-14.

Table 5-14. SO_2 Control for Gas-Fired Boilers with a Rating < 100 MMBtu/hr

Control Technology	Number of Determinations	Emission Limits
Low Sulfur Fuel	6	0.03 – 0.12 lb/hr
Good Combustion Practices	4	0.0048 – 0.6 lb/MMBtu
Pipeline Quality Natural Gas	28	0.0006 – 0.0048 lb/MMBtu
No Control Specified	4	0.0021 lb/MMBtu

RBLC Review
A review of similar units in the RBLC indicates that good combustion practices and combustion of low sulfur fuel are the principle SO_2 control technologies installed on propane-fired boilers. The lowest SO_2 emission rate listed in the RBLC is 0.0006 lb/MMBtu.

Step 1 - Identification of SO_2 Control Technology for the Propane-Fired Boilers
From research, the Department identified the following technologies as available for SO_2 control for the propane-fired boilers:

(a) Low Sulfur Fuel
The theory of low sulfur fuel was discussed in detail in the $PM_{2.5}$ BACT for the propane-fired boilers and will not be repeated here. The Department considers low sulfur fuel a technically feasible control technology for the propane-fired boilers.

(b) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle gas turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2. The Department considers GCPs a technically feasible control technology for the propane-fired boilers.

Step 2 - Eliminate Technically Infeasible SO_2 Technologies for the Propane-Fired Boilers
All identified control devices are technically feasible technologies for the propane-fired boilers.

Step 3 - Rank the Remaining SO_2 Control Technologies for the Propane-Fired Boilers
GVEA has accepted the only technically feasible control technology for the propane-fired boilers. Therefore, ranking is not required.

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA proposed the following as BACT for SO_2 emissions from the propane-fired boilers:

(a) SO_2 emissions from the operation of the propane-fired boilers shall be controlled by using low sulfur fuel at all times of operation.

(b) SO_2 emissions from the propane-fired boilers shall not exceed 0.0012 lb/kgal over a 4-hour averaging period.

Department Evaluation of BACT for SO_2 Emissions from the Propane-Fired Boilers
The Department reviewed GVEA's proposal for the propane-fired boilers and finds that the SO_2 emission rate provided by GVEA was erroneously calculated. The Department used AP-42 Table 1.5-1 emission factor for propane combustion (0.10S lb/1,000 gal, where S = gr/100 scf) and using the existing sulfur limit in Condition 11 of the stationary source's Operating Permit AQ0110TVP03 (120 ppmv) The Department corrected this emission factor to 0.75 lb/1,000 gal, assuming 16 ppmv sulfur = 1 gr/100 scf.

Step 5 - Selection of SO_2 BACT for the Propane-Fired Boilers
The Department's finding is that BACT for SO_2 emissions from the propane-fired boilers is as follows:

(a) SO_2 emissions from EUs 11 and 12 shall be controlled by only combusting gas fuel (propane) with a total sulfur content of no more than 120 ppmv, or direct emissions of 0.75 lb/1,000 gal;

(b) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation; and

(c) Compliance with the emission rate limit will be demonstrated with fuel shipment receipts that indicate that propane was the fuel that was delivered.

6. BACT DETERMINATION SUMMARY

Table 6-1. NOx BACT Limits

EU ID	Description	Capacity	BACT Limit	BACT Control
All	N/A	N/A	**EPA approved a comprehensive precursor demonstration for NOx** **See details in the Section 1 Introduction**	

Table 6-2. $PM_{2.5}$ BACT Limits

EU ID	Description	Capacity	BACT Limit	BACT Control
1	Fuel Oil-Fired Simple Cycle Gas Turbine	672 MMBtu/hr	0.012 lb/MMBtu	Low Ash Fuel Limited Operation Good Combustion Practices
2	Fuel Oil-Fired Simple Cycle Gas Turbine	672 MMBtu/hr	0.012 lb/MMBtu	
5	Fuel Oil-Fired Combined Cycle Gas Turbine	455 MMBtu/hr	0.012 lb/MMBtu	Limited Operation Good Combustion Practices
6	Fuel Oil-Fired Combined Cycle Gas Turbine	455 MMBtu/hr	0.012 lb/MMBtu	
7	Large Diesel-Fired Engine	619 hp	0.32 g/hp-hr	Limited Operation Positive Crankcase Ventilation Good Combustion Practices
11	Propane-Fired Boiler	5.0 MMBtu/hr	0.008 lb/MMBtu	Propane as Fuel Good Combustion Practices
12	Propane-Fired Boiler	5.0 MMBtu/hr	0.008 lb/MMBtu	

Table 6-3. SO_2 BACT Limits

EU ID	Description	Capacity	BACT Limit	BACT Control
1	Fuel Oil-Fired Simple Cycle Gas Turbine	672 MMBtu/hr	15 ppmw S in fuel	Limited Operation Ultra-Low Sulfur Diesel Good Combustion Practices
2	Fuel Oil-Fired Simple Cycle Gas Turbine	672 MMBtu/hr	15 ppmw S in fuel	
5	Fuel Oil-Fired Combined Cycle Gas Turbine	455 MMBtu/hr	50 ppmw S in fuel **(Normal Ops)**	Limited Operation Light Straight Run Turbine Fuel **(Normal Operations)** **ULSD (Start-Up)** Good Combustion Practices
			15 ppmw S in fuel (Start-Up)	
6	Fuel Oil-Fired Combined Cycle Gas Turbine	455 MMBtu/hr	**50 ppmw S in fuel (Normal Ops)**	
			15 ppmw S in fuel (Start-Up)	
7	Large Diesel-Fired Engine	619 hp	500 ppmw S in fuel	Limited Operation Good Combustion Practices **Low Sulfur Fuel**
11	Propane-Fired Boiler	5.0 MMBtu/hr	120 ppmv S in fuel	Propane as Fuel Good Combustion Practices
12	Propane-Fired Boiler	5.0 MMBtu/hr	120 ppmv S in fuel	

Stationary Source: North Pole Power Plant

Emission Units: EU IDs 1 and 2 (672 MMBtu/hr (60.5 MW) Simple Cycle Turbines)

Pollutant of Concern: $PM_{2.5}$	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** [1]
0.012 lb/MMBtu (3-hr avg);	• In each Annual Compliance Certification required by the Operating Permit, report the compliance status for this requirement. • Conduct a one-time performance test using Method 201A and 202 at maximum achievable load to demonstrate compliance and submit results to the Department.
Combust Only Low Ash (Distillate) Fuel	• For each shipment of fuel combusted, keep receipts that specify fuel grade, and quantity of fuel received. • Include a statement in each operating report required by the Operating Permit, affirming that the fuel delivered was a low ash (distillate) fuel.
Good Combustion Practices	• Keep records of maintenance conducted on emission units to comply with this BACT measure. • Keep a copy of the manufacturer's and the operator's recommended maintenance procedures. • If manufacturer specifications provide specific recommended combustion settings for CO and O2 concentrations in the flue gas, at least once during each quarter that the emission unit operates, measure CO and O2 in the exhaust stream using a portable handheld combustion analyzer and report these values in the following semi-annual operating report required by the Operating Permit.
Limited Operation	• EU 1 shall comply with the combined annual NOx limit for EUs 1, 5, and 6, listed in Condition 16.1a, and the MR&R listed in Conditions 16.1 through 16.4 of Construction Permit AQ0110CPT01 Rev. 1. • EU 2 shall comply with the 7,992 hour NOx limit listed in Condition 16.1 of Construction Permit AQ0110CPT01 Rev. 1 and the MR&R listed in Conditions 19.1 through 19.4 of Operating Permit AQ0110TVP04.

Emission Units: EU IDs 5 and 6 (455 MMBtu/hr (43 MW) Combined Cycle Turbines)

Pollutant of Concern: $PM_{2.5}$	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements**[1]
0.012 lb/MMBtu (3-hr avg)	• In each Annual Compliance Certification required by the Operating Permit, report the compliance status for this requirement. • Conduct a one-time performance test at maximum achievable load using EPA Method 201A and 202 to demonstrate compliance and submit results to the Department.

[1] While the substantive requirements are described here, for any permit containing the requirement, the actual language may differ in non-substantive ways and include additional details.

Comply with 1,600 TPY combined NOx limit for EUs 1, 5, and 6, listed in Condition 16.1a of Construction Permit AQ0110CPT01 Rev. 1	• Include a statement in each operating report required by the Operating Permit, affirming that the Permittee complied with the combined NOx limit for EUs 1, 5, and 6 found in Condition 16.1a of Construction Permit AQ0110CPT01 Rev. 1. • Perform the MR&R required by Conditions 16.1 through 16.4 of Construction Permit AQ0110CPT01 Rev. 1.
Good Combustion Practices	• Keep records of maintenance conducted on emission units to comply with this BACT measure. • Keep a copy of the manufacturer's and the operator's recommended maintenance procedures. • If manufacturer specifications provide specific recommended combustion settings for CO and O_2 concentrations in the flue gas, at least once during each quarter that the emission unit operates, measure CO and O_2 in the exhaust stream using a portable handheld combustion analyzer and report these values in the following semi-annual operating report required by the Operating Permit.

Emission Units: EU IDs 7 (400 kW Emergency Diesel Engine)

Pollutant of Concern: $PM_{2.5}$	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** [1]
Limit Operation to 52 hours per 12-month rolling period	• Demonstrate compliance by complying with Conditions 6 through 6.2 of Construction Permit AQ0110CPT01 Rev. 1.
Installation of positive crankcase ventilation (PVC)	• Submit initial certification in a Facility Operating Report that a positive crankcase ventilation system has been installed or is an inherent design. • Operate, maintain, and inspect according to the manufacturer's instructions and recommendations.
0.32 g/hp-hr (3-hr avg)	• Demonstrate compliance by complying with the NESHAP Subpart ZZZZ general requirements listed in 40 CFR 63.6605 and the monitoring, installation, collection, operation, and maintenance requirements listed in 63.6625(e).
Good Combustion Practices	• Demonstrate compliance by complying with the NESHAP Subpart ZZZZ general requirements listed in 40 CFR 63.6605 and the monitoring, installation, collection, operation, and maintenance requirements listed in 63.6625(e).

Emission Units: EU IDs 11 and 12 (5.0 MMBtu/hr Boilers)

Pollutant of Concern: $PM_{2.5}$	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** [1]

0.008 lb/MMBtu (3-hr avg)	• In each Annual Compliance Certification required by the Operating Permit, report the compliance status for this requirement.
Combust Only Propane as Fuel	• Demonstrate compliance by complying with Conditions 7 through 7.3 of Construction Permit AQ0110CPT01 Rev. 1.
Good Combustion Practices and Periodic O_2 Monitoring	• Keep records of maintenance conducted on emission units to comply with this BACT measure. • Keep a copy of the manufacturer's and the operator's recommended maintenance procedures. • If manufacturer specifications provide specific recommended combustion settings for CO and O_2 concentrations in the flue gas, at least once during each quarter that the emission unit operates, measure CO and O_2 in the exhaust stream using a portable handheld combustion analyzer and report these values in the following semi-annual operating report required by the Operating Permit.

Stationary Source: North Pole Power Plant

Emission Units: EU IDs 1 and 2 (672 MMBtu/hr (60.5 MW) Simple Cycle Turbines)

Pollutant of Concern: SO_2	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** Error! Bookmark not defined.
Combust Only Ultra Low Sulfur fuel at no more than 0.0015 percent sulfur by weight	• For each shipment of fuel, test sulfur content or keep receipts that specify fuel grade, date and time, and quantity of fuel received. Keep records of the results of sulfur content tests and receipts for fuel shipments. • Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.
Good Combustion Practices	• Keep records of maintenance conducted on emission units to comply with this BACT measure. • Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.

Emission Units: EU IDs 5 and 6 (455 MMBtu/hr (43 MW) Combined Cycle Turbines)

BACT Measure	Monitoring, Recordkeeping and Reporting Requirements Error! Bookmark not defined.
Combust Only Ultra Low Sulfur fuel during startup	• For each shipment of fuel, test the sulfur content or keep receipts that specify fuel grade, date and time, and quantity of fuel received. Keep records of the results of sulfur content tests and receipts for fuel shipments. • Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.
Except during startup, limit sulfur content in fuel to 50 ppmw	• For each shipment of fuel, test the sulfur content or keep receipts that specify fuel grade, date and time, and quantity of fuel received. Keep records of the results of sulfur content tests and receipts for fuel shipments. • Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.
Good Combustion Practices	• Keep records of maintenance conducted on emission units to comply with this BACT measure. • Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.

Emission Unit: EU ID 7 (400 kW Emergency Diesel Engine)

Pollutant of Concern: SO_2	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** Error! Bookmark not defined.

Limit the sulfur content of the fuel combusted to 0.05 weight percent	• For each shipment of fuel combusted in EU ID 7, keep receipts that specify fuel grade, and quantity of fuel received. • Include in each semi-annual operating report a summary of the records listed above.
Good Combustion Practices	• Demonstrate compliance by complying with the NESHAP Subpart ZZZZ general requirements listed in 40 CFR 63.6605 and the monitoring, installation, collection, operation, and maintenance requirements listed in 63.6625(e).
Limit operation to no more than 52 hours per 12 month rolling period	• Demonstrate compliance by complying with Conditions 6 through 6.2 of Construction Permit AQ0110CPT01 Rev. 1.

Emission Units: EU IDs 11 and 12 (5.0 MMBtu/hr Boilers)

Pollutant of Concern: SO_2	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** Error! Bookmark not defined.
Combust only propane with a total sulfur content of no more than 120 ppmv, or direct emissions of 0.75 lb/1,000 gal;	• For each shipment of fuel, test the sulfur content or keep receipts that specify fuel grade, date and time, and quantity of fuel received. Keep records of the results of sulfur content tests and receipts for fuel shipments. • Alternatively, conduct a stack test to directly measure SO_2 emissions and report results in lb/1,000 gal of fuel combusted. • Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.
Good Combustion Practices	• Keep records of maintenance conducted on emission units to comply with this BACT measure. • Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.

All prices per gallon

								VDZ 5/24	VDZ 5/26																		WK 1	WK 2	WK 3		Average for fuel type
			Jan-19	Feb-19	Mar-19	Apr-19	May-19	May-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Oct-20	Oct-20		
North Pole	Naphtha	PSI Base Price	-		-	-	$1.661	-	-	$1.614	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$1.638	
		PSI & Federal surcharges *	-		-	-	$0.001	-	-	$0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$0.001	$1.639
	LSR Naphtha	PSI Base Price	$1.503	$1.534	$1.553	$1.462	$1.305	-	-	$1.343	$1.349	$1.293	$1.870	$1.100	$1.403	$1.625	$1.608	$1.291	$1.070	$0.836	$0.928	$1.210	$1.239	$1.250	$1.230	$1.222	-	-	$1.328	
		PSI & Federal surcharges *	$0.001	$0.001	$0.001	$0.001	$0.001	-	-	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	$0.002	$1.330
	QB Naphtha	PSI Base Price	$1.747	$1.890	$1.940	-	$2.006	-	-	$1.890	$1.925	$1.784	$1.237	$1.840	$1.864	$1.910	$1.882	$1.671	$0.951	$0.668	$0.912	$1.250	$1.295	$1.261	$1.178	$1.183	-	-	$1.537	
		PSI & Federal surcharges *	$0.001	$0.001	$0.001	-	$0.001	-	-	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	$0.002	$1.539
	DF2+10	PSI Base Price	-	-	-	-	$2.295	-	-	$2.249	$2.135	$2.027	$2.095	-	-	-	-	-	-	-	$0.860	$1.170	$1.277	$1.254	$1.139	$1.237	$1.268	-	$1.584	
		PSI & Federal surcharges *	-	-	-	-	$0.001	-	-	$0.001	$0.001	$0.001	$0.001	-	-	-	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	$0.002	
		PSI Ops Surcharge	-	-	-	-	$0.05	-	-	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	-	-	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	-	$0.058	
		Big State Delivery	-	-	-	-	$0.020	-	-	$0.020	$0.020	$0.020	$0.020	-	-	-	-	-	-	-	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	-	$0.020	
		Big State Fuel Surcharge	-	-	-	-	28.0%	-	-	27.0%	27.0%	26.0%	26.0%	-	-	-	-	-	-	-	17.0%	17.0%	18.0%	18.0%	18.5%	18.5%	18.5%	-	$0.0043	$1.668
	DF2-15	PSI Base Price	$1.938	$2.083	$2.157	$2.228	$2.295	-	-	-	-	-	$2.095	$2.108	$2.144	$2.150	$2.131	$1.831	$1.345	$0.794	$0.860	-	$1.277	$1.254	-	$1.237	$1.268	$1.339	$1.712	
		PSI & Federal surcharges *	$0.001	$0.001	$0.001	$0.001	$0.001	-	-	-	-	-	$0.001	$0.001	$0.001	$0.001	$0.003	$0.003	$0.031	$0.003	$0.003	-	$0.003	$0.003	-	$0.003	$0.003	$0.003	$0.004	
		PSI Ops Surcharge	$0.05	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.06	$0.06	$0.06	$0.06	$0.06	-	$0.06	$0.06	-	$0.06	$0.06	$0.06	$0.057	
		Big State Delivery	$0.020	$0.020	$0.020	$0.020	$0.020	-	-	-	-	-	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	-	$0.020	$0.020	-	$0.020	$0.020	$0.020	$0.020	
		Big State Fuel Surcharge	23.5%	24.0%	26.0%	26.0%	28.0%	-	-	-	-	-	26.0%	26.5%	30.0%	26.5%	26.5%	24.0%	22.0%	19.0%	17.0%	-	18.0%	18.0%	-	18.5%	18.5%	18.5%	$0.0046	$1.798
	DF1 HS	PSI Base Price	-	-	-	-	$2.295	-	-	$2.249	-	-	-	-	-	$2.150	$2.131	-	-	$0.794	$0.860	$1.170	$1.277	$1.254	$1.139	-	-	-	$1.532	
		PSI & Federal surcharges *	-	-	-	-	$0.001	-	-	$0.001	-	-	-	-	-	$0.001	$0.003	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	-	$0.003	
		PSI Ops Surcharge	-	-	-	-	$0.05	-	-	$0.05	-	-	-	-	-	$0.05	$0.06	-	-	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	-	-	-	$0.060	
		Big State Delivery	-	-	-	-	$0.020	-	-	$0.020	-	-	-	-	-	$0.020	$0.020	-	-	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	-	-	-	$0.020	
		Big State Fuel Surcharge	-	-	-	-	28.0%	-	-	27.0%	-	-	-	-	-	26.5%	26.5%	-	-	19.0%	17.0%	17.0%	18.0%	18.0%	18.5%	-	-	-	$0.0043	$1.618
	ULSD	PSI Base Price	$1.747	$1.894	$1.971	$2.096	$2.158	$2.176	$2.717	$1.907	$1.997	$1.523	$1.961	$2.148	$2.223	$2.237	$2.155	$1.843	$1.456	$0.964	$0.969	$1.230	$1.375	$1.401	$1.299	$1.411	-	-	$1.786	
		PSI & Federal surcharges *	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001	$0.014	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	$0.002	
		PSI Delivery Charge	$0.155	$0.155	$0.155	$0.155	$0.155	$0.000	$0.000	$0.155	$0.155	$0.155	$0.155	$0.170	$0.170	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	-	-	$0.072	
		PSI Fuel Surcharge	17.5%	16.5%	18.0%	19.0%	20.0%	0.0%	0.0%	21.0%	18.5%	19.5%	18.5%	19.0%	21.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-	-	$0.0063	
		PSI Truck Freight	15.0%	15.0%	15.0%	15.0%	15.0%	0.0%	0.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-	-	$0.0118	
		Big State Delivery	$0.020	$0.020	$0.020	$0.020	$0.020	$0.165	$0.165	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	-	-	$0.032	
		Big State Fuel Surcharge	23.5%	24.0%	26.0%	26.0%	28.0%	28.0%	28.0%	27.0%	27.0%	26.0%	26.0%	26.5%	30.0%	26.5%	26.5%	24.0%	22.0%	19.0%	17.0%	17.0%	18.0%	18.0%	18.5%	18.5%	-	-	$0.0076	$1.918

$1.918	$0.250	Difference between ULSD and DF2+10 at NPPP
$1.918	$0.185	Difference between ULSD and No.2 fuels at NPPP
$1.918	$0.223	Difference between ULSD and No. 1 and No.2 fuel at NPPP
$1.918	$0.300	Difference between ULSD and No. 1
$1.918	$0.588	Difference between ULSD and LSR Naphtha at NPPP
$1.918	$0.415	Difference between ULSD and Naphtha (average)

	HS#2+10	HS#2-15	No. 1 ULS <15 ppm	Difference between ULS and HS2	NO 1 < 1,000 ppm	Difference between ULS and No. 1
Weighted Average	$ 4.2754	$ 2.7819	$ 3.8870	$ 0.358	$3.2358	$ 0.651

GVEA
Golden Valley Electric Association
PO Box 71249, Fairbanks, AK 99707-1249 • (907) 452-1151 • www.gvea.com
Your Touchstone Energy® Cooperative

April 28, 2023

Certified Mail
Return Receipt Requested
7018 1130 0001 6544 6793

ADEC Air Permits Program
ATTN: Emissions Inventory
555 Cordova Street
Anchorage, AK 99501

Subject: Golden Valley Electric Association
2022 Point Source Emission Inventory
North Pole Power Plant

Golden Valley Electric Association (GVEA) is submitting a 2022 Annual Point Source Emission Inventory for the North Pole Power Plant (Permit No. AQ0110TVP04, Rev. 1).

An excel template and guidance document are available on the ADEC website at http://dec.alaska.gov/Applications/Air/airtoolsweb/PointSourceEmissionInventory. The guidance document posted on the ADEC website requires reporting of:

- PM10 Primary (Filt + Cond)(PM10-PRI);
- PM2.5 Primary (Filt + Cond)(PM25-PRI); and, if applicable,
- PM10 Filterable (PM10-FIL);
- PM2.5 Filterable (PM25-FIL); and
- PM Condensable (PM-CON).

The excel template available on the ADEC website includes reporting of:

- PM10 Primary (Filt + Cond)(PM10-PRI);

Due to the discrepancies between the excel template and guidance document, GVEA has chosen to report the following PM-related pollutants in the 2022 Point Source Emission Inventory similar to previous inventories.

- PM10 Primary (Filt + Cond)(PM10-PRI);
- PM2.5 Primary (Filt + Cond)(PM25-PRI);
- PM2.5 Filterable (PM25-FIL); and
- PM Condensable (PM-CON).

If you have any questions please contact me by phone at 907-458-4557 or by email at nmknight@gvea.com. The certification from Christopher Forrest, Director of Power Supply, follows.

Sincerely,

Naomi Morton Knight, P.E.
Environmental Officer

Enclosures: 2022 North Pole Point Source Emission Inventory

Certification

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate and complete.

Sincerely,

Christopher Forrest
Director of Power Supply

Stationary Source Detail		
Inventory Start Date	1/1/2022	
Inventory End Date	12/31/2022	
ADEC ID	110	
AFS ID	0209000011	
Census Area	Fairbanks North Star Borough (090)	
Name	North Pole Power Plant	
Physical Location	1500 H & H Lane	
	North Pole, AK 99705	
	Lat 64.73444	Long -147.3453
	Legal Description: Not Available	
Owner Name, Address, and Contact Number	Naomi Morton Knight, P.E.	
	Golden Valley Electric Association	
	PO Box 71249	
	Fairbanks, AK 99707-1249	
	907-458-4557	
Line of Business (NAICS)	221112	
Line of Business (SIC)	4911	
Facility Status	Operating	
Facility Status Year	1976	

Emission Unit 01					
Specifications					
ID	01		Design Capacity	672 MILLION BTU PER HOUR	
Description	GT#1 Gas Turbine		Emission Unit Status	Operating	
Manufacturer	General Electric		Manufactured Year	Installed 1976	
Model Number	Frame 7 Series 7001 Model BR		Serial Number	238057	
Regulations					
Regulation/Description					
Not Applicable					
> Control Equipment					
Capture Efficiency (%)	0				
System Description	None				
Equipment Type(s)	None				
Pollutants Controlled					
Pollutant Description				Reduction Efficiency (%)	
Not Applicable				Not Applicable	
Processes					
Process	Primary Process				
SCC Code	20100109				
	> Internal Combustion Engines				
	> Electric Generation				
	> Distillate Oil (Diesel)				
	> Turbine: Exhaust				
Material Processed	Distillate Oil (No. 2)				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
484,209	gallons	16.6	25.8	24.9	32.7
Operational Schedule					
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
0.1	0.5	1.0	167.9		
Fuel Characteristics					
Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content	Ash Content		
136.602	0.303	Not Available	Not Available		
Heating					
Heat Input (MMBtu/hr)		Heat Output		Heat Values Convention	
394		Not Available		HHV	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	6.5E+00	POUNDS	HOUR	2022 CEMS Average	5.456E-01
Ammonia (NH_3)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO_X)	3.1E+02	POUNDS	HOUR	2022 CEMS Average	2.584E+01
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	3.969E-01
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	3.969E-01
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.422E-01
PM Condensible (PM-CON)	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.381E-01
Sulfur Dioxide (SO_2)	4.4E-02	POUNDS	GALLON	Mass Balance	1.071E+01
Volatile Organic Compounds (VOC)	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.356E-02
Lead and lead compounds	1.4E-05	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	4.630E-04
Process	Secondary Process				
SCC Code	20100109				
	> Internal Combustion Engines				
	> Electric Generation				
	> Distillate Oil (Diesel)				
	> Turbine: Exhaust				
Material Processed	Distillate Oil (No. 1 ULS)				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
3,220	gallons	12.0	17.2	41.6	29.2
Operational Schedule					
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
8.9E-04	3.1E-03	6.6E-03	1.1		

Emission Unit 01					
Fuel Characteristics					
Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content	Ash Content		
133.699	0.101	Not Available	Not Available		
Heating					
Heat Input (MMBtu/hr)		Heat Output		Heat Values Convention	
386		Not Available		HHV	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	6.5E+00	POUNDS	HOUR	2022 CEMS Average	3.628E-03
Ammonia (NH_3)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO_X)	3.08E+02	POUNDS	HOUR	2022 CEMS Average	1.718E-01
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.583E-03
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.583E-03
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	9.256E-04
PM Condensible (PM-CON)	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.550E-03
Sulfur Dioxide (SO_2)	1.4E-02	POUNDS	GALLON	Mass Balance	2.211E-02
Volatile Organic Compounds (VOC)	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	8.825E-05
Lead and lead compounds	1.4E-05	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	3.014E-06
Release Points					
ID	Description			Type	Apportion %
01N	GT #1 North Stack			Vertical	50
01S	GT #1 South Stack			Vertical	50

Release Point 01N					
Specifications					
ID	01N		Type	Vertical	
Description	GT #1 North Stack				
Stack Status	Active				
Stack Parameters					
Stack Height (ft)	Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfm)	
62	8.46	729	182	620,700	
Geographic Coordinate					
Latitude	64.73549	Longitude	-147.35021	Datum	NAD 1983
Base Elevation	150	Accuracy	1		
Location Description	North Pole, AK				
Data Source	Engineering Estimate				

Release Point 01S					
Specifications					
ID	01S		Type	Vertical	
Description	GT #1 South Stack				
Stack Status	Active				
Stack Parameters					
Stack Height (ft)	Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfm)	
62	8.46	729	182	620,700	
Geographic Coordinate					
Latitude	64.73525	Longitude	-147.35021	Datum	NAD 1983
Base Elevation	150	Accuracy	1		
Location Description	North Pole, AK				
Data Source	Engineering Estimate				

Emission Unit 02

Specifications

ID	02	Design Capacity	672 MILLION BTU PER HOUR
Description	GT#2 Gas Turbine	Emission Unit Status	Operating
Manufacturer	General Electric	Manufactured Year	Prior to October 4, 1977
Model Number	Frame 7, Series 7001, Model BR	Serial Number	248861

Regulations

Regulation/Description
Not Applicable

> Control Equipment

Capture Efficiency (%)	0
System Description	None
Equipment Type(s)	None

Pollutants Controlled

Pollutant Description	Reduction Efficiency (%)
Not Applicable	Not Applicable

Processes

Process	Primary Process		
SCC Code	20100109 > Internal Combustion Engines > Electric Generation > Distillate Oil (Diesel) > Turbine: Exhaust		
Material Processed	Distillate Oil (No. 2)		
Period Start	1/1/2022	Period End	12/31/2022

Throughput

Total		Summer %	Fall %	Winter %	Spring %
5,384,656	gallons	18.3	8.2	25.8	47.7

Operational Schedule

Days/Week	Hours/Day	Weeks/Period	Hours/Period
1.4	4.8	10.5	1,767

Fuel Characteristics

Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content	Ash Content
136.602	0.303	Not Available	Not Available

Heating

Heat Input (MMBtu/hr)	Heat Output	Heat Values Convention
416	Not Available	HHV

Emissions

Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	3.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-1	1.214E+00
Ammonia (NH_3)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO_X)	8.8E-01	POUNDS	MILLION BTUS	AP-42 Table 3.1-1	3.236E+02
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	4.413E+00
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	4.413E+00
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.581E+00
PM Condensible (PM-CON)	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.648E+00
Sulfur Dioxide (SO_2)	4.4E-02	POUNDS	GALLON	Mass Balance	1.191E+02
Volatile Organic Compounds (VOC)	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.508E-01
Lead and lead compounds	1.4E-05	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	5.149E-03

Emission Unit 02					
Process	Secondary Process				
SCC Code	20100109				
	> Internal Combustion Engines				
	> Electric Generation				
	> Distillate Oil (Diesel)				
	> Turbine: Exhaust				
Material Processed	Distillate Oil (No. 1 ULS)				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
444,249	gallons	96.0	0.8	1.7	1.5
Operational Schedule					
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
0.1	0.4	0.9	145.8		
Fuel Characteristics					
Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content	Ash Content		
133.699	0.101	Not Available	Not Available		
Heating					
Heat Input (MMBtu/hr)		Heat Output		Heat Values Convention	
407		Not Available		HHV	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	3.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-1	9.800E-02
Ammonia (NH_3)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO_X)	8.8E-01	POUNDS	MILLION BTUS	AP-42 Table 3.1-1	2.613E+01
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	3.564E-01
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	3.564E-01
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.277E-01
PM Condensible (PM-CON)	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.138E-01
Sulfur Dioxide (SO_2)	1.5E-02	POUNDS	GALLON	Mass Balance	3.275E+00
Volatile Organic Compounds (VOC)	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.218E-02
Lead and lead compounds	1.4E-05	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	4.158E-04
Release Points					
ID	Description			Type	Apportion %
02N	GT #2 North Stack			Vertical	50
02S	GT #2 South Stack			Vertical	50

Release Point 02N					
Specifications					
ID	02N		Type	Vertical	
Description	GT #2 North Stack				
Stack Parameters					
Stack Height (ft)	Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfm)	
62	8.46	729	182	620,700	
Geographic Coordinate					
Latitude	64.735044	Longitude	-147.351072	Datum	NAD 1983
Base Elevation	150	Accuracy	1		
Location Description	North Pole, AK				
Data Source	Engineering Estimate				

Release Point 02S					
Specifications					
ID	02S		Type	Vertical	
Description	GT #2 South Stack				
Stack Parameters					
Stack Height (ft)	Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfm)	
62	8.46	729	182	620,700	
Geographic Coordinate					
Latitude	64.73525	Longitude	-147.35127	Datum	NAD 1983
Base Elevation	150	Accuracy	1		
Location Description	North Pole, AK				
Data Source	Engineering Estimate				

Emission Unit 05

Specifications

ID	05	Design Capacity	455 MILLION BTU PER HOUR
Description	GT#3 Gas Turbine	Emission Unit Status	Operating
Manufacturer	General Electric	Manufactured Year	Purchased 2004
Model Number	LM6000PC	Serial Number	191-548

Regulations

Regulation/Description
40 CFR 60 Subpart GG

> Control Equipment

Capture Efficiency (%)	100
System Description	Weir Rotojet Water Injection (NO) Emerachem LLC CO catalyst
Equipment Type(s)	Water Injection

Pollutants Controlled

Pollutant Description	Reduction Efficiency (%)
Carbon Monoxide	66
Nitrogen Oxides	77

Processes

Process	Primary Process		
SCC Code	20100901		
	> Internal Combustion Engines		
	> Electric Generation		
	> Kerosene/Naphtha (Jet Fuel)		
	> Turbine: Exhaust		
Material Processed	Naphtha		
Period Start	1/1/2022	Period End	12/31/2022

Throughput

Total		Summer %	Fall %	Winter %	Spring %
26,058,464	gallons	23.5	25.2	29.7	21.7

Operational Schedule

Days/Week	Hours/Day	Weeks/Period	Hours/Period
6.4	22.0	47.7	8,019

Fuel Characteristics

Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content	Ash Content
109.068	0.0018	Not Available	Not Available

Heating

Heat Input (MMBtu/hr)	Heat Output	Heat Values Convention
354	Not Available	HHV

Emissions

Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	1.7E+00	POUNDS	HOUR	2022 CEMS Average	6.816E+00
Ammonia (NH_3)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO_X)	1.18E+02	POUNDS	HOUR	2022 CEMS Average	4.731E+02
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.705E+01
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.705E+01
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	6.111E+00
PM Condensible (PM-CON)	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.023E+01
Sulfur Dioxide (SO_2)	2.1E-04	POUNDS	GALLON	Mass Balance	2.934E-01
Volatile Organic Compounds (VOC)	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	5.826E-01
Lead and lead compounds	1.4E-05	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.989E-02

Emission Unit 05

Process	Secondary Process				
SCC Code	20100109				
	> Internal Combustion Engines				
	> Electric Generation				
	> Distillate Oil (Diesel)				
	> Turbine: Exhaust				
Material Processed	Distillate Oil (No. 1 ULS)				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
262,514	gallons	21.2	0.8	0.3	77.6
Operational Schedule					
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
0.1	0.2	0.5	80.8		
Fuel Characteristics					
Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content	Ash Content		
133.699	0.0015	Not Available	Not Available		
Heating					
Heat Input (MMBtu/hr)		Heat Output		Heat Values Convention	
434		Not Available		HHV	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	1.7E+00	POUNDS	HOUR	2022 CEMS Average	6.867E-02
Ammonia (NH_3)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO_X)	1.18E+02	POUNDS	HOUR	2022 CEMS Average	4.766E+00
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.106E-01
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.106E-01
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	7.546E-02
PM Condensible (PM-CON)	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.264E-01
Sulfur Dioxide (SO_2)	2.0E-04	POUNDS	GALLON	Mass Balance	2.678E-02
Volatile Organic Compounds (VOC)	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	7.195E-03
Lead and lead compounds	1.4E-05	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.457E-04
Release Points					
ID	Description			Type	Apportion %
05	GT#3 Stack			Vertical	100

Release Point 05

Specifications					
ID	05		Type	Vertical	
Description	GT#3 Stack				
Stack Parameters					
Stack Height (ft)	Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfm)	
110	11.11	270	73.8	347,949	
Geographic Coordinate					
Latitude	64.73526	Longitude	-147.34985	Datum	NAD 1983
Base Elevation	150	Accuracy	1		
Location Description	North Pole, AK				
Data Source	Engineering Estimate				

Emission Unit 06					
Specifications					
ID	06		Design Capacity	455 MILLION BTU PER HOUR	
Description	GT#4 Gas Turbine		Emission Unit Status	Not Installed	
Manufacturer	General Electric		Manufactured Year	This unit has not been installed	
Model Number	LM6000PC		Serial Number	TBD	
Regulations					
Regulation/Description					
40 CFR 60 Subpart KKKK					
> Control Equipment					
Capture Efficiency (%)	Not Applicable				
System Description	Not Applicable				
Equipment Type(s)	Not Applicable				
Pollutants Controlled					
Pollutant Description				Reduction Efficiency (%)	
Not Applicable				Not Applicable	
Processes					
Process	Primary Process				
SCC Code	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
Material Processed	Not Applicable				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Operational Schedule					
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Fuel Characteristics					
Heat Content	Elem. Sulfur Content	H_2S Sulfur Content	Ash Content		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Heating					
Heat Input		Heat Output		Heat Values Convention	
Not Applicable		Not Applicable		Not Applicable	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ammonia (NH_3)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Nitrogen Oxides (NO_X)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM2.5 Filterable ($PM_{2.5}$-FIL)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM Condensible (PM-CON)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Sulfur Dioxide (SO_2)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Volatile Organic Compounds (VOC)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Lead and lead compounds	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Emission Unit 06					
Process	Secondary Process				
SCC Code	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
Material Processed	Not Applicable				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Operational Schedule					
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Fuel Characteristics					
Heat Content	Elem. Sulfur Content	H_2S Sulfur Content	Ash Content		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Heating					
Heat Input		Heat Output		Heat Values Convention	
Not Applicable		Not Applicable		Not Applicable	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ammonia (NH_3)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Nitrogen Oxides (NO_X)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM2.5 Filterable ($PM_{2.5}$-FIL)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM Condensible (PM-CON)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Sulfur Dioxide (SO_2)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Volatile Organic Compounds (VOC)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Lead and lead compounds	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Release Points					
ID	Description			Type	Apportion %
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Emission Unit 07

Specifications

ID	07	Design Capacity	565 HORSEPOWER
Description	Emergency Generator Engine	Emission Unit Status	Operating
Manufacturer	Mitsubishi	Manufactured Year	Installed 2005
Model Number	0A8829	Serial Number	2083094

Regulations

Regulation/Description
40 CFR 63 Subpart ZZZZ

> Control Equipment

Capture Efficiency (%)	0
System Description	None
Equipment Type(s)	None

Pollutants Controlled

Pollutant Description	Reduction Efficiency (%)
Not Applicable	Not Applicable

Processes

Process	Primary Process		
SCC Code	20200107		
	> Internal Combustion Engines		
	> Electric Generation		
	> Distillate Oil (Diesel)		
	> Reciprocating: Exhaust		
Material Processed	Distillate Oil (No. 1 ULSD)		
Period Start	1/1/2022	Period End	12/31/2022

Throughput

Total		Summer %	Fall %	Winter %	Spring %
57.6	gallons	61.1	16.7	0.0	22.2

Operational Schedule

Days/Week	Hours/Day	Weeks/Period	Hours/Period
1.4E-03	4.9E-03	0.01	2

Fuel Characteristics

Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content	Ash Content
133.699	0.0015	Not Available	Not Available

Heating

Heat Input (MMBtu/hr)	Heat Output	Heat Values Convention
4	Not Available	HHV

Emissions

Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	6.68E-03	POUNDS	HORSEPOWER-HOUR	AP-42 Table 3.3-1	3.397E-03
Ammonia (NH_3)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO_X)	3.1E-02	POUNDS	HORSEPOWER-HOUR	AP-42 Table 3.3-1	1.576E-02
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	2.2E-03	POUNDS	HORSEPOWER-HOUR	AP-42 Table 3.3-1	1.119E-03
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	2.2E-03	POUNDS	HORSEPOWER-HOUR	AP-42 Table 3.3-1	1.119E-03
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	2.2E-03	POUNDS	HORSEPOWER-HOUR	AP-42 Table 3.3-1	1.119E-03
PM Condensible (PM-CON)	Not Available	Not Available	Not Available	Not Available	Not Available
Sulfur Dioxide (SO_2)	2.0E-04	POUNDS	GALLON	Mass Balance	5.875E-06
Volatile Organic Compounds (VOC)	2.5E-03	POUNDS	HORSEPOWER-HOUR	AP-42 Table 3.3-1	1.278E-03
Lead and lead compounds	Not Available	Not Available	Not Available	Not Available	Not Available

Emission Unit 07					
Process	Secondary Process				
SCC Code	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
Material Processed	Not Applicable				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Operational Schedule					
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Fuel Characteristics					
Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content	Ash Content		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Heating					
Heat Input		Heat Output		Heat Values Convention	
Not Applicable		Not Applicable		Not Applicable	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons Per Year
Carbon Monoxide (CO)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ammonia (NH_3)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Nitrogen Oxides (NO_x)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM Condensible (PM-CON)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Sulfur Dioxide (SO_2)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Volatile Organic Compounds (VOC)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Lead and lead compounds	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Release Points					
ID	Description			Type	Apportion %
07	Emergency Engine Stack			Vertical	100

Release Point 07					
Specifications					
ID	07		Type	Vertical	
Description	Emergency Engine Stack				
Stack Parameters					
Stack Height (ft)	Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfm)	
27	0.83	1,299	88.7	2,878	
Geographic Coordinate					
Latitude	64.7341	Longitude	-147.35072	Datum	NAD 1983
Base Elevation	150	Accuracy	1		
Location Description	North Pole, AK				
Data Source	Engineering Estimate				

Emission Unit 11

Specifications

ID	11	Design Capacity	5 MILLION BTU PER HOUR
Description	Building Boiler	Emission Unit Status	Operating
Manufacturer	Bryan Steam	Manufactured Year	Installed 2005
Model Number	RV500	Serial Number	93433

Regulations

Regulation/Description
Not Applicable

> Control Equipment

Capture Efficiency (%)	0
System Description	None
Equipment Type(s)	None

Pollutants Controlled

Pollutant Description	Reduction Efficiency (%)
Not Applicable	Not Applicable

Processes

Process	Primary Process		
SCC Code	10301002 > External Combustion Boilers > Space Heaters > Commercial/Institutional > Liquified Petroleum Gas (LPG)		
Material Processed	Propane		
Period Start	1/1/2022	Period End	12/31/2022

Throughput

Total		Summer %	Fall %	Winter %	Spring %
3,677	gallons	29.6	20.4	19.0	31.0

Operational Schedule

Days/Week	Hours/Day	Weeks/Period	Hours/Period
0.1	0.2	0.4	67.3

Fuel Characteristics

Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content (vol. pct. H_2S)	Ash Content
91.6	3.12E-06	0.2	Not Available

Heating

Heat Input (MMBtu/hr)	Heat Output	Heat Values Convention
5	Not Available	HHV

Emissions

Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	7.5	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.379E-02
Ammonia (NH_3)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO_x)	13	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	2.390E-02
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	0.7	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.287E-03
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	0.7	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.287E-03
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	0.2	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	3.677E-04
PM Condensible (PM-CON)	0.5	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	9.192E-04
Sulfur Dioxide (SO_2)	2.6E-07	POUNDS	GALLON	Mass Balance	4.823E-07
Volatile Organic Compounds (VOC)	0.8	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.471E-03
Lead and lead compounds	Not Available	Not Available	Not Available	Not Available	Not Available

Emission Unit 11					
Process	Secondary Process				
SCC Code	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
Material Processed	Not Applicable				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Operational Schedule					
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Fuel Characteristics					
Heat Content	Elem. Sulfur Content	H_2S Sulfur Content	Ash Content		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Heating					
Heat Input		Heat Output		Heat Values Convention	
Not Applicable		Not Applicable		Not Applicable	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ammonia (NH_3)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Nitrogen Oxides (NO_x)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM Condensible (PM-CON)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Sulfur Dioxide (SO_2)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Volatile Organic Compounds (VOC)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Lead and lead compounds	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Release Points					
ID	Description			Type	Apportion %
11	Building Boiler			Vertical	100

Release Point 11					
Specifications					
ID	11		Type	Vertical	
Description	Building Boiler				
Stack Parameters					
Stack Height (ft)	Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfm)	
63	0.98	450	121	5,477	
Geographic Coordinate					
Latitude	64.73416	Longitude	-147.35072	Datum	NAD 1983
Base Elevation	150	Accuracy	1		
Location Description	North Pole, AK				
Data Source	Engineering Estimate				

Emission Unit 12

Specifications

ID	12	Design Capacity	5 MILLION BTU PER HOUR
Description	Building Boiler	Emission Unit Status	Operating
Manufacturer	Bryan Steam	Manufactured Year	Installed 2005
Model Number	RV500	Serial Number	93434

Regulations

Regulation/Description
Not Applicable

> Control Equipment

Capture Efficiency (%)	0
System Description	None
Equipment Type(s)	None

Pollutants Controlled

Pollutant Description	Reduction Efficiency (%)
Not Applicable	Not Applicable

Processes

Process	Primary Process		
SCC Code	10301002 > External Combustion Boilers > Space Heaters > Commercial/Institutional > Liquified Petroleum Gas (LPG)		
Material Processed	Propane		
Period Start	1/1/2022	Period End	12/31/2022

Throughput

Total		Summer %	Fall %	Winter %	Spring %
3,677	gallons	29.6	20.4	19.0	31.0

Operational Schedule

Days/Week	Hours/Day	Weeks/Period	Hours/Period
0.1	0.2	0.4	67.3

Fuel Characteristics

Heat Content (MMBtu/kgal)	Elem. Sulfur Content (wt. pct. S)	H_2S Sulfur Content (vol. pct. H_2S)	Ash Content
91.6	3.12E-06	0.2	Not Available

Heating

Heat Input (MMBtu/hr)	Heat Output	Heat Values Convention
5	Not Available	HHV

Emissions

Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	7.5	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.379E-02
Ammonia (NH_3)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO_X)	13	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	2.390E-02
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	0.7	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.287E-03
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	0.7	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.287E-03
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	0.2	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	3.677E-04
PM Condensible (PM-CON)	0.5	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	9.192E-04
Sulfur Dioxide (SO_2)	2.6E-07	POUNDS	GALLON	Mass Balance	4.823E-07
Volatile Organic Compounds (VOC)	0.8	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.471E-03
Lead and lead compounds	N/A	N/A	N/A	N/A	N/A

Emission Unit 12					
Process	Secondary Process				
SCC Code	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
Material Processed	Not Applicable				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Operational Schedule					
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Fuel Characteristics					
Heat Content	Elem. Sulfur Content	H_2S Sulfur Content	Ash Content		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Heating					
Heat Input		Heat Output		Heat Values Convention	
Not Applicable		Not Applicable		Not Applicable	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Carbon Monoxide (CO)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ammonia (NH_3)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Nitrogen Oxides (NO_X)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM_{10} Primary (Filt + Cond)(PM_{10}-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
$PM_{2.5}$ Primary (Filt + Cond)($PM_{2.5}$-PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
$PM_{2.5}$ Filterable ($PM_{2.5}$-FIL)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM Condensible (PM-CON)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Sulfur Dioxide (SO_2)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Volatile Organic Compounds (VOC)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Lead and lead compounds	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Release Points					
ID	Description			Type	Apportion %
12	Building Boiler			Vertical	100

Release Point 12					
Specifications					
ID	12		Type	Vertical	
Description	Building Boiler				
Stack Parameters					
Stack Height (ft)	Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfm)	
63	0.98	450	121	5,477	
Geographic Coordinate					
Latitude	64.73415	Longitude	-147.35011	Datum	NAD 1983
Base Elevation	150	Accuracy	1		
Location Description	North Pole, AK				
Data Source	Engineering Estimate				

EU ID	Fuel Type	Fuel Usage (Gallons)[1]												
		January	February	March	April	May	June	July	August	September	October	November	December	Total
1	Jet A	-	-	-	-	-	-	-	-	-	-	-	-	-
	No. 1 ULS & blends	304	402	240	-	700	-	386	-	417	137	-	634	**3,220**
	No. 2 Diesel & blends	52,202	47,810	27,734	-	130,614	-	80,483	-	41,304	83,627	-	20,435	**484,209**
2	Jet A	-	-	-	-	-	-	-	-	-	-	-	-	-
	No. 1 ULS & blends	1,434	2,369	3,622	506	2,695	422,858	2,533	880	1,967	976	685	3,724	**444,249**
	No. 2 Diesel & blends	669,586	109,913	628,714	366,684	1,571,479	454,541	455,064	77,712	185,225	62,604	194,556	608,578	**5,384,656**
5	Jet A	-	-	-	-	-	-	-	-	-	-	-	-	-
	No. 1 ULS & blends	-	387	344	328	203,094	54,077	367	1,304	509	583	993	528	**262,514**
	Naphtha	2,649,997	2,362,166	2,378,305	2,368,272	903,124	2,267,786	2,192,979	1,650,436	1,999,623	2,327,830	2,233,472	2,724,474	**26,058,464**
7	ULSD	-	-	13	-	-	19	6	10	-	10	-	-	**57.6**
	hours	0.0	0.0	0.4	0.0	0.0	0.6	0.2	0.3	0.0	0.3	0.0	0.0	**1.8**
11	Propane		-	-	-	2,277	-	-	2,179	-	-	1,498	1,400	**7,354**
12														

EU ID	Fuel Type	Fuel Usage by Season (%)			
		Summer	Fall	Winter	Spring
1	Jet A	-	-	-	-
	No. 1 ULS	12.0	17.2	41.6	29.2
	No. 2 Diesel & blends	16.6	25.8	24.9	32.7
2	Jet A	-	-	-	-
	No. 1 ULS	96.0	0.8	1.7	1.5
	No. 2 Diesel & blends	18.3	8.2	25.8	47.7
5	Jet A	-	-	-	-
	No. 1 ULS	21.2	0.8	0.3	77.6
	Naptha	23.5	25.2	29.7	21.7
7	ULSD	61.1	16.7	-	22.2
11	Propane	29.6	20.4	19	31
12					

Tank	Fuel Usage by Season (%)			
	Summer	Fall	Winter	Spring
Jet A	0	0	0	0
No. 1 Diesel	67.9	0.9	1.4	29.8
No. 2 Diesel	18.2	9.7	25.7	46.4
ULSD	61.1	16.7	0.0	22.2

EU ID	Operating Hours[2]
1	169.0
2	1,913.3
5	8,100.0
7	1.8
11	67.3
12	67.3

Fuel Type	Total Fuel Usage (Gallons)												
	January	February	March	April	May	June	July	August	September	October	November	December	Total
Jet A	-	-	-	-	-	-	-	-	-	-	-	-	-
No. 1 ULS	1,738	3,158	4,206	834	206,489	476,935	3,286	2,184	2,893	1,696	1,678	4,886	**709,983**
No. 2 Diesel & blends	721,788	157,723	656,448	366,684	1,702,093	454,541	535,547	77,712	226,529	146,231	194,556	629,013	**5,868,865**
ULSD	-	-	13	-	-	19	6	10	-	10	-	-	**58**
Naphtha	2,649,997	2,362,166	2,378,305	2,368,272	903,124	2,267,786	2,192,979	1,650,436	1,999,623	2,327,830	2,233,472	2,724,474	**26,058,464**
Propane	-	-	-	-	2,277	-	-	2,179	-	-	1,498	1,400	**7,354**

Fuel Type	Fuel HHV (Btu/gal)[3]												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Jet A	-	-	-	-	-	-	-	-	-	-	-	-	-
No. 1 Diesel & blends	133,556	134,135	134,045	133,866	131,824	133,867	133,774	-	135,480	132,761	133,542	133,835	**133,699**
No. 2 Diesel & blends	133,556	133,952	137,855	138,168	138,645	139,560	142,510	-	135,032	129,375	140,142	133,828	**136,602**
ULSD	133,556	134,135	134,045	133,866	131,824	133,867	133,774	-	135,480	132,761	133,542	133,835	**133,699**
Naphtha	107,765	-	107,652	107,811	107,888	109,326	-	109,400	-	118,898	106,470	106,398	**109,068**

Fuel Type	Fuel Sulfur (max wt. pct. S)[3]												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Jet A	-	-	-	-	-	-	-	-	-	-	-	-	-
No. 1 Diesel & blends	0.088	0.089	0.089	0.089	0.089	0.104	0.114	0.114	0.098	0.112	0.113	0.113	**0.101**
No. 2 Diesel & blends	0.304	0.306	0.304	0.467	0.436	0.452	0.462	0.468	0.098	0.112	0.113	0.113	**0.303**
ULSD	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	**0.0015**
Naphtha	0.0020	0.0019	0.0017	0.0013	0.0015	0.0015	0.0020	0.0014	0.0014	0.0020	0.0020	0.0026	**0.0018**

Fuel Type	Fuel Sulfur (vol pct. H_2S)[3]												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Propane	-	-	-	-	0.2	-	-	0.2	-	-	0.2	0.2	**0.2**

Fuel Type	Fuel Density (lb/gal)[1]
Jet A	6.8
No. 1 Diesel	6.8
No. 2 Diesel	7.3
Naphtha[4]	5.8
Propane[5]	4.2

[1] Assumed

[2] Hours for EU IDs 1, 2, and 5 are from plant report, hours for EU ID 7 are from the FOR, and hours for EU IDs 11, and 12 are estimated based on fuel use

[3] From fuel test records

[4] Provided by the supplier.

[5] Estimate from vendor propane factor notifications

	Fuel Prices ($/gallon) representative April 2016		NPP				ZNP	
			Naphtha	LSR Turbine **	DF#1, DF#2	ULSD	DF#1, DF#2	ULSD
A	PSI Base Price		$1.127000	$0.792619	$1.492381	$1.378810	$1.492381	$1.378810
B	PSI & Federal surcharges *		$0.012405	$0.012405	$0.052405	$0.012405	$0.052405	$0.012405
C	PSI Delivery Charge					$0.155000		$0.155000
D	PSI Fuel Surcharge	C * 15%				$0.023250		$0.023250
E	PSI Truck Freight	(C + D) * 15%				$0.026738		$0.026738
F	Big State Delivery				$0.020000	$0.020000	$0.030000	$0.030000
G	Big State fuel surcharge	(F) * 15%			$0.003000	$0.003000	$0.004500	$0.004500
		Total	$1.139405	$0.805024	$1.567786	$1.619203	$1.579286	$1.630703

* Includes GVEA OPS surcharge, Federal Oil Spill Liability, Federal Excise Tax, and SOA Surcharge
** Estimated, will take delivery early 2017

Naphtha and LSR fuel direct pipe supply to North Pole GT3 (LM600, EUID 5).
DF#1, DF#2, and ULSD trucked from PSI to North Pole and Zehnder.

Sulfur	Specification MAX ppm	Aug-15 ppm	Sep-15 ppm	Oct-15 ppm	Nov-15 ppm	Dec-15 ppm	Jan-16 ppm	Feb-16 ppm	Mar-16 ppm	Apr-16 ppm
Naphtha, Sulfur Specification	100	20.7	24.0	23.4	23.2	20.7	20.5	20.2	19.3	20.8
LSR Turbine, Sulfur Specification	30	12 predicted								
# 1 HSD	3000	950.0	970.0	940.0	940.0	960.0	980.0	950.0	940.0	950.0
# 2 HSD -15	4000	3220.0	3010.0	2840.0	3300.0	3130.0	3170.0	2940.0	2730.0	
# 2 HSD + 10	4000	4510.0	4720.0							4080.0
ULSD	15									0.8

All prices per gallon

		Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-18	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18				
Naphtha	PSI Base Price	$1.338	-	-	-	-	-	$1.269	-	-	-	-	-	-	-	-	-	-	-	$1.912	-	-	-	$1.506			
	PSI & Federal surcharges *	$0.003	-	-	-	-	-	$0.003	-	-	-	-	-	-	-	-	-	-	-	$0.003	-	-	-	$0.003	$1.509		
LSR Naphtha	PSI Base Price	-	$1.329	$1.071	$1.083	$1.022	$1.004	$0.999	$1.055	$1.056	$1.200	$1.418	$1.561	$1.584	$1.540	$1.494	$1.516	$1.682	$1.641	$1.713	$1.716	$1.779	$1.785	$1.393			
	PSI & Federal surcharges *	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$1.396		
QB Naphtha	PSI Base Price	-	$1.590	$1.587	$1.625	$1.569	$1.481	$1.516	$1.542	-	-	-	-	-	-	-	-	-	-	$2.142	$1.829	$2.158	$2.207	$1.750			
	PSI & Federal surcharges *	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	-	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$1.753		
DF2+10	PSI Base Price	-	-	-	-	$1.625	$1.576	$1.621	$1.708	-	-	-	-	-	-	-	-	$2.150	$2.286	$2.395	$2.400	$2.408	-	$2.019			
	PSI & Federal surcharges *	-	-	-	-	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	-	$0.003			
	PSI Ops Surcharge	-	-	-	-	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	-	$0.050			
	Big State Delivery	-	-	-	-	$0.020	$0.020	$0.020	$0.020	-	-	-	-	-	-	-	-	$0.020	$0.020	$0.020	$0.020	$0.020	-	$0.020			
	Big State Fuel Surcharge	-	-	-	-	20.5%	20.5%	20.5%	19.0%	-	-	-	-	-	-	-	-	29.0%	27.0%	27.0%	23.5%	26.0%	-	$0.0047	$2.097		
DF2-15	PSI Base Price	$1.750	$1.797	$1.712	$1.732	-	-	-	-	$1.874	$1.911	$2.040	$2.021	$2.174	$2.204	$2.188	$2.175	-	-	-	-	-	$2.499	$2.006			
	PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	$0.003	$0.003			
	PSI Ops Surcharge	$0.04	$0.05	$0.05	$0.05	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	$0.05	$0.049			
	Big State Delivery	$0.020	$0.020	$0.020	$0.020	-	-	-	-	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	-	-	-	-	-	$0.020	$0.020			
	Big State Fuel Surcharge	18.5%	20.5%	20.5%	20.5%	-	-	-	-	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	-	-	-	-	-	26.0%	$0.0046	$2.083		
ULSD	PSI Base Price	$1.963	$1.904	$1.805	$1.852	$1.806	$1.703	$1.622	$1.797	$2.074	$2.107	$2.159	$2.038	$2.129	$2.083	$2.083	$2.309	$2.417	$3.129	$2.301	$2.225	$2.308	$2.406	$2.101			
	PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003			
	PSI Delivery Charge	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155			
	PSI Fuel Surcharge	16.5%	17.5%	17.5%	16.5%	16.5%	16.5%	16.5%	14.5%	16.5%	16.5%	19.5%	20.0%	19.0%	20.0%	20.0%	20.0%	21.5%	22.5%	22.5%	22.0%	21.0%	22.0%	$0.0292			
	PSI Truck Freight	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	$0.0276			
	Big State Delivery	$0.133	$0.133	$0.133	$0.133	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.159			
	Big State Fuel Surcharge	18.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	19.0%	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	29.0%	27.0%	27.0%	23.5%	26.0%	26.0%	$0.0371	$2.512	$0.416	$1.116
DF2+10	PSI Base Price	-	-	-	-	$1.625	$1.576	$1.621	$1.708	-	-	-	-	-	-	-	-	$2.150	$2.286	$2.395	$2.400	$2.408	-	$2.019			
	PSI & Federal surcharges *	-	-	-	-	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	-	$0.003			
	PSI Ops Surcharge	-	-	-	-	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	-	$0.050			
	Big State Delivery	-	-	-	-	$0.030	$0.030	$0.030	$0.030	-	-	-	-	-	-	-	-	$0.030	$0.030	$0.030	$0.030	$0.030	-	$0.030			
	Big State Fuel Surcharge	-	-	-	-	20.5%	20.5%	20.5%	19.0%	-	-	-	-	-	-	-	-	29.0%	27.0%	27.0%	23.5%	26.0%	-	$0.0071	$2.109		
DF2-15	PSI Base Price	$1.750	$1.797	$1.712	$1.732	-	-	-	-	$1.874	$1.911	$2.040	$2.021	$2.174	$2.204	$2.188	$2.175	-	-	-	-	-	$2.499	$2.006			
	PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	$0.003	$0.003			
	PSI Ops Surcharge	$0.04	$0.05	$0.05	$0.05	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	$0.05	$0.049			
	Big State Delivery	$0.025	$0.025	$0.025	$0.025	-	-	-	-	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	-	-	-	-	-	$0.030	$0.028			
	Big State Fuel Surcharge	18.5%	20.5%	20.5%	20.5%	-	-	-	-	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	-	-	-	-	-	26.0%	$0.0066	$2.093		
ULSD	PSI Base Price	$1.963	$1.904	$1.805	$1.852	$1.806	$1.703	$1.622	$1.797	$2.074	$2.107	$2.159	$2.038	$2.129	$2.083	$2.083	$2.309	$2.417	$3.129	$2.301	$2.225	$2.308	$2.406	$2.101			
	PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.006	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003			
	PSI Delivery Charge	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155			
	PSI Fuel Surcharge	16.5%	17.5%	17.5%	16.5%	16.5%	16.5%	16.5%	14.5%	16.5%	16.5%	19.5%	20.0%	19.0%	20.0%	20.0%	20.0%	21.5%	22.5%	22.5%	22.0%	21.0%	22.0%	$0.0292			
	PSI Truck Freight	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	$0.0276			
	Big State Delivery	$0.025	$0.025	$0.025	$0.025	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.029			
	Big State Fuel Surcharge	18.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	19.0%	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	29.0%	27.0%	27.0%	23.5%	26.0%	26.0%	$0.0068	$2.352	$0.243	

GVEA Fuel Pricing per Gallon

			Average	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-18	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18
North Pole	LSR Naphtha	PSI Base Price		-	$1.329	$1.071	$1.083	$1.022	$1.004	$0.999	$1.055	$1.056	$1.200	$1.418	$1.561	$1.584	$1.540	$1.494	$1.516	$1.682	$1.641	$1.713	$1.716	$1.779	$1.785
		PSI & Federal surcharges *		-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		Total $/Gallon	**$1.396**	**-**	**$1.332**	**$1.074**	**$1.086**	**$1.025**	**$1.007**	**$1.002**	**$1.058**	**$1.059**	**$1.203**	**$1.421**	**$1.564**	**$1.587**	**$1.543**	**$1.497**	**$1.519**	**$1.685**	**$1.644**	**$1.716**	**$1.719**	**$1.782**	**$1.788**
	DF2+10	PSI Base Price		-	-	-	-	$1.625	$1.576	$1.621	$1.708	-	-	-	-	-	-	-	-	$2.150	$2.286	$2.395	$2.400	$2.408	-
		PSI & Federal surcharges *		-	-	-	-	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	-
		PSI Ops Surcharge		-	-	-	-	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	-
		Delivery Charge		-	-	-	-	$0.020	$0.020	$0.020	$0.020	-	-	-	-	-	-	-	-	$0.020	$0.020	$0.020	$0.020	$0.020	-
		Delivery Fuel Surcharge %		-	-	-	-	20.5%	20.5%	20.5%	19.0%	-	-	-	-	-	-	-	-	29.0%	27.0%	27.0%	23.5%	26.0%	-
		Delivery Fuel Surchage (%*Delivery)		-	-	-	-	$0.004	$0.004	$0.004	$0.004	-	-	-	-	-	-	-	-	$0.006	$0.005	$0.005	$0.005	$0.005	-
		Total $/Gallon	**$2.097**	**-**	**-**	**-**	**-**	**$1.702**	**$1.653**	**$1.699**	**$1.785**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$2.229**	**$2.364**	**$2.474**	**$2.478**	**$2.486**	**-**
	DF2-15	PSI Base Price		$1.750	$1.797	$1.712	$1.732	-	-	-	-	$1.874	$1.911	$2.040	$2.021	$2.174	$2.204	$2.188	$2.175	-	-	-	-	-	$2.499
		PSI & Federal surcharges *		$0.003	$0.003	$0.003	$0.003	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	$0.003
		PSI Ops Surcharge		$0.04	$0.05	$0.05	$0.05	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	$0.05
		Truck Delivery		$0.020	$0.020	$0.020	$0.020	-	-	-	-	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	-	-	-	-	-	$0.020
		Delivery Fuel Surcharge %		18.5%	20.5%	20.5%	20.5%	-	-	-	-	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	-	-	-	-	-	26.0%
		Delivery Fuel Surchate (%*Delivery)		$0.004	$0.004	$0.004	$0.004	-	-	-	-	$0.005	$0.005	$0.005	$0.005	$0.005	$0.005	$0.005	$0.005	-	-	-	-	-	$0.005
		Total $/Gallon	**$2.083**	**$1.817**	**$1.874**	**$1.789**	**$1.809**	**-**	**-**	**-**	**-**	**$1.951**	**$1.989**	**$2.117**	**$2.099**	**$2.251**	**$2.282**	**$2.266**	**$2.253**	**-**	**-**	**-**	**-**	**-**	**$2.577**
	ULSD	PSI Base Price		$1.963	$1.904	$1.805	$1.852	$1.806	$1.703	$1.622	$1.797	$2.074	$2.107	$2.159	$2.038	$2.129	$2.083	$2.083	$2.309	$2.417	$3.129	$2.301	$2.225	$2.308	$2.406
		PSI & Federal surcharges *		$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Delivery Charge		$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155
		PSI Fuel Surcharge %		16.5%	17.5%	17.5%	16.5%	16.5%	16.5%	16.5%	14.5%	16.5%	16.5%	19.5%	20.0%	19.0%	20.0%	20.0%	20.0%	21.5%	22.5%	22.5%	22.0%	21.0%	22.0%
		PSI Fuel Surcharge (%*Delivery)		$0.026	$0.027	$0.027	$0.026	$0.026	$0.026	$0.026	$0.022	$0.026	$0.026	$0.030	$0.031	$0.029	$0.031	$0.031	$0.031	$0.033	$0.035	$0.035	$0.034	$0.033	$0.034
		PSI Truck Freight %		15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
		PSI Truck Freight (%*Delivery+Surchage)		$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028
		Truck Delivery		$0.133	$0.133	$0.133	$0.133	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165
		Delivery Fuel Surcharge %		18.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	19.0%	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	29.0%	27.0%	27.0%	23.5%	26.0%	26.0%
		Delivery Fuel Surchage (%*Delivery)		$0.025	$0.027	$0.027	$0.027	$0.034	$0.034	$0.034	$0.031	$0.038	$0.038	$0.038	$0.038	$0.040	$0.043	$0.043	$0.043	$0.048	$0.045	$0.045	$0.039	$0.043	$0.043
		Total $/Gallon	**$2.512**	**$2.331**	**$2.277**	**$2.178**	**$2.223**	**$2.216**	**$2.112**	**$2.032**	**$2.200**	**$2.487**	**$2.521**	**$2.578**	**$2.458**	**$2.549**	**$2.508**	**$2.508**	**$2.734**	**$2.849**	**$3.560**	**$2.732**	**$2.649**	**$2.735**	**$2.834**
Zehnder	DF2+10	PSI Base Price		-	-	-	-	$1.625	$1.576	$1.621	$1.708	-	-	-	-	-	-	-	-	$2.150	$2.286	$2.395	$2.400	$2.408	-
		PSI & Federal surcharges *		-	-	-	-	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	-
		PSI Ops Surcharge		-	-	-	-	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	-
		Delivery Charge		-	-	-	-	$0.030	$0.030	$0.030	$0.030	-	-	-	-	-	-	-	-	$0.030	$0.030	$0.030	$0.030	$0.030	-
		Delivery Fuel Surcharge %		-	-	-	-	20.5%	20.5%	20.5%	19.0%	-	-	-	-	-	-	-	-	29.0%	27.0%	27.0%	23.5%	26.0%	-
		Delivery Fuel Surchage (%*Delivery)		-	-	-	-	$0.006	$0.006	$0.006	$0.006	-	-	-	-	-	-	-	-	$0.009	$0.008	$0.008	$0.007	$0.008	-
		Total $/Gallon	**$2.109**	**-**	**-**	**-**	**-**	**$1.714**	**$1.665**	**$1.711**	**$1.797**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$2.242**	**$2.377**	**$2.487**	**$2.490**	**$2.499**	**-**
	DF2-15	PSI Base Price		$1.750	$1.797	$1.712	$1.732	-	-	-	-	$1.874	$1.911	$2.040	$2.021	$2.174	$2.204	$2.188	$2.175	-	-	-	-	-	$2.499
		PSI & Federal surcharges *		$0.003	$0.003	$0.003	$0.003	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	$0.003
		PSI Ops Surcharge		$0.04	$0.05	$0.05	$0.05	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	$0.05
		Truck Delivery		$0.025	$0.025	$0.025	$0.025	-	-	-	-	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	-	-	-	-	-	$0.030
		Delivery Fuel Surcharge %		18.5%	20.5%	20.5%	20.5%	-	-	-	-	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	-	-	-	-	-	26.0%
		Delivery Fuel Surchate (%*Delivery)		$0.005	$0.005	$0.005	$0.005	-	-	-	-	$0.007	$0.007	$0.007	$0.007	$0.007	$0.008	$0.008	$0.008	-	-	-	-	-	$0.008
		Total $/Gallon	**$2.093**	**$1.823**	**$1.880**	**$1.795**	**$1.815**	**-**	**-**	**-**	**-**	**$1.964**	**$2.001**	**$2.129**	**$2.111**	**$2.264**	**$2.294**	**$2.279**	**$2.266**	**-**	**-**	**-**	**-**	**-**	**$2.590**
	ULSD	PSI Base Price		$1.963	$1.904	$1.805	$1.852	$1.806	$1.703	$1.622	$1.797	$2.074	$2.107	$2.159	$2.038	$2.129	$2.083	$2.083	$2.309	$2.417	$3.129	$2.301	$2.225	$2.308	$2.406
		PSI & Federal surcharges *		$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.006	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Delivery Charge		$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155
		PSI Fuel Surcharge %		16.5%	17.5%	17.5%	16.5%	16.5%	16.5%	16.5%	14.5%	16.5%	16.5%	19.5%	20.0%	19.0%	20.0%	20.0%	20.0%	21.5%	22.5%	22.5%	22.0%	21.0%	22.0%
		PSI Fuel Surcharge (%*Delivery)		$0.026	$0.027	$0.027	$0.026	$0.026	$0.026	$0.026	$0.022	$0.026	$0.026	$0.030	$0.031	$0.029	$0.031	$0.031	$0.031	$0.033	$0.035	$0.035	$0.034	$0.033	$0.034
		PSI Truck Freight %		15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
		PSI Truck Freight (%*Delivery+Surchage)		$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028
		Truck Delivery		$0.025	$0.025	$0.025	$0.025	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030
		Delivery Fuel Surcharge %		18.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	19.0%	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	29.0%	27.0%	27.0%	23.5%	26.0%	26.0%
		Delivery Fuel Surchage (%*Delivery)		$0.005	$0.005	$0.005	$0.005	$0.006	$0.006	$0.006	$0.006	$0.007	$0.007	$0.007	$0.007	$0.007	$0.008	$0.008	$0.008	$0.009	$0.008	$0.008	$0.007	$0.008	$0.008
		Total $/Gallon	**$2.352**	**$2.203**	**$2.147**	**$2.048**	**$2.093**	**$2.053**	**$1.950**	**$1.869**	**$2.040**	**$2.324**	**$2.355**	**$2.412**	**$2.292**	**$2.382**	**$2.338**	**$2.338**	**$2.564**	**$2.675**	**$3.389**	**$2.560**	**$2.482**	**$2.564**	**$2.664**

Notes: During the time frame shown here, 5,755,774 gallons of DF2+10 and 8,829,573 gallons of DF2-15 were consumed by EU ID's 1 and 2 at the North Pole Plant, giving a weighted average cost differential between No. 2 HSD and ULSD of $0.424 per gallon.

		Gallons	Product	
North Pole ULSD DF2+10 Difference	$0.416	5,755,774	2,392,769	$0.424
North Pole ULSD DF2-15 Difference	$0.430	8,829,573	3,793,174	
North Pole ULSD LSR/Naptha Difference	$1.117			

Golden Valley Electric Association
PO Box 71249, Fairbanks, AK 99707-1249 • (907) 452-1151 • www.gvea.com
Your Touchstone Energy® Cooperative

March 27, 2020

Email Submittal
dec.aq.airreports@alaska.gov

Alaska Department of Environmental Conservation
Air Permits Program
ATTN: Assessable Emissions Estimate
410 Willoughby Avenue, Suite 303
PO Box 111800
Juneau, AK 99811-1800

Subject: Golden Valley Electric Association
FY2021 Assessable Emission Estimates

Dear Compliance Technician,

Enclosed please find the FY2021 Assessable Emission Estimates for the following Golden Valley Electric Association (GVEA) facilities.

Facility	Air Quality Permit No.	CY2019 Actual Emissions (Tons)	Fee Estimate
Healy Power Plant	AQ0173TVP03	1,568	$67,346
North Pole Power Plant	AQ0110TVP03	1,390	$59,695
Zehnder Facility	AQ0109TVP03	101	$ 4,359
Delta	AQ0880TVP03	0	$0

Assessable emission estimates for all facilities are based on actual emissions from calendar year 2019.

If you have any questions or would like any additional information, please contact me by phone at 907-458-4557 or by email at nmknight@gvea.com. The certification from Frank E. Perkins, Vice President Power Supply Follows.

Sincerely,

Naomi Morton Knight, P.E.
Environmental Officer

Certification

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate and complete.

Frank E. Perkins
Vice President Power Supply

Enclosures

Golden Valley Electric Association
FY2021 Assessable Emission Estimates

Healy Power Plant – Permit No. AQ0173TVP03

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Table 1. FY2021 Assessable Emissions Summary
Golden Valley Electric Association - Healy Power Plant

Assessable Emissions - Tons Per Year							
Description	**NO_X**	**CO**	**PM**	**VOC**	**SO_2**	**HAPs**	**Total**
Assessable PTE	606	980	198	14	707	13	2,518

From Condition 112 and Table E of the Statement of Basis for Permit AQ0173TVP03.

	Regulated Air Pollutant Emissions (tons per year) [1]					
	NO_X	**CO**	**PM**	**VOC**	**SO_2**	**HAPs**
Significant	277.8	922.8	20.9	8.0	345.0	5.0
Insignificant	0.0	0.0	1.1	0.0	0.0	0.0
Total Emissions	**278**	**923**	**22**	**8**	**345**	**5**
Fees Apply to Pollutant? [2]	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**
CY2019 Actual Emissions	**1,568**					
Fee Estimate [3]	**$67,346**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[3] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2021 Significant Emissions Unit Summary
Golden Valley Electric Association - Healy Power Plant

Emissions Unit				Fuel / Material	CY2019 Actual
ID	Name	Description	Rating	Type	Operation [1]
1	Unit No. 1	Foster-Wheeler Boiler (w/ SNCR)	327 MMBtu/hr	Coal/ULSD	7,441 hours
				ULSD	116,247 gallons
2	Unit No. 2	TRW Integrated Entrained Combustion System (w SCR)	658 MMBtu/hr	Coal/ULSD	6,350 hours
				ULSD	986,566 gallons
3	Auxiliary Boiler No. 1	Cleaver Brooks CB 189-300	12.554 MMBtu/hr	ULSD	12,857 gallons
4	Auxiliary Boiler No. 2	Cleaver Brooks CB 100-800	23.0 MMBtu/hr	ULSD	40,339 gallons
5	Diesel Generator Engine No. 1	Electro-Motive Diesel EMD 20-645-E4	2.75 MW	ULSD	29 gallons
6	Crusher System	2 grizzlies, 1 primary Stamler crusher, 2 belt feeders, 2 secondary Flextooth-Dresser crushers, 2 hoppers, and the No. 1 conveyor belt (tail-end), all commonly vented to Dust Collector No. 1 (baghouse/exhaust fan).	12,000 cfm	Coal	2,510 hours [2]
7	Limestone Storage Silo	Limestone Storage Silo with Baghouse	800 cfm	Lime	0 hours
8	Flyash Storage Silo	Flyash Storage Silo with Baghouse	5,000 cfm	Flyash	6,350 hours
9	Sodium Bicarbonate Handling System	Mill, Sodium Bicarbonate Silo, and Baghouse	440 cfm	Sodium Bicarbonate	123 hours
10	Coal Handling System	No. 1 conveyor belt (head-end), No. 2 2a conveyor belt, No. 2b conveyor belt, one bucket elevator, No. 3 conveyor belt, No. 4 conveyor belt, two 600 ton EU ID 2 coal storage silos, two EU ID 1 bunkers, all commonly vented to Dust Collector No. 2 (baghouse/exhaust fan). Note: When EU ID 2 is not operational, dust is collected at the EU ID 1 transfer points via a Dust Collector No. 3 (baghouse/exhaust fan).	20,000 cfm	Coal	2,510 hours [2]
11	Haul Road	Haul Road (located on GVEA property) from Usibelli Coal Mine property line to coal pile	0.25 miles	Fugitive Dust	8,760 hours
12	Coal Storage Pile	Open Coal Storage Pile	15 day supply	Coal	8,760 hours
13	Firewater Pump Engine	Caterpillar 3406B	264 hp	ULSD	6 hours

Notes:
[1] Hours are based on CY2019 operation in accordance with condition 112 Permit No. AQ0173TVP03.
[2] Emissions units do not operate continuously.

Table 2b. FY2021 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel / Material	CY2019 Actual	Rating
ID	Description	Make/Model	Type	Operation	
N/A	Lime Storage Silo No. 1	N/A	Lime	6,357 hours [1]	1,800 acfm
N/A	Lime Storage Silo No. 2	N/A	Lime	hours [1]	1,800 acfm
N/A	Ash Handling	N/A	Ash	8,760 hours	Not Applicable
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	8,760 hours	Not Applicable
N/A	AST Diesel Tanks (2)	N/A	Diesel	8,760 hours	25,000 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,760 hours	2,000 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,760 hours	300 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,760 hours	425 gallons
N/A	Central Vac (3)	Turbo Tron	Coal	1,095 hours [2]	900 acfm
N/A	Urea Storage Silo A/B Bin Vent Filter	N/A	Urea	136 hours [3]	1,500 acfm
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	N/A	Urea	170 hours [4]	400 acfm
N/A	Sodium Bicarbonate Unloading Portable Baghouse	N/A	Sodium Bicarbonate	15 hours [5]	850 scfm

Note:
[1] This emissions unit is associated with EU ID 2.
[2] Estimated operation of 1,095 hours is assumed with each of the three units operating one hour per day.
[3] The estimated maximum annual use is 160 hr/yr. This emissions unit is associated with the EU ID 1 SNCR system and the EU ID 2 SCR system.
Estimated CY2019 Hours = (160 hr/yr) x (maximum actual hours for EU IDs 1 or 2 during CY2019) / (8,760 potential hours)
[4] The estimated maximum annual use is 200 hr/yr. This emissions unit is associated with the EU ID 1 SNCR system and the EU ID 2 SCR system.
Estimated CY2019 Hours = (200 hr/yr) x (maximum actual hours for EU IDs 1 or 2 during CY2019) / (8,760 potential hours)
[5] This emissions unit is associated with EU ID 1.

Table 3. FY2021 Assessable Emissions Calculations - Oxides of Nitrogen (NOX) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Emissions Unit Rating/Capacity	Fuel Type	Factor Reference	NO_X Emission Factor	CY2019 Actual Operation	CY2019 Actual NO_X Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2019 CEMS Data (with SNCR)	54.9 lb/hr	7,441 hours	204.3 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2019 CEMS Data (with SCR)	23.0 lb/hr	6,350 hours	73.0 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42 Table 1.3-1	20 lb/10^3 gal	12,857 gallons	0.1 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42 Table 1.3-1	20 lb/10^3 gal	40,339 gallons	0.4 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42 Table 3.4-1	3.2 lb/MMBtu	29 gallons	0 tpy [1]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,510 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	6,350 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	123 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,510 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.031 lb/hp-hr	6 hours	2.5E-02 tpy
						Significant Emissions Units Emissions - CY2019 Actual Emissions - NOX	**277.8 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	6,357 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,760 hours	0 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	136 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	170 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	15 hours	0 tpy
						Insignificant Emissions Units Emissions - CY2019 Actual Emissions - NOX	**0 tpy**
						CY2019 Actual Emissions - NOX	**277.8 tpy**

Notes:
[1] Diesel Heating Value 133,450 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 4. FY2021 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	CO Emission	CY2019 Actual	CY2019 Actual
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	CO Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2019 CEMS Data	246.2 lb/hr	7,441 hours	916.0 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2019 CEMS Data	2.1 lb/hr	6,350 hours	6.7 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-1	5 lb/10^3 gal	12,857 gallons	3.2E-02 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Table 1.3-1	5 lb/10^3 gal	40,339 gallons	1.0E-01 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42, Table 3.4-1	0.85 lb/MMBtu	29 gallons	0 tpy [1]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,510 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	6,350 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	123 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,510 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.00668 lb/hp-hr	6 hours	5.3E-03 tpy
						Significant Emissions Units Emissions - CY2019 Actual Emissions - CO	**922.8 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	6,357 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,760 hours	0 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	136 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	170 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	15 hours	0 tpy
						Insignificant Emissions Units Emissions - CY2019 Actual Emissions - CO	**0 tpy**
						CY2019 Actual Emissions - CO	**922.8 tpy**

Notes
[1] Diesel Heating Value 133,450 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 5. FY2021 Assessable Emissions Calculations - Particulate Matter (PM) Emissions (Filterable and Condensable)
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	PM Emission	CY2019 Actual	CY2019 Actual
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	PM Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2019 CEMS Data	0.9 lb/hr	7,441 hours	3.3 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2019 CEMS Data	3.16 lb/hr	6,350 hours	2.9 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Tables 1.3-2 and 1.3-7	2.3 lb/10^3gal	12,857 gallons	0.0 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Tables 1.3-2 and 1.3-7	2.3 lb/10^3gal	40,339 gallons	0.0 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42 Table 3.4-2	0.0573 lb/MMBtu	29 gallons	0.0 tpy [1]
6	Crusher System	12,000 cfm	Coal	Permit AQ0173TVP03, Table B	2.05 lb/hr	2,510 hours	2.6 tpy
7	Limestone Storage Silo	800 cfm	Lime	Permit AQ0173TVP03, Table B	0.14 lb/hr	0 hours	0.0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	Permit AQ0173TVP03, Table B	0.86 lb/hr	6,350 hours	2.7 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	Design Specifications	0.02 gr/dscf	123 hours	0.0 tpy
10	Coal Handling System	20,000 cfm	Coal	Permit AQ0173TVP03, Table B	3.43 lb/hr	2,510 hours	4.3 tpy
11	Haul Road	0.25 miles	Fugitive Dust	See Table 5a		8,760 hours	3.0 tpy
12	Coal Storage Pile	15 day supply	Coal	See Table 5b		8,760 hours	2.0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.0022 lb/hp-hr	6 hours	0.0 tpy
Significant Emissions Units Emissions - CY2019 Actual Emissions - PM							**20.9 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf	6,357 hours	0.2 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf		
N/A	Ash Handling	Not Applicable	Ash	See Table 5c		8,760 hours	0.1 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	See Table 5d		8,760 hours	0.5 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0.0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0.0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0.0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0.0 tpy
N/A	Central Vac (3)	900 acfm	Coal	Engineering Estimate	0.05 gr/dcf	1,095 hours	0.2 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	Engineering Estimate	0.005 gr/dcf	136 hours	0.0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	Engineering Estimate	0.005 gr/dcf	170 hours	0.0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	Vendor Data	0.02 gr/acf	15 hours	0.0 tpy
Insignificant Emissions Units Emissions - CY2019 Actual Emissions - PM							**1.11 tpy**
CY2019 Actual PM Emissions							**22.1 tpy**

Notes

[1] Diesel Heating Value 133,450 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton
7,000 grains/lb

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, gr/dcf) x (Rating, cfm) x (Conversion, 60 min/hr) x (Operation, hr/yr) / (Conversion, 7,000 gr/lb) / (Conversion, 2,000 lb/ton)

Table 5a. FY2021 Assessable Emissions Calculations - Haul Road Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit		Factor Reference	Emission Factor	CY2019 Actual Operation	CY2019 Actual PM Emissions
ID	Description				
11	Coal Haul - Unpaved Portion	AP-42, Section 13.2.2	5.10 lb/VMT	1,190 VMT	3.0 tpy [1]
				CY2019 Actual PM Emissions	**3.0 tpy**

Notes:
[1] Coal Haul Road

Unpaved Road Emission Factor
AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	4.9	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	193.75	tons, estimate - average of full (262.5 ton) and empty (125 ton) truck
a (empirical constant)	0.7	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	17.56	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	7.03	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	5.10	lb/VMT

Table 5a. FY2021 Assessable Emissions Calculations - Haul Road Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Coal Throughput

$$Throughput = \frac{Capacity\left(\frac{MMBtu}{hr}\right) \times Operation\left(\frac{hr}{year}\right)}{Coal\ Heat\ Value\left(\frac{MMBtu}{ton}\right)}$$

EU ID 1 CY2019 actual coal throughput	146,690	tons	from Healy environmental report
EU ID 2 CY2019 actual coal throughput	180,524	tons	from Healy environmental report
Total CY2019 actual coal throughput	327,213	tons	

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\left(\frac{tons}{trip}\right)}$$

Haul truck capacity	138	tons, estimate
Unpaved distance from coal pile to paved road (round trip)	0.50	miles/trip
Unpaved road VMT =	1,189.87	miles

Table 5b. FY2021 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Factor Reference	Emission Factor	CY2019 Actual Operation	CY2019 Actual PM Emissions
12	Truck Drop Onto Stockpile	AP-42, Section 13.2.4	2.43E-04 lb/ton	327,213 tpy	0.0 tpy [1]
	Front End Loader Drop Into Grizzly	AP-42, Section 13.2.4	2.43E-04 lb/ton	327,213 tpy	0.0 tpy [1]
	Front End Loader Movement - Coal Pile to Grizzly	AP-42, Section 13.2.2	3.27 lb/VMT	1,189 VMT	1.9 tpy [2]
	Stockpile Wind Erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr	10,150 m^2	0.0 tpy [3]
				CY2019 Actual PM Emissions	**2.0 tpy**

Notes:

[1] Truck Drop onto Stockpile and Front End Loader Drop to Grizzly

Drop Operation Emission Factor:

AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

	PM		
k	0.74		AP-42, Section 13.2.4
U = mean wind speed	16.50	miles/hr	Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant
M = coal moisture content	30.80	percent	Weighted average from EU ID 1 and 2 CY2019 coal proximate analyses
E =	2.43E-04	lb/ton	

Annual Stockpile Throughput:

$$Throughput = \frac{Capacity\left(\frac{MMBtu}{hr}\right) \times Operation\left(\frac{hr}{year}\right)}{Coal\ Heat\ Value\left(\frac{MMBtu}{ton}\right)}$$

EU ID 1 CY2019 actual coal throughput	146,690	tons	from Healy environmental report
EU ID 2 CY2019 actual coal throughput	180,524	tons	from Healy environmental report
Total CY2019 actual coal throughput	327,213	tons	

[2] Front End Loader Movement

Coal moved per trip:

$$Coal\ (tons) = \frac{Coal\ Density\left(\frac{lb}{ft^3}\right) \times 27\left(\frac{ft^3}{yd^3}\right) \times Bucket\ Size(yd^3)}{2000\left(\frac{lb}{ton}\right)}$$

Size of load bucket	11	yd^3
Density of coal	52.63	lb/ft^3
Coal moved per trip	7.815555	tons

Table 5b. FY2021 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emission Factor
AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	4.9	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	33.2	tons, estimate
a (empirical constant)	0.7	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	11.26	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	4.50	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	3.27	lb/VMT

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\left(\frac{tons}{trip}\right)}$$

Total Actual Coal Throughput	327,213	tons
Coal moved per trip	7.815555	tons
Approximate distance from coal pile to grizzly (round trip)	150	feet
VMT = vehicles miles traveled per year	1,189	

Table 5b. FY2021 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

[3] Stockpile Wind Erosion

Coal Pile Surface Area

Surface area of active face = 10,150 m^2 — Engineering estimate of projected use

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\left(\frac{g}{m^2yr}\right) = k\sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (AP-42 Section 13.2.5.3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\,(u^* - u_t^*)^2 + 25\,(u^* - u_t^*)$$

$$P = 0 \; for \; u^* \le u_t^*$$

where u* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u*

$$u^* = \frac{0.4 \times u(z)}{\ln\left(\frac{z}{z_o}\right)} \quad when\; z > z_o$$

where u* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Using average wind speed recorded at GVEA's Eva Creek Wind farm for each month in CY2019 (see table below)
z	10	meters
N	365	disturbances/year for active face, estimated
	30	average disturbances/month

Table 5b. FY2021 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Month-Year	Average Wind Speed (u(10)) [a]		Wind Direction	Uncrusted Coal Pile [b] (Table 13.2.5-2)				Ground Coal (Table 13.2.5-2)						
				Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Jan-19	18.6	8.3	150	0.3	1.12	0.41	0	0.01	0.55	0.29	0	0		
Feb-19	17.4	7.8	180	0.3	1.12	0.38	0	0.01	0.55	0.27	0	0		
Mar-19	19.9	8.9	179	0.3	1.12	0.44	0	0.01	0.55	0.31	0	0		
Apr-19	14.8	6.6	173	0.3	1.12	0.33	0	0.01	0.55	0.23	0	0		
May-19	15.5	6.9	181	0.3	1.12	0.34	0	0.01	0.55	0.24	0	0		
Jun-19	9.7	4.3	204	0.3	1.12	0.21	0	0.01	0.55	0.15	0	0		
Jul-19	11.2	5.0	202	0.3	1.12	0.25	0	0.01	0.55	0.17	0	0		
Aug-19	13.1	5.9	224	0.3	1.12	0.29	0	0.01	0.55	0.20	0	0		
Sep-19	16.9	7.6	197	0.3	1.12	0.37	0	0.01	0.55	0.26	0	0		
Oct-19	20	8.9	182	0.3	1.12	0.44	0	0.01	0.55	0.31	0	0		
Nov-19	23.1	10.3	153	0.3	1.12	0.51	0	0.01	0.55	0.36	0	0		
Dec-19	17.4	7.8	152	0.3	1.12	0.38	0	0.01	0.55	0.27	0	0		
CY2019 PM_{10} Annual Total							0				0.00	0.00	0.5	**0.00**

[a] Per MET data recorded at GVEA's Eva Creek Wind farm CY2019.

[b] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions.

Table 5c. FY2021 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Factor Reference	Emission	Emission Factor	CY2019 Actual Operation	CY2019 Actual PM Emissions
N/A	Front End Loader / Flyash Storage Silo Drop Into Truck	AP-42, Section 13.2.4	PM	2.68E-04 lb/ton	14,319 tons	1.9E-03 tpy [1]
	Front End Loader Movement - Ash Drying Area to Truck	AP-42, Section 13.2.2	PM	2.98 lb/VMT	86 VMT	1.3E-01 tpy [2]
	Ash Drying Area Wind Erosion	AP-42, Section 13.2.5	PM	0.00 g/m^2	4,800 m^2	0 tpy [3]
					CY2019 Actual PM Emissions	**1.3E-01 tpy**

Notes:
[1] Front End Loader / Flyash Storage Silo Drop into Truck
AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

	PM		
k	0.74		
U = mean wind speed	16.50	miles/hr	Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant
M = ash moisture content	17.5	percent	Avg of slag, bottom ash, and fly ash from Heat and Material Balance for HCCP - March 6, 1998
E (uncontrolled) =	5.37E-04	lb/ton	
Efficiency =	50%	assumption because material is wet	
E (controlled) =	2.68E-04	lb/ton	

Annual stockpile throughput:

EU ID 1 CY2019 Ash Throughput	14,319	tons	from Healy environmental report
EU ID 2 CY2019 Ash Throughput	19,657	tons	from Healy environmental report
Total Ash Throughput	33,976	tons	

[2] Front End Loader Movement - Ash Pile to Truck
Ash moved per trip:

$$Ash\,(tons) = \frac{Ash\ Density\left(\frac{lb}{ft^3}\right) \times 27\left(\frac{ft^3}{yd^3}\right) \times Bucket\ Size(yd^3)}{2000\left(\frac{lb}{ton}\right)}$$

Size of load bucket	8	yd^3
Density of ash	60	lb/ft^3
Ash moved per trip	6.48	tons

Table 5c. FY2021 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

AP-42, Section 13.2.2

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}$$

	PM	
k	4.9	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons, estimate
a (empirical constant)	0.7	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	10.26	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	4.10	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	2.98	lb/VMT

Approximate distance from ash pile to truck (round trip)	150	feet
VMT = vehicles miles traveled per year	86.18	

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion
Ash Pile Surface Area

Surface area of active face =	4,800 m^2	Engineering estimate of projected use

AP-42 Section 13.2.5, Equation (2)
Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\left(\frac{g}{m^2 yr}\right) = k\sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (0.5 for particle size < 10 microns, per AP-42 Section 13.2.5.3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

Table 5c. FY2021 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\,(u^* - u_t^*)^2 + 25\,(u^* - u_t^*)$$

$$P = 0\ for\ u^* \le u_t^*$$

where u* = friction velocity (m/s)

u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u*

$$u^* = \frac{0.4 \times u(z)}{\ln\left(\frac{z}{z_o}\right)}\quad when\ z > z_o$$

where u* = friction velocity (cm/s)

u(z) = wind speed at height z above test surface (cm/s)

z = height above test surface (cm)

z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at McKinley Airport ASOS for each month in CY2018 (see table below)
z	10	meters
N	365	disturbances/year for active face, estimated
	30	average disturbances/month

Ash pile [a] (Table 13.2.5-2)												
Month-Year	Average Wind Speed (u(10)) [b]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor (uncontrolled), EF	Emission Factor (controlled), EF [c]
	mph	m/s	deg	cm	m/s	m/s				g/m^2-yr	g/m^2-yr
Jan-19	18.6	8.3	150	0.3	1.02	0.41	0	0.0			
Feb-19	17.4	7.8	180	0.3	1.02	0.38	0	0.0			
Mar-19	19.9	8.9	179	0.3	1.02	0.44	0	0.0			
Apr-19	14.8	6.6	173	0.3	1.02	0.33	0	0.0			
May-19	15.5	6.9	181	0.3	1.02	0.34	0	0.0			
Jun-19	9.7	4.3	204	0.3	1.02	0.21	0	0.0			
Jul-19	11.2										
Aug-19	13.1	5.9	224	0.3	1.02	0.29	0	0.0			
Sep-19	16.9	7.6	197	0.3	1.02	0.37	0	0.0			
Oct-19	20	8.9	182	0.3	1.02	0.44	0	0.0			
Nov-19	23.1	10.3	153	0.3	1.02	0.51	0	0.0			
Dec-19	17.4	7.8	152	0.3	1.02	0.38	0	0.0			
CY2018 PM_{10} Annual Total							0	0.00	0.5	**0.00**	**0.00**

[a] No emission factor exists for ash. Overburden is considered the most representative alternative because it includes both fine (ash) and coarse (slag) particles.

[b] Per www.ncdc.noaa.gov for CY2018, McKinley Airport ASOS (PAIN).

[c] Control efficiency of 50% is assumed since material wet.

Table 5d. FY2021 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit		Factor Reference	Emission Factor	CY2019 Actual Operation	CY2019 Actual PM Emissions
ID	Description				
N/A	Ash Haul - Unpaved (EU ID 1)	AP-42, Section 13.2.2	4.56 lb/VMT	106 VMT	0.24 tpy [1]
	Ash Haul - Unpaved (EU ID 2)	AP-42, Section 13.2.2	4.56 lb/VMT	109 VMT	2.5E-01 tpy [1]
	Limestone/Lime Delivery - Paved Portion	AP-42, Section 13.2.1	0.40 lb/VMT	13 VMT	2.5E-03 tpy [2]
	Limestone/Lime Delivery - Unpaved Portion	AP-42, Section 13.2.2	4.15 lb/VMT	6 VMT	1.2E-02 tpy [2]
	Miscellaneous Traffic - Paved Portion	AP-42, Section 13.2.1	0.007 lb/VMT	5,185 VMT	1.7E-02 tpy [3]
				CY2019 Actual PM Emissions	**0.52 tpy**

Notes:
[1] Ash Haul Road

Unpaved Road Emission Factor
AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	4.9	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	151.25	tons, estimate - average of full (197.5 ton) and empty (105 ton) truck
a (empirical constant)	0.7	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	15.71	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	6.28	lb/VMT

Table 5d. FY2021 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	4.56	lb/VMT

Ash Throughput

EU ID 1 ash disposal throughput	14,319	tons	from Healy environmental report
EU ID 2 ash disposal throughput	19,657	tons	from Healy environmental report

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\ \left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\ \left(\frac{tons}{trip}\right)}$$

Haul truck capacity	92.5	tons, estimate
Unpaved distance to ash drying area (round trip)	0.68	miles/trip
Unpaved distance to EU ID 8 (round trip)	0.51	miles/trip
EU ID 1 unpaved road VMT =	105.55	miles
EU ID 2 unpaved road VMT =	108.67	miles

Table 5d. FY2021 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

[2] Limestone/Lime/Sodium Bicarbonate Haul Road

Paved Road Emission Factor

AP-42, Section 13.2.1, Equation 1:

$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

	PM	
k = particle size multiplier	0.011	lb/VMT from AP-42 Table 13.2.1-1
sL = surface material silt content (haul road)	0.6	g/m^2, from AP-42, Table 13.2.1-3
W = mean vehicle weight	122.5	tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer
E (uncontrolled) =	0.86	lb/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	0.43	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.

AP-42, Section 13.2.1, Equation 2:

$$E_{ext} = E\left(1 - \frac{P}{4 * 365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT

E = emission factor from Equation 1a

P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.40	lb/VMT

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}$$

	PM	
k	4.9	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	122.5	tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer
a (empirical constant)	0.7	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	14.29	lb/VMT
Efficiency =	60%	assumed control efficiency for water
E (controlled) =	5.72	lb/VMT

Table 5d. FY2021 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	4.15	lb/VMT

Throughput

Limestone/Lime Throughput	718	tons, CY2018 actual
Sodium Bicarbonate Throughput	383	tons, CY2018 actual

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\,\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\,\left(\frac{tons}{trip}\right)}$$

Haul truck capacity	25	tons, estimate
Paved distance (round trip)	0.28	miles/trip
Unpaved distance (round trip)	0.13	miles/trip
Paved road VMT =	12.51	miles
Unpaved road VMT =	5.84	miles

[3] Miscellaneous Traffic

Paved Road Emission Factor

AP-42, Section 13.2.1, Equation 1:

$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

	PM	
k = particle size multiplier	0.011	lb/VMT from AP-42 Table 13.2.1-1
sL = surface material silt content (haul road)	0.6	g/m^2, from AP-42, Table 13.2.1-3
W = mean vehicle weight	2	tons, estimate
E (uncontrolled) =	0.01	lb/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	7.05E-03	lb/VMT

Table 5d. FY2021 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.1, Equation 2:

$$E_{ext} = E\left(1 - \frac{P}{4 * 365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.007	lb/VMT

Vehicle Miles Traveled (VMT)

Traffic volume	50	trips per day
Paved distance (round trip)	0.28	miles/trip
Paved road VMT =	5,184.66	miles

Table 6. FY2021 Assessable Emissions Calculations - Volatile Organic Compounds (VOC) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Rating/Capacity	Fuel Type	Factor Reference	VOC Emission Factor	CY2019 Actual Operation	CY2019 Actual VOC Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	AP-42, Table 1.1-19	0.06 lb/ton	7,441 hours	4.4 tpy [1]
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	AP-42, Table 1.1-19	0.04 lb/ton	6,350 hours	3.6 tpy [2]
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10^3 gal	12,857 gallons	2.2E-03 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10^3 gal	40,339 gallons	6.9E-03 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42, Table 3.4-1	0.0819 lb/MMBtu	29 gallons	0 tpy [3]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,510 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	6,350 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	123 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,510 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	6 hours	2.0E-03 tpy
Significant Emissions Units Emissions - CY2019 Actual Emissions - VOC							**8.0 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	6,357 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	136 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	170 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	15 hours	0 tpy
Insignificant Emissions Units Emissions - CY2019 Actual Emissions - VOC							**0 tpy**
CY2019 Actual Emissions - VOC							**8.0 tpy**

Notes

[1] EU ID 1 actual coal throughput	146,690 tons	
[2] EU ID 2 actual coal throughput	180,524 tons	
[3] Diesel Heating Value	133,450 Btu/gal	lab analysis
Conversion factors:	2,000 lb/ton	

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/ton) x (Potential throughput, ton/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 7. FY2021 Assessable Emissions Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Healy Power Plant

ID	Description	Rating/Capacity	Fuel Type	Factor Reference	Maximum Fuel Sulfur Content	SO_2 Emission Factor	CY2019 Actual Operation	CY2019 Actual SO_2 Emissions
Significant Emissions Units								
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2019 CEMS Data	N/A	75.5 lb/hr	7,441 hours	280.9 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2019 CEMS Data	N/A	20.2 lb/hr	6,350 hours	64.1 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	12,857 gallons	1.4E-03 tpy [3]
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	40,339 gallons	4.3E-03 tpy [3]
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	29 gallons	0 tpy [3]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	N/A	2,510 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	N/A	6,350 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	N/A	123 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	N/A	2,510 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	6 hours	8.8E-06 tpy [3,4]
Significant Emissions Units Emissions - CY2019 Actual Emissions - SO_2								**345.0 tpy**
Insignificant Emissions Units								
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	N/A	6,357 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	N/A	136 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	N/A	170 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	N/A	15 hours	0 tpy
Insignificant Emissions Units Emissions - CY2019 Actual Emissions - SO_2								**0 tpy**
CY2019 Actual Emissions - SO_2								**345.0 tpy**

Notes:
[1] Mass balance:
For diesel units, the SO_2 emission factor is calculated based on the sulfur content in diesel fuel
Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol; Stoichiometry: 1 mol S = 1 mol SO_2
SO_2 Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

[2] Diesel Fuel Density 7.1 lb/gal AP 42, Table 3.4-1, footnote a
[3] Diesel Heating Value 133,450 Btu/gal lab analysis
[4] Engine Heat Rate 7,000 Btu/hp-hr AP 42, Table 3.4-1, footnote e

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/gal) x (Fuel consumption, gal/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/gal) / (Fuel heat value, Btu/gal) x (Engine heat rate, Btu/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 8. FY2021 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Golden Valley Electric Association - Healy Power Plant

Hazardous Air Pollutant	CY2019 Actual HAP Emissions by Emissions Unit Category (tons per year) [1]						CY2019 Actual HAP Emissions
	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling [2]	Insignificant Units [3]	
Acetaldehyde	9.33E-02	----	4.25E-06	4.88E-08	----	----	9.33E-02
Acetophenone	2.45E-03	----	----	----	----	----	2.45E-03
Acrolein	4.74E-02	----	5.13E-07	1.52E-08	----	----	4.74E-02
Benzene	0.21	1.24E-04	5.17E-06	1.50E-06	----	----	0.21
Benzyl chloride	1.15E-01	----	----	----	----	----	1.15E-01
Biphenyl	2.78E-04	----	----	----	----	----	2.78E-04
Bis(2-ethylhexyl)phthalate (DEHP)	1.19E-02	----	----	----	----	----	1.19E-02
Bromoform	6.38E-03	----	----	----	----	----	6.38E-03
1,3 Butadiene	----	----	2.17E-07	----	----	----	2.17E-07
Carbon disulfide	2.13E-02	----	----	----	----	----	2.13E-02
2-Chloroacetophenone	1.15E-03	----	----	----	----	----	1.15E-03
Chlorobenzene	3.60E-03	----	----	----	----	----	3.60E-03
Chloroform	9.65E-03	----	----	----	----	----	9.65E-03
Cumene	8.67E-04	----	----	----	----	----	8.67E-04
Dibenzofurans	1.78E-07	----	----	----	----	----	1.78E-07
Dimethyl sulfate	7.85E-03	----	----	----	----	----	7.85E-03
2,4-Dinitrotoluene	4.58E-05	----	----	----	----	----	4.58E-05
Ethyl benzene	1.54E-02	3.68E-05	----	----	----	----	1.54E-02
Ethyl chloride (Chloroethane)	6.87E-03	----	----	----	----	----	6.87E-03
Ethylene dibromide (Dibromoethane)	1.96E-04	----	----	----	----	----	1.96E-04
Ethylene dichloride (1,2-Dichloroethane)	6.54E-03	----	----	----	----	----	6.54E-03
Formaldehyde	3.93E-02	1.91E-02	6.54E-06	1.53E-07	----	----	5.83E-02
Hexane	1.10E-02	----	----	----	----	----	1.10E-02
Hydrochloric acid	1.08	----	----	----	----	----	1.08
Hydrogen fluoride (Hydrofluoric acid)	0.14	----	----	----	----	----	0.14
Isophorone	9.49E-02	----	----	----	----	----	9.49E-02
Methyl bromide (Bromomethane)	2.62E-02	----	----	----	----	----	2.62E-02
Methyl chloride (Chloromethane)	8.67E-02	----	----	----	----	----	8.67E-02
Methyl chloroform (1,1,1-Trichloroethane)	3.27E-03	1.36E-04	----	----	----	----	3.41E-03
Methyl hydrazine	2.78E-02	----	----	----	----	----	2.78E-02
Methyl methacrylate	3.27E-03	----	----	----	----	----	3.27E-03
Methyl tert butyl ether	5.73E-03	----	----	----	----	----	5.73E-03
Methylene chloride (Dichloromethane)	4.74E-02	----	----	----	----	----	4.74E-02
Phenol	2.62E-03	----	----	----	----	----	2.62E-03
Polycyclic Organic Matter (POM)	3.12E-03	6.88E-04	9.32E-07	4.09E-07	----	----	3.81E-03
Acenaphthene	8.34E-05	1.46E-07	7.87E-09	9.06E-09	----	----	
Acenaphthylene	4.09E-05	1.22E-05	2.81E-08	1.79E-08	----	----	
Anthracene	3.44E-05	7.05E-07	1.04E-08	2.38E-09	----	----	
Benzo(a)anthracene	1.31E-05	2.32E-06	9.31E-09	1.20E-09	----	----	
Benzo(a)pyrene	6.22E-06	----	1.04E-09	4.97E-10	----	----	
Benzo(b)fluoranthene	----	----	5.49E-10	2.15E-09	----	----	
Benzo(g,h,i)perylene	4.42E-06	----	2.71E-09	----	----	----	
Benzo(k)fluoranthene	----	----	8.59E-10	4.22E-10	----	----	

Table 8. FY2021 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Golden Valley Electric Association - Healy Power Plant

Hazardous Air Pollutant	CY2019 Actual HAP Emissions by Emissions Unit Category (tons per year) [1]						CY2019 Actual HAP Emissions
	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling [2]	Insignificant Units [3]	
Chrysene	1.64E-05	1.38E-06	1.96E-09	2.96E-09	----	----	
Dibenz(a,h)anthracene	----	9.65E-07	3.23E-09	6.70E-10	----	----	
Acenaphthene	8.34E-05	1.46E-07	7.87E-09	9.06E-09	----	----	
Fluoranthene	1.16E-04	2.80E-06	4.22E-08	7.80E-09	----	----	
Fluorene	1.49E-04	2.58E-06	1.62E-07	2.48E-08	----	----	
Indeno(1,2,3-cd)pyrene	----	1.24E-06	----	8.01E-10	----	----	
Naphthalene	2.13E-03	6.53E-04	4.70E-07	2.52E-07	----	----	
Pyrene	5.40E-05	2.46E-06	2.65E-08	7.18E-09	----	----	
Propionaldehyde	6.22E-02	----	----	----	----	----	6.22E-02
Styrene	4.09E-03	----	----	----	----	----	4.09E-03
2,3,7,8-Tetrachlorodibenzo-p-dioxin	2.34E-09	----	----	----	----	----	2.34E-09
Tetrachloroethylene (Perchloroethylene)	7.04E-03	----	----	----	----	----	7.04E-03
Toluene	3.93E-02	3.58E-03	2.27E-06	5.44E-07	----	----	4.29E-02
Vinyl acetate	1.24E-03	----	----	----	----	----	1.24E-03
Xylenes (isomers and mixture)	6.05E-03	----	1.58E-06	3.73E-07	----	----	6.06E-03
Antimony Compounds	2.94E-03	----	----	----	----	----	2.94E-03
Arsenic Compounds	6.71E-02	3.09E-04	----	----	----	----	6.74E-02
Beryllium Compounds	3.44E-03	2.31E-04	----	----	----	----	3.67E-03
Cadmium Compounds	8.34E-03	2.31E-04	----	----	----	----	8.58E-03
Chromium Compounds	5.55E-02	2.31E-04	----	----	----	----	5.57E-02
Cobalt Compounds	1.64E-02	----	----	----	----	----	1.64E-02
Cynaide Compounds	0.41	----	----	----	----	----	0.41
Lead Compounds	6.87E-02	6.94E-04	----	----	----	----	6.94E-02
Magnesium Compounds	1.80	----	----	----	----	----	1.80
Manganese Compounds	8.02E-02	4.63E-04	----	----	----	----	8.06E-02
Mercury Compounds	3.86E-03	2.31E-04	----	----	----	----	4.10E-03
Nickel Compounds	4.58E-02	2.31E-04	----	----	----	----	4.60E-02
Selenium Compounds	0.21	1.16E-03	----	----	----	----	0.21
Total HAPs - Maximum Individual HAP	**1.80**	**1.91E-02**	**6.54E-06**	**1.50E-06**	**0**	**0**	**1.80**
Total VOC HAP Emissions	**1.03**	**2.36E-02**	**2.15E-05**	**3.04E-06**	**0**	**0**	**1.06**
Total HAPs Emissions	**5.02**	**2.74E-02**	**2.15E-05**	**3.04E-06**	**0**	**0**	**5.05**

Notes:
[1] See individual emissions unit category emissions calculations for details on methodology and assumptions.
[2] Emissions units in the coal preparation and handling, ash handling and coal storage pile systems do not have HAP emissions
[3] HAP emissions from the fuel storage tanks are negligible.

Table 8a. FY2021 Assessable Emissions Calculations - Hazardous Air Pollutant (HAP) Emissions
Coal-Fired Boilers
Golden Valley Electric Association - Healy Power Plant

EU ID 1 CY2019 actual coal throughput	146,690	tons
EU ID 2 CY2019 actual coal throughput	180,524	tons
Total CY2019 actual coal throughput	**327,213**	**tons**

CAS No.	Chemical Name	CY2019 Actual Source Category Emission Calculations Emission Factor [1]	Estimated Emissions
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.43E-11 lb/ton	2.34E-09 tpy
121142	2,4-Dinitrotoluene	2.80E-07 lb/ton	4.58E-05 tpy
532274	2-Chloroacetophenone	7.00E-06 lb/ton	1.15E-03 tpy
75-07-0	Acetaldehyde	5.70E-04 lb/ton	9.33E-02 tpy
98862	Acetophenone	1.50E-05 lb/ton	2.45E-03 tpy
107-02-8	Acrolein	2.90E-04 lb/ton	4.74E-02 tpy
71-43-2	Benzene	1.30E-03 lb/ton	2.13E-01 tpy
100447	Benzyl chloride	7.00E-04 lb/ton	1.15E-01 tpy
92524	Biphenyl	1.70E-06 lb/ton	2.78E-04 tpy
117817	Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05 lb/ton	1.19E-02 tpy
75252	Bromoform	3.90E-05 lb/ton	6.38E-03 tpy
75150	Carbon disulfide	1.30E-04 lb/ton	2.13E-02 tpy
108907	Chlorobenzene	2.20E-05 lb/ton	3.60E-03 tpy
67663	Chloroform	5.90E-05 lb/ton	9.65E-03 tpy
98828	Cumene	5.30E-06 lb/ton	8.67E-04 tpy
132649	Dibenzofurans	1.09E-09 lb/ton	1.78E-07 tpy
77781	Dimethyl sulfate	4.80E-05 lb/ton	7.85E-03 tpy
100-41-4	Ethyl benzene	9.40E-05 lb/ton	1.54E-02 tpy
75003	Ethyl chloride (Chloroethane)	4.20E-05 lb/ton	6.87E-03 tpy
1006934	Ethylene dibromide (Dibromoethane)	1.20E-06 lb/ton	1.96E-04 tpy
107062	Ethylene dichloride (1,2-Dichloroethane)	4.00E-05 lb/ton	6.54E-03 tpy
50-00-0	Formaldehyde	2.40E-04 lb/ton	3.93E-02 tpy
110543	Hexane	6.70E-05 lb/ton	1.10E-02 tpy
7647010	Hydrochloric acid - EU ID 1	1.42E-02 lb/ton [2]	1.04 tpy
7647010	Hydrochloric acid - EU ID 2	3.71E-04 lb/ton [3]	0.03 tpy
7664393	Hydrogen fluoride (Hydrofluoric acid) - EU ID 1	1.44E-03 lb/ton [2]	0.11 tpy
7664393	Hydrogen fluoride (Hydrofluoric acid) - EU ID 2	3.31E-04 lb/ton [3]	2.98E-02 tpy
78591	Isophorone	5.80E-04 lb/ton	9.49E-02 tpy
74839	Methyl bromide (Bromomethane)	1.60E-04 lb/ton	2.62E-02 tpy
60344	Methyl hydrazine	1.70E-04 lb/ton	2.78E-02 tpy
80626	Methyl methacrylate	2.00E-05 lb/ton	3.27E-03 tpy
1634044	Methyl tert butyl ether	3.50E-05 lb/ton	5.73E-03 tpy
74873	Methyl chloride (Chloromethane)	5.30E-04 lb/ton	8.67E-02 tpy
71-55-6	Methyl chloroform (1,1,1-Trichloroethane)	2.00E-05 lb/ton	3.27E-03 tpy
75092	Methylene chloride (Dichloromethane)	2.90E-04 lb/ton	4.74E-02 tpy
108952	Phenol	1.60E-05 lb/ton	2.62E-03 tpy
N/A	Polycyclic Organic Matter (POM)	1.91E-05 lb/ton	3.12E-03 tpy
	Polycyclic aromatic compounds(PAH)		
83-32-9	Acenaphthene	5.10E-07 lb/ton	8.34E-05 tpy
203-96-8	Acenaphthylene	2.50E-07 lb/ton	4.09E-05 tpy
120-12-7	Anthracene	2.10E-07 lb/ton	3.44E-05 tpy
56-55-3	Benzo(a)anthracene	8.00E-08 lb/ton	1.31E-05 tpy
205-99-5	Benzo(b,j,k)fluoranthene	1.10E-07 lb/ton	1.80E-05 tpy
50-32-8	Benzo(a)pyrene	3.80E-08 lb/ton	6.22E-06 tpy
191-24-2	Benzo(g,h,i)perylene	2.70E-08 lb/ton	4.42E-06 tpy
218-01-9	Chrysene	1.00E-07 lb/ton	1.64E-05 tpy
206-44-0	Fluoranthene	7.10E-07 lb/ton	1.16E-04 tpy
86-73-7	Fluorene	9.10E-07 lb/ton	1.49E-04 tpy
193-39-5	Ideno(1,2,3-cd)pyrene	6.10E-08 lb/ton	9.98E-06 tpy
	5-methylchrysene	2.20E-08 lb/ton	3.60E-06 tpy
91-20-3	Naphthalene	1.30E-05 lb/ton	2.13E-03 tpy

Table 8a. FY2021 Assessable Emissions Calculations - Hazardous Air Pollutant (HAP) Emissions
Coal-Fired Boilers
Golden Valley Electric Association - Healy Power Plant

EU ID 1 CY2019 actual coal throughput	146,690	tons
EU ID 2 CY2019 actual coal throughput	180,524	tons
Total CY2019 actual coal throughput	**327,213**	**tons**

		CY2019 Actual Source Category Emission Calculations	
CAS No.	**Chemical Name**	**Emission Factor [1]**	**Estimated Emissions**
85-01-8	Phenanathrene	2.70E-06 lb/ton	4.42E-04 tpy
129-00-0	Pyrene	3.30E-07 lb/ton	5.40E-05 tpy
123386	Propionaldehyde	3.80E-04 lb/ton	6.22E-02 tpy
100425	Styrene	2.50E-05 lb/ton	4.09E-03 tpy
127184	Tetrachloroethylene (Perchloroethylene)	4.30E-05 lb/ton	7.04E-03 tpy
108-88-3	Toluene	2.40E-04 lb/ton	3.93E-02 tpy
108054	Vinyl acetate	7.60E-06 lb/ton	1.24E-03 tpy
1330-20-7	Xylenes (isomers and mixture)	3.70E-05 lb/ton	6.05E-03 tpy
N/A	Antimony Compounds	1.80E-05 lb/ton	2.94E-03 tpy
N/A	Arsenic Compounds	4.10E-04 lb/ton	6.71E-02 tpy
N/A	Beryllium Compounds	2.10E-05 lb/ton	3.44E-03 tpy
N/A	Cadmium Compounds	5.10E-05 lb/ton	8.34E-03 tpy
N/A	Chromium Compounds	3.39E-04 lb/ton	5.55E-02 tpy
N/A	Cobalt Compounds	1.00E-04 lb/ton	1.64E-02 tpy
N/A	Cynaide Compounds	2.50E-03 lb/ton	4.09E-01 tpy
N/A	Lead Compounds	4.20E-04 lb/ton	6.87E-02 tpy
N/A	Magnesium Compounds	1.10E-02 lb/ton	1.80 tpy
N/A	Manganese Compounds	4.90E-04 lb/ton	8.02E-02 tpy
N/A	Mercury Compounds - EU ID 1	6.18E-06 lb/ton [4]	4.53E-04 tpy
	Mercury Compounds - EU ID 2	3.78E-05 lb/ton [5]	3.41E-03 tpy
N/A	Nickel Compounds	2.80E-04 lb/ton	4.58E-02 tpy
N/A	Selenium Compounds	1.30E-03 lb/ton	2.13E-01 tpy
		Total CY2019 Actual HAP Emissions	**5.02 tpy**

Notes:
[1] Reference: AP-42, Tables 1.1-12, 1.1-13, 1.1-14, 1.1-15, 1.1-18
[2] HCl and HF emission factors from EU ID 1 source test completed in November 2017
[3] HCl and HF emission factors from EU ID 2 source test completed in December 2018
[4] Emission factor from EU ID 1 source test completed in March 2019
[5] Emission factor from EU ID 2 CEMS average 2019

Conversion Factors:

Coal Heating Value	14.37	MMBtu/ton	CY2019 weighted average

Table 8b. FY2021 Assessable Emissions Calculations - Hazardous Air Pollutant (HAP) Emissions
Diesel-Fired Boilers and Heaters
Golden Valley Electric Association - Healy Power Plant

CY2019 Actual Heat Input: **154,269 MMBtu/yr [1]**

CAS No.	Chemical Name	CY2019 Actual Source Category Emission Calculations Emission Factor [2,3]	Estimated Emissions
71-43-2	Benzene	1.60E-06 lb/MMBtu	1.24E-04 tpy
100-41-4	Ethyl benzene	4.77E-07 lb/MMBtu	3.68E-05 tpy
50-00-0	Formaldehyde	2.47E-04 lb/MMBtu	1.91E-02 tpy
71-55-6	Methyl chloroform (1,1,1-Trichloroethane)	1.77E-06 lb/MMBtu	1.36E-04 tpy
NA	Polycyclic Organic Matter (POM)	8.92E-06 lb/MMBtu	6.88E-04 tpy
NA	Polycyclic aromatic compounds(PAH)		
83-32-9	Acenaphthylene	1.58E-07 lb/MMBtu	1.22E-05 tpy
208-96-8	Acenaphthene	1.90E-09 lb/MMBtu	1.46E-07 tpy
120-12-7	Anthracene	9.14E-09 lb/MMBtu	7.05E-07 tpy
56-55-3	Benzo(a)anthracene	3.00E-08 lb/MMBtu	2.32E-06 tpy
205-82-3/207-09-9	Benzo(b,k)fluoranthene	1.11E-08 lb/MMBtu	8.55E-07 tpy
191-24-2	Benzo(g,h,l)perylene	1.69E-08 lb/MMBtu	1.31E-06 tpy
218-01-9	Chrysene	1.78E-08 lb/MMBtu	1.38E-06 tpy
53-70-3	Dibenz(a,h)anthracene	1.25E-08 lb/MMBtu	9.65E-07 tpy
206-44-0	Fluoranthene	3.63E-08 lb/MMBtu	2.80E-06 tpy
86-73-7	Fluorene	3.35E-08 lb/MMBtu	2.58E-06 tpy
193-39-5	Indeno(1,2,3-cd)pyrene	1.60E-08 lb/MMBtu	1.24E-06 tpy
91-20-3	Naphthalene	8.47E-06 lb/MMBtu	6.53E-04 tpy
85-01-8	Phenanthrene	7.87E-08 lb/MMBtu	6.07E-06 tpy
129-00-0	Pyrene	3.18E-08 lb/MMBtu	2.46E-06 tpy
108-88-3	Toluene	4.65E-05 lb/MMBtu	3.58E-03 tpy
1330-20-7	Xylenes	8.17E-07 lb/MMBtu	6.30E-05 tpy
NA	Arsenic Compounds	4.00E-06 lb/MMBtu	3.09E-04 tpy
NA	Beryllium Compounds	3.00E-06 lb/MMBtu	2.31E-04 tpy
NA	Cadmium Compounds	3.00E-06 lb/MMBtu	2.31E-04 tpy
NA	Chromium Compounds	3.00E-06 lb/MMBtu	2.31E-04 tpy
NA	Lead Compounds	9.00E-06 lb/MMBtu	6.94E-04 tpy
NA	Manganese Compounds	6.00E-06 lb/MMBtu	4.63E-04 tpy
NA	Mercury Compounds	3.00E-06 lb/MMBtu	2.31E-04 tpy
NA	Nickel Compounds	3.00E-06 lb/MMBtu	2.31E-04 tpy
NA	Selenium Compounds	1.50E-05 lb/MMBtu	1.16E-03 tpy
		CY2019 Actual HAP Emissions:	**2.75E-02 tpy**

[1] Total fuel use based on actual CY2019 operation as noted below:

EU ID 1	Unit No. 1	327	MMBtu/hr
		116,247	gallons
	Actual Heat Input:	15,513.16	MMBtu/yr
EU ID 2	Unit No. 2	658	MMBtu/hr
		986,566	gallons
	Actual Heat Input:	131,656.78	MMBtu/hr
EU ID 3	Auxiliary Boiler No. 1	12.554	MMBtu/hr
		12,857	gallons
	Actual Heat Input:	1,715.76	MMBtu/yr
EU ID 4	Auxiliary Boiler No. 2	23.0	MMBtu/hr
		40,339	gallons
	Actual Heat Input:	5,383.27	MMBtu/hr
	Total CY2019 Heat Input:	**154,269**	**MMBtu/yr**

[2] Reference: AP-42, Tables 1.3-9, and 1.3-10.

[3] Diesel high heat value: 133,450 Btu/gal lab analysis

Table 8c. FY2021 Assessable Emissions Calculations - Hazardous Air Pollutant (HAP) Emissions
Diesel Engines Greater Than or Equal to 600 Horsepower
Golden Valley Electric Association - Healy Power Plant

CY2019 Actual Heat Input: 3.9 MMBtu/yr [1]

		CY2019 Actual Source Category Emission Calculations	
CAS No.	**Chemical Name**	**Emission Factor [2]**	**Estimated Emissions**
75-07-0	Acetaldehyde	2.52E-05 lb/MMBtu	4.88E-08 tpy
107-02-8	Acrolein	7.88E-06 lb/MMBtu	1.52E-08 tpy
71-43-2	Benzene	7.76E-04 lb/MMBtu	1.50E-06 tpy
50-00-0	Formaldehyde	7.89E-05 lb/MMBtu	1.53E-07 tpy
108-88-3	Toluene	2.81E-04 lb/MMBtu	5.44E-07 tpy
1330-20-7	Xylenes (isomers and mixture)	1.93E-04 lb/MMBtu	3.73E-07 tpy
N/A	Polycyclic Organic Matter (POM)	2.12E-04 lb/MMBtu	4.09E-07 tpy
	Polycyclic aromatic compounds(PAH)		
	Acenaphthene	4.68E-06 lb/MMBtu	9.06E-09 tpy
	Acenaphthylene	9.23E-06 lb/MMBtu	1.79E-08 tpy
	Anthracene	1.23E-06 lb/MMBtu	2.38E-09 tpy
	Benzo(a)anthracene	6.22E-07 lb/MMBtu	1.20E-09 tpy
	Benzo(b)fluoranthene	1.11E-06 lb/MMBtu	2.15E-09 tpy
	Benzo(k)fluoranthene	2.18E-07 lb/MMBtu	4.22E-10 tpy
	Benzo(a)pyrene	2.57E-07 lb/MMBtu	4.97E-10 tpy
	Benzo(g,h,l)perylene	5.56E-07 lb/MMBtu	1.08E-09 tpy
	Chrysene	1.53E-06 lb/MMBtu	2.96E-09 tpy
	Dibenz(a,h)anthracene	3.46E-07 lb/MMBtu	6.70E-10 tpy
	Fluoranthene	4.03E-06 lb/MMBtu	7.80E-09 tpy
	Fluorene	1.28E-05 lb/MMBtu	2.48E-08 tpy
	Indeno(1,2,3-cd)pyrene	4.14E-07 lb/MMBtu	8.01E-10 tpy
91-20-3	Naphthalene	1.30E-04 lb/MMBtu	2.52E-07 tpy
	Phenanthrene	4.08E-05 lb/MMBtu	7.89E-08 tpy
	Pyrene	3.71E-06 lb/MMBtu	7.18E-09 tpy
		CY2019 Actual HAP Emissions:	**3.04E-06 tpy**

Notes:
[1] Total fuel use based on actual operation as noted below:

EU ID 5	Diesel Generator Engine No. 1	2.75	MW
		29	gallons
	Potential Heat Input:	4	MMBtu/yr
	Total CY2019 Heat Input:	**4**	**MMBtu/yr**

[2] Reference: AP-42, Worst Case Tables 3.2-1, 3.2-2, 3.2-3.

Table 8d. FY2021 Assessable Emissions Calculations - Hazardous Air Pollutant (HAP) Emissions
Diesel Engines Less Than 600 Horsepower
Golden Valley Electric Association - Healy Power Plant

CY2019 Actual Heat Input: 11 MMBtu/yr [1]

CAS No.	Chemical Name	Emission Factor [2]	Estimated Emissions
		CY2019 Actual Source Category Emission Calculations	
75-07-0	Acetaldehyde	7.67E-04 lb/MMBtu	4.25E-06 tpy
107-02-8	Acrolein	9.25E-05 lb/MMBtu	5.13E-07 tpy
71-43-2	Benzene	9.33E-04 lb/MMBtu	5.17E-06 tpy
106-99-0	1,3 Butadiene	3.91E-05 lb/MMBtu	2.17E-07 tpy
50-00-0	Formaldehyde	1.18E-03 lb/MMBtu	6.54E-06 tpy
108-88-3	Toluene	4.09E-04 lb/MMBtu	2.27E-06 tpy
1330-20-7	Xylenes (isomers and mixture)	2.85E-04 lb/MMBtu	1.58E-06 tpy
N/A	Polycyclic Organic Matter (POM)	1.68E-04 lb/MMBtu	9.32E-07 tpy
	Polycyclic aromatic compounds(PAH)		
	Acenaphthene	1.42E-06 lb/MMBtu	7.87E-09 tpy
	Acenaphthylene	5.06E-06 lb/MMBtu	2.81E-08 tpy
	Anthracene	1.87E-06 lb/MMBtu	1.04E-08 tpy
	Benzo(a)anthracene	1.68E-06 lb/MMBtu	9.31E-09 tpy
	Benzo(b)fluoranthene	9.91E-08 lb/MMBtu	5.49E-10 tpy
	Benzo(k)fluoranthene	1.55E-07 lb/MMBtu	8.59E-10 tpy
	Benzo(a)pyrene	1.88E-07 lb/MMBtu	1.04E-09 tpy
	Benzo(g,h,i)perylene	4.89E-07 lb/MMBtu	2.71E-09 tpy
	Chrysene	3.53E-07 lb/MMBtu	1.96E-09 tpy
	Dibenz(a,h)anthracene	5.83E-07 lb/MMBtu	3.23E-09 tpy
	Fluoranthene	7.61E-06 lb/MMBtu	4.22E-08 tpy
	Fluorene	2.92E-05 lb/MMBtu	1.62E-07 tpy
	Ideno(1,2,3-cd)pyrene	3.75E-07 lb/MMBtu	2.08E-09 tpy
91-20-3	Naphthalene	8.48E-05 lb/MMBtu	4.70E-07 tpy
	Phenanthrene	2.94E-05 lb/MMBtu	1.63E-07 tpy
	Pyrene	4.78E-06 lb/MMBtu	2.65E-08 tpy
		CY2019 Actual HAP Emissions:	**2.15E-05 tpy**

Notes:

[1] Total fuel use based on actual operation as noted below:

EU ID 13 Firewater Pump Engine	264	hp
	6.0	hr/yr
Potential Heat Input:	11	MMBtu/yr
Total CY2019 Heat Input:	**11**	**MMBtu/yr**

Engines heat rate: 7,000 Btu/hp-hr

[2] Reference: AP-42, Table 3.3-2.

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Golden Valley Electric Association
FY2021 Assessable Emission Estimates

North Pole Power Plant – Permit No. AQ0110TVP03

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Table 1. FY2021 Assessable Emissions Summary
Golden Valley Electric Association - North Pole Power Plant

Assessable Emissions - Tons Per Year							
Description	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAPs**	**Total**
Assessable PTE	5,337	118	479	4,302	4	-	10,240

From Condition 48 and Table C of the SOB for AQ0110TVP03

Potential to Emit	**Regulated Air Pollutant Emissions (tons per year)** [1]					
	NO_X	**CO**	**PM_{10}**	**VOC**	**SO_2**	**HAP**
Significant	1095.9	14.8	26.0		253.0	
Insignificant	0	0	0		0	
Total Emissions	**1,096**	**15**	**26**		**253**	
Use Assessable PTE				**4**		**0**
Assessable Emission Subtotals	**1,096**	**15**	**26**	**4**	**253**	**0**
Fees Apply to Pollutant? [2]	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**
2019 Actual Emissions	**1,390**					
Fee Estimate [3]	**$59,695**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[3] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

[4] Actual emissions are not provided for VOC or HAPs because potential emissions are less than 10 tpy each. Actual emissions must be less than or equal to potential emissions, so actual emissions are also less than 10 tpy.

Table 2a. FY2021 Significant Emission Unit Summary
Golden Valley Electric Association - North Pole Power Plant

Emission Unit			Fuel	Maximum	2019 Actual	2019 Actual
ID	Description	Make/Model	Type	Capacity	Operation	Fuel Consumption
1	Simple Cycle Gas Turbine	GE Frame 7, Series 7001, Model BR	ULS	672 MMBtu/hr	392.6 hr/yr	149,925 gal/yr
			No. 1 Diesel			82,294 gal/yr
			No. 2 Diesel			805,827 gal/yr
2	Simple Cycle Gas Turbine	GE Frame 7, Series 7001, Model BR	ULS	672 MMBtu/hr	3,130.3 hr/yr	1,055,209 gal/yr
			No. 1 Diesel			330,134 gal/yr
			No. 2 Diesel			10,001,632 gal/yr
5	Combined Cycle Gas Turbine	GE LM6000PC	ULS	455 MMBtu/hr	8,458.7 hr/yr	465,490 gal/yr
			No. 1 Diesel			0 gal/yr
			Naphtha			25,706,042 gal/yr
6	Combined Cycle Gas Turbine	GE LM6000PC	ULS	455 MMBtu/hr	0 hr/yr	0 gal/yr
			No. 1 Diesel			0 gal/yr
			Naphtha			0 gal/yr
7	Emergency Generator Engine	Mitsubishi 0A8829	ULSD	564.6 hp[1]	5.0 hr/yr	160 gal/yr
11	Boiler	Bryan Steam RV500	Propane	5.0 MMBtu/hr	67.1 hr/yr	3,665 gal/yr
12	Boiler	Bryan Steam RV500		5.0 MMBtu/hr		

[1] The generator has an electrical output of 400 kW. Assuming a 95% efficiency (per Section 2.7.2.1 of ADEC Modeling Review Procedures Manual) and converting from Kw to hp, the input rating is 564.6 hp.
Input Rating, hp= (Output Rating, kW) / (Efficiency, 0.95) * (Conversion, 1.341 hp/kW)

Table 2b. FY2021 Insignificant Emission Unit Inventory
Golden Valley Electric Association - North Pole Power Plant

Emission Unit		Fuel Type/ Material	Rating/Size	2019 Actual Operation	2019 Actual Fuel Consumption
ID[1]	Description				
3	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,760 hr/yr	N/A
4	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,760 hr/yr	N/A
N/A	FHR Warehouse Boiler 1	No. 2 Diesel	0.784 MMBtu/hr	8,760 hr/yr	5,068 gal/yr
N/A	FHR Warehouse Boiler 2	No. 2 Diesel	0.784 MMBtu/hr	8,760 hr/yr	
N/A	Burnham 17 A-T Boiler	No. 1 ULSD	0.222 MMBtu/hr	1,642 hr/yr	3,120 gal/yr

[1] EU IDs 3 and 4 are not currently subject to 40 CFR 60 Subpart Kb.

Table 3. FY2021 Assessable Emission Calculations - Oxides of Nitrogen (NO_X) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	NO_X Emission Factor	2019 Actual Operation	2019 Actual NO_X Emissions
Significant Emission Units							
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	2019 CEMS Average[1]	243.3 lb/hr	392.6 hours	47.8 tpy
			No. 1 Diesel				
			No. 2 Diesel				
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	1,055,209 gal/yr	0.0 tpy
			No. 1 Diesel			330,134 gal/yr	19.4 tpy
			No. 2 Diesel			10,001,632 gal/yr	608.7 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	2019 CEMS Average[1]	99.3 lb/hr	8,458.7 hours	420.0 tpy
			No. 1 Diesel				
			Naphtha				
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	AP-42 Table 3.1-1	0.24 lb/MMBtu	0 gal/yr	0.0 tpy
			No. 1 Diesel			0 gal/yr	0.0 tpy
			Naphtha			0 gal/yr	0.0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.031 lb/hp-hr	5.0 hr/yr	4.4E-02 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	13 lb/10^3gal	3,665 gal/yr	2.4E-02 tpy
12	Boiler	5.0 MMBtu/hr					
Significant Emission Units - 2019 Actual Emissions - NO_X							**1095.9 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Table 1.3-1	18 lb/10^3gal	5,068 gal/yr	4.6E-02 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	18 lb/10^3gal	3,120 gal/yr	2.8E-02 tpy
Insignificant Emission Units - 2019 Actual Emissions - NO_X							**7.4E-02 tpy**
2019 Actual Emissions - NO_X							**1096.0 tpy**

Note:

[1] The emission factors for EU IDs 1 and 5 are an average emission rate from 2019 measured using Continuous Emissions Monitoring Systems (CEMS).

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Operation, gal/yr) / (2,000 lb/ton)

HHV No. 1 Diesel =	133,441	Btu/gal	(based on average of 2019 fuel tests)
HHV No. 2 Diesel=	138,321	Btu/gal	(based on average of 2019 fuel tests)
HHV Naphtha=	108,141	Btu/gal	(based on average of 2019 fuel tests)

Table 4. FY2021 Assessable Emission Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	CO Emission Factor	2019 Actual Operation	2019 Actual CO Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	2019 CEMS Average1	13.6 lb/hr	392.6 hours	2.7 tpy
			No. 1 Diesel				
			No. 2 Diesel				
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	1,055,209 gal/yr	0 tpy
			No. 1 Diesel			330,134 gal/yr	0.07 tpy
			No. 2 Diesel			10,001,632 gal/yr	2.3 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	2019 CEMS Average1	2.3 lb/hr	8,458.7 hours	9.7 tpy
			No. 1 Diesel				
			Naphtha				
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	AP-42 Table 3.1-1	0.076 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.00668 lb/hp-hr	5.0 hr/yr	9.4E-03 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	7.5 lb/10^3gal	3,665 gal/yr	1.4E-02 tpy
12	Boiler	5.0 MMBtu/hr					
						Significant Emission Units - 2019 Actual Emissions - CO	**14.8 tpy**
			Insignificant Emission Units				
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Table 1.3-1	5.0 lb/10^3gal	5,068 gal/yr	1.3E-02 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	5.0 lb/10^3gal	3,120 gal/yr	7.8E-03 tpy
						Insignificant Emission Units - 2019 Actual Emissions - CO	**2.0E-02 tpy**
						2019 Actual Emissions - CO	**14.8 tpy**

Note:

[1] The emission factors for EU IDs 1 and 5 are an average emission rate from 2019 measured using Continuous Emissions Monitoring Systems (CEMS).

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Operation, gal/yr) / (2,000 lb/ton)

HHV No. 1 Diesel = 133,441 Btu/gal (based on average of 2019 fuel tests)
HHV No. 2 Diesel= 138,321 Btu/gal (based on average of 2019 fuel tests)
HHV Naphtha= 108,141 Btu/gal (based on average of 2019 fuel tests)

Table 5. FY2021 Assessable Emission Calculations - Particulate Matter (PM_{10}) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	PM_{10} Emission Factor	2019 Actual Operation	2019 Actual PM10 Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	149,925 gal/yr	0 tpy
			No. 1 Diesel			82,294 gal/yr	0.07 tpy
			No. 2 Diesel			805,827 gal/yr	0.67 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	1,055,209 gal/yr	0 tpy
			No. 1 Diesel			330,134 gal/yr	0.3 tpy
			No. 2 Diesel			10,001,632 gal/yr	8.3 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	465,490 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0.00 tpy
			Naphtha			25,706,042 gal/yr	16.7 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.0022 lb/hp-hr	5.0 hr/yr	3.1E-03 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	0.7 $lb/10^3gal$	3,665 gal/yr	1.3E-03 tpy
12	Boiler	5.0 MMBtu/hr					
Significant Emission Units - 2019 Actual Emissions - PM10							**26.0 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Tables 1.3-1 and 1.3-2	1.7 $lb/10^3gal$	5,068 gal/yr	4.3E-03 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-1 and 1.3-2	1.7 $lb/10^3gal$	3,120 gal/yr	2.7E-03 tpy
Insignificant Emission Units - 2019 Actual Emissions - PM10							**7.0E-03 tpy**
2019 Actual Emissions - PM10							**26.0 tpy**

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Operation, gal/yr) / (2,000 lb/ton)

HHV No. 1 Diesel =	133,441	Btu/gal	(based on average of 2019 fuel tests)
HHV No. 2 Diesel=	138,321	Btu/gal	(based on average of 2019 fuel tests)
HHV Naphtha=	108,141	Btu/gal	(based on average of 2019 fuel tests)

Table 6. FY2021 Assessable Emission Calculations - Sulfur Dioxide (SO2) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	Maximum Fuel Sulfur Content [1]	SO_2 Emission Factor	2019 Actual Operation	2019 Actual SO_2 Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	Mass Balance	0.00045 wt. pct. S	6.1E-05 lb/gal	149,925 gal/yr	0.00 tpy
			No. 1 Diesel	Mass Balance	0.09372 wt. pct. S	0.013 lb/gal	82,294 gal/yr	0.52 tpy
			No. 2 Diesel	Mass Balance	0.29916 wt. pct. S	0.044 lb/gal	805,827 gal/yr	17.60 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	Mass Balance	0.00051 wt. pct. S	0.000 lb/gal	1,055,209 gal/yr	0.04 tpy
			No. 1 Diesel	Mass Balance	0.08071 wt. pct. S	0.011 lb/gal	330,134 gal/yr	1.81 tpy
			No. 2 Diesel	Mass Balance	0.31484 wt. pct. S	0.046 lb/gal	10,001,632 gal/yr	229.87 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	Mass Balance	0.00200 wt. pct. S	0.000 lb/gal	465,490 gal/yr	0.06 tpy
			No. 1 Diesel	Mass Balance	0.08071 wt. pct. S	0.011 lb/gal	0 gal/yr	0.00 tpy
			Naphtha	Mass Balance	0.00208 wt. pct. S	2.4E-04 lb/gal	25,706,042 gal/yr	3.10 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	Mass Balance	0.00045 wt. pct. S	0.000 lb/gal	0 gal/yr	0.00 tpy
			No. 1 Diesel	Mass Balance	0.09372 wt. pct. S	0.013 lb/gal	0 gal/yr	0.00 tpy
			Naphtha	Mass Balance	0.00208 wt. pct. S	2.4E-04 lb/gal	0 gal/yr	0.00 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	Mass Balance	0.0015 wt. pct. S	2.2E-04 lb/gal	5.0 hr/yr	0.00 tpy
11	Boiler	5.0 MMBtu/hr	Propane	Mass Balance	7.81E-06 wt. pct. S	6.6E-07 lb/gal	3,665 gal/yr	1.2E-06 tpy
12	Boiler	5.0 MMBtu/hr						
							Significant Emission Units - 2019 Actual Emissions - SO2	**253.0 tpy**
				Insignificant Emission Units				
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	Mass Balance	0.299 wt. pct. S	4.07E-02 lb/gal	5,068 gal/yr	1.03E-01 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel					
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	Mass Balance	0.0015 wt. pct. S	2.04E-04 lb/gal	3,120 gal/yr	3.2E-04 tpy
							Insignificant Emission Units - 2019 Actual Emissions - SO2	**1.0E-01 tpy**
							2019 Actual Emissions - SO2	**253.1 tpy**

Notes:

Sample Calculations: [2, 3, 4]

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

Turbine Emissions, tpy= (Emission factor, lb/gal) x (Fuel Use gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/gal) x (Capacity, gal/hr) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/gal) x (Operation, gal/yr) / (2,000 lb/ton)

Boiler wt. pct. S= (Sulfur compound content, ppmv SO_2) x (Conversion, 1.66E-7 lb SO_2/scf / ppm SO_2) x (F-factor, 8,710 scf/MMBtu) x (Conversion, 0.0216 MMBtu/lb) x (Conversion, mole SO_2/64 lb SO_2) x (Conversion, mole S/mole SO_2) x (Conversion, 32 lb S/ mole S)

Notes:

[1] Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2019 as received from supplier sampling.

[2] Fuel density assumed equal to 6.8 lb/gal for ULS and No. 1 Diesel, 7.3 lb/gal for No. 2 Diesel, 5.2 lb/gal for naphtha, 4.2 lb/gal for propane, and 6.8 lb/gal for No. 2 Fuel Oil.

[3] The engine specification datasheet indicates a maximum fuel throughput of 32 gal/hr.

[4] Propane fuel analysis results from 2019 indicate a fuel sulfur content less than 0.5 ppmv.

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Golden Valley Electric Association
FY2021 Assessable Emission Estimates

Zehnder Facility – Permit No. AQ0109TVP03

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Table 1. FY2021 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

Assessable Emissions - Tons Per Year							
Description	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAPs**	**Total**
Assessable PTE	2,854	217	746	580	23	-	4,420

From Condition 30 and Table C of the SOB for AQ0109TVP03

Potential to Emit	**Regulated Air Pollutant Emissions (tons per year) [1]**					
	NO_X	**CO**	**PM_{10}**	**VOC**	**SO_2**	**HAP**
Significant	73.8	0.3	1.0	0.0	27.1	
Insignificant	0.3	0.1	0.0	0.0	0.3	
Total Emissions	**74**	**0**	**1**	**0**	**27**	
Use Assessable PTE						**0**
Assessable Emission Subtotals	**74**	**0**	**1**	**0**	**27**	**0**
Fees Apply to Pollutant? [2]	**Yes**	**No**	**No**	**No**	**Yes**	**No**
CY2019 Actual Emissions	**101**					
Fee Estimate [3]	**$4,359**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[3] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

[4] Actual emissions are not provided for HAPs because potential emissions for HAPs are less than 10 tpy. Actual emissions must be less than or equal to potential emissions, so actual emissions are also less than 10 tpy.

Table 2a. FY2021 Significant Emission Unit Summary
Golden Valley Electric Association - Zehnder Facility

Emission Unit			Fuel	2019 Actual	Maximum	2019 Actual
ID	Description	Make/Model	Type	Operation	Capacity	Fuel Consumption
1	Simple Cycle Gas Turbine	General Electric Frame 5 MS 5001-M	No. 1 ULS	61.3 hr/yr	268 MMBtu/hr	2,288 gal/yr
			No. 1 Diesel			1,106 gal/yr
			No. 2 Diesel			60,457 gal/yr
2	Simple Cycle Gas Turbine	General Electric Frame 5 MS 5001-M	No. 1 ULS	1,097.0 hr/yr	268 MMBtu/hr	15,684 gal/yr
			No. 1 Diesel			21,127 gal/yr
			No. 2 Diesel			1,153,638 gal/yr
3	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD	0.5 hr/yr	28 MMBtu/hr	299 gal/yr
4	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD		28 MMBtu/hr	
10	Boiler	Weil McLain H-688	No. 2 Heating Oil	292 hr/yr	1.7 MMBtu/hr	6,892 gal/yr
11	Boiler	Weil McLain H-688	No. 2 Heating Oil	292 hr/yr	1.7 MMBtu/hr	

Source: Air Quality Permit No. AQ0109TVP03

Table 2b. FY2021 Insignificant Emission Unit Inventory
Golden Valley Electric Association - Zehnder Facility

Emission Unit		Fuel Type/	Rating/Size	2019 Actual
ID [1]	Description	Material		Operation
6	Fuel Oil Storage Tank	No. 2 Diesel	50,000 gallons	8,760 hr/yr
7	Fuel Oil Storage Tank	No. 2 Diesel	50,000 gallons	8,760 hr/yr
N/A	Fuel Oil Storage Tank	No. 1 Diesel	12,000 gallons	8,760 hr/yr
8	Burnham Boiler	No. 2 Heating Oil	0.44 MMBtu/hr	13,117 gal/yr
9	Burnham Boiler	No. 2 Heating Oil	0.44 MMBtu/hr	
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	1,174,080 scf
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	Waste Oil	0.28 MMBtu/hr	0 gal/yr
N/A	Energy Logic EL-340H Heater	Waste Oil	0.275 MMBtu/hr	648 gal/yr
N/A	Metzger Machine Corp. Boiler	No. 1 Diesel	0.12 MMBtu/hr	6,192 gal/yr
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	0.2 MMBtu/hr	2,352 gal/yr
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	0.2 MMBtu/hr	0 gal/yr
N/A	Energy Logic EL-350H Heater	Waste Oil - Transformer	0.35 MMBtu/hr	5,100 gal/yr

[1] Source: Renewal application for AQ0109TVP02

Table 3. FY2021 Assessable Emission Calculations - Oxides of Nitrogen (NO_x) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit		Maximum	Fuel	Factor	NO_X Emission	2019 Actual	2019 Actual NO_X
ID	Description	Capacity	Type	Reference	Factor	Operation	Emissions
Significant Emision Units							
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	2,288 gal/yr	0.1 tpy
			No. 1 Diesel			1,106 gal/yr	0.1 tpy
			No. 2 Diesel			60,457 gal/yr	3.5 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	15,684 gal/yr	0.9 tpy
			No. 1 Diesel			21,127 gal/yr	1.3 tpy
			No. 2 Diesel			1,153,638 gal/yr	67.7 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	3.2 lb/MMBtu	299 gal/yr	6.6E-02 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	20 $lb/10^3gal$	6,892 gal/yr	0.07 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emision Units - 2019 Actual Emissions - NO_X							**73.8 tpy**
Insignificant Emision Units							
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	Fuel Oil Storage Tank	12,000 gallons	No. 1 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	18 $lb/10^3gal$	13,117 gal/yr	1.2E-01 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	100 $lb/10^6scf$	1,174,080 scf	5.9E-02 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 $lb/10^3gal$	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 $lb/10^3gal$	648 gal/yr	6.2E-03 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-1	18 $lb/10^3gal$	6,192 gal/yr	5.6E-02 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 $lb/10^3gal$	2,352 gal/yr	1.3E-02 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 $lb/10^3gal$	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	19 $lb/10^3gal$	5,100 gal/yr	4.8E-02 tpy
Insignificant Emision Units - 2019 Actual Emissions - NO_X							**0.30 tpy**
2019 Actual Emissions - NO_X							**74.1 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, $lb/10^6scf$) / (Conversion 1,000,000 $scf/10^6scf$) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 Diesel = 133,441 Btu/gal (based on average of 2019 fuel tests)
HHV No. 2 Diesel= 138,321 Btu/gal (based on average of 2019 fuel tests)

Table 4. FY2021 Assessable Emission Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	CO Emission Factor	2019 Actual Operation	2019 Actual CO Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	2,288 gal/yr	5.0E-04 tpy
			No. 1 Diesel			1,106 gal/yr	2.5E-04 tpy
			No. 2 Diesel			60,457 gal/yr	1.4E-02 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	15,684 gal/yr	3.5E-03 tpy
			No. 1 Diesel			21,127 gal/yr	4.8E-03 tpy
			No. 2 Diesel			1,153,638 gal/yr	2.6E-01 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	0.85 lb/MMBtu	299 gal/yr	1.8E-02 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 lb/10^3gal	6,892 gal/yr	1.7E-02 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emission Units - 2019 Actual Emissions - CO							**0.32 tpy**
Insignificant Emission Units							
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	Fuel Oil Storage Tank	12,000 gallons	No. 1 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 lb/10^3gal	13,117 gal/yr	3.3E-02 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	84 lb/10^6scf	1,174,080 scf	4.9E-02 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	5.0 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	5.0 lb/10^3gal	648 gal/yr	1.6E-03 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-1	5 lb/10^3gal	6,192 gal/yr	1.5E-02 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	1.7 lb/10^3gal	2,352 gal/yr	2.0E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	1.7 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	5.0 lb/10^3gal	5,100 gal/yr	1.3E-02 tpy
Insignificant Emission Units - 2019 Actual Emissions - CO							**0.11 tpy**
2019 Actual Emissions - CO							**0.43 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 Diesel = 133,441 Btu/gal (based on average of 2019 fuel tests)
HHV No. 2 Diesel= 138,321 Btu/gal (based on average of 2019 fuel tests)

Table 5. FY2021 Assessable Emission Calculations - Volatile Organic Compound (VOC) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	VOC Emission Factor	2019 Actual Operation	2019 Actual VOC Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	2,288 gal/yr	6.3E-05 tpy
			No. 1 Diesel			1,106 gal/yr	3.1E-05 tpy
			No. 2 Diesel			60,457 gal/yr	1.7E-03 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	15,684 gal/yr	4.3E-04 tpy
			No. 1 Diesel			21,127 gal/yr	6.0E-04 tpy
			No. 2 Diesel			1,153,638 gal/yr	3.3E-02 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	0.08 lb/MMBtu	299 gal/yr	1.7E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.34 lb/10^3gal	6,892 gal/yr	1.2E-03 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emission Units - 2019 Actual Emissions - VOC							**3.8E-02 tpy**
Insignificant Emission Units							
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	Tanks 4.09d	N/A	8,760 hr/yr	<0.01 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	Tanks 4.09d	N/A	8,760 hr/yr	<0.01 tpy
N/A	Fuel Oil Storage Tank	12,000 gallons	No. 1 Diesel	Tanks 4.09d	N/A	8,760 hr/yr	<0.01 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.7 lb/10^3gal	13,117 gal/yr	4.7E-03 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	7.6 lb/10^6scf	1,174,080 scf	4.5E-03 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-3	1 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-3	1 lb/10^3gal	648 gal/yr	3.2E-04 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-3	0.713 lb/10^3gal	6,192 gal/yr	2.2E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1 lb/10^3gal	2,352 gal/yr	1.2E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1 lb/10^3gal	5,100 gal/yr	2.6E-03 tpy
Insignificant Emission Units - 2019 Actual Emissions - VOC							**1.5E-02 tpy**
2019 Actual Emissions - VOC							**5.4E-02 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 Diesel = 133,441 Btu/gal (based on average of 2019 fuel tests)
HHV No. 2 Diesel= 138,321 Btu/gal (based on average of 2019 fuel tests)

Table 6. FY2021 Assessable Emission Calculations - Particulate Matter (PM_{10}) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit		Maximum	Fuel	Factor	PM_{10} Emission	2019 Actual	2019 Actual PM10
ID	Description	Capacity	Type	Reference	Factor	Operation	Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	2,288 gal/yr	1.8E-03 tpy
			No. 1 Diesel			1,106 gal/yr	9.2E-04 tpy
			No. 2 Diesel			60,457 gal/yr	5.0E-02 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	15,684 gal/yr	1.3E-02 tpy
			No. 1 Diesel			21,127 gal/yr	0.02 tpy
			No. 2 Diesel			1,153,638 gal/yr	0.96 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.4-2	0.0573 lb/MMBtu	299 gal/yr	1.2E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-2 & 1.3-7	2.38 $lb/10^3gal$	6,892 gal/yr	8.2E-03 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emission Units - 2019 Actual Emissions - PM10							**1.05 tpy**
Insignificant Emission Units							
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	Fuel Oil Storage Tank	12,000 gallons	No. 1 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Tables 1.3-1 & 1.3-2	1.7 $lb/10^3gal$	13,117 gal/yr	1.1E-02 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	5.5 $lb/10^6scf$	1,174,080 scf	3.2E-03 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-1	12 $lb/10^3gal$ [1]	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-1	12 $lb/10^3gal$ [1]	648 gal/yr	3.9E-03 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Tables 1.3-1 & 1.3-2	1.7 $lb/10^3gal$	6,192 gal/yr	5.3E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	N/A	2,352 gal/yr	0 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	N/A	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	0.1 $lb/10^3gal$ [2]	5,100 gal/yr	1.3E-04 tpy
Insignificant Emission Units - 2019 Actual Emissions - PM10							**2.4E-02 tpy**
2019 Actual Emissions - PM10							**1.07 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, $lb/10^6scf$) / (Conversion 1,000,000 $scf/10^6scf$) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 Diesel = 133,441 Btu/gal (based on average of 2019 fuel tests)
HHV No. 2 Diesel= 138,321 Btu/gal (based on average of 2019 fuel tests)

[1] Ash Content of 0.233 percent by weight was determined through testing conducted in December 2016.
[2] Ash Content of 0.001 percent by weight was determined through testing conducted in December 2016.

Table 7. FY2021 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Fuel Type	Factor Reference	Fuel Sulfur Content [1,2]	SO_2 Emission Factor	2019 Actual Operation	2019 Actual SO2 Emissions
1	Simple Cycle Gas Turbine	No. 1 ULS	Mass Balance	0.00027 wt. pct. S	0.000 lb/gal	2,288 gal/yr	0.00 tpy
		No. 1 Diesel	Mass Balance	0.09417 wt. pct. S	0.013 lb/gal	1,106 gal/yr	0.01 tpy
		No. 2 Diesel	Mass Balance	0.29949 wt. pct. S	0.043 lb/gal	60,457 gal/yr	1.29 tpy
2	Simple Cycle Gas Turbine	No. 1 ULS	Mass Balance	0.00047 wt. pct. S	0.000 lb/gal	15,684 gal/yr	0.00 tpy
		No. 1 Diesel	Mass Balance	0.09284 wt. pct. S	0.013 lb/gal	21,127 gal/yr	0.14 tpy
		No. 2 Diesel	Mass Balance	0.31235 wt. pct. S	0.044 lb/gal	1,153,638 gal/yr	25.58 tpy
3	Diesel Generator Engine	No. 1 ULSD	Mass Balance	0.0015 wt. pct. S	2.13E-04 lb/gal	299 gal/yr	3.2E-05 tpy
4	Diesel Generator Engine	No. 1 ULSD					
10	Boiler	No. 2 Heating Oil	Mass Balance	0.2 wt. pct. S	0.028 lb/gal	6,892 gal/yr	0.10 tpy
11	Boiler	No. 2 Heating Oil					
						Significant Emission Units - 2019 Actual Emissions - SO2	**27.1 tpy**
			Insignificant Emission Units				
6	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
N/A	Fuel Oil Storage Tank	No. 1 Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	No. 2 Heating Oil	Mass Balance	0.2 wt. pct. S	0.0 lb/gal	13,117 gal/yr	0.19 tpy
9	Burnham Boiler	No. 2 Heating Oil	Mass Balance				
N/A	Burnham Boiler - FE Building	Natural Gas	AP-42 Table 1.4-2	2,000 gr/10^6scf	0.6 lb/10^6scf	1,174,080 scf	3.5E-04 tpy
N/A	Burnham Boiler - FE Building	Natural Gas					
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	Waste Oil	Mass Balance	0.124 wt. pct. S	0.018 lb/gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	Waste Oil	Mass Balance	0.124 wt. pct. S	0.018 lb/gal	648 gal/yr	5.7E-03 tpy
N/A	Metzger Machine Corp. Boiler	No. 1 Diesel	Mass Balance	0.00027 wt. pct. S	0.000 lb/gal	6,192 gal/yr	1.2E-04 tpy
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	2,352 gal/yr	2.0E-02 tpy
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	5,100 gal/yr	0 tpy
						Insignificant Emission Units - 2019 Actual Emissions - SO2	**0.26 tpy**
						2019 Actual Emissions - SO2	**27.4 tpy**

Sample Calculations: [3]

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

Emissions, tpy= (Emission factor, lb/gal) x (Fuel Use gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

Notes:

[1] Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2019 as received from supplier sampling.

[2] For waste oil and waste transformer oil, fuel sulfur content was determined by testing conducted in December 2016.

[3] Diesel fuel density is equal 6.8 lb/gal for No. 1 Diesel and 7.1 lb/gal for No. 2 Diesel per plant report.

Golden Valley Electric Association
FY2021 Assessable Emission Estimates

Delta Power Plant – Permit No. AQ0880TVP03

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Table 1. FY2021 Assessable Emissions Summary
Golden Valley Electric Association - Delta Power Plant

	Assessable Emissions - Tons Per Year						
Description	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAPs**	**Total**
Assessable PTE	249	-	-	72	-	-	321

From Condition 27 and Table D of the Statement of Basis for AQ0880TVP03.

Potential to Emit	**Regulated Air Pollutant Emissions (tons per year)** [1]					
	NO_X	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAP**
Significant	0.4			0.0		
Insignificant	0			0		
Total Emissions	**0**			**0**		
Use Assessable PTE [2]		**0**	**0**		**0**	**0**
Assessable Emission Subtotals	**0**	**0**	**0**	**0**	**0**	**0**
Fees Apply to Pollutant? [3]	**No**	**No**	**No**	**No**	**No**	**No**
Total Assessable Emissions	**0**					
Fee Estimate [4]	**$0**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Actual emissions are provided for NO_X and SO_2 only, because potential emissions for all other pollutants are less than 10 tpy each. Actual emissions must be less than or equal to potential emissions, so actual emissions are also less than 10 tpy.

[3] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[4] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2021 Significant Emission Unit Inventory
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel	2019 Actual	Nominal	2019 Actual
ID	Description	Make/Model	Type	Operation	Capacity	Fuel Consumption
1	Gas Turbine	John Brown Ltd. Frame 5P	Fuel Oil	6.5 hr/yr	23.1 MW	7,200 gal/yr
2	Black Start Engine	Delta Detroit	Fuel Oil	0.25 hr/yr	500 bhp	7 gal/yr
3	Furnace	Thermo Pride	Fuel Oil	1,605 hr/yr [1]	0.4 MMBtu/hr	4,825 gal/yr

1. Estimated as follows:
Operation (hr/yr) = (Fuel Consumption, gal/yr) x (Fuel Heating value, 0.133021 MMBtu/gal) / (Capacity, 0.4 MMBtu/hr)

Table 2b. FY2021 Insignificant Emission Unit Inventory
Golden Valley Electric Association - Delta Power Plant

Emission Unit		Fuel Type/ Material	Rating/Size	2019 Actual Operation
ID	Description			
Tank	Fuel Oil Storage Tank	Fuel Oil	50,000 gallons	8,760 hr/yr

Table 3. FY2021 Assessable Emission Calculations - Oxides of Nitrogen (NO_X) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	Factor Reference	NO_X Emission Factor	Actual Operation	2019 Actual NO_X Emissions
ID	Description	Rating/Capacity					
Significant Emission Units							
1	Gas Turbine	23.1 MW	Fuel Oil	AQ0880TVP03 Condition 10.2	0.70 lb/MMBtu	7,200 gal/yr	0.34 tpy
2	Black Start Engine	500 bhp	Fuel Oil	AP-42 Table 3.3-1	0.031 lb/hp-hr	0.25 hr/yr [1]	0.00 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	AP-42 Table 1.3-1	18 lb/kgal	4,825 gal/yr	0.04 tpy
Significant Emission Units - Total Assessable Emissions - NO_X							**0.38 tpy**
Insignificant Emission Units							
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	N/A	NA	8,760 hr/yr	0 tpy
Insignificant Emission Units - Total Assessable Emissions - NO_X							**0 tpy**
Total Assessable Emissions - NO_X							**0.38 tpy**

Notes:
[1] Operating hours were determined based on two startss during calendar year 2019 lasting an estimated duration of 5 minutes, each.

Fuel Heating Value 0.133021 MMBtu/gal AQ0880TVP03, Condition 10.2

Example Calculations:

Turbine emissions (tpy) = (Maximum fuel consumption, gal/yr) x (Fuel Heating value, MMBtu/gal) x (Emission factor, lb/MMBtu) / (2,000 lb/ton)
Engine emissions (tpy) = (Rating, bhp) x (Emission factor, lb/hp-hr) x (Operation, hr/yr) / (2,000 lb/ton)
Furnace emissions (tpy) = (Emission factor, lb/kgal) / (Conversion, 1,000 gal/kgal) x (Operation, gal/yr) / (2,000 lb/ton)

Table 4. FY2021 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	Maximum Fuel Sulfur Content	Factor Reference	SO_2 Emission Factor	Actual Operation	2019 Actual SO_2 Emissions
ID	Description	Rating/Capacity						
Significant Emission Units								
1	Gas Turbine	23.1 MW	Fuel Oil	0.0015 wt. pct. S [1]	Mass Balance [2,3]	0.0002 lb/gal	7,200 gal/yr	0.00 tpy
2	Black Start Engine	7 gal/hr	Fuel Oil	0.0015 wt. pct. S [1]	Mass Balance [2,3]	0.0002 lb/gal	0.25 hr/yr	0.00 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	0.0015 wt. pct. S [1]	Mass Balance [2,3]	0.0002 lb/gal	4,825 gal/yr	4.8E-04 tpy
							Significant Emission Units - Total Assessable Emissions - SO_2	**1.2E-03 tpy**
Insignificant Emission Units								
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	NA	N/A	NA	8,760 hr/yr	0 tpy
							Insignificant Emission Units - Total Assessable Emissions - SO_2	**0 tpy**
							Total Assessable Emissions - SO_2	**1.2E-03 tpy**

Notes:

1 The emission units fired ULSD in 2019.

[2] Mass balance:

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

[3] A fuel density of 6.7 lb/gal is assumed based on an API gravity of 43.3 from the February 2006 source test.

Turbine and Furnace emissions (tpy) = (Emission factor, lb/gal) x (Operation, gal/yr) / (2,000 lb/ton)

Engine emissions (tpy) = (Emission factor, lb/gal) x (Capacity, gal/hr) x (Operation, hr/yr) / (2,000 lb/ton)

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Golden Valley Electric Association
PO Box 71249, Fairbanks, AK 99707-1249 • (907) 452-1151 • www.gvea.com
Your Touchstone Energy® Cooperative

March 30, 2021

Email Submittal
dec.aq.airreports@alaska.gov

Alaska Department of Environmental Conservation
Air Permits Program
ATTN: Assessable Emissions Estimate
410 Willoughby Avenue, Suite 303
PO Box 111800
Juneau, AK 99811-1800

Subject: Golden Valley Electric Association
FY2022 Assessable Emission Estimates

Dear Compliance Technician,

Enclosed please find the FY2022 Assessable Emission Estimates for the following Golden Valley Electric Association (GVEA) facilities.

Facility	Air Quality Permit No.	CY2020 Actual Emissions (Tons)	Fee Estimate
Healy Power Plant	AQ0173TVP03	1,903	$81,734
North Pole Power Plant	AQ0110TVP04	1,606	$68,989
Zehnder Facility	AQ0109TVP03	168	$ 7,231
Delta	AQ0880TVP03	0	$0

Assessable emission estimates for all facilities are based on actual emissions from calendar year 2020.

If you have any questions or would like any additional information, please contact me by phone at 907-458-4557 or by email at nmknight@gvea.com. The certification from Frank E. Perkins, Vice President Power Supply Follows.

Sincerely,

Naomi Morton Knight, P.E.
Environmental Officer

Certification

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate and complete.

Frank E Perkins

Digitally signed by Frank E Perkins
Date: 2021.03.30 08:02:52 -08'00'

Frank E. Perkins
Vice President Power Supply

Enclosures

Golden Valley Electric Association
FY2022 Assessable Emission Estimates

Healy Power Plant – Permit No. AQ0173TVP03

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Table 1. FY2022 Assessable Emissions Summary
Golden Valley Electric Association - Healy Power Plant

Assessable Emissions - Tons Per Year							
Description	**NO_X**	**CO**	**PM**	**VOC**	**SO_2**	**HAPs**	**Total**
Assessable PTE	606	980	198	14	707	13	2,518

From Condition 112 and Table E of the Statement of Basis for Permit AQ0173TVP03.

	Regulated Air Pollutant Emissions (tons per year) [1]					
	NO_X	**CO**	**PM**	**VOC**	**SO_2**	**HAPs**
Significant	302.1	1177.0	17.3	8.8	406.2	5.6
Insignificant	0.0	0.0	0.6	0.0	0.0	0.0
Total Emissions	**302**	**1,177**	**18**	**9**	**406**	**6**
Fees Apply to Pollutant? [2]	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**
CY2020 Actual Emissions	**1,903**					
Fee Estimate [3]	**$81,734**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[3] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2022 Significant Emissions Unit Summary
Golden Valley Electric Association - Healy Power Plant

Emissions Unit				Fuel / Material	CY2020 Actual
ID	Name	Description	Rating	Type	Operation [1]
1	Unit No. 1	Foster-Wheeler Boiler (w/ SNCR)	327 MMBtu/hr	Coal/ULSD	8,330 hours
				ULSD	198,169 gallons
2	Unit No. 2	TRW Integrated Entrained Combustion System (w SCR)	658 MMBtu/hr	Coal/ULSD	5,707 hours
				ULSD	851,816 gallons
3	Auxiliary Boiler No. 1	Cleaver Brooks CB 189-300	12.554 MMBtu/hr	ULSD	3,329 gallons
4	Auxiliary Boiler No. 2	Cleaver Brooks CB 100-800	23.0 MMBtu/hr	ULSD	52,535 gallons
5	Diesel Generator Engine No. 1	Electro-Motive Diesel EMD 20-645-E4	2.75 MW	ULSD	0 gallons
6	Crusher System	2 grizzlies, 1 primary Stamler crusher, 2 belt feeders, 2 secondary Flextooth-Dresser crushers, 2 hoppers, and the No. 1 conveyor belt (tail-end), all commonly vented to Dust Collector No. 1 (baghouse/exhaust fan).	12,000 cfm	Coal	2,719 hours [2]
7	Limestone Storage Silo	Limestone Storage Silo with Baghouse	800 cfm	Lime	0 hours
8	Flyash Storage Silo	Flyash Storage Silo with Baghouse	5,000 cfm	Flyash	8,446 hours
9	Sodium Bicarbonate Handling System	Mill, Sodium Bicarbonate Silo, and Baghouse	440 cfm	Sodium Bicarbonate	225 hours
10	Coal Handling System	No. 1 conveyor belt (head-end), No. 2 2a conveyor belt, No. 2b conveyor belt, one bucket elevator, No. 3 conveyor belt, No. 4 conveyor belt, two 600 ton EU ID 2 coal storage silos, two EU ID 1 bunkers, all commonly vented to Dust Collector No. 2 (baghouse/exhaust fan). Note: When EU ID 2 is not operational, dust is collected at the EU ID 1 transfer points via a Dust Collector No. 3 (baghouse/exhaust fan).	20,000 cfm	Coal	2,719 hours [2]
11	Haul Road	Haul Road (located on GVEA property) from Usibelli Coal Mine property line to coal pile	0.25 miles	Fugitive Dust	8,784 hours
12	Coal Storage Pile	Open Coal Storage Pile	15 day supply	Coal	8,784 hours
13	Firewater Pump Engine	Caterpillar 3406B	264 hp	ULSD	6 hours

Notes:
[1] Hours are based on CY2020 operation in accordance with condition 112 Permit No. AQ0173TVP03.
[2] Emissions units do not operate continuously.

Table 2b. FY2022 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel / Material	CY2020 Actual	Rating
ID	Description	Make/Model	Type	Operation	
N/A	Lime Storage Silo No. 1	N/A	Lime	5,707 hours [1]	1,800 acfm
N/A	Lime Storage Silo No. 2	N/A	Lime		1,800 acfm
N/A	Ash Handling	N/A	Ash	8,784 hours	Not Applicable
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	8,784 hours	Not Applicable
N/A	AST Diesel Tanks (2)	N/A	Diesel	8,784 hours	25,000 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,784 hours	2,000 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,784 hours	300 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,784 hours	425 gallons
N/A	Central Vac (3)	Turbo Tron	Coal	1,095 hours [2]	900 acfm
N/A	Urea Storage Silo A/B Bin Vent Filter	N/A	Urea	152 hours [3]	1,500 acfm
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	N/A	Urea	190 hours [4]	400 acfm
N/A	Sodium Bicarbonate Unloading Portable Baghouse	N/A	Sodium Bicarbonate	23 hours [5]	850 scfm

Note:
[1] This emissions unit is associated with EU ID 2.
[2] Estimated operation of 1,095 hours is assumed with each of the three units operating one hour per day.
[3] The estimated maximum annual use is 160 hr/yr. This emissions unit is associated with the EU ID 1 SNCR system and the EU ID 2 SCR system.
Estimated CY2020 Hours = (160 hr/yr) x (maximum actual hours for EU IDs 1 or 2 during CY2020) / (8,784 potential hours)
[4] The estimated maximum annual use is 200 hr/yr. This emissions unit is associated with the EU ID 1 SNCR system and the EU ID 2 SCR system.
Estimated CY2020 Hours = (200 hr/yr) x (maximum actual hours for EU IDs 1 or 2 during CY2020) / (8,784 potential hours)
[5] This emissions unit is associated with EU ID 1.

Table 3. FY2022 Assessable Emissions Calculations - Oxides of Nitrogen (NOX) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Rating/Capacity	Fuel Type	Factor Reference	NO_X Emission Factor	CY2020 Actual Operation	CY2020 Actual NO_X Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data (with SNCR)	57.5 lb/hr	8,330 hours	239.57 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data (with SCR)	18.9 lb/hr	5,707 hours	61.95 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42 Table 1.3-1	20 lb/10^3 gal	3,329 gallons	0.03 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42 Table 1.3-1	20 lb/10^3 gal	52,535 gallons	0.53 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42 Table 3.4-1	3.2 lb/MMBtu	0 gallons	0 tpy [1]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,719 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	8,446 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	225 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,719 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,784 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,784 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.031 lb/hp-hr	6 hours	0.02 tpy
				Significant Emissions Units Emissions - CY2020 Actual Emissions - NOX			**302.1 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	5,707 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,784 hours	0 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	152 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	190 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	23 hours	0 tpy
				Insignificant Emissions Units Emissions - CY2020 Actual Emissions - NOX			**0 tpy**
						CY2020 Actual Emissions - NOX	**302.1 tpy**

Notes:

[1] Diesel Heating Value 133,141 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton

Sample Calculations:

Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Emissions (tpy) = (Emission factor, lb/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)

Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)

Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 4. FY2022 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	CO Emission	CY2020 Actual	CY2020 Actual
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	CO Emissions
			Significant Emissions Units				
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	280.6 lb/hr	8,330 hours	1,168.71 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	2.96 lb/hr	5,707 hours	8.13 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-1	5 lb/10^3 gal	3,329 gallons	8E-03 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Table 1.3-1	5 lb/10^3 gal	52,535 gallons	0.13 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42, Table 3.4-1	0.85 lb/MMBtu	0 gallons	0 tpy [1]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,719 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	8,446 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	225 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,719 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,784 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,784 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.00668 lb/hp-hr	6 hours	5E-03 tpy
				Significant Emissions Units Emissions - CY2020 Actual Emissions - CO			**1,177.0 tpy**
			Insignificant Emissions Units				
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	5,707 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,784 hours	0 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	152 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	190 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	23 hours	0 tpy
				Insignificant Emissions Units Emissions - CY2020 Actual Emissions - CO			**0 tpy**
						CY2020 Actual Emissions - CO	**1,177.0 tpy**

Notes
[1] Diesel Heating Value 133,141 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 5. FY2022 Assessable Emissions Calculations - Particulate Matter (PM) Emissions (Filterable and Condensable)
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Emissions Unit Rating/Capacity	Fuel Type	Factor Reference	PM Emission Factor	CY2020 Actual Operation	CY2020 Actual PM Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	0.73 lb/hr	8,330 hours	2.98 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	0.51 lb/hr	5,707 hours	1.67 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Tables 1.3-2 and 1.3-7	2.38 $lb/10^3 gal$	3,329 gallons	4.E-03 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Tables 1.3-2 and 1.3-7	2.38 $lb/10^3 gal$	52,535 gallons	0.06 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42 Table 3.4-2	0.0573 lb/MMBtu	0 gallons	0 tpy [1]
6	Crusher System	12,000 cfm	Coal	Permit AQ0173TVP03, Table B	2.05 lb/hr	2,719 hours	2.79 tpy
7	Limestone Storage Silo	800 cfm	Lime	Permit AQ0173TVP03, Table B	0.14 lb/hr	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	Permit AQ0173TVP03, Table B	0.86 lb/hr	8,446 hours	3.63 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	Design Specifications	0.02 gr/dscf	225 hours	0.01 tpy
10	Coal Handling System	20,000 cfm	Coal	Permit AQ0173TVP03, Table B	3.43 lb/hr	2,719 hours	4.66 tpy
11	Haul Road	0.25 miles	Fugitive Dust	See Table 5a		8,784 hours	0.84 tpy
12	Coal Storage Pile	15 day supply	Coal	See Table 5b		8,784 hours	0.63 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.0022 lb/hp-hr	6 hours	2.E-03 tpy
Significant Emissions Units Emissions - CY2020 Actual Emissions - PM							17.3 tpy
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf	5,707 hours	0.22 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf		
N/A	Ash Handling	Not Applicable	Ash	See Table 5c		8,784 hours	0.03 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	See Table 5d		8,784 hours	0.14 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	Engineering Estimate	0.05 gr/dcf	1,095 hours	0.21 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	Engineering Estimate	0.005 gr/dcf	152 hours	5.E-03 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	Engineering Estimate	0.005 gr/dcf	190 hours	2.E-03 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	Vendor Data	0.02 gr/acf	23 hours	2.E-03 tpy
Insignificant Emissions Units Emissions - CY2020 Actual Emissions - PM							0.61 tpy
CY2020 Actual PM Emissions							17.9 tpy

Notes
[1] Diesel Heating Value 133,141 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton
7,000 grains/lb

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, $lb/10^3$ gal) x (Fuel consumption, gal) / (Conversion, 1,000 $gal/10^3$ gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, gr/dcf) x (Rating, cfm) x (Conversion, 60 min/hr) x (Operation, hr/yr) / (Conversion, 7,000 gr/lb) / (Conversion, 2,000 lb/ton)

Table 5a. FY2022 Assessable Emissions Calculations - Haul Road Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit		Factor Reference	Emission Factor	CY2020 Actual Operation	CY2020 Actual PM Emissions
ID	Description				
11	Coal Haul - Unpaved Portion	AP-42, Section 13.2.2	1.32 lb/VMT	1,275 VMT	0.84 tpy [1]
				CY2020 Actual PM Emissions	**0.8 tpy**

Notes:
[1] Coal Haul Road

Unpaved Road Emission Factor
AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2 for PM-10
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	193.75	tons, estimate - average of full (262.5 ton) and empty (125 ton) truck
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for PM-10
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	4.53	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.81	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	1.32	lb/VMT

Table 5a. FY2022 Assessable Emissions Calculations - Haul Road Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Coal Throughput

$$Throughput = \frac{Capacity\left(\frac{MMBtu}{hr}\right) \times Operation\left(\frac{hr}{year}\right)}{Coal\ Heat\ Value\left(\frac{MMBtu}{ton}\right)}$$

EU ID 1 CY2020 actual coal throughput	179,230	tons	from Healy environmental report
EU ID 2 CY2020 actual coal throughput	171,470	tons	from Healy environmental report
Total CY2020 actual coal throughput	350,700	tons	

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\ (tons) \times Roundtrip\ Distance\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\left(\frac{tons}{trip}\right)}$$

Haul truck capacity	138	tons, estimate
Unpaved distance from coal pile to paved road (round trip)	0.50	miles/trip
Unpaved road VMT =	1,275.27	miles

Table 5b. FY2022 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Factor Reference	Emission Factor	CY2020 Actual Operation	CY2020 Actual PM Emissions
12	Truck Drop Onto Stockpile	AP-42, Section 13.2.4	1.13E-04 lb/ton	350,700 tpy	0.0 tpy [1]
	Front End Loader Drop Into Grizzly	AP-42, Section 13.2.4	1.13E-04 lb/ton	350,700 tpy	0.0 tpy [1]
	Front End Loader Movement - Coal Pile to Grizzly	AP-42, Section 13.2.2	0.93 lb/VMT	1,275 VMT	0.6 tpy [2]
	Stockpile Wind Erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr	10,150 m^2	0.0 tpy [3]
				CY2020 Actual PM Emissions	**0.6 tpy**

Notes:

[1] Truck Drop onto Stockpile and Front End Loader Drop to Grizzly

Drop Operation Emission Factor:

AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right)=\frac{k\times 0.0032\times\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

	PM		
k	0.35		AP-42, Section 13.2.4 for PM-10
U = mean wind speed	16.5	miles/hr	Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant
M = coal moisture content	31.16	percent	Weighted average from EU ID 1 and 2 CY2020 coal proximate analyses
E =	1.13E-04	lb/ton	

Annual Stockpile Throughput:

$$Throughput=\frac{Capacity\left(\frac{MMBtu}{hr}\right)\times Operation\left(\frac{hr}{year}\right)}{Coal\ Heat\ Value\left(\frac{MMBtu}{ton}\right)}$$

EU ID 1 CY2020 actual coal throughput	179,230	tons	from Healy environmental report
EU ID 2 CY2020 actual coal throughput	171,470	tons	from Healy environmental report
Total CY2020 actual coal throughput	350,700	tons	

[2] Front End Loader Movement

Coal moved per trip:

$$Coal\ (tons)=\frac{Coal\ Density\left(\frac{lb}{ft^3}\right)\times 27\left(\frac{ft^3}{yd^3}\right)\times Bucket\ Size(yd^3)}{2000\ \left(\frac{lb}{ton}\right)}$$

Size of load bucket	11	yd^3
Density of coal	52.63	lb/ft^3
Coal moved per trip	7.82	tons

Table 5b. FY2022 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emission Factor
AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2 for PM-10
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	33.2	tons, estimate
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for PM-10
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	3.21	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.28	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.93	lb/VMT

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\,\left(\frac{miles}{trip}\right)}{Haul\,Truck\ Capacity\,\left(\frac{tons}{trip}\right)}$$

Total Actual Coal Throughput	350,700	tons
Coal moved per trip	7.815555	tons
Approximate distance from coal pile to grizzly (round trip)	150	feet
VMT = vehicles miles traveled per year	1,275	

Table 5b. FY2022 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

[3] Stockpile Wind Erosion
Coal Pile Surface Area

Surface area of active face = 10,150 m^2 — Engineering estimate of projected use

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\left(\frac{g}{m^2 yr}\right) = k \sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (AP-42 Section 13.2.5.3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\,(u^* - u_t^*)^2 + 25\,(u^* - u_t^*)$$

$$P = 0 \; for \; u^* \le u_t^*$$

where

u* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u*

$$u^* = \frac{0.4 \times u(z)}{\ln\left(\frac{z}{z_o}\right)} \quad when\; z > z_o$$

where

u* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Using average wind speed recorded at GVEA's Eva Creek Wind farm for each month in CY2019 (see table below)
z	10	meters
N	365	disturbances/year for active face, estimated
	30	average disturbances/month

Table 5b. FY2022 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Month-Year	Average Wind Speed (u(10)) [a]		Wind Direction	Uncrusted Coal Pile [b] (Table 13.2.5-2) Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u^*)	Erosion potential function, P	Ground Coal (Table 13.2.5-2) Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u^*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Jan-19	18.6	8.3	150	0.3	1.12	0.41	0	0.01	0.55	0.29	0	0		
Feb-19	17.4	7.8	180	0.3	1.12	0.38	0	0.01	0.55	0.27	0	0		
Mar-19	19.9	8.9	179	0.3	1.12	0.44	0	0.01	0.55	0.31	0	0		
Apr-19	14.8	6.6	173	0.3	1.12	0.33	0	0.01	0.55	0.23	0	0		
May-19	15.5	6.9	181	0.3	1.12	0.34	0	0.01	0.55	0.24	0	0		
Jun-19	9.7	4.3	204	0.3	1.12	0.21	0	0.01	0.55	0.15	0	0		
Jul-19	11.2	5.0	202	0.3	1.12	0.25	0	0.01	0.55	0.17	0	0		
Aug-19	13.1	5.9	224	0.3	1.12	0.29	0	0.01	0.55	0.20	0	0		
Sep-19	16.9	7.6	197	0.3	1.12	0.37	0	0.01	0.55	0.26	0	0		
Oct-19	20	8.9	182	0.3	1.12	0.44	0	0.01	0.55	0.31	0	0		
Nov-19	23.1	10.3	153	0.3	1.12	0.51	0	0.01	0.55	0.36	0	0		
Dec-19	17.4	7.8	152	0.3	1.12	0.38	0	0.01	0.55	0.27	0	0		
CY2019 PM_{10} Annual Total							0				0.00	0.00	0.5	**0.00**

[a] Per MET data recorded at GVEA's Eva Creek Wind farm CY2019.

[b] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions.

Table 5c. FY2022 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit		Factor Reference	Emission	Emission Factor	CY2020 Actual Operation	CY2020 Actual PM Emissions
ID	Description					
N/A	Front End Loader / Flyash Storage Silo Drop Into Truck	AP-42, Section 13.2.4	PM	1.27E-04 lb/ton	17,115 tons	1.1E-03 tpy [1]
	Front End Loader Movement - Ash Drying Area to Truck	AP-42, Section 13.2.2	PM	0.85 lb/VMT	69 VMT	2.9E-02 tpy [2]
	Ash Drying Area Wind Erosion	AP-42, Section 13.2.5	PM	0.00 g/m^2	4,800 m^2	0 tpy [3]
					CY2020 Actual PM Emissions	**3.0E-02 tpy**

Notes:

[1] Front End Loader / Flyash Storage Silo Drop into Truck

AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

	PM		
k	0.35		AP-42, Section 13.2.4 for PM-10
U = mean wind speed	16.5	miles/hr	Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant
M = ash moisture content	17.5	percent	Avg of slag, bottom ash, and fly ash from Heat and Material Balance for HCCP - March 6, 1998
E (uncontrolled) =	2.54E-04	lb/ton	
Efficiency =	50%	assumption because material is wet	
E (controlled) =	1.27E-04	lb/ton	

Annual stockpile throughput:

EU ID 1 CY2020 Ash Throughput	17,115	tons
EU ID 2 CY2020 Ash Throughput	15,686	tons
Total Ash Throughput	32,801	tons

[2] Front End Loader Movement - Ash Pile to Truck

Ash moved per trip:

$$Ash\,(tons) = \frac{Ash\ Density\left(\frac{lb}{ft^3}\right) \times 27\left(\frac{ft^3}{yd^3}\right) \times Bucket\ Size(yd^3)}{2000\left(\frac{lb}{ton}\right)}$$

Size of load bucket	8	yd^3
Density of ash	60	lb/ft^3
Ash moved per trip	6.48	tons

Table 5c. FY2022 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

AP-42, Section 13.2.2

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2 for PM-10
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons, estimate
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for PM-10
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	2.92	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.17	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.85	lb/VMT

Approximate distance from ash pile to truck (round trip)	150	feet
VMT = vehicles miles traveled per year	68.77	

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion
Ash Pile Surface Area

Surface area of active face =	4,800 m^2	Engineering estimate of projected use

AP-42 Section 13.2.5, Equation (2)
Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\left(\frac{g}{m^2yr}\right) = k\sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (0.5 for particle size < 10 microns, per AP-42 Section 13.2.5.3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

Table 5c. FY2022 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\,(u^* - u_t^*)^2 + 25\,(u^* - u_t^*)$$

$$P = 0 \; for \; u^* \leq u_t^*$$

where u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = \frac{0.4 \times u(z)}{\ln\left(\frac{z}{z_o}\right)} \quad when\; z > z_o$$

where u^* = friction velocity (cm/s)
$u(z)$ = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at McKinley Airport ASOS for each month in CY2018 (see table below)
z	10	meters
N	365	disturbances/year for active face, estimated
	30	average disturbances/month

Ash pile [a] (Table 13.2.5-2)											
Month-Year	Average Wind Speed (u(10)) [b]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor (uncontrolled), EF	Emission Factor (controlled), EF [c]
	mph	m/s	deg	cm	m/s	m/s				g/m²-yr	g/m²-yr
Jan-19	18.6	8.3	150	0.3	1.02	0.41	0	0.0			
Feb-19	17.4	7.8	180	0.3	1.02	0.38	0	0.0			
Mar-19	19.9	8.9	179	0.3	1.02	0.44	0	0.0			
Apr-19	14.8	6.6	173	0.3	1.02	0.33	0	0.0			
May-19	15.5	6.9	181	0.3	1.02	0.34	0	0.0			
Jun-19	9.7	4.3	204	0.3	1.02	0.21	0	0.0			
~~Jul-19~~	11.2										
Aug-19	13.1	5.9	224	0.3	1.02	0.29	0	0.0			
Sep-19	16.9	7.6	197	0.3	1.02	0.37	0	0.0			
Oct-19	20	8.9	182	0.3	1.02	0.44	0	0.0			
Nov-19	23.1	10.3	153	0.3	1.02	0.51	0	0.0			
Dec-19	17.4	7.8	152	0.3	1.02	0.38	0	0.0			
CY2018 PM_{10} Annual Total							0	0.00	0.5	**0.00**	**0.00**

[a] No emission factor exists for ash. Overburden is considered the most representative alternative because it includes both fine (ash) and coarse (slag) particles.
[b] Per www.ncdc.noaa.gov for CY2018, McKinley Airport ASOS (PAIN).
[c] Control efficiency of 50% is assumed since material wet.

Table 5d. FY2022 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit		Factor Reference	Emission Factor	CY2020 Actual Operation	CY2020 Actual PM Emissions
ID	**Description**				
N/A	Ash Haul - Unpaved (EU ID 1)	AP-42, Section 13.2.2	1.18 lb/VMT	126 VMT	0.07 tpy [1]
	Ash Haul - Unpaved (EU ID 2)	AP-42, Section 13.2.2	1.18 lb/VMT	87 VMT	5.1E-02 tpy [1]
	Limestone/Lime Delivery - Paved Portion	AP-42, Section 13.2.1	0.08 lb/VMT	45 VMT	1.8E-03 tpy [2]
	Limestone/Lime Delivery - Unpaved Portion	AP-42, Section 13.2.2	1.07 lb/VMT	21 VMT	1.1E-02 tpy [2]
	Miscellaneous Traffic - Paved Portion	AP-42, Section 13.2.1	0.001 lb/VMT	5,185 VMT	3.4E-03 tpy [3]
				CY2020 Actual PM Emissions	**0.14 tpy**

Notes:
[1] Ash Haul Road

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2 for PM-10
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	151.25	tons, estimate - average of full (197.5 ton) and empty (105 ton) truck
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for PM-10
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	4.05	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.62	lb/VMT

Table 5d. FY2022 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	1.18	lb/VMT

Ash Throughput

EU ID 1 ash disposal throughput	17,115 tons	from Healy environmental report
EU ID 2 ash disposal throughput	15,686 tons	from Healy environmental report

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\,\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\,\left(\frac{tons}{trip}\right)}$$

Haul truck capacity	92.5	tons, estimate
Unpaved distance to ash drying area (round trip)	0.68	miles/trip
Unpaved distance to EU ID 8 (round trip)	0.51	miles/trip
EU ID 1 unpaved road VMT =	126.16	miles
EU ID 2 unpaved road VMT =	86.71	miles

Table 5d. FY2022 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

[2] Limestone/Lime/Sodium Bicarbonate Haul Road

Paved Road Emission Factor

AP-42, Section 13.2.1, Equation 1:

$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

	PM	
k = particle size multiplier	0.0022	lb/VMT from AP-42 Table 13.2.1-1 for PM-10
sL = surface material silt content (haul road)	0.6	g/m^2, from AP-42, Table 13.2.1-2
W = mean vehicle weight	122.5	tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer
E (uncontrolled) =	0.17	lb/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	0.09	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.1, Equation 2:

$$E_{ext} = E\left(1 - \frac{P}{4 * 365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.08	lb/VMT

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2 for PM-10
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	122.5	tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for PM-10
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	3.69	lb/VMT
Efficiency =	60%	assumed control efficiency for water
E (controlled) =	1.47	lb/VMT

Table 5d. FY2022 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	1.07	lb/VMT

Throughput

Limestone/Lime Throughput	3,396	tons, CY2020 actual
Sodium Bicarbonate Throughput	573	tons, CY2020 actual

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\ \left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\ \left(\frac{tons}{trip}\right)}$$

Haul truck capacity	25	tons, estimate
Paved distance (round trip)	0.28	miles/trip
Unpaved distance (round trip)	0.13	miles/trip
Paved road VMT =	45.10	miles
Unpaved road VMT =	21.05	miles

[3] Miscellaneous Traffic

Paved Road Emission Factor

AP-42, Section 13.2.1, Equation 1:

$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

	PM	
k = particle size multiplier	0.0022	lb/VMT from AP-42 Table 13.2.1-1 for PM-10
sL = surface material silt content (haul road)	0.6	g/m^2, from AP-42, Table 13.2.1-2
W = mean vehicle weight	2	tons, estimate
E (uncontrolled) =	0.00	lb/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	1.41E-03	lb/VMT

Table 5d. FY2022 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.1, Equation 2:

$$E_{ext} = E\left(1 - \frac{P}{4 * 365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.001	lb/VMT

Vehicle Miles Traveled (VMT)

Traffic volume	50	trips per day
Paved distance (round trip)	0.28	miles/trip
Paved road VMT =	5,184.66	miles

Table 6. FY2022 Assessable Emissions Calculations - Volatile Organic Compounds (VOC) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	VOC Emission	CY2020 Actual	CY2020 Actual
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	VOC Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	AP-42, Table 1.1-19	0.06 lb/ton	8,330 hours	5.38 tpy [1]
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	AP-42, Table 1.1-19	0.04 lb/ton	5,707 hours	3.43 tpy [2]
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10^3 gal	3,329 gallons	6E-04 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10^3 gal	52,535 gallons	9E-03 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42, Table 3.4-1	0.0819 lb/MMBtu	0 gallons	0 tpy [3]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,719 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	8,446 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	225 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,719 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,784 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,784 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	6 hours	2E-03 tpy
				Significant Emissions Units Emissions - CY2020 Actual VOC Emissions			**8.8 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	5,707 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	152 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	190 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	23 hours	0 tpy
				Insignificant Emissions Units Emissions - CY2020 Actual VOC Emissions			**0 tpy**
						CY2020 Actual VOC Emissions	**8.8 tpy**

Notes
[1] EU ID 1 actual coal throughput 179,230 tons
[2] EU ID 2 actual coal throughput 171,470 tons
[3] Diesel Heating Value 133,141 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/ton) x (Potential throughput, ton/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 7. FY2022 Assessable Emissions Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	Maximum Fuel	SO_2 Emission	CY2020 Actual	CY2020 Actual
ID	Description	Rating/Capacity	Type	Reference	Sulfur Content	Factor	Operation	SO_2 Emissions
			Significant Emissions Units					
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	N/A	81.1 lb/hr	8,330 hours	337.90 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	N/A	20.6 lb/hr	5,707 hours	68.31 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	3,329 gallons	4E-04 tpy [3]
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	52,535 gallons	6E-03 tpy [3]
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	0 gallons	0 tpy [3]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	N/A	2,719 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	N/A	8,446 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	N/A	225 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	N/A	2,719 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	N/A	8,784 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	N/A	8,784 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	6 hours	9E-06 tpy [3,4]
							Significant Emissions Units Emissions - CY2020 Actual Emissions - SO_2	**406.2 tpy**
			Insignificant Emissions Units					
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	N/A	5,707 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	N/A	8,784 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	N/A	8,784 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	N/A	152 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	N/A	190 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	N/A	23 hours	0 tpy
							Insignificant Emissions Units Emissions - CY2020 Actual Emissions - SO_2	**0 tpy**
							CY2020 Actual Emissions - SO_2	**406.2 tpy**

Notes:
[1] Mass balance:
For diesel units, the SO_2 emission factor is calculated based on the sulfur content in diesel fuel
Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol; Stoichiometry: 1 mol S = 1 mol SO_2
SO_2 Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

[2] Diesel Fuel Density — 7.1 lb/gal — AP 42, Table 3.4-1, footnote a
[3] Diesel Heating Value — 133,141 Btu/gal — lab analysis
[4] Engine Heat Rate — 7,000 Btu/hp-hr — AP 42, Table 3.4-1, footnote e

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/gal) x (Fuel consumption, gal/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/gal) / (Fuel heat value, Btu/gal) x (Engine heat rate, Btu/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 8. FY2022 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Golden Valley Electric Association - Healy Power Plant

Hazardous Air Pollutant	CY2020 Actual HAP Emissions by Emissions Unit Category (tons per year) [1]						CY2020 Actual HAP Emissions
	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling [2]	Insignificant Units [3]	
Acetaldehyde	0.10	----	4.3E-06	0	----	----	0.10
Acetophenone	2.6E-03	----	----	----	----	----	2.6E-03
Acrolein	5.1E-02	----	5.1E-07	0	----	----	5.1E-02
Benzene	0.23	1.2E-04	5.2E-06	0	----	----	0.23
Benzyl chloride	0.12	----	----	----	----	----	0.12
Biphenyl	3.0E-04	----	----	----	----	----	3.0E-04
Bis(2-ethylhexyl)phthalate (DEHP)	1.3E-02	----	----	----	----	----	1.3E-02
Bromoform	6.8E-03	----	----	----	----	----	6.8E-03
1,3 Butadiene	----	----	2.2E-07	----	----	----	2.2E-07
Carbon disulfide	2.3E-02	----	----	----	----	----	2.3E-02
2-Chloroacetophenone	1.2E-03	----	----	----	----	----	1.2E-03
Chlorobenzene	3.9E-03	----	----	----	----	----	3.9E-03
Chloroform	1.0E-02	----	----	----	----	----	1.0E-02
Cumene	9.3E-04	----	----	----	----	----	9.3E-04
Dibenzofurans	1.9E-07	----	----	----	----	----	1.9E-07
Dimethyl sulfate	8.4E-03	----	----	----	----	----	8.4E-03
2,4-Dinitrotoluene	4.9E-05	----	----	----	----	----	4.9E-05
Ethyl benzene	1.6E-02	3.5E-05	----	----	----	----	1.7E-02
Ethyl chloride (Chloroethane)	7.4E-03	----	----	----	----	----	7.4E-03
Ethylene dibromide (Dibromoethane)	2.1E-04	----	----	----	----	----	2.1E-04
Ethylene dichloride (1,2-Dichloroethane)	7.0E-03	----	----	----	----	----	7.0E-03
Formaldehyde	4.2E-02	1.8E-02	6.5E-06	0	----	----	6.0E-02
Hexane	1.2E-02	----	----	----	----	----	1.2E-02
Hydrochloric acid	1.31	----	----	----	----	----	1.31
Hydrogen fluoride (Hydrofluoric acid)	0.16	----	----	----	----	----	0.16
Isophorone	0.10	----	----	----	----	----	0.10
Methyl bromide (Bromomethane)	2.8E-02	----	----	----	----	----	2.8E-02
Methyl chloride (Chloromethane)	9.3E-02	----	----	----	----	----	9.3E-02
Methyl chloroform (1,1,1-Trichloroethane)	3.5E-03	1.3E-04	----	----	----	----	3.6E-03
Methyl hydrazine	3.0E-02	----	----	----	----	----	3.0E-02
Methyl methacrylate	3.5E-03	----	----	----	----	----	3.5E-03
Methyl tert butyl ether	6.1E-03	----	----	----	----	----	6.1E-03
Methylene chloride (Dichloromethane)	5.1E-02	----	----	----	----	----	5.1E-02
Phenol	2.8E-03	----	----	----	----	----	2.8E-03
Polycyclic Organic Matter (POM)	3.3E-03	6.6E-04	9.3E-07	0	----	----	4.0E-03
Acenaphthene	8.9E-05	1.4E-07	7.9E-09	0	----	----	
Acenaphthylene	4.4E-05	1.2E-05	2.8E-08	0	----	----	
Anthracene	3.7E-05	6.7E-07	1.0E-08	0	----	----	
Benzo(a)anthracene	1.4E-05	2.2E-06	9.3E-09	0	----	----	
Benzo(a)pyrene	6.7E-06	----	1.0E-09	0	----	----	
Benzo(b)fluoranthene	----	----	5.5E-10	0	----	----	
Benzo(g,h,i)perylene	4.7E-06	----	2.7E-09	----	----	----	
Benzo(k)fluoranthene	----	----	8.6E-10	0	----	----	

Table 8. FY2022 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Golden Valley Electric Association - Healy Power Plant

Hazardous Air Pollutant	CY2020 Actual HAP Emissions by Emissions Unit Category (tons per year) [1]						CY2020 Actual HAP Emissions
	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling [2]	Insignificant Units [3]	
Chrysene	1.8E-05	1.3E-06	2.0E-09	0	----	----	
Dibenz(a,h)anthracene	----	9.2E-07	3.2E-09	0	----	----	
Acenaphthene	8.9E-05	1.4E-07	7.9E-09	0	----	----	
Fluoranthene	1.2E-04	2.7E-06	4.2E-08	0	----	----	
Fluorene	1.6E-04	2.5E-06	1.6E-07	0	----	----	
Indeno(1,2,3-cd)pyrene	----	1.2E-06	----	0	----	----	
Naphthalene	2.3E-03	6.2E-04	4.7E-07	0	----	----	
Pyrene	5.8E-05	2.3E-06	2.7E-08	0	----	----	
Propionaldehyde	6.7E-02	----	----	----	----	----	6.7E-02
Styrene	4.4E-03	----	----	----	----	----	4.4E-03
2,3,7,8-Tetrachlorodibenzo-p-dioxin	2.5E-09	----	----	----	----	----	2.5E-09
Tetrachloroethylene (Perchloroethylene)	7.5E-03	----	----	----	----	----	7.5E-03
Toluene	4.2E-02	3.4E-03	2.3E-06	0	----	----	4.6E-02
Vinyl acetate	1.3E-03	----	----	----	----	----	1.3E-03
Xylenes (isomers and mixture)	6.5E-03	6.0E-05	1.6E-06	0	----	----	6.5E-03
Antimony Compounds	3.2E-03	----	----	----	----	----	3.2E-03
Arsenic Compounds	7.2E-02	2.9E-04	----	----	----	----	7.2E-02
Beryllium Compounds	3.7E-03	2.2E-04	----	----	----	----	3.9E-03
Cadmium Compounds	8.9E-03	2.2E-04	----	----	----	----	9.2E-03
Chromium Compounds	5.9E-02	2.2E-04	----	----	----	----	6.0E-02
Cobalt Compounds	1.8E-02	----	----	----	----	----	1.8E-02
Cynaide Compounds	0.44	----	----	----	----	----	0.44
Lead Compounds	7.4E-02	6.6E-04	----	----	----	----	7.4E-02
Magnesium Compounds	1.93	----	----	----	----	----	1.93
Manganese Compounds	8.6E-02	4.4E-04	----	----	----	----	8.6E-02
Mercury Compounds	4.9E-03	2.2E-04	----	----	----	----	5.1E-03
Nickel Compounds	4.9E-02	2.2E-04	----	----	----	----	4.9E-02
Selenium Compounds	0.23	1.1E-03	----	----	----	----	0.23
Total HAPs - Maximum Individual HAP	**1.93**	**1.8E-02**	**6.5E-06**	**0**	**0**	**0**	**1.93**
Total VOC HAP Emissions	**1.11**	**2.3E-02**	**2.1E-05**	**0**	**0**	**0**	**1.13**
Total HAPs Emissions	**5.54**	**2.6E-02**	**2.1E-05**	**0**	**0**	**0**	**5.57**

Notes:
[1] See individual emissions unit category emissions calculations for details on methodology and assumptions.
[2] Emissions units in the coal preparation and handling, ash handling and coal storage pile systems do not have HAP emissions
[3] HAP emissions from the fuel storage tanks are negligible.

Table 8a. FY2022 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Coal-Fired Boilers
Golden Valley Electric Association - Healy Power Plant

EU ID 1 CY2020 actual coal throughput	179,230	tons
EU ID 2 CY2020 actual coal throughput	171,470	tons
Total CY2020 actual coal throughput	**350,700**	**tons**

		CY2020 Actual Source Category Emission Calculations	
CAS No.	**Chemical Name**	**Emission Factor** [1]	**Estimated Emissions**
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.43E-11 lb/ton	2.51E-09 tpy
121142	2,4-Dinitrotoluene	2.80E-07 lb/ton	4.91E-05 tpy
532274	2-Chloroacetophenone	7.00E-06 lb/ton	1.23E-03 tpy
75-07-0	Acetaldehyde	5.70E-04 lb/ton	9.99E-02 tpy
98862	Acetophenone	1.50E-05 lb/ton	2.63E-03 tpy
107-02-8	Acrolein	2.90E-04 lb/ton	5.09E-02 tpy
71-43-2	Benzene	1.30E-03 lb/ton	2.28E-01 tpy
100447	Benzyl chloride	7.00E-04 lb/ton	1.23E-01 tpy
92524	Biphenyl	1.70E-06 lb/ton	2.98E-04 tpy
117817	Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05 lb/ton	1.28E-02 tpy
75252	Bromoform	3.90E-05 lb/ton	6.84E-03 tpy
75150	Carbon disulfide	1.30E-04 lb/ton	2.28E-02 tpy
108907	Chlorobenzene	2.20E-05 lb/ton	3.86E-03 tpy
67663	Chloroform	5.90E-05 lb/ton	1.03E-02 tpy
98828	Cumene	5.30E-06 lb/ton	9.29E-04 tpy
132649	Dibenzofurans	1.09E-09 lb/ton	1.91E-07 tpy
77781	Dimethyl sulfate	4.80E-05 lb/ton	8.42E-03 tpy
100-41-4	Ethyl benzene	9.40E-05 lb/ton	1.65E-02 tpy
75003	Ethyl chloride (Chloroethane)	4.20E-05 lb/ton	7.36E-03 tpy
1006934	Ethylene dibromide (Dibromoethane)	1.20E-06 lb/ton	2.10E-04 tpy
107062	Ethylene dichloride (1,2-Dichloroethane)	4.00E-05 lb/ton	7.01E-03 tpy
50-00-0	Formaldehyde	2.40E-04 lb/ton	4.21E-02 tpy
110543	Hexane	6.70E-05 lb/ton	1.17E-02 tpy
7647010	Hydrochloric acid - EU ID 1	1.42E-02 lb/ton [2]	1.27 tpy
7647010	Hydrochloric acid - EU ID 2	3.71E-04 lb/ton [3]	0.03 tpy
7664393	Hydrogen fluoride (Hydrofluoric acid) - EU ID 1	1.44E-03 lb/ton [2]	0.13 tpy
7664393	Hydrogen fluoride (Hydrofluoric acid) - EU ID 2	3.31E-04 lb/ton [3]	2.83E-02 tpy
78591	Isophorone	5.80E-04 lb/ton	1.02E-01 tpy
74839	Methyl bromide (Bromomethane)	1.60E-04 lb/ton	2.81E-02 tpy
60344	Methyl hydrazine	1.70E-04 lb/ton	2.98E-02 tpy
80626	Methyl methacrylate	2.00E-05 lb/ton	3.51E-03 tpy
1634044	Methyl tert butyl ether	3.50E-05 lb/ton	6.14E-03 tpy
74873	Methyl chloride (Chloromethane)	5.30E-04 lb/ton	9.29E-02 tpy
71-55-6	Methyl chloroform (1,1,1-Trichloroethane)	2.00E-05 lb/ton	3.51E-03 tpy
75092	Methylene chloride (Dichloromethane)	2.90E-04 lb/ton	5.09E-02 tpy
108952	Phenol	1.60E-05 lb/ton	2.81E-03 tpy
N/A	Polycyclic Organic Matter (POM)	1.91E-05 lb/ton	3.34E-03 tpy
	Polycyclic aromatic compounds(PAH)		
83-32-9	Acenaphthene	5.10E-07 lb/ton	8.94E-05 tpy
203-96-8	Acenaphthylene	2.50E-07 lb/ton	4.38E-05 tpy
120-12-7	Anthracene	2.10E-07 lb/ton	3.68E-05 tpy
56-55-3	Benzo(a)anthracene	8.00E-08 lb/ton	1.40E-05 tpy
205-99-5	Benzo(b,j,k)fluoranthene	1.10E-07 lb/ton	1.93E-05 tpy
50-32-8	Benzo(a)pyrene	3.80E-08 lb/ton	6.66E-06 tpy
191-24-2	Benzo(g,h,i)perylene	2.70E-08 lb/ton	4.73E-06 tpy
218-01-9	Chrysene	1.00E-07 lb/ton	1.75E-05 tpy
206-44-0	Fluoranthene	7.10E-07 lb/ton	1.24E-04 tpy
86-73-7	Fluorene	9.10E-07 lb/ton	1.60E-04 tpy
193-39-5	Ideno(1,2,3-cd)pyrene	6.10E-08 lb/ton	1.07E-05 tpy
	5-methylchrysene	2.20E-08 lb/ton	3.86E-06 tpy

Table 8a. FY2022 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Coal-Fired Boilers
Golden Valley Electric Association - Healy Power Plant

EU ID 1 CY2020 actual coal throughput	179,230	tons
EU ID 2 CY2020 actual coal throughput	171,470	tons
Total CY2020 actual coal throughput	**350,700**	**tons**

CAS No.	Chemical Name	CY2020 Actual Source Category Emission Calculations: Emission Factor [1]	Estimated Emissions
91-20-3	Naphthalene	1.30E-05 lb/ton	2.28E-03 tpy
85-01-8	Phenanathrene	2.70E-06 lb/ton	4.73E-04 tpy
129-00-0	Pyrene	3.30E-07 lb/ton	5.79E-05 tpy
123386	Propionaldehyde	3.80E-04 lb/ton	6.66E-02 tpy
100425	Styrene	2.50E-05 lb/ton	4.38E-03 tpy
127184	Tetrachloroethylene (Perchloroethylene)	4.30E-05 lb/ton	7.54E-03 tpy
108-88-3	Toluene	2.40E-04 lb/ton	4.21E-02 tpy
108054	Vinyl acetate	7.60E-06 lb/ton	1.33E-03 tpy
1330-20-7	Xylenes (isomers and mixture)	3.70E-05 lb/ton	6.49E-03 tpy
N/A	Antimony Compounds	1.80E-05 lb/ton	3.16E-03 tpy
N/A	Arsenic Compounds	4.10E-04 lb/ton	7.19E-02 tpy
N/A	Beryllium Compounds	2.10E-05 lb/ton	3.68E-03 tpy
N/A	Cadmium Compounds	5.10E-05 lb/ton	8.94E-03 tpy
N/A	Chromium Compounds	3.39E-04 lb/ton	5.94E-02 tpy
N/A	Cobalt Compounds	1.00E-04 lb/ton	1.75E-02 tpy
N/A	Cynaide Compounds	2.50E-03 lb/ton	4.38E-01 tpy
N/A	Lead Compounds	4.20E-04 lb/ton	7.36E-02 tpy
N/A	Magnesium Compounds	1.10E-02 lb/ton	1.93 tpy
N/A	Manganese Compounds	4.90E-04 lb/ton	8.59E-02 tpy
N/A	Mercury Compounds - EU ID 1	1.62E-05 lb/ton [4]	1.46E-03 tpy
	Mercury Compounds - EU ID 2	4.02E-05 lb/ton [5]	3.45E-03 tpy
N/A	Nickel Compounds	2.80E-04 lb/ton	4.91E-02 tpy
N/A	Selenium Compounds	1.30E-03 lb/ton	2.28E-01 tpy
	Total CY2020 Actual HAP Emissions		**5.54 tpy**

Notes:
[1] Reference: AP-42, Tables 1.1-12, 1.1-13, 1.1-14, 1.1-15, 1.1-18
[2] HCl and HF emission factors from EU ID 1 source test completed in November 2017
[3] HCl and HF emission factors from EU ID 2 source test completed in December 2018
[4] Emission factor from EU ID 1 source test completed in March 2019
[5] Emission factor from EU ID 2 CEMS average 2020

Conversion Factors:

Coal Heating Value	14.37	MMBtu/ton	CY2020 weighted average
Unit 1	1.13	lb/TBtu	
Unit 2	2.80	lb/TBtu	

Table 8b. FY2022 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Diesel-Fired Boilers and Heaters
Golden Valley Electric Association - Healy Power Plant

CY2020 Actual Heat Input: 147,233 MMBtu/yr [1]

CAS No.	Chemical Name	CY2020 Actual Source Category Emission Calculations: Emission Factor [2,3]	Estimated Emissions
71-43-2	Benzene	1.61E-06 lb/MMBtu	1.18E-04 tpy
100-41-4	Ethyl benzene	4.78E-07 lb/MMBtu	3.52E-05 tpy
50-00-0	Formaldehyde	2.48E-04 lb/MMBtu	1.82E-02 tpy
71-55-6	Methyl chloroform (1,1,1-Trichloroethane)	1.77E-06 lb/MMBtu	1.30E-04 tpy
NA	Polycyclic Organic Matter (POM)	8.94E-06 lb/MMBtu	6.58E-04 tpy
NA	Polycyclic aromatic compounds(PAH)		
83-32-9	Acenaphthylene	1.58E-07 lb/MMBtu	1.17E-05 tpy
208-96-8	Acenaphthene	1.90E-09 lb/MMBtu	1.40E-07 tpy
120-12-7	Anthracene	9.16E-09 lb/MMBtu	6.75E-07 tpy
56-55-3	Benzo(a)anthracene	3.01E-08 lb/MMBtu	2.22E-06 tpy
205-82-3/207-09-9	Benzo(b,k)fluoranthene	1.11E-08 lb/MMBtu	8.18E-07 tpy
191-24-2	Benzo(g,h,l)perylene	1.70E-08 lb/MMBtu	1.25E-06 tpy
218-01-9	Chrysene	1.79E-08 lb/MMBtu	1.32E-06 tpy
53-70-3	Dibenz(a,h)anthracene	1.25E-08 lb/MMBtu	9.23E-07 tpy
206-44-0	Fluoranthene	3.64E-08 lb/MMBtu	2.68E-06 tpy
86-73-7	Fluorene	3.36E-08 lb/MMBtu	2.47E-06 tpy
193-39-5	Indeno(1,2,3-cd)pyrene	1.61E-08 lb/MMBtu	1.18E-06 tpy
91-20-3	Naphthalene	8.49E-06 lb/MMBtu	6.25E-04 tpy
85-01-8	Phenanthrene	7.89E-08 lb/MMBtu	5.81E-06 tpy
129-00-0	Pyrene	3.19E-08 lb/MMBtu	2.35E-06 tpy
108-88-3	Toluene	4.66E-05 lb/MMBtu	3.43E-03 tpy
1330-20-7	Xylenes (isomers and mixture)	8.19E-07 lb/MMBtu	6.03E-05 tpy
NA	Arsenic Compounds	4.00E-06 lb/MMBtu	2.94E-04 tpy
NA	Beryllium Compounds	3.00E-06 lb/MMBtu	2.21E-04 tpy
NA	Cadmium Compounds	3.00E-06 lb/MMBtu	2.21E-04 tpy
NA	Chromium Compounds	3.00E-06 lb/MMBtu	2.21E-04 tpy
NA	Lead Compounds	9.00E-06 lb/MMBtu	6.63E-04 tpy
NA	Manganese Compounds	6.00E-06 lb/MMBtu	4.42E-04 tpy
NA	Mercury Compounds	3.00E-06 lb/MMBtu	2.21E-04 tpy
NA	Nickel Compounds	3.00E-06 lb/MMBtu	2.21E-04 tpy
NA	Selenium Compounds	1.50E-05 lb/MMBtu	1.10E-03 tpy
		CY2020 Actual HAP Emissions:	**2.6E-02 tpy**

[1] Total fuel use based on actual CY2020 operation as noted below:

EU ID 1 Unit No. 1		327 MMBtu/hr
		198,169 gallons
	Actual Heat Input:	26,384.28 MMBtu/yr
EU ID 2 Unit No. 2		658 MMBtu/hr
		851,816 gallons
	Actual Heat Input:	113,411.19 MMBtu/hr
EU ID 3 Auxiliary Boiler No. 1		12.554 MMBtu/hr
		3,329 gallons
	Actual Heat Input:	443.21 MMBtu/yr
EU ID 4 Auxiliary Boiler No. 2		23.0 MMBtu/hr
		52,535 gallons
	Actual Heat Input:	6,994.47 MMBtu/hr
	Total CY2020 Heat Input:	**147,233 MMBtu/yr**

[2] Reference: AP-42, Tables 1.3-9, and 1.3-10.

[3] Diesel high heat value: 133,141 Btu/gal lab analysis

Table 8c. FY2022 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Diesel Engines Greater Than or Equal to 600 Horsepower
Golden Valley Electric Association - Healy Power Plant

CY2020 Actual Heat Input: 0.0 MMBtu/yr [1]

		CY2020 Actual Source Category Emission Calculations	
CAS No.	**Chemical Name**	**Emission Factor [2]**	**Estimated Emissions**
75-07-0	Acetaldehyde	2.52E-05 lb/MMBtu	0.00E+00 tpy
107-02-8	Acrolein	7.88E-06 lb/MMBtu	0.00E+00 tpy
71-43-2	Benzene	7.76E-04 lb/MMBtu	0.00E+00 tpy
50-00-0	Formaldehyde	7.89E-05 lb/MMBtu	0.00E+00 tpy
108-88-3	Toluene	2.81E-04 lb/MMBtu	0.00E+00 tpy
1330-20-7	Xylenes (isomers and mixture)	1.93E-04 lb/MMBtu	0.00E+00 tpy
N/A	Polycyclic Organic Matter (POM)	2.12E-04 lb/MMBtu	0.00E+00 tpy
	Polycyclic aromatic compounds(PAH)		
	Acenaphthene	4.68E-06 lb/MMBtu	0.00E+00 tpy
	Acenaphthylene	9.23E-06 lb/MMBtu	0.00E+00 tpy
	Anthracene	1.23E-06 lb/MMBtu	0.00E+00 tpy
	Benzo(a)anthracene	6.22E-07 lb/MMBtu	0.00E+00 tpy
	Benzo(b)fluoranthene	1.11E-06 lb/MMBtu	0.00E+00 tpy
	Benzo(k)fluoranthene	2.18E-07 lb/MMBtu	0.00E+00 tpy
	Benzo(a)pyrene	2.57E-07 lb/MMBtu	0.00E+00 tpy
	Benzo(g,h,I)perylene	5.56E-07 lb/MMBtu	0.00E+00 tpy
	Chrysene	1.53E-06 lb/MMBtu	0.00E+00 tpy
	Dibenz(a,h)anthracene	3.46E-07 lb/MMBtu	0.00E+00 tpy
	Fluoranthene	4.03E-06 lb/MMBtu	0.00E+00 tpy
	Fluorene	1.28E-05 lb/MMBtu	0.00E+00 tpy
	Indeno(1,2,3-cd)pyrene	4.14E-07 lb/MMBtu	0.00E+00 tpy
91-20-3	Naphthalene	1.30E-04 lb/MMBtu	0.00E+00 tpy
	Phenanthrene	4.08E-05 lb/MMBtu	0.00E+00 tpy
	Pyrene	3.71E-06 lb/MMBtu	0.00E+00 tpy
		CY2020 Actual HAP Emissions:	**0.00E+00 tpy**

Notes:

[1] Total fuel use based on actual operation as noted below:

EU ID 5 Diesel Generator Engine No. 1	2.75	MW
	0	gallons
Potential Heat Input:	0	MMBtu/yr
Total CY2020 Heat Input:	**0**	**MMBtu/yr**

[2] Reference: AP-42, Worst Case Tables 3.2-1, 3.2-2, 3.2-3.

[3] Diesel high heat value: 133,141 Btu/gal lab analysis

Table 8d. FY2022 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Diesel Engines Less Than 600 Horsepower
Golden Valley Electric Association - Healy Power Plant

CY2020 Actual Heat Input: 11 MMBtu/yr [1]

		CY2020 Actual Source Category Emission Calculations	
CAS No.	**Chemical Name**	**Emission Factor** [2]	**Estimated Emissions**
75-07-0	Acetaldehyde	7.67E-04 lb/MMBtu	4.25E-06 tpy
107-02-8	Acrolein	9.25E-05 lb/MMBtu	5.13E-07 tpy
71-43-2	Benzene	9.33E-04 lb/MMBtu	5.17E-06 tpy
106-99-0	1,3 Butadiene	3.91E-05 lb/MMBtu	2.17E-07 tpy
50-00-0	Formaldehyde	1.18E-03 lb/MMBtu	6.54E-06 tpy
108-88-3	Toluene	4.09E-04 lb/MMBtu	2.27E-06 tpy
1330-20-7	Xylenes (isomers and mixture)	2.85E-04 lb/MMBtu	1.58E-06 tpy
N/A	Polycyclic Organic Matter (POM)	1.68E-04 lb/MMBtu	9.32E-07 tpy
	Polycyclic aromatic compounds(PAH)		
	Acenaphthene	1.42E-06 lb/MMBtu	7.87E-09 tpy
	Acenaphthylene	5.06E-06 lb/MMBtu	2.81E-08 tpy
	Anthracene	1.87E-06 lb/MMBtu	1.04E-08 tpy
	Benzo(a)anthracene	1.68E-06 lb/MMBtu	9.31E-09 tpy
	Benzo(b)fluoranthene	9.91E-08 lb/MMBtu	5.49E-10 tpy
	Benzo(k)fluoranthene	1.55E-07 lb/MMBtu	8.59E-10 tpy
	Benzo(a)pyrene	1.88E-07 lb/MMBtu	1.04E-09 tpy
	Benzo(g,h,i)perylene	4.89E-07 lb/MMBtu	2.71E-09 tpy
	Chrysene	3.53E-07 lb/MMBtu	1.96E-09 tpy
	Dibenz(a,h)anthracene	5.83E-07 lb/MMBtu	3.23E-09 tpy
	Fluoranthene	7.61E-06 lb/MMBtu	4.22E-08 tpy
	Fluorene	2.92E-05 lb/MMBtu	1.62E-07 tpy
	Ideno(1,2,3-cd)pyrene	3.75E-07 lb/MMBtu	2.08E-09 tpy
91-20-3	Naphthalene	8.48E-05 lb/MMBtu	4.70E-07 tpy
	Phenanthrene	2.94E-05 lb/MMBtu	1.63E-07 tpy
	Pyrene	4.78E-06 lb/MMBtu	2.65E-08 tpy
		CY2020 Actual HAP Emissions:	**2.1E-05 tpy**

Notes:

[1] Total fuel use based on actual operation as noted below:

EU ID 13 Firewater Pump Engine	264	hp
	6.0	hr/yr
Potential Heat Input:	11	MMBtu/yr
Total CY2020 Heat Input:	**11**	**MMBtu/yr**

Engines heat rate: 7,000 Btu/hp-hr

[2] Reference: AP-42, Table 3.3-2.

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Golden Valley Electric Association
FY2022 Assessable Emission Estimates

North Pole Power Plant – Permit No. AQ0110TVP04

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Table 1. FY2022 Assessable Emissions Summary
Golden Valley Electric Association - North Pole Power Plant

Assessable Emissions - Tons Per Year							
Description	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAPs**	**Total**
Assessable PTE	3,970	128	102	2,347	4	11	6,554

From Condition 49 and Table C of the SOB for AQ0110TVP04

Potential to Emit	Regulated Air Pollutant Emissions (tons per year) [1]					
	NO_X	**CO**	**PM_{10}**	**VOC**	**SO_2**	**HAP**
Significant	1269.7	19.1	30.4		286.8	
Insignificant	0	0	0		0	
Total Emissions	**1,270**	**19**	**30**		**287**	
Use Assessable PTE				**4**		**0**
Assessable Emission Subtotals	**1,270**	**19**	**30**	**4**	**287**	**0**
Fees Apply to Pollutant? [2]	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**
2020 Actual Emissions	**1,606**					
Fee Estimate [3]	**$68,989**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[3] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

[4] Actual emissions are not provided for VOC or HAPs because potential emissions are less than 10 tpy each. Actual emissions must be less than or equal to potential emissions, so actual emissions are also less than 10 tpy.

Table 2a. FY2022 Significant Emissions Unit Summary
Golden Valley Electric Association - North Pole Power Plant

Emission Unit			Fuel	Maximum	CY2020 Actual	CY2020 Actual
ID	Description	Make/Model	Type	Capacity	Operation	Fuel Consumption
1	Simple Cycle Gas Turbine	GE Frame 7, Series 7001, Model BR	ULSD	672 MMBtu/hr	1,186.8 hr/yr	222,153 gal/yr
			No. 1 Diesel			450,638 gal/yr
			No. 2 Diesel			2,445,052 gal/yr
2	Simple Cycle Gas Turbine	GE Frame 7, Series 7001, Model BR	ULSD	672 MMBtu/hr	4,049.7 hr/yr	480,856 gal/yr
			No. 1 Diesel			2,902,310 gal/yr
			No. 2 Diesel			8,438,903 gal/yr
5	Combined Cycle Gas Turbine	GE LM6000PC	ULSD	455 MMBtu/hr	6,391.6 hr/yr	132,442 gal/yr
			No. 1 Diesel			0 gal/yr
			Naphtha			27,922,690 gal/yr
6	Combined Cycle Gas Turbine	GE LM6000PC	ULSD	455 MMBtu/hr	0 hr/yr	0 gal/yr
			No. 1 Diesel			0 gal/yr
			Naphtha			0 gal/yr
7	Emergency Generator Engine	Mitsubishi 0A8829	ULSD	564.6 hp[1]	3.8 hr/yr	122 gal/yr
11	Boiler	Bryan Steam RV500	Propane	5.0 MMBtu/hr	228.6 hr/yr	12,483 gal/yr
12	Boiler	Bryan Steam RV500		5.0 MMBtu/hr		

[1] The generator has an electrical output of 400 kW. Assuming a 95% efficiency (per Section 2.7.2.1 of ADEC Modeling Review Procedures Manual) and converting from Kw to hp, the input rating is 564.6 hp.
Input Rating, hp= (Output Rating, kW) / (Efficiency, 0.95) * (Conversion, 1.341 hp/kW)

Table 2b. FY2022 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - North Pole Power Plant

Emission Unit		Fuel Type/	Rating/Size	CY2020 Actual	CY2020 Actual
ID[1]	Description	Material		Operation	Fuel Consumption
3	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,784 hr/yr	N/A
4	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,784 hr/yr	N/A
N/A	FHR Warehouse Boiler 1	No. 2 Diesel	0.784 MMBtu/hr	8,784 hr/yr	6,678 gal/yr
N/A	FHR Warehouse Boiler 2	No. 2 Diesel	0.784 MMBtu/hr	8,784 hr/yr	
N/A	Burnham 17 A-T Boiler	No. 1 ULSD	0.222 MMBtu/hr	1,998 hr/yr	3,797 gal/yr

[1] EU IDs 3 and 4 are not currently subject to 40 CFR 60 Subpart Kb.

Table 3. FY2022 Assessable Emission Calculations - Oxides of Nitrogen (NO_X) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	NO_X Emission Factor	CY2020 Actual Operation	CY2020 Actual NO_x Emissions
Significant Emission Units							
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	2019 CEMS Average[1]	243.3 lb/hr	1,186.8 hours	240.30 tpy
			No. 1 Diesel				
			No. 2 Diesel				
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-1	0.88 lb/MMBtu	480,856 gal/yr	28.99 tpy
			No. 1 Diesel			2,902,310 gal/yr	169.51 tpy
			No. 2 Diesel			8,438,903 gal/yr	508.69 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	2019 CEMS Average[1]	99.3 lb/hr	6,391.6 hours	322.10 tpy
			No. 1 Diesel				
			Naphtha				
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-1	0.24 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.031 lb/hp-hr	3.8 hr/yr	0.03 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	13 lb/10^3gal	12,483 gal/yr	0.08 tpy
12	Boiler	5.0 MMBtu/hr					
						Significant Emission Units - 2020 Actual Emissions - NO_X	**1269.70 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,784 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,784 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Table 1.3-1	18 lb/10^3gal	6,678 gal/yr	0.06 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	18 lb/10^3gal	3,797 gal/yr	0.03 tpy
						Insignificant Emission Units - 2020 Actual Emissions - NO_X	**0.09 tpy**
						2020 Actual Emissions - NO_X	**1269.8 tpy**

Note:

[1] The emission factors for EU IDs 1 and 5 are an average emission rate from 2020 measured using Continuous Emissions Monitoring Systems (CEMS).

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Operation, gal/yr) / (2,000 lb/ton)

HHV No. 1 Diesel = 132,742 Btu/gal (based on average of CY2020 fuel tests)
HHV No. 2 Diesel= 136,998 Btu/gal (based on average of CY2020 fuel tests)
HHV Naphtha= 108,178 Btu/gal (based on average of CY2020 fuel tests)

Table 4. FY2022 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	CO Emission Factor	CY2020 Actual Operation	CY2020 Actual Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	2019 CEMS Average1	13.6 lb/hr	1,186.8 hours	8.07 tpy
			No. 1 Diesel				
			No. 2 Diesel				
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-1	0.0033 lb/MMBtu	480,856 gal/yr	0.11 tpy
			No. 1 Diesel			2,902,310 gal/yr	0.64 tpy
			No. 2 Diesel			8,438,903 gal/yr	1.91 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	2019 CEMS Average1	2.3 lb/hr	6,391.6 hours	8.30 tpy
			No. 1 Diesel				
			Naphtha				
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-1	0.076 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.00668 lb/hp-hr	3.8 hr/yr	0.01 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	7.5 lb/10^3gal	12,483 gal/yr	0.05 tpy
12	Boiler	5.0 MMBtu/hr					
Significant Emission Units - CY2020 Actual Emissions - CO							**19.08 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,784 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,784 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Table 1.3-1	5.0 lb/10^3gal	6,678 gal/yr	0.02 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	5.0 lb/10^3gal	3,797 gal/yr	0.01 tpy
Insignificant Emission Units - CY2020 Actual Emissions - CO							**0.03 tpy**
CY2020 Actual Emissions - CO							**19.1 tpy**

Note:

[1] The emission factors for EU IDs 1 and 5 are an average emission rate from 2020 measured using Continuous Emissions Monitoring Systems (CEMS).

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Operation, gal/yr) / (2,000 lb/ton)

HHV No. 1 Diesel = 132,742 Btu/gal (based on average of CY2020 fuel tests)
HHV No. 2 Diesel= 136,998 Btu/gal (based on average of CY2020 fuel tests)
HHV Naphtha= 108,178 Btu/gal (based on average of CY2020 fuel tests)

Table 5. FY2022 Assessable Emission Calculations - Particulate Matter (PM_{10}) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	PM_{10} Emission Factor	CY2020 Actual Operation	CY2020 Actual PM_{10} Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.012 lb/MMBtu	222,153 gal/yr	0.18 tpy
			No. 1 Diesel			450,638 gal/yr	0.36 tpy
			No. 2 Diesel			2,445,052 gal/yr	2.01 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.012 lb/MMBtu	480,856 gal/yr	0.40 tpy
			No. 1 Diesel			2,902,310 gal/yr	2.3 tpy
			No. 2 Diesel			8,438,903 gal/yr	6.9 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.012 lb/MMBtu	132,442 gal/yr	0.11 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			27,922,690 gal/yr	18.12 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.0022 lb/hp-hr	3.8 hr/yr	2E-03 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	0.7 $lb/10^3gal$	12,483 gal/yr	4E-03 tpy
12	Boiler	5.0 MMBtu/hr					
					Significant Emission Units - 2020 Actual Emissions - PM_{10}		**30.43 tpy**
			Insignificant Emission Units				
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,784 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,784 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Tables 1.3-1 and 1.3-2	1.7 $lb/10^3gal$	6,678 gal/yr	6E-03 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-1 and 1.3-2	1.7 $lb/10^3gal$	3,797 gal/yr	3E-03 tpy
					Insignificant Emission Units - 2020 Actual Emissions - PM_{10}		**9E-03 tpy**
					2020 Actual Emissions - PM_{10}		**30.4 tpy**

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Operation, gal/yr) / (2,000 lb/ton)

HHV No. 1 Diesel = 132,742 Btu/gal (based on average of CY2020 fuel tests)
HHV No. 2 Diesel= 136,998 Btu/gal (based on average of CY2020 fuel tests)
HHV Naphtha= 108,178 Btu/gal (based on average of CY2020 fuel tests)

Table 6. FY2022 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	Maximum Fuel Sulfur Content [1]	SO_2 Emission Factor	CY2020 Actual Operation	CY2020 Actual SO_2 Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	Mass Balance	4.1E-04 wt. pct. S	5.6E-05 lb/gal	222,153 gal/yr	0.01 tpy
			No. 1 Diesel	Mass Balance	0.099 wt. pct. S	0.013 lb/gal	450,638 gal/yr	3.02 tpy
			No. 2 Diesel	Mass Balance	0.329 wt. pct. S	0.048 lb/gal	2,445,052 gal/yr	58.68 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	Mass Balance	4.1E-04 wt. pct. S	5.6E-05 lb/gal	480,856 gal/yr	0.01 tpy
			No. 1 Diesel	Mass Balance	0.099 wt. pct. S	0.013 lb/gal	2,902,310 gal/yr	19.47 tpy
			No. 2 Diesel	Mass Balance	0.329 wt. pct. S	0.048 lb/gal	8,438,903 gal/yr	202.52 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	Mass Balance	4.1E-04 wt. pct. S	5.6E-05 lb/gal	132,442 gal/yr	0.00 tpy
			No. 1 Diesel	Mass Balance	0.099 wt. pct. S	0.013 lb/gal	0 gal/yr	0 tpy
			Naphtha	Mass Balance	1.9E-03 wt. pct. S	2.2E-04 lb/gal	27,922,690 gal/yr	3.06 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	Mass Balance	4.1E-04 wt. pct. S	5.6E-05 lb/gal	0 gal/yr	0 tpy
			No. 1 Diesel	Mass Balance	0.099 wt. pct. S	0.013 lb/gal	0 gal/yr	0 tpy
			Naphtha	Mass Balance	1.9E-03 wt. pct. S	2.2E-04 lb/gal	0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	Mass Balance	1.5E-03 wt. pct. S	2.2E-04 lb/gal	3.8 hr/yr	1.E-05 tpy
11	Boiler	5.0 MMBtu/hr	Propane	Mass Balance	7.8E-06 wt. pct. S	6.6E-07 lb/gal	12,483 gal/yr	4E-06 tpy
12	Boiler	5.0 MMBtu/hr						
							Significant Emission Units - CY2020 Actual Emissions - SO_2	286.78 tpy
			Insignificant Emission Units					
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	N/A	8,784 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	N/A	8,784 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	Mass Balance	0.33 wt. pct. S	0.045 lb/gal	6,678 gal/yr	0.15 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel					
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	Mass Balance	1.5E-03 wt. pct. S	2.04E-04 lb/gal	3,797 gal/yr	4E-04 tpy
							Insignificant Emission Units - CY2020 Actual Emissions - SO_2	0.15 tpy
							CY2020 Actual Emissions - SO_2	286.9 tpy

Notes:

Sample Calculations: [2, 3, 4]

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

Turbine Emissions, tpy= (Emission factor, lb/gal) x (Fuel Use gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/gal) x (Capacity, gal/hr) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/gal) x (Operation, gal/yr) / (2,000 lb/ton)

Boiler wt. pct. S= (Sulfur compound content, ppmv SO_2) x (Conversion, 1.66E-7 lb SO_2/scf / ppm SO_2) x (F-factor, 8,710 scf/MMBtu) x (Conversion, 0.0216 MMBtu/lb) x (Conversion, mole SO_2/64 lb SO_2) x (Conversion, mole S/mole SO_2) x (Conversion, 32 lb S/ mole S)

Notes:

[1] Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2020 as received from supplier sampling.

[2] Fuel density assumed equal to 6.8 lb/gal for ULS and No. 1 Diesel, 7.3 lb/gal for No. 2 Diesel, 5.2 lb/gal for naphtha, 4.2 lb/gal for propane, and 6.8 lb/gal for No. 2 Fuel Oil.

[3] The engine specification datasheet indicates a maximum fuel throughput of 32 gal/hr.

[4] Propane fuel analysis results from 2020 indicate a fuel sulfur content less than 0.5 ppmv.

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Golden Valley Electric Association
FY2022 Assessable Emission Estimates

Zehnder Facility – Permit No. AQ0109TVP03

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Table 1. FY2022 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

	Assessable Emissions - Tons Per Year						
Description	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAPs**	**Total**
Assessable PTE	2,115	20.9	30.4	580	2.6	-	2,749

From Table A of the TAR for AQ0109MSS01

Potential to Emit	Regulated Air Pollutant Emissions (tons per year) [1]					
	NO_X	**CO**	**PM_{10}**	**VOC**	**SO_2**	**HAP**
Significant	123.1	0.6	1.7	0.1	44.8	
Insignificant	0.2	0.1	0.0	0.1	0.2	
Total Emissions	**123**	**1**	**2**	**0**	**45**	
Use Assessable PTE						**0**
Assessable Emission Subtotals	**123**	**1**	**2**	**0**	**45**	**0**
Fees Apply to Pollutant? [2]	**Yes**	**No**	**No**	**No**	**Yes**	**No**
CY2019 Actual Emissions	**168**					
Fee Estimate [3]	**$7,231**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[3] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

[4] Actual emissions are not provided for HAPs because potential emissions for HAPs are less than 10 tpy. Actual emissions must be less than or equal to potential emissions, so actual emissions are also less than 10 tpy.

Table 2a. FY2022 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

Emission Unit			Fuel	CY2020 Actual	Maximum	CY2020 Actual
ID	Description	Make/Model	Type	Operation	Capacity	Fuel Consumption
1	Simple Cycle Gas Turbine	General Electric Frame 5 MS 5001-M	No. 1 ULS	117.5 hr/yr	268 MMBtu/hr	2,601 gal/yr
			No. 1 Diesel			25,543 gal/yr
			No. 2 Diesel			117,723 gal/yr
2	Simple Cycle Gas Turbine	General Electric Frame 5 MS 5001-M	No. 1 ULS	1,567.6 hr/yr	268 MMBtu/hr	21,838 gal/yr
			No. 1 Diesel			340,628 gal/yr
			No. 2 Diesel			1,569,863 gal/yr
3	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD	1.0 hr/yr	28 MMBtu/hr	1,167 gal/yr
4	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD		28 MMBtu/hr	
10	Boiler	Weil McLain H-688	No. 2 Heating Oil	935 hr/yr	1.7 MMBtu/hr	22,056 gal/yr
11	Boiler	Weil McLain H-688	No. 2 Heating Oil	935 hr/yr	1.7 MMBtu/hr	

Source: Air Quality Permit No. AQ0109TVP03

Table 2b. FY2022 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

Emission Unit		Fuel Type/	Rating/Size	CY2020 Actual
ID [1]	Description	Material		Operation
6	Fuel Oil Storage Tank	No. 2 Diesel	50,000 gallons	8,784 hr/yr
7	Fuel Oil Storage Tank	No. 2 Diesel	50,000 gallons	8,784 hr/yr
N/A	Fuel Oil Storage Tank	No. 1 Diesel	12,000 gallons	8,784 hr/yr
8	Burnham Boiler	No. 2 Heating Oil	0.44 MMBtu/hr	12,345 gal/yr
9	Burnham Boiler	No. 2 Heating Oil	0.44 MMBtu/hr	
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	12,168 scf
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	Waste Oil	0.28 MMBtu/hr	0 gal/yr
N/A	Energy Logic EL-340H Heater	Waste Oil	0.275 MMBtu/hr	750 gal/yr
N/A	Metzger Machine Corp. Boiler	No. 1 Diesel	0.12 MMBtu/hr	4,389 gal/yr
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	0.2 MMBtu/hr	2,500 gal/yr
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	0.2 MMBtu/hr	0 gal/yr
N/A	Energy Logic EL-350H Heater	Waste Oil - Transformer	0.35 MMBtu/hr	5,100 gal/yr

[1] Source: Renewal application for AQ0109TVP03

EU ID 8 and 9 Fuel Throughput=	3.2 gallon/hr	(estimate from AQ0109TVP03 renewal application)
Lean Burn Inc. Heater Fuel Throughput=	2 gallon/hr	(from nameplate)
Energy Logic EL-340H Heater Fuel Throughput=	2.25 gallon/hr	(from nameplate)
Metzger Boiler Fuel Throughput=	1 gallon/hr	(from nameplate)
Energy Logic EL-200H Heater Fuel Throughput=	1.4 gallon/hr	(from nameplate)
Energy Logic EL-350H Heater Fuel Throughput=	2.5 gallon/hr	(from nameplate)

Table 3. FY2022 Assessable Emission Calculations - Oxides of Nitrogen (NO_x) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	NO_x Emission Factor	CY2020 Actual Operation	CY2020 Actual NO_x Emissions
Significant Emision Units							
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	2,601 gal/yr	0.15 tpy
			No. 1 Diesel			25,543 gal/yr	1.54 tpy
			No. 2 Diesel			117,723 gal/yr	6.91 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	21,838 gal/yr	1.28 tpy
			No. 1 Diesel			340,628 gal/yr	20.53 tpy
			No. 2 Diesel			1,569,863 gal/yr	92.17 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	3.2 lb/MMBtu	1,167 gal/yr	0.26 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	20 lb/10^3gal	22,056 gal/yr	0.22 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
					Significant Emision Units - 2020 Actual Emissions - NO_x		**123.07 tpy**
Insignificant Emision Units							
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
N/A	Fuel Oil Storage Tank	12,000 gallons	No. 1 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	18 lb/10^3gal	12,345 gal/yr	0.11 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	100 lb/10^6scf	12,168 scf	0.00 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 lb/10^3gal	750 gal/yr	7.1E-03 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-1	18 lb/10^3gal	4,389 gal/yr	0.04 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 lb/10^3gal	2,500 gal/yr	0.01 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	19 lb/10^3gal	5,100 gal/yr	0.05 tpy
					Insignificant Emision Units - 2020 Actual Emissions - NO_x		**0.22 tpy**
						2020 Actual Emissions - NO_x	**123.3 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 Diesel = 133,441 Btu/gal (based on average of CY2020 fuel tests)
HHV No. 2 Diesel= 136,998 Btu/gal (based on average of CY2020 fuel tests)

Table 4. FY2022 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	CO Emission Factor	CY2020 Actual Operation	CY2020 Actual CO Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	2,601 gal/yr	6E-04 tpy
			No. 1 Diesel			25,543 gal/yr	6E-03 tpy
			No. 2 Diesel			117,723 gal/yr	0.03 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	21,838 gal/yr	5E-03 tpy
			No. 1 Diesel			340,628 gal/yr	0.08 tpy
			No. 2 Diesel			1,569,863 gal/yr	0.35 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	0.85 lb/MMBtu	1,167 gal/yr	0.07 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 $lb/10^3gal$	22,056 gal/yr	6E-02 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
						Significant Emission Units - CY2020 Actual Emissions - CO	**0.59 tpy**
			Insignificant Emission Units				
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
N/A	Fuel Oil Storage Tank	12,000 gallons	No. 1 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 $lb/10^3gal$	12,345 gal/yr	0.03 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	84 $lb/10^6scf$	12,168 scf	0.00 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	5.0 $lb/10^3gal$	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	5.0 $lb/10^3gal$	750 gal/yr	2E-03 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-1	5 $lb/10^3gal$	4,389 gal/yr	0.01 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	1.7 $lb/10^3gal$	2,500 gal/yr	2E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	1.7 $lb/10^3gal$	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	5.0 $lb/10^3gal$	5,100 gal/yr	0.01 tpy
						Insignificant Emission Units - CY2020 Actual Emissions - CO	**0.06 tpy**
						CY2020 Actual Emissions - CO	**0.65 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, $lb/10^6scf$) / (Conversion 1,000,000 $scf/10^6scf$) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 Diesel = 133,441 Btu/gal (based on average of CY2020 fuel tests)
HHV No. 2 Diesel= 136,998 Btu/gal (based on average of CY2020 fuel tests)

Table 4. FY2022 Assessable Emissions Calculations - Volatile Organic Compound (VOC) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit		Maximum	Fuel	Factor	VOC Emission	CY2020 Actual	CY2020 Actual
ID	Description	Capacity	Type	Reference	Factor	Operation	VOC Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	2,601 gal/yr	7E-05 tpy
			No. 1 Diesel			25,543 gal/yr	7E-04 tpy
			No. 2 Diesel			117,723 gal/yr	3E-03 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	21,838 gal/yr	6E-04 tpy
			No. 1 Diesel			340,628 gal/yr	1E-02 tpy
			No. 2 Diesel			1,569,863 gal/yr	0.04 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	0.08 lb/MMBtu	1,167 gal/yr	7E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.34 lb/10^3gal	22,056 gal/yr	4E-03 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
						Significant Emission Units - CY2020 Actual Emissions - VOC	**0.07 tpy**
			Insignificant Emission Units				
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	Tanks 4.09d	N/A	8,784 hr/yr	<0.01 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	Tanks 4.09d	N/A	8,784 hr/yr	<0.01 tpy
N/A	Fuel Oil Storage Tank	12,000 gallons	No. 1 Diesel	Tanks 4.09d	N/A	8,784 hr/yr	<0.01 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.713 lb/10^3gal	12,345 gal/yr	4E-03 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	5.5 lb/10^6scf	12,168 scf	3E-05 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-3	1.0 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-3	1.0 lb/10^3gal	750 gal/yr	4E-04 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-3	0.713 lb/10^3gal	4,389 gal/yr	2E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1.0 lb/10^3gal	2,500 gal/yr	1E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1.0 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1.0 lb/10^3gal	5,100 gal/yr	3E-03 tpy
						Insignificant Emission Units - CY2020 Actual Emissions - VOC	**0.01 tpy**
						CY2020 Actual Emissions - VOC	**0.08 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 Diesel = 133,441 Btu/gal (based on average of CY2020 fuel tests)
HHV No. 2 Diesel= 136,998 Btu/gal (based on average of CY2020 fuel tests)

Table 6. FY2022 Assessable Emission Calculations - Particulate Matter (PM_{10}) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	PM_{10} Emission Factor	CY2020 Actual Operation	CY2020 Actual PM_{10} Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	2,601 gal/yr	2E-03 tpy
			No. 1 Diesel			25,543 gal/yr	0.02 tpy
			No. 2 Diesel			117,723 gal/yr	0.10 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	21,838 gal/yr	0.02 tpy
			No. 1 Diesel			340,628 gal/yr	0.28 tpy
			No. 2 Diesel			1,569,863 gal/yr	1.29 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.4-2	0.0573 lb/MMBtu	1,167 gal/yr	5E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-2 & 1.3-7	2.38 lb/10^3gal	22,056 gal/yr	3E-02 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
					Significant Emission Units - 2020 Actual Emissions - PM_{10}		**1.74 tpy**
			Insignificant Emission Units				
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
N/A	Fuel Oil Storage Tank	12,000 gallons	No. 1 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Tables 1.3-1 & 1.3-2	1.7 lb/10^3gal	12,345 gal/yr	0.01 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	7.6 lb/10^6scf	12,168 scf	5E-05 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-1	12 lb/10^3gal [1]	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-1	12 lb/10^3gal [1]	750 gal/yr	4E-03 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Tables 1.3-1 & 1.3-2	1.7 lb/10^3gal	4,389 gal/yr	4E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	N/A	2,500 gal/yr	0 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	N/A	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	0.1 lb/10^3gal [2]	5,100 gal/yr	1E-04 tpy
					Insignificant Emission Units - 2020 Actual Emissions - PM_{10}		**0.02 tpy**
					2020 Actual Emissions - PM_{10}		**1.76 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 Diesel = 133,441 Btu/gal (based on average of CY2020 fuel tests)
HHV No. 2 Diesel= 136,998 Btu/gal (based on average of CY2020 fuel tests)

[1] Ash Content of 0.233 percent by weight was determined through testing conducted in December 2016.
[2] Ash Content of 0.001 percent by weight was determined through testing conducted in December 2016.

Table 7. FY2022 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit		Fuel	Factor	Fuel	SO_2 Emission	CY2020 Actual	CY2020 Actual
ID	Description	Type	Reference	Sulfur Content [1,2]	Factor	Operation	SO_2 Emissions
1	Simple Cycle Gas Turbine	No. 1 ULS	Mass Balance	0.00051 wt. pct. S	0.000 lb/gal	2,601 gal/yr	9.E-05 tpy
		No. 1 Diesel	Mass Balance	0.16408 wt. pct. S	0.022 lb/gal	25,543 gal/yr	0.29 tpy
		No. 2 Diesel	Mass Balance	0.33733 wt. pct. S	0.048 lb/gal	117,723 gal/yr	2.82 tpy
2	Simple Cycle Gas Turbine	No. 1 ULS	Mass Balance	0.00051 wt. pct. S	0.000 lb/gal	21,838 gal/yr	8.E-04 tpy
		No. 1 Diesel	Mass Balance	0.16408 wt. pct. S	0.022 lb/gal	340,628 gal/yr	3.80 tpy
		No. 2 Diesel	Mass Balance	0.33733 wt. pct. S	0.048 lb/gal	1,569,863 gal/yr	37.60 tpy
3	Diesel Generator Engine	No. 1 ULSD	Mass Balance	0.0015 wt. pct. S	2.04E-04 lb/gal	1,167 gal/yr	1.2E-04 tpy
4	Diesel Generator Engine	No. 1 ULSD					
10	Boiler	No. 2 Heating Oil	Mass Balance	0.2 wt. pct. S	0.028 lb/gal	22,056 gal/yr	0.31 tpy
11	Boiler	No. 2 Heating Oil					
					Significant Emission Units - 2020 Actual Emissions - SO_2		**44.8 tpy**
			Insignificant Emission Units				
6	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,784 hr/yr	0 tpy
7	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,784 hr/yr	0 tpy
N/A	Fuel Oil Storage Tank	No. 1 Diesel	N/A	N/A	N/A	8,784 hr/yr	0 tpy
8	Burnham Boiler	No. 2 Heating Oil	Mass Balance	0.2 wt. pct. S	0.0 lb/gal	12,345 gal/yr	0.18 tpy
9	Burnham Boiler	No. 2 Heating Oil	Mass Balance				
N/A	Burnham Boiler - FE Building	Natural Gas	AP-42 Table 1.4-2	2,000 $gr/10^6scf$	0.6 $lb/10^6scf$	12,168 scf	4E-06 tpy
N/A	Burnham Boiler - FE Building	Natural Gas					
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	Waste Oil	Mass Balance	0.124 wt. pct. S	0.018 lb/gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	Waste Oil	Mass Balance	0.124 wt. pct. S	0.018 lb/gal	750 gal/yr	7.E-03 tpy
N/A	Metzger Machine Corp. Boiler	No. 1 Diesel	Mass Balance	0.0005133 wt. pct. S	0.000 lb/gal	4,389 gal/yr	2.E-04 tpy
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	2,500 gal/yr	0.02 tpy
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	5,100 gal/yr	0.04 tpy
					Insignificant Emission Units - 2020 Actual Emissions - SO_2		**0.25 tpy**
						2020 Actual Emissions - SO_2	**45.1 tpy**

Sample Calculations: [3]

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

Emissions, tpy= (Emission factor, lb/gal) x (Fuel Use gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, $lb/10^6scf$) / (Conversion 1,000,000 $scf/10^6scf$) x (Fuel Consumption, scf) / (2,000 lb/ton)

Notes:

1 Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2020 as received from supplier sampling.

2 For waste oil and waste transformer oil, fuel sulfur content was determined by testing conducted in December 2016.

3 Diesel fuel density is equal 6.8 lb/gal for No. 1 Diesel and 7.1 lb/gal for No. 2 Diesel per plant report.

Golden Valley Electric Association
FY2022 Assessable Emission Estimates

Delta Power Plant – Permit No. AQ0880TVP03

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Table 1. FY2022 Assessable Emissions Summary
Golden Valley Electric Association - Delta Power Plant

	Assessable Emissions - Tons Per Year						
Description	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAPs**	**Total**
Assessable PTE	249	-	-	72	-	-	321

From Condition 27 and Table D of the Statement of Basis for AQ0880TVP03.

Potential to Emit	Regulated Air Pollutant Emissions (tons per year) [1]					
	NO_X	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAP**
Significant	0.7			0.1		
Insignificant	0			0		
Total Emissions	**1**			**0**		
Use Assessable PTE [2]		**0**	**0**		**0**	**0**
Assessable Emission Subtotals	**1**	**0**	**0**	**0**	**0**	**0**
Fees Apply to Pollutant? [3]	**No**	**No**	**No**	**No**	**No**	**No**
Total Assessable Emissions	**0**					
Fee Estimate [4]	**$0**					

Notes:
[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.
[2] Actual emissions are provided for NO_X and SO_2 only, because potential emissions for all other pollutants are less than 10 tpy each. Actual emissions must be less than or equal to potential emissions, so actual emissions are also less than 10 tpy.
[3] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.
[4] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2022 Significant Emissions Unit Summary
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel	CY2020 Actual	Nominal	CY2020 Actual
ID	Description	Make/Model	Type	Operation	Capacity	Fuel Consumption
1	Gas Turbine	John Brown Ltd. Frame 5P	Fuel Oil	12.0 hr/yr	23.1 MW	14,469 gal/yr
2	Black Start Engine	Delta Detroit	Fuel Oil	0.67 hr/yr [1]	500 bhp	18 gal/yr
3	Furnace	Thermo Pride	Fuel Oil	1,931 hr/yr [2]	0.4 MMBtu/hr	5,806 gal/yr

1. Operating hours were determined based on two starts during calendar year 2020 lasting an estimated duration of 5 minutes, each.
2. Estimated as follows:
   Operation (hr/yr) = (Fuel Consumption, gal/yr) x (Fuel Heating value, 0.133021 MMBtu/gal) / (Capacity, 0.4 MMBtu/hr)

Table 2b. FY2022 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - Delta Power Plant

Emission Unit		Fuel Type/ Material	Rating/Size	CY2020 Actual Operation
ID	Description			
Tank	Fuel Oil Storage Tank	Fuel Oil	50,000 gallons	8,760 hr/yr

Table 3. FY2022 Assessable Emissions Calculations - Oxides of Nitrogen (NO_X) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel	Factor	NO_X Emission	Actual	CY2020 Actual
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	NO_X Emissions
			Significant Emission Units				
1	Gas Turbine	23.1 MW	Fuel Oil	AQ0880TVP03 Condition 10.2	0.70 lb/MMBtu	14,469 gal/yr	0.67 tpy
2	Black Start Engine	500 bhp	Fuel Oil	AP-42 Table 3.3-1	0.031 lb/hp-hr	0.67 hr/yr	5.E-03 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	AP-42 Table 1.3-1	18 lb/kgal	5,806 gal/yr	0.05 tpy
				Significant Emission Units - Total Assessable Emissions - NO_X			**0.73 tpy**
			Insignificant Emission Units				
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	N/A	NA	8,760 hr/yr	0 tpy
				Insignificant Emission Units - Total Assessable Emissions - NO_X			**0 tpy**
				Total Assessable Emissions - NO_X			**0.73 tpy**

Fuel Heating Value 0.133021 MMBtu/gal AQ0880TVP03, Condition 10.2

Example Calculations:

Turbine emissions (tpy) = (Maximum fuel consumption, gal/yr) x (Fuel Heating value, MMBtu/gal) x (Emission factor, lb/MMBtu) / (2,000 lb/ton)
Engine emissions (tpy) = (Rating, bhp) x (Emission factor, lb/hp-hr) x (Operation, hr/yr) / (2,000 lb/ton)
Furnace emissions (tpy) = (Emission factor, lb/kgal) / (Conversion, 1,000 gal/kgal) x (Operation, gal/yr) / (2,000 lb/ton)

Table 4. FY2022 Assessable Emission Calculations - Sulfur Dioxide (SC_2) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel	Maximum Fuel	Factor	SO_2 Emission	Actual	CY2020 Actual
ID	Description	Rating/Capacity	Type	Sulfur Content	Reference	Factor	Operation	SO_2 Emissions
Significant Emission Units								
1	Gas Turbine	23.1 MW	Fuel Oil	0.0950 wt. pct. S [1]	Mass Balance [2,3]	0.0127 lb/gal	14,469 gal/yr	9.E-02 tpy
2	Black Start Engine	18 gal/hr	Fuel Oil	0.0950 wt. pct. S [1]	Mass Balance [2,3]	0.0127 lb/gal	0.67 hr/yr	8.E-05 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	0.0950 wt. pct. S [1]	Mass Balance [2,3]	0.0127 lb/gal	5,806 gal/yr	4.E-02 tpy
					Significant Emission Units - Total Assessable Emissions - SO_2			**1E-01 tpy**
Insignificant Emission Units								
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	NA	N/A	NA	8,760 hr/yr	0 tpy
					Insignificant Emission Units - Total Assessable Emissions - SO_2			**0 tpy**
							Total Assessable Emissions - SO_2	**1E-01 tpy**

Notes:

1 Both No. 1 ULS and No. 1 Heating Oil were delivered during 2020. The weighted average sulfur content of the fuel received based on the maximum monthly value provided by Petro Star Inc, was 0.061 wt pct S. Calculations are based on the maximun value for fuel received in April of 0.095 wt. pct. S .

2 Mass balance:

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

3 A fuel density of 6.7 lb/gal is assumed based on an API gravity of 43.3 from the February 2006 source test.

Turbine and Furnace emissions (tpy) = (Emission factor, lb/gal) x (Operation, gal/yr) / (2,000 lb/ton)

Engine emissions (tpy) = (Emission factor, lb/gal) x (Capacity, gal/hr) x (Operation, hr/yr) / (2,000 lb/ton)

Golden Valley Electric Association
PO Box 71249, Fairbanks, AK 99707-1249 • (907) 452-1151 • www.gvea.com
Your Touchstone Energy® Cooperative

March 29, 2022

Email Submittal
dec.aq.airreports@alaska.gov

Alaska Department of Environmental Conservation
Air Permits Program
ATTN: Assessable Emissions Estimate
410 Willoughby Avenue, Suite 303
PO Box 111800
Juneau, AK 99811-1800

Subject: Golden Valley Electric Association
FY2023 Assessable Emission Estimates

Dear Compliance Technician,

Enclosed please find the FY2023 Assessable Emission Estimates for the following Golden Valley Electric Association (GVEA) facilities.

Facility	Air Quality Permit No.	CY2021 Actual Emissions (Tons)	Fee Estimate
Healy Power Plant	AQ0173TVP03	1,407	$60,431
North Pole Power Plant	AQ0110TVP04, Rev. 1	1,222	$52,498
Zehnder Facility	AQ0109TVP04	124	$ 5,342
Delta	AQ0880TVP03	0	$0

Assessable emission estimates for all facilities are based on actual emissions from calendar year 2021.

If you have any questions or would like any additional information, please contact me by phone at 907-458-4557 or by email at nmknight@gvea.com. The certification from Frank E. Perkins, Vice President Power Supply Follows.

Sincerely,

Naomi Morton Knight, P.E.
Environmental Officer

Certification

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate and complete.

Frank E. Perkins
Vice President Power Supply

Enclosures

Golden Valley Electric Association
FY2023 Assessable Emission Estimates

Healy Power Plant – Permit No. AQ0173TVP03

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Table 1. FY2023 Assessable Emissions Summary
Golden Valley Electric Association - Healy Power Plant

Assessable Emissions - Tons Per Year							
Description	**NO_X**	**CO**	**PM**	**VOC**	**SO_2**	**HAPs**	**Total**
Assessable PTE	606	980	198	14	707	13	2,518

From Condition 112 and Table E of the Statement of Basis for Permit AQ0173TVP03.

	Regulated Air Pollutant Emissions (tons per year) [1]					
	NO_X	**CO**	**PM**	**VOC**	**SO_2**	**HAPs**
Significant	288.5	752.8	23.3	8.8	341.9	4.2
Insignificant	0.0	0.0	0.6	0.0	0.0	0.0
Total Emissions	**289**	**753**	**24**	**9**	**342**	**4**
Fees Apply to Pollutant? [2]	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**
CY2021 Actual Emissions	**1,407**					
Fee Estimate [3]	**$60,431**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[3] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2023 Significant Emissions Unit Summary
Golden Valley Electric Association - Healy Power Plant

Emissions Unit				Fuel / Material	CY2021 Actual
ID	Name	Description	Rating	Type	Operation [1]
1	Unit No. 1	Foster-Wheeler Boiler (w/ SNCR)	327 MMBtu/hr	Coal/ULSD	7,948 hours
				ULSD	216,822 gallons
2	Unit No. 2	TRW Integrated Entrained Combustion System (w SCR)	658 MMBtu/hr	Coal/ULSD	5,917 hours
				ULSD	557,434 gallons
3	Auxiliary Boiler No. 1	Cleaver Brooks CB 189-300	12.554 MMBtu/hr	ULSD	12,055 gallons
4	Auxiliary Boiler No. 2	Cleaver Brooks CB 100-800	23.0 MMBtu/hr	ULSD	69,156 gallons
5	Diesel Generator Engine No. 1	Electro-Motive Diesel EMD 20-645-E4	2.75 MW	ULSD	0 gallons
6	Crusher System	2 grizzlies, 1 primary Stamler crusher, 2 belt feeders, 2 secondary Flextooth-Dresser crushers, 2 hoppers, and the No. 1 conveyor belt (tail-end), all commonly vented to Dust Collector No. 1 (baghouse/exhaust fan).	12,000 cfm	Coal	2,748 hours [2]
7	Limestone Storage Silo	Limestone Storage Silo with Baghouse	800 cfm	Lime	5,404 hours
8	Flyash Storage Silo	Flyash Storage Silo with Baghouse	5,000 cfm	Flyash	7,809 hours
9	Sodium Bicarbonate Handling System	Mill, Sodium Bicarbonate Silo, and Baghouse	440 cfm	Sodium Bicarbonate	150 hours
10	Coal Handling System	No. 1 conveyor belt (head-end), No. 2 2a conveyor belt, No. 2b conveyor belt, one bucket elevator, No. 3 conveyor belt, No. 4 conveyor belt, two 600 ton EU ID 2 coal storage silos, two EU ID 1 bunkers, all commonly vented to Dust Collector No. 2 (baghouse/exhaust fan). Note: When EU ID 2 is not operational, dust is collected at the EU ID 1 transfer points via a Dust Collector No. 3 (baghouse/exhaust fan).	20,000 cfm	Coal	2,748 hours [2]
11	Haul Road	Haul Road (located on GVEA property) from Usibelli Coal Mine property line to coal pile	0.25 miles	Fugitive Dust	8,760 hours
12	Coal Storage Pile	Open Coal Storage Pile	15 day supply	Coal	8,760 hours
13	Firewater Pump Engine	Caterpillar 3406B	264 hp	ULSD	6 hours

Notes:
[1] Hours are based on CY2021 operation in accordance with condition 112 Permit No. AQ0173TVP03.
[2] Emissions units do not operate continuously.

Table 2b. FY2023 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel / Material	CY2021 Actual	Rating
ID	Description	Make/Model	Type	Operation	
N/A	Lime Storage Silo No. 1	N/A	Lime	5,404 hours [1]	1,800 acfm
N/A	Lime Storage Silo No. 2	N/A	Lime	hours [1]	1,800 acfm
N/A	Ash Handling	N/A	Ash	8,760 hours	Not Applicable
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	8,760 hours	Not Applicable
N/A	AST Diesel Tanks (2)	N/A	Diesel	8,760 hours	25,000 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,760 hours	2,000 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,760 hours	300 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,760 hours	425 gallons
N/A	Central Vac (3)	Turbo Tron	Coal	1,095 hours [2]	900 acfm
N/A	Urea Storage Silo A/B Bin Vent Filter	N/A	Urea	145 hours [3]	1,500 acfm
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	N/A	Urea	181 hours [4]	400 acfm
N/A	Sodium Bicarbonate Unloading Portable Baghouse	N/A	Sodium Bicarbonate	15 hours [5]	850 scfm

Note:
[1] This emissions unit is associated with EU ID 2.
[2] Estimated operation of 1,095 hours is assumed with each of the three units operating one hour per day.
[3] The estimated maximum annual use is 160 hr/yr. This emissions unit is associated with the EU ID 1 SNCR system and the EU ID 2 SCR system.
Estimated CY2021 Hours = (160 hr/yr) x (maximum actual hours for EU IDs 1 or 2 during CY2021) / (8,760 potential hours)
[4] The estimated maximum annual use is 200 hr/yr. This emissions unit is associated with the EU ID 1 SNCR system and the EU ID 2 SCR system.
Estimated CY2021 Hours = (200 hr/yr) x (maximum actual hours for EU IDs 1 or 2 during CY2021) / (8,760 potential hours)
[5] This emissions unit is associated with EU ID 1.

Table 3. FY2023 Assessable Emissions Calculations - Oxides of Nitrogen (NOX) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	NO_X Emission	CY2021 Actual	CY2021 Actual
ID	**Description**	**Rating/Capacity**	**Type**	**Reference**	**Factor**	**Operation**	**NO_X Emissions**
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2021 CEMS Data (with SNCR)	55.1 lb/hr	7,948 hours	219.0 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2021 CEMS Data (with SCR)	23.2 lb/hr	5,917 hours	68.7 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42 Table 1.3-1	20 lb/10^3 gal	12,055 gallons	0.1 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42 Table 1.3-1	20 lb/10^3 gal	69,156 gallons	0.7 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42 Table 3.4-1	3.2 lb/MMBtu	0 gallons	0 tpy [1]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,748 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	5,404 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	7,809 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	150 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,748 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.031 lb/hp-hr	6 hours	0.02 tpy
Significant Emissions Units Emissions - CY2021 Actual Emissions - NOX							**288.5 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	5,404 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,760 hours	0 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	145 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	181 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	15 hours	0 tpy
Insignificant Emissions Units Emissions - CY2021 Actual Emissions - NOX							**0 tpy**
CY2021 Actual Emissions - NOX							**288.5 tpy**

Notes:
[1] Diesel Heating Value 133,366 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 4. FY2023 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	CO Emission	CY2021 Actual	CY2021 Actual
ID	**Description**	**Rating/Capacity**	**Type**	**Reference**	**Factor**	**Operation**	**CO Emissions**
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2021 CEMS Data	186.5 lb/hr	7,948 hours	741.2 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2021 CEMS Data	3.85 lb/hr	5,917 hours	11.4 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-1	5 lb/10^3 gal	12,055 gallons	0.03 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Table 1.3-1	5 lb/10^3 gal	69,156 gallons	0.17 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42, Table 3.4-1	0.85 lb/MMBtu	0 gallons	0 tpy [1]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,748 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	5,404 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	7,809 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	150 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,748 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.00668 lb/hp-hr	6 hours	5.3E-03 tpy
Significant Emissions Units Emissions - CY2021 Actual Emissions - CO							**752.8 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	5,404 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,760 hours	0 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	145 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	181 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	15 hours	0 tpy
Insignificant Emissions Units Emissions - CY2021 Actual Emissions - CO							**0 tpy**
CY2021 Actual Emissions - CO							**752.8 tpy**

Notes
[1] Diesel Heating Value 133,366 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 5. FY2023 Assessable Emissions Calculations - Particulate Matter (PM) Emissions (Filterable and Condensable)
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Description	Rating/Capacity	Fuel Type	Factor Reference	PM Emission Factor	CY2021 Actual Operation	CY2021 Actual PM Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2021 CEMS Data	2.17 lb/hr	7,948 hours	8.6 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2021 CEMS Data	0.61 lb/hr	5,917 hours	1.8 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Tables 1.3-2 and 1.3-7	2.3 lb/10^3gal	12,055 gallons	0.01 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Tables 1.3-2 and 1.3-7	2.3 lb/10^3gal	69,156 gallons	0.1 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42 Table 3.4-2	0.0573 lb/MMBtu	0 gallons	0 tpy [1]
6	Crusher System	12,000 cfm	Coal	Permit AQ0173TVP03, Table B	2.05 lb/hr	2,748 hours	2.8 tpy
7	Limestone Storage Silo	800 cfm	Lime	Permit AQ0173TVP03, Table B	0.14 lb/hr	5,404 hours	0.4 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	Permit AQ0173TVP03, Table B	0.86 lb/hr	7,809 hours	3.4 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	Design Specifications	0.02 gr/dscf	150 hours	5.7E-03 tpy
10	Coal Handling System	20,000 cfm	Coal	Permit AQ0173TVP03, Table B	3.43 lb/hr	2,748 hours	4.7 tpy
11	Haul Road	0.25 miles	Fugitive Dust	See Table 5a		8,760 hours	0.9 tpy
12	Coal Storage Pile	15 day supply	Coal	See Table 5b		8,760 hours	0.7 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.0022 lb/hp-hr	6 hours	1.7E-03 tpy
Significant Emissions Units Emissions - CY2021 Actual Emissions - PM							**23.3 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf	5,404 hours	0.21 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf		
N/A	Ash Handling	Not Applicable	Ash	See Table 5c		8,760 hours	0.05 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	See Table 5d		8,760 hours	0.17 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	Engineering Estimate	0.05 gr/dcf	1,095 hours	0.21 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	Engineering Estimate	0.005 gr/dcf	145 hours	4.7E-03 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	Engineering Estimate	0.005 gr/dcf	181 hours	1.6E-03 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	Vendor Data	0.02 gr/acf	15 hours	1.1E-03 tpy
Insignificant Emissions Units Emissions - CY2021 Actual Emissions - PM							**0.64 tpy**
CY2021 Actual PM Emissions							**23.9 tpy**

Notes

[1] Diesel Heating Value 133,366 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton
7,000 grains/lb

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, gr/dcf) x (Rating, cfm) x (Conversion, 60 min/hr) x (Operation, hr/yr) / (Conversion, 7,000 gr/lb) / (Conversion, 2,000 lb/ton)

Table 5a. FY2023 Assessable Emissions Calculations - Haul Road Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit		Factor Reference	Emission Factor	CY2021 Actual Operation	CY2021 Actual PM Emissions
ID	Description				
11	Coal Haul - Unpaved Portion	AP-42, Section 13.2.2	1.32 lb/VMT	1,307 VMT	0.9 tpy [1]
				CY2021 Actual PM Emissions	**0.9 tpy**

Notes:
[1] Coal Haul Road

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	193.75	tons, estimate - average of full (262.5 ton) and empty (125 ton) truck
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	4.53	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.81	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	1.32	lb/VMT

Table 5a. FY2023 Assessable Emissions Calculations - Haul Road Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Coal Throughput

$$Throughput = \frac{Capacity\left(\frac{MMBtu}{hr}\right) \times Operation\left(\frac{hr}{year}\right)}{Coal\ Heat\ Value\left(\frac{MMBtu}{ton}\right)}$$

EU ID 1 CY2021 actual coal throughput	160,733	tons	from Healy environmental report
EU ID 2 CY2021 actual coal throughput	198,645	tons	from Healy environmental report
Total CY2021 actual coal throughput	359,378	tons	

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\ (tons) \times Roundtrip\ Distance\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\left(\frac{tons}{trip}\right)}$$

Haul truck capacity	138	tons, estimate
Unpaved distance from coal pile to paved road (round trip)	0.50	miles/trip
Unpaved road VMT =	1,306.83	miles

Table 5b. FY2023 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit		Factor Reference	Emission Factor	CY2021 Actual Operation	CY2021 Actual PM Emissions
ID	Description				
12	Truck Drop Onto Stockpile	AP-42, Section 13.2.4	1.16E-04 lb/ton	359,378 tpy	0.02 tpy [1]
12	Front End Loader Drop Into Grizzly	AP-42, Section 13.2.4	1.16E-04 lb/ton	359,378 tpy	0.02 tpy [1]
12	Front End Loader Movement - Coal Pile to Grizzly	AP-42, Section 13.2.2	0.93 lb/VMT	1,306 VMT	0.6 tpy [2]
12	Stockpile Wind Erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr	10,150 m^2	0.0 tpy [3]
				CY2021 Actual PM Emissions	**0.7 tpy**

Notes:

[1] Truck Drop onto Stockpile and Front End Loader Drop to Grizzly

Drop Operation Emission Factor:

AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

	PM		
k	0.35		AP-42, Section 13.2.4
U = mean wind speed	17.67	miles/hr	Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant
M = coal moisture content	32.62	percent	Weighted average from EU ID 1 and 2 CY2021 coal proximate analyses
E =	1.16E-04	lb/ton	

Annual Stockpile Throughput:

$$Throughput = \frac{Capacity\left(\frac{MMBtu}{hr}\right) \times Operation\left(\frac{hr}{year}\right)}{Coal\ Heat\ Value\left(\frac{MMBtu}{ton}\right)}$$

EU ID 1 CY2021 actual coal throughput	160,733	tons	from Healy environmental report
EU ID 2 CY2021 actual coal throughput	198,645	tons	from Healy environmental report
Total CY2021 actual coal throughput	359,378	tons	

[2] Front End Loader Movement

Coal moved per trip:

$$Coal\ (tons) = \frac{Coal\ Density\left(\frac{lb}{ft^3}\right) \times 27\left(\frac{ft^3}{yd^3}\right) \times Bucket\ Size(yd^3)}{2000\left(\frac{lb}{ton}\right)}$$

Size of load bucket	11	yd^3
Density of coal	52.63	lb/ft^3
Coal moved per trip	7.815555	tons

Table 5b. FY2023 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emission Factor
AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	33.2	tons, estimate
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	3.21	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.28	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.93	lb/VMT

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\,\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\,\left(\frac{tons}{trip}\right)}$$

Total Actual Coal Throughput	359,378	tons
Coal moved per trip	7.815555	tons
Approximate distance from coal pile to grizzly (round trip)	150	feet
VMT = vehicles miles traveled per year	1,306	

Table 5b. FY2023 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

[3] Stockpile Wind Erosion

Coal Pile Surface Area

Surface area of active face = 10,150 m^2 — Engineering estimate of projected use

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\left(\frac{g}{m^2 yr}\right) = k\sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (AP-42 Section 13.2.5.3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\,(u^* - u_t^*)^2 + 25\,(u^* - u_t^*)$$

$$P = 0\ for\ u^* \leq u_t^*$$

where u* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u*

$$u^* = \frac{0.4 \times u(z)}{\ln\left(\frac{z}{z_o}\right)}\quad when\ z > z_o$$

where u* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at McKinley Airport ASOS for each month in CY2021 (see table below)
z	10	meters
N	365	disturbances/year for active face, estimated
	30	average disturbances/month

Table 5b. FY2023 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

				Uncrusted Coal Pile [b] (Table 13.2.5-2)				Ground Coal (Table 13.2.5-2)						
Month-Year	Average Wind Speed (u(10)) [a]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Jan-21	18.4	8.2	360	0.3	1.12	0.41	0	0.01	0.55	0.29	0	0		
Feb-21	24.2	10.8	10	0.3	1.12	0.53	0	0.01	0.55	0.38	0	0		
Mar-21	17.3	7.7	3	0.3	1.12	0.38	0	0.01	0.55	0.27	0	0		
Apr-21	19.6	8.7	240	0.3	1.12	0.43	0	0.01	0.55	0.30	0	0		
May-21	24.2	10.8	100	0.3	1.12	0.53	0	0.01	0.55	0.38	0	0		
Jun-21	16.1	7.2	190	0.3	1.12	0.35	0	0.01	0.55	0.25	0	0		
Jul-21	17.3	7.7	190	0.3	1.12	0.38	0	0.01	0.55	0.27	0	0		
Aug-21	12.7	5.7	38	0.3	1.12	0.28	0	0.01	0.55	0.20	0	0		
Sep-21	18.4	8.2	360	0.3	1.12	0.41	0	0.01	0.55	0.29	0	0		
Oct-21	18.4	8.2	170	0.3	1.12	0.41	0	0.01	0.55	0.29	0	0		
Nov-21	17.3	7.7	360	0.3	1.12	0.38	0	0.01	0.55	0.27	0	0		
Dec-21	21.9	9.8	355	0.3	1.12	0.48	0	0.01	0.55	0.34	0	0		
CY2021 PM_{10} Annual Total							0				0	0	0.5	**0**

[a] Per https://mesonet.agron.iastate.edu/request/download.phtml?network=AK_ASOS for CY2021, McKinley Airport ASOS (PAIN).
[b] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions.

Table 5c. FY2023 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Factor Reference	Emission	Emission Factor	CY2021 Actual Operation	CY2021 Actual PM Emissions
N/A	Front End Loader / Flyash Storage Silo Drop Into Truck	AP-42, Section 13.2.4	PM	1.39E-04 lb/ton	17,232 tons	1.2E-03 tpy [1]
	Front End Loader Movement - Ash Drying Area to Truck	AP-42, Section 13.2.2	PM	0.85 lb/VMT	106 VMT	4.5E-02 tpy [2]
	Ash Drying Area Wind Erosion	AP-42, Section 13.2.5	PM	0.00 g/m^2	4,800 m^2	0 tpy [3]
					CY2021 Actual PM Emissions	**4.6E-02 tpy**

Notes:
[1] Front End Loader / Flyash Storage Silo Drop into Truck
AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

	PM		
k	0.35		
U = mean wind speed	17.67	miles/hr	Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant
M = ash moisture content	17.5	percent	Avg of slag, bottom ash, and fly ash from Heat and Material Balance for HCCP - March 6, 1998
E (uncontrolled) =	2.77E-04	lb/ton	
Efficiency =	50%	assumption because material is wet	
E (controlled) =	1.39E-04	lb/ton	

Annual stockpile throughput:

EU ID 1 CY2021 Ash Throughput	17,232	tons	from Healy environmental report
EU ID 2 CY2021 Ash Throughput	24,068	tons	from Healy environmental report
Total Ash Throughput	41,300	tons	

[2] Front End Loader Movement - Ash Pile to Truck
Ash moved per trip:

$$Ash\,(tons) = \frac{Ash\,Density\left(\frac{lb}{ft^3}\right) \times 27\left(\frac{ft^3}{yd^3}\right) \times Bucket\,Size(yd^3)}{2000\left(\frac{lb}{ton}\right)}$$

Size of load bucket	8	yd^3
Density of ash	60	lb/ft^3
Ash moved per trip	6.48	tons

Table 5c. FY2023 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

AP-42, Section 13.2.2

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons, estimate
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	2.92	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.17	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.85	lb/VMT

Approximate distance from ash pile to truck (round trip)	150	feet
VMT = vehicles miles traveled per year	105.52	

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion
Ash Pile Surface Area

Surface area of active face =	4,800	m^2	Engineering estimate of projected use

AP-42 Section 13.2.5, Equation (2)
Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\left(\frac{g}{m^2 yr}\right) = k\sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (0.5 for particle size < 10 microns, per AP-42 Section 13.2.5.3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

Table 5c. FY2023 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\,(u^* - u_t^*)^2 + 25\,(u^* - u_t^*)$$

$$P = 0\; for\; u^* \leq u_t^*$$

where u* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u*

$$u^* = \frac{0.4 \times u(z)}{\ln\left(\frac{z}{z_o}\right)} \quad when\; z > z_o$$

where u* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at McKinley Airport ASOS for each month in CY2021 (see table below)
z	10	meters
N	365	disturbances/year for active face, estimated
	30	average disturbances/month

Ash pile [a] (Table 13.2.5-2)											
Month-Year	Average Wind Speed (u(10)) [b]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor (uncontrolled), EF	Emission Factor (controlled), EF [c]
	mph	m/s	deg	cm	m/s	m/s				g/m^2-yr	g/m^2-yr
Jan-21	18.4	8.2	360	0.3	1.02	0.41	0	0			
Feb-21	24.2	10.8	010	0.3	1.02	0.53	0	0			
Mar-21	17.3	7.7	003	0.3	1.02	0.38	0	0			
Apr-21	19.6	8.7	240	0.3	1.02	0.43	0	0			
May-21	24.2	10.8	100	0.3	1.02	0.53	0	0			
Jun-21	16.1	7.2	190	0.3	1.02	0.35	0	0			
Jul-21	17.3	7.7	190	0.3	1.02	0.38	0	0			
Aug-21	12.7	5.7	038	0.3	1.02	0.28	0	0			
Sep-21	18.4	8.2	360	0.3	1.02	0.41	0	0			
Oct-21	18.4	8.2	170	0.3	1.02	0.41	0	0			
Nov-21	17.3	7.7	360	0.3	1.02	0.38	0	0			
Dec-21	21.9	9.8	355	0.3	1.02	0.48	0	0			
CY2021 PM_{10} Annual Total							0	0	0.5	**0**	**0**

[a] No emission factor exists for ash. Overburden is considered the most representative alternative because it includes both fine (ash) and coarse (slag) particles.

[b] Per https://mesonet.agron.iastate.edu/request/download.phtml?network=AK_ASOS for CY2021, McKinley Airport ASOS (PAIN).

[c] Control efficiency of 50% is assumed since material wet.

Table 5d. FY2023 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit		Factor Reference	Emission Factor	CY2021 Actual Operation	CY2021 Actual PM Emissions
ID	Description				
N/A	Ash Haul - Unpaved (EU ID 1)	AP-42, Section 13.2.2	1.18 lb/VMT	127 VMT	0.07 tpy [1]
	Ash Haul - Unpaved (EU ID 2)	AP-42, Section 13.2.2	1.18 lb/VMT	133 VMT	7.8E-02 tpy [1]
	Limestone/Lime Delivery - Paved Portion	AP-42, Section 13.2.1	0.08 lb/VMT	34 VMT	1.4E-03 tpy [2]
	Limestone/Lime Delivery - Unpaved Portion	AP-42, Section 13.2.2	1.07 lb/VMT	16 VMT	8.5E-03 tpy [2]
	Miscellaneous Traffic - Paved Portion	AP-42, Section 13.2.1	0.001 lb/VMT	5,185 VMT	3.4E-03 tpy [3]
				CY2021 Actual PM Emissions	**0.17 tpy**

Notes:
[1] Ash Haul Road

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a \left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	151.25	tons, estimate - average of full (197.5 ton) and empty (105 ton) truck
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	4.05	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.62	lb/VMT

Table 5d. FY2023 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	1.18	lb/VMT

Ash Throughput

EU ID 1 ash disposal throughput	17,232	tons	from Healy environmental report
EU ID 2 ash disposal throughput	24,068	tons	from Healy environmental report

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\ \left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\ \left(\frac{tons}{trip}\right)}$$

Haul truck capacity	92.5	tons, estimate
Unpaved distance to ash drying area (round trip)	0.68	miles/trip
Unpaved distance to EU ID 8 (round trip)	0.51	miles/trip
EU ID 1 unpaved road VMT =	127.02	miles
EU ID 2 unpaved road VMT =	133.05	miles

Table 5d. FY2023 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

[2] Limestone/Lime/Sodium Bicarbonate Haul Road

Paved Road Emission Factor

AP-42, Section 13.2.1, Equation 1:

$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

	PM	
k = particle size multiplier	0.0022	lb/VMT from AP-42 Table 13.2.1-1
sL = surface material silt content (haul road)	0.6	g/m^2, from AP-42, Table 13.2.1-3
W = mean vehicle weight	122.5	tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer
E (uncontrolled) =	0.17	lb/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	0.09	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.1, Equation 2:

$$E_{ext} = E\left(1 - \frac{P}{4 * 365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.08	lb/VMT

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	122.5	tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	3.69	lb/VMT
Efficiency =	60%	assumed control efficiency for water
E (controlled) =	1.47	lb/VMT

Table 5d. FY2023 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	1.07	lb/VMT

Throughput

Limestone/Lime Throughput	2,593	tons, CY2021 actual
Sodium Bicarbonate Throughput	386	tons, CY2021 actual

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\ \left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\ \left(\frac{tons}{trip}\right)}$$

Haul truck capacity	25	tons, estimate
Paved distance (round trip)	0.28	miles/trip
Unpaved distance (round trip)	0.13	miles/trip
Paved road VMT =	33.86	miles
Unpaved road VMT =	15.80	miles

[3] Miscellaneous Traffic

Paved Road Emission Factor

AP-42, Section 13.2.1, Equation 1:

$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

	PM	
k = particle size multiplier	0.0022	lb/VMT from AP-42 Table 13.2.1-1
sL = surface material silt content (haul road)	0.6	g/m^2, from AP-42, Table 13.2.1-3
W = mean vehicle weight	2	tons, estimate
E (uncontrolled) =	0.0028	lb/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	1.41E-03	lb/VMT

Table 5d. FY2023 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.1, Equation 2:

$$E_{ext} = E\left(1 - \frac{P}{4 * 365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.001	lb/VMT

Vehicle Miles Traveled (VMT)

Traffic volume	50	trips per day
Paved distance (round trip)	0.28	miles/trip
Paved road VMT =	5,184.66	miles

Table 6. FY2023 Assessable Emissions Calculations - Volatile Organic Compounds (VOC) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Description	Rating/Capacity	Fuel Type	Factor Reference	VOC Emission Factor	CY2021 Actual Operation	CY2021 Actual VOC Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	AP-42, Table 1.1-19	0.06 lb/ton	7,948 hours	4.8 tpy [1]
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	AP-42, Table 1.1-19	0.04 lb/ton	5,917 hours	4.0 tpy [2]
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10^3 gal	12,055 gallons	2.0E-03 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10^3 gal	69,156 gallons	0.01 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42, Table 3.4-1	0.0819 lb/MMBtu	0 gallons	0 tpy [3]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,748 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	5,404 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	7,809 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	150 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,748 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	6 hours	2.0E-03 tpy
						Significant Emissions Units Emissions - CY2021 Actual VOC Emissions	**8.8 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	5,404 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	145 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	181 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	15 hours	0 tpy
						Insignificant Emissions Units Emissions - CY2021 Actual VOC Emissions	**0 tpy**
						CY2021 Actual VOC Emissions	**8.8 tpy**

Notes
[1] EU ID 1 actual coal throughput 160,733 tons
[2] EU ID 2 actual coal throughput 198,645 tons
[3] Diesel Heating Value 133,366 Btu/gal lab analysis

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/ton) x (Potential throughput, ton/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 7. FY2022 Assessable Emissions Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	Maximum Fuel	SO_2 Emission	CY2021 Actual	CY2021 Actual
ID	Description	Rating/Capacity	Type	Reference	Sulfur Content	Factor	Operation	SO_2 Emissions
Significant Emissions Units								
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2021 CEMS Data	N/A	72.6 lb/hr	7,948 hours	288.6 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2021 CEMS Data	N/A	18.0 lb/hr	5,917 hours	53.3 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	12,055 gallons	1.3E-03 tpy [3]
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	69,156 gallons	7.4E-03 tpy [3]
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	0 gallons	0 tpy [3]
6	Crusher System	12,000 cfm	Coal	N/A	N/A	N/A	2,748 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	N/A	5,404 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	N/A	7,809 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	N/A	150 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	N/A	2,748 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	6 hours	8.9E-06 tpy [3,4]
							Significant Emissions Units Emissions - CY2021 Actual Emissions - SO_2	**341.9 tpy**
Insignificant Emissions Units								
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	N/A	5,404 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	N/A	145 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	N/A	181 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	N/A	15 hours	0 tpy
							Insignificant Emissions Units Emissions - CY2021 Actual Emissions - SO_2	**0 tpy**
							CY2021 Actual Emissions - SO_2	**341.9 tpy**

Notes:
[1] Mass balance:
For diesel units, the SO_2 emission factor is calculated based on the sulfur content in diesel fuel
Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol; Stoichiometry: 1 mol S = 1 mol SO_2
SO_2 Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

[2] Diesel Fuel Density 7.1 lb/gal AP 42, Table 3.4-1, footnote a
[3] Diesel Heating Value 133,366 Btu/gal lab analysis
[4] Engine Heat Rate 7,000 Btu/hp-hr AP 42, Table 3.4-1, footnote e

Conversion factors: 2,000 lb/ton

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/gal) x (Fuel consumption, gal/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/gal) / (Fuel heat value, Btu/gal) x (Engine heat rate, Btu/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 8. FY2023 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Golden Valley Electric Association - Healy Power Plant

Hazardous Air Pollutant	CY2021 Actual HAP Emissions by Emissions Unit Category (tons per year) [1]						CY2021 Actual HAP Emissions
	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling [2]	Insignificant Units [3]	
Acetaldehyde	1.02E-01	----	4.25E-06	0	----	----	0.10
Acetophenone	2.70E-03	----	----	----	----	----	2.70E-03
Acrolein	5.21E-02	----	5.13E-07	0	----	----	0.05
Benzene	0.23	9.15E-05	5.17E-06	0	----	----	0.23
Benzyl chloride	1.26E-01	----	----	----	----	----	0.13
Biphenyl	3.05E-04	----	----	----	----	----	3.05E-04
Bis(2-ethylhexyl)phthalate (DEHP)	1.31E-02	----	----	----	----	----	0.01
Bromoform	7.01E-03	----	----	----	----	----	7.01E-03
1,3 Butadiene	----	----	2.17E-07	----	----	----	2.17E-07
Carbon disulfide	2.34E-02	----	----	----	----	----	0.02
2-Chloroacetophenone	1.26E-03	----	----	----	----	----	1.26E-03
Chlorobenzene	3.95E-03	----	----	----	----	----	3.95E-03
Chloroform	1.06E-02	----	----	----	----	----	0.01
Cumene	9.52E-04	----	----	----	----	----	9.52E-04
Dibenzofurans	1.96E-07	----	----	----	----	----	1.96E-07
Dimethyl sulfate	8.63E-03	----	----	----	----	----	8.63E-03
2,4-Dinitrotoluene	5.03E-05	----	----	----	----	----	5.03E-05
Ethyl benzene	1.69E-02	2.72E-05	----	----	----	----	0.02
Ethyl chloride (Chloroethane)	7.55E-03	----	----	----	----	----	7.55E-03
Ethylene dibromide (Dibromoethane)	2.16E-04	----	----	----	----	----	2.16E-04
Ethylene dichloride (1,2-Dichloroethane)	7.19E-03	----	----	----	----	----	7.19E-03
Formaldehyde	4.31E-02	1.41E-02	6.54E-06	0	----	----	0.06
Hexane	1.20E-02	----	----	----	----	----	0.01
Hydrochloric acid	0.28	----	----	----	----	----	0.28
Hydrogen fluoride (Hydrofluoric acid)	0.15	----	----	----	----	----	0.15
Isophorone	1.04E-01	----	----	----	----	----	0.10
Methyl bromide (Bromomethane)	2.88E-02	----	----	----	----	----	0.03
Methyl chloride (Chloromethane)	9.52E-02	----	----	----	----	----	0.10
Methyl chloroform (1,1,1-Trichloroethane)	3.59E-03	1.01E-04	----	----	----	----	3.69E-03
Methyl hydrazine	3.05E-02	----	----	----	----	----	0.03
Methyl methacrylate	3.59E-03	----	----	----	----	----	3.59E-03
Methyl tert butyl ether	6.29E-03	----	----	----	----	----	6.29E-03
Methylene chloride (Dichloromethane)	5.21E-02	----	----	----	----	----	0.05
Phenol	2.88E-03	----	----	----	----	----	2.88E-03
Polycyclic Organic Matter (POM)	3.42E-03	5.09E-04	9.32E-07	0	----	----	3.93E-03
Acenaphthene	9.16E-05	1.08E-07	7.87E-09	0	----	----	
Acenaphthylene	4.49E-05	9.03E-06	2.81E-08	0	----	----	
Anthracene	3.77E-05	5.22E-07	1.04E-08	0	----	----	
Benzo(a)anthracene	1.44E-05	1.72E-06	9.31E-09	0	----	----	
Benzo(a)pyrene	6.83E-06	----	1.04E-09	0	----	----	
Benzo(b)fluoranthene	----	----	5.49E-10	0	----	----	
Benzo(g,h,i)perylene	4.85E-06	----	2.71E-09	----	----	----	

Table 8. FY2023 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Golden Valley Electric Association - Healy Power Plant

Hazardous Air Pollutant	CY2021 Actual HAP Emissions by Emissions Unit Category (tons per year) [1]						CY2021 Actual HAP Emissions
	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling [2]	Insignificant Units [3]	
Benzo(k)fluoranthene	----	----	8.59E-10	0	----	----	
Chrysene	1.80E-05	1.02E-06	1.96E-09	0	----	----	
Dibenz(a,h)anthracene	----	7.14E-07	3.23E-09	0	----	----	
Acenaphthene	9.16E-05	1.08E-07	7.87E-09	0	----	----	
Fluoranthene	1.28E-04	2.07E-06	4.22E-08	0	----	----	
Fluorene	1.64E-04	1.91E-06	1.62E-07	0	----	----	
Indeno(1,2,3-cd)pyrene	----	9.15E-07	----	0	----	----	
Naphthalene	2.34E-03	4.83E-04	4.70E-07	0	----	----	
Pyrene	5.93E-05	1.82E-06	2.65E-08	0	----	----	
Propionaldehyde	6.83E-02	----	----	----	----	----	0.07
Styrene	4.49E-03	----	----	----	----	----	4.49E-03
2,3,7,8-Tetrachlorodibenzo-p-dioxin	2.57E-09	----	----	----	----	----	2.57E-09
Tetrachloroethylene (Perchloroethylene)	7.73E-03	----	----	----	----	----	7.73E-03
Toluene	4.31E-02	2.65E-03	2.27E-06	0	----	----	0.05
Vinyl acetate	1.37E-03	----	----	----	----	----	1.37E-03
Xylenes (isomers and mixture)	6.65E-03	----	1.58E-06	0	----	----	6.65E-03
Antimony Compounds	3.23E-03	----	----	----	----	----	3.23E-03
Arsenic Compounds	7.37E-02	2.28E-04	----	----	----	----	0.07
Beryllium Compounds	3.77E-03	1.71E-04	----	----	----	----	3.94E-03
Cadmium Compounds	9.16E-03	1.71E-04	----	----	----	----	9.34E-03
Chromium Compounds	6.09E-02	1.71E-04	----	----	----	----	0.06
Cobalt Compounds	1.80E-02	----	----	----	----	----	0.02
Cynaide Compounds	----	----	----	----	----	----	0
Lead Compounds	7.55E-02	5.13E-04	----	----	----	----	0.08
Magnesium Compounds	1.98	----	----	----	----	----	1.98
Manganese Compounds	8.80E-02	3.42E-04	----	----	----	----	0.09
Mercury Compounds	1.39E-03	1.71E-04	----	----	----	----	1.56E-03
Nickel Compounds	5.03E-02	1.71E-04	----	----	----	----	0.05
Selenium Compounds	0.23	8.56E-04	----	----	----	----	0.23
Total HAPs - Maximum Individual HAP	**1.98**	**1.41E-02**	**6.54E-06**	**0**	**0**	**0**	**1.98**
Total VOC HAP Emissions	**1.14**	**1.75E-02**	**2.15E-05**	**0**	**0**	**0**	**1.15**
Total HAPs Emissions	**4.15**	**2.03E-02**	**2.15E-05**	**0**	**0**	**0**	**4.17**

Notes:
[1] See individual emissions unit category emissions calculations for details on methodology and assumptions.
[2] Emissions units in the coal preparation and handling, ash handling and coal storage pile systems do not have HAP emissions
[3] HAP emissions from the fuel storage tanks are negligible.

Table 8a. FY2023 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Coal-Fired Boilers
Golden Valley Electric Association - Healy Power Plant

EU ID 1 CY2021 actual coal throughput	160,733	tons
EU ID 2 CY2021 actual coal throughput	198,645	tons
Total CY2021 actual coal throughput	**359,378**	**tons**

CAS No.	Chemical Name	CY2021 Actual Source Category Emission Calculations: Emission Factor [1]		Estimated Emissions	
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.43E-11	lb/ton	2.57E-09	tpy
121142	2,4-Dinitrotoluene	2.80E-07	lb/ton	5.03E-05	tpy
532274	2-Chloroacetophenone	7.00E-06	lb/ton	1.26E-03	tpy
75-07-0	Acetaldehyde	5.70E-04	lb/ton	1.02E-01	tpy
98862	Acetophenone	1.50E-05	lb/ton	2.70E-03	tpy
107-02-8	Acrolein	2.90E-04	lb/ton	5.21E-02	tpy
71-43-2	Benzene	1.30E-03	lb/ton	2.34E-01	tpy
100447	Benzyl chloride	7.00E-04	lb/ton	1.26E-01	tpy
92524	Biphenyl	1.70E-06	lb/ton	3.05E-04	tpy
117817	Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05	lb/ton	1.31E-02	tpy
75252	Bromoform	3.90E-05	lb/ton	7.01E-03	tpy
75150	Carbon disulfide	1.30E-04	lb/ton	2.34E-02	tpy
108907	Chlorobenzene	2.20E-05	lb/ton	3.95E-03	tpy
67663	Chloroform	5.90E-05	lb/ton	1.06E-02	tpy
98828	Cumene	5.30E-06	lb/ton	9.52E-04	tpy
132649	Dibenzofurans	1.09E-09	lb/ton	1.96E-07	tpy
77781	Dimethyl sulfate	4.80E-05	lb/ton	8.63E-03	tpy
100-41-4	Ethyl benzene	9.40E-05	lb/ton	1.69E-02	tpy
75003	Ethyl chloride (Chloroethane)	4.20E-05	lb/ton	7.55E-03	tpy
1006934	Ethylene dibromide (Dibromoethane)	1.20E-06	lb/ton	2.16E-04	tpy
107062	Ethylene dichloride (1,2-Dichloroethane)	4.00E-05	lb/ton	7.19E-03	tpy
50-00-0	Formaldehyde	2.40E-04	lb/ton	4.31E-02	tpy
110543	Hexane	6.70E-05	lb/ton	1.20E-02	tpy
7647010	Hydrochloric acid - EU ID 1	2.85E-03	lb/ton [2]	0.23	tpy
7647010	Hydrochloric acid - EU ID 2	4.98E-04	lb/ton [3]	0.05	tpy
7664393	Hydrogen fluoride (Hydrofluoric acid) - EU ID 1	1.42E-03	lb/ton [4]	0.11	tpy
7664393	Hydrogen fluoride (Hydrofluoric acid) - EU ID 2	3.27E-04	lb/ton [5]	3.25E-02	tpy
78591	Isophorone	5.80E-04	lb/ton	1.04E-01	tpy
74839	Methyl bromide (Bromomethane)	1.60E-04	lb/ton	2.88E-02	tpy
60344	Methyl hydrazine	1.70E-04	lb/ton	3.05E-02	tpy
80626	Methyl methacrylate	2.00E-05	lb/ton	3.59E-03	tpy
1634044	Methyl tert butyl ether	3.50E-05	lb/ton	6.29E-03	tpy
74873	Methyl chloride (Chloromethane)	5.30E-04	lb/ton	9.52E-02	tpy
71-55-6	Methyl chloroform (1,1,1-Trichloroethane)	2.00E-05	lb/ton	3.59E-03	tpy
75092	Methylene chloride (Dichloromethane)	2.90E-04	lb/ton	5.21E-02	tpy
108952	Phenol	1.60E-05	lb/ton	2.88E-03	tpy
N/A	Polycyclic Organic Matter (POM)	1.91E-05	lb/ton	3.42E-03	tpy
	Polycyclic aromatic compounds(PAH)				
83-32-9	Acenaphthene	5.10E-07	lb/ton	9.16E-05	tpy
203-96-8	Acenaphthylene	2.50E-07	lb/ton	4.49E-05	tpy
120-12-7	Anthracene	2.10E-07	lb/ton	3.77E-05	tpy
56-55-3	Benzo(a)anthracene	8.00E-08	lb/ton	1.44E-05	tpy
205-99-5	Benzo(b,j,k)fluoranthene	1.10E-07	lb/ton	1.98E-05	tpy
50-32-8	Benzo(a)pyrene	3.80E-08	lb/ton	6.83E-06	tpy
191-24-2	Benzo(g,h,i)perylene	2.70E-08	lb/ton	4.85E-06	tpy
218-01-9	Chrysene	1.00E-07	lb/ton	1.80E-05	tpy
206-44-0	Fluoranthene	7.10E-07	lb/ton	1.28E-04	tpy
86-73-7	Fluorene	9.10E-07	lb/ton	1.64E-04	tpy
193-39-5	Ideno(1,2,3-cd)pyrene	6.10E-08	lb/ton	1.10E-05	tpy
	5-methylchrysene	2.20E-08	lb/ton	3.95E-06	tpy

Table 8a. FY2023 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Coal-Fired Boilers
Golden Valley Electric Association - Healy Power Plant

EU ID 1 CY2021 actual coal throughput	160,733	tons
EU ID 2 CY2021 actual coal throughput	198,645	tons
Total CY2021 actual coal throughput	**359,378**	**tons**

CAS No.	Chemical Name	Emission Factor [1]		Estimated Emissions	
		CY2021 Actual Source Category Emission Calculations			
91-20-3	Naphthalene	1.30E-05	lb/ton	2.34E-03	tpy
85-01-8	Phenanathrene	2.70E-06	lb/ton	4.85E-04	tpy
129-00-0	Pyrene	3.30E-07	lb/ton	5.93E-05	tpy
123386	Propionaldehyde	3.80E-04	lb/ton	6.83E-02	tpy
100425	Styrene	2.50E-05	lb/ton	4.49E-03	tpy
127184	Tetrachloroethylene (Perchloroethylene)	4.30E-05	lb/ton	7.73E-03	tpy
108-88-3	Toluene	2.40E-04	lb/ton	4.31E-02	tpy
108054	Vinyl acetate	7.60E-06	lb/ton	1.37E-03	tpy
1330-20-7	Xylenes (isomers and mixture)	3.70E-05	lb/ton	6.65E-03	tpy
N/A	Antimony Compounds	1.80E-05	lb/ton	3.23E-03	tpy
N/A	Arsenic Compounds	4.10E-04	lb/ton	7.37E-02	tpy
N/A	Beryllium Compounds	2.10E-05	lb/ton	3.77E-03	tpy
N/A	Cadmium Compounds	5.10E-05	lb/ton	9.16E-03	tpy
N/A	Chromium Compounds	3.39E-04	lb/ton	6.09E-02	tpy
N/A	Cobalt Compounds	1.00E-04	lb/ton	1.80E-02	tpy
N/A	Cyanide Compounds	2.50E-03	lb/ton	4.49E-01	tpy
N/A	Lead Compounds	4.20E-04	lb/ton	7.55E-02	tpy
N/A	Magnesium Compounds	1.10E-02	lb/ton	1.98	tpy
N/A	Manganese Compounds	4.90E-04	lb/ton	8.80E-02	tpy
N/A	Mercury Compounds - EU ID 1	1.72E-05	lb/ton [6]	1.38E-03	tpy
	Mercury Compounds - EU ID 2 [7]	- -		3.35E-06	tpy
N/A	Nickel Compounds	2.80E-04	lb/ton	5.03E-02	tpy
N/A	Selenium Compounds	1.30E-03	lb/ton	2.34E-01	tpy
		Total CY2021 Actual HAP Emissions		**4.60**	**tpy**

Notes:
[1] Reference: AP-42, Tables 1.1-12, 1.1-13, 1.1-14, 1.1-18
[2] HCl emission factors from EU ID 1 source test completed in August 2020
[3] HCl emission factors from EU ID 2 source test completed in September 2021
[4] HF emission factors from EU ID 1 source test completed in November 2017
[5] HF emission factors from EU ID 2 source test completed in December 2018
[6] Emission factor from EU ID 1 source test completed September-October 2021
[7] Emissions from EU ID 2 CEMS 2021

Conversion Factors:

Coal Heating Value	14.24	MMBtu/ton	CY2021 average
Unit 1	1.21	lb/TBtu	

Table 8b. FY2023 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Diesel-Fired Boilers and Heaters
Golden Valley Electric Association - Healy Power Plant

CY2021 Actual Heat Input: 114,090 MMBtu/yr [1]

CAS No.	Chemical Name	CY2021 Actual Source Category Emission Calculations Emission Factor [2,3]	Estimated Emissions
71-43-2	Benzene	1.60E-06 lb/MMBtu	9.15E-05 tpy
100-41-4	Ethyl benzene	4.77E-07 lb/MMBtu	2.72E-05 tpy
50-00-0	Formaldehyde	2.47E-04 lb/MMBtu	1.41E-02 tpy
71-55-6	Methyl chloroform (1,1,1-Trichloroethane)	1.77E-06 lb/MMBtu	1.01E-04 tpy
NA	Polycyclic Organic Matter (POM)	8.93E-06 lb/MMBtu	5.09E-04 tpy
NA	Polycyclic aromatic compounds(PAH)		
83-32-9	Acenaphthylene	1.58E-07 lb/MMBtu	9.03E-06 tpy
208-96-8	Acenaphthene	1.90E-09 lb/MMBtu	1.08E-07 tpy
120-12-7	Anthracene	9.15E-09 lb/MMBtu	5.22E-07 tpy
56-55-3	Benzo(a)anthracene	3.01E-08 lb/MMBtu	1.72E-06 tpy
205-82-3/207-09-9	Benzo(b,k)fluoranthene	1.11E-08 lb/MMBtu	6.33E-07 tpy
191-24-2	Benzo(g,h,l)perylene	1.69E-08 lb/MMBtu	9.67E-07 tpy
218-01-9	Chrysene	1.78E-08 lb/MMBtu	1.02E-06 tpy
53-70-3	Dibenz(a,h)anthracene	1.25E-08 lb/MMBtu	7.14E-07 tpy
206-44-0	Fluoranthene	3.63E-08 lb/MMBtu	2.07E-06 tpy
86-73-7	Fluorene	3.35E-08 lb/MMBtu	1.91E-06 tpy
193-39-5	Indeno(1,2,3-cd)pyrene	1.60E-08 lb/MMBtu	9.15E-07 tpy
91-20-3	Naphthalene	8.47E-06 lb/MMBtu	4.83E-04 tpy
85-01-8	Phenanthrene	7.87E-08 lb/MMBtu	4.49E-06 tpy
129-00-0	Pyrene	3.19E-08 lb/MMBtu	1.82E-06 tpy
108-88-3	Toluene	4.65E-05 lb/MMBtu	2.65E-03 tpy
1330-20-7	Xylenes	8.17E-07 lb/MMBtu	4.66E-05 tpy
NA	Arsenic Compounds	4.00E-06 lb/MMBtu	2.28E-04 tpy
NA	Beryllium Compounds	3.00E-06 lb/MMBtu	1.71E-04 tpy
NA	Cadmium Compounds	3.00E-06 lb/MMBtu	1.71E-04 tpy
NA	Chromium Compounds	3.00E-06 lb/MMBtu	1.71E-04 tpy
NA	Lead Compounds	9.00E-06 lb/MMBtu	5.13E-04 tpy
NA	Manganese Compounds	6.00E-06 lb/MMBtu	3.42E-04 tpy
NA	Mercury Compounds	3.00E-06 lb/MMBtu	1.71E-04 tpy
NA	Nickel Compounds	3.00E-06 lb/MMBtu	1.71E-04 tpy
NA	Selenium Compounds	1.50E-05 lb/MMBtu	8.56E-04 tpy
		CY2021 Actual HAP Emissions:	**2.03E-02 tpy**

[1] Total fuel use based on actual CY2020 operation as noted below:

EU ID 1	Unit No. 1		327 MMBtu/hr
			216,822 gallons
		Actual Heat Input:	28,916.66 MMBtu/yr
EU ID 2	Unit No. 2		658 MMBtu/hr
			557,434 gallons
		Actual Heat Input:	74,342.67 MMBtu/hr
EU ID 3	Auxiliary Boiler No. 1		12.554 MMBtu/hr
			12,055 gallons
		Actual Heat Input:	1,607.75 MMBtu/yr
EU ID 4	Auxiliary Boiler No. 2		23.0 MMBtu/hr
			69,156 gallons
		Actual Heat Input:	9,223.01 MMBtu/hr
		Total CY2021 Heat Input:	**114,090 MMBtu/yr**

[2] Reference: AP-42, Tables 1.3-9, and 1.3-10.

[3] Diesel high heat value: 133,366 Btu/gal lab analysis

Table 8c. FY2023 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Diesel Engines Greater Than or Equal to 600 Horsepower
Golden Valley Electric Association - Healy Power Plant

CY2021 Actual Heat Input: **0.0 MMBtu/yr** [1]

		CY2021 Actual Source Category Emission Calculations	
CAS No.	Chemical Name	Emission Factor [2]	Estimated Emissions
75-07-0	Acetaldehyde	2.52E-05 lb/MMBtu	0.00E+00 tpy
107-02-8	Acrolein	7.88E-06 lb/MMBtu	0.00E+00 tpy
71-43-2	Benzene	7.76E-04 lb/MMBtu	0.00E+00 tpy
50-00-0	Formaldehyde	7.89E-05 lb/MMBtu	0.00E+00 tpy
108-88-3	Toluene	2.81E-04 lb/MMBtu	0.00E+00 tpy
1330-20-7	Xylenes (isomers and mixture)	1.93E-04 lb/MMBtu	0.00E+00 tpy
N/A	Polycyclic Organic Matter (POM)	2.12E-04 lb/MMBtu	0.00E+00 tpy
	Polycyclic aromatic compounds(PAH)		
	Acenaphthene	4.68E-06 lb/MMBtu	0.00E+00 tpy
	Acenaphthylene	9.23E-06 lb/MMBtu	0.00E+00 tpy
	Anthracene	1.23E-06 lb/MMBtu	0.00E+00 tpy
	Benzo(a)anthracene	6.22E-07 lb/MMBtu	0.00E+00 tpy
	Benzo(b)fluoranthene	1.11E-06 lb/MMBtu	0.00E+00 tpy
	Benzo(k)fluoranthene	2.18E-07 lb/MMBtu	0.00E+00 tpy
	Benzo(a)pyrene	2.57E-07 lb/MMBtu	0.00E+00 tpy
	Benzo(g,h,l)perylene	5.56E-07 lb/MMBtu	0.00E+00 tpy
	Chrysene	1.53E-06 lb/MMBtu	0.00E+00 tpy
	Dibenz(a,h)anthracene	3.46E-07 lb/MMBtu	0.00E+00 tpy
	Fluoranthene	4.03E-06 lb/MMBtu	0.00E+00 tpy
	Fluorene	1.28E-05 lb/MMBtu	0.00E+00 tpy
	Indeno(1,2,3-cd)pyrene	4.14E-07 lb/MMBtu	0.00E+00 tpy
91-20-3	Naphthalene	1.30E-04 lb/MMBtu	0.00E+00 tpy
	Phenanthrene	4.08E-05 lb/MMBtu	0.00E+00 tpy
	Pyrene	3.71E-06 lb/MMBtu	0.00E+00 tpy
		CY2021 Actual HAP Emissions:	**0.00E+00 tpy**

Notes:

[1] Total fuel use based on actual operation as noted below:

EU ID 5	Diesel Generator Engine No. 1	2.75 MW
		0 gallons
	Potential Heat Input:	0 MMBtu/yr
	Total CY2021 Heat Input:	**0 MMBtu/yr**

[2] Reference: AP-42, Table 3.4-3

[3] Diesel high heat value: 133,366 Btu/gal lab analysis

Table 8d. FY2023 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Diesel Engines Less Than 600 Horsepower
Golden Valley Electric Association - Healy Power Plant

CY2021 Actual Heat Input: 11 MMBtu/yr [1]

		CY2021 Actual Source Category Emission Calculations	
CAS No.	**Chemical Name**	**Emission Factor [2]**	**Estimated Emissions**
75-07-0	Acetaldehyde	7.67E-04 lb/MMBtu	4.25E-06 tpy
107-02-8	Acrolein	9.25E-05 lb/MMBtu	5.13E-07 tpy
71-43-2	Benzene	9.33E-04 lb/MMBtu	5.17E-06 tpy
106-99-0	1,3 Butadiene	3.91E-05 lb/MMBtu	2.17E-07 tpy
50-00-0	Formaldehyde	1.18E-03 lb/MMBtu	6.54E-06 tpy
108-88-3	Toluene	4.09E-04 lb/MMBtu	2.27E-06 tpy
1330-20-7	Xylenes (isomers and mixture)	2.85E-04 lb/MMBtu	1.58E-06 tpy
N/A	Polycyclic Organic Matter (POM)	1.68E-04 lb/MMBtu	9.32E-07 tpy
	Polycyclic aromatic compounds(PAH)		
	Acenaphthene	1.42E-06 lb/MMBtu	7.87E-09 tpy
	Acenaphthylene	5.06E-06 lb/MMBtu	2.81E-08 tpy
	Anthracene	1.87E-06 lb/MMBtu	1.04E-08 tpy
	Benzo(a)anthracene	1.68E-06 lb/MMBtu	9.31E-09 tpy
	Benzo(b)fluoranthene	9.91E-08 lb/MMBtu	5.49E-10 tpy
	Benzo(k)fluoranthene	1.55E-07 lb/MMBtu	8.59E-10 tpy
	Benzo(a)pyrene	1.88E-07 lb/MMBtu	1.04E-09 tpy
	Benzo(g,h,i)perylene	4.89E-07 lb/MMBtu	2.71E-09 tpy
	Chrysene	3.53E-07 lb/MMBtu	1.96E-09 tpy
	Dibenz(a,h)anthracene	5.83E-07 lb/MMBtu	3.23E-09 tpy
	Fluoranthene	7.61E-06 lb/MMBtu	4.22E-08 tpy
	Fluorene	2.92E-05 lb/MMBtu	1.62E-07 tpy
	Ideno(1,2,3-cd)pyrene	3.75E-07 lb/MMBtu	2.08E-09 tpy
91-20-3	Naphthalene	8.48E-05 lb/MMBtu	4.70E-07 tpy
	Phenanthrene	2.94E-05 lb/MMBtu	1.63E-07 tpy
	Pyrene	4.78E-06 lb/MMBtu	2.65E-08 tpy
		CY2021 Actual HAP Emissions:	**2.15E-05 tpy**

Notes:

[1] Total fuel use based on actual operation as noted below:

EU ID 13	Firewater Pump Engine	264	hp
		6.0	hr/yr
	Potential Heat Input:	11	MMBtu/yr
	Total CY2021 Heat Input:	**11**	**MMBtu/yr**

Engines heat rate: 7,000 Btu/hp-hr

[2] Reference: AP-42, Table 3.3-2.

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Golden Valley Electric Association
FY2023 Assessable Emission Estimates

North Pole Power Plant – Permit No. AQ0110TVP04 Rev 1

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Table 1. FY2023 Assessable Emissions Summary
Golden Valley Electric Association - North Pole Power Plant

Assessable Emissions - Tons Per Year							
Description	NO_X	CO	PM_{10}	SO_2	VOC	HAPs	Total
Assessable PTE	5,337	118	479	4,302	4	-	10,240

From Condition 53 and Table C of the SOB for AQ0110TVP04 Rev 1

Potential to Emit	Regulated Air Pollutant Emissions (tons per year) [1]					
	NO_X	CO	PM_{10}	VOC	SO_2	HAP
Significant	955.4	11.5	24.7		230.4	
Insignificant	0	0	0		0	
Total Emissions	**955**	**12**	**25**		**231**	
Use Assessable PTE				**4**		**0**
Assessable Emission Subtotals	**955**	**12**	**25**	**4**	**231**	**0**
Fees Apply to Pollutant? [2]	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**
2021 Actual Emissions	**1,222**					
Fee Estimate [3]	**$52,498**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[3] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

[4] Actual emissions are not provided for VOC or HAPs because potential emissions are less than 10 tpy each. Actual emissions must be less than or equal to potential emissions, so actual emissions are also less than 10 tpy.

Table 2a. FY2023 Significant Emissions Unit Summary
Golden Valley Electric Association - North Pole Power Plant

Emission Unit			Fuel	Maximum	CY2021 Actual	CY2021 Actual
ID	Description	Make/Model	Type	Capacity	Operation	Fuel Consumption
1	Simple Cycle Gas Turbine	GE Frame 7, Series 7001, Model BR	ULS	672 MMBtu/hr	169.0 hr/yr	150 gal/yr
			No. 1 Diesel			801 gal/yr
			No. 2 Diesel			371,324 gal/yr
2	Simple Cycle Gas Turbine	GE Frame 7, Series 7001, Model BR	ULS	672 MMBtu/hr	2,815.0 hr/yr	7,115 gal/yr
			No. 1 Diesel			287,123 gal/yr
			No. 2 Diesel			7,434,443 gal/yr
5	Combined Cycle Gas Turbine	GE LM6000PC	ULS	455 MMBtu/hr	8,247.8 hr/yr	9,189 gal/yr
			No. 1 Diesel			0 gal/yr
			Naphtha			27,185,671 gal/yr
6	Combined Cycle Gas Turbine	GE LM6000PC	ULS	455 MMBtu/hr	0 hr/yr	0 gal/yr
			No. 1 Diesel			0 gal/yr
			Naphtha			0 gal/yr
7	Emergency Generator Engine	Mitsubishi 0A8829	ULSD	564.6 hp[1]	2.5 hr/yr	80 gal/yr
11	Boiler	Bryan Steam RV500	Propane	5.0 MMBtu/hr	100.8 hr/yr	5,505 gal/yr
12	Boiler	Bryan Steam RV500		5.0 MMBtu/hr		

[1] The generator has an electrical output of 400 kW. Assuming a 95% efficiency (per Section 2.7.2.1 of ADEC Modeling Review Procedures Manual) and converting from Kw to hp, the input rating is 564.6 hp.
Input Rating, hp= (Output Rating, kW) / (Efficiency, 0.95) * (Conversion, 1.341 hp/kW)

Table 2b. FY2023 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - North Pole Power Plant

Emission Unit		Fuel Type/ Material	Rating/Size	CY2021 Actual Operation	CY2021 Actual Fuel Consumption
ID[1]	Description				
3	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,760 hr/yr	N/A
4	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,760 hr/yr	N/A
N/A	FHR Warehouse Boiler 1	No. 2 Diesel	0.784 MMBtu/hr	8,760 hr/yr	6,305 gal/yr
N/A	FHR Warehouse Boiler 2	No. 2 Diesel	0.784 MMBtu/hr	8,760 hr/yr	
N/A	Burnham 17 A-T Boiler	No. 1 ULSD	0.222 MMBtu/hr	2,100 hr/yr	3,990 gal/yr

[1] EU IDs 3 and 4 are not currently subject to 40 CFR 60 Subpart Kb.

Table 3. FY2023 Assessable Emission Calculations - Oxides of Nitrogen (NO_X) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	NO_X Emission Factor	CY2021 Actual Operation	CY2021 Actual NO_x Emissions
Significant Emission Units							
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	2021 CEMS Average[1]	292.9 lb/hr	169.0 hours	24.8 tpy
			No. 1 Diesel				
			No. 2 Diesel				
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	7,115 gal/yr	0.4 tpy
			No. 1 Diesel			287,123 gal/yr	17.5 tpy
			No. 2 Diesel			7,434,443 gal/yr	452.9 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	2021 CEMS Average[1]	111.5 lb/hr	8,247.8 hours	459.8 tpy
			No. 1 Diesel				
			Naphtha				
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	AP-42 Table 3.1-1	0.24 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.031 lb/hp-hr	2.5 hr/yr	2.2E-02 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	13 lb/10^3gal	5,505 gal/yr	3.6E-02 tpy
12	Boiler	5.0 MMBtu/hr					
Significant Emission Units - 2021 Actual Emissions - NO_X							**955.4 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Table 1.3-1	18 lb/10^3gal	6,305 gal/yr	5.7E-02 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	18 lb/10^3gal	3,990 gal/yr	3.6E-02 tpy
Insignificant Emission Units - 2021 Actual Emissions - NO_X							**9.3E-02 tpy**
2021 Actual Emissions - NO_X							**955.5 tpy**

Note:

[1] The emission factors for EU IDs 1 and 5 are an average emission rate from 2021 measured using Continuous Emissions Monitoring Systems (CEMS).

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Operation, gal/yr) / (2,000 lb/ton)

HHV No. 1 Diesel = 138,443 Btu/gal (based on average of CY2021 fuel tests)
HHV No. 2 Diesel= 138,443 Btu/gal (based on average of CY2021 fuel tests)
HHV ULS = 133,821 Btu/gal (based on average of CY2021 fuel tests)
HHV Naphtha= 109,822 Btu/gal (based on average of CY2021 fuel tests)

Table 4. FY2023 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	CO Emission Factor	CY2021 Actual Operation	CY2021 Actual Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	2021 CEMS Average1	5.4 lb/hr	169.0 hours	0.5 tpy
			No. 1 Diesel				
			No. 2 Diesel				
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	7,115 gal/yr	1.57E-03 tpy
			No. 1 Diesel			287,123 gal/yr	0.07 tpy
			No. 2 Diesel			7,434,443 gal/yr	1.7 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	2021 CEMS Average1	2.3 lb/hr	8,247.8 hours	9.3 tpy
			No. 1 Diesel				
			Naphtha				
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	AP-42 Table 3.1-1	0.076 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.00668 lb/hp-hr	2.5 hr/yr	4.7E-03 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	7.5 $lb/10^3gal$	5,505 gal/yr	2.1E-02 tpy
12	Boiler	5.0 MMBtu/hr					
Significant Emission Units - CY2021 Actual Emissions - CO							**11.5 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Table 1.3-1	5.0 $lb/10^3gal$	6,305 gal/yr	1.6E-02 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	5.0 $lb/10^3gal$	3,990 gal/yr	1.0E-02 tpy
Insignificant Emission Units - CY2021 Actual Emissions - CO							**2.6E-02 tpy**
CY2021 Actual Emissions - CO							**11.5 tpy**

Note:

[1] The emission factors for EU IDs 1 and 5 are an average emission rate from 2021 measured using Continuous Emissions Monitoring Systems (CEMS).

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Operation, gal/yr) / (2,000 lb/ton)

HHV No. 1 Diesel = 138,443 Btu/gal (based on average of CY2021 fuel tests)
HHV No. 2 Diesel= 138,443 Btu/gal (based on average of CY2021 fuel tests)
HHV ULS = 133,821 Btu/gal (based on average of CY2021 fuel tests)
HHV Naphtha= 109,822 Btu/gal (based on average of CY2021 fuel tests)

Table 5. FY2023 Assessable Emission Calculations - Particulate Matter (PM_{10}) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	PM_{10} Emission Factor	CY2021 Actual Operation	CY2021 Actual PM_{10} Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	150 gal/yr	1.20E-04 tpy
			No. 1 Diesel			801 gal/yr	6.65E-04 tpy
			No. 2 Diesel			371,324 gal/yr	0.31 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	7,115 gal/yr	5.71E-03 tpy
			No. 1 Diesel			287,123 gal/yr	0.2 tpy
			No. 2 Diesel			7,434,443 gal/yr	6.2 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	9,189 gal/yr	0.01 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			27,185,671 gal/yr	17.9 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.0022 lb/hp-hr	2.5 hr/yr	1.6E-03 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	0.7 $lb/10^3gal$	5,505 gal/yr	1.9E-03 tpy
12	Boiler	5.0 MMBtu/hr					
Significant Emission Units - 2021 Actual Emissions - PM_{10}							**24.7 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Tables 1.3-1 and 1.3-2	1.7 $lb/10^3gal$	6,305 gal/yr	5.4E-03 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-1 and 1.3-2	1.7 $lb/10^3gal$	3,990 gal/yr	3.4E-03 tpy
Insignificant Emission Units - 2021 Actual Emissions - PM_{10}							**8.8E-03 tpy**
2021 Actual Emissions - PM_{10}							**24.7 tpy**

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Operation, gal/yr) / (2,000 lb/ton)

HHV No. 1 Diesel =	138,443	Btu/gal	(based on average of CY2021 fuel tests)
HHV No. 2 Diesel=	138,443	Btu/gal	(based on average of CY2021 fuel tests)
HHV ULS =	133,821	Btu/gal	(based on average of CY2021 fuel tests)
HHV Naphtha=	109,822	Btu/gal	(based on average of CY2021 fuel tests)

Table 6. FY2023 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	Maximum Fuel Sulfur Content [1]	SO_2 Emission Factor	CY2021 Actual Operation	CY2021 Actual SO_2 Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	150 gal/yr	0.00 tpy
			No. 1 Diesel	Mass Balance	0.1066 wt. pct. S	0.014 lb/gal	801 gal/yr	0.01 tpy
			No. 2 Diesel	Mass Balance	0.3953 wt. pct. S	0.058 lb/gal	371,324 gal/yr	10.72 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULS	Mass Balance	0.0015 wt. pct. S	0.000 lb/gal	7,115 gal/yr	0.00 tpy
			No. 1 Diesel	Mass Balance	0.1066 wt. pct. S	0.014 lb/gal	287,123 gal/yr	2.08 tpy
			No. 2 Diesel	Mass Balance	0.3953 wt. pct. S	0.058 lb/gal	7,434,443 gal/yr	214.53 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	Mass Balance	0.0015 wt. pct. S	0.000 lb/gal	9,189 gal/yr	0.00 tpy
			No. 1 Diesel	Mass Balance	0.1066 wt. pct. S	0.014 lb/gal	0 gal/yr	0.00 tpy
			Naphtha	Mass Balance	0.0020 wt. pct. S	2.3E-04 lb/gal	27,185,671 gal/yr	3.10 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULS	Mass Balance	0.0015 wt. pct. S	0.000 lb/gal	0 gal/yr	0.00 tpy
			No. 1 Diesel	Mass Balance	0.1066 wt. pct. S	0.014 lb/gal	0 gal/yr	0.00 tpy
			Naphtha	Mass Balance	0.0020 wt. pct. S	2.3E-04 lb/gal	0 gal/yr	0.00 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	Mass Balance	0.0015 wt. pct. S	2.2E-04 lb/gal	2.5 hr/yr	0.00 tpy
11	Boiler	5.0 MMBtu/hr	Propane	Mass Balance	7.81E-06 wt. pct. S	6.6E-07 lb/gal	5,505 gal/yr	1.8E-06 tpy
12	Boiler	5.0 MMBtu/hr						
Significant Emission Units - CY2021 Actual Emissions - SO_2								**230.4 tpy**
Insignificant Emission Units								
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	Mass Balance	0.3953 wt. pct. S	5.38E-02 lb/gal	6,305 gal/yr	1.69E-01 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel					
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	Mass Balance	0.0015 wt. pct. S	2.04E-04 lb/gal	3,990 gal/yr	4.1E-04 tpy
Insignificant Emission Units - CY2021 Actual Emissions - SO_2								**1.7E-01 tpy**
CY2021 Actual Emissions - SO_2								**230.6 tpy**

Notes:

Sample Calculations: [2, 3, 4]

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

Turbine Emissions, tpy= (Emission factor, lb/gal) x (Fuel Use gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/gal) x (Capacity, gal/hr) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/gal) x (Operation, gal/yr) / (2,000 lb/ton)

Boiler wt. pct. S= (Sulfur compound content, ppmv SO_2) x (Conversion, 1.66E-7 lb SO_2/scf / ppm SO_2) x (F-factor, 8,710 scf/MMBtu) x (Conversion, 0.0216 MMBtu/lb) x (Conversion, mole SO_2/64 lb SO_2) x (Conversion, mole S/mole SO_2) x (Conversion, 32 lb S/ mole S)

Notes:

[1] Based on the average of monthly maximum fuel sulfur content values for calendar year 2021 as received from supplier sampling.

[2] Fuel density assumed equal to 6.8 lb/gal for ULS and No. 1 Diesel, 7.3 lb/gal for No. 2 Diesel, 5.2 lb/gal for naphtha, 4.2 lb/gal for propane, and 6.8 lb/gal for No. 2 Fuel Oil.

[3] The engine specification datasheet indicates a maximum fuel throughput of 32 gal/hr.

[4] Propane fuel analysis results from 2021 indicate a fuel sulfur content less than 0.5 ppmv.

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Golden Valley Electric Association
FY2023 Assessable Emission Estimates

Zehnder Facility – Permit No. AQ0109TVP03

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Table 1. FY2023 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

Assessable Emissions - Tons Per Year							
Description	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAPs**	**Total**
PTE - After June 9, 2021	2,115	20.9	30.4	69.2	2.59	3.0	2,238
PTE - After September 1, 2022	2,115	20.9	30.4	67.4	2.59	3.0	2,234
Assessable PTE - after June 9, 2021	2,115	20.9	30.4	69.2	0	-	2,236
Assessable PTE - after September 1, 2022	2,115	20.9	30.4	67.4	0	-	2,234

From Table C of the SOB for AQ0109TVP04

Potential to Emit	**Regulated Air Pollutant Emissions (tons per year)** [1]					
	NO_X	**CO**	**PM_{10}**	**VOC**	**SO_2**	**HAP**[4]
Significant	85.6	0.5	1.2	0.1	38.2	
Insignificant	0.3	0.1	0.0	0.1	0.3	
Total Emissions	**86**	**1**	**1**	**0**	**38**	
Use Assessable PTE						**0**
Assessable Emission Subtotals	**86**	**1**	**1**	**0**	**38**	**0**
Fees Apply to Pollutant? [2]	**Yes**	**No**	**No**	**No**	**Yes**	**No**
CY2021 Actual Emissions	**124**					
Fee Estimate [3]	**$5,342**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[3] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

[4] Actual emissions are not provided for HAPs because potential emissions for HAPs are less than 10 tpy. Actual emissions must be less than or equal to potential emissions, so actual emissions are also less than 10 tpy.

Table 2a. FY2023 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

Emission Unit			Fuel Type	CY2021 Actual Operation	Maximum Capacity	CY2021 Actual Fuel Consumption
ID[1]	Description	Make/Model				
1	Simple Cycle Gas Turbine	General Electric Frame 5 MS 5001-M	No. 1 ULS	480.6 hr/yr	268 MMBtu/hr	6,724 gal/yr
			No. 1 Diesel			13,161 gal/yr
			No. 2 Diesel			572,148 gal/yr
2	Simple Cycle Gas Turbine	General Electric Frame 5 MS 5001-M	No. 1 ULS	638.7 hr/yr	268 MMBtu/hr	27,715 gal/yr
			No. 1 Diesel			17,459 gal/yr
			No. 2 Diesel			758,983 gal/yr
3	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD	2.8 hr/yr	28 MMBtu/hr	1,076 gal/yr
4	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD	1.5 hr/yr	28 MMBtu/hr	
10	Boiler	Weil McLain H-688	No. 2 Heating Oil	1,278 hr/yr	1.7 MMBtu/hr	30,170 gal/yr
11	Boiler	Weil McLain H-688	No. 2 Heating Oil	1,278 hr/yr	1.7 MMBtu/hr	

[1] Source: Air Quality Permit No. AQ0109TVP04

Table 2b. FY2023 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

Emission Unit		Fuel Type/ Material	Rating/Size	CY2021 Actual Operation
ID [1]	Description			
5	Fuel Oil Storage Tank	No. 2 Diesel	12,000 gallons	8,760 hr/yr
6	Fuel Oil Storage Tank	No. 2 Diesel	50,000 gallons	8,760 hr/yr
7	Fuel Oil Storage Tank	No. 2 Diesel	50,000 gallons	8,760 hr/yr
8	Burnham Boiler	No. 2 Heating Oil	0.44 MMBtu/hr	18,280 gal/yr
9	Burnham Boiler	No. 2 Heating Oil	0.44 MMBtu/hr	
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	9,557 scf
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	Waste Oil	0.28 MMBtu/hr	0 gal/yr
N/A	Energy Logic EL-340H Heater	Waste Oil	0.275 MMBtu/hr	750 gal/yr
N/A	Metzger Machine Corp. Boiler	No. 1 Diesel	0.12 MMBtu/hr	6,206 gal/yr
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	0.2 MMBtu/hr	2,500 gal/yr
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	0.2 MMBtu/hr	0 gal/yr
N/A	Energy Logic EL-350H Heater	Waste Oil - Transformer	0.35 MMBtu/hr	5,100 gal/yr

[1] Source: Renewal application for AQ0109TVP04

Table 3. FY2023 Assessable Emission Calculations - Oxides of Nitrogen (NO_x) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	NO_x Emission Factor	CY2021 Actual Operation	CY2021 Actual NO_x Emissions
Significant Emision Units							
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	6,724 gal/yr	0.4 tpy
			No. 1 Diesel			13,161 gal/yr	0.8 tpy
			No. 2 Diesel			572,148 gal/yr	34.9 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	27,715 gal/yr	1.7 tpy
			No. 1 Diesel			17,459 gal/yr	1.1 tpy
			No. 2 Diesel			758,983 gal/yr	46.2 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	3.2 lb/MMBtu	1,076 gal/yr	0.24 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	20 $lb/10^3gal$	30,170 gal/yr	0.30 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
						Significant Emision Units - 2021 Actual Emissions - NO_x	**85.6 tpy**
Insignificant Emision Units							
5	Fuel Oil Storage Tank	12,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	18 $lb/10^3gal$	18,280 gal/yr	0.16 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	100 $lb/10^6scf$	9,557 scf	4.78E-04 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 $lb/10^3gal$	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 $lb/10^3gal$	750 gal/yr	0.01 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-1	18 $lb/10^3gal$	6,206 gal/yr	0.06 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 $lb/10^3gal$	2,500 gal/yr	0.01 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 $lb/10^3gal$	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	19 $lb/10^3gal$	5,100 gal/yr	0.05 tpy
						Insignificant Emision Units - 2021 Actual Emissions - NO_x	**0.29 tpy**
						2021 Actual Emissions - NO_x	**85.9 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, $lb/10^6scf$) / (Conversion 1,000,000 $scf/10^6scf$) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 and 2 Diesel = 138,443 Btu/gal (based on average of CY2021 fuel tests)

Table 4. FY2023 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	CO Emission Factor	CY2021 Actual Operation	CY2021 Actual CO Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	6,724 gal/yr	1.5E-03 tpy
			No. 1 Diesel			13,161 gal/yr	3.0E-03 tpy
			No. 2 Diesel			572,148 gal/yr	1.3E-01 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	27,715 gal/yr	6.3E-03 tpy
			No. 1 Diesel			17,459 gal/yr	4.0E-03 tpy
			No. 2 Diesel			758,983 gal/yr	1.7E-01 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	0.85 lb/MMBtu	1,076 gal/yr	6.3E-02 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 $lb/10^3gal$	30,170 gal/yr	7.5E-02 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emission Units - CY2021 Actual Emissions - CO							**0.46 tpy**
Insignificant Emission Units							
5	Fuel Oil Storage Tank	12,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 $lb/10^3gal$	18,280 gal/yr	0.05 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	84 $lb/10^6scf$	9,557 scf	4.01E-04 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	5.0 $lb/10^3gal$	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	5.0 $lb/10^3gal$	750 gal/yr	1.9E-03 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-1	5 $lb/10^3gal$	6,206 gal/yr	0.02 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	1.7 $lb/10^3gal$	2,500 gal/yr	2.1E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	1.7 $lb/10^3gal$	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	5.0 $lb/10^3gal$	5,100 gal/yr	0.01 tpy
Insignificant Emission Units - CY2021 Actual Emissions - CO							**0.08 tpy**
CY2021 Actual Emissions - CO							**0.54 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, $lb/10^6scf$) / (Conversion 1,000,000 $scf/10^6scf$) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 and 2 Diesel = 138,443 Btu/gal (based on average of CY2021 fuel tests)

Table 5. FY2023 Assessable Emissions Calculations - Volatile Organic Compound (VOC) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit		Maximum	Fuel	Factor	VOC Emission	CY2021 Actual	CY2021 Actual
ID	Description	Capacity	Type	Reference	Factor	Operation	VOC Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	6,724 gal/yr	1.9E-04 tpy
			No. 1 Diesel			13,161 gal/yr	3.7E-04 tpy
			No. 2 Diesel			572,148 gal/yr	0.02 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	27,715 gal/yr	7.9E-04 tpy
			No. 1 Diesel			17,459 gal/yr	5.0E-04 tpy
			No. 2 Diesel			758,983 gal/yr	0.02 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	0.08 lb/MMBtu	1,076 gal/yr	6.1E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.34 lb/10^3gal	30,170 gal/yr	5.1E-03 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emission Units - CY2021 Actual Emissions - VOC							**0.05 tpy**
Insignificant Emission Units							
5	Fuel Oil Storage Tank	12,000 gallons	No. 2 Diesel	AP-42, Section 7.1	N/A	8,760 hr/yr	<0.01 tpy
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	AP-42, Section 7.1	N/A	8,760 hr/yr	<0.01 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	AP-42, Section 7.1	N/A	8,760 hr/yr	<0.01 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.7 lb/10^3gal	18,280 gal/yr	6.5E-03 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	7.6 lb/10^6scf	9,557 scf	3.6E-05 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-3	1 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-3	1 lb/10^3gal	750 gal/yr	3.8E-04 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-3	0.713 lb/10^3gal	6,206 gal/yr	2.2E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1 lb/10^3gal	2,500 gal/yr	1.3E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1 lb/10^3gal	5,100 gal/yr	2.6E-03 tpy
Insignificant Emission Units - CY2021 Actual Emissions - VOC							**0.01 tpy**
CY2021 Actual Emissions - VOC							**0.06 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 and 2 Diesel = 138,443 Btu/gal (based on average of CY2021 fuel tests)

Table 6. FY2023 Assessable Emission Calculations - Particulate Matter (PM_{10}) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	PM_{10} Emission Factor	CY2021 Actual Operation	CY2021 Actual PM_{10} Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	6,724 gal/yr	5.6E-03 tpy
			No. 1 Diesel			13,161 gal/yr	1.1E-02 tpy
			No. 2 Diesel			572,148 gal/yr	4.8E-01 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	27,715 gal/yr	0.02 tpy
			No. 1 Diesel			17,459 gal/yr	0.01 tpy
			No. 2 Diesel			758,983 gal/yr	0.63 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.4-2	0.0573 lb/MMBtu	1,076 gal/yr	4.3E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-2 & 1.3-7	2.38 lb/10^3gal	30,170 gal/yr	3.6E-02 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
						Significant Emission Units - 2021 Actual Emissions - PM_{10}	**1.20 tpy**
			Insignificant Emission Units				
5	Fuel Oil Storage Tank	12,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Tables 1.3-1 & 1.3-2	1.7 lb/10^3gal	18,280 gal/yr	0.02 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	5.5 lb/10^6scf	9,557 scf	2.6E-05 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-1	12 lb/10^3gal [1]	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-1	12 lb/10^3gal [1]	750 gal/yr	4.5E-03 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Tables 1.3-1 & 1.3-2	1.7 lb/10^3gal	6,206 gal/yr	5.3E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	N/A	2,500 gal/yr	0 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	N/A	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	0.1 lb/10^3gal [2]	5,100 gal/yr	1.3E-04 tpy
						Insignificant Emission Units - 2021 Actual Emissions - PM_{10}	**0.03 tpy**
						2021 Actual Emissions - PM_{10}	**1.23 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 and 2 Diesel = 138,443 Btu/gal (based on average of CY2021 fuel tests)

[1] Ash Content of 0.233 percent by weight was determined through testing conducted in December 2016.
[2] Ash Content of 0.001 percent by weight was determined through testing conducted in December 2016.

Table 7. FY2023 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Fuel Type	Factor Reference	Fuel Sulfur Content [1,2]	SO_2 Emission Factor	CY2021 Actual Operation	CY2021 Actual SO_2 Emissions
1	Simple Cycle Gas Turbine	No. 1 ULS	Mass Balance	0.00072 wt. pct. S	0.000 lb/gal	6,724 gal/yr	0.00 tpy
		No. 1 Diesel	Mass Balance	0.10742 wt. pct. S	0.015 lb/gal	13,161 gal/yr	0.10 tpy
		No. 2 Diesel	Mass Balance	0.39675 wt. pct. S	0.056 lb/gal	572,148 gal/yr	16.12 tpy
2	Simple Cycle Gas Turbine	No. 1 ULS	Mass Balance	0.00072 wt. pct. S	0.000 lb/gal	27,715 gal/yr	0.00 tpy
		No. 1 Diesel	Mass Balance	0.10742 wt. pct. S	0.015 lb/gal	17,459 gal/yr	0.13 tpy
		No. 2 Diesel	Mass Balance	0.39675 wt. pct. S	0.056 lb/gal	758,983 gal/yr	21.38 tpy
3	Diesel Generator Engine	No. 1 ULSD	Mass Balance	0.0015 wt. pct. S	2.13E-04 lb/gal	1,076 gal/yr	1.1E-04 tpy
4	Diesel Generator Engine	No. 1 ULSD					
10	Boiler	No. 2 Heating Oil	Mass Balance	0.2 wt. pct. S	0.028 lb/gal	30,170 gal/yr	0.43 tpy
11	Boiler	No. 2 Heating Oil					
Significant Emission Units - 2021 Actual Emissions - SO_2							**38.2 tpy**
Insignificant Emission Units							
5	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
6	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	No. 2 Heating Oil	Mass Balance	0.2 wt. pct. S	0.0 lb/gal	18,280 gal/yr	0.26 tpy
9	Burnham Boiler	No. 2 Heating Oil	Mass Balance				
N/A	Burnham Boiler - FE Building	Natural Gas	AP-42 Table 1.4-2	2,000 gr/10^6scf	0.6 lb/10^6scf	9,557 scf	2.9E-06 tpy
N/A	Burnham Boiler - FE Building	Natural Gas					
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	Waste Oil	Mass Balance	0.124 wt. pct. S	0.018 lb/gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	Waste Oil	Mass Balance	0.124 wt. pct. S	0.018 lb/gal	750 gal/yr	6.6E-03 tpy
N/A	Metzger Machine Corp. Boiler	No. 1 Diesel	Mass Balance	0.0007192 wt. pct. S	0.000 lb/gal	6,206 gal/yr	3.2E-04 tpy
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	2,500 gal/yr	0.02 tpy
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	5,100 gal/yr	0 tpy
Insignificant Emission Units - 2021 Actual Emissions - SO_2							**0.33 tpy**
2021 Actual Emissions - SO_2							**38.5 tpy**

Sample Calculations: [3]

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

Emissions, tpy= (Emission factor, lb/gal) x (Fuel Use gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

Notes:

[1] Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2021 as received from supplier sampling.

[2] For waste oil and waste transformer oil, fuel sulfur content was determined by testing conducted in December 2016.

[3] Diesel fuel density is equal 6.8 lb/gal for No. 1 Diesel and 7.1 lb/gal for No. 2 Diesel per plant report.

Golden Valley Electric Association
FY2023 Assessable Emission Estimates

Delta Power Plant – Permit No. AQ0880TVP03

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Table 1. FY2023 Assessable Emissions Summary
Golden Valley Electric Association - Delta Power Plant

Assessable Emissions - Tons Per Year							
Description	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAPs**	**Total**
Assessable PTE	249	-	-	72	-	-	321

From Condition 27 and Table D of the Statement of Basis for AQ0880TVP03.

Potential to Emit	**Regulated Air Pollutant Emissions (tons per year)** [1]					
	NO_X	**CO**	**PM_{10}**	**SO_2**	**VOC**	**HAP**
Significant	0.4			0.0		
Insignificant	0			0		
Total Emissions	**0**			**0**		
Use Assessable PTE [2]		**0**	**0**		**0**	**0**
Assessable Emission Subtotals	**0**	**0**	**0**	**0**	**0**	**0**
Fees Apply to Pollutant? [3]	**No**	**No**	**No**	**No**	**No**	**No**
Total Assessable Emissions	**0**					
Fee Estimate [4]	**$0**					

Notes:
[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.
[2] Actual emissions are provided for NO_X and SO_2 only, because potential emissions for all other pollutants are less than 10 tpy each. Actual emissions must be less than or equal to potential emissions, so actual emissions are also less than 10 tpy.
[3] Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.
[4] A fee rate of $42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2023 Significant Emissions Unit Summary
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel	CY2021 Actual	Nominal	CY2021 Actual
ID	Description	Make/Model	Type	Operation	Capacity	Fuel Consumption
1	Gas Turbine	John Brown Ltd. Frame 5P	Fuel Oil	6.3 hr/yr	23.1 MW	7,805 gal/yr
2	Black Start Engine	Delta Detroit	Fuel Oil	0.02 hr/yr	500 bhp	0 gal/yr
3	Furnace	Thermo Pride	Fuel Oil	2,152 hr/yr [1]	0.4 MMBtu/hr	6,472 gal/yr

1. Estimated as follows:
Operation (hr/yr) = (Fuel Consumption, gal/yr) x (Fuel Heating value, 0.133021 MMBtu/gal) / (Capacity, 0.4 MMBtu/hr)

Table 2b. FY2023 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - Delta Power Plant

Emission Unit		Fuel Type/ Material	Rating/Size	CY2021 Actual Operation
ID	Description			
Tank	Fuel Oil Storage Tank	Fuel Oil	50,000 gallons	8,760 hr/yr

Table 3. FY2023 Assessable Emissions Calculations - Oxides of Nitrogen (NO_X) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	Factor Reference	NO_X Emission Factor	Actual Operation	CY2021 Actual NO_X Emissions
ID	Description	Rating/Capacity					
Significant Emission Units							
1	Gas Turbine	23.1 MW	Fuel Oil	AQ0880TVP03 Condition 10.2	0.70 lb/MMBtu	7,805 gal/yr	0.36 tpy
2	Black Start Engine	500 bhp	Fuel Oil	AP-42 Table 3.3-1	0.031 lb/hp-hr	0.02 hr/yr [1]	1.3E-04 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	AP-42 Table 1.3-1	18 lb/kgal	6,472 gal/yr	0.06 tpy
Significant Emission Units - Total Assessable Emissions - NO_X							**0.42 tpy**
Insignificant Emission Units							
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	N/A	NA	8,760 hr/yr	0 tpy
Insignificant Emission Units - Total Assessable Emissions - NO_X							**0 tpy**
Total Assessable Emissions - NO_X							**0.42 tpy**

Notes:
[1] Operating hours were determined based on two starts during calendar year 2021 lasting an estimated duration of 5 minutes each.

Fuel Heating Value 0.133021 MMBtu/gal AQ0880TVP03, Condition 10.2

Example Calculations:
Turbine emissions (tpy) = (Maximum fuel consumption, gal/yr) x (Fuel Heating value, MMBtu/gal) x (Emission factor, lb/MMBtu) / (2,000 lb/ton)
Engine emissions (tpy) = (Rating, bhp) x (Emission factor, lb/hp-hr) x (Operation, hr/yr) / (2,000 lb/ton)
Furnace emissions (tpy) = (Emission factor, lb/kgal) / (Conversion, 1,000 gal/kgal) x (Operation, gal/yr) / (2,000 lb/ton)

Table 4. FY2023 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	Maximum Fuel Sulfur Content	Factor Reference	SO_2 Emission Factor	Actual Operation	CY2021 Actual SO_2 Emissions
ID	Description	Rating/Capacity						
Significant Emission Units								
1	Gas Turbine	23.1 MW	Fuel Oil	0.0015 wt. pct. S [1]	Mass Balance [2,3]	0.0002 lb/gal	7,805 gal/yr	7.8E-04 tpy
2	Black Start Engine	0 gal/hr	Fuel Oil	0.0015 wt. pct. S [1]	Mass Balance [2,3]	0.0002 lb/gal	0.02 hr/yr	7.3E-10 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	0.0015 wt. pct. S [1]	Mass Balance [2,3]	0.0002 lb/gal	6,472 gal/yr	6.5E-04 tpy
Significant Emission Units - Total Assessable Emissions - SO_2								**1.4E-03 tpy**
Insignificant Emission Units								
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	NA	N/A	NA	8,760 hr/yr	0 tpy
Insignificant Emission Units - Total Assessable Emissions - SO_2								**0 tpy**
Total Assessable Emissions - SO_2								**1.4E-03 tpy**

Notes:

1 The emission units fired ULSD in 2021.

[2] Mass balance:

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

[3] A fuel density of 6.7 lb/gal is assumed based on an API gravity of 43.3 from the February 2006 source test.

Turbine and Furnace emissions (tpy) = (Emission factor, lb/gal) x (Operation, gal/yr) / (2,000 lb/ton)

Engine emissions (tpy) = (Emission factor, lb/gal) x (Capacity, gal/hr) x (Operation, hr/yr) / (2,000 lb/ton)

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Golden Valley Electric Association
PO Box 71249, Fairbanks, AK 99707-1249 • (907) 452-1151 • www.gvea.com
Your Touchstone Energy® Cooperative

March 29, 2023

Certified Mail
~~Email Submittal~~
~~dec.aq.airreports@alaska.gov~~
Return Receipt Requested
7018 1130 0001 6544 6786

Alaska Department of Environmental Conservation
Air Permits Program
ATTN: Assessable Emissions Estimate
410 Willoughby Avenue, Suite 303
PO Box 111800
Juneau, AK 99811-1800

Subject: Golden Valley Electric Association
FY2024 Assessable Emission Estimates

Dear Compliance Technician,

Enclosed please find the FY2024 Assessable Emission Estimates for the following Golden Valley Electric Association (GVEA) facilities.

Facility	Air Quality Permit No.	CY2022 Actual Emissions (Tons)	Fee Estimate
Healy Power Plant	AQ0173TVP03	1,513	$127,512
North Pole Power Plant	AQ0110TVP04, Rev. 1	1,003	$84,504
Zehnder Facility	AQ0109TVP04	98	$ 8,266
Delta	AQ0880TVP03	1.65	$139

Assessable emission estimates for all facilities are based on actual emissions from calendar year 2022.

If you have any questions or would like any additional information, please contact me by phone at 907-458-4557 or by email at nmknight@gvea.com. The certification from Christopher Forrest, Director of Power Supply follows.

Sincerely,

Naomi Morton Knight, P.E.
Environmental Officer

Certification

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate and complete.

Christopher M. Forrest

Christopher Forrest
Director of Power Supply

Enclosures

Golden Valley Electric Association
FY2024 Assessable Emission Estimates

Healy Power Plant – Permit No. AQ0173TVP03

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Table 1. FY2024 Assessable Emissions Summary
Golden Valley Electric Association - Healy Power Plant

	Regulated Air Pollutant Emissions (tons per year) [1, 2]					
	NO_X	CO	PM_{10} [3]	VOC	SO_2	HAP [4]
Significant	300.8	835.0	22.2	9.2	344.9	
Insignificant	0.0	0.0	0.7	0.0	0.0	
Total Emissions	**301**	**835**	**23**	**9**	**345**	**0**
CY2022 Actual Emissions	**1,513**					
Fee Estimate [5]	**$127,512**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Assessable emission fees for GHGs have not been established under 18 AAC 50.

[3] $PM_{2.5}$ emissions are a subset of PM_{10} emissions and are excluded from the assessable emissions total to avoid a double payment.

[4] HAP emissions are a subset of either VOC emissions or PM emissions and are excluded from the assessable emissions total to avoid a double payment.

[5] A fee rate of $84.29 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2024 Significant Emissions Unit Summary
Golden Valley Electric Association - Healy Power Plant

Emissions Unit				Fuel / Material Type	CY2022 Actual Operation [1]
ID	Name	Description	Rating		
1	Unit No. 1	Foster-Wheeler Boiler (w/ SNCR)	327 MMBtu/hr	Coal/ULSD	8,102 hours
				ULSD	249,930 gallons
2	Unit No. 2	TRW Integrated Entrained Combustion System (w SCR)	658 MMBtu/hr	Coal/ULSD	6,626 hours
				ULSD	700,600 gallons
3	Auxiliary Boiler No. 1	Cleaver Brooks CB 189-300	12.554 MMBtu/hr	ULSD	8,111 gallons
4	Auxiliary Boiler No. 2	Cleaver Brooks CB 100-800	23.0 MMBtu/hr	ULSD	64,040 gallons
5	Diesel Generator Engine No. 1	Electro-Motive Diesel EMD 20-645-E4	2.75 MW	ULSD	0 gallons
6	Crusher System	2 grizzlies, 1 primary Stamler crusher, 2 belt feeders, 2 secondary Flextooth-Dresser crushers, 2 hoppers, and the No. 1 conveyor belt (tail-end), all commonly vented to Dust Collector No. 1 (baghouse/exhaust fan).	12,000 cfm	Coal	2,754 hours [2]
7	Limestone Storage Silo	Limestone Storage Silo with Baghouse	800 cfm	Lime	0 hours
8	Flyash Storage Silo	Flyash Storage Silo with Baghouse	5,000 cfm	Flyash	7,787 hours
9	Sodium Bicarbonate Handling System	Mill, Sodium Bicarbonate Silo, and Baghouse	440 cfm	Sodium Bicarbonate	3,086 hours
10	Coal Handling System	No. 1 conveyor belt (head-end), No. 2 2a conveyor belt, No. 2b conveyor belt, one bucket elevator, No. 3 conveyor belt, No. 4 conveyor belt, two 600 ton EU ID 2 coal storage silos, two EU ID 1 bunkers, all commonly vented to Dust Collector No. 2 (baghouse/exhaust fan). Note: When EU ID 2 is not operational, dust is collected at the EU ID 1 transfer points via a Dust Collector No. 3 (baghouse/exhaust fan).	20,000 cfm	Coal	2,321 hours [2]
11	Haul Road	Haul Road (located on GVEA property) from Usibelli Coal Mine property line to coal pile	0.25 miles	Fugitive Dust	8,760 hours
12	Coal Storage Pile	Open Coal Storage Pile	15 day supply	Coal	8,760 hours
13	Firewater Pump Engine	Caterpillar 3406B	264 hp	ULSD	6 hours

Notes:
[1] Hours are based on CY2022 operation in accordance with condition 112 Permit No. AQ0173TVP03.
[2] Emissions units do not operate continuously.

Table 2b. FY2024 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel / Material	CY2022 Actual	Rating
ID	Description	Make/Model	Type	Operation	
N/A	Lime Storage Silo No. 1	N/A	Lime	6,580 hours [1]	1,800 acfm
N/A	Lime Storage Silo No. 2	N/A	Lime		1,800 acfm
N/A	Ash Handling	N/A	Ash	8,760 hours	Not Applicable
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	8,760 hours	Not Applicable
N/A	AST Diesel Tanks (2)	N/A	Diesel	8,760 hours	25,000 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,760 hours	2,000 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,760 hours	300 gallons
N/A	AST Diesel Tank	N/A	Diesel	8,760 hours	425 gallons
N/A	Central Vac (3)	Turbo Tron	Coal	1,095 hours [2]	900 acfm
N/A	Urea Storage Silo A/B Bin Vent Filter	N/A	Urea	148 hours [3]	1,500 acfm
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	N/A	Urea	185 hours [4]	400 acfm
N/A	Sodium Bicarbonate Unloading Portable Baghouse	N/A	Sodium Bicarbonate	0 hours [5]	850 scfm

Note:
[1] This emissions unit is associated with EU ID 2.
[2] Estimated operation of 1,095 hours is assumed with each of the three units operating one hour per day.
[3] The estimated maximum annual use is 160 hr/yr. This emissions unit is associated with the EU ID 1 SNCR system and the EU ID 2 SCR system.
Estimated CY2022 Hours = (160 hr/yr) x (maximum actual hours for EU IDs 1 or 2 during CY2022) / (8,760 potential hours)
[4] The estimated maximum annual use is 200 hr/yr. This emissions unit is associated with the EU ID 1 SNCR system and the EU ID 2 SCR system.
Estimated CY2022 Hours = (200 hr/yr) x (maximum actual hours for EU IDs 1 or 2 during CY2022) / (8,760 potential hours)
[5] This emissions unit is associated with EU ID 1.

Table 3. FY2024 Assessable Emissions Calculations - Oxides of Nitrogen (NOX) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	NO_X Emission	CY2022 Actual	CY2022 Actual
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	NO_X Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2022 CEMS Data (with SNCR)	51.9 lb/hr	8,102 hours	210.3 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2022 CEMS Data (with SCR)	27.1 lb/hr	6,626 hours	89.8 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42 Table 1.3-1	20 lb/10^3 gal	8,111 gallons	0.1 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42 Table 1.3-1	20 lb/10^3 gal	64,040 gallons	0.6 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42 Table 3.4-1	3.2 lb/MMBtu	0 gallons	0 tpy
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,754 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	7,787 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	3,086 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,321 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.031 lb/hp-hr	6 hours	0.02 tpy
Significant Emissions Units Emissions - CY2022 Actual Emissions - NOX							**300.8 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	6,580 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,760 hours	0 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	148 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	185 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	0 hours	0 tpy
Insignificant Emissions Units Emissions - CY2022 Actual Emissions - NOX							**0 tpy**
CY2022 Actual Emissions - NOX							**300.8 tpy**

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 4. FY2024 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Emissions Unit Rating/Capacity	Fuel Type	Factor Reference	CO Emission Factor	CY2022 Actual Operation	CY2022 Actual CO Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2022 CEMS Data	203.7 lb/hr	8,102 hours	825.2 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2022 CEMS Data	2.9 lb/hr	6,626 hours	9.6 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-1	5 lb/10^3 gal	8,111 gallons	0.02 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Table 1.3-1	5 lb/10^3 gal	64,040 gallons	0.2 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42, Table 3.4-1	0.85 lb/MMBtu	0 gallons	0 tpy
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,754 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	7,787 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	3,086 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,321 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.00668 lb/hp-hr	6 hours	0.005 tpy
Significant Emissions Units Emissions - CY2022 Actual Emissions - CO							**835.0 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	6,580 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,760 hours	0 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	148 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	185 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	0 hours	0 tpy
Insignificant Emissions Units Emissions - CY2022 Actual Emissions - CO							**0 tpy**
CY2022 Actual Emissions - CO							**835.0 tpy**

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 5. FY2024 Assessable Emissions Calculations - Particulate Matter (PM) Emissions (Filterable and Condensable)
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	PM Emission	CY2022 Actual	CY2022 Actual
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	PM Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2022 CEMS Data	1.3 lb/hr	8,102 hours	5.3 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2022 CEMS Data	1.5 lb/hr	6,626 hours	5.0 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Tables 1.3-2 and 1.3-6	2.3 lb/10^3gal	8,111 gallons	0.009 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Tables 1.3-2 and 1.3-6	2.3 lb/10^3gal	64,040 gallons	0.07 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42 Table 3.4-2	0.0573 lb/MMBtu	0 gallons	0 tpy
6	Crusher System	12,000 cfm	Coal	Permit AQ0173TVP03, Table B	2.05 lb/hr	2,754 hours	2.8 tpy
7	Limestone Storage Silo	800 cfm	Lime	Permit AQ0173TVP03, Table B	0.14 lb/hr	0 hours	0.0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	Permit AQ0173TVP03, Table B	0.86 lb/hr	7,787 hours	3.3 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	Design Specifications	0.02 gr/dscf	3,086 hours	0.1 tpy
10	Coal Handling System	20,000 cfm	Coal	Permit AQ0173TVP03, Table B	3.43 lb/hr	2,321 hours	4.0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	See Table 5a		8,760 hours	0.9 tpy
12	Coal Storage Pile	15 day supply	Coal	See Table 5b		8,760 hours	0.7 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.0022 lb/hp-hr	6 hours	0.002 tpy
Significant Emissions Units Emissions - CY2022 Actual Emissions - PM							**22.2 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf	6,580 hours	0.3 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf		
N/A	Ash Handling	Not Applicable	Ash	See Table 5c		8,760 hours	0.05 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	See Table 5d		8,760 hours	0.2 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	Engineering Estimate	0.05 gr/dcf	1,095 hours	0.2 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	Engineering Estimate	0.005 gr/dcf	148 hours	0.005 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	Engineering Estimate	0.005 gr/dcf	185 hours	0.002 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	Vendor Data	0.02 gr/acf	0 hours	0 tpy
Insignificant Emissions Units Emissions - CY2022 Actual Emissions - PM							**0.68 tpy**
CY2022 Actual PM Emissions							**22.9 tpy**

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, gr/dcf) x (Rating, cfm) x (Conversion, 60 min/hr) x (Operation, hr/yr) / (Conversion, 7,000 gr/lb) / (Conversion, 2,000 lb/ton)

Table 5a. FY2024 Assessable Emissions Calculations - Haul Road Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Factor Reference	Emission Factor	CY2022 Actual Operation	CY2022 Actual PM Emissions
11	Coal Haul - Unpaved Portion	AP-42, Section 13.2.2	1.32 lb/VMT [1]	1,385 VMT [1]	0.9 tpy
				CY2022 Actual PM Emissions	**0.9 tpy**

Notes:
[1] Coal Haul Road

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	193.75	tons, estimate - average of full (262.5 ton) and empty (125 ton) truck
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	4.53	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.81	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	1.32	lb/VMT

Table 5a. FY2024 Assessable Emissions Calculations - Haul Road Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Coal Throughput

$$Throughput = \frac{Capacity\left(\frac{MMBtu}{hr}\right) \times Operation\left(\frac{hr}{year}\right)}{Coal\ Heat\ Value\left(\frac{MMBtu}{ton}\right)}$$

EU ID 1 CY2022 actual coal throughput	153,568	tons
EU ID 2 CY2022 actual coal throughput	227,339	tons
Total CY2022 actual coal throughput	380,907	tons

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\left(\frac{tons}{trip}\right)}$$

Haul truck capacity	138	tons, estimate
Unpaved distance from coal pile to paved road (round trip)	0.50	miles/trip
Unpaved road VMT =	1,385.12	miles

Table 5b. FY2024 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Factor Reference	Emission Factor	CY2022 Actual Operation	CY2022 Actual PM Emissions
12	Truck Drop Onto Stockpile	AP-42, Section 13.2.4	1.20E-04 lb/ton [1]	380,907 tpy [1]	0.02 tpy
	Front End Loader Drop Into Grizzly	AP-42, Section 13.2.4	1.20E-04 lb/ton [1]	380,907 tpy [1]	0.02 tpy
	Front End Loader Movement - Coal Pile to Grizzly	AP-42, Section 13.2.2	0.93 lb/VMT [2]	1,385 VMT [2]	0.6 tpy
	Stockpile Wind Erosion	AP-42, Section 13.2.5	0 g/m^2-yr [3]	10,150 m^2 [3]	0 tpy
				CY2022 Actual PM Emissions	**0.7 tpy**

Notes:

[1] Truck Drop onto Stockpile and Front End Loader Drop to Grizzly

Drop Operation Emission Factor:

AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right)=\frac{k\times 0.0032\times\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

	PM		
k	0.35		AP-42, Section 13.2.4
U = mean wind speed	17.67	miles/hr	Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant
M = coal moisture content	31.80	percent	Weighted average from EU ID 1 and 2 CY2022 coal proximate analyses
E =	1.20E-04	lb/ton	

Annual Stockpile Throughput:

$$Throughput=\frac{Capacity\left(\frac{MMBtu}{hr}\right)\times Operation\left(\frac{hr}{year}\right)}{Coal\ Heat\ Value\left(\frac{MMBtu}{ton}\right)}$$

EU ID 1 CY2022 actual coal throughput	153,568	tons
EU ID 2 CY2022 actual coal throughput	227,339	tons
Total CY2022 actual coal throughput	380,907	tons

[2] Front End Loader Movement

Coal moved per trip:

$$Coal\ (tons)=\frac{Coal\ Density\left(\frac{lb}{ft^3}\right)\times 27\left(\frac{ft^3}{yd^3}\right)\times Bucket\ Size(yd^3)}{2000\left(\frac{lb}{ton}\right)}$$

Size of load bucket	11	yd^3
Density of coal	52.63	lb/ft^3
Coal moved per trip	7.815555	tons

Table 5b. FY2024 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emission Factor
AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	33.2	tons, estimate
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	3.21	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.28	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.93	lb/VMT

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\left(\frac{tons}{trip}\right)}$$

Total Actual Coal Throughput	380,907	tons
Coal moved per trip	7.815555	tons
Approximate distance from coal pile to grizzly (round trip)	150	feet
VMT = vehicles miles traveled per year	1,385	

Table 5b. FY2024 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

[3] Stockpile Wind Erosion

Coal Pile Surface Area

Surface area of active face = 10,150 m^2 — Engineering estimate of projected use

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\left(\frac{g}{m^2 yr}\right) = k\sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (AP-42 Section 13.2.5.3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\,(u^* - u_t^*)^2 + 25\,(u^* - u_t^*)$$

$$P = 0\ for\ u^* \leq u_t^*$$

where u* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u*

$$u^* = \frac{0.4 \times u(z)}{\ln\left(\frac{z}{z_o}\right)}\quad when\ z > z_o$$

where u* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at McKinley Airport ASOS for each month in CY2021 (see table below)
z	10	meters
N	365	disturbances/year for active face, estimated
	30	average disturbances/month

Table 5b. FY2024 Assessable Emissions Calculations - Coal Storage Pile Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

				Uncrusted Coal Pile [b] (Table 13.2.5-2)				Ground Coal (Table 13.2.5-2)						
Month-Year	Average Wind Speed (u(10)) [a]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Jan-22	2.9	1.3	200	0.3	1.12	0.06	0	0.01	0.55	0.05	0	0		
Feb-22	4.9	2.2	297	0.3	1.12	0.11	0	0.01	0.55	0.08	0	0		
Mar-22	4.9	2.2	200	0.3	1.12	0.11	0	0.01	0.55	0.08	0	0		
Apr-22	4.3	1.9	360	0.3	1.12	0.10	0	0.01	0.55	0.07	0	0		
May-22	3.6	1.6	150	0.3	1.12	0.08	0	0.01	0.55	0.06	0	0		
Jun-22	4.3	1.9	15	0.3	1.12	0.10	0	0.01	0.55	0.07	0	0		
Jul-22	3.4	1.5	265	0.3	1.12	0.08	0	0.01	0.55	0.05	0	0		
Aug-22	2.8	1.3	360	0.3	1.12	0.06	0	0.01	0.55	0.04	0	0		
Sep-22	3.8	1.7	180	0.3	1.12	0.08	0	0.01	0.55	0.06	0	0		
Oct-22	4.2	1.9	360	0.3	1.12	0.09	0	0.01	0.55	0.06	0	0		
Nov-22	3.6	1.6	10	0.3	1.12	0.08	0	0.01	0.55	0.06	0	0		
Dec-22	2.9	1.3	20	0.3	1.12	0.06	0	0.01	0.55	0.05	0	0		
CY2022 PM_{10} Annual Total							0				0	0	0.5	**0**

[a] Per https://mesonet.agron.iastate.edu/request/download.phtml?network=AK_ASOS for CY2022, McKinley Airport ASOS (PAIN).

[b] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions.

Table 5c. FY2024 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Factor Reference	Emission	Emission Factor	CY2022 Actual Operation	CY2022 Actual PM Emissions
N/A	Front End Loader / Flyash Storage Silo Drop Into Truck	AP-42, Section 13.2.4	PM	1.39E-04 lb/ton [1]	17,232 tons	1.2E-03 tpy
	Front End Loader Movement - Ash Drying Area to Truck	AP-42, Section 13.2.2	PM	0.85 lb/VMT [1]	106 VMT	4.5E-02 tpy
	Ash Drying Area Wind Erosion	AP-42, Section 13.2.5	PM	0 g/m^2	4,800 m^2 [2]	0 tpy
					CY2022 Actual PM Emissions	**4.6E-02 tpy**

Notes:

[1] Front End Loader / Flyash Storage Silo Drop into Truck

AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

	PM		
k	0.35		
U = mean wind speed	17.67	miles/hr	Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant
M = ash moisture content	17.5	percent	Avg of slag, bottom ash, and fly ash from Heat and Material Balance for HCCP - March 6, 1998
E (uncontrolled) =	2.77E-04	lb/ton	
Efficiency =	50%	assumption because material is wet	
E (controlled) =	1.39E-04	lb/ton	

Annual stockpile throughput:

EU ID 1 CY2022 Ash Throughput	17,232	tons
EU ID 2 CY2022 Ash Throughput	24,068	tons
Total Ash Throughput	41,300	tons

[2] Front End Loader Movement - Ash Pile to Truck

Ash moved per trip:

$$Ash\,(tons) = \frac{Ash\ Density\left(\frac{lb}{ft^3}\right) \times 27\left(\frac{ft^3}{yd^3}\right) \times Bucket\ Size(yd^3)}{2000\left(\frac{lb}{ton}\right)}$$

Size of load bucket	8	yd^3
Density of ash	60	lb/ft^3
Ash moved per trip	6.48	tons

Table 5c. FY2024 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

AP-42, Section 13.2.2

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons, estimate
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	2.92	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.17	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.85	lb/VMT

Approximate distance from ash pile to truck (round trip)	150	feet
VMT = vehicles miles traveled per year	105.52	

From AP-42, Section 13.2.5, Industrial Wind Erosion
Ash Pile Surface Area

Surface area of active face =	4,800	m^2	Engineering estimate of projected use

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\left(\frac{g}{m^2 yr}\right) = k\sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (0.5 for particle size < 10 microns, per AP-42 Section 13.2.5.3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

Table 5c. FY2024 Assessable Emissions Calculations - Ash Handling Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\,(u^* - u_t^*)^2 + 25\,(u^* - u_t^*)$$

$$P = 0\ for\ u^* \le u_t^*$$

where u* = friction velocity (m/s)

u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u*

$$u^* = \frac{0.4 \times u(z)}{\ln\left(\frac{z}{z_o}\right)}\quad when\ z > z_o$$

where u* = friction velocity (cm/s)

u(z) = wind speed at height z above test surface (cm/s)

z = height above test surface (cm)

z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at McKinley Airport ASOS for each month in CY2021 (see table below)
z	10	meters
N	365	disturbances/year for active face, estimated
	30	average disturbances/month

Ash pile [a] (Table 13.2.5-2)												
Month-Year	Average Wind Speed (u(10)) [b]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor (uncontrolled), EF	Emission Factor (controlled), EF [c]
	mph	m/s	deg	cm	m/s	m/s				g/m²-yr	g/m²-yr
Jan-22	2.9	1.3	200	0.3	1.02	0.06	0	0			
Feb-22	4.9	2.2	297	0.3	1.02	0.11	0	0			
Mar-22	4.9	2.2	200	0.3	1.02	0.11	0	0			
Apr-22	4.3	1.9	360	0.3	1.02	0.10	0	0			
May-22	3.6	1.6	150	0.3	1.02	0.08	0	0			
Jun-22	4.3	1.9	015	0.3	1.02	0.10	0	0			
Jul-22	3.4	1.5	265	0.3	1.02	0.08	0	0			
Aug-22	2.8	1.3	360	0.3	1.02	0.06	0	0			
Sep-22	3.8	1.7	180	0.3	1.02	0.08	0	0			
Oct-22	4.2	1.9	360	0.3	1.02	0.09	0	0			
Nov-22	3.6	1.6	010	0.3	1.02	0.08	0	0			
Dec-22	2.9	1.3	020	0.3	1.02	0.06	0	0			
CY2022 PM_{10} Annual Total							0	0	0.5	**0**	**0**

[a] No emission factor exists for ash. Overburden is considered the most representative alternative because it includes both fine (ash) and coarse (slag) particles.

[b] Per https://mesonet.agron.iastate.edu/request/download.phtml?network=AK_ASOS for CY2022, McKinley Airport ASOS (PAIN).

[c] Control efficiency of 50% is assumed since material wet.

Table 5d. FY2024 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit ID	Emissions Unit Description	Factor Reference	Emission Factor	CY2022 Actual Operation	CY2022 Actual PM Emissions
N/A	Ash Haul - Unpaved (EU ID 1)	AP-42, Section 13.2.2	1.18 lb/VMT [1]	127 VMT [1]	0.07 tpy
	Ash Haul - Unpaved (EU ID 2)	AP-42, Section 13.2.2	1.18 lb/VMT [1]	133 VMT [1]	7.8E-02 tpy
	Limestone/Lime Delivery - Paved Portion	AP-42, Section 13.2.1	0.08 lb/VMT [2]	28 VMT [2]	1.1E-03 tpy
	Limestone/Lime Delivery - Unpaved Portion	AP-42, Section 13.2.2	1.07 lb/VMT [2]	13 VMT [2]	7.1E-03 tpy
	Miscellaneous Traffic - Paved Portion	AP-42, Section 13.2.1	0.001 lb/VMT [3]	5,185 VMT [3]	3.4E-03 tpy
				CY2022 Actual PM Emissions	**0.16 tpy**

Notes:
[1] Ash Haul Road

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	151.25	tons, estimate - average of full (197.5 ton) and empty (105 ton) truck
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	4.05	lb/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.62	lb/VMT

Table 5d. FY2024 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	1.18	lb/VMT

Ash Throughput

EU ID 1 ash disposal throughput	17,232	tons	from Healy environmental report
EU ID 2 ash disposal throughput	24,068	tons	from Healy environmental report

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\,(tons) \times Roundtrip\ Distance\,\left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\,\left(\frac{tons}{trip}\right)}$$

Haul truck capacity	92.5	tons, estimate
Unpaved distance to ash drying area (round trip)	0.68	miles/trip
Unpaved distance to EU ID 8 (round trip)	0.51	miles/trip
EU ID 1 unpaved road VMT =	127.02	miles
EU ID 2 unpaved road VMT =	133.05	miles

Table 5d. FY2024 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

[2] Limestone/Lime/Sodium Bicarbonate Haul Road

Paved Road Emission Factor

AP-42, Section 13.2.1, Equation 1:

$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

	PM	
k = particle size multiplier	0.0022	lb/VMT from AP-42 Table 13.2.1-1
sL = surface material silt content (haul road)	0.6	g/m^2, from AP-42, Table 13.2.1-3
W = mean vehicle weight	122.5	tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer
E (uncontrolled) =	0.17	lb/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	0.09	lb/VMT

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.

AP-42, Section 13.2.1, Equation 2:

$$E_{ext} = E\left(1 - \frac{P}{4 * 365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT

E = emission factor from Equation 1a

P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.08	lb/VMT

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

$$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}$$

	PM	
k	1.5	from AP-42, Table 13.2.2-2
s = surface material silt content (haul road)	5.1	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	122.5	tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
E (uncontrolled) =	3.69	lb/VMT
Efficiency =	60%	assumed control efficiency for water
E (controlled) =	1.47	lb/VMT

Table 5d. FY2024 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.2, Equation 2:

$$E_{ext} = E\left(\frac{365 - P}{365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	1.07	lb/VMT

Throughput

Limestone/Lime Throughput	2,042	tons, CY2022 actual
Sodium Bicarbonate Throughput	463	tons, CY2022 actual

Vehicle Miles Traveled (VMT)

$$VMT = \frac{Throughput\ (tons) \times Roundtrip\ Distance\ \left(\frac{miles}{trip}\right)}{Haul\ Truck\ Capacity\ \left(\frac{tons}{trip}\right)}$$

Haul truck capacity	25	tons, estimate
Paved distance (round trip)	0.28	miles/trip
Unpaved distance (round trip)	0.13	miles/trip
Paved road VMT =	28.47	miles
Unpaved road VMT =	13.29	miles

[3] Miscellaneous Traffic

Paved Road Emission Factor

AP-42, Section 13.2.1, Equation 1:

$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

	PM	
k = particle size multiplier	0.0022	lb/VMT from AP-42 Table 13.2.1-1
sL = surface material silt content (haul road)	0.6	g/m^2, from AP-42, Table 13.2.1-3
W = mean vehicle weight	2	tons, estimate
E (uncontrolled) =	0.0028	lb/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	1.41E-03	lb/VMT

Table 5d. FY2024 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions
Golden Valley Electric Association - Healy Power Plant

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center.
AP-42, Section 13.2.1, Equation 2:

$$E_{ext} = E\left(1 - \frac{P}{4 * 365}\right)$$

E_{ext} = annual size-specific emission factor extrapolated for water mitigation, lb/VMT
E = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

	PM	
E (controlled) =	0.001	lb/VMT

Vehicle Miles Traveled (VMT)

Traffic volume	50	trips per day
Paved distance (round trip)	0.28	miles/trip
Paved road VMT =	5,184.66	miles

Table 6. FY2024 Assessable Emissions Calculations - Volatile Organic Compounds (VOC) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	VOC Emission	CY2022 Actual	CY2022 Actual
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	VOC Emissions
Significant Emissions Units							
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	AP-42, Table 1.1-19	0.06 lb/ton	8,102 hours	4.6 tpy [1]
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	AP-42, Table 1.1-19	0.04 lb/ton	6,626 hours	4.5 tpy [2]
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10^3 gal	8,111 gallons	0.001 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10^3 gal	64,040 gallons	0.01 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42, Table 3.4-1	0.0819 lb/MMBtu	0 gallons	0 tpy
6	Crusher System	12,000 cfm	Coal	N/A	N/A	2,754 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	7,787 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	3,086 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,321 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	6 hours	0.002 tpy
						Significant Emissions Units Emissions - CY2022 Actual VOC Emissions	**9.2 tpy**
Insignificant Emissions Units							
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	6,580 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	148 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	185 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	0 hours	0 tpy
						Insignificant Emissions Units Emissions - CY2022 Actual VOC Emissions	**0 tpy**
						CY2022 Actual VOC Emissions	**9.2 tpy**

Notes
[1] EU ID 1 actual coal throughput 153,568 tons
[2] EU ID 2 actual coal throughput 227,339 tons

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/ton) x (Potential throughput, ton/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/10^3 gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10^3 gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Table 7. FY2024 Assessable Emissions Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Healy Power Plant

Emissions Unit			Fuel	Factor	Maximum Fuel	SO_2 Emission	CY2022 Actual	CY2022 Actual
ID	Description	Rating/Capacity	Type	Reference	Sulfur Content	Factor	Operation	SO_2 Emissions
Significant Emissions Units								
1	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2022 CEMS Data	N/A	68.7 lb/hr	8,102 hours	278.4 tpy
2	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2022 CEMS Data	N/A	20.1 lb/hr	6,626 hours	66.6 tpy
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	8,111 gallons	8.6E-04 tpy
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	64,040 gallons	0.007 tpy
5	Diesel Generator Engine No. 1	2.75 MW	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	0 gallons	0 tpy
6	Crusher System	12,000 cfm	Coal	N/A	N/A	N/A	2,754 hours	0 tpy
7	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	N/A	0 hours	0 tpy
8	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	N/A	7,787 hours	0 tpy
9	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	N/A	3,086 hours	0 tpy
10	Coal Handling System	20,000 cfm	Coal	N/A	N/A	N/A	2,321 hours	0 tpy
11	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	N/A	8,760 hours	0 tpy
12	Coal Storage Pile	15 day supply	Coal	N/A	N/A	N/A	8,760 hours	0 tpy
13	Firewater Pump Engine	264 hp	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal [1,2]	6 hours	8.9E-06 tpy [3,4]
Significant Emissions Units Emissions - CY2022 Actual Emissions - SO_2								**344.9 tpy**
Insignificant Emissions Units								
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	N/A	6,580 hours	0 tpy
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	N/A		
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	N/A	8,760 hours	0 tpy
N/A	Central Vac (3)	900 acfm	Coal	N/A	N/A	N/A	1,095 hours	0 tpy
N/A	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	N/A	148 hours	0 tpy
N/A	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	N/A	185 hours	0 tpy
N/A	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	N/A	0 hours	0 tpy
Insignificant Emissions Units Emissions - CY2022 Actual Emissions - SO_2								**0 tpy**
CY2022 Actual Emissions - SO_2								**344.9 tpy**

Notes:

[1] Mass balance:

For diesel units, the SO_2 emission factor is calculated based on the sulfur content in diesel fuel

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol; Stoichiometry: 1 mol S = 1 mol SO_2

SO_2 Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

[2] Diesel Fuel Density	7.1 lb/gal	AP 42, Table 3.4-1, footnote a
[3] Diesel Heating Value	133,117 Btu/gal	lab analysis
[4] Engine Heat Rate	7,000 Btu/hp-hr	AP 42, Table 3.4-1, footnote e

Sample Calculations:
Emissions (tpy) = (Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/gal) x (Fuel consumption, gal/yr) / (Conversion, 2,000 lb/ton)
Emissions (tpy) = (Emission factor, lb/gal) / (Fuel heat value, Btu/gal) x (Engine heat rate, Btu/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

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Golden Valley Electric Association
FY2024 Assessable Emission Estimates

North Pole Power Plant – Permit No. AQ0110TVP04 Rev 1

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Table 1. FY2024 Assessable Emissions Summary
Golden Valley Electric Association - North Pole Power Plant

	Regulated Air Pollutant Emissions (tons per year) [1,2]					
	NO_X	CO	PM_{10} [3]	VOC	SO_2	HAP [4]
Significant	852.4	8.7	22.3	0.77	118.1	
Insignificant	0	0	0	0	0	
Total Emissions	**853**	**9**	**22**	**1**	**118**	
Assessable Emission Subtotals	**853**	**9**	**22**	**1**	**118**	**0**
2022 Actual Emissions	**1,003**					
Fee Estimate [5]	**$84,504**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Assessable emission fees for GHGs have not been established under 18 AAC 50.

[3] $PM_{2.5}$ emissions are a subset of PM_{10} emissions and are excluded from the assessable emissions total to avoid a double payment.

[4] HAP emissions are a subset of either VOC emissions or PM emissions and are excluded from the assessable emissions total to avoid a double payment.

[5] A fee rate of $84.29 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2024 Significant Emissions Unit Summary
Golden Valley Electric Association - North Pole Power Plant

Emission Unit			Fuel Type	Maximum Capacity	CY2022 Actual Operation	CY2022 Actual Fuel Consumption
ID	Description	Make/Model				
1	Simple Cycle Gas Turbine	GE Frame 7, Series 7001, Model BR	ULSD	672 MMBtu/hr	169.0 hr/yr	66,576 gal/yr
			No. 1 Diesel			115,669 gal/yr
			No. 2 Diesel			305,184 gal/yr
2	Simple Cycle Gas Turbine	GE Frame 7, Series 7001, Model BR	ULSD	672 MMBtu/hr	1,913.3 hr/yr	1,476,484 gal/yr
			No. 1 Diesel			967,541 gal/yr
			No. 2 Diesel			3,384,881 gal/yr
5	Combined Cycle Gas Turbine	GE LM6000PC	ULSD	455 MMBtu/hr	8,100.0 hr/yr	262,514 gal/yr
			No. 1 Diesel			0 gal/yr
			Naphtha			26,058,464 gal/yr
6	Combined Cycle Gas Turbine	GE LM6000PC	ULSD	455 MMBtu/hr	0 hr/yr	0 gal/yr
			No. 1 Diesel			0 gal/yr
			Naphtha			0 gal/yr
7	Emergency Generator Engine	Mitsubishi 0A8829	ULSD	564.6 hp[1]	1.8 hr/yr	58 gal/yr
11	Boiler	Bryan Steam RV500	Propane	5.0 MMBtu/hr	134.7 hr/yr	7,354 gal/yr
12	Boiler	Bryan Steam RV500		5.0 MMBtu/hr		

Notes:
[1] The generator has an electrical output of 400 kW. Assuming a 95% efficiency (per Section 2.7.2.1 of ADEC Modeling Review Procedures Manual) and converting from Kw to hp, the rating is 564.6 hp.
Input Rating, hp= (Output Rating, kW) / (Efficiency, 0.95) * (Conversion, 1.341 hp/kW)

Table 2b. FY2024 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - North Pole Power Plant

Emission Unit		Fuel Type/ Material	Rating/Size	CY2022 Actual Operation	CY2022 Actual Fuel Consumption
ID[1]	Description				
3	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,760 hr/yr	N/A
4	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,760 hr/yr	N/A
N/A	FHR Warehouse Boiler 1	No. 2 Diesel	0.784 MMBtu/hr	8,760 hr/yr	6,052 gal/yr
N/A	FHR Warehouse Boiler 2	No. 2 Diesel	0.784 MMBtu/hr	8,760 hr/yr	
N/A	Burnham 17 A-T Boiler	ULSD	0.222 MMBtu/hr	1,703 hr/yr	3,235 gal/yr

[1] EU IDs 3 and 4 are not currently subject to 40 CFR 60 Subpart Kb.

Table 3. FY2024 Assessable Emission Calculations - Oxides of Nitrogen (NO_X) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	NO_X Emission Factor	CY2022 Actual Operation	CY2022 Actual NO_x Emissions [2]
Significant Emission Units							
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD No. 1 Diesel No. 2 Diesel	2022 CEMS Average [1]	307.8 lb/hr	169.0 hours	26.0 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-1	0.88 lb/MMBtu	1,476,484 gal/yr	86.9 tpy
			No. 1 Diesel			967,541 gal/yr	58.2 tpy
			No. 2 Diesel			3,384,881 gal/yr	203.4 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD No. 1 Diesel Naphtha	2022 CEMS Average [1]	118.0 lb/hr	8,100.0 hours	477.9 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-1	0.24 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.031 lb/hp-hr	1.8 hr/yr	0.02 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	13 lb/10^3gal	7,354 gal/yr	0.05 tpy
12	Boiler	5.0 MMBtu/hr					
						Significant Emission Units - 2022 Actual Emissions - NO_X	**852.4 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Table 1.3-1	18 lb/10^3gal	6,052 gal/yr	0.05 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	ULSD	AP-42 Table 1.3-1	18 lb/10^3gal	3,235 gal/yr	0.03 tpy
						Insignificant Emission Units - 2022 Actual Emissions - NO_X	**0.08 tpy**
						2022 Actual Emissions - NO_X	**852.5 tpy**

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Operation, gal/yr) / (2,000 lb/ton)

Notes:

[1] The emission factors for EU IDs 1 and 5 are an average emission rate from 2022 measured using Continuous Emissions Monitoring Systems (CEMS).
[2] Parameters:

HHV No. 1 Diesel =	136,602	Btu/gal	(based on average of CY2022 fuel tests)
HHV No. 2 Diesel=	136,602	Btu/gal	(based on average of CY2022 fuel tests)
HHV ULSD =	133,699	Btu/gal	(based on average of CY2022 fuel tests)
HHV Naphtha=	108,471	Btu/gal	(based on average of CY2022 fuel tests)

Table 4. FY2024 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	CO Emission Factor	CY2022 Actual Operation	CY2022 Actual CO Emissions [2]
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	2022 CEMS Average[1]	6.5 lb/hr	169.0 hours	0.5 tpy
			No. 1 Diesel				
			No. 2 Diesel				
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-1	0.0033 lb/MMBtu	1,476,484 gal/yr	0.3 tpy
			No. 1 Diesel			967,541 gal/yr	0.2 tpy
			No. 2 Diesel			3,384,881 gal/yr	0.8 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	2022 CEMS Average[1]	1.7 lb/hr	8,100.0 hours	6.8 tpy
			No. 1 Diesel				
			Naphtha				
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-1	0.076 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.00668 lb/hp-hr	1.8 hr/yr	0.003 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	7.5 lb/10^3gal	7,354 gal/yr	0.03 tpy
12	Boiler	5.0 MMBtu/hr					
Significant Emission Units - CY2022 Actual Emissions - CO							**8.7 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Table 1.3-1	5.0 lb/10^3gal	6,052 gal/yr	0.02 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	ULSD	AP-42 Table 1.3-1	5.0 lb/10^3gal	3,235 gal/yr	0.008 tpy
Insignificant Emission Units - CY2022 Actual Emissions - CO							**0.02 tpy**
CY2022 Actual Emissions - CO							**8.7 tpy**

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Operation, gal/yr) / (2,000 lb/ton)

Notes:

[1] The emission factors for EU IDs 1 and 5 are an average emission rate from 2022 measured using Continuous Emissions Monitoring Systems (CEMS).

[2] Parameters:

HHV No. 1 Diesel =	136,602	Btu/gal	(based on average of CY2022 fuel tests)
HHV No. 2 Diesel=	136,602	Btu/gal	(based on average of CY2022 fuel tests)
HHV ULSD =	133,699	Btu/gal	(based on average of CY2022 fuel tests)
HHV Naphtha=	108,471	Btu/gal	(based on average of CY2022 fuel tests)

Table 5. FY2024 Assessable Emission Calculations - Particulate Matter (PM_{10}) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	PM_{10} Emission Factor	CY2022 Actual Operation	CY2022 Actual PM_{10} Emissions [1]
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.012 lb/MMBtu	66,576 gal/yr	0.053 tpy
			No. 1 Diesel			115,669 gal/yr	0.09 tpy
			No. 2 Diesel			305,184 gal/yr	0.3 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.012 lb/MMBtu	1,476,484 gal/yr	1.2 tpy
			No. 1 Diesel			967,541 gal/yr	0.8 tpy
			No. 2 Diesel			3,384,881 gal/yr	2.8 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.012 lb/MMBtu	262,514 gal/yr	0.2 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			26,058,464 gal/yr	17.0 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.0022 lb/hp-hr	1.8 hr/yr	0.001 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	0.7 lb/10^3gal	7,354 gal/yr	0.003 tpy
12	Boiler	5.0 MMBtu/hr					
Significant Emission Units - 2022 Actual Emissions - PM_{10}							**22.3 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Tables 1.3-1 and 1.3-2	1.7 lb/10^3gal	6,052 gal/yr	0.005 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	ULSD	AP-42 Tables 1.3-1 and 1.3-2	1.7 lb/10^3gal	3,235 gal/yr	0.003 tpy
Insignificant Emission Units - 2022 Actual Emissions - PM_{10}							**0.008 tpy**
2022 Actual Emissions - PM_{10}							**22.3 tpy**

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Operation, gal/yr) / (2,000 lb/ton)

Notes:

[1] Parameters:

HHV No. 1 Diesel =	136,602	Btu/gal	(based on average of CY2022 fuel tests)
HHV No. 2 Diesel=	136,602	Btu/gal	(based on average of CY2022 fuel tests)
HHV ULSD =	133,699	Btu/gal	(based on average of CY2022 fuel tests)
HHV Naphtha=	108,471	Btu/gal	(based on average of CY2022 fuel tests)

Table 6. FY2024 Assessable Emission Calculations - Volatile Organic Compounds (VOC) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	VOC Emission Factor	CY2022 Actual Operation	CY2022 Actual VOC Emissions [1]
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	66,576 gal/yr	1.8E-03 tpy
			No. 1 Diesel			115,669 gal/yr	0.003 tpy
			No. 2 Diesel			305,184 gal/yr	0.01 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	1,476,484 gal/yr	0.04 tpy
			No. 1 Diesel			967,541 gal/yr	0.03 tpy
			No. 2 Diesel			3,384,881 gal/yr	0.1 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	262,514 gal/yr	0.007 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			26,058,464 gal/yr	0.6 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	0 gal/yr	0 tpy
			No. 1 Diesel			0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	AP-42 Table 3.3-1	0.0025 lb/hp-hr	1.8 hr/yr	0.001 tpy
11	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	1.0 lb/10^3gal	7,354 gal/yr	0.004 tpy
12	Boiler	5.0 MMBtu/hr					
Significant Emission Units - 2022 Actual Emissions - VOC							**0.8 tpy**
Insignificant Emission Units							
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	AP-42 Table 1.3-3	0.713 lb/10^3gal	6,052 gal/yr	0.002 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel				
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	ULSD	AP-42 Table 1.3-3	0.713 lb/10^3gal	3,235 gal/yr	0.001 tpy
Insignificant Emission Units - 2022 Actual Emissions - VOC							**0.003 tpy**
2022 Actual Emissions - VOC							**0.8 tpy**

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Operation, gal/yr) / (2,000 lb/ton)

Notes:

[1] Parameters:

HHV No. 1 Diesel =	136,602	Btu/gal	(based on average of CY2022 fuel tests)
HHV No. 2 Diesel=	136,602	Btu/gal	(based on average of CY2022 fuel tests)
HHV ULSD =	133,699	Btu/gal	(based on average of CY2022 fuel tests)
HHV Naphtha=	108,471	Btu/gal	(based on average of CY2022 fuel tests)

Table 7. FY2024 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	Maximum Fuel Sulfur Content [1]	SO_2 Emission Factor [2]	CY2022 Actual Operation	CY2022 Actual SO_2 Emissions
1	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	66,576 gal/yr	6.8E-03 tpy
			No. 1 Diesel	Mass Balance	0.101 wt. pct. S	0.014 lb/gal	115,669 gal/yr	0.79 tpy
			No. 2 Diesel	Mass Balance	0.400 wt. pct. S	0.058 lb/gal	305,184 gal/yr	8.9 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	1,476,484 gal/yr	0.15 tpy
			No. 1 Diesel	Mass Balance	0.101 wt. pct. S	0.014 lb/gal	967,541 gal/yr	6.6 tpy
			No. 2 Diesel	Mass Balance	0.400 wt. pct. S	0.058 lb/gal	3,384,881 gal/yr	98.8 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	262,514 gal/yr	0.03 tpy
			No. 1 Diesel	Mass Balance	0.101 wt. pct. S	0.014 lb/gal	0 gal/yr	0 tpy
			Naphtha	Mass Balance	0.0018 wt. pct. S	2.1E-04 lb/gal	26,058,464 gal/yr	2.7 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	0 gal/yr	0 tpy
			No. 1 Diesel	Mass Balance	0.101 wt. pct. S	0.014 lb/gal	0 gal/yr	0 tpy
			Naphtha	Mass Balance	0.0018 wt. pct. S	2.1E-04 lb/gal	0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	57.6 hr/yr	5.9E-06 tpy
11	Boiler	5.0 MMBtu/hr	Propane	Mass Balance	3.1E-06 wt. pct. S [3]	2.6E-07 lb/gal	7,354 gal/yr	9.6E-07 tpy
12	Boiler	5.0 MMBtu/hr						
Significant Emission Units - CY2022 Actual Emissions - SO_2								**118.1 tpy**
Insignificant Emission Units								
3	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
4	Fuel Oil Storage Tank	50,000 gallons	Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
N/A	FHR Warehouse Boiler 1	0.784 MMBtu/hr	No. 2 Diesel	Mass Balance	0.400 wt. pct. S	0.058 lb/gal	6,052 gal/yr	0.18 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel					
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	3,235 gal/yr	3.3E-04 tpy
Insignificant Emission Units - CY2022 Actual Emissions - SO_2								**0.2 tpy**
CY2022 Actual Emissions - SO_2								**118.2 tpy**

Sample Calculations: [2, 3, 4]

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

Turbine Emissions, tpy= (Emission factor, lb/gal) x (Fuel Use gal/yr) / (2,000 lb/ton)

Engine Emissions, tpy= (Emission factor, lb/gal) x (Capacity, gal/hr) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/gal) x (Operation, gal/yr) / (2,000 lb/ton)

Boiler wt. pct. S= (Sulfur compound content, ppmv SO_2) x (Conversion, 1.66E-7 lb SO_2/scf / ppm SO_2) x (F-factor, 8,710 scf/MMBtu) x (Conversion, 0.0216 MMBtu/lb) x (Conversion, mole SO_2/64 lb SO_2) x (Conversion, mole S/mole SO_2) x (Conversion, 32 lb S/ mole S)

Notes:

[1] Based on the average of monthly maximum fuel sulfur content values for calendar year 2022 as received from supplier sampling.

[2] Fuel density assumed equal to 6.8 lb/gal for ULSD and No. 1 Diesel, 7.3 lb/gal for No. 2 Diesel, 5.8 lb/gal for naphtha, and 4.2 lb/gal for propane.

[3] Propane fuel analysis results from 2022 indicate a fuel sulfur content less than 0.2 ppmv.

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Golden Valley Electric Association
FY2024 Assessable Emission Estimates

Zehnder Facility – Permit No. AQ0109TVP04

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Table 1. FY2024 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

	Regulated Air Pollutant Emissions (tons per year) [1,2]					
	NO_X	CO	PM_{10} [3]	VOC	SO_2	HAP [4]
Significant	72.7	0.4	1.0	0.04	23.0	
Insignificant	0.3	0.1	0.02	0.04	0.4	
Assessable Emission Subtotals	**73**	**0**	**1**	**0**	**23**	**0**
CY2022 Actual Emissions	**98**					
Fee Estimate [5]	**$8,266**					

Notes:

[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

[2] Assessable emission fees for GHGs have not been established under 18 AAC 50.

[3] $PM_{2.5}$ emissions are a subset of PM_{10} emissions and are excluded from the assessable emissions total to avoid a double payment.

[4] HAP emissions are a subset of either VOC emissions or PM emissions and are excluded from the assessable emissions total to avoid a double payment.

[5] A fee rate of $84.29 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2024 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

Emission Unit			Fuel	CY2022 Actual	Maximum	CY2022 Actual
ID[1]	Description	Make/Model	Type	Operation	Capacity	Fuel Consumption
1	Simple Cycle Gas Turbine	General Electric Frame 5 MS 5001-M	No. 1 ULS	896.9 hr/yr	268 MMBtu/hr	8,213 gal/yr
			No. 1 Diesel			443,243 gal/yr
			No. 2 Diesel			548,946 gal/yr
2	Simple Cycle Gas Turbine	General Electric Frame 5 MS 5001-M	No. 1 ULS	250.1 hr/yr	268 MMBtu/hr	5,372 gal/yr
			No. 1 Diesel			88,030 gal/yr
			No. 2 Diesel			109,024 gal/yr
3	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD	3.4 hr/yr	28 MMBtu/hr	1,218 gal/yr
4	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD	1.8 hr/yr	28 MMBtu/hr	
10	Boiler	Weil McLain H-688	No. 2 Heating Oil	743 hr/yr	1.7 MMBtu/hr	17,535 gal/yr
11	Boiler	Weil McLain H-688	No. 2 Heating Oil	743 hr/yr	1.7 MMBtu/hr	

[1] Source: Air Quality Permit No. AQ0109TVP04

Table 2b. FY2024 Assessable Emissions Summary
Golden Valley Electric Association - Zehnder Facility

Emission Unit		Fuel Type/ Material	Rating/Size	CY2022 Actual Operation
ID [1]	Description			
5	Fuel Oil Storage Tank	No. 2 Diesel	12,000 gallons	8,760 hr/yr
6	Fuel Oil Storage Tank	No. 2 Diesel	50,000 gallons	8,760 hr/yr
7	Fuel Oil Storage Tank	No. 2 Diesel	50,000 gallons	8,760 hr/yr
8	Burnham Boiler	No. 2 Heating Oil	0.44 MMBtu/hr	18,627 gal/yr
9	Burnham Boiler	No. 2 Heating Oil	0.44 MMBtu/hr	
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	10,671 scf
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	Waste Oil	0.28 MMBtu/hr	0 gal/yr
N/A	Energy Logic EL-340H Heater	Waste Oil	0.275 MMBtu/hr	0 gal/yr
N/A	Metzger Machine Corp. Boiler	No. 1 Diesel	0.12 MMBtu/hr	9,121 gal/yr
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	0.2 MMBtu/hr	916 gal/yr
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	0.2 MMBtu/hr	0 gal/yr
N/A	Energy Logic EL-350H Heater	Waste Oil - Transformer	0.35 MMBtu/hr	3,755 gal/yr

[1] Source: Renewal application for AQ0109TVP04

Table 3. FY2024 Assessable Emission Calculations - Oxides of Nitrogen (NO_X) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	NO_X Emission Factor	CY2022 Actual Operation	CY2022 Actual NO_x Emissions
Significant Emision Units							
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	8,213 gal/yr	0.5 tpy
			No. 1 Diesel			443,243 gal/yr	26.6 tpy
			No. 2 Diesel			548,946 gal/yr	33.0 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.88 lb/MMBtu	5,372 gal/yr	0.3 tpy
			No. 1 Diesel			88,030 gal/yr	5.3 tpy
			No. 2 Diesel			109,024 gal/yr	6.6 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	3.2 lb/MMBtu	1,218 gal/yr	0.27 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	20 lb/10^3gal	17,535 gal/yr	0.18 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emision Units - CY2022 Actual Emissions - NO_X							**72.7 tpy**
Insignificant Emision Units							
5	Fuel Oil Storage Tank	12,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	18 lb/10^3gal	18,627 gal/yr	0.17 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	100 lb/10^6scf	10,671 scf	5.34E-04 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 lb/10^3gal	0 gal/yr	0.00 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-1	18 lb/10^3gal	9,121 gal/yr	0.08 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 lb/10^3gal	916 gal/yr	0.01 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	19 lb/10^3gal	3,755 gal/yr	0.04 tpy
Insignificant Emision Units - CY2022 Actual Emissions - NO_X							**0.29 tpy**
CY2022 Actual Emissions - NO_X							**73.0 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 and 2 Diesel = 136,602 Btu/gal (based on average of CY2022 fuel tests)

Table 4. FY2024 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	CO Emission Factor	CY2022 Actual Operation	CY2022 Actual CO Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	8,213 gal/yr	1.9E-03 tpy
			No. 1 Diesel			443,243 gal/yr	1.0E-01 tpy
			No. 2 Diesel			548,946 gal/yr	1.2E-01 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-1	0.0033 lb/MMBtu	5,372 gal/yr	1.2E-03 tpy
			No. 1 Diesel			88,030 gal/yr	2.0E-02 tpy
			No. 2 Diesel			109,024 gal/yr	2.5E-02 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	0.85 lb/MMBtu	1,218 gal/yr	7.1E-02 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 lb/10^3gal	17,535 gal/yr	4.4E-02 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emission Units - CY2022 Actual Emissions - CO							**0.39 tpy**
Insignificant Emission Units							
5	Fuel Oil Storage Tank	12,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 lb/10^3gal	18,627 gal/yr	0.05 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	84 lb/10^6scf	10,671 scf	4.48E-04 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	5.0 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	5.0 lb/10^3gal	0 gal/yr	0.0E+00 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-1	5 lb/10^3gal	9,121 gal/yr	0.02 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	1.7 lb/10^3gal	916 gal/yr	7.8E-04 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	1.7 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	5.0 lb/10^3gal	3,755 gal/yr	0.01 tpy
Insignificant Emission Units - CY2022 Actual Emissions - CO							**0.08 tpy**
CY2022 Actual Emissions - CO							**0.47 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 and 2 Diesel = 136,602 Btu/gal (based on average of CY2022 fuel tests)

Table 5. FY2024 Assessable Emission Calculations - Particulate Matter (PM_{10}) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	PM_{10} Emission Factor	CY2022 Actual Operation	CY2022 Actual PM_{10} Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	8,213 gal/yr	6.7E-03 tpy
			No. 1 Diesel			443,243 gal/yr	3.6E-01 tpy
			No. 2 Diesel			548,946 gal/yr	4.5E-01 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.012 lb/MMBtu	5,372 gal/yr	0.00 tpy
			No. 1 Diesel			88,030 gal/yr	0.07 tpy
			No. 2 Diesel			109,024 gal/yr	0.09 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.4-2	0.0573 lb/MMBtu	1,218 gal/yr	4.8E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-2 & 1.3-7	2.38 $lb/10^3gal$	17,535 gal/yr	2.1E-02 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emission Units - CY2022 Actual Emissions - PM_{10}							**1.01 tpy**
Insignificant Emission Units							
5	Fuel Oil Storage Tank	12,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Tables 1.3-1 & 1.3-2	1.7 $lb/10^3gal$	18,627 gal/yr	0.02 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	5.5 $lb/10^6scf$	10,671 scf	2.9E-05 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-1	12 $lb/10^3gal$ [1]	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-1	12 $lb/10^3gal$ [1]	0 gal/yr	0.0E+00 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Tables 1.3-1 & 1.3-2	1.7 $lb/10^3gal$	9,121 gal/yr	7.8E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	N/A	916 gal/yr	0 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	N/A	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-1	0.1 $lb/10^3gal$ [2]	3,755 gal/yr	9.6E-05 tpy
Insignificant Emission Units - CY2022 Actual Emissions - PM_{10}							**0.02 tpy**
CY2022 Actual Emissions - PM_{10}							**1.04 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, $lb/10^3gal$) / (Conversion 1,000 $gal/10^3gal$) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)
Boiler Emissions, tpy= (Emission factor, $lb/10^6scf$) / (Conversion 1,000,000 $scf/10^6scf$) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 and 2 Diesel = 136,602 Btu/gal (based on average of CY2022 fuel tests)

[1] Ash Content of 0.233 percent by weight was determined through testing conducted in December 2016.
[2] Ash Content of 0.001 percent by weight was determined through testing conducted in December 2016.

Table 6. FY2024 Assessable Emissions Calculations - Volatile Organic Compound (VOC) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Maximum Capacity	Fuel Type	Factor Reference	VOC Emission Factor	CY2022 Actual Operation	CY2022 Actual VOC Emissions
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	8,213 gal/yr	2.3E-04 tpy
			No. 1 Diesel			443,243 gal/yr	1.2E-02 tpy
			No. 2 Diesel			548,946 gal/yr	0.02 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 ULS	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	5,372 gal/yr	1.5E-04 tpy
			No. 1 Diesel			88,030 gal/yr	2.5E-03 tpy
			No. 2 Diesel			109,024 gal/yr	0.00 tpy
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	0.08 lb/MMBtu	1,218 gal/yr	6.8E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD				
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.34 lb/10^3gal	17,535 gal/yr	3.0E-03 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil				
Significant Emission Units - CY2022 Actual Emissions - VOC							**0.04 tpy**
Insignificant Emission Units							
5	Fuel Oil Storage Tank	12,000 gallons	No. 2 Diesel	AP-42, Section 7.1	N/A	8,760 hr/yr	<0.01 tpy
6	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	AP-42, Section 7.1	N/A	8,760 hr/yr	<0.01 tpy
7	Fuel Oil Storage Tank	50,000 gallons	No. 2 Diesel	AP-42, Section 7.1	N/A	8,760 hr/yr	<0.01 tpy
8	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.7 lb/10^3gal	18,627 gal/yr	6.6E-03 tpy
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil				
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	7.6 lb/10^6scf	10,671 scf	4.1E-05 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas				
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-3	1 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-3	1 lb/10^3gal	0 gal/yr	0.0E+00 tpy
N/A	Metzger Machine Corp. Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-3	0.713 lb/10^3gal	9,121 gal/yr	3.3E-03 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1 lb/10^3gal	916 gal/yr	4.6E-04 tpy
N/A	Energy Logic EL-200H Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1 lb/10^3gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-3	1 lb/10^3gal	3,755 gal/yr	1.9E-03 tpy
Insignificant Emission Units - CY2022 Actual Emissions - VOC							**0.01 tpy**
CY2022 Actual Emissions - VOC							**0.06 tpy**

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, lb/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^3gal) / (Conversion 1,000 gal/10^3gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

HHV No. 1 and 2 Diesel = 136,602 Btu/gal (based on average of CY2022 fuel tests)

Table 7. FY2024 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Zehnder Facility

Emission Unit ID	Emission Unit Description	Fuel Type	Factor Reference	Fuel Sulfur Content [1,2]	SO_2 Emission Factor	CY2022 Actual Operation	CY2022 Actual SO_2 Emissions
1	Simple Cycle Gas Turbine	No. 1 ULS	Mass Balance	0.00041 wt. pct. S	0.000 lb/gal	8,213 gal/yr	0.00 tpy
		No. 1 Diesel	Mass Balance	0.10475 wt. pct. S	0.015 lb/gal	443,243 gal/yr	3.30 tpy
		No. 2 Diesel	Mass Balance	0.39988 wt. pct. S	0.057 lb/gal	548,946 gal/yr	15.59 tpy
2	Simple Cycle Gas Turbine	No. 1 ULS	Mass Balance	0.00041 wt. pct. S	0.000 lb/gal	5,372 gal/yr	0.00 tpy
		No. 1 Diesel	Mass Balance	0.10475 wt. pct. S	0.015 lb/gal	88,030 gal/yr	0.65 tpy
		No. 2 Diesel	Mass Balance	0.39988 wt. pct. S	0.057 lb/gal	109,024 gal/yr	3.10 tpy
3	Diesel Generator Engine	No. 1 ULSD	Mass Balance	0.0015 wt. pct. S	2.13E-04 lb/gal	1,218 gal/yr	1.3E-04 tpy
4	Diesel Generator Engine	No. 1 ULSD					
10	Boiler	No. 2 Heating Oil	Mass Balance	0.3015 wt. pct. S	0.043 lb/gal	17,535 gal/yr	0.38 tpy
11	Boiler	No. 2 Heating Oil					
						Significant Emission Units - CY2022 Actual Emissions - SO_2	**23.0 tpy**
			Insignificant Emission Units				
5	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
6	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
7	Fuel Oil Storage Tank	No. 2 Diesel	N/A	N/A	N/A	8,760 hr/yr	0 tpy
8	Burnham Boiler	No. 2 Heating Oil	Mass Balance	0.3015 wt. pct. S	0.0 lb/gal	18,627 gal/yr	0.40 tpy
9	Burnham Boiler	No. 2 Heating Oil	Mass Balance				
N/A	Burnham Boiler - FE Building	Natural Gas	AP-42 Table 1.4-2	2,000 gr/10^6scf	0.6 lb/10^6scf	10,671 scf	3.2E-06 tpy
N/A	Burnham Boiler - FE Building	Natural Gas					
N/A	Lean Burn Inc. CB 2800 Overhead Shop Heater	Waste Oil	Mass Balance	0.124 wt. pct. S	0.018 lb/gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-340H Heater	Waste Oil	Mass Balance	0.124 wt. pct. S	0.018 lb/gal	0 gal/yr	0.0E+00 tpy
N/A	Metzger Machine Corp. Boiler	No. 1 Diesel	Mass Balance	0.0004 wt. pct. S	0.000 lb/gal	9,121 gal/yr	2.6E-04 tpy
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	916 gal/yr	0.01 tpy
N/A	Energy Logic EL-200H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	0 gal/yr	0 tpy
N/A	Energy Logic EL-350H Heater	Waste Oil - Transformer	Mass Balance	0.121 wt. pct. S	0.017 lb/gal	3,755 gal/yr	0 tpy
						Insignificant Emission Units - CY2022 Actual Emissions - SO_2	**0.44 tpy**
						CY2022 Actual Emissions - SO_2	**23.4 tpy**

Sample Calculations: [3]

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

Emissions, tpy= (Emission factor, lb/gal) x (Fuel Use gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10^6scf) / (Conversion 1,000,000 scf/10^6scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

Notes:

1 Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2021 as received from supplier sampling.

2 For waste oil and waste transformer oil, fuel sulfur content was determined by testing conducted in December 2016.

3 Diesel fuel density is equal 6.8 lb/gal for No. 1 Diesel and 7.1 lb/gal for No. 2 Diesel per plant report.

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Golden Valley Electric Association
FY2024 Assessable Emission Estimates

Delta Power Plant – Permit No. AQ0880TVP03

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Table 1. FY2024 Assessable Emissions Summary
Golden Valley Electric Association - Delta Power Plant

Assessable Emissions - Tons Per Year						
Description	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**VOC**	**Total**
Assessable PTE	249	-	-	72	-	321

From Condition 27 and Table D of the Statement of Basis for AQ0880TVP03.

Potential to Emit	**Regulated Air Pollutant Emissions (tons per year)** [1]				
	NO_X	**CO**	**PM_{10}**	**SO_2**	**VOC**
Significant	1.4	0.02	0.01	0.254	0.002
Insignificant	0	0	0	0	0.004
Assessable Emission Subtotals	**1.40**	**0.02**	**0.01**	**0.25**	**0.01**
Total Assessable Emissions	**1.65**				
Fee Estimate [2]	**$139**				

Notes:
[1] Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.
[2] A fee rate of $84.29 per ton applies in accordance with 18 AAC 50.410(b)(1).

Table 2a. FY2024 Significant Emissions Unit Summary
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	CY2022 Actual Operation	Nominal Capacity	CY2022 Actual Fuel Consumption
ID	Description	Make/Model				
1	Gas Turbine	John Brown Ltd. Frame 5P	Fuel Oil	24.7 hr/yr	23.1 MW	28,766 gal/yr
2	Black Start Engine	Delta Detroit	Fuel Oil	0.58 hr/yr	500 bhp	15 gal/yr
3	Furnace	Thermo Pride	Fuel Oil	1,914 hr/yr [1]	0.4 MMBtu/hr	5,756 gal/yr

1. Estimated as follows:
Operation (hr/yr) = (Fuel Consumption, gal/yr) x (Fuel Heating value, 0.133021 MMBtu/gal) / (Capacity, 0.4 MMBtu/hr)

Table 2b. FY2024 Insignificant Emissions Unit Inventory
Golden Valley Electric Association - Delta Power Plant

Emission Unit		Fuel Type/ Material	Rating/Size	CY2022 Actual Operation
ID	Description			
Tank	Fuel Oil Storage Tank	Fuel Oil	50,000 gallons	8,760 hr/yr

Table 3. FY2024 Assessable Emissions Calculations - Oxides of Nitrogen (NO_X) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	Factor Reference	NO_X Emission Factor	Actual Operation	CY2022 Actual NO_X Emissions
ID	Description	Rating/Capacity					
Significant Emission Units							
1	Gas Turbine	23.1 MW	Fuel Oil	AQ0880TVP03 Condition 10.2	0.70 lb/MMBtu	28,766 gal/yr	1.34 tpy
2	Black Start Engine	500 bhp	Fuel Oil	AP-42 Table 3.3-1	0.031 lb/hp-hr	0.58 hr/yr [1]	4.5E-03 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	AP-42 Table 1.3-1	18 lb/kgal	5,756 gal/yr	0.05 tpy
Significant Emission Units - Total Assessable Emissions - NO_X							**1.40 tpy**
Insignificant Emission Units							
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	N/A	NA	8,760 hr/yr	0 tpy
Insignificant Emission Units - Total Assessable Emissions - NO_X							**0 tpy**
Total Assessable Emissions - NO_X							**1.40 tpy**

Notes:
[1] Operating hours were determined based on seven starts during calendar year 2022 lasting an estimated duration of 5 minutes each.

Fuel Heating Value 0.133021 MMBtu/gal AQ0880TVP03, Condition 10.2

Example Calculations:

Turbine emissions (tpy) = (Maximum fuel consumption, gal/hr) x (Fuel Heating value, MMBtu/gal) x (Emission factor, lb/MMBtu) x (Operation, hr/yr) / (2,000 lb/ton)
Engine emissions (tpy) = (Rating, bhp) x (Emission factor, lb/hp-hr) x (Operation, hr/yr) / (2,000 lb/ton)
Furnace emissions (tpy) = (Rating, MMBtu/hr) x (Emission factor, lb/kgal) / (Heating value, MMBtu/gal) / (Conversion, 1,000 gal/kgal) x (Operation, hr/yr) / (2,000 lb/ton)

Table 4. FY2024 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	Factor Reference	CO Emission Factor	Actual Operation	CY2022 Actual CO Emissions
ID	**Description**	**Rating/Capacity**					
Significant Emission Units							
1	Gas Turbine	23.1 MW	Fuel Oil	AP-42 Table 3.1-1	0.0033 lb/MMBtu	24.7 hr/yr	1.3E-04 tpy
2	Black Start Engine	500 bhp	Fuel Oil	AP-42 Table 3.3-1	0.0067 lb/hp-hr	0.6 hr/yr	9.7E-04 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	AP-42 Table 1.3-1	5 lb/kgal	1,914 hr/yr[1]	0.01 tpy
						Significant Emission Units - Total Assessable Emissions - CO	**0.02 tpy**
Insignificant Emission Units							
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	N/A	NA	8,760 hr/yr	0 tpy
						Insignificant Emission Units - Total Assessable Emissions - CO	**0 tpy**
						Total Assessable Emissions - CO	**0.02 tpy**

Notes:
[1] Operating hours were determined based on seven starts during calendar year 2022 lasting an estimated duration of 5 minutes each.

Fuel Heating Value 0.133021 MMBtu/gal AQ0880TVP03, Condition 10.2

Example Calculations:

Turbine emissions (tpy) = (Maximum fuel consumption, gal/hr) x (Fuel Heating value, MMBtu/gal) x (Emission factor, lb/MMBtu) x (Operation, hr/yr) / (2,000 lb/ton)

Engine emissions (tpy) = (Rating, bhp) x (Emission factor, lb/hp-hr) x (Operation, hr/yr) / (2,000 lb/ton)

Furnace emissions (tpy) = (Rating, MMBtu/hr) x (Emission factor, lb/kgal) / (Heating value, MMBtu/gal) / (Conversion, 1,000 gal/kgal) x (Operation, hr/yr) / (2,000 lb/ton)

Table 5. FY2024 Assessable Emissions Calculations - Particulate Matter (PM_{10}) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	Factor Reference	PM_{10} Emission Factor	Actual Operation	CY2022 Actual PM_{10} Emissions
ID	Description	Rating/Capacity					
Significant Emission Units							
1	Gas Turbine	23.1 MW	Fuel Oil	AP-42 Table 3.1-2a	0.012 lb/MMBtu	24.7 hr/yr	4.6E-04 tpy
2	Black Start Engine	500 bhp	Fuel Oil	AP-42 Table 3.3-1	0.0022 lb/hp-hr	0.6 hr/yr	3.2E-04 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	AP-42 Tables 1.3-1 and 1.3-2	1.70 lb/kgal	1,914 hr/yr[1]	4.9E-03 tpy
Significant Emission Units - Total Assessable Emissions - PM_{10}							**0.01 tpy**
Insignificant Emission Units							
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	N/A	NA	8,760 hr/yr	0 tpy
Insignificant Emission Units - Total Assessable Emissions - PM_{10}							**0 tpy**
Total Assessable Emissions - PM_{10}							**0.01 tpy**

Notes:
[1] Operating hours were determined based on seven starts during calendar year 2022 lasting an estimated duration of 5 minutes each.

Fuel Heating Value 0.133021 MMBtu/gal AQ0880TVP03, Condition 10.2

Example Calculations:
Turbine emissions (tpy) = (Maximum fuel consumption, gal/hr) x (Fuel Heating value, MMBtu/gal) x (Emission factor, lb/MMBtu) x (Operation, hr/yr) / (2,000 lb/ton)
Engine emissions (tpy) = (Rating, bhp) x (Emission factor, lb/hp-hr) x (Operation, hr/yr) / (2,000 lb/ton)
Furnace emissions (tpy) = (Rating, MMBtu/hr) x (Emission factor, lb/kgal) / (Heating value, MMBtu/gal) / (Conversion, 1,000 gal/kgal) x (Operation, hr/yr) / (2,000 lb/ton)

Table 6. FY2024 Assessable Emission Calculations - Sulfur Dioxide (SO_2) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	Maximum Fuel Sulfur Content	Factor Reference	SO_2 Emission Factor	Actual Operation	CY2022 Actual SO_2 Emissions
ID	Description	Rating/Capacity						
Significant Emission Units								
1	Gas Turbine	23.1 MW	Fuel Oil	0.11 wt. pct. S [1]	Mass Balance [2,3]	0.0147 lb/gal	28,766 gal/yr	0.21 tpy
2	Black Start Engine	15 gal/hr	Fuel Oil	0.11 wt. pct. S [1]	Mass Balance [2,3]	0.0147 lb/gal	0.58 hr/yr	6.6E-05 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	0.11 wt. pct. S [1]	Mass Balance [2,3]	0.0147 lb/gal	5,756 gal/yr	0.04 tpy
Significant Emission Units - Total Assessable Emissions - SO_2								**2.5E-01 tpy**
Insignificant Emission Units								
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	NA	N/A	NA	8,760 hr/yr	0 tpy
Insignificant Emission Units - Total Assessable Emissions - SO_2								**0 tpy**
Total Assessable Emissions - SO_2								**0.25 tpy**

Notes:

[1] The fuel received at Delta during 2022 had a maximum sulfur analysis result of 0.110 weight percent.

[2] Mass balance:

Molar mass ratio is 32 lb S/mol : 64 lb SO_2/mol

Stoichiometry: 1 mol S = 1 mol SO_2

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO_2:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

[3] A fuel density of 6.7 lb/gal is assumed based on an API gravity of 43.3 from the February 2006 source test.

Turbine and Furnace emissions (tpy) = (Emission factor, lb/gal) x (Operation, gal/yr) / (2,000 lb/ton)

Engine emissions (tpy) = (Emission factor, lb/gal) x (Capacity, gal/hr) x (Operation, hr/yr) / (2,000 lb/ton)

Table 7. FY2024 Assessable Emissions Calculations - Volatile Organic Compound (VOC) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel Type	Factor Reference	VOC Emission Factor	Actual Operation	CY2022 Actual VOC Emissions
ID	Description	Rating/Capacity					
Significant Emission Units							
1	Gas Turbine	23.1 MW	Fuel Oil	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	24.7 hr/yr	1.6E-05 tpy
2	Black Start Engine	500 bhp	Fuel Oil	AP-42 Table 3.3-1	0.0025 lb/hp-hr	0.6 hr/yr	3.7E-04 tpy
3	Furnace	0.4 MMBtu/hr	Fuel Oil	AP-42 Table 1.3-3	0.713 lb/kgal	1,914 hr/yr[1]	2.1E-03 tpy
Significant Emission Units - Total Assessable Emissions - VOC							**0.002 tpy**
Insignificant Emission Units							
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	See Table 8	NA	8,760 hr/yr	4.5E-03 tpy
Insignificant Emission Units - Total Assessable Emissions - VOC							**4.5E-03 tpy**
Total Assessable Emissions - VOC							**0.007 tpy**

Notes:
[1] Operating hours were determined based on seven starts during calendar year 2022 lasting an estimated duration of 5 minutes each.

Fuel Heating Value 0.133021 MMBtu/gal AQ0880TVP03, Condition 10.2

Example Calculations:

Turbine emissions (tpy) = (Maximum fuel consumption, gal/hr) x (Fuel Heating value, MMBtu/gal) x (Emission factor, lb/MMBtu) x (Operation, hr/yr) / (2,000 lb/ton)
Engine emissions (tpy) = (Rating, bhp) x (Emission factor, lb/hp-hr) x (Operation, hr/yr) / (2,000 lb/ton)
Furnace emissions (tpy) = (Rating, MMBtu/hr) x (Emission factor, lb/kgal) / (Heating value, MMBtu/gal) / (Conversion, 1,000 gal/kgal) x (Operation, hr/yr) / (2,000 lb/ton)

Table 8. FY2024 Assessable Emissions Calculations - VOC Tank Emissions
Golden Valley Electric Association - Delta Power Plant

	Factor Reference	Tank
Orientation	N/A	Horizontal
Contents	N/A	Diesel
Diameter (ft)	N/A	12
Tank Length (ft), H_S	N/A	60
Color	N/A	White
Capacity (gal)	N/A	50,000
Diesel Throughput (gal/yr)[1]	N/A	28,980
Paint Condition	N/A	Average
Standing Loss (L_S) Calculations		
D_E (ft)	AP-42, Section 7.1, Equation 1-14	30.278
H_E (ft)	AP-42, Section 7.1, Equation 1-15	9.42
K_E (per day)	AP-42, Section 7.1, Equation 1-12	0.033
H_{VO} (ft)	AP-42, Section 7.1, Equation 1-16	4.71
K_S	AP-42, Section 7.1, Equation 1-21	0.998
T_{AA} (°R)	AP-42, Section 7.1, Equation 1-30	487.40
T_B (°R)	AP-42, Section 7.1, Equation 1-31	488.03
T_V (°R)	AP-42, Section 7.1, Equation 1-33	489.47
W_V (lb/ft^3)	AP-42, Section 7.1, Equation 1-22	1.98E-04
L_S (lb/yr)	AP-42, Section 7.1, Equation 1-4	8.20
Working Loss (L_W) Calculations		
Q (bbl)	42 gal/bbl	690
V_Q (ft^3)	AP-42, Section 7.1, Equation 1-39	3,874
$\sum H_{QI}$ (ft/yr)	AP-42, Section 7.1, Equation 1-37	5
H_{LX} (ft)	AP-42, Section 7.1, Equation 1-36	9
N	AP-42, Section 7.1, Equation 1-36	1
K_N	AP-42, Section 7.1, Equation 1-35 note	52.72
L_W (lb/yr)	AP-42, Section 7.1, Equation 1-35	0.77
TOTAL VOCs L_T (tpy)	**AP-42, Section 7.1, Equation 1-1**	**4.5E-03**

Note:
[1] Assumed equal to maximum fuel consumption for EU ID 1.

Meteorological Inputs (Fairbanks, AK):

	T_{AX} =	38.0	°F		497.7 °R
	T_{AN} =	17.4	°F		477.1 °R
AP-42, Section 7.1, Table 7.1-6	α =	0.25	White, Average		
AP-42, Section 7.1, Table 7.1-7	I =	838	Btu/ft^2-d From the 1995 version of AP-42		

Constants:

AP-42, Section 7.1, Table 7.1-2	M_V	130	lb/lb-mol	Jet A, Diesel #1
AP-42, Section 7.1, Table 7.1-2	P_{VA}=	0.008	psi	Jet A, Diesel #1
AP-42, Section 7.1, Note below	K_P=	1		Diesel
equation 1-37	K_B =	1		Diesel
For turnovers ≤36	K_N =	1		

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From: Naomi J. Morton Knight
To: Jones, Dave F (DEC)
Cc: Toni J. Smith
Subject: GVEA, updated fuel prices
Date: Friday, December 29, 2023 1:56:13 PM

CAUTION: This email originated from outside the State of Alaska mail system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dave,

Hope your Holiday's have been restful! I've been behind on tabulating updates to our fuel pricing. Below is a table showing the weighted average price of our fuels for the North Pole Power plant Frame 7 units, EU ID's 1 and 2, by month. These prices include surcharges, transportation, and storage fees. In the far column I tabulated the difference between the ULS pricing and the LSHO #1 (<1,000ppm) fuel for months when we've received NO. 1 ULS. Some months like December 22 and January 23 look like the ULS is less expensive, however fuel is received during different times of the month and the base price of oil is different. Because of this the weighted average cost over time is probably the best indicator of the cost difference between NO. 1 ULS and the <1000ppm LSHO #1. Over this period GVEA has paid $0.6512 per gallon more for ULS. The second table shows the gallons of fuel purchased by grade. I know you guys are under a crunch to get the SIP updates done, hope this helps! Let me know if there is anything else that can help.

GVEA: Fuel Prices by Grade for the North Pole Power Plant [1]

Month	HS #2+10	HS #2-15	LSHO #1 <1000 ppm	NO. 1 ULS <15 ppm	NO. 2 ULS <15ppm	Difference ULS and LSHO #1
Oct-21		$2.3850		$2.9766		$0.5916
Nov-21		$2.4906	$2.5111	$2.8504		$0.3393
Dec-21		$2.4130	$2.3557			
Jan-22		$2.4363	$2.4811			
Feb-22		$2.7677	$2.7741	$3.3580		$0.5838
Mar-22		$3.5862	$4.1081			
Apr-22	$4.1736	$4.1081				
May-22	$4.3061		$4.0961	$4.5522		$0.4561
Jun-22	$4.2862		$4.4072	$5.0143		$0.6071
Jul-22	$3.8581		$3.2579			
Aug-22	$3.6561					
Sep-22			$3.7353	$3.7613		$0.0260
Oct-22			$3.8290	$3.3246		-$0.5043
Nov-22			$3.3407			
Nov-22			$3.3541			
Dec-22			$3.1418	$3.1038		-$0.0380
Jan-23			$3.8200	$3.3530		-$0.4670
Feb-23			$3.1098	$3.4112		$0.3014
Mar-23			$2.9323	$3.1785		$0.2462
Apr-23			$2.6994		$2.9547	
Weighted Average	**$4.2754**	**$2.7819**	**$3.2358**	**$3.8870**	**$2.9547**	**$0.6512**

[1] Includes surcharges, transportation, and storage. This is the weighted average price of fuel purchased during each period.

GVEA: Fuel Gallons Purchased by Grade for the North Pole Power Plant

Month	HS #2+10	HS #2-15	LSHO #1 <1000 ppm	NO. 1 ULS <15 ppm	NO. 2 ULS <15ppm
Oct-21		662,210		89,915	
Nov-21		657,786	127,114	264,564	
Dec-21		548,855	435,211		
Jan-22		42,891	533,632		
Feb-22		112,768	95,288	100,896	
Mar-22		652,088	102,633		
Apr-22	254,795	112,240			
May-22	574,648		9,459	433,142	
Jun-22	785,790		496,978	650,376	
Jul-22	57		205,884		
Aug-22	268				
Sep-22			262,214	67,503	
Oct-22			328,731	8,041	
Nov-22			154,827		
Nov-22			40,572		
Dec-22			375,943	363,813	
Jan-23			286,830	351,057	
Feb-23			206,566	88,747	
Mar-23			384,170	118,917	
Apr-23			184,764		27,625
Total	1,615,557	2,788,838	4,230,815	2,536,971	27,625

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Safety: You Have The Power!

Table 5-1. Summary of Available SO_2 Emission Control Technology

Emission Unit		Available Emission Control Technology
1, 2	Simple Cycle Gas Turbine	ULSD
		Low Sulfur Fuel
		Good Combustion Practices
5, 6	Combined Cycle Gas Turbine	ULSD
		LSR
		Limited Operation
		Good Combustion Practices
7	Emergency Generator Engine	ULSD
		Low Sulfur Fuel
		Limited Operation
		Good Combustion Practices
11, 12	Propane-Fired Boiler	Low Sulfur Fuel
		Good Combustion Practices

Table 5-2. Summary of Technically Feasible SO_2 Emission Control Technology

Emission Unit		Technically Feasible Control Technology
1, 2	Simple Cycle Gas Turbine	ULSD
		Low Sulfur Fuel
		Good Combustion Practices
5, 6	Combined Cycle Gas Turbine	ULSD
		Good Combustion Practices and LSR
7	Emergency Generator Engine	ULSD
		Low Sulfur Fuel
		Limited Operation
		Good Combustion Practices
11, 12	Propane-Fired Boiler	Low Sulfur Fuel
		Good Combustion Practices

Table 5-3. Ranking of Technically Feasible SO_2 Emission Control Technology

Emission Unit		Emission Control Technology	Control Efficiency (pct.)	SO_2 Emissions (tpy)	SO_2 Emissions Reduction (tpy)
1	Simple Cycle Turbine	ULSD (0.0015 wt. pct. S)	99.7	4.5	1,481.9
		Low Sulfur Fuel (0.05 wt. pct. S)	90.0	148.6	1,337.8
		Good Combustion Practices (0.50 wt. pct. S) (existing)	0	1,486.4	0
2	Simple Cycle Turbine	Limited Operation + ULSD (0.0015 wt. pct. S)	99.7	4.1	1,352.0
		Limited Operation + Low Sulfur Fuel (0.05 wt. pct. S)	90.0	135.6	1,220.5
		Good Combustion Practices (0.50 wt. pct. S) (existing)	0	1,356.1	0
5, 6	Combined Cycle Gas Turbines (per turbine)	ULSD (0.0015 wt. pct. S)	70.0%	2.9	6.7
		ULSD (0.0015 wt. pct. S) compared to JetA/No. 1	0	36.0	0.0
		LSR (0.0050 wt. pct. S) + JetA/No. 1 Diesel (0.3 wt. pct. S, 1.5x10^6 gal/yr) Good Combustion Practices (existing)	0	9.54	0.0
7	Emergency Generator Engine	ULSD (0.0015 wt. pct. S) + Limited Operation	98.5%	0.00018	0.0116
		Low Sulfur Fuel (0.05 wt. pct. S) + Limited Operation	50	0.006	0.0059
		Limited Operation (0.1 wt. pct. S) (existing)	0	0.0118	0
11, 12	Propane-Fired Boiler	Low Sulfur Fuel (existing)	0	0.0002	0

Table 5-4. Annualized Costs for ULSD on the Diesel-fired Simple Cycle Gas Turbine (EU ID 1)

Shaded cells indicate user inputs

Project: GVEA North Pole - $PM_{2.5}$ BACT Analysis (EU ID 1 - GE Frame 7 CT)

Prepared By:
Checked By:
Rev:

Annualized Costs						
DIRECT ANNUAL COSTS	**QTY**	**UNIT**		**TOTAL MATERIALS COST**	**TOTAL LABOR COST**	**TOTAL**
(1) Operating & Maintenance Costs		%			$ -	$ -
(2) Repair & Replacement Costs		%			$ -	$ -
(3) Maintenance Materials		LOT		excluded in this estimate		
(4) Utilities						
(a) ULSD Costs:	45,282,462	GAL	0.185	$ 8,377,255		$ 8,377,255
Total Direct Annual Costs (TDAC)					TDAC =	$ 8,377,255
INDIRECT ANNUAL COSTS						
(5) Overhead		%		excluded in this estimate	$ -	$ -
(6) Administrative Charges, Property Taxes, Insurance		% of capital			$ -	$ -
Capital Recovery Factor [see inputs below]	0.0931					
(7) Capital Recovery					CRF * TCI =	$ -
Total Indirect Annual Costs (TIAC) (refer to Table 5-10)					TIAC =	$ 1,446,967
TOTAL ANNUALIZED COSTS (TAC)					TAC = (TDAC) + (TIAC) =	$ 9,824,223

Cost Effectiveness Summary		
TOTAL TONS SO_2 AVOIDED PER YEAR	=	1,482
COST EFFECTIVENESS ($ PER TON AVOIDED BASED ON PTE)	(TAC)/(TPY) =	$ 6,629
COST EFFECTIVENESS ($ PER TON AVOIDED BASED ON ACTUAL HISTORIC RUN TIMES, AVOIDING 142.3 TONS PER YEAR)[1]	(TAC)/(TPY) =	$ 9,653
COST EFFECTIVENESS ($ PER TON PM AVOIDED BASED ON 6 TONS SO_2 AVOIDED = 1 TON PM AVOIDED)[2]	(TAC)/(TPY) =	$ 57,920

Data Inputs for Capital Recovery Factor:		
Annual Interest Rate (EPA OAQPS Control Cost Manual)	8.50	%
Project Life (EPA OAQPS Control Cost Manual)	30	years

[1] Annual average run hours for EU 1 from 2009-2016 is 833 hours, and the peak in the last four years has been 587 hours. 833 hours equates to 4,305,969 gallons of fuel, a TDAC of $1,148,832, and a TAC of $3,068,356. The capital cost of bulk fuel storage would be less and the TIAC for actuals is shown in Table 5-10.

[2] Alaska Department of Environmental Conservation, Amendments to State Air Quality Control Plan Vol. III: Appendix III.D.5.7, page 52. In reference to fuel oil emissions, "Ambient sampling and modeling in FNSB indicates that reduction of six tons of SO_X emissions result in the same reduction in ambient $PM_{2.5}$ concentration as the reduction of one ton of directly emitted $PM_{2.5}$".

Table 5-4. Annualized Costs for ULSD on the Diesel-fired Simple Cycle Gas Turbine (EU ID 1)

Shaded cells indicate user inputs

Project: GVEA North Pole - $PM_{2.5}$ BACT Analysis (EU ID 1 - GE Frame 7 CT)

Prepared By:
Checked By:
Rev:

Annualized Costs							
DIRECT ANNUAL COSTS		**QTY**	**UNIT**		**TOTAL MATERIALS COST**	**TOTAL LABOR COST**	**TOTAL**
(1)	Operating & Maintenance Costs		%			$ -	$ -
(2)	Repair & Replacement Costs		%			$ -	$ -
(3)	Maintenance Materials		LOT		excluded in this estimate		
(4)	Utilities						
(a)	ULSD Costs:	45,282,462	GAL	0.424	$ 19,199,764		$ 19,199,764
Total Direct Annual Costs (TDAC)						TDAC =	$ 19,199,764
INDIRECT ANNUAL COSTS							
(5)	Overhead		%		excluded in this estimate	$ -	$ -
(6)	Administrative Charges, Property Taxes, Insurance		% of capital			$ -	$ -
	Capital Recovery Factor [see inputs below]	0.0931					
(7)	Capital Recovery					CRF * TCI =	$ -
Total Indirect Annual Costs (TIAC) **(refer to Table 5-10)**						TIAC =	$ 1,446,967
TOTAL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC) =	$ 20,646,731

Cost Effectiveness Summary		
TOTAL TONS SO_2 AVOIDED PER YEAR	=	1,482
COST EFFECTIVENESS ($ PER TON AVOIDED BASED ON PTE)	(TAC)/(TPY) =	$ 13,932
COST EFFECTIVENESS ($ PER TON AVOIDED BASED ON ACTUAL HISTORIC RUN TIMES, AVOIDING 142.3 TONS PER YEAR)[1]	(TAC)/(TPY) =	$ 16,885
COST EFFECTIVENESS ($ PER TON PM AVOIDED BASED ON 6 TONS SO_2 AVOIDED = 1 TON PM AVOIDED)[2]	(TAC)/(TPY) =	$ 101,313

Data Inputs for Capital Recovery Factor:		
Annual Interest Rate (EPA OAQPS Control Cost Manual)	8.50	%
Project Life (EPA OAQPS Control Cost Manual)	30	years

[1] Annual average run hours for EU 1 from 2009-2016 is 833 hours, and the peak in the last four years has been 587 hours. 833 hours equates to 4,305,969 gallons of fuel, a TDAC of $1,148,832, and a TAC of $3,068,356. The capital cost of bulk fuel storage would be less and the TIAC for actuals is shown in Table 5-10.

[2] Alaska Department of Environmental Conservation, Amendments to State Air Quality Control Plan Vol. III: Appendix III.D.5.7, page 52. In reference to fuel oil emissions, "Ambient sampling and modeling in FNSB indicates that reduction of six tons of SO_X emissions result in the same reduction in ambient $PM_{2.5}$ concentration as the reduction of one ton of directly emitted $PM_{2.5}$".

Table 5-5. Annualized Costs for ULSD on the Diesel-fired Simple Cycle Gas Turbine (EU ID 2)

Shaded cells indicate user inputs

Project: GVEA North Pole - $PM_{2.5}$ BACT Analysis (EU ID 2 - GE Frame 7 CT)

Prepared By:
Checked By:
Rev:

Annualized Costs							
DIRECT ANNUAL COSTS		**QTY**	**UNIT**		**TOTAL MATERIALS COST**	**TOTAL LABOR COST**	**TOTAL**
(1)	Operating & Maintenance Costs		%			$ -	$ -
(2)	Repair & Replacement Costs		%			$ -	$ -
(3)	Maintenance Materials		LOT		excluded in this estimate		
(4)	Utilities						
	(a) ULSD Costs:	41,312,492	GAL	0.185	$ 7,642,811		$ 7,642,811
Total Direct Annual Costs (TDAC)						TDAC =	$ 7,642,811
INDIRECT ANNUAL COSTS							
(5)	Overhead		%		excluded in this estimate	$ -	$ -
(6)	Administrative Charges, Property Taxes, Insurance		% of capital			$ -	$ -
	Capital Recovery Factor [see inputs below]	0.0931					
(7)	Capital Recovery					CRF * TCI =	$ -
Total Indirect Annual Costs (TIAC) **(refer to Table 5-10)**						TIAC =	$ 1,446,967
TOTAL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC) =	$ 9,089,779

Cost Effectiveness Summary		
TOTAL TONS SO_2 AVOIDED PER YEAR	=	1,352.0
COST EFFECTIVENESS ($ PER TON AVOIDED BASED ON PTE)	(TAC)/(TPY) =	$ 6,723
COST EFFECTIVENESS ($ PER TON AVOIDED BASED ON ACTUALS, AVOIDING 422.3 TONS PER YEAR)[1]	(TAC)/(TPY) =	$ 6,964
COST EFFECTIVENESS ($ PER TON PM AVOIDED BASED ON 6 TONS SO_2 AVOIDED = EQUIVALENT TO 1 TON PM AVOIDED)[2]	(TAC)/(TPY) =	$ 41,786

Data Inputs for Capital Recovery Factor:		
Annual Interest Rate (EPA OAQPS Control Cost Manual)	8.50	%
Project Life (EPA OAQPS Control Cost Manual)	30	years

[1] Annual average run hours for EU 2 from 2009-2016 is 2472 hours, and the peak in the last four years has been 2873 hours. 2472 hours equates to 12,778,338 gallons of fuel, a TDAC of $3,409,261, and a TAC of $5,328,784. The capital cost of bulk fuel storage would be less and the TIAC for actuals is shown in Table 5-10.

[2] Alaska Department of Environmental Conservation, Amendments to State Air Quality Control Plan Vol. III: Appendix III.D.5.7, page 52. In reference to fuel oil emissions, "Ambient sampling and modeling in FNSB indicates that reduction of six tons of SO_X emissions result in the same reduction in ambient $PM_{2.5}$ concentration as the reduction of one ton of directly emitted $PM_{2.5}$".

Table 5-5. Annualized Costs for ULSD on the Diesel-fired Simple Cycle Gas Turbine (EU ID 2)

Shaded cells indicate user inputs

Project: GVEA North Pole - $PM_{2.5}$ BACT Analysis (EU ID 2 - GE Frame 7 CT)

Prepared By:
Checked By:
Rev:

Annualized Costs

DIRECT ANNUAL COSTS		QTY	UNIT		TOTAL MATERIALS COST	TOTAL LABOR COST	TOTAL
(1)	Operating & Maintenance Costs		%			$ -	$ -
(2)	Repair & Replacement Costs		%			$ -	$ -
(3)	Maintenance Materials		LOT		excluded in this estimate		
(4)	Utilities						
	(a) ULSD Costs:	41,312,492	GAL	0.424	$ 17,516,497		$ 17,516,497
Total Direct Annual Costs (TDAC)						TDAC =	$ 17,516,497
INDIRECT ANNUAL COSTS							
(5)	Overhead		%		excluded in this estimate	$ -	$ -
(6)	Administrative Charges, Property Taxes, Insurance		% of capital			$ -	$ -
	Capital Recovery Factor [see inputs below]	0.0931					
(7)	Capital Recovery					CRF * TCI =	$ -
Total Indirect Annual Costs (TIAC) **(refer to Table 5-10)**						TIAC =	$ 1,446,967
TOTAL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC) =	$ 18,963,464

Cost Effectiveness Summary

TOTAL TONS SO_2 AVOIDED PER YEAR	=	1,352.0
COST EFFECTIVENESS ($ PER TON AVOIDED BASED ON PTE)	(TAC)/(TPY) =	$ 14,026
COST EFFECTIVENESS ($ PER TON AVOIDED BASED ON ACTUALS, AVOIDING 422.3 TONS PER YEAR)[1]	(TAC)/(TPY) =	$ 14,196
COST EFFECTIVENESS ($ PER TON PM AVOIDED BASED ON 6 TONS SO_2 AVOIDED = EQUIVALENT TO 1 TON PM AVOIDED)[2]	(TAC)/(TPY) =	$ 85,178

Data Inputs for Capital Recovery Factor:		
Annual Interest Rate (EPA OAQPS Control Cost Manual)	8.50	%
Project Life (EPA OAQPS Control Cost Manual)	30	years

[1] Annual average run hours for EU 2 from 2009-2016 is 2472 hours, and the peak in the last four years has been 2873 hours. 2472 hours equates to 12,778,338 gallons of fuel, a TDAC of $3,409,261, and a TAC of $5,328,784. The capital cost of bulk fuel storage would be less and the TIAC for actuals is shown in Table 5-10.

[2] Alaska Department of Environmental Conservation, Amendments to State Air Quality Control Plan Vol. III: Appendix III.D.5.7, page 52. In reference to fuel oil emissions, "Ambient sampling and modeling in FNSB indicates that reduction of six tons of SO_X emissions result in the same reduction in ambient $PM_{2.5}$ concentration as the reduction of one ton of directly emitted $PM_{2.5}$".

Table 5-6. Annualized Costs for ULSD on the Diesel-fired Combined Cycle Gas Turbines (EU IDs 5 and 6)

Shaded cells indicate user inputs

Project: GVEA North Pole - $PM_{2.5}$ BACT Analysis (EU IDs 5 and 6 - GE LM6000PC CT)

Prepared By:
Checked By:
Rev:

Annualized Costs

DIRECT ANNUAL COSTS	QTY	UNIT		TOTAL MATERIALS COST	TOTAL LABOR COST	TOTAL
(1) Operating & Maintenance Costs		%			$ -	$ -
(2) Repair & Replacement Costs		%			$ -	$ -
(3) Maintenance Materials		LOT		excluded in this estimate		
(4) Utilities						
(a) ULSD Costs:	29,057,000	GAL	0.588	$ 17,085,516		$ 17,085,516
Total Direct Annual Costs (TDAC)					TDAC =	$ 17,085,516
INDIRECT ANNUAL COSTS						
(5) Overhead		%		excluded in this estimate	$ -	$ -
(6) Administrative Charges, Property Taxes, Insurance		% of capital			$ -	$ -
Capital Recovery Factor [see inputs below]	0.0931					
(7) Capital Recovery					CRF * TCI =	$ -
Total Indirect Annual Costs (TIAC)					TIAC =	$ -
TOTAL ANNUALIZED COSTS (TAC)					TAC = (TDAC) + (TIAC) =	$ 17,085,516

Cost Effectiveness Summary

TOTAL TONS SO_2 AVOIDED PER YEAR	=	6.7
COST EFFECTIVENESS ($ PER TON AVOIDED)	(TAC)/(TPY) =	$ 2,559,025

Data Inputs for Capital Recovery Factor:		
Annual Interest Rate (EPA OAQPS Control Cost Manual)	8.50	%
Project Life (EPA OAQPS Control Cost Manual)	30	years

Table 5-6. Annualized Costs for ULSD on the Diesel-fired Combined Cycle Gas Turbines (EU IDs 5 and 6)

Shaded cells indicate user inputs

Project: GVEA North Pole - $PM_{2.5}$ BACT Analysis (EU IDs 5 and 6 - GE LM6000PC CT)

Prepared By:
Checked By:
Rev:

Annualized Costs							
DIRECT ANNUAL COSTS		**QTY**	**UNIT**		**TOTAL MATERIALS COST**	**TOTAL LABOR COST**	**TOTAL**
(1)	Operating & Maintenance Costs		%			$ -	$ -
(2)	Repair & Replacement Costs		%			$ -	$ -
(3)	Maintenance Materials		LOT		excluded in this estimate		
(4)	Utilities						
	(a) ULSD Costs:	29,057,000	GAL	1.117	$ 32,456,669		$ 32,456,669
Total Direct Annual Costs (TDAC)						TDAC =	$ 32,456,669
INDIRECT ANNUAL COSTS							
(5)	Overhead		%		excluded in this estimate	$ -	$ -
(6)	Administrative Charges, Property Taxes, Insurance		% of capital			$ -	$ -
	Capital Recovery Factor [see inputs below]	0.0931					
(7)	Capital Recovery					**CRF * TCI =**	$ -
Total Indirect Annual Costs (TIAC)						TIAC =	$ -
TOTAL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC) =	$ 32,456,669

Cost Effectiveness Summary		
TOTAL TONS SO_2 AVOIDED PER YEAR	=	6.7
COST EFFECTIVENESS ($ PER TON AVOIDED)	(TAC)/(TPY) =	$ 4,861,277

Data Inputs for Capital Recovery Factor:		
Annual Interest Rate (EPA OAQPS Control Cost Manual)	8.50	%
Project Life (EPA OAQPS Control Cost Manual)	30	years

Table 5-7. Annualized Costs for ULSD on the Diesel-fired Emergency Generator Engine (EU ID 7)

Shaded cells indicate user inputs

Project: GVEA North Pole - $PM_{2.5}$ BACT Analysis (EU ID 7 - Generac Gen Set Engine)

Prepared By:
Checked By:
Rev:

Annualized Costs							
DIRECT ANNUAL COSTS	**QTY**	**UNIT**		**TOTAL MATERIALS COST**	**TOTAL LABOR COST**		**TOTAL**
(1) Operating & Maintenance Costs		%			$ -		$ -
(2) Repair & Replacement Costs		%			$ -		$ -
(3) Maintenance Materials		LOT		excluded in this estimate			
(4) Utilities							
(a) ULSD Costs:	1,664	GAL	0.2668	$ 444			$ 444
Total Direct Annual Costs (TDAC)						TDAC =	$ 444
INDIRECT ANNUAL COSTS							
(5) Overhead		%		excluded in this estimate	$ -		$ -
(6) Administrative Charges, Property Taxes, Insurance		% of capital			$ -		$ -
Capital Recovery Factor [see inputs below]	0.0931						
(7) Capital Recovery						**CRF * TCI =**	$ -
Total Indirect Annual Costs (TIAC)						TIAC =	$ -
TOTAL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC) =	$ 444

Cost Effectiveness Summary		
TOTAL TONS SO_2 AVOIDED PER YEAR	=	0.012
COST EFFECTIVENESS ($ PER TON AVOIDED)	(TAC)/(TPY) =	$ 38,150

Data Inputs for Capital Recovery Factor:		
Annual Interest Rate (EPA OAQPS Control Cost Manual)	8.50	%
Project Life (EPA OAQPS Control Cost Manual)	30	years

Table 5-7. Annualized Costs for ULSD on the Diesel-fired Emergency Generator Engine (EU ID 7)

Shaded cells indicate user inputs

Project:	GVEA North Pole - $PM_{2.5}$ BACT Analysis (EU ID 7 - Generac Gen Set Engine)					Prepared By:
						Checked By:
						Rev:
Annualized Costs						
DIRECT ANNUAL COSTS	**QTY**	**UNIT**		**TOTAL MATERIALS COST**	**TOTAL LABOR COST**	**TOTAL**
(1) Operating & Maintenance Costs		%			$ -	$ -
(2) Repair & Replacement Costs		%			$ -	$ -
(3) Maintenance Materials		LOT		excluded in this estimate		
(4) Utilities						
(a) ULSD Costs:	1,664	GAL	0.651	$ 1,083		$ 1,083
Total Direct Annual Costs (TDAC)					TDAC =	$ 1,083
INDIRECT ANNUAL COSTS						
(5) Overhead		%		excluded in this estimate	$ -	$ -
(6) Administrative Charges, Property Taxes, Insurance		% of capital			$ -	$ -
Capital Recovery Factor [see inputs below]	0.0931					
(7) Capital Recovery					**CRF * TCI =**	$ -
Total Indirect Annual Costs (TIAC)					TIAC =	$ -
TOTAL ANNUALIZED COSTS (TAC)					TAC = (TDAC) + (TIAC) =	$ 1,083
Cost Effectiveness Summary						
TOTAL TONS SO_2 AVOIDED PER YEAR					=	0.012
COST EFFECTIVENESS ($ PER TON AVOIDED)					(TAC)/(TPY) =	$ 93,086

Data Inputs for Capital Recovery Factor:		
Annual Interest Rate (EPA OAQPS Control Cost Manual)	8.50	%
Project Life (EPA OAQPS Control Cost Manual)	30	years

Table 5-8. GVEA North Pole Facility - SO_2 BACT Cost Effectiveness

Summary[1] for Each Emission Unit Based on PTE

Simple Cycle Gas Turbine (EU ID 1)					
ULSD (0.0015 wt. pct. S)	4	$10,875,319	$20,646,731	$19,199,764	$13,932
Good Combustion Practices (0.50 wt. pct. S) (existing)	1,486	~	~	~	~
Simple Cycle Gas Turbine (EU ID 2)					
Limited Operation + ULSD (0.0015 wt. pct. S)	4	$10,875,319	$18,963,464	$17,516,497	$14,026
Good Combustion Practices (0.50 wt. pct. S) (existing)	1,356	~	~	~	~
Combined Cycle Gas Turbines (EU IDs 5 and 6)					
ULSD (0.0015 wt. pct. S)	3	~	$32,456,669	~	$4,861,277
LSR (0.0050 wt. pct. S) + JetA/No. 1 Diesel (0.3 wt. pct. S, 1.5x10^6 gal/yr) Good Combustion Practices (existing)	10	~	~	~	~
Emergency Generator Engine (EU ID 7)					
ULSD (0.0015 wt. pct. S) + Limited Operation	0.0002	~	$1,083	~	$93,086
Limited Operation (0.1 wt. pct. S) (existing)	0.01	~	~	~	~
Propane Fired Boilers (EU IDs 11 and 12)					
Low Sulfur Fuel (propane) (existing)	0	~	~	~	~

Summary[1] for Each Emission Unit Based on Actuals

Control Technology Option	SO_2 Emissions (tpy)	Total Installed Capital ($)	Total Annualized Cost ($/year)	Annual O&M Cost ($/year)	Cost Effectiveness ($/ton SO_2 removed)
Simple Cycle Gas Turbine (EU ID 1)					
ULSD (0.0015 wt. pct. S)	4	$10,875,319	$3,068,356	$1,148,832	$21,563
Good Combustion Practices (0.50 wt. pct. S) (existing)	1,486	~	~	~	~
Simple Cycle Gas Turbine (EU ID 2)					
Limited Operation + ULSD (0.0015 wt. pct. S)	4	$10,875,319	$5,328,784	$3,409,261	$12,618
Good Combustion Practices (0.50 wt. pct. S) (existing)	1,356	~	~	~	~
Combined Cycle Gas Turbines (EU IDs 5 and 6)					
ULSD (0.0015 wt. pct. S)	3	~	$32,456,669	~	$4,861,277
LSR (0.0050 wt. pct. S) + JetA/No. 1 Diesel (0.3 wt. pct. S, 1.5x10^6 gal/yr) Good Combustion Practices (existing)	10	~	~	~	~
Emergency Generator Engine (EU ID 7)					
ULSD (0.0015 wt. pct. S) + Limited Operation	0.0002	~	$1,083	~	$93,086
Limited Operation (0.1 wt. pct. S) (existing)	0.01	~	~	~	~
Propane Fired Boilers (EU IDs 11 and 12)					
Low Sulfur Fuel (propane) (existing)	0	~	~	~	~

[1] All emission costs are on a per emission unit basis.

Table 5-9. GVEA North Pole Facility - Proposed SO_2 BACT and Associated Emission Rate for Each Emission Unit

ID	Description		Description	Emission Rate[1]
1, 2	Simple Cycle Gas Turbine	Fuel Oil	Good Combustion Practices (existing)	500 ppm S in fuel
5, 6	Combined Cycle Gas Turbine	LSR	LSR (existing)	30 ppm S in fuel
7	Emergency Generator Engine	Fuel Oil	Good Combustion Practices (existing)	500 ppm S in fuel
11, 12	Boiler	Propane	Low Sulfur Fuel - Propane (existing)	0.0012 lb/kgal

[1] Emissions are on a per emission unit basis.

Table 5-10. Capital Cost for New ULSD Storage Based on Maximum Fuel Use and Actual Fuel Use

	North Pole EUs 1 and 2 Maximum Fuel Use	Zehnder EUs 1 and 2 Maximum Fuel Use	North Pole EUs 1 and 2 Actual Fuel Use	Zehnder EUs 1 and 2 Actual Fuel Use
Capital Cost Estimate	$30,425,000		$21,050,000	
Heat Input, MMBtu/day (combined for each set of combustion turbines)	32,256	12,864	32,256	12,864
Percentage of Heat Input	71.5%	28.5%	71.5%	28.5%
Capital Cost (apportioned based on heat input ratio)	$ 21,750,638	$ 8,674,362	$ 15,048,511	$ 6,001,489
Capital Cost (apportioned per combustion turbine)	$ 10,875,319	$ 4,337,181	$ 7,524,255	$ 3,000,745
Capital Recovery (per combustion turbine)	$ 1,011,955	$ 403,577	$ 700,136	$ 279,221
Administrative Charges, Property Taxes, Insurance (per combustion turbine)	$ 435,013	$ 173,487	$ 300,970	$ 120,030
Total Annual Indirect Cost (per combustion turbine)	**$ 1,446,967**	**$ 577,064**	**$ 1,001,106**	**$ 399,251**

Capital recovery factor 0.0931

Data Inputs for Capital Recovery Factor:

Annual Interest Rate (EPA OAQPS Control Cost Manual) 8.50 pct.

Project Life (EPA OAQPS Control Cost Manual) 30 years

Administrative Charges, Property Taxes Insurance (percentage of total capital cost) 4.00%

Capital cost estimate for 1.27 million gallons of storage capacity.

GVEA Zehnder BACT Cover Page

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ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Air Permits Program

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION ADDENDUM
for
Golden Valley Electric Association
Zehnder Facility

Prepared by: Dave Jones
Reviewed by: Moses Coss
Final Date: March 23, 2024

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Abbreviations/Acronyms

AAC ....Alaska Administrative Code
AAAQS ....Alaska Ambient Air Quality Standards
Department ....Alaska Department of Environmental Conservation
BACT ....Best Available Control Technology
CFB……………………Circulating Fluidized Bed
CFR. ....Code of Federal Regulations
Cyclones………………Mechanical Separators
DFP……………………Diesel Particulate Filter
DLN..............................Dry Low NOx
DOC…………………...Diesel Oxidation Catalyst
EPA ....Environmental Protection Agency
ESP……………………Electrostatic Precipitator
EU.................................Emission Unit
FITR…………………...Fuel Injection Timing Retard
GCPs…………………..Good Combustion Practices
HAP ....Hazardous Air Pollutant
ITR……………………Ignition Timing Retard
LEA……………………Low Excess Air
LNB……………………Low NOx Burners
MR&Rs ....Monitoring, Recording, and Reporting
NESHAPS ....National Emission Standards for Hazardous Air Pollutants
NSCR…………………Non-Selective Catalytic Reduction
NSPS ....New Source Performance Standards
ORL ....Owner Requested Limit
PSD................................Prevention of Significant Deterioration
PTE................................Potential to Emit
RICE, ICE ....Reciprocating Internal Combustion Engine, Internal Combustion Engine
SCR ....Selective Catalytic Reduction
SIP ....Alaska State Implementation Plan
SNCR…………………Selective Non-Catalytic Reduction
ULSD ....Ultra Low Sulfur Diesel

Units and Measures

gal/hr..............................gallons per hour
g/kWh ....grams per kilowatt hour
g/hp-hr ....grams per horsepower hour
hr/day.............................hours per day
hr/yr ....hours per year
hp ....horsepower
lb/hr ....pounds per hour
lb/MMBtu ....pounds per million British thermal units
lb/1000 gal ....pounds per 1,000 gallons
kW ....kilowatts
MMBtu/hr......................million British thermal units per hour
MMscf/hr.......................million standard cubic feet per hour
ppmv..............................parts per million by volume
tpy ....tons per year

Pollutants

CO ....Carbon Monoxide
HAP ....Hazardous Air Pollutant
NOx ....Oxides of Nitrogen
SO_2 ....Sulfur Dioxide
$PM_{2.5}$ ....Particulate Matter with an aerodynamic diameter not exceeding 2.5 microns
PM_{10} ....Particulate Matter with an aerodynamic diameter not exceeding 10 microns

1. INTRODUCTION

The Zehnder Facility (Zehnder) is an electric generating facility that combusts distillate fuel in combustion turbines to provide power to the Golden Valley Electric Association (GVEA) grid. The power plant contains two fuel oil-fired simple cycle gas combustion turbines and two diesel-fired generators (electro-motive diesels) used for emergency power and to serve as black start engines for the GVEA generation system. The primary fuel is stored in two 50,000 gallon aboveground storage tanks. Turbine startup fuel and electro-motive diesels primary fuel is stored in a 12,000 gallon above ground storage tank.

In a letter dated April 24, 2015, the Alaska Department of Environmental Conservation (Department) requested the stationary sources expected to be major stationary sources in the particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$) serious nonattainment area perform a voluntary Best Available Control Technology (BACT) review in support of the state agency's required SIP submittal once the nonattainment area is re-classified as a Serious $PM_{2.5}$ nonattainment area. The designation of the area as "Serious" with regard to nonattainment of the 2006 24-hour $PM_{2.5}$ ambient air quality standards was published in Federal Register Vol. 82, No. 89, May 10, 2017, pages 21703-21706, with an effective date of June 9, 2017.[1]

T**he initial BACT Determination for Zehnder was included in Part 4 of Appendix III.D.7.07 Control Strategies Chapter, in the State Air Quality Control Plan adopted on November 19, 2019, with amendments adopted on November 18, 2020, as part of a complete SIP package.[2] The *EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour $PM_{2.5}$ Serious Area and 189(d) Plan*[3] published in the Federal Register on December 5, 2023 (*88 Fed. Reg. 84658*) disapproved of Alaska's initial BACT determinations for $PM_{2.5}$ and SO_2 controls. This BACT addendum addresses the EPA's disapproval of the significant emissions units (EUs) listed in the Zehnder facility's operating permit AQ0109TVP04. The BACT addendum also accounts for EPA's comments listed in Memorandum dated August 24, 2022 from Zach Hedgpeth, LSASD to Matthew Jentgen, ARD.[4] This BACT addendum provides the Department's review of the BACT analysis for $PM_{2.5}$, and the BACT analysis for sulfur dioxide (SO_2) emissions, which is a precursor pollutant that can form $PM_{2.5}$ in the atmosphere post combustion. Note that the section for oxides of nitrogen (NOx), which is also a precursor pollutant that can form $PM_{2.5}$ in the atmosphere post combustion, has been removed from this addendum because the EPA has approved[3] of the Department's comprehensive NOx precursor demonstration under 40 C.F.R. 51.1006(a)(1) and 51.1010(a)(2)(ii).**

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[1] Federal Register, Vol. 82, No. 89, Wednesday May 10, 2017 (https://dec.alaska.gov/air/anpms/comm/docs/2017-09391-CFR.pdf)

[2] Background and detailed information regarding Fairbanks $PM_{2.5}$ State Implementation Plan (SIP) can be found at http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip/.

[3] The EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour $PM_{2.5}$ Serious Area and 189(d) Plan can be found at https://www.regulations.gov/document/EPA-R10-OAR-2022-0115-0426.

[4] Document 000007_EPA Technical Support Document – GVEA BACT TSD v20220824: https://www.regulations.gov/document/EPA-R10-OAR-2022-0115-0214.

The following sections review GVEA's BACT analysis for the Zehnder Facility for technical accuracy and adherence to accepted engineering cost estimation practices.

2. BACT EVALUATION

A BACT analysis is an evaluation of all available control options for equipment emitting the triggered pollutants and a process for selecting the best option based on feasibility, economics, energy, and other impacts. 40 CFR 52.21(b)(12) defines BACT as a site-specific determination on a case-by-case basis. The Department's goal is to identify BACT for the permanent emission units (EUs) at the GVEA Zehnder facility that emit $PM_{2.5}$ and SO_2, establish emission limits which represent BACT, and assess the level of monitoring, recordkeeping, and reporting (MR&R) necessary to ensure GVEA applies BACT for the EUs. The Department based the BACT review on the five-step top-down approach set forth in Federal Register Volume 61, Number 142, July 23, 1996 (Environmental Protection Agency). Table A presents the EUs subject to BACT review.

Table A: Emission Units Subject to BACT Review

EU ID	Description of EU	Rating/Size	Installation or Construction Date
1	Fuel Oil-Fired Regenerative Simple Cycle Gas Turbine	268 MMBtu/hr (18.4 MW)	1971
2	Fuel Oil-Fired Regenerative Simple Cycle Gas Turbine	268 MMBtu/hr (18.4 MW)	1972
3	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr (2.75 MW)	1970
4	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr (2.75 MW)	1970
10	Diesel-Fired Boiler	1.7 MMBtu/hr	2012
11	Diesel-Fired Boiler	1.7 MMBtu/hr	2012

Five-Step BACT Determinations

The following sections explain the steps used to determine BACT for $PM_{2.5}$ and SO_2 for the applicable equipment.

Step 1 Identify All Potentially Available Control Technologies

The Department identifies all available control options for the EU and the pollutant under consideration. This includes technologies used throughout the world or emission reductions through the application of available control techniques, changes in process design, and/or operational limitations. To assist in identifying available controls, the Department reviews available controls listed on the Reasonably Available Control Technology (RACT), BACT, and Lowest Achievable Emission Rate (LAER) Clearinghouse (RBLC). The RBLC is an EPA database where permitting agencies nationwide post imposed BACT for PSD sources. It is usually the first stop for BACT research. In addition to the RBLC search, the Department used several search engines to look for emerging and tried technologies used to control $PM_{2.5}$ and SO_2 emissions from equipment similar to those listed in Table A.

Step 2 Eliminate Technically Infeasible Control Technologies:
The Department evaluates the technical feasibility of each control technology based on source specific factors in relation to each EU subject to BACT. Based on sound documentation and demonstration, the Department eliminates control technologies deemed technically infeasible due to physical, chemical, and engineering difficulties.

Step 3 Rank the Remaining Control Technologies by Control Effectiveness
The Department ranks the remaining control technologies in order of control effectiveness with the most effective at the top.

Step 4 Evaluate the Most Effective Controls and Document the Results as Necessary
The Department reviews the detailed information in the BACT analysis about the control efficiency, emission rate, emission reduction, cost, environmental, and energy impacts for each option to decide the final level of control. The analysis must present an objective evaluation of both the beneficial and adverse energy, environmental, and economic impacts. A proposal to use the most effective option does not need to provide the detailed information for the less effective options. If cost is not an issue, a cost analysis is not required. Cost effectiveness for a control option is defined as the total net annualized cost of control divided by the tons of pollutant removed per year. Annualized cost includes annualized equipment purchase, erection, electrical, piping, insulation, painting, site preparation, buildings, supervision, transportation, operation, maintenance, replacement parts, overhead, raw materials, utilities, engineering, start-up costs, financing costs, and other contingencies related to the control option. Sections 4 and 5 present the Department's BACT Determinations for $PM_{2.5}$ and SO_2.

Step 5 Select BACT
The Department selects the most effective control option not eliminated in Step 4 as BACT for the pollutant and EU under review and lists the final BACT requirements determined for each EU in this step. A project may achieve emission reductions through the application of available technologies, changes in process design, and/or operational limitations. The Department reviewed GVEA's BACT analysis and made BACT determinations for $PM_{2.5}$ and SO_2 for the GVEA Zehnder Facility. These BACT determinations are based on the information submitted by GVEA in their analysis, information from vendors, suppliers, sub-contractors, RBLC, and an exhaustive internet search.

3. BACT DETERMINATION FOR NO_X

As discussed in the Section 1 Introduction, this BACT addendum has removed the previous NOx BACT determinations included in the State Air Quality Control Plan adopted on November 19, 2019, with amendments adopted on November 18, 2020,[2] because the optional comprehensive precursor demonstration (as allowed under 40 C.F.R. 51.1006(1) and 51.1010(a)(2)(ii)) for the precursor gas NOx for point sources illustrates that NOx controls are not needed. The Department submitted with the Serious SIP a final comprehensive precursor demonstration as justification not to require post emission controls for NOx. Please see the precursor demonstration for NOx in the Serious SIP Modeling Chapter III.D.7.8.[2] The $PM_{2.5}$ NAAQS Final SIP Requirements Rule states if the state determines through a precursor demonstration that controls for a precursor gas are not needed for attaining the standard, then the controls identified as

BACT/BACM or Most Stringent Measure for the precursor gas are not required to be implemented.[5] The Department's NOx precursor demonstration was approved in *EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour $PM_{2.5}$ Serious Area and 189(d) Plan*[3] published in the Federal Register on December 5, 2023 (*88 Fed. Reg. 84658*).

4. BACT DETERMINATION FOR $PM_{2.5}$

The Department based its $PM_{2.5}$ assessment on BACT determinations found in the RBLC, internet research, and BACT analyses submitted to the Department by GVEA for the North Pole Power Plant and Zehnder Facility, Aurora for the Chena Power Plant, US Army for Fort Wainwright, and UAF for the Combined Heat and Power Plant.

4.1 $PM_{2.5}$ BACT for the Fuel Oil-Fired Simple Cycle Gas Turbines (EUs 1 and 2)

Possible $PM_{2.5}$ emission control technologies for the fuel oil-fired simple cycle gas turbines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 15.190, Simple Cycle Gas Turbines (> 25 MW) The search results for simple cycle gas turbines are summarized in Table 4-1.

Table 4-1. RBLC Summary of $PM_{2.5}$ Control for Simple Cycle Gas Turbines

Control Technology	Number of Determinations	Emission Limits
Good Combustion Practices	25	0.0038 – 0.0076 lb/MMBtu
Clean Fuels	12	5 – 14 lb/hr

RBLC Review

A review of similar units in the RBLC indicates restrictions on fuel sulfur contents and good combustion practices are the principle PM control technologies installed on simple cycle gas turbines. The lowest $PM_{2.5}$ emission rate listed in the RBLC is 0.0038 lb/MMBtu.

Step 1 - Identification of $PM_{2.5}$ Control Technology for the Simple Cycle Gas Turbines

From research, the Department identified the following technologies as available for control of $PM_{2.5}$ emissions from fuel oil-fired simple cycle gas turbines:

(a) Low Sulfur Fuel
Low sulfur fuel has been known to reduce particulate matter emissions. $PM_{2.5}$ emission rates for low sulfur fuel are not available and therefore a BACT emissions rate cannot be set for low sulfur fuel. The Department does not consider low sulfur fuel a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(b) Low Ash Fuel
Residual fuels and crude oil are known to contain ash forming components, while refined fuels are low ash. Fuels containing ash can cause excessive wear to equipment and foul

[5] https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf

combustion components. EUs 1 and 2 are fired exclusively on distillate fuel which is a form of refined fuel, and potential $PM_{2.5}$ emissions are based on emission factors for distillate fuel. The Department considers low ash fuel a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(c) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. Due to EUs 1 and 2 currently operating under limits, the Department considers limited operation as a feasible control technology for the fuel oil-fired simple cycle gas turbines.

(d) Good Combustion Practices (GCPs)
GCPs typically include the following elements:

1. **Sufficient residence time to complete combustion;**
2. **Providing and maintaining proper air/fuel ratio;**
3. **High temperatures and low oxygen levels in the primary combustion zone;**
4. **High enough overall excess oxygen levels to complete combustion and maximize thermal efficiency.**

Combustion efficiency is dependent on the gas residence time, the combustion temperature, and the amount of mixing in the combustion zone. GCPs are accomplished primarily through combustion chamber design as it relates to residence time, combustion temperature, air-to-fuel mixing, and excess oxygen levels. Proper management of the combustion process will result in a reduction of **$PM_{2.5}$ emissions**. The Department considers GCPs a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

Step 2 - Eliminate Technically Infeasible $PM_{2.5}$ Controls for the Simple Cycle Gas Turbines
As explained in Step 1 of Section 4.1, the Department does not consider low sulfur fuel as technically feasible technology to control $PM_{2.5}$ emissions from the fuel oil-fired simple cycle gas turbines.

Step 3 - Rank the Remaining $PM_{2.5}$ Control Technologies for the Simple Cycle Gas Turbines
The following control technologies have been identified and ranked by efficiency for the control of $PM_{2.5}$ emissions from the fuel oil-fired simple cycle gas turbines:

(d) Good Combustion Practices	(Less than 40% Control)
(b) Low Ash Fuel	(0% Control)
(c) Limited Operation	(0% Control)

Control technologies already in practice at the stationary source or included in the design of the EU are considered 0% control for the purpose of the SIP BACT for existing stationary sources.

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA proposes the following as BACT for $PM_{2.5}$ emissions from the fuel oil-fired simple cycle gas turbines:

(a) $PM_{2.5}$ emissions from EUs 1 and 2 shall not exceed 0.012 lb/MMBtu over a 4-hour averaging period; and

(b) Maintaining good combustion practices.

Step 5 - Selection of $PM_{2.5}$ BACT for the Simple Cycle Gas Turbines

The Department's finding is that BACT for $PM_{2.5}$ emissions from the fuel oil-fired simple cycle gas turbines is as follows:

(a) $PM_{2.5}$ emissions from EUs 1 and 2 shall be controlled by combusting only low ash fuel;

(b) Maintain good combustion practices at all times of operation by following the manufacturer's operation and maintenance procedures;

(c) Initial compliance with the proposed $PM_{2.5}$ emission limit will be demonstrated by conducting a performance test to obtain an emission rate; and

(d) $PM_{2.5}$ emissions from EUs 1 & 2 shall not exceed 0.012 lb/MMBtu[6] over a 3-hour averaging period.

Table 4-2 lists the proposed $PM_{2.5}$ BACT determination for this facility along with those for other fuel oil-fired simple cycle gas turbines located in the Serious $PM_{2.5}$ nonattainment area.

Table 4-2. Comparison of $PM_{2.5}$ BACT for Simple Cycle Gas Turbines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
GVEA – North Pole	Two Fuel Oil-Fired Simple Cycle Gas Turbines	1,344 MMBtu/hr	0.012 lb/MMBtu[6] (3-hour averaging period)	Good Combustion Practices
GVEA – Zehnder	Two Fuel Oil-Fired Simple Cycle Gas Turbines	536 MMBtu/hr	0.012 lb/MMBtu[6] (3-hour averaging period)	Good Combustion Practices

4.2 $PM_{2.5}$ BACT for the Large Diesel Fired Engines

Possible $PM_{2.5}$ emission control technologies for large engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 17.110-17.190, Large Internal Combustion Engines (>500 hp). The search results for large diesel-fired engines are summarized in Table 4-3.

Table 4-3. RBLC Summary of $PM_{2.5}$ Control for Large Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Federal Emission Standards	12	0.03 – 0.02
Good Combustion Practices	28	0.03 – 0.24
Limited Operation	11	0.04 – 0.17
Low Sulfur Fuel	14	0.15 – 0.17
No Control Specified	14	0.02 – 0.15

[6] Table 3.1-2a of US EPA's AP-42 Emission Factors. https://www3.epa.gov/ttnchie1/ap42/ch03/final/c03s01.pdf

RBLC Review

A review of similar units in the RBLC indicates that good combustion practices, compliance with the federal emission standards, low ash/sulfur diesel, and limited operation are the principle $PM_{2.5}$ control technologies installed on large diesel-fired engines. The lowest $PM_{2.5}$ emission rate in the RBLC is 0.02 g/hp-hr.

Step 1 - Identification of $PM_{2.5}$ Control Technology for the Large Diesel-Fired Engines

From research, the Department identified the following technologies as available for controls of $PM_{2.5}$ emissions from diesel fired engines rated at 500 hp or greater:

(a) Diesel Particulate Filter (DPF)
DPFs are a control technology that is designed to physically filter particulate matter from the exhaust stream. Several designs exist which require cleaning and replacement of the filter media after soot has become caked onto the filter media. Regenerative filter designs are also available that burn the soot on a regular basis to regenerate the filter media. DPF can reduce $PM_{2.5}$ emissions by 85%. The Department considers DPF a technically feasible control technology for the large diesel-fired engines.

(b) Diesel Oxidation Catalyst (DOC)
DOC can reportedly reduce $PM_{2.5}$ emissions by 30% and PM emissions by 50%. A DOC is a form of "bolt on" technology that uses a chemical process to reduce pollutants in the diesel exhaust into decreased concentrations. They replace mufflers on vehicles, and require no modifications. More specifically, this is a honeycomb type structure that has a large area coated with an active catalyst layer. As CO and other gaseous hydrocarbon particles travel along the catalyst, they are oxidized thus reducing pollution. The Department considers DOC a technically feasible control technology for the large diesel-fired engines.

(c) Positive Crankcase Ventilation
Positive crankcase ventilation is the process of re-introducing the combustion air into the cylinder chamber for a second chance at combustion after the air has seeped into and collected in the crankcase during the downward stroke of the piston cycle. This process allows any unburned fuel to be subject to a second combustion opportunity. Any combustion products act as a heat sink during the second pass through the piston, which will lower the temperature of combustion and reduce the thermal NOx formation. The Department considers positive crankcase ventilation a technically feasible control technology for the large diesel-fired engines.

(d) Low Sulfur Fuel
Low sulfur fuel has been known to reduce particulate matter emissions. The Department considers low sulfur fuel as a technically feasible control technology for the large diesel-fired engine.

(e) Low Ash Diesel
Residual fuels and crude oil are known to contain ash forming components, while refined fuels are low ash. Fuels containing ash can cause excessive wear to equipment and foul engine components. The Department considers low ash diesel a technically feasible control technology for the large diesel-fired engines.

(f) Federal Emission Standards
RBLC NOx determinations for federal emission standards require the engines meet the requirements of 40 C.F.R. 60 NSPS Subpart IIII, 40 C.F.R 63 Subpart ZZZZ, non-road engines (NREs), or EPA tier certifications. NSPS Subpart IIII applies to stationary compression ignition internal combustion engines that are manufactured or reconstructed after July 11, 2005. The Department considers meeting the technology based New Source Performance Standards (NSPS) as a technically feasible control technology for the large diesel-fired engines.

(g) Limited Operation
Limiting the operation of emissions units reduces the potential to emit of those units. The Department considers limited operation as a feasible control technology for the large diesel-fired engines.

(h) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle gas turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of $PM_{2.5}$ emissions. The Department considers GCPs a technically feasible control technology for the large diesel-fired engines.

Step 2 - Eliminate Technically Infeasible $PM_{2.5}$ Control Technologies for the Large Engines
$PM_{2.5}$ emission rates for low sulfur fuel are not available and therefore a BACT emissions rate cannot be set for low sulfur fuel. Low sulfur fuel is not a technically feasible control technology.

Step 3 - Rank the Remaining $PM_{2.5}$ Control Technologies for the Large Diesel-Fired Engines
The following control technologies have been identified and ranked by efficiency for the control of $PM_{2.5}$ emissions from the large diesel-fired engines:

(g)	Limited Operation	(94% Control)
(a)	Diesel Particulate Filters	(85% Control)
(h)	Good Combustion Practices	(Less than 40% Control)
(b)	Diesel Oxidation Catalyst	(30% Control)
(e)	Low Ash Diesel	(25% Control)
(c)	Positive Crankcase Ventilation	(10% Control)
(f)	Federal Emission Standards	(Baseline)

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA proposes limited operation as BACT for $PM_{2.5}$ emissions from the large diesel-fired engines:

(a) Limit non-emergency operation of EUs 3 and 4 to no more than 500 hours per year each for maintenance checks and readiness testing; and

(b) $PM_{2.5}$ emissions from EUs 3 and 4 shall not exceed 0.1 lb/MMBtu[7] over a 4-hour averaging period.

Department Evaluation of BACT for $PM_{2.5}$ Emissions from the Large Diesel-Fired Engines
The Department reviewed GVEA's proposal finds that $PM_{2.5}$ emissions from the large diesel-fired engines can also be controlled by good combustion practices.

Step 5 - Selection of $PM_{2.5}$ BACT for the Large Diesel-Fired Engines
The Department's finding is that the BACT for $PM_{2.5}$ emissions from the large diesel-fired engines is as follows:

(a) Limit non-emergency operation of EUs 3 and 4 to no more than 100 hours per year each;

(b) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation;

(c) <u>$PM_{2.5}$ emissions from EUs 3 and 4 shall not exceed 0.32 g/hp-hr[7] over a 3-hour averaging period; and</u>

(d) Demonstrate compliance with the numerical BACT emission limit by complying with 40 C.F.R 63 Subpart ZZZZ.

Table 4-4 lists the proposed $PM_{2.5}$ BACT determination for the facility along with those for other diesel-fired engines rated at more than 500 hp located in the Serious $PM_{2.5}$ nonattainment area.

Table 4-4. Comparison of $PM_{2.5}$ BACT for Large Diesel Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
UAF	Large Diesel-Fired Engines	**> 500 hp**	**0.05 -** 0.32 g/hp-hr	Positive Crankcase Ventilation Limited Operation **Ultra-Low Sulfur Diesel**
Fort Wainwright	8 Large Diesel-Fired Engines	> 500 hp	0.15 – 0.32 g/hp-hr	Limited Operation Ultra-Low Sulfur Diesel Federal Emission Standards
GVEA North Pole	Large Diesel-Fired Engine	600 hp	0.32 g/hp-hr	Positive Crankcase Ventilation Good Combustion Practices
GVEA Zehnder	2 Large Diesel-Fired Engines	11,000 hp (each)	0.32 g/hp-hr	Limited Operation Good Combustion Practices

4.3 $PM_{2.5}$ BACT for the Diesel Fired Boilers

Possible $PM_{2.5}$ emission control technologies for small diesel-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13.220, Commercial/Institutional Size Boilers (<100 MMBtu/hr). The search results for diesel-fired boilers are summarized in Table 4-5.

Table 4-5. RBLC Summary of $PM_{2.5}$ Control for Diesel Fired Boilers

Control Technology	Number of Determinations	Emission Limits

[7] Table 3.4-1 of US EPA's AP-42 Emission Factors (PM). https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf

Good Combustion Practices	3	0.25 lb/gal
		0.1 tpy
		2.17 lb/hr

RBLC Review
A review of similar units in the RBLC indicates that good combustion practices is the principle $PM_{2.5}$ control technology determined for small diesel-fired boilers. The lowest $PM_{2.5}$ emission rate listed in the RBLC is 0.1 tpy.

Step 1 - Identification of $PM_{2.5}$ Control Technology for the Diesel Fired Boilers
From research, the Department identified the following technologies as available for control of $PM_{2.5}$ emissions from diesel-fired boilers:

(a) Wet Scrubbers
Wet scrubbers use a scrubbing solution to remove $PM/PM_{10}/PM_{2.5}$ from exhaust gas streams. The mechanism for particulate collection is impaction and interception by water droplets. Wet scrubbers are configured as counter-flow, cross-flow, or concurrent flow, but typically employ counter-flow where the scrubbing fluid is in the opposite direction as the gas flow. Wet scrubbers have control efficiencies of 50% - 99%.[8] One advantage of wet scrubbers is that they can be effective on condensable particulate matter. A disadvantage of wet scrubbers is that they consume water and produce water and sludge. For fine particulate control, a venturi scrubber can be used, but typical loadings for such a scrubber are 0.1-50 grains/scf. The Department considers the use of wet scrubbers a technically feasible control technology for the diesel-fired boilers.

(b) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle gas turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of $PM_{2.5}$ emissions. The Department considers GCPs a technically feasible control technology for the diesel-fired boilers.

Step 2 - Eliminate Technically Infeasible $PM_{2.5}$ Control Technologies for the Diesel Fired Boilers
All identified control devices are technically feasible for the diesel-fired boilers.

Step 3 - Rank the Remaining $PM_{2.5}$ Control Technologies for the Diesel Fired Boilers
The following control technologies have been identified and ranked by efficiency for the control of $PM_{2.5}$ emissions from the diesel-fired boilers:

(a) Wet Scrubbers (50% - 99% Control)
(b) Good Combustion Practices (Less than 40% Control)

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

[8] https://www3.epa.gov/ttn/catc/dir1/fcondnse.pdf
https://www3.epa.gov/ttn/catc/dir1/fiberbed.pdf
https://www3.epa.gov/ttn/catc/dir1/fventuri.pdf

GVEA proposes the following as BACT for $PM_{2.5}$ emissions from the diesel-fired boilers:

(a) Good Combustion Practices; and

(b) $PM_{2.5}$ emissions shall not exceed 2.13 lb/1,000 gallons[9] over a 4-hour averaging period.

Department Evaluation of BACT for $PM_{2.5}$ Emissions from Diesel-Fired Boilers

The Department reviewed GVEA's proposal and finds that the two diesel-fired boilers have a combined PTE of less than two tpy for $PM_{2.5}$ based on continuous operation of 8,760 hours per year. At two tpy, the cost effectiveness in terms of dollars per ton for add-on pollution control for these units is economically infeasible.

Step 5 - Selection of $PM_{2.5}$ BACT for the Diesel-Fired Boilers

The Department's finding is that BACT for $PM_{2.5}$ emissions from the diesel-fired boilers is as follows:

(a) $PM_{2.5}$ emissions from the diesel-fired boilers shall not exceed **0.016 lb/MMBtu**[10] over a 3-hour averaging period;

(b) Demonstrate compliance with the numerical BACT emission limit by complying with 40 C.F.R 63 Subpart JJJJJJ; and

(c) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation.

Table 4-6 lists the proposed $PM_{2.5}$ BACT determination for this facility along with those for other diesel-fired boilers rated at less than 100 MMBtu/hr in the Serious $PM_{2.5}$ nonattainment area.

Table 4-6. Comparison of $PM_{2.5}$ BACT for the Diesel-Fired Boilers at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
UAF	**6 Small Diesel-Fired Boilers**	< 100 MMBtu/hr	**0.016 lb/MMbtu**[10]	Limited Operation **& Good Combustion Practices**
Fort Wainwright	**4** Small Diesel-Fired Boilers	< 100 MMBtu/hr	**0.016 lb/MMbtu**[10]	Good Combustion Practices
GVEA Zehnder	2 Small Diesel-Fired Boilers	1.7 MMBtu/hr (each)	**0.016 lb/MMbtu**[10]	Good Combustion Practices

5. BACT DETERMINATION FOR SO_2

The Department based its SO_2 assessment on BACT determinations found in the RBLC, internet research, and BACT analyses submitted to the Department by GVEA for the North Pole Power Plant and Zehnder Facility, Aurora for the Chena Power Plant, US Army for Fort Wainwright, and UAF for the Combined Heat and Power Plant.

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[9] Tables 1.3-2 & 1.3-7 of US EPA's AP-42 Emission Factors: https://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf

[10] Emissions factor from AP-42 Table's 1.3-2 (total condensable particulate matter from No. 2 oil, 1.3 lb/1,000 gal) and 1.3-7 ($PM_{2.5}$ size-specific factor from distillate oil, **0.83 lb/1,000 gal)** converted to lb/MMBtu**. Note that the E.F. has been corrected from the previous SIP because the small boilers are considered "commercial" under Table 1.3-7 and not "industrial" under Table 1.3-6.**

5.1 SO_2 BACT for the Fuel Oil-Fired Simple Cycle Gas Turbines

Possible SO_2 emission control technologies for the large dual fuel fired boiler was obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 15.190, Liquid Fuel-Fired Simple Cycle Gas Turbines (> 25 MW). The search results for simple cycle gas turbines are summarized in Table 5-1.

Table 5-1. RBLC Summary of SO_2 Controls for Fuel Oil-Fired Simple Cycle Gas Turbines

Control Technology	Number of Determinations	Emission Limits	
Ultra-Low Sulfur Diesel	7	0.0015	% S by wt.
Low Sulfur Fuel	2	0.0026 – 0.055	lb/MMBtu
Good Combustion Practices	3	0.6	lb/hr

RBLC Review

A review of similar units in the RBLC indicates that limiting the sulfur content of fuel and good combustion practices are the principle SO_2 control technologies determined as BACT for fuel oil-fired simple cycle gas turbines. The lowest SO_2 emission rate listed in the RBLC is combustion of ULSD at 0.0015 % S by wt.

Step 1 - Identification of SO_2 Control Technology for the Simple Cycle Gas Turbines

From research, the Department identified the following technologies as available for control of SO_2 emissions from fuel oil-fired simple cycle gas turbines:

(a) Ultra Low Sulfur Diesel (ULSD)
ULSD has a fuel sulfur content of 0.0015 percent sulfur by weight or less. Using ULSD would reduce SO_2 emissions because the fuel oil-fired simple cycle gas turbines are combusting standard diesel that has a sulfur content of up to 0.5 percent sulfur by weight. Switching to ULSD could reach a great than 99 percent decrease in SO_2 emissions from the fuel oil-fired simple cycle gas turbines. The Department considers ULSD a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(b) Low Sulfur Fuel (No. 1 Fuel Oil)
No. 1 Fuel Oil has a fuel sulfur content of approximately 0.1 percent sulfur by weight. Using No. 1 fuel oil would reduce SO_2 emissions because the fuel oil-fired simple cycle gas turbines are combusting standard No. 2 fuel oil that has a sulfur content of up to 0.5 percent sulfur by weight. Switching to No. 1 fuel oil could reach an 80 percent decrease in SO_2 emissions from the fuel oil-fired simple cycle gas turbines during non-startup operation. The Department considers No. 1 fuel oil a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

(c) Good Combustion Practices (GCPs)
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle gas turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2. The Department considers GCPs a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

Step 2 - Eliminate Technically Infeasible SO_2 Controls for the Simple Cycle Gas Turbines
All control technologies identified are technically feasible for the fuel oil-fired simple cycle gas turbines.

Step 3 - Rank Remaining SO_2 Control Technologies for the Simple Cycle Gas Turbines
The following control technologies have been identified and ranked for control of SO_2 emissions from the fuel oil-fired simple cycle turbines:

(a) Ultra Low Sulfur Diesel (99.7% Control)
(b) Low Sulfur Fuel (No. 1 Fuel Oil) (80% Control)
(c) Good Combustion Practices (Less than 40% Control)

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA provided an economic analysis for switching the fuel combusted in the simple cycle gas turbines to ultra-low sulfur diesel (ULSD). A summary of the analysis for both of the turbines combined is shown below:

Table 5-2. GVEA Economic Analysis for Technically Feasible SO_2 Controls for Turbines

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD (0.0015 % S wt.)	580	578	$8,674,362	$8,239,935	$14,250
Capital Recovery Factor = 0.0944 (7% interest rate for a 20 year equipment life)					

GVEA contends that the economic analysis indicates the level of SO_2 reduction does not justify the fuel switch to ULSD in the simple cycle turbines based on the excessive cost per ton of SO_2 removed per year.

GVEA proposes the following as BACT for SO_2 emissions from the simple cycle gas turbines:

(a) SO_2 emissions from the operation of the fuel oil-fired simple cycle gas turbines will be controlled with good combustion practices; and

(b) Fuel burned in the fuel oil-fired simple cycle gas turbine will be limited to a sulfur content of 0.5 percent by weight.

Department Evaluation of BACT for SO_2 Emissions from the Simple Cycle Gas Turbines
The Department revised the cost analysis provided for the fuel switch to ULSD in the simple cycle gas turbines by changing the interest rate to 8.5% (current bank prime interest rate) and updated the equipment life to 30 years. The Department **left the existing 580 ton per year**

sulfur limit for the facility and the average fuel cost increase provided by GVEA for the Zehnder Facility of $0.251/gallon unchanged from the previous BACT cost calculation conducted on November 13, 2019. Additionally, the Department reviewed the cost information provided by GVEA to appropriately evaluate the total capital investment of installing two new 1.5-million-gallon ULSD storage tanks at GVEA's North Pole Facility. The capital investment for EUs 1 and 2 at the Zehnder Facility equates to 28.5% of the total capital investment for the new tanks.

A summary of these analyses for both of the turbines combined is shown in Table 5-3:

Table 5-3. Department Economic Analysis for Technically Feasible SO_2 Controls for Turbines

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD	580	578	$8,674,362	$5,109,893	$8,387
Capital Recovery Factor = 0.0931 (8.5% interest rate for a 30-year equipment life)					

The Department's economic analysis indicates the level of SO_2 reduction justifies the use of ULSD as BACT for the fuel oil-fired simple cycle gas turbines located in the Serious PM-2.5 nonattainment area.

Step 5 - Selection of SO_2 BACT for the Simple Cycle Gas Turbines
The Department's finding is that BACT for SO_2 emissions from the fuel oil-fired simple cycle gas turbines is as follows:

(a) SO_2 emissions from EUs 1 and 2 shall be controlled by limiting the sulfur content of fuel combusted in the turbines to no more than 0.0015 percent by weight **(15 ppmw, ULSD)**;
(b) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation; and
(c) Compliance with the proposed fuel sulfur content limit will be demonstrated with fuel shipment receipts and/or fuel test results for sulfur content.

Table 5-4 lists the proposed SO_2 BACT determination for this facility along with those for other fuel oil-fired simple cycle gas turbines located in the Serious $PM_{2.5}$ nonattainment area.

Table 5-4. Comparison of SO_2 BACT for Simple Cycle Gas Turbines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
GVEA – North Pole	Two Fuel Oil-Fired Simple Cycle Gas Turbines	1,344 MMBtu/hr	0.0015 % S wt.	ULSD
GVEA – Zehnder	Two Fuel Oil-Fired Simple Cycle Gas Turbines	536 MMBtu/hr	0.0015 % S wt.	ULSD

5.2 SO_2 BACT for the Large Diesel-Fired Engines

Possible SO_2 emission control technologies for large engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 17.100 to

17.190, Large Internal Combustion Engines (>500 hp). The search results for large diesel-fired engines are summarized in Table 5-5.

Table 5-5. RBLC Summary Results for SO_2 Control for Large Diesel-Fired Engines

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Low Sulfur Diesel	27	0.005 – 0.02
Federal Emission Standards	6	0.001 – 0.005
Limited Operation	6	0.005 – 0.006
Good Combustion Practices	3	None Specified
No Control Specified	11	0.005 – 0.008

RBLC Review
A review of similar units in the RBLC indicates combustion of low sulfur fuel, limited operation, good combustion practices, and compliance with the federal emission standards are the principle SO_2 control technologies installed on large diesel-fired engines. The lowest SO_2 emission rate listed in the RBLC is 0.001 g/hp-hr.

Step 1 - Identification of SO_2 Control Technology for the Large Diesel-Fired Engines
From research, the Department identified the following technologies as available for control of SO_2 emissions from diesel fired engines rated at 500 hp or greater:

(a) Ultra Low Sulfur Diesel
The theory of ULSD was discussed in detail in the SO_2 BACT for the fuel oil-fired simple cycle gas turbines and will not be repeated here. The Department considers ULSD a technically feasible control technology for the large diesel-fired engines.

(b) Federal Emission Standards
The **federal emission standards require the engines meet the requirements of 40 C.F.R. 60 NSPS Subpart IIII, 40 C.F.R 63 Subpart ZZZZ, non-road engines (NREs), or EPA tier certifications. NSPS Subpart IIII applies to stationary compression ignition internal combustion engines that are manufactured or reconstructed after July 11, 2005. The Department considers meeting the technology based New Source Performance Standards (NSPS) of Subpart IIII as a technically feasible control technology for the large diesel-fired engines.**

(c) Limited Operation
Limiting the operation of emission units reduces the potential to emit for those units. The Department considers limited operation a technically feasible control technology for the large diesel-fired engines.

(d) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle gas turbines and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2 emissions. The Department considers GCPs a technically feasible control technology for the large diesel-fired engines.

Step 2 - Eliminate Technically Infeasible SO_2 Control Technologies for the Large Engines
All identified control technologies are technically feasible for the large diesel-fired engines.

Step 3 - Rank the Remaining SO_2 Control Technologies for the Large Diesel-Fired Engines
The following control technologies have been identified and ranked by efficiency for the control of SO_2 emissions from the large diesel-fired engines.

(a) Ultra-Low Sulfur Diesel (99% Control)
(c) Limited Operation (94% Control)
(d) Good Combustion Practices (Less than 40% Control)
(b) Federal Emission Standards (Baseline)

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA provided an economic analysis of the control technologies available for the large diesel-fired engine to demonstrate that the use of ULSD with limited operation is not economically feasible on these units. A summary of the analysis for EUs 3 and 4 is shown below:

Table 5-6. GVEA Economic Analysis for Technically Feasible SO_2 Controls per Engine

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment ($)	Total Annualized Costs ($/year)	Cost Effectiveness ($/ton)
ULSD	3.71	3.70	--	$28,732	$7,768
Capital Recovery Factor = 0.1424 (7% interest rate for a 10 year equipment life)					

GVEA contends that the economic analysis indicates the level of SO_2 reduction does not justify the use of ULSD for the large diesel-fired engines based on the excessive cost per ton of SO_2 removed per year.

GVEA proposes the following as BACT for SO_2 emissions from the diesel-fired engines:

(a) SO_2 emissions from the operation of the diesel fired engines will be controlled with good combustion practices; and

(b) Limit the sulfur content of fuel combusted in EUs 3 and 4 to no more than 0.5 percent sulfur by weight.

Department Evaluation of BACT for SO_2 Emissions from the Diesel-Fired Engines

The Department reviewed GVEA's proposal for EUs 3 and 4 and finds that ULSD is an economically feasible control technology for large diesel-fired engines located in the Serious $PM_{2.5}$ nonattainment area. The Department does not agree with some of the assumptions provided in GVEA's cost analysis that cause an overestimation of the cost effectiveness. However, since this overestimation is still cost effective, the Department did not revise the cost analysis. The Department further finds that SO_2 emissions from the large diesel-fired engines can additionally be controlled by limiting the use of the units during non-emergency operation.

Step 5 - Selection of SO_2 BACT for the Large Diesel Fired Engines
The Department's finding is that the BACT for SO_2 emissions from the diesel-fired engines is as follows:

(a) SO_2 emissions from EUs 3 and 4 shall be controlled limiting the sulfur content of fuel combusted in the engines to no more than 0.0015 percent by weight;
(b) Limit non-emergency operation of EUs 3 and 4 to no more than 100 hours per year each;
(c) Maintain good combustion practices by following the manufacturer's maintenance procedures at all times of operation; and
(d) Compliance with the proposed fuel sulfur content limit will be demonstrated with fuel shipment receipts and/or fuel test results for sulfur content.

Table 5-7 lists the proposed SO_2 BACT determination for this facility along with those for other diesel-fired engines rated at more than 500 hp located in the Serious $PM_{2.5}$ nonattainment area.

Table 5-7. Comparison of SO_2 BACT for Large Diesel-Fired Engines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	8 Large Diesel-Fired Engines	> 500 hp	15 ppmw S in fuel	Limited Operation Good Combustion Practices Ultra-Low Sulfur Diesel
UAF	Large Diesel-Fired Engine	13,266 hp	15 ppmw S in fuel	Limited Operation Good Combustion Practices Ultra-Low Sulfur Diesel
GVEA North Pole	Large Diesel-Fired Engine	600 hp	<u>**15**</u> ppmw S in fuel	Limited Operation Good Combustion Practices
GVEA Zehnder	2 Large Diesel-Fired Engines	11,000 hp	15 ppmw S in fuel	Good Combustion Practices Ultra-Low Sulfur Diesel

5.3 SO_2 BACT for the Diesel Fired Boilers

Possible SO_2 emission control technologies for small diesel-fired boilers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13.220, Industrial Size Boilers (<100 MMBtu/hr). The search results for diesel-fired engines are summarized in Table 5-8.

Table 5-8. RBLC Summary of SO_2 Control for the Small Diesel-Fired Boilers

Control Technology	Number of Determinations	Emission Limits (lb/MMBtu)
Low Sulfur Fuel	5	0.0036 – 0.0094
Good Combustion Practices	4	0.0005
No Control Specified	5	0.0005

RBLC Review
A review of similar units in the RBLC indicates that good combustion practices and combustion of low sulfur fuel are the principle SO_2 control technologies installed on diesel-fired boilers. The lowest SO_2 emission rate listed in the RBLC is 0.0005 lb/MMBtu.

Step 1 - Identification of SO_2 Control Technology for the Diesel Fired Boilers
From research, the Department identified the following technologies as available for SO_2 control for the diesel-fired boilers:

(a) Ultra Low Sulfur Diesel
ULSD has a fuel sulfur content of 0.0015 percent sulfur by weight or less. Using ULSD would reduce SO_2 emissions because the mid-sized diesel boilers are combusting standard diesel that has a sulfur content of up to 0.5 percent sulfur by weight. Switching to ULSD could control 99 percent decrease in SO_2 emissions from the diesel fired boilers. The Department considers ULSD a technically feasible control technology for the diesel-fired boilers.

(b) Good Combustion Practices
The theory of GCPs was discussed in detail in the $PM_{2.5}$ BACT section for the fuel oil-fired simple cycle gas turbine and will not be repeated here. Proper management of the combustion process will result in a reduction of SO_2 emissions. The Department considers GCPs a technically feasible control technology for the diesel-fired boilers.

Step 2 - Eliminate Technically Infeasible SO_2 Control Technologies for the Diesel-Fired Boilers
All identified control technologies are technically feasible for the diesel-fired boilers.

Step 3 - Rank the Remaining SO_2 Control Technologies for the Diesel-Fired Boilers
The following control technologies have been identified and ranked by efficiency for the control of SO_2 emissions from the diesel-fired boilers.

(a) Ultra Low Sulfur Diesel (99% Control)
(b) Good Combustion Practices (Less than 40% Control)

Step 4 - Evaluate the Most Effective Controls

GVEA BACT Proposal

GVEA proposes the following as BACT for SO_2 emissions from the diesel-fired boilers:

(a) Combust only ULSD.

Department Evaluation of BACT for SO_2 Emissions from Diesel-Fired Boilers
The Department reviewed GVEA's proposal and finds that SO_2 emissions from the diesel-fired boilers can additionally be controlled with good combustion practices.

Step 5 - Selection of SO_2 BACT for the Diesel-Fired Boilers
The Department's finding is that BACT for SO_2 emissions from the diesel-fired boilers is as follows:

(a) SO_2 emissions from EUs 10 and 11 shall be controlled limiting the sulfur content of fuel combusted in the turbines to no more than 0.0015 percent by weight;
(b) Maintain good combustion practices by following the manufacturer's operating and maintenance procedures at all times of operation; and

(c) Compliance with the proposed fuel sulfur content limit will be demonstrated with fuel shipment receipts and/or fuel test results for sulfur content.

Table 5-9 lists the proposed SO_2 BACT determination for this facility along with those for other diesel-fired boilers rated at less than 100 MMBtu/hr in the Serious $PM_{2.5}$ nonattainment area.

Table 5-9. Comparison of SO_2 BACT for the Diesel-Fired Boilers at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
Fort Wainwright	**4** Diesel-Fired Boilers	< 100 MMBtu/hr	15 ppmw S in fuel	Limited Operation Good Combustion Practices Ultra-Low Sulfur Diesel
UAF	**6** Diesel-Fired Boilers	< 100 MMBtu/hr	15 ppmw S in fuel	Good Combustion Practices Ultra-Low Sulfur Diesel
GVEA Zehnder	2 Diesel-Fired Boilers	< 100 MMBtu/hr	15 ppmw S in fuel	Good Combustion Practices Ultra-Low Sulfur Diesel

6. BACT DETERMINATION SUMMARY

Table 6-1. Proposed NOx BACT Limits

EU ID	Description of EU	Capacity	Proposed BACT Limit	Proposed BACT Control
All	N/A	N/A	**EPA approved a comprehensive precursor demonstration for NOx See details in the Section 1 Introduction**	

Table 6-2. Proposed $PM_{2.5}$ BACT Limits

EU ID	Description of EU	Capacity	Proposed BACT Limit	Proposed BACT Control
1	Fuel Oil-Fired Regenerative Gas Simple Cycle Gas Turbine	268 MMBtu/hr	0.012 lb/MMBtu	Low Ash Fuel Good Combustion Practices
2	Fuel Oil-Fired Regenerative Gas Simple Cycle Gas Turbine	268 MMBtu/hr	0.012 lb/MMBtu	
3	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr	0.32 g/hp-hr	Good Combustion Practices Limited Operation (100 hours/year each, for non-emergency operation)
4	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr	0.32 g/hp-hr	
10	Diesel-Fired Boiler	1.7 MMBtu/hr	**0.016** lb/MMBtu	Good Combustion Practices
11	Diesel-Fired Boiler	1.7 MMBtu/hr	**0.016** lb/MMBtu	

Table 6-3. Proposed SO_2 BACT Limits

EU ID	Description of EU	Capacity	Proposed BACT Limit	Proposed BACT Control
1	Fuel Oil-Fired Regenerative Gas Simple Cycle Gas Turbine	268 MMBtu/hr	**15 ppmw S in Fuel**	Ultra Low Sulfur Diesel
2	Fuel Oil-Fired Regenerative Gas Simple Cycle Gas Turbine	268 MMBtu/hr	**15 ppmw S in Fuel**	
3	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr	15 ppmw S in Fuel	Ultra Low Sulfur Diesel Good Combustion Practices Limited Operation (100 hours/year each, for non-emergency operation)
4	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr	15 ppmw S in Fuel	
10	Diesel-Fired Boiler	1.7 MMBtu/hr	15 ppmw S in Fuel	Ultra Low Sulfur Diesel Good Combustion Practices
11	Diesel-Fired Boiler	1.7 MMBtu/hr	15 ppmw S in Fuel	

Stationary Source: Zehnder Facility

Emission Units: EU IDs 1 and 2 (268 MMBtu/hr (18.4 MW) Simple Cycle Turbines)

Pollutant of Concern: $PM_{2.5}$	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** [1]
0.012 lb/MMBtu (3-hr avg);	• In each Annual Compliance Certification required by the Operating Permit, report the compliance status for this requirement. • Conduct a one-time performance test at the maximum achievable load to demonstrate compliance and submit results to the Department.
Combust Only Low Ash (Distillate) Fuel	• For each shipment of fuel combusted, keep receipts that specify fuel grade, and quantity of fuel received. • Include a statement in each operating report required by the Operating Permit, affirming that the fuel delivered was a low ash (distillate) fuel.
Good Combustion Practices	• Keep records of maintenance conducted on emission units to comply with this BACT measure. • Keep a copy of the manufacturer's and the operator's recommended maintenance procedures. • If manufacturer specifications provide specific recommended combustion settings for CO and O_2 concentrations in the flue gas, at least once during each quarter that the emission unit operates, measure CO and O_2 in the exhaust stream using a portable handheld combustion analyzer and report these values in the following semi-annual operating report required by the Operating Permit.

Emission Units: EU IDs 3 and 4 (28.5 MMBtu/hr (2.75 MW) Emergency Diesel Engines)

Pollutant of Concern: $PM_{2.5}$	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** [1]
Limited Operation (100 hours of non-emergency operation per year)	• Demonstrate compliance by complying with the NESHAP Subpart ZZZZ emissions limitations, operating limitations, and other requirements listed in 40 CFR 63.6640(f).
0.32 g/hp-hr (3-hr avg);	• Demonstrate compliance by complying with the NESHAP Subpart ZZZZ general requirements listed in 40 CFR 63.6605 and the monitoring, installation, collection, operation, and maintenance requirements listed in 63.6625(e).
Good Combustion Practices	• Demonstrate compliance by complying with the NESHAP Subpart ZZZZ general requirements listed in 40 CFR 63.6605 and the monitoring, installation, collection, operation, and maintenance requirements listed in 63.6625(e).

[1] While the substantive requirements are described here, for any permit containing the requirement, the actual language may differ in non-substantive ways and include additional details.

Emission Units: EU IDs 10 and 11 (1.7 MMBtu/hr Boilers)

Pollutant of Concern: $PM_{2.5}$	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** [1]
0.16 lb/MMBtu/hr (3-hr avg);	• Demonstrate compliance by complying with the NESHAP Subpart JJJJJJ general requirements listed in 40 CFR 63.11205(a) and the work practice and management practice standards listed in 40 CFR 63.11223 and Item 12 of Table 2 to NESHAP Subpart JJJJJJ.
Good Combustion Practices	• Demonstrate compliance by complying with the NESHAP Subpart JJJJJJ general requirements listed in 40 CFR 63.11205(a) and the work practice and management practice standards listed in 40 CFR 63.11223 and Item 12 of Table 2 to NESHAP Subpart JJJJJJ.

Stationary Source: Zehnder Facility

Emission Units: EU IDs 1 and 2 (268 MMBtu/hr (18.4 MW) Simple Cycle Turbines)

Pollutant of Concern: SO_2	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** Error! Bookmark not defined.
Combust Only Ultra Low Sulfur fuel at no more than 0.0015 percent sulfur by weight	• For each shipment of fuel, test the sulfur content or keep receipts that specify fuel grade, date and time, and quantity of fuel received. Keep records of the results of sulfur content tests and receipts for fuel shipments. • Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.
Good Combustion Practices	• Keep records of maintenance conducted on emission units to comply with this BACT measure. • Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.

Emission Units: EU IDs 3 and 4 (28.5 MMBtu/hr (2.75 MW) Emergency Diesel Engines)

Pollutant of Concern: SO_2	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** Error! Bookmark not defined.
Combust Only Ultra Low Sulfur fuel at no more than 0.0015 percent sulfur by weight	• For each shipment of fuel, test the sulfur content or keep receipts that specify fuel grade, date and time, and quantity of fuel received. Keep records of the results of sulfur content tests and receipts for fuel shipments. • Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.
Limited Operation (100 hours of non-emergency operation per year)	• Demonstrate compliance by complying with the NESHAP Subpart ZZZZ emissions limitations, operating limitations, and other requirements listed in 40 CFR 63.6640(f).
Good Combustion Practices	• Demonstrate compliance by complying with the NESHAP Subpart ZZZZ general requirements listed in 40 CFR 63.6605 and the monitoring, installation, collection, operation, and maintenance requirements listed in 63.6625(e).

Emission Unit: EU IDs 10 and 11 (1.7 MMBtu/hr Boilers)

Pollutant of Concern: SO_2	
BACT Measure	**Monitoring, Recordkeeping and Reporting Requirements** Error! Bookmark not defined.
Combust Only Ultra Low Sulfur fuel at no more than 0.0015 percent sulfur by weight	• For each shipment of fuel, test the sulfur content or keep receipts that specify fuel grade, date and time, and quantity of fuel received. Keep records of the results of sulfur content tests and receipts for fuel shipments.

	• Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.
Good Combustion Practices	• Demonstrate compliance by complying with the NESHAP Subpart JJJJJJ general requirements listed in 40 CFR 63.11205(a) and the work practice and management practice standards listed in 40 CFR 63.11223 and Item 12 of Table 2 to NESHAP Subpart JJJJJJ.

	Fuel Prices ($/gallon) representative April 2016		NPP				ZNP	
			Naphtha	LSR Turbine **	DF#1, DF#2	ULSD	DF#1, DF#2	ULSD
A	PSI Base Price		$1.127000	$0.792619	$1.492381	$1.378810	$1.492381	$1.378810
B	PSI & Federal surcharges *		$0.012405	$0.012405	$0.052405	$0.012405	$0.052405	$0.012405
C	PSI Delivery Charge					$0.155000		$0.155000
D	PSI Fuel Surcharge	C * 15%				$0.023250		$0.023250
E	PSI Truck Freight	(C + D) * 15%				$0.026738		$0.026738
F	Big State Delivery				$0.020000	$0.020000	$0.030000	$0.030000
G	Big State fuel surcharge	(F) * 15%			$0.003000	$0.003000	$0.004500	$0.004500
		Total	$1.139405	$0.805024	$1.567786	$1.619203	$1.579286	$1.630703

* Includes GVEA OPS surcharge, Federal Oil Spill Liability, Federal Excise Tax, and SOA Surcharge
** Estimated, will take delivery early 2017

Naphtha and LSR fuel direct pipe supply to North Pole GT3 (LM600, EUID 5).
DF#1, DF#2, and ULSD trucked from PSI to North Pole and Zehnder.

Sulfur	Specification MAX ppm	Aug-15 ppm	Sep-15 ppm	Oct-15 ppm	Nov-15 ppm	Dec-15 ppm	Jan-16 ppm	Feb-16 ppm	Mar-16 ppm	Apr-16 ppm
Naphtha, Sulfur Specification	100	20.7	24.0	23.4	23.2	20.7	20.5	20.2	19.3	20.8
LSR Turbine, Sulfur Specification	30	12 predicted								
# 1 HSD	3000	950.0	970.0	940.0	940.0	960.0	980.0	950.0	940.0	950.0
# 2 HSD -15	4000	3220.0	3010.0	2840.0	3300.0	3130.0	3170.0	2940.0	2730.0	
# 2 HSD + 10	4000	4510.0	4720.0							4080.0
ULSD	15									0.8

All prices per gallon

Location	Product	Item	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-18
North Pole	Naphtha	PSI Base Price	$1.338	-	-	-	-	-	$1.269	-
		PSI & Federal surcharges *	$0.003	-	-	-	-	-	$0.003	-
	LSR Naphtha	PSI Base Price	-	$1.329	$1.071	$1.083	$1.022	$1.004	$0.999	$1.055
		PSI & Federal surcharges *	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
	QB Naphtha	PSI Base Price	-	$1.590	$1.587	$1.625	$1.569	$1.481	$1.516	$1.542
		PSI & Federal surcharges *	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
	DF2+10	PSI Base Price	-	-	-	-	$1.625	$1.576	$1.621	$1.708
		PSI & Federal surcharges *	-	-	-	-	$0.003	$0.003	$0.003	$0.003
		PSI Ops Surcharge	-	-	-	-	$0.05	$0.05	$0.05	$0.05
		Big State Delivery	-	-	-	-	$0.020	$0.020	$0.020	$0.020
		Big State Fuel Surcharge	-	-	-	-	20.5%	20.5%	20.5%	19.0%
	DF2-15	PSI Base Price	$1.750	$1.797	$1.712	$1.732	-	-	-	-
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	-	-	-	-
		PSI Ops Surcharge	$0.04	$0.05	$0.05	$0.05	-	-	-	-
		Big State Delivery	$0.020	$0.020	$0.020	$0.020	-	-	-	-
		Big State Fuel Surcharge	18.5%	20.5%	20.5%	20.5%	-	-	-	-
	ULSD	PSI Base Price	$1.963	$1.904	$1.805	$1.852	$1.806	$1.703	$1.622	$1.797
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Delivery Charge	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155
		PSI Fuel Surcharge	16.5%	17.5%	17.5%	16.5%	16.5%	16.5%	16.5%	14.5%
		PSI Truck Freight	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
		Big State Delivery	$0.133	$0.133	$0.133	$0.133	$0.165	$0.165	$0.165	$0.165
		Big State Fuel Surcharge	18.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	19.0%
Zehnder	DF2+10	PSI Base Price	-	-	-	-	$1.625	$1.576	$1.621	$1.708
		PSI & Federal surcharges *	-	-	-	-	$0.003	$0.003	$0.003	$0.003
		PSI Ops Surcharge	-	-	-	-	$0.05	$0.05	$0.05	$0.05
		Big State Delivery	-	-	-	-	$0.030	$0.030	$0.030	$0.030
		Big State Fuel Surcharge	-	-	-	-	20.5%	20.5%	20.5%	19.0%
	DF2-15	PSI Base Price	$1.750	$1.797	$1.712	$1.732	-	-	-	-
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	-	-	-	-
		PSI Ops Surcharge	$0.04	$0.05	$0.05	$0.05	-	-	-	-
		Big State Delivery	$0.025	$0.025	$0.025	$0.025	-	-	-	-
		Big State Fuel Surcharge	18.5%	20.5%	20.5%	20.5%	-	-	-	-
	ULSD	PSI Base Price	$1.963	$1.904	$1.805	$1.852	$1.806	$1.703	$1.622	$1.797
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Delivery Charge	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155
		PSI Fuel Surcharge	16.5%	17.5%	17.5%	16.5%	16.5%	16.5%	16.5%	14.5%
		PSI Truck Freight	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
		Big State Delivery	$0.025	$0.025	$0.025	$0.025	$0.030	$0.030	$0.030	$0.030
		Big State Fuel Surcharge	18.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	19.0%

Location	Product	Item	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18
North Pole	Naphtha	PSI Base Price	-	-	-	-	-	-	-	-
		PSI & Federal surcharges *	-	-	-	-	-	-	-	-
	LSR Naphtha	PSI Base Price	$1.056	$1.200	$1.418	$1.561	$1.584	$1.540	$1.494	$1.516
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
	QB Naphtha	PSI Base Price	-	-	-	-	-	-	-	-
		PSI & Federal surcharges *	-	-	-	-	-	-	-	-
	DF2+10	PSI Base Price	-	-	-	-	-	-	-	-
		PSI & Federal surcharges *	-	-	-	-	-	-	-	-
		PSI Ops Surcharge	-	-	-	-	-	-	-	-
		Big State Delivery	-	-	-	-	-	-	-	-
		Big State Fuel Surcharge	-	-	-	-	-	-	-	-
	DF2-15	PSI Base Price	$1.874	$1.911	$2.040	$2.021	$2.174	$2.204	$2.188	$2.175
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Ops Surcharge	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05
		Big State Delivery	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020
		Big State Fuel Surcharge	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%
	ULSD	PSI Base Price	$2.074	$2.107	$2.159	$2.038	$2.129	$2.083	$2.083	$2.309
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Delivery Charge	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155
		PSI Fuel Surcharge	16.5%	16.5%	19.5%	20.0%	19.0%	20.0%	20.0%	20.0%
		PSI Truck Freight	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
		Big State Delivery	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165
		Big State Fuel Surcharge	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%
Zehnder	DF2+10	PSI Base Price	-	-	-	-	-	-	-	-
		PSI & Federal surcharges *	-	-	-	-	-	-	-	-
		PSI Ops Surcharge	-	-	-	-	-	-	-	-
		Big State Delivery	-	-	-	-	-	-	-	-
		Big State Fuel Surcharge	-	-	-	-	-	-	-	-
	DF2-15	PSI Base Price	$1.874	$1.911	$2.040	$2.021	$2.174	$2.204	$2.188	$2.175
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Ops Surcharge	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05
		Big State Delivery	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030
		Big State Fuel Surcharge	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%
	ULSD	PSI Base Price	$2.074	$2.107	$2.159	$2.038	$2.129	$2.083	$2.083	$2.309
		PSI & Federal surcharges *	$0.006	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Delivery Charge	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155
		PSI Fuel Surcharge	16.5%	16.5%	19.5%	20.0%	19.0%	20.0%	20.0%	20.0%
		PSI Truck Freight	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
		Big State Delivery	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030
		Big State Fuel Surcharge	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%

Location	Product	Item	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18				
North Pole	Naphtha	PSI Base Price	-	-	$1.912	-	-	-	$1.506			
		PSI & Federal surcharges *	-	-	$0.003	-	-	-	$0.003	$1.509		
	LSR Naphtha	PSI Base Price	$1.682	$1.641	$1.713	$1.716	$1.779	$1.785	$1.393			
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$1.396		
	QB Naphtha	PSI Base Price	-	-	$2.142	$1.829	$2.158	$2.207	$1.750			
		PSI & Federal surcharges *	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$1.753		
	DF2+10	PSI Base Price	$2.150	$2.286	$2.395	$2.400	$2.408	-	$2.019			
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	-	$0.003			
		PSI Ops Surcharge	$0.05	$0.05	$0.05	$0.05	$0.05	-	$0.050			
		Big State Delivery	$0.020	$0.020	$0.020	$0.020	$0.020	-	$0.020			
		Big State Fuel Surcharge	29.0%	27.0%	27.0%	23.5%	26.0%	-	$0.0047	$2.097		
	DF2-15	PSI Base Price	-	-	-	-	-	$2.499	$2.006			
		PSI & Federal surcharges *	-	-	-	-	-	$0.003	$0.003			
		PSI Ops Surcharge	-	-	-	-	-	$0.05	$0.049			
		Big State Delivery	-	-	-	-	-	$0.020	$0.020			
		Big State Fuel Surcharge	-	-	-	-	-	26.0%	$0.0046	$2.083		
	ULSD	PSI Base Price	$2.417	$3.129	$2.301	$2.225	$2.308	$2.406	$2.101			
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003			
		PSI Delivery Charge	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155			
		PSI Fuel Surcharge	21.5%	22.5%	22.5%	22.0%	21.0%	22.0%	$0.0292			
		PSI Truck Freight	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	$0.0276			
		Big State Delivery	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.159			
		Big State Fuel Surcharge	29.0%	27.0%	27.0%	23.5%	26.0%	26.0%	$0.0371	$2.512	$0.416	$1.116
Zehnder	DF2+10	PSI Base Price	$2.150	$2.286	$2.395	$2.400	$2.408	-	$2.019			
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	-	$0.003			
		PSI Ops Surcharge	$0.05	$0.05	$0.05	$0.05	$0.05	-	$0.050			
		Big State Delivery	$0.030	$0.030	$0.030	$0.030	$0.030	-	$0.030			
		Big State Fuel Surcharge	29.0%	27.0%	27.0%	23.5%	26.0%	-	$0.0071	$2.109		
	DF2-15	PSI Base Price	-	-	-	-	-	$2.499	$2.006			
		PSI & Federal surcharges *	-	-	-	-	-	$0.003	$0.003			
		PSI Ops Surcharge	-	-	-	-	-	$0.05	$0.049			
		Big State Delivery	-	-	-	-	-	$0.030	$0.028			
		Big State Fuel Surcharge	-	-	-	-	-	26.0%	$0.0066	$2.093		
	ULSD	PSI Base Price	$2.417	$3.129	$2.301	$2.225	$2.308	$2.406	$2.101			
		PSI & Federal surcharges *	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003			
		PSI Delivery Charge	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155			
		PSI Fuel Surcharge	21.5%	22.5%	22.5%	22.0%	21.0%	22.0%	$0.0292			
		PSI Truck Freight	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	$0.0276			
		Big State Delivery	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.029			
		Big State Fuel Surcharge	29.0%	27.0%	27.0%	23.5%	26.0%	26.0%	$0.0068	$2.352	$0.243	

GVEA Fuel Pricing per Gallon

			Average	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-18	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18
North Pole	LSR Naphtha	PSI Base Price		-	$1.329	$1.071	$1.083	$1.022	$1.004	$0.999	$1.055	$1.056	$1.200	$1.418	$1.561	$1.584	$1.540	$1.494	$1.516	$1.682	$1.641	$1.713	$1.716	$1.779	$1.785
		PSI & Federal surcharges *		-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		Total $/Gallon	**$1.396**	**-**	**$1.332**	**$1.074**	**$1.086**	**$1.025**	**$1.007**	**$1.002**	**$1.058**	**$1.059**	**$1.203**	**$1.421**	**$1.564**	**$1.587**	**$1.543**	**$1.497**	**$1.519**	**$1.685**	**$1.644**	**$1.716**	**$1.719**	**$1.782**	**$1.788**
	DF2+10	PSI Base Price		-	-	-	-	$1.625	$1.576	$1.621	$1.708	-	-	-	-	-	-	-	-	$2.150	$2.286	$2.395	$2.400	$2.408	-
		PSI & Federal surcharges *		-	-	-	-	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	-
		PSI Ops Surcharge		-	-	-	-	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	-
		Delivery Charge		-	-	-	-	$0.020	$0.020	$0.020	$0.020	-	-	-	-	-	-	-	-	$0.020	$0.020	$0.020	$0.020	$0.020	-
		Delivery Fuel Surcharge %		-	-	-	-	20.5%	20.5%	20.5%	19.0%	-	-	-	-	-	-	-	-	29.0%	27.0%	27.0%	23.5%	26.0%	-
		Delivery Fuel Surchage (%*Delivery)		-	-	-	-	$0.004	$0.004	$0.004	$0.004	-	-	-	-	-	-	-	-	$0.006	$0.005	$0.005	$0.005	$0.005	-
		Total $/Gallon	**$2.097**	**-**	**-**	**-**	**-**	**$1.702**	**$1.653**	**$1.699**	**$1.785**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$2.229**	**$2.364**	**$2.474**	**$2.478**	**$2.486**	**-**
	DF2-15	PSI Base Price		$1.750	$1.797	$1.712	$1.732	-	-	-	-	$1.874	$1.911	$2.040	$2.021	$2.174	$2.204	$2.188	$2.175	-	-	-	-	-	$2.499
		PSI & Federal surcharges *		$0.003	$0.003	$0.003	$0.003	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	$0.003
		PSI Ops Surcharge		$0.04	$0.05	$0.05	$0.05	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	$0.05
		Truck Delivery		$0.020	$0.020	$0.020	$0.020	-	-	-	-	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	-	-	-	-	-	$0.020
		Delivery Fuel Surcharge %		18.5%	20.5%	20.5%	20.5%	-	-	-	-	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	-	-	-	-	-	26.0%
		Delivery Fuel Surchate (%*Delivery)		$0.004	$0.004	$0.004	$0.004	-	-	-	-	$0.005	$0.005	$0.005	$0.005	$0.005	$0.005	$0.005	$0.005	-	-	-	-	-	$0.005
		Total $/Gallon	**$2.083**	**$1.817**	**$1.874**	**$1.789**	**$1.809**	**-**	**-**	**-**	**-**	**$1.951**	**$1.989**	**$2.117**	**$2.099**	**$2.251**	**$2.282**	**$2.266**	**$2.253**	**-**	**-**	**-**	**-**	**-**	**$2.577**
	ULSD	PSI Base Price		$1.963	$1.904	$1.805	$1.852	$1.806	$1.703	$1.622	$1.797	$2.074	$2.107	$2.159	$2.038	$2.129	$2.083	$2.083	$2.309	$2.417	$3.129	$2.301	$2.225	$2.308	$2.406
		PSI & Federal surcharges *		$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Delivery Charge		$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155
		PSI Fuel Surcharge %		16.5%	17.5%	17.5%	16.5%	16.5%	16.5%	16.5%	14.5%	16.5%	16.5%	19.5%	20.0%	19.0%	20.0%	20.0%	20.0%	21.5%	22.5%	22.5%	22.0%	21.0%	22.0%
		PSI Fuel Surcharge (%*Delivery)		$0.026	$0.027	$0.027	$0.026	$0.026	$0.026	$0.026	$0.022	$0.026	$0.026	$0.030	$0.031	$0.029	$0.031	$0.031	$0.031	$0.033	$0.035	$0.035	$0.034	$0.033	$0.034
		PSI Truck Freight %		15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
		PSI Truck Freight (%*Delivery+Surchage)		$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028
		Truck Delivery		$0.133	$0.133	$0.133	$0.133	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165	$0.165
		Delivery Fuel Surcharge %		18.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	19.0%	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	29.0%	27.0%	27.0%	23.5%	26.0%	26.0%
		Delivery Fuel Surchage (%*Delivery)		$0.025	$0.027	$0.027	$0.027	$0.034	$0.034	$0.034	$0.031	$0.038	$0.038	$0.038	$0.038	$0.040	$0.043	$0.043	$0.043	$0.048	$0.045	$0.045	$0.039	$0.043	$0.043
		Total $/Gallon	**$2.512**	**$2.331**	**$2.277**	**$2.178**	**$2.223**	**$2.216**	**$2.112**	**$2.032**	**$2.200**	**$2.487**	**$2.521**	**$2.578**	**$2.458**	**$2.549**	**$2.508**	**$2.508**	**$2.734**	**$2.849**	**$3.560**	**$2.732**	**$2.649**	**$2.735**	**$2.834**
Zehnder	DF2+10	PSI Base Price		-	-	-	-	$1.625	$1.576	$1.621	$1.708	-	-	-	-	-	-	-	-	$2.150	$2.286	$2.395	$2.400	$2.408	-
		PSI & Federal surcharges *		-	-	-	-	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	-
		PSI Ops Surcharge		-	-	-	-	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	-
		Delivery Charge		-	-	-	-	$0.030	$0.030	$0.030	$0.030	-	-	-	-	-	-	-	-	$0.030	$0.030	$0.030	$0.030	$0.030	-
		Delivery Fuel Surcharge %		-	-	-	-	20.5%	20.5%	20.5%	19.0%	-	-	-	-	-	-	-	-	29.0%	27.0%	27.0%	23.5%	26.0%	-
		Delivery Fuel Surchage (%*Delivery)		-	-	-	-	$0.006	$0.006	$0.006	$0.006	-	-	-	-	-	-	-	-	$0.009	$0.008	$0.008	$0.007	$0.008	-
		Total $/Gallon	**$2.109**	**-**	**-**	**-**	**-**	**$1.714**	**$1.665**	**$1.711**	**$1.797**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$2.242**	**$2.377**	**$2.487**	**$2.490**	**$2.499**	**-**
	DF2-15	PSI Base Price		$1.750	$1.797	$1.712	$1.732	-	-	-	-	$1.874	$1.911	$2.040	$2.021	$2.174	$2.204	$2.188	$2.175	-	-	-	-	-	$2.499
		PSI & Federal surcharges *		$0.003	$0.003	$0.003	$0.003	-	-	-	-	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	-	-	-	-	-	$0.003
		PSI Ops Surcharge		$0.04	$0.05	$0.05	$0.05	-	-	-	-	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	-	-	-	-	-	$0.05
		Truck Delivery		$0.025	$0.025	$0.025	$0.025	-	-	-	-	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	-	-	-	-	-	$0.030
		Delivery Fuel Surcharge %		18.5%	20.5%	20.5%	20.5%	-	-	-	-	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	-	-	-	-	-	26.0%
		Delivery Fuel Surchate (%*Delivery)		$0.005	$0.005	$0.005	$0.005	-	-	-	-	$0.007	$0.007	$0.007	$0.007	$0.007	$0.008	$0.008	$0.008	-	-	-	-	-	$0.008
		Total $/Gallon	**$2.093**	**$1.823**	**$1.880**	**$1.795**	**$1.815**	**-**	**-**	**-**	**-**	**$1.964**	**$2.001**	**$2.129**	**$2.111**	**$2.264**	**$2.294**	**$2.279**	**$2.266**	**-**	**-**	**-**	**-**	**-**	**$2.590**
	ULSD	PSI Base Price		$1.963	$1.904	$1.805	$1.852	$1.806	$1.703	$1.622	$1.797	$2.074	$2.107	$2.159	$2.038	$2.129	$2.083	$2.083	$2.309	$2.417	$3.129	$2.301	$2.225	$2.308	$2.406
		PSI & Federal surcharges *		$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.006	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
		PSI Delivery Charge		$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155	$0.155
		PSI Fuel Surcharge %		16.5%	17.5%	17.5%	16.5%	16.5%	16.5%	16.5%	14.5%	16.5%	16.5%	19.5%	20.0%	19.0%	20.0%	20.0%	20.0%	21.5%	22.5%	22.5%	22.0%	21.0%	22.0%
		PSI Fuel Surcharge (%*Delivery)		$0.026	$0.027	$0.027	$0.026	$0.026	$0.026	$0.026	$0.022	$0.026	$0.026	$0.030	$0.031	$0.029	$0.031	$0.031	$0.031	$0.033	$0.035	$0.035	$0.034	$0.033	$0.034
		PSI Truck Freight %		15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
		PSI Truck Freight (%*Delivery+Surchage)		$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.027	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028	$0.028
		Truck Delivery		$0.025	$0.025	$0.025	$0.025	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030	$0.030
		Delivery Fuel Surcharge %		18.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	19.0%	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	29.0%	27.0%	27.0%	23.5%	26.0%	26.0%
		Delivery Fuel Surchage (%*Delivery)		$0.005	$0.005	$0.005	$0.005	$0.006	$0.006	$0.006	$0.006	$0.007	$0.007	$0.007	$0.007	$0.007	$0.008	$0.008	$0.008	$0.009	$0.008	$0.008	$0.007	$0.008	$0.008
		Total $/Gallon	**$2.352**	**$2.203**	**$2.147**	**$2.048**	**$2.093**	**$2.053**	**$1.950**	**$1.869**	**$2.040**	**$2.324**	**$2.355**	**$2.412**	**$2.292**	**$2.382**	**$2.338**	**$2.338**	**$2.564**	**$2.675**	**$3.389**	**$2.560**	**$2.482**	**$2.564**	**$2.664**

Notes: During the time frame shown here, 5,755,774 gallons of DF2+10 and 8,829,573 gallons of DF2-15 were consumed by EU ID's 1 and 2 at the North Pole Plant, giving a weighted average cost differential between No. 2 HSD and ULSD of $0.424 per gallon.

		Gallons	Product	
North Pole ULSD DF2+10 Difference	$0.416	5,755,774	2,392,769	$0.424
North Pole ULSD DF2-15 Difference	$0.430	8,829,573	3,793,174	
North Pole ULSD LSR/Naptha Difference	$1.117			

Table 5-4. Annualized Costs for ULSD Combustion in the Diesel-fired Simple Cycle Gas Turbines (EU ID 1 and 2)

Shaded cells indicate user inputs

Cost Effectiveness Determination - ULSD Fuel Switch - No Additional Tank Storage

Project: GVEA Zhender - SO_2 BACT Analysis (EU ID 1 and 2 - Frame 5 CTs, cost per turbine)

Date:
Prepared By:
Checked By:
Rev:

Annualized Costs

DIRECT ANNUAL COSTS		QTY	UNIT		TOTAL MATERIALS COST	TOTAL LABOR COST	TOTAL
(1)	Operating & Maintenance Costs		%			$ -	$ -
(2)	Repair & Replacement Costs		%			$ -	$ -
(3)	Maintenance Materials		LOT				
(4)	Utilities						
	(a) ULSD Costs:	18,059,076.92	GAL	0.251	$ 4,532,828		$ 4,532,828
Total Direct Annual Costs (TDAC)						TDAC =	$ 4,532,828
INDIRECT ANNUAL COSTS							
(5)	Overhead		%			$ -	$ -
(6)	Administrative Charges, Property Taxes, Insurance		% of capital			$ -	$ -
	Capital Recovery Factor [see inputs below]	0.0931					
(7)	Capital Recovery					CRF * TCI =	$ -
Total Indirect Annual Costs (TIAC) (refer to Table 5-10)						TIAC =	$ 577,064
TOTAL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC) =	$ 5,109,893

Cost Effectiveness Summary

TOTAL TONS SO2 AVOIDED PER YEAR	=	578
COST EFFECTIVENESS ($ PER TON AVOIDED BASED ON PTE)	(TAC)/(TPY) =	$ 8,837

Data Inputs for Capital Recovery Factor:		
Annual Interest Rate (EPA OAQPS Control Cost Manual)	8.50	%
Project Life (EPA OAQPS Control Cost Manual)	30	years

Table 5-10. Capital Cost for New ULSD Storage Based on PTE Maximum Fuel Use and Historic Actual Use

	North Pole EUs 1 and 2 Maximum Fuel Use	Zehnder EUs 1 and 2 Maximum Fuel Use	North Pole EUs 1 and 2 Actual Fuel Use	Zehnder EUs 1 and 2 Actual Fuel Use
Capital Cost Estimate	$30,425,000		$21,050,000	
Heat Input, MMBtu/day (combined for each set of combustion turbines)	32,256	12,864	32,256	12,864
Percentage of Heat Input	71.5%	28.5%	71.5%	28.5%
Capital Cost (apportioned based on heat input ratio)	$ 21,750,638	$ 8,674,362	$ 15,048,511	$ 6,001,489
Capital Cost (apportioned per combustion turbine)	$ 10,875,319	$ 4,337,181	$ 7,524,255	$ 3,000,745
Capital Recovery (per combustion turbine)	$ 1,011,955	$ 403,577	$ 700,136	$ 279,221
Administrative Charges, Property Taxes, Insurance (per combustion turbine)	$ 435,013	$ 173,487	$ 300,970	$ 120,030
Total Annual Indirect Cost (per combustion turbine)	**$ 1,446,967**	**$ 577,064**	**$ 1,001,106**	**$ 399,251**

Capital recovery factor: 0.0931

Data Inputs for Capital Recovery Factor:

Annual Interest Rate (EPA OAQPS Control Cost Manual): 8.50 pct.

Project Life (EPA OAQPS Control Cost Manual): 30 years

Administrative Charges, Property Taxes Insurance (percentage of total capital cost): 4.00%